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- **SCHOLZ, Jan Pascal**
Portland, OR 97217 (US)
- **WOOD, Darren Michael**
Portland, OR 97217 (US)
- **COUPE, Austin**
Portland, OR 97217 (US)
- **POLSTER, Christopher**
Portland, OR 97217 (US)
- **ELVIDGE, Tom**
Portland, OR 97217 (US)
- **SPARKS, Aaron**
Portland, OR 97217 (US)
- **BLIGH, Reuben**
Portland, OR 97217 (US)

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(71) Applicant: **adidas AG**
91074 Herzogenaurach (DE)

(72) Inventors:

- **BROCCOLI-HICKEY, Joseph Thomas**
Portland, OR 97217 (US)
- **PADILLA, Christopher N.**
Portland, OR 97217 (US)

(74) Representative: **Bardehle Pagenberg**
Partnerschaft mbB
Patentanwälte Rechtsanwälte
Prinzregentenplatz 7
81675 München (DE)

(54) **SHOE HAVING A SOLE WITH A STABILITY STRUCTURE**

(57) A shoe (10) has an upper (12) and a sole structure (20) connected to the upper. A stability structure (30) is positioned between a midsole (22) and an outsole (24). The stability structure has a plurality of rods (32, 33, 34) extending in a length direction from at least a midfoot region (48) toward a toe end (52). At

least one connection bar (42) connects at least two of the plurality of rods in a forefoot region of the shoe, the connection bar extending in a width direction being transverse to the length direction a contact cycle with the ground and configured to control movement of the sole structure in the medial-lateral direction.

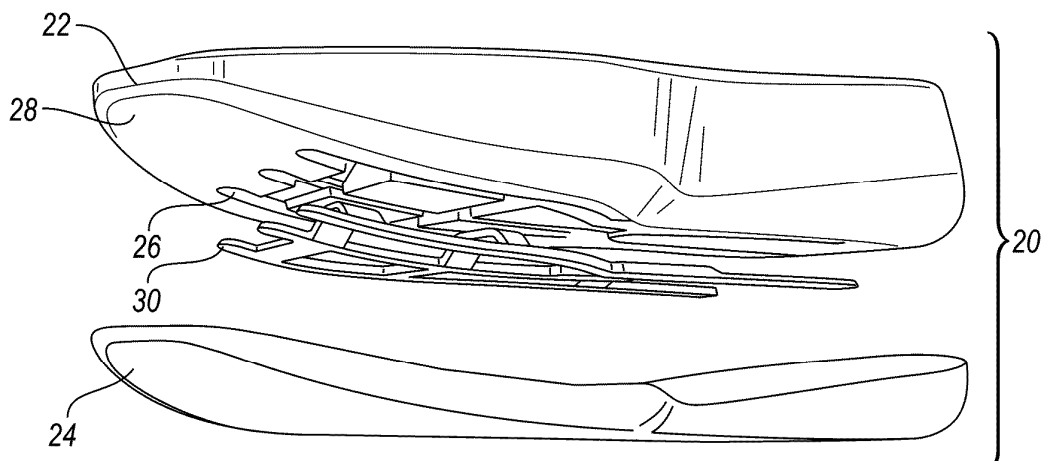


FIG. 2

Description

TECHNICAL FIELD

[0001] The present disclosure relates to a sole structure for an athletic shoe having stability structure.

BACKGROUND

[0002] Court sports, such as basketball, volleyball, and tennis, are intense, high-impact activities requiring athletes to perform frequent running, jumping, and rapid lateral movements. The unique physical demands of these sports necessitate footwear specifically designed to provide enhanced support, stability, traction, and cushioning. Unlike running shoes, which prioritize forward motion and energy return, court sports shoes must accommodate multidirectional movement and protect players from the repetitive stress associated with abrupt changes in motion and high-velocity jumps. In basketball specifically, the high level of physicality and versatility required adds further complexity to shoe design, emphasizing the need for performance-enhancing features tailored to the sport's demands.

[0003] In today's era of court sports, athletes are expected to perform at an elite level, combining speed, agility, and explosive power to succeed in highly dynamic environments. Basketball, in particular, demands footwear that enables players to excel in multidirectional movements and transitions across the entire court, whether on offense or defense. These shoes must provide exceptional responsiveness, allowing athletes to accelerate linearly for fast breaks, move laterally to guard opponents, and jump vertically to contest shots or finish plays above the rim. Moreover, the rapid stops, multidirectional cuts, sudden pivots, and repeated jumps and landings inherent in court sports often occur in quick succession or simultaneously. Footwear designed for such activities not only enhances player performance but also helps mitigate fatigue and reduces the risk of injury during high-intensity gameplay.

SUMMARY

[0004] In at least one embodiment, a shoe is provided with a sole structure connected to a shoe upper. The sole structure comprises a midsole providing cushioning, an outsole having an outer surface for contacting the ground and a stability structure at least partially positioned within the midsole. The stability structure has a plurality of rods extending in a length direction from at least a midfoot region of the shoe toward a toe end of the shoe. At least one connection bar connects at least two of the plurality of rods in a forefoot region of the shoe, the connection bar extends in a width direction being transverse to the length direction.

[0005] In another embodiment, each of the plurality

of rods are connected at a first end at a junction area along the midfoot region. A second end of the rods is adjacent the toe end is free. The connection bar is positioned between the first end and the second end.

[0006] In another embodiment, the plurality of rods is generally planar along the forefoot region. In another embodiment, the plurality of rods extend generally parallel to a generally flat outer support surface of the outsole.

[0007] In another embodiment, the connection bar includes at least one segment being arched and extending above a plane of the plurality of rods. In another embodiment, the connection bar has a first segment connecting at least two of the rods, and a second segment connecting at least two rods. The first and second segments are configured to move the rods independently during a contact cycle with the ground. In another embodiment, the first segment connects at least two rods on a medial side, and the second segment connects at least two rods on a lateral side. The first and second segments are configured to move the medial side independently from the lateral side during the contact cycle with the ground. In another embodiment, the first segment has a first shape, and the second segment has a second shape. In another embodiment, the at least one connection bar has at least two connection bars spaced apart in the length direction.

[0008] In another embodiment, the midsole includes a cavity to receive the stability structure.

[0009] In another embodiment, the outsole includes one or more relief areas that change in width during a contact cycle with the ground.

[0010] In at least one embodiment, a sole structure for a shoe is provided. The sole structure has a midsole and a stability structure. The stability structure is at least partially positioned within the midsole and has a plurality of rods extending in a length direction. At least two of the plurality of rods are connected by a connection bar extending in a width direction being transverse to the length direction.

[0011] In another embodiment, the plurality of rods comprises three rods. In another embodiment, the connection bar is connected to the three rods. In another embodiment, the plurality of rods comprises at least four rods. In another embodiment, the connection bar is connected to the four rods. In another embodiment, the at least one connection bar comprises at least two connection bars spaced apart in the length direction.

[0012] In at least one embodiment, a shoe is provided having an upper and a sole structure connected to the upper. The sole structure has a midsole providing cushioning and a stability structure at least partially positioned within the midsole. The sole structure has a plurality of rods extending in a length direction from at least a midfoot region toward a toe end. At least one connection bar connects the plurality of rods in a forefoot region of the shoe. The connection bar has a first segment connecting at least two rods on a medial side,

and a second segment connecting at least two rods on a lateral side. The first and second segments are configured to move the medial side independently from the lateral side during a contact cycle with the ground.

[0013] In another embodiment, the at least one connection bar has at least two connection bars spaced apart in the length direction. 5

[0014] In another embodiment, the plurality of rods is generally planar from the midfoot region to the forefoot region. 10

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

FIG. 1 is a shoe with a portion of the sole structure cut-away to illustrate a stability structure according to some embodiments. 15

FIG. 2 is an exploded view of the sole structure in FIG. 1. 20

FIG. 3 is a top perspective view of the outsole and stability structure in FIG. 1. 25

FIG. 4 is a perspective view of the stability structure of FIG. 1. 30

FIG. 5 is a bottom perspective view of the stability structure and midsole of FIG. 1. 35

FIG. 6 shows a bottom view of a shoe making initial contact with the floor where medial-lateral width is allowed to widen. 40

FIG. 7 shows the bottom view of a shoe in FIG. 6 in contact with the floor during a second movement where medial-lateral compression occurs. 45

FIG. 8 shows the stability structure from the bottom view of a shoe that is in contact with the floor. 50

FIG. 9 is a top perspective view of the outsole and stability structure according to some embodiments. 55

FIG. 10 is a perspective view of the stability structure of FIG. 9.

FIG. 11 is a top perspective view of the outsole and stability structure according to some embodiments.

FIG. 12 is a top perspective view of the outsole and stability structure according to some embodiments.

FIG. 13 is a perspective view of the stability structure of FIG. 12.

FIG. 14 illustrates profiles for three-rod stability

structures.

FIG. 15 illustrates profiles for four-rod stability structures.

FIG. 16 illustrates a cross section showing an alternate profile of the sole structure and stability structure.

FIG. 17 illustrates a cross section showing an alternate profile of the sole structure and stability structure.

FIG. 18 illustrates a cross section showing an alternate profile of the sole structure and stability structure.

FIG. 19 illustrates a cross section showing an alternate profile of the sole structure and stability structure.

FIG. 20 is a shoe with a portion of the sole structure cut-away to illustrate a stability structure according to some embodiments.

FIG. 21 is an exploded view of the sole structure in FIG. 20.

FIG. 22 is a bottom view of the outsole and stability structure in FIG. 20.

FIG. 23 is a shoe with a portion of the sole structure cut-away to illustrate a stability structure according to some embodiments.

FIG. 24 is an exploded view of the sole structure in FIG. 23.

FIG. 25 is a bottom view of the outsole and stability structure in FIG. 23.

FIG. 26 is a perspective view of the stability structure according to some embodiments.

FIG. 27 is a perspective view of a stability structure according to some embodiments.

FIG. 28 is a top view of a stability structure according to some embodiments.

FIG. 29 is a top view of a stability structure according to some embodiments.

FIG. 30 is a top view of a stability structure according to some embodiments.

FIG. 31 is a top view of a stability structure according to some embodiments.

FIG. 32 is a top view of a stability structure according to some embodiments.

FIG. 33 is a top view of a stability structure according to some embodiments.

FIG. 34 is a top view of a stability structure according to some embodiments.

FIG. 35 is a top view of a stability structure according to some embodiments.

DETAILED DESCRIPTION

[0016] As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various and alternative forms. The figures are not necessarily to scale; some features may be exaggerated or minimized to show details of particular components. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a representative basis for teaching one skilled in the art to variously employ the present invention. A person of ordinary skill in the art will understand, however, that the features and possible modifications described with reference to these specific embodiments may also be further modified and/or combined with one another in a different manner or in different sub-combinations, without departing from the scope of the present disclosure.

[0017] Possible embodiments of the various aspects of the present disclosure are described below, predominantly with respect to basketball shoes. It is, however, contemplated that the different aspects of the present disclosure may also be practiced in different kinds of shoes including athletic shoes such as court shoes and are not limited to the specific embodiments described below.

[0018] In the prior art, basketball torsion bars and plates are commonly utilized to provide structure and stability to the shoe. These components are typically thin plastic pieces, positioned above, within, or below the midsole, and are relatively thin being approximately 0.8-1.2 millimeters thick. Their primary functions include offering midfoot flexion stiffness to reduce injury risk, enhancing forefoot flexion stiffness for improved propulsion and force distribution, and providing torsion support to limit excessive eversion, thereby maintaining the athlete's stability on the shoe during high-force movements. However, these elements often face limitations in delivering these benefits at an optimal level, particularly when compared to the more advanced plates or frames used in running or cleated sports footwear.

[0019] One significant constraint in basketball footwear design is the midsole height. While running shoes

may reach stack heights of up to 40 millimeters, a high stack height in basketball shoes would be bulky and unstable if the forefoot height even exceeds approximately 15 millimeters, for example. To address the challenges of providing midfoot and forefoot flexion stiffness and whole-shoe torsion support in a more effective manner, a novel torsion and plate concept is required. The stability structure of the present application provides the ability for medial and lateral splay in the forefoot section. Under vertical force, the system expands the forefoot's surface area to enhance flex stiffness and responsiveness while simultaneously providing a mechanical support structure for the shoe's lateral side. The stability structure improves control, containment, and performance for basketball athletes during high-intensity movements.

[0020] FIGS. 1-5 illustrate a shoe 10 according to one embodiment of the present application. The shoe 10 includes a shoe upper 12 and a sole structure 20. The sole structure 20 includes a midsole 22 to provide cushioning and an outsole 24 to deliver traction and make contact with specific surface types, such as courts or ground terrain. FIGS. 1-2 show a cut-away view and exploded view of the shoe 10 that includes a stability structure 30.

[0021] The stability structure 30 incorporated into the sole structure 20 addresses two critical performance aspects in athletic footwear. First, the stability structure facilitates splay or a slight increase in forefoot (FF) width during the initial contact phase, particularly on the medial side of the wearer's foot. This increase in width enhances ground contact area and stability, enabling athletes to perform faster and more controlled cuts. Second, the stability structure 30 prevents excessive compression or collapse of the midsole in the medial-lateral direction throughout the remainder of the contact phase. By maintaining structural integrity and optimizing forefoot width during dynamic movements, the stability structure 30 allows athletes to achieve improved stability and responsiveness without the added weight that would result from simply increasing the shoe's overall forefoot width. Additionally, as the stability structure 30 compresses vertical forces during ground contact, the forefoot section spreads, providing additional lateral and medial support while preserving forefoot flexion stiffness. This synergy enhances both cutting performance and overall foot control, offering a balanced combination of flexibility, stability, and responsiveness for high-performance athletes.

[0022] The midsole 22 is often constructed from cushioning materials such as foam, polyurethane (PU), thermoplastic polyurethane (TPU), polyether block amide (PEBA), thermoplastic polyester elastomer (TPEE) or a combination of materials or other materials, and is designed to absorb impact forces, provide energy return, and enhance comfort during use. These materials are often chosen for their cost-effectiveness and ease of processing, particularly for manufacturing

techniques like injection molding. The midsole 22 may also include a particle foam, such as expanded thermoplastic polyurethane (eTPU), expanded polyamide (ePA), expanded polyether block amide (ePEBA), or expanded thermoplastic polyester ether elastomer (eT-
 5 PEE), expanded polylactide (ePLA), expanded polyethylene terephthalate (ePET), expanded polybutylene terephthalate (ePBT), or expanded thermoplastic olefin (eTPO), or other suitable particle foams used individually or in combination.

[0023] Particle foams and homogeneous foam materials may also be combined within the midsole to create a multilayered structure or region-specific properties. For instance, different foam materials may be strategically placed to enhance cushioning, support, or energy
 10 return in targeted areas of the sole. Alternatively or additionally, the midsole may be constructed from non-foam materials, such as a lattice structure manufactured using additive manufacturing techniques like three-dimensional printing, laser sintering, or stereo-
 15 lithography. The midsole may also include gel inserts or other insert materials embedded within midsoles to enhance shock absorption, energy return or desired properties.

[0024] The outsole 24 is coupled to the midsole 22. The outsole 24 forms the outer surface of the shoe 10 designed to contact the ground. As shown in FIG. 1, the outsole 24 of a basketball shoe 10 typically features a flat, wide base with a wider forefoot region 50 and heel to maximize ground contact and enhance stability during lateral movements and quick pivots. The outsole
 20 shape often includes rounded edges or outrigger extensions to prevent rollover and provide additional support for multidirectional agility on the court. Unlike running shoes, which have a narrower and more curved outsole optimized for forward motion and heel-to-toe transitions, court shoes such as basketball shoes are designed with a broader profile to accommodate the sport's multidirectional demands.

[0025] The outsole 24, like the midsole 22 may be formed of suitable materials including but not limited to rubber, EVA, TPU, PEBA, thermoplastic rubber (TPR), or any suitable materials to achieve desired performance characteristics. In some embodiments, the mid-
 25 sole 22 and the outsole 24 may vary in hardness, material density, or modulus for desired performance. The outsole 24 may have a higher hardness and/or higher stiffness and/or higher density than the midsole 22 to enhance durability and support.

[0026] The sole structure 20, including the midsole 22 and outsole 24, may be manufactured using various techniques, including injection molding, blow molding, compression molding, rotational molding, three-dimensional printing, or any other suitable manufacturing method or technique. In some designs, the midsole 22 and outsole 24 are separately formed components that are attached using methods such as adhesive bonding, stitching, welding, or combinations thereof. For exam-
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ple, an adhesive may be applied between the midsole 22 and outsole 24 to secure them together. Alternatively, the midsole 22 and outsole 24 may be integrally formed as a single piece using processes such as injection molding or three-dimensional printing, for exam-
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[0027] In some embodiments, the outsole 24 may extend from a bottom surface around the lateral and medial sides as well as around the toe end 52 and heel end 54 to enclose part or all of the midsole 22 and possibly some of the upper 12 to enhance the performance and durability of the shoe. As shown in FIG. 3 for example, the outsole 24 may form a lower cavity for receiving the midsole 22 and/or upper 12.

[0028] The stability structure 30 can be formed from materials like carbon fibers, carbon fiber composites, glass fiber composites, or a combination of these materials. These materials may provide high stability and stiffness while maintaining a comparatively low weight. For example, the stability structure 30 may be formed of a carbon fiber composite of polyamide combined with carbon fibers, or a glass fiber composite formed of a polyamide material with glass fibers.

[0029] The stability structure 30 may be formed of other materials such as metal, injection-molded plastics, wood, or other suitable materials. The material of the stability structure 30 may vary between different parts of the structure, allowing for different sections to have specific properties to meet different functions or performance goals.

[0030] The stability structure 30 may be manufactured using a variety of methods, depending on the materials and design. For example, the stability structure 30 may be formed with molding techniques like injection molding, additive manufacturing such as three-dimensional printing, or carbon extrusion.

[0031] The sole structure 20 includes the stability structure 30 that increases athlete performance without increasing the stack height of the shoe. As shown in FIGS. 1-2, the sole structure 20 includes a stability structure 30 at least partially positioned within the mid-
 35 sole 22.

[0032] FIG. 2 is an exploded view of the sole structure 20 illustrating that the midsole 22 may have a cavity 26 formed on a lower surface 28 to receive at least a portion of the stability structure 30. The cavity 26 in the midsole 22 may correspond to the stability structure 30 so that the stability structure is at least partially contained within the midsole 22, while a lower surface of the stability structure 30 may contact an inner surface of the outsole 24. In this arrangement, the stability structure 30 may be positioned between the midsole 22 and the outsole 24 so the stability structure 30 may held within the midsole 22 with the outsole 24. In other
 40 embodiments, the stability structure 30 may be fully embedded within the midsole 22. The stability structure 30 may be fixed within the cavity 26 of the midsole with an interference fit or with adhesive, for example. In an-
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other example, the stability structure 30 may be overmolded within the midsole 22 and fully embedded within the midsole foam. In another embodiment, the shoe may only have a midsole 22 that also acts as the outsole, where the support structure 30 is embedded in the midsole 22. For example, the midsole 22 may be formed of an outsole grade material, such as EVA, and have no separate outsole so the support structure 30 is contained within the midsole 22. In a further embodiment, the outsole 24 may also have a cavity to correspond to the lower surface of the stability structure 30, so that the stability structure 30 is contained or embedded in both the midsole 22 and outsole 24.

[0033] FIG. 3 illustrates a top perspective view of the outsole 24 with the midsole removed in order to better show the stability structure 30. FIG. 4 illustrates the stability structure 30 removed from the sole structure. As shown in FIGS. 3-4, the stability structure 30 includes several rods. The stability structure 30 may have three rods 32, 33, 34 spaced apart in the medial-lateral direction in the forefoot region 50. The stability structure 30 may include other numbers of rods, such as two rods, four rods, five rods or other suitable number of rods.

[0034] As shown in the embodiment in FIGS. 1-5, the rods 32-34 extend longitudinally in the sole structure 20. In the embodiment in FIGS. 1-5, the rods 32-34 extend from a midfoot region 48 toward the toe end 52. A medial rod 32 is positioned adjacent the medial side 56 of the shoe 10 and a lateral rod 34 is positioned adjacent the lateral side 58 of the shoe 10. A center rod 33 is positioned between the medial and lateral rods 32, 34.

[0035] The rods 32-34 are elongated and have a relatively small cross-section compared to the longitudinal dimension of the rods. The rods 32-34 have a generally rectangular cross-section. In one embodiment, the rods may have a thickness in the range of 1-5 millimeters. In another embodiment, the rods may have a thickness in the range of 1-3 millimeters. However, any suitable thickness or cross-section dimensions may be used. In other embodiments, the cross-section may be generally circular, elliptical, hexagonal trapezoidal, or other suitable shape. The rods 32-34 may be generally solid but may also be formed as generally hollow. Further, the cross-sectional shape may vary along a length of the rods 32-34 in the length direction, where the length direction extends from a toe end 52 to a heel end 54. In addition, each of the size and shape of each of the rods 32-34 may be different or vary. Not all of the rods 32-34 must be of the same geometry.

[0036] Each of the rods 32-34 may extend in the length direction in a generally horizontal plane. As such, the rods 32-34 may extend a plane parallel to a flat, level ground in the front half of the sole structure 20 from the midfoot region 48 to the forefoot region 50. In the embodiment shown in FIGS. 1-5, the rods 32-34 may extend generally parallel to a bottom surface 36 of

the outsole 24 that is relatively flat. In at least one embodiment, there is no foam or cushioning between the inner surface 38 of the outsole 24 and the rods 32-34.

[0037] As the rods 32-34 extend in the length direction, the rods 32-34 may be non-linear and not extending in a straight line and may be curved or bent. Each of the rods 32-34 may have different or varying shapes, contours, and/or positions in the medial-lateral direction. Having non-linear shapes along the longitudinal length of the rods 32-34 may allow the rods 32-34 be contoured to follow the general shape and anatomy of the foot. For example, the rods 32-34 may follow the contour of a toe or metatarsal bone, which may allow the metatarsal and phalangeal bone structures to be supported and guided through the movement phases and improve joint alignment during cuts and jumping.

[0038] The stability structure 30 also includes at least one connection bar connecting the rods 32-34. In the embodiment in FIGS. 1-5, the stability structure 30 includes two connections bars 40, 42. The connection bars 40, 42 are spaced apart in the length direction. The connection bars 40, 42 may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48. The connection bars 40, 42 may be positioned at or adjacent to a region of the metatarsophalangeal joints (MTP joints) and the bending location of the forefoot region. Positioning the connection bars 40, 42 at or adjacent to the MTP joints of the bone structure and anatomy of the foot helps to provide adequate support to the foot during movements. Further, the connection bars 40, 42 increase the stiffness at the MTP joints to increase propulsion while allowing for rotation in the frontal plane to account for the lateral component during curvilinear sprints, for example.

[0039] As one example, in a shoe that may be approximately 335 millimeters in length, the first connection bar 40 may be positioned approximately 262 millimeters from the heel end 54. The second connection bar 40 is spaced apart in the length direction and may be positioned approximately 209 millimeters from the heel end 54. In this example, the first and second connection bars 40, 42 may be positioned on either side of the MTP joint or bending line in the shoe. The dimension and positions may vary based on the shoe size or other features of the footwear. Further, the rods 32-34 may project towards the toe end 52, but have a free end spaced apart from the toe end 52 of the shoe.

[0040] As shown in FIGS. 3-4, the connection bars 40, 42 may extend from the medial side 56 to the lateral side 58 of the stability structure 30. The connection bars 40, 42 extend in a width direction being transverse to the length direction and/or transverse to the rods 32-34. The width direction may include an angle that is different than perpendicular to the length direction and/or rods 32-34. For example, the connection bars 40, 42 may extend at an angle where a medial side is positioned forward of a lateral side, or vice versa.

[0041] The connection bars 40, 42 may include con-

nection segments connecting at least two of the rods 32-34. The connection bar 40 has a first connection segment 43 and a second connection segment 44. The first connection segment 43 connects the medial rod 32 and the center rod 33. The second connection segment 44 connects the center rod 33 and the lateral rod 34.

[0042] The connection bar 42 has a third connection segment 45 and a fourth connection segment 46. The third connection segment 45 connects the medial rod 32 and the center rod 33. The fourth connection segment 46 connects the center rod 33 and the lateral rod 34.

[0043] The stability structure 30 may include a junction area 70 in the midfoot region 48 that connects a first end of the rods 32-34. The junction area 70 may constrain movement of the rods 32-34 at the first ends. In contrast, the toe ends of the rods 32-34 may be free ends that are not joined to allow each of the rods 32-34 to move independently.

[0044] As illustrated, each of the connection segments 43-46 may have different shapes or profiles. As shown in the embodiment in FIGS. 3-4, the first connection segment 43 and the third connection segment 45 have an arched shape that extends above the horizontal plane of the rods 32-34 while the second connection segment 44 and the fourth connection segment 46 have a flat linear shape.

[0045] FIGS. 6-7 show a bottom view of a shoe in contact with the floor during various stages of a contact cycle and how the forefoot of a shoe is impacted. In FIG. 6, the forefoot region 50 is making initial contact with the floor and the medial-lateral width widens at arrow A. During a second movement, medial-lateral compression occurs, as shown in FIG. 7 at arrow B, where the width on the lateral side 58 is compressed.

[0046] FIG. 8 shows the bottom view of a shoe with the stability structure 30 during contact with the floor. The connection segments 43, 45 on the medial side 56 allow the forefoot region 50 to splay or increase on the medial side during initial contact so the forefoot width increases to increase stability and to help the athletes cut faster. The arched shape of the connection segments 43, 45 may further increase the splay.

[0047] The connection segments 44, 46 on the lateral side 58 of the forefoot region 50 prevent the forefoot region from collapsing or compressing in the medial-lateral direction and increase forefoot width. The flat linear shape of the connection segments 44, 46 may further help maintain the forefoot width.

[0048] The stability structure 30 utilizes vertical forces during ground contact to press connection bars 40, 42 into the energy rods 32-34. This interaction spreads the forefoot section, providing additional lateral and medial support while preserving forefoot flexion stiffness. This synergy enhances both cutting performance and overall foot control, offering a balanced combination of flexibility, stability, and responsiveness

for high-performance athletes.

[0049] The vertical force from the athlete to the stability structure 30 expands the total potential surface area in the forefoot region 50 that provides flex stiffness and response while also providing a mechanical support structure to the lateral portion of the shoe 10 which would help with control and containment. The stability structure 30 in the forefoot region 50 has connection bars which act like a bridge. When force is applied to the bridge, it directs the pressure downward into the rods, causing them to move laterally and medially in a "splay" motion. This splay action increases the functional surface area of the stiff forefoot element, enhancing stability during cutting and other high-force maneuvers. Additionally, this mechanism improves eversion torsion control and extends the stiff rods to the lateral side of the shoe, reinforcing stability and providing added resistance against shearing forces.

[0050] The region from the toe end 52 to the midfoot 48 is particularly important and plays a critical role in push-off movements of the foot when the athlete changes direction or sprints in a non-linear path. To support these movements, the stability structure 30 of the sole is specifically designed to provide targeted reinforcement in this area. However, portions of the stability structure 30 may also extend beyond the midfoot area 48 into the heel region 60 of the sole. The stability structure 30 may include at least one heel extension 64 that extends rearward from the midfoot region 48. As illustrated, the stability structure 30 includes two heel extension rods 66, 68.

[0051] FIGS. 9-10 illustrate a sole structure 120 according to another embodiment. The midsole 122 is not shown in order to better view the stability structure 130. The sole structure 120 with the midsole 122 and outsole 124 may have common features and corresponding components as discussed above and are not repeated again here.

[0052] The sole structure 120 includes the stability structure 130, as shown in FIGS. 9-10. As shown in FIGS. 9-10, the stability structure 130 includes several rods. The stability structure 130 may have three rods 132, 133, 134 spaced apart in the medial-lateral direction in the forefoot region 50. The stability structure 130 may include other numbers of rods, such as two rods, four rods, five rods, or other suitable numbers of rods.

[0053] As shown in the embodiment in FIGS. 9-10, the rods 132-134 extend longitudinally in the sole structure 120. In the embodiment in FIGS. 9-10 the rods 132-134 extend from a midfoot region 48 toward the toe end 52. A medial rod 132 is positioned adjacent the medial side 56 of the shoe, and a lateral rod 134 is positioned adjacent the lateral side 58 of the shoe. A center rod 133 is positioned between the medial and lateral rods 132, 134.

[0054] The stability structure 130 also includes at least one connection bar connecting the rods 132-134. In the embodiment in FIGS. 9-10, the stability structure

130 includes two connection bars 140, 142. The connection bars 140, 142 are spaced apart in the length direction. The connection bars 140, 142 may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48. The connection bars 140, 142 may be positioned at or adjacent to a region of the metatarsophalangeal joints (MTP joints).

[0055] The connection bars 140, 142 may include connection segments connecting at least two of the rods 132-134. The connection bar 140 has a first connection segment 143 and a second connection segment 144. The first connection segment 143 connects the medial rod 132 and the center rod 133. The second connection segment 144 connects the center rod 133 and the lateral rod 134.

[0056] The connection bar 142 has a third connection segment 145 and a fourth connection segment 146. The third connection segment 145 connects the medial rod 132 and the center rod 133. The fourth connection segment 146 connects the center rod 133 and the lateral rod 134.

[0057] As shown in FIGS. 9-10, the connection segments 143-146 have an arched shape that extends above the horizontal plane. The arched shape of the connection segments 143, 145 may further enhance the splay during contact with the floor. The connection segments 143, 145 on the medial side 56 allow the forefoot region 50 to splay or expand on the medial side during initial contact, increasing forefoot width to improve stability and help athletes cut faster.

[0058] The connection segments 144, 146 on the lateral side 58 of the forefoot region 50 allow the forefoot region 50 to splay or expand on the lateral side 58 during a second movement, such as a cutting movement, increasing forefoot width to improve stability and help athletes change direction faster, for example.

[0059] Each of the rods 132-134 may extend in the length direction in a generally horizontal plane. As such, the rods 132-134 may extend in a plane parallel to a flat, level ground in the front half of the sole structure 120 from the midfoot region 48 to the forefoot region 50. In the embodiment shown in FIGS. 9-10, the rods 132-134 may extend generally parallel to a bottom surface 136 of the outsole 124, which is relatively flat. In at least one embodiment, there is no foam or cushioning between the inner surface 138 of the outsole and stability structure 130.

[0060] In another embodiment, shown in FIG. 11, the stability structure 130 also includes support portions 160 positioned under the connection bars 140, 142. In particular, support portions 160 are positioned under each of the connection segments 143-146. In one embodiment, the support portions 160 are positioned between the connection segments 143-146 and one of the midsole 122 or the outsole 124. The support portions 160 may be formed of foam, such as the foam in the midsole 122. The support portions 160 may be integrally formed with the midsole 122 and may be the

same material. Alternatively, the support portions 160 may be a different foam or material than the midsole 122 to provide different deformation properties to the stability structure 130. The support portions 160 may control the rate of splay along the forefoot based on the different forces by the athlete. The stability portions 160 may be positioned under all of the connection segments 143-146 or may be positioned under a few of the connection segments 143-146.

[0061] FIGS. 12-13 illustrate a sole structure 220 according to another embodiment. The midsole 222 is not shown in order to better view the stability structure 230. The sole structure 220, with the midsole 222 and outsole 224, may have common features and corresponding components as discussed above and are not repeated again here.

[0062] The sole structure 220 includes the stability structure 230, as shown in FIGS. 12-13. As shown in FIGS. 12-13, the stability structure 230 includes several rods. The stability structure 230 may have three rods 232, 233, 234 spaced apart in the medial-lateral direction in the forefoot region 50. The stability structure 230 may include other numbers of rods, such as two rods, four rods, five rods, or other suitable numbers of rods.

[0063] As shown in the embodiment in FIGS. 12-13, the rods 232-234 extend longitudinally in the sole structure 120. In the embodiment in FIGS. 12-13 the rods 232-234 extend from a midfoot region 48 toward the toe end 52. A medial rod 232 is positioned adjacent the medial side 56 of the shoe, and a lateral rod 234 is positioned adjacent the lateral side 58 of the shoe. A center rod 233 is positioned between the medial and lateral rods 232, 234.

[0064] The stability structure 230 also includes at least one connection bar connecting the rods 232-234. In the embodiment in FIGS. 12-13, the stability structure 230 includes two connection bars 240, 242. The connection bars 240, 242 are spaced apart in the length direction. The connection bars 240, 242 that may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48. The connection bars 240, 242 may be positioned at or adjacent to a region of the metatarsophalangeal joints (MTP joints).

[0065] As illustrated, each of the connection bars 240, 242 may be generally planar. The connection bars 240, 242 may be generally linear and extend between the rods 232-234. The connection bars 240, 242 may be in the same plane as the rods 232-234 or may be in a plane above or below the rods 232-234.

[0066] The connection bars 240, 242 may include connection segments connecting at least two of the rods 232-234. Each of the connection segments 243, 244, 245, 246 may be generally planar and linear. As shown, the connection segments 243-246 may be generally parallel to each other. Further, a first connection segment 243 and a second connection segment 244 may be colinear with each other, as shown. Alternatively, the connection segments 243-246 may be posi-

tioned at different angles relative to the rods 232-234.

[0067] The flat planar shape of the connection segments 243-246 prevent the forefoot width from collapsing during contact of the sole structure 230 to improve stability and athlete performance.

[0068] FIGS. 14-19 illustrate examples of various configurations of the sole structure and connection bars of the stability structure. The connection bars and/or connection segments within the stability structure may have various arched shapes, each designed to provide unique stiffness and splay properties tailored to enhance athletic performance. These shapes may include elliptical profiles, parabolic curves, sinusoidal waves, and linear peaks, hills, among others. Each shape may be strategically positioned to influence the medial-lateral (M-L) stiffness and the degree of forefoot splay during dynamic movements. FIG. 14 illustrates two connection segments connecting stability structures with three rods, while FIG. 15 illustrates three connection segments connecting stability structures with four rods.

[0069] In one embodiment, the connection segments may be elliptical-shaped connection segments 300, 400. The elliptical shaped connection segments 300, 400 may vary in their aspect ratios, ranging from narrow, elongated ellipses to wider, more circular shapes, depending on the desired balance of stiffness and flexibility, for example, and to vary the height and width dimensions within the sole structure. A larger major-to-minor radius ratio results in a narrower, elongated ellipse. In contrast, a smaller ratio produces a wider, more circular profile. The curved design ensures consistent distribution of force along the segment without creating pressure points. The elliptical connection segments may connect to the rods along the major axis, as generally shown in FIGS. 14 and 15, or may connect to the rods along any portion of the ellipse.

[0070] In another embodiment, the connection segments may be sinusoidal-shaped connection segments 302, 402. The wave-like sinusoidal-shape connection segments 302, 402 have wave-like, undulating geometry, featuring alternating peaks and troughs along their length. The sinusoid shape can vary in amplitude, which determines the height of the peaks and depth of the troughs, as well as in wavelength, which defines the distance between consecutive peaks or troughs. The sinusoidal pattern may also include symmetrical or asymmetrical variations, with peaks and troughs of differing heights or widths. Additionally, the transitions between peaks and troughs can range from smooth, gradual curves to sharper, more angular changes. The rods may generally connect at the troughs of the sinusoid.

[0071] In another embodiment, the connection segments may be parabolic-shaped connection segments 304, 404. The parabolic-shaped connection segments 304, 404 are defined by their curved shape, following the geometry of a parabola. The vertex location is posi-

tioned between the rods, and curvature is determined by the parabola's focal length and orientation. A shorter focal length results in a steeper curve, while a longer focal length produces a more gradual slope. As shown in FIGS. 14-15, the vertex is generally symmetrically positioned between the rods, however the symmetry of the parabola can be modified, allowing for asymmetric profiles.

[0072] In another embodiment, the connection segments may be linear peak connection segments 306, 406. The linear peak connection segments 306, 406 are characterized by their angular, triangular geometry, defined by a central peak and sloping sides. The height of the peak can vary, creating profiles with taller, sharper points or shorter, flatter summits. The peak location is positioned between the rods. The linear slopes can have varying steepness, ranging to have narrow or wide triangular shapes. As shown in FIGS. 14-15, the peak is generally symmetrically positioned between the rods, however the linear peak profile can be asymmetric where one side of the peak is steeper or longer than the other.

[0073] In another embodiment, the connection segments may be hill-shaped segments 308, 408 or 310, 410. The hill-shaped connection segments 308, 408 may have linear slopes and a linear plateau, where the rods are connected at the base of the slopes. In contrast, the hill-shaped connection segments 310, 410 may have a more gradually curved flat top where the rods are connected at the base of the hill. As shown in FIGS. 14-15, the hill is generally symmetrically positioned between the rods, however the hill profile can be asymmetric where one side of the slope is steeper or longer than the other.

[0074] In one embodiment, the height of the arched connection segments In FIGS. 14-15, may have a height in the range of 5-20 millimeters. In another embodiment, the height of the arched connection segments may be in the range of 6-10 millimeters. However other heights of the arched connection segments are contemplated based on the overall sole structure height and stability requirements. Further, the stability structure may use a combination of arched shape connection rods that extend above the rods and/or flat connection rods. For example, increasing horizontal arch length could increase medial-lateral stiffness. The longer the horizontal arch, the stiffer the stability structure. By carefully selecting and integrating these shapes into the stability structure, the design ensures a seamless blend of support, splay, and stiffness, addressing the multifaceted needs of basketball players.

[0075] The different shapes may have different stiffness properties and provide different amounts of splay. The connection segments may achieve similar vertical stiffness properties as the foam, and typical flex properties so athletes cannot feel the arched shape as a pressure point. FIGS. 16-19 illustrate variations in the mid-sole configuration that may also provide variations in

splay. The foam in the midsole has a small amount of horizontal deformation/splay by itself. By adding gaps or holes in the material, such as foam, the horizontal deformation or splay may be increased.

[0076] FIG. 16 illustrates a midsole 420 with a stability structure 422, where the midsole has a hole or gap 424 positioned adjacent each arched connection segment 426. The gap 424 may be generally vertical. The gap 424 may also be positioned symmetrically between the rods.

[0077] FIG. 17 illustrates a midsole 420 with a stability structure 422, where the midsole has an angled hole or gap 430 positioned adjacent each arched connection segment 426. The angled gap 430 may be angled outward, as illustrated. The gap 430 may also be arranged in mirrored symmetry between the rods.

[0078] FIG. 18 illustrates a midsole 420 with a stability structure 422, where the midsole has a plurality of vertical gaps 424, 434. The vertical gaps 424 may be positioned below each arched connection segment 426 and additional vertical gaps 434 may be positioned outside each connection segment 426. The vertical gaps 424, 434 may have a height that is generally the same as the height of the connection segment.

[0079] FIG. 19 illustrates a midsole 420 with a stability structure 422, where the midsole has angled holes 430 and vertical holes 434. As shown, the vertical holes may be positioned outside each connection segment 426, however, the vertical holes may also be positioned below each arched connection segment 426.

[0080] FIGS. 20-22 illustrate a shoe 500 with a sole structure 520 according to another embodiment. The description of corresponding members, elements, and components of the shoe 10 also applies to FIGS. 20-23 and is therefore not repeated again. As shown in FIGS. 20-22, the sole structure includes a stability structure 530 positioned within the midsole 522. FIG. 20 illustrates the shoe 500 and a cut-away section view of the sole structure 520 to illustrate the stability structure 530 embedded or contained within the midsole 522 and/or the outsole 524.

[0081] FIG. 21 is an exploded view of the sole structure 520. The midsole 522 may have a cavity to correspond to the stability structure 30 so that the stability structure is at least partially contained within the midsole. As shown, the midsole 522 may include two portions, an upper midsole portion 526 and a heel midsole portion 528. The heel midsole portion 528 may be positioned between the stability structure 530 and the outsole 524, while the upper midsole portion 526 is positioned above the stability structure 530. The stability structure 530 may be supported by the heel midsole portion 528 along the midfoot region 48 and the heel region 60. The stability structure 530 may slope down to be supported by the outsole 524 in the forefoot region 50. In this arrangement, the stability structure 530 may be positioned between the midsole 22 and the outsole 24 or partially embedded within both the midsole

522. In other embodiments, the stability structure 530 may be fully embedded within the midsole 522. For example, the stability structure 30 may be over molded within the midsole 522 and fully contained within the midsole foam of the upper midsole portion 526 and heel midsole portion 528.

[0082] FIG. 22 illustrates the bottom view of the shoe 500. As shown in FIG. 22, the stability structure 530 includes several rods. The stability structure 530 may have six rods 531, 532, 533, 534, 535 spaced apart in the medial-lateral direction in the forefoot region 50. The stability structure 530 may include other numbers of rods, such as two rods, three rods, four rods, five rods, or other suitable number of rods.

[0083] As shown in the embodiment in FIGS. 20-22 and discussed above, the rods 531-536 extend longitudinally in the sole structure 520. In the embodiment in FIGS. 20-22, the rods 531-536 extend from a midfoot region 48 toward the toe end 52. A medial rod 531 is positioned adjacent the medial side 56 of the shoe 500 and a lateral rod 536 is positioned adjacent the lateral side 58 of the shoe 500. The stability structure 530 includes central rods 532, 533, 534 spaced apart in the medial-lateral direction between the medial and lateral rods 531, 535.

[0084] The rods 531-536 are elongated and have a relatively small cross-section compared to the longitudinal dimension of the rods. The rods 531-536 have a generally rectangular cross-section. However, the cross-section may be generally circular, elliptical, hexagonal, trapezoidal, or other suitable shape. The rods 531-536 may be generally solid but may also be formed as generally hollow. Further, the cross-sectional shape may vary along a length of the rods in the length direction. In addition, each of the size and shape of each of the rods 531-536 may be different or vary. Not all of the rods 531-536 must be of the same geometry.

[0085] As shown in FIG. 20, the rods 531-536 may slope down from the midfoot region 58 and extend in the length direction in a generally horizontal plane in the forefoot region 50. In the forefoot region 50, the rods 531-536 may extend in a plane parallel to a flat, level ground and generally parallel to a bottom surface 556 of the outsole 524 that is relatively flat.

[0086] As the rods 531-536 extend in length direction, the rods 531-536 may be non-linear and not extending in a straight line and may be curved or bent. Each of the rods 531-536 may have different or varying shapes, contours, and/or positions in the medial-lateral direction. Having non-linear shapes along the longitudinal length of the rods 531-536 may allow contour to the general shape and anatomy of the foot. For example, the five rods 531-536 may follow the contour of each toe or metatarsal bone, which may allow the metatarsal and phalangeal bone structures to be supported and guided through the movement phases and improve joint alignment during cuts and jumps.

[0087] The stability structure 530 also includes at

least one connection bar connecting the rods 531-536. In the embodiment in FIGS. 20-22, the stability structure 530 includes three connections bars 540, 542, 544. The connection bars 540, 542, 544 are spaced apart in the length direction. The connection bars 540, 542, 544 may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48. The connection bars 540, 542, 544 may be positioned at or adjacent to a region of the metatarsophalangeal joints (MTP joints). Positioning the connection bars 540, 542, 544 at or adjacent to the MTP joints of the bone structure and anatomy of the foot helps to provide adequate support to the foot during movements. Further, the connection bars 540, 542, 544 increase the stiffness at the MTP joints to increase propulsion while allowing for rotation in the frontal plane to account for the lateral component during curvilinear sprints, for example.

[0088] The connection bars 540, 542, 544 may include connection segments connecting at least two of the rods 531-536. As shown in FIG. 22, the first and third connection bars 540, 544 connect two of the center rods 533, 534. The second connection bar 542 may connect to the two other center rods 532, 535 and may be a bridge over but may not be connected the other center rods 533, 534. In an alternate embodiment, the second connection bar 542 may connect the four center rods 532-535. The connection bar 542 has a webbed connection segments 546, a solid connection segment 547. The webbed connection segments 546 may have at least two webbed legs connected to a rod, as shown in FIG. 22.

[0089] In the embodiment in FIGS. 20-22, the medial rod 531 and the lateral rod 536 may not be connected to any connection bars. However, the connection bars 540, 542, 544 may extend from the medial side 56 to the lateral side 58 of the stability structure 530. The connection bars 540, 542, 544 extend transverse to the length direction and/or transverse to the rods 531-536. The width direction may include an angle that is different than perpendicular to the length direction and/or rods 531-536. As illustrated and discussed above, each of the connection bars 540, 542, 544 may have different shapes or profiles.

[0090] The stability structure 530 may include a junction area 570 in the midfoot region 50 that connects a first end of the rods 531-535. The junction area 570 may constrain movement of the rods 531-535 at the first ends. In contrast, the toe ends of the rods 531-535 may be free ends that are not joined to allow each of the rods 531-535 to move independently.

[0091] FIG. 22 illustrates the bottom view of the shoe 500 with the stability structure 530 shown in broken lines. The outsole 524 may include at least one relief area 580. As shown, the outsole 524 includes six relief areas 580, however, any number of relief areas 580 may be provided in the outsole 524 as slits or openings that extend through the outsole 524. The relief areas 580 allow the sole to widen or splay in the medial-lat-

eral direction. When the outsole 524 contacts the floor, the relief areas 580 may widen in the medial-lateral direction. Alternatively, the relief areas 580 may be formed to be thinner than the rest of the outsole 524 or formed of a different material being different than the rest of the outsole 524, having less stiffness or rigidity, for example.

[0092] FIGS. 23-25 illustrate a shoe 600 with a sole structure 620 according to another embodiment. As shown in FIGS. 23-25 the sole structure 620 includes a stability structure 630 positioned having two parts. The description of corresponding members, elements, and components of the shoe 10 also applies to FIG. 23-25 and is therefore not repeated again.

[0093] FIG. 24 is an exploded view of the sole structure 620. The stability structure 630 includes an upper stability structure 632 and a lower stability structure 634. The midsole 622 may also include two portions, an upper midsole portion 626 and a heel midsole portion 628.

[0094] The heel midsole portion 628 may be positioned between the upper stability structure 632 and lower stability structure 634. The upper midsole portion 626 is positioned above the upper stability structure 632.

[0095] The upper stability structure 632 may be supported by the heel midsole portion 628 along the midfoot 48 and then slope down toward the outsole 624 in the forefoot region 50. The lower stability structure 634 extends in a plane parallel to a flat, level ground and generally parallel to a bottom surface 636 of the outsole 624 that is relatively flat. Along the forefoot region 50, the upper and lower stability structures 632, 634 may be generally coplanar.

[0096] As shown in FIGS. 24-25, the stability structure 630 includes several rods. The stability structure 630 may have four rods 651, 652, 653, 654 spaced apart in the medial-lateral direction in the forefoot region 50. As shown in the embodiment in FIGS. 23-25 and discussed above, the rods 651-654 extend longitudinally in the sole structure 620. The upper stability structure 632 includes a medial rod 651 that is positioned adjacent the medial side 56 of the shoe 600 and a lateral rod 654 is positioned adjacent the lateral side 58 of the shoe 600. The lower stability structure 634 includes central rods 652, 653 between the medial and lateral rods 651, 654.

[0097] As the rods 651-654 extend in length direction, the rods 651-654 may be non-linear and not extending in a straight line and may be curved or bent. Each of the rods 651-654 may have different or varying shapes, contours, and/or positions in the medial-lateral direction. Having non-linear shapes along the longitudinal length of the rods 651-654 may allow contour to the general shape and anatomy of the foot. For example, the four rods 651-654 may follow the contour of each toe or metatarsal bone, which may allow the metatarsal and phalangeal bone structures to be supported guided

through the movement phases and improve joint alignment during cuts and jumping.

[0098] The upper stability structure 632 includes at least one connection bar 640 connecting the rods 651, 654. The lower stability structure 634 also includes at least one connection bar 642 connecting the center rods 652, 653. In one embodiment, the lower stability structure 634 has two connection bars 642, 644 connecting the center rods 652, 653. As discussed above, the connection bars 540, 542, 544 may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48.

[0099] FIG. 25 illustrates the bottom view of the shoe 600 with the stability structure 630 shown in broken lines. The outsole 624 may include one or more relief areas 680. As shown, the outsole 624 includes two relief areas 680, however, any number of relief areas 680 may be provided in the outsole 624. The relief areas 680 allow the sole to widen or splay in the medial-lateral direction. The relief areas 680 may be slits or openings that extend through the outsole 624, as illustrated in FIG. 25. When the outsole 624 contacts the floor, the relief areas 680 may widen in the medial-lateral direction. As illustrated, the outsole 624 includes two relief areas 680. The relief areas 680 may be positioned between the rods 651-654 of the upper and lower stability structures 632, 634.

[0100] FIG. 26 illustrates a stability structure 730 according to another embodiment. The description of corresponding members, elements, and components of the shoe 10 also applies to FIG. 26 and is therefore not repeated again.

[0101] FIG. 26 illustrates a stability structure 730 removed from the sole structure. As shown in FIG. 26, the stability structure 730 includes five rods 731, 732, 733, 734, 735 spaced apart in the medial-lateral direction. The stability structure 730 may include other numbers of rods, such as two rods, three rods, four rods, or other suitable number of rods.

[0102] In the embodiment in FIG. 26 the stability structure 730 includes three connections bars 740, 742, 744. The connection bars 740, 742, 744 are spaced apart in the length direction. The connection bars 740, 742, 744 may be positioned in the forefoot region 50 between the toe end 52 and the midfoot region 48. The connection bars 740, 742, 744 may be positioned at or adjacent to a region of the metatarsophalangeal joints (MTP joints).

[0103] As the rods 731-735 extend in length direction, the rods 731-735 may be non-linear and not extending in a straight line and may be curved or bent. Each of the rods 731-735 may have different or varying shapes, contours, and/or positions in the medial-lateral direction. Having non-linear shapes along the longitudinal length of the rods 731-735 may allow contour to the general shape and anatomy of the foot. For example, the five rods 731-735 may follow the contour of each toe or metatarsal bone, which may allow the metatarsal

and phalangeal bone structures to be supported and guided through the movement phases and improve joint alignment during cuts and jumps.

[0104] The connection bars 740, 742, 744 may include connection segments connecting at least two of the rods 731-735. As shown in FIG. 26, the first and third connection bars 740, 744 connects two of the center rods 732, 734 and arch over rod 733. The second connection bar 742 connects three rods 731, 733, 735. The connection bar 742 has a first connection segment 753, a second connection segment 744 and a third connection segment 754. The first connection segment 753 extends from the medial rod 731 toward the center rod 733. The second connection segment 754 is connected to the center rod 733. The third connection segment 755 extends from the lateral rod 735 toward the center rod 733. The second connection segment 754 is generally flat or planar. The first and third connection segments 753, 755 are arched over rods 732, 734, respectively. The second connection bar 742 may have only two connection segments that connects the rods 731, 733, 735 or be any suitable shape.

[0105] The connection bars 740, 742, 744 may extend from the medial side 56 to the lateral side 58 of the stability structure 730. The connection bars 740, 742, 744 extend transverse to the length direction and/or transverse to the rods 731-735. The width direction may include an angle that is different than perpendicular to the length direction and/or rods 731-735. As illustrated and discussed above, each of the connection bars 740, 742, 744 may have different shapes or profiles.

[0106] FIG. 27 illustrates a stability structure 770 according to another embodiment. The description of corresponding members, elements, and components of the shoe 10 also applies to FIG. 26 and is therefore not repeated again.

[0107] FIG. 27 illustrates a stability structure 770 removed from the sole structure. As shown in FIG. 27, the stability structure 770 includes three rods 782, 783, 784 spaced apart in the medial-lateral direction. The stability structure 770 may include other numbers of rods, such as two rods, four rods, five rods or other suitable number of rods.

[0108] In the embodiment in FIG. 27 the stability structure 770 includes three connections bars 790, 792, 794. The connection bars 790, 792, 794 are spaced apart in the length direction. As shown, the connection bars 790, 792, 794 may be equally spaced apart by a distance generally equal to a longitudinal dimension of the connection bars.

[0109] The connection bars 790, 792, 794 may extend from the medial side 56 to the lateral side 58 of the stability structure 770. Alternatively, the connection bars 790, 792, 794 may connect at least two rods or connect to only a portion of the rods. The connection bars 790, 792, 794 extend transverse to the length direction and/or transverse to the rods 782-784. The

width direction may include an angle that is different than perpendicular to the length direction and/or rods 782-784. As illustrated and discussed above, each of the connection bars 790, 792, 794 may have the same shapes or profiles, however the connection bars 790, 792, 794 may have different shapes or profiles.

[0110] FIGS. 28-35 illustrate further embodiments of the stability structure of the present disclosure having rods in various configurations connected by connection bars to increase splay and provide stability in the forefoot region of the shoe. The description of corresponding members, elements, and components of the shoe 10 also applies to FIGS. 28-35 is therefore not repeated again.

[0111] FIG. 28 illustrates a stability structure 830 removed from the sole structure. As shown in FIG. 28, the stability structure 830 includes five rods spaced apart in the medial-lateral direction. The stability structure 830 has a single connection bar 840 in the forefoot region 50. The connection bar 840 connects at least a medial rod 831 to a lateral rod 835. However, the connection bar 840 may connect all of the rods 831-835 or connect some of the rods with connection segments. The rods 831-835 may intersect at the midfoot region, but there may not be a solid junction member. The stability structure 830 may also have heel extension 860 that extends rearwardly beyond the midfoot region 48 and into a heel area of the sole structure. The rods 831-835 wrap and merge into each other in the heel region 60 and form the heel extension 860 as a rear loop.

[0112] FIG. 29 illustrates a stability structure 930 removed from the sole structure. As shown in FIG. 29, the stability structure 930 includes five rods 931-935 spaced apart in the medial-lateral direction. The stability structure 930 has a single connection bar 940 in the forefoot region 50. The connection bar 940 is formed as a webbed bar and connects at least the medial rod 931 to the lateral rod 935 with webbed connection legs 942. However, the connection bar 940 may connect all of the rods 931-935 or connect some of the rods with connection segments.

[0113] FIGS. 30-31 illustrate stability structures similar to FIG. 29 having webbed connection bar. In FIG. 30, a stability structure 1030 has an increased forefoot width at the location of the connection bar 1040 which allows greater spacing between the rods in the medial-lateral direction. FIG. 31 illustrates a stability structure 1130 with more curvature in the rods. While the connection rod 1140 extends transverse to the rods, the connection rod 1140 may not be perpendicular to the length direction of the shoe.

[0114] FIG. 32 illustrates a stability structure 1230 removed from the sole structure. As shown in FIG. 32, the stability structure 1230 includes five rods 1231-1235 spaced apart in the medial-lateral direction. The stability structure 1230 has at least two connection bars 1140, 1242 in the forefoot region 50. The connec-

tion bar 1240 is formed as a webbed bar and connects at least the medial rod 1231 to the lateral rod 1235 with webbed connection legs. The second connection bar 1242 connects the central rods 1232, 1224. The first connection bar 1240 may be position over the connection bar 1242. The stability structure 1230 may also have heel extension 1260 that extends rearwardly beyond the junction area 1270 in midfoot region 48. The heel extension 1260 may include two heel rods 1262 spaced apart in the medial-lateral direction in the heel area of the sole structure. The heel rods 1262 may have a greater width and/or cross-sectional area than rods 1231-1235 in the forefoot region.

[0115] FIG. 33 illustrates a stability structure 1330 removed from the sole structure. As shown in FIG. 33, the stability structure 1330 includes five rods 1331-1335 spaced apart in the medial-lateral direction. The stability structure 1330 has at least three connection bars 1340, 1342 in the forefoot region 50. The connection bar 1340 is formed as a webbed bar and connects at least the medial rod 1331 to the lateral rod 1335 with webbed connection legs. The second and third connection bars 1342 connects the central rods 1332, 1334. The connection bars 1342 may be adjacent the first connection rod 1340 and spaced apart longitudinally. The first connection bar 1240 may be position over the connection bars 1342. The heel extension 1360 extends rearwardly beyond the midfoot region 48 and into a heel area of the sole structure. The rods 1331-1335 wrap and merge into each other in the heel region 60 and form the heel extension 1360 as a rear loop.

[0116] FIG. 34 illustrates a stability structure 1430 removed from the sole structure. As shown in FIG. 34, the stability structure 1430 includes five rods spaced apart in the medial-lateral direction. The stability structure 1430 has at least three connection bars 1440, 1442 in the forefoot region 50, similar to FIG. 33. The stability structure 1230 may also have heel extension 1460 that extends rearwardly beyond the junction area 1470 in midfoot region 48. The junction area may have an elongated plate area in the midfoot region 48 to provide additional support to the athlete's arch. The junction area 1470 may also have a relief opening 1472 to provide the desired flexibility while also having increased stability. The heel extension 1460 may include two heel rods 1462 spaced apart in the medial-lateral direction in the heel area of the sole structure. The heel rods 1462 may have a greater width and/or cross-sectional area than rods in the forefoot region.

[0117] FIG. 35 illustrates a stability structure 1530 removed from the sole structure. As shown in FIG. 35, the stability structure 1530 includes three rods spaced apart in the medial-lateral direction. The stability structure 1530 has a single connection bar 1540 in the forefoot region that connects the rods 1531, 1532, 1533. The connection bar 1540 may have slot openings 1546 positioned between the rods. The stability structure

1530 may also have heel extension 1560 that extends rearwardly beyond the junction area 1570 in midfoot region 48. The heel extension 1560 may include two heel rods 1562 spaced apart in the medial-lateral direction in the heel area of the sole structure. The heel rods 1562 may have a width and/or cross-sectional area that is generally the same as the rods 1531-1533 in the forefoot region.

[0118] While exemplary embodiments are described above, it is not intended that these embodiments describe all possible forms of the invention. Rather, the words used in the specification are words of description rather than limitation, and it is understood that various changes may be made without departing from the spirit and scope of the invention. Additionally, the features of various implementing embodiments may be combined to form further embodiments of the invention.

[0119] A person of ordinary skill in the art will understand, however, that the features and possible modifications described with reference to these specific embodiments may also be further modified and/or combined with one another in a different manner or in different sub-combinations, without departing from the scope of the present disclosure. Individual features or sub-features may also be omitted if they are dispensable to obtain the desired result.

[0120] In the following, further embodiments are described to facilitate understanding the invention:

1. A shoe comprising:

a sole structure connected to a shoe upper, the sole structure comprising:

a midsole providing cushioning;

an outsole having an outer surface for contacting the ground;

a stability structure at least partially positioned within the midsole comprising:

a plurality of rods extending in a length direction from at least a midfoot region of the shoe toward a toe end of the shoe; and

at least one connection bar connecting at least two of the plurality of rods in a forefoot region of the shoe, the connection bar extending in a width direction being transverse to the length direction.

2. The shoe of embodiment 1, wherein each of the plurality of rods are connected at a first end at a junction area along the midfoot region and wherein a second end adjacent the toe end is free, wherein the connection bar is positioned between the first end and the second end.

3. The shoe of one of embodiments 1 or 2, wherein the plurality of rods is generally planar along the

forefoot region.

4. The shoe of one of the preceding embodiments, wherein the connection bar includes at least one segment being arched and extending above a plane of the plurality of rods.

5. The shoe of one of the preceding embodiments, wherein the connection bar comprises a first segment connecting at least two of the rods, and a second segment connecting at least two rods, wherein the first and second segments are configured to move the rods independently during a contact cycle with the ground.

6. The shoe of embodiment 5, wherein the first segment connects at least two rods on a medial side, and the second segment connects at least two rods on a lateral side, wherein the first and second segments are configured to move the medial side independently from the lateral side during the contact cycle with the ground.

7. The shoe of one of embodiments 5 or 6, wherein the first segment has a first shape, and the second segment has a second shape.

8. The shoe of one of the preceding embodiments, wherein the at least one connection bar comprises at least two connection bars spaced apart in the length direction.

9. The shoe of one of the preceding embodiments, wherein the plurality of rods extend generally parallel to a generally flat outer support surface of the outsole.

10. The shoe of one of the preceding embodiments, wherein the midsole includes a cavity to receive the stability structure.

11. The shoe of one of the preceding embodiments, wherein the outsole includes one or more relief areas that change in width during a contact cycle with the ground.

12. A sole structure for a shoe, the sole structure comprising:

a midsole;

a stability structure at least partially positioned within the midsole and comprising a plurality of rods extending in a length direction, wherein at least two of the plurality of rods are connected by a connection bar extending in a width direction being transverse to the length direction.

13. The sole structure of one of the preceding em-

bodiments, wherein the plurality of rods comprises three rods.

14. The sole structure of embodiment 13, wherein the connection bar is connected to the three rods.

15. The sole structure of one of the preceding embodiments, wherein the plurality of rods comprises at least four rods.

16. The sole structure of embodiment 15, wherein the connection bar is connected to the four rods.

17. The sole structure of one of the preceding embodiments, wherein the at least one connection bar comprises at least two connection bars spaced apart in the length direction.

18. A shoe comprising:

an upper;
a sole structure connected to the upper, the sole structure comprising:

a midsole providing cushioning;

a stability structure at least partially positioned within the midsole comprising:

a plurality of rods extending in a length direction from at least a midfoot region toward a toe end,
at least one connection bar connecting the plurality of rods in a forefoot region of the shoe, the connection bar having a first segment connecting at least two rods on a medial side, and a second segment connecting at least two rods on a lateral side,
wherein the first and second segments are configured to move the medial side independently from the lateral side during a contact cycle with the ground.

19. The shoe of one of the preceding embodiments, wherein the at least one connection bar comprises at least two connection bars spaced apart in the length direction.

20. The shoe of one of the preceding embodiments, wherein the plurality of rods is generally planar from the midfoot region to the forefoot region.

Claims

1. A shoe comprising:
a sole structure connected to a shoe upper, the sole structure comprising:

a midsole providing cushioning;
an outsole having an outer surface for contacting the ground;
a stability structure at least partially positioned within the midsole comprising:

a plurality of rods extending in a length direction from at least a midfoot region of the shoe toward a toe end of the shoe; and
at least one connection bar connecting at least two of the plurality of rods in a forefoot region of the shoe, the connection bar extending in a width direction being transverse to the length direction.

2. The shoe of claim 1, wherein each of the plurality of rods are connected at a first end at a junction area along the midfoot region and wherein a second end adjacent the toe end is free, wherein the connection bar is positioned between the first end and the second end.

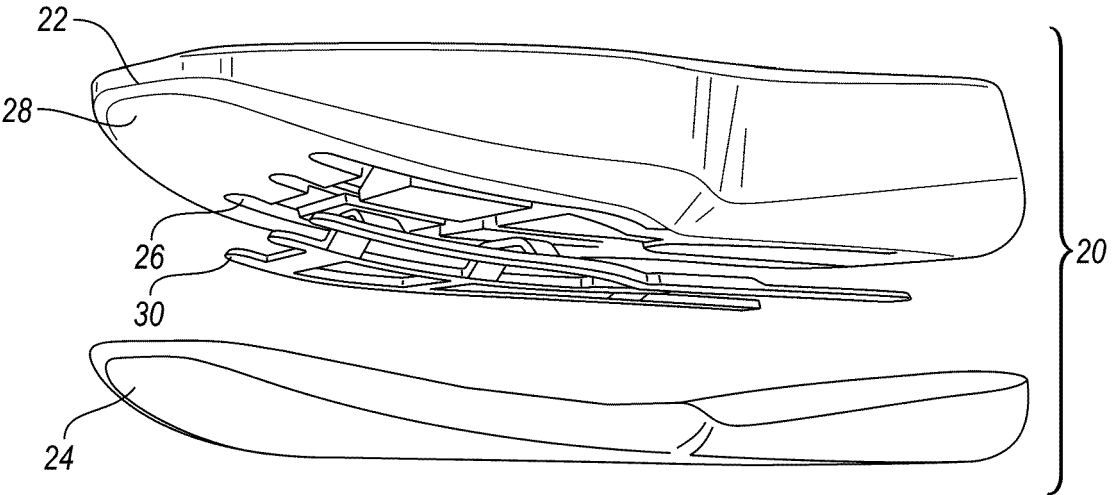
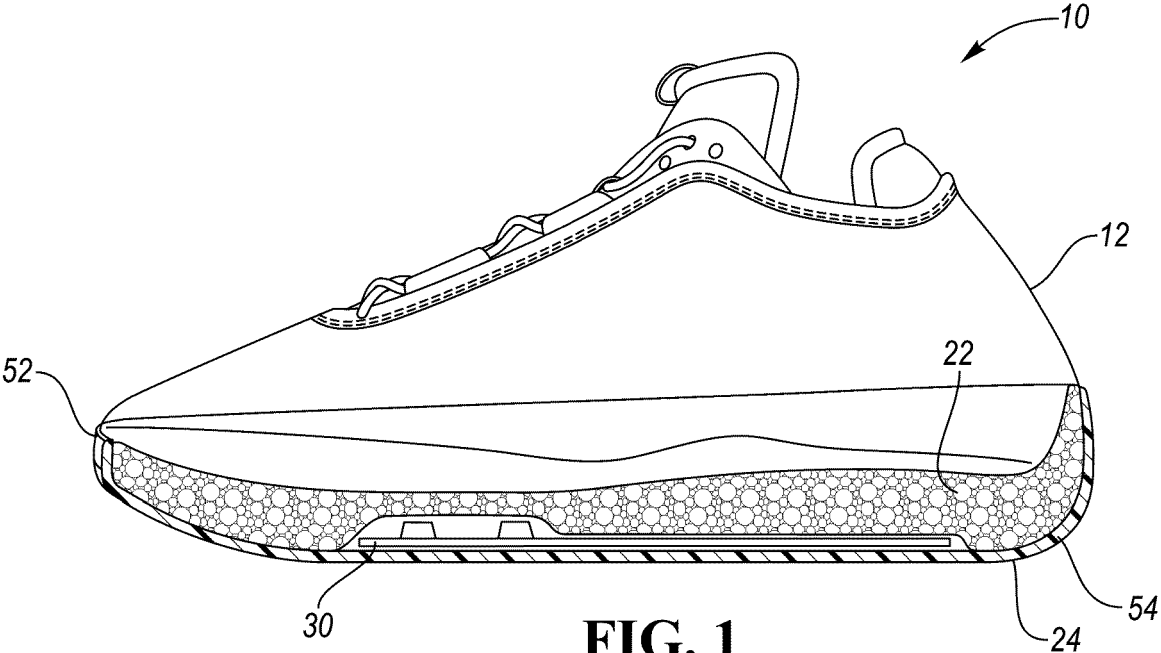
3. The shoe of one of claims 1 or 2, wherein the plurality of rods is generally planar along the forefoot region.

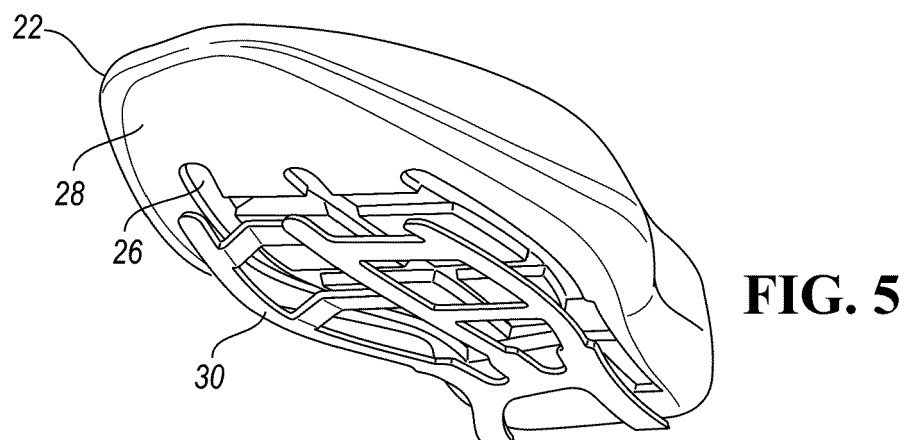
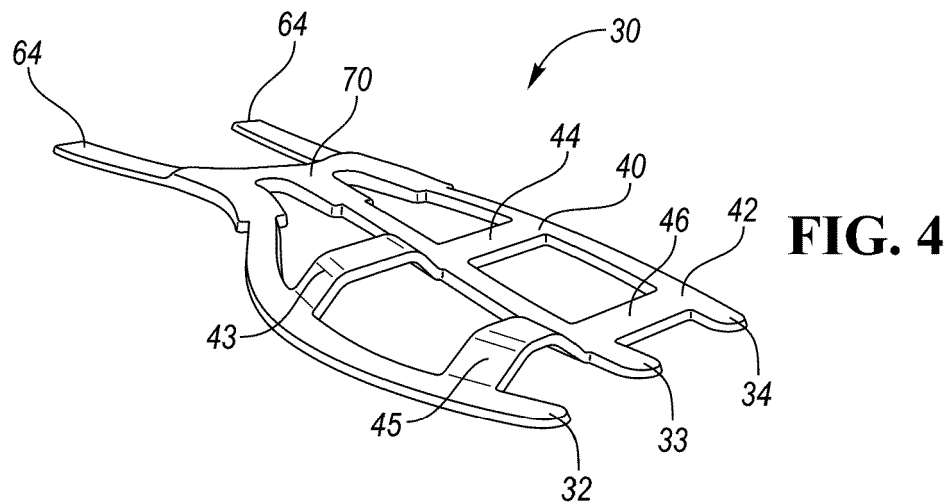
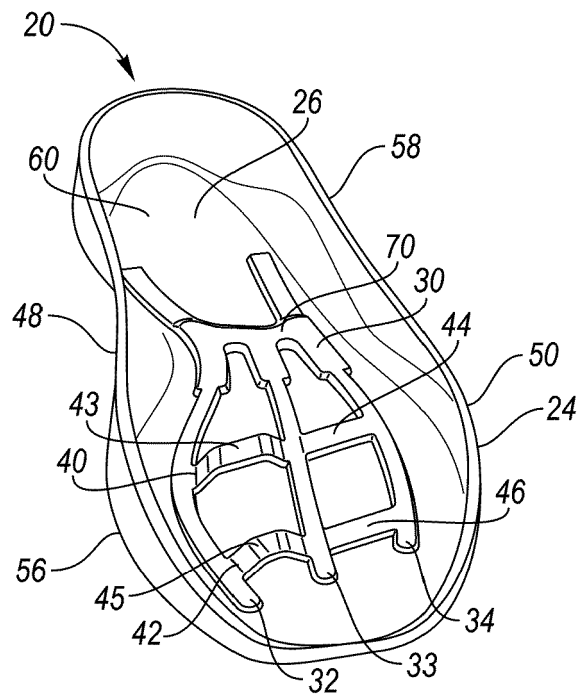
4. The shoe of one of the preceding claims, wherein the connection bar includes at least one segment being arched and extending above a plane of the plurality of rods.

5. The shoe of one of the preceding claims, wherein the connection bar comprises a first segment connecting at least two of the rods, and a second segment connecting at least two rods, wherein the first and second segments are configured to move the rods independently during a contact cycle with the ground, preferably, wherein the first segment connects at least two rods on a medial side, and the second segment connects at least two rods on a lateral side, wherein the first and second segments are configured to move the medial side independently from the lateral side during the contact cycle with the ground, further preferably, wherein the first segment has a first shape, and the second segment has a second shape.

6. The shoe of one of the preceding claims, wherein the plurality of rods extend generally parallel to a generally flat outer support surface of the outsole.

7. The shoe of one of the preceding claims, wherein the midsole includes a cavity to receive the stability structure.
8. The shoe of one of the preceding claims, wherein the outsole includes one or more relief areas that change in width during a contact cycle with the ground.
9. A sole structure for a shoe, the sole structure comprising:
- a midsole;
 - a stability structure at least partially positioned within the midsole and comprising a plurality of rods extending in a length direction, wherein at least two of the plurality of rods are connected by a connection bar extending in a width direction being transverse to the length direction.
10. The sole structure of one of the preceding claims, wherein the plurality of rods comprises three rods, preferably wherein the connection bar is connected to the three rods.
11. The sole structure of one of the preceding claims, wherein the plurality of rods comprises at least four rods, preferably wherein the connection bar is connected to the four rods.
12. The sole structure of one of the preceding claims, wherein the at least one connection bar comprises at least two connection bars spaced apart in the length direction.
13. A shoe comprising:
- an upper;
 - a sole structure connected to the upper, the sole structure comprising:
 - a midsole providing cushioning;
 - a stability structure at least partially positioned within the midsole comprising:
 - a plurality of rods extending in a length direction from at least a midfoot region toward a toe end,
 - at least one connection bar connecting the plurality of rods in a forefoot region of the shoe, the connection bar having a first segment connecting at least two rods on a medial side, and a second segment connecting at least two rods on a lateral side,
 - wherein the first and second segments are configured to move the medial side independently from the lateral side during a contact cycle with the ground.
14. The shoe of one of the preceding claims, wherein the at least one connection bar comprises at least two connection bars spaced apart in the length direction.
15. The shoe of one of the preceding claims, wherein the plurality of rods is generally planar from the midfoot region to the forefoot region.





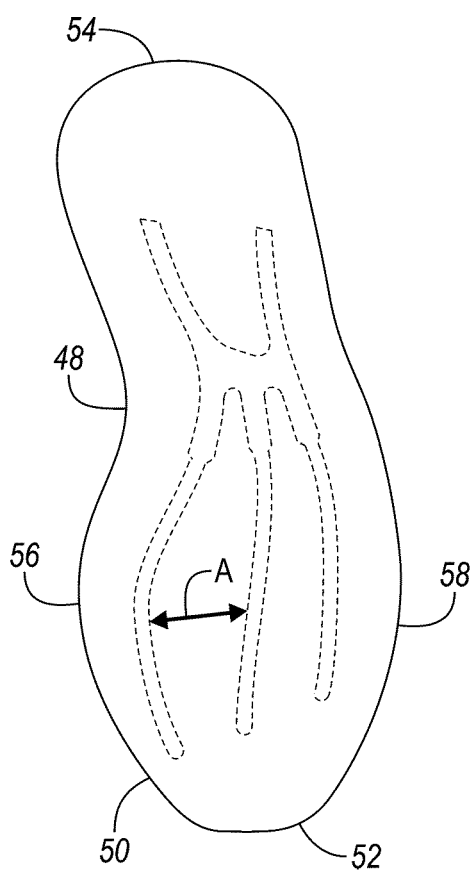


FIG. 6

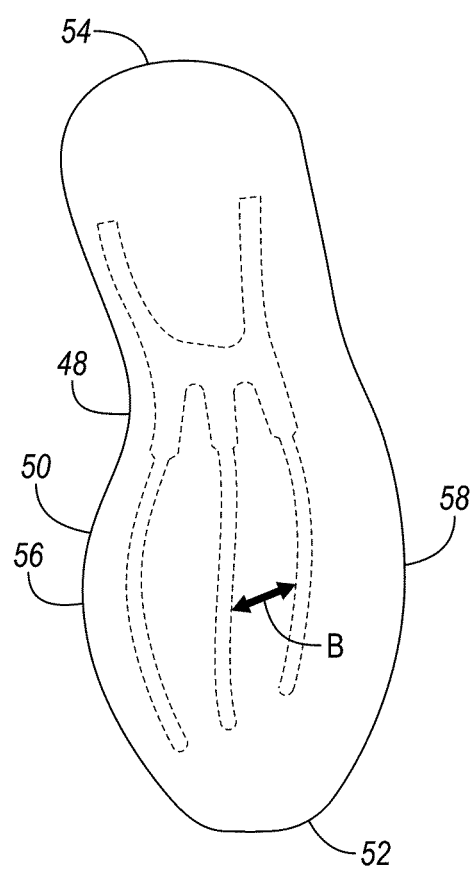


FIG. 7

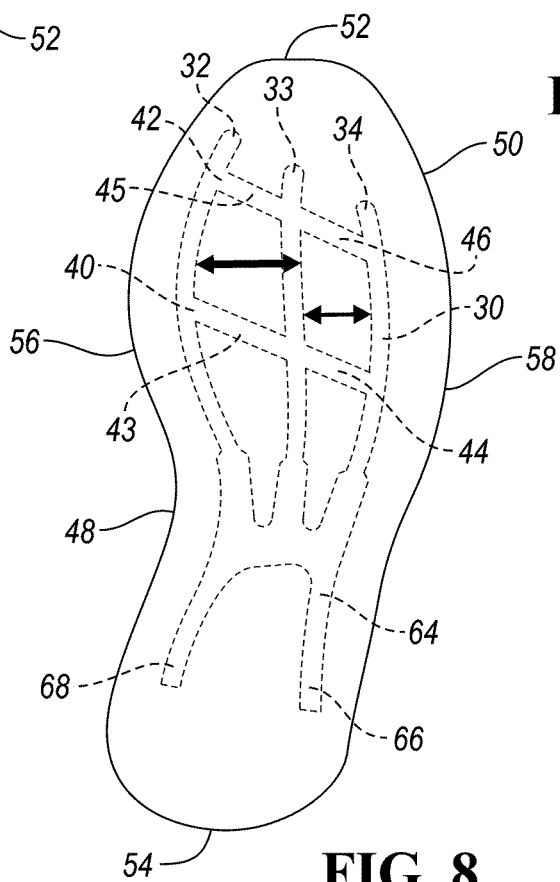


FIG. 8

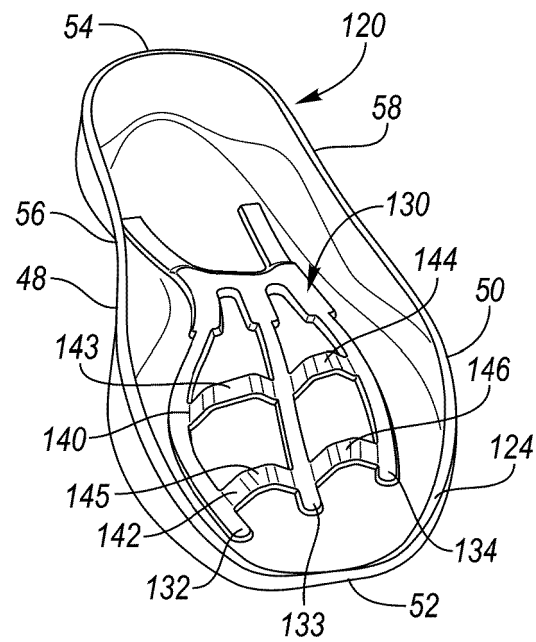


FIG. 9

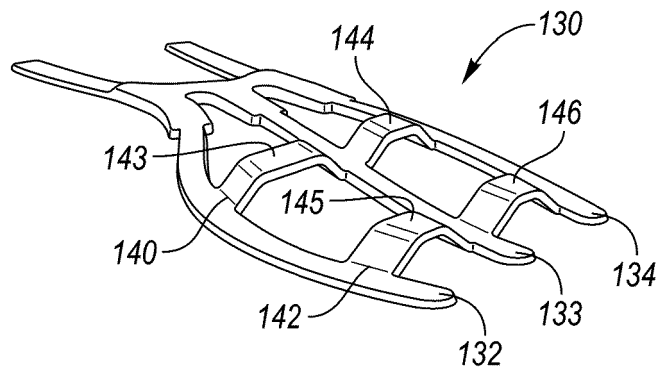


FIG. 10

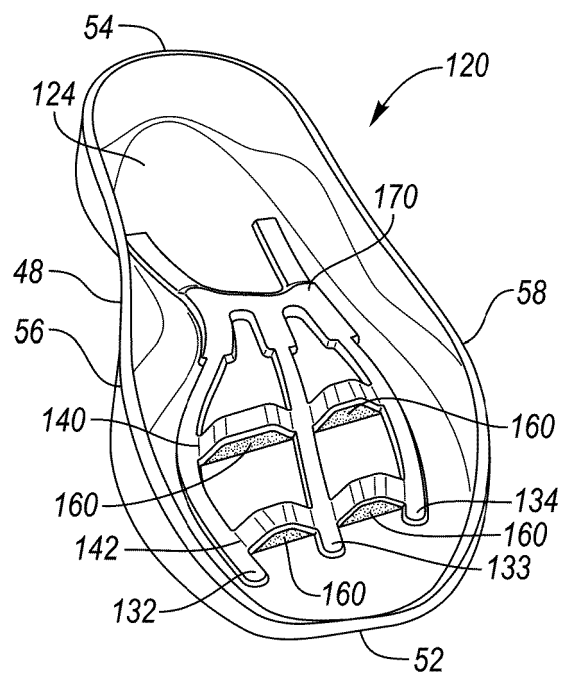


FIG. 11

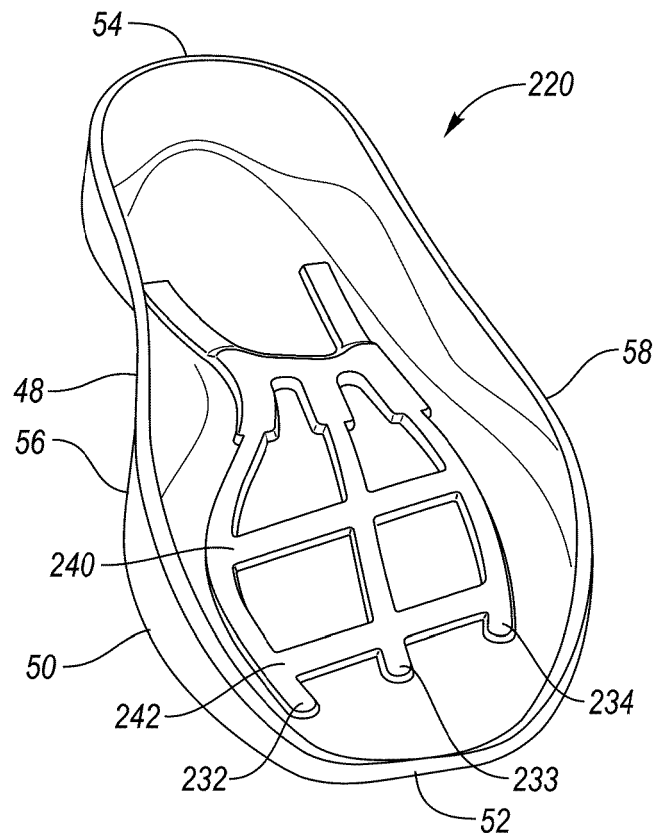


FIG. 12

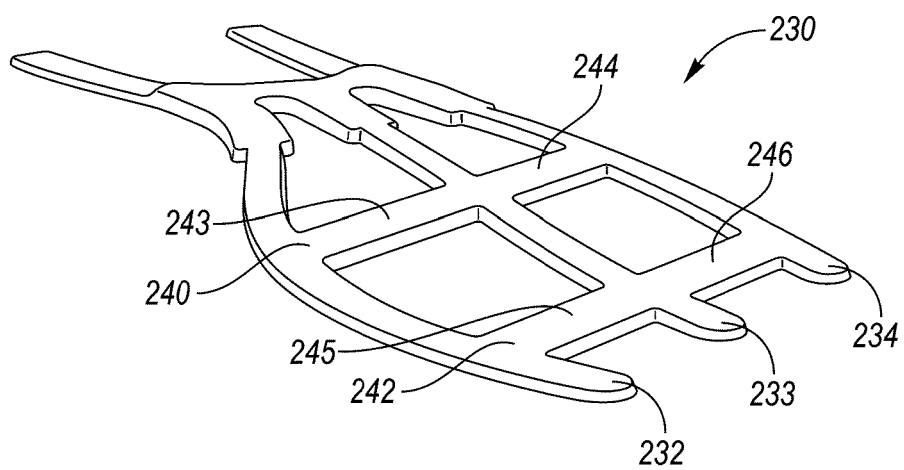


FIG. 13

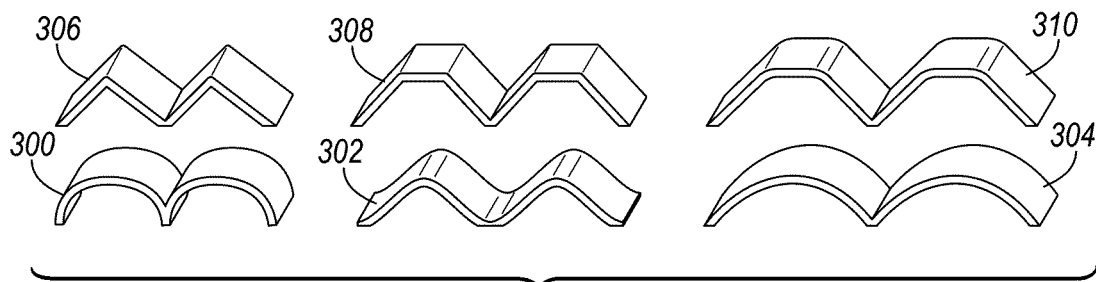


FIG. 14

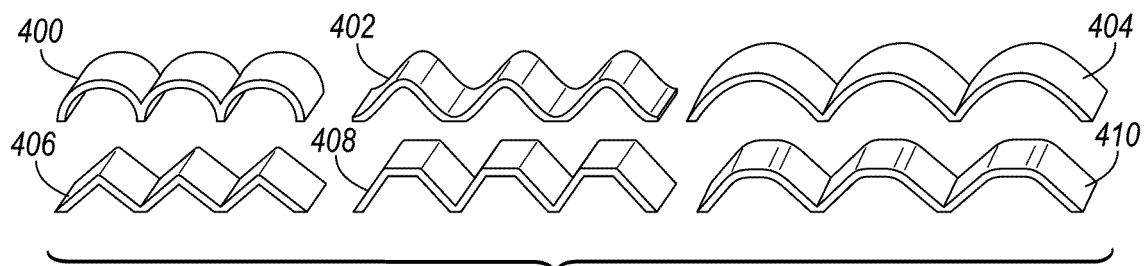


FIG. 15

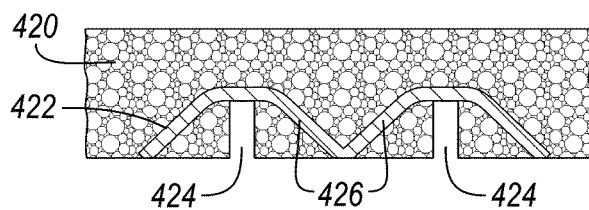


FIG. 16

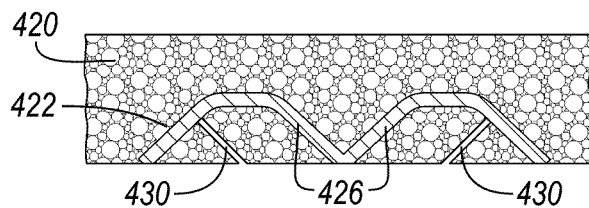


FIG. 17

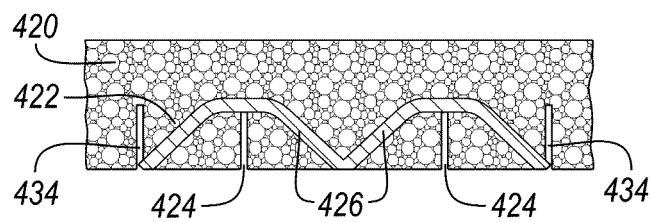


FIG. 18

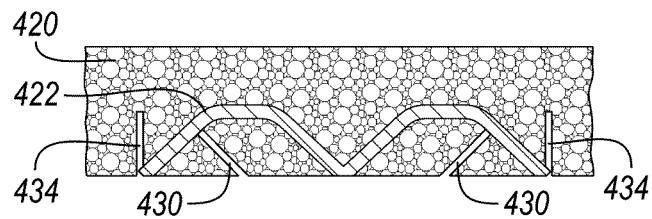
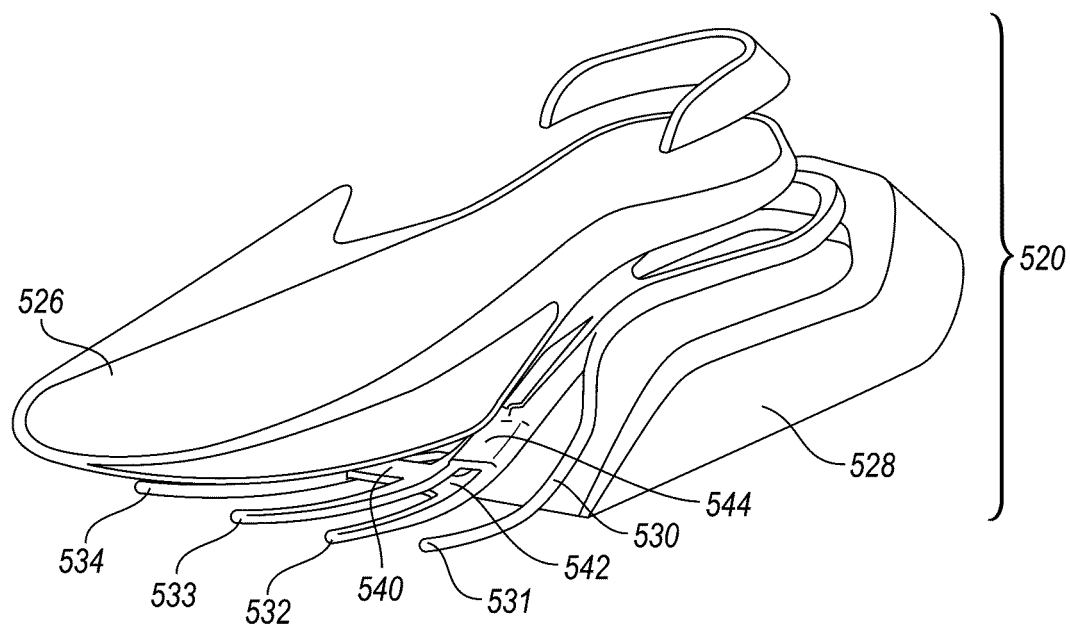
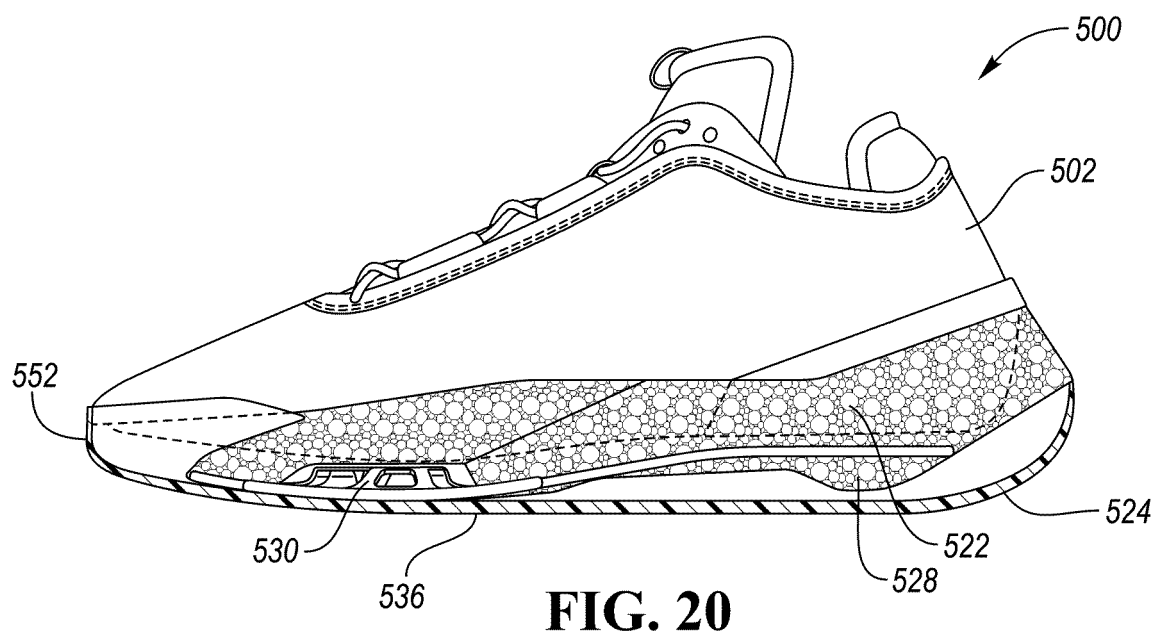


FIG. 19



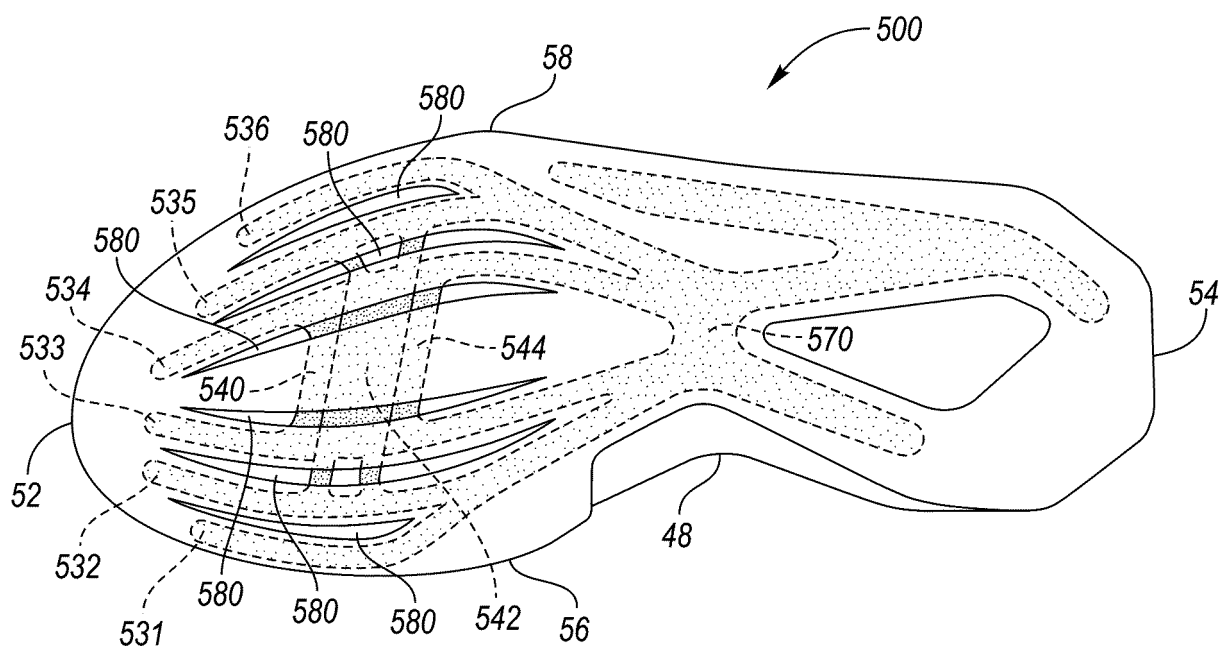


FIG. 22

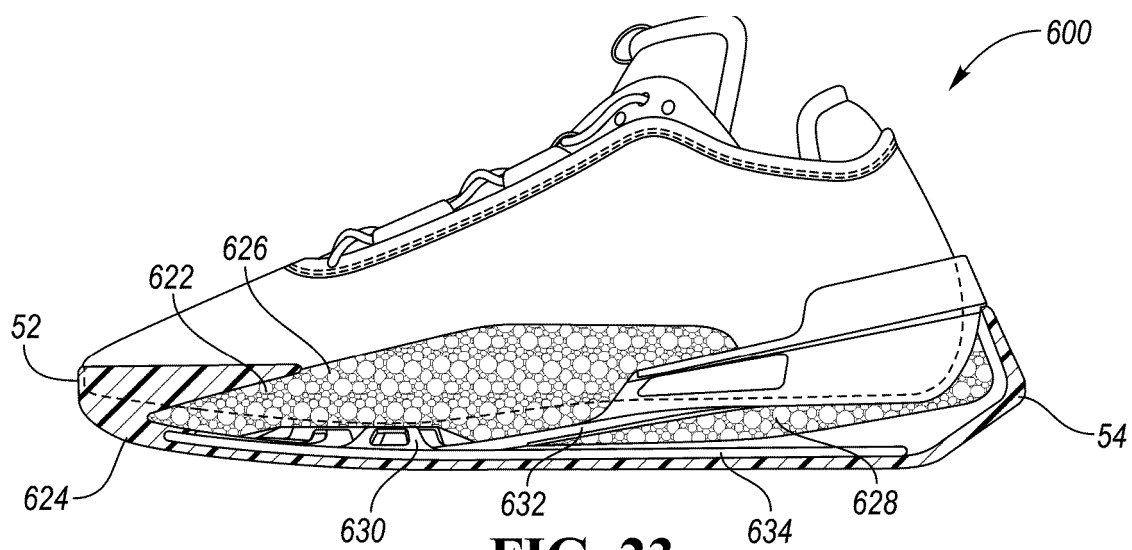


FIG. 23

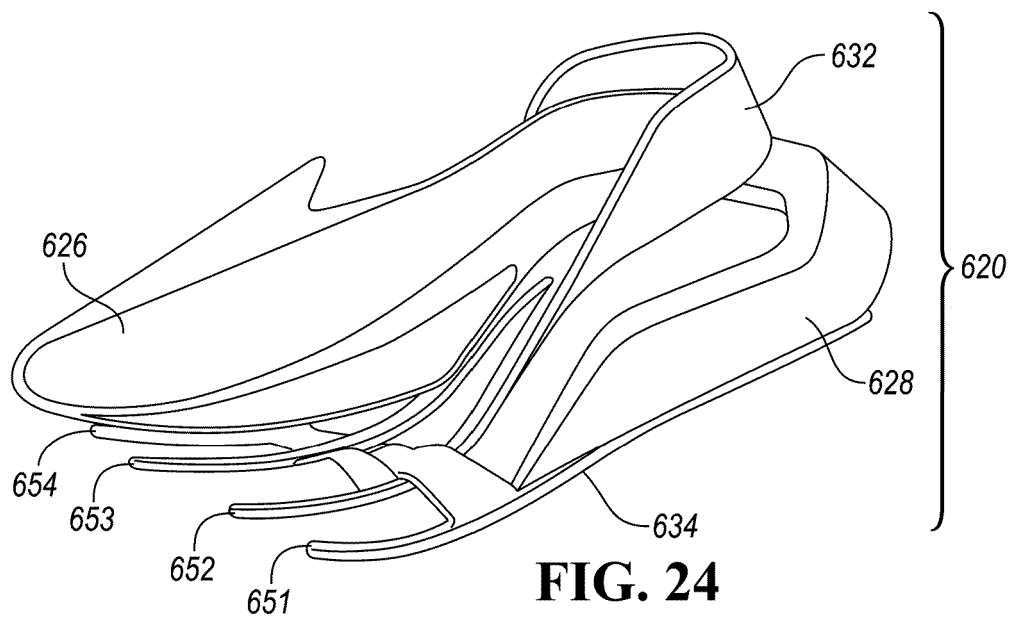


FIG. 24

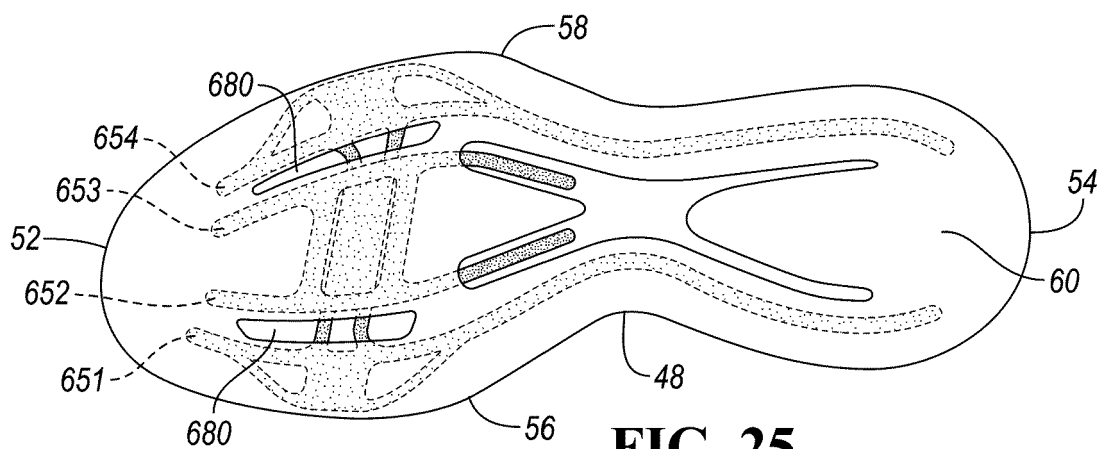


FIG. 25

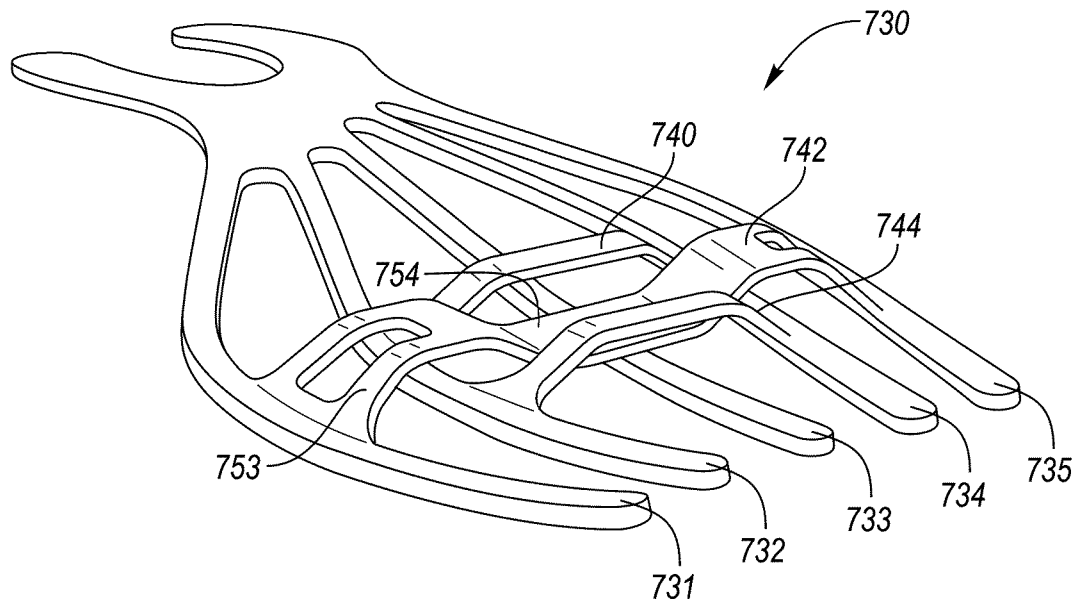


FIG. 26

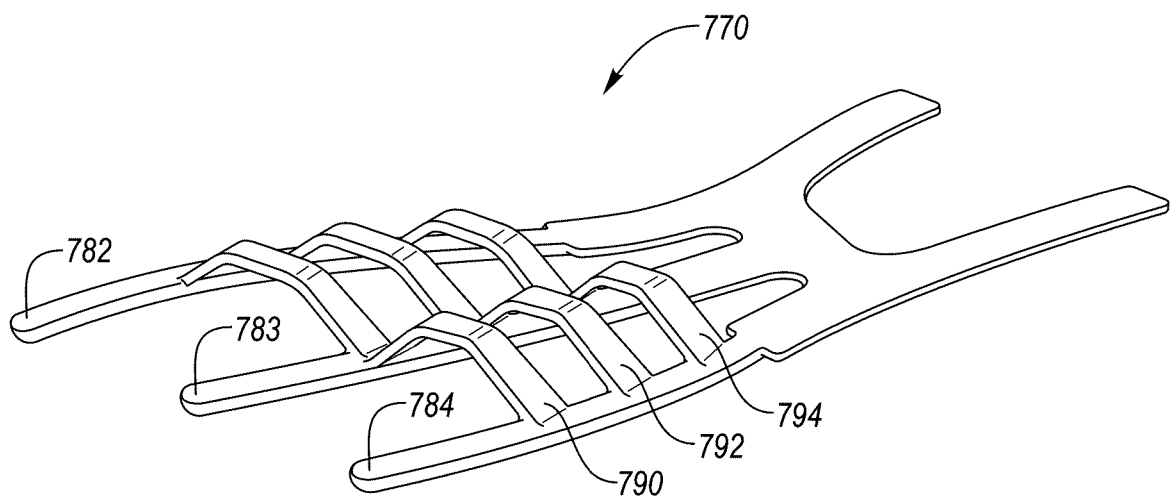


FIG. 27

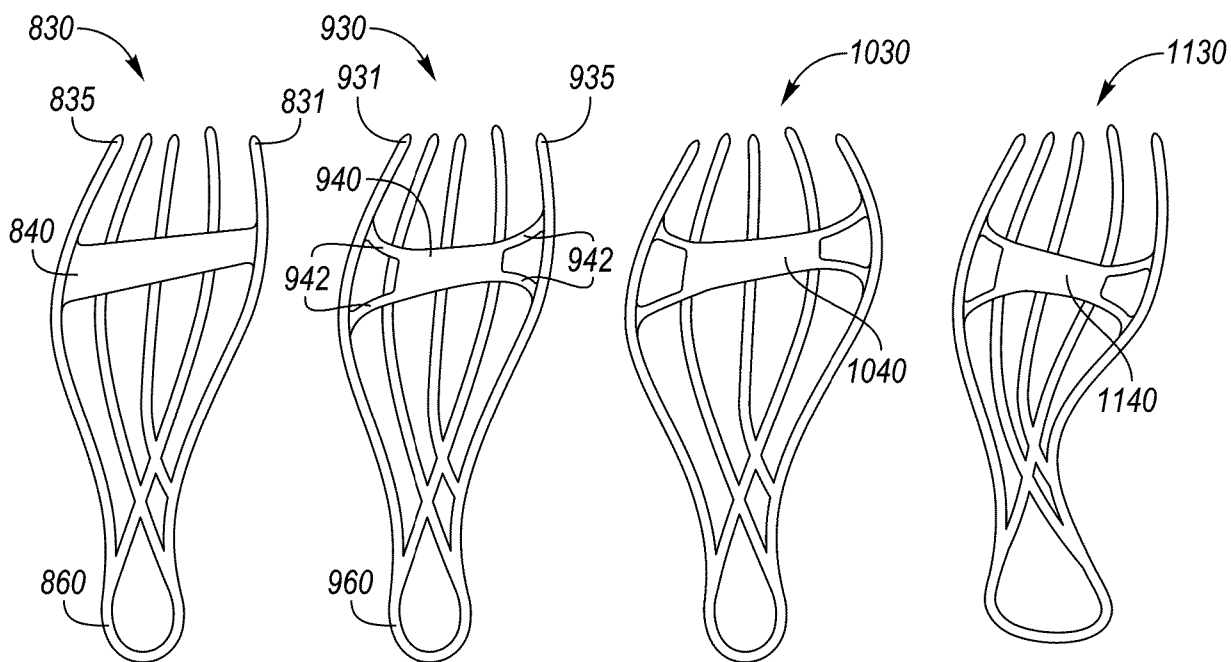


FIG. 28

FIG. 29

FIG. 30

FIG. 31

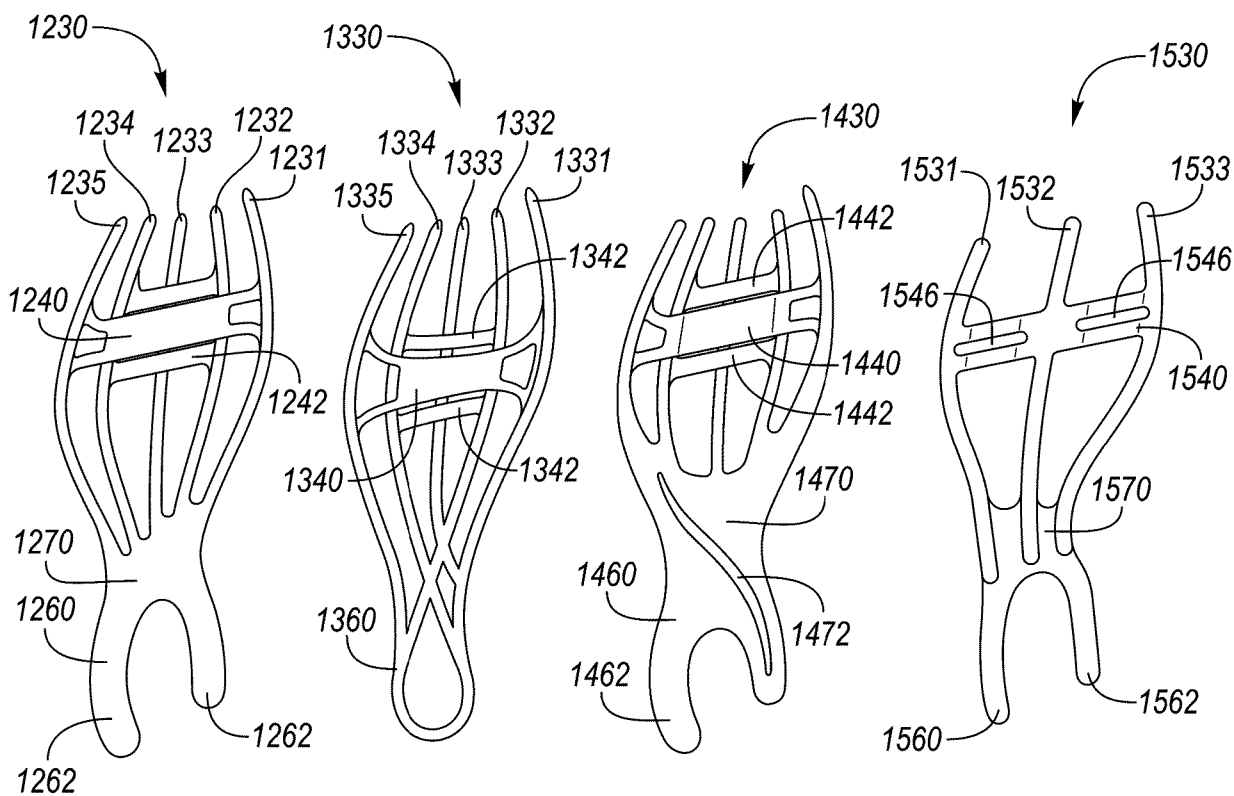


FIG. 32

FIG. 33

FIG. 34

FIG. 35



PARTIAL EUROPEAN SEARCH REPORT

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

EP 26 15 6354

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2021/259357 A1 (PATERSON ROBBIE [DE] ET AL) 26 August 2021 (2021-08-26) * paragraph [0182] - paragraph [0185]; figure 4 *	9-11,15	INV. A43B13/14 A43B13/18
X	US 2022/378147 A1 (BRUNS FALK [DE] ET AL) 1 December 2022 (2022-12-01) * paragraph [0301] - paragraph [0303]; figures 1a-11f *	9-11,15	
X	WO 2014/152886 A1 (NIKE INNOVATE CV [US]; NIKE INC [US]) 25 September 2014 (2014-09-25) * paragraph [0061]; figure 12 *	9,12,15	
X	US 2021/093040 A1 (YOSHIDA YOHEI [JP]) 1 April 2021 (2021-04-01) * paragraph [0101] - paragraph [0105]; figures 17-19 *	9-12,15	
			TECHNICAL FIELDS SEARCHED (IPC)
			A43B
INCOMPLETE SEARCH			
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.			
Claims searched completely :			
Claims searched incompletely :			
Claims not searched :			
Reason for the limitation of the search:			
see sheet C			
Place of search		Date of completion of the search	Examiner
The Hague		11 September 2026	Papatheofrastou, M
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 1503 03.82 (P24E07)

INCOMPLETE SEARCH
SHEET C

Application Number

EP 26 15 6354

Claim(s) completely searchable:

9-12, 15

Claim(s) not searched:

1-8, 13, 14

Reason for the limitation of the search:

Claims 1, 9 and 13 have been drafted as separate independent claims. Under Article 84 in combination with Rule 43(2) EPC, an application may contain more than one independent claim in a particular category only if the subject-matter claimed falls within one or more of the exceptional situations set out in paragraph (a), (b) or (c) of Rule 43(2) EPC. This is not the case in the present application, however, for the following reason(s):

claims 1, 9 and 13 they appear to relate effectively to the same subject-matter, i.e. a shoe with a stability structure having rods and a connection bar, and to differ from each other only with regard to the definition of the subject-matter for which protection is sought and/or in respect of the terminology used for the features of that subject-matter.

The aforementioned claims therefore lack conciseness and as such do not meet the requirements of Article 84 EPC. The applicant was requested to indicate on which independent claim the search has to be carried out. The applicant replied on 22.07.2026 that the search should be based on independent claim 9 and the dependend claims upon this claim, i.e. claims 9-12 and 15.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 26 15 6354

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-09-2026

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