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(54) **FOOT SUPPORT ASSEMBLY FOR LATERAL AND MEDIAL STABILITY OF FOOT**

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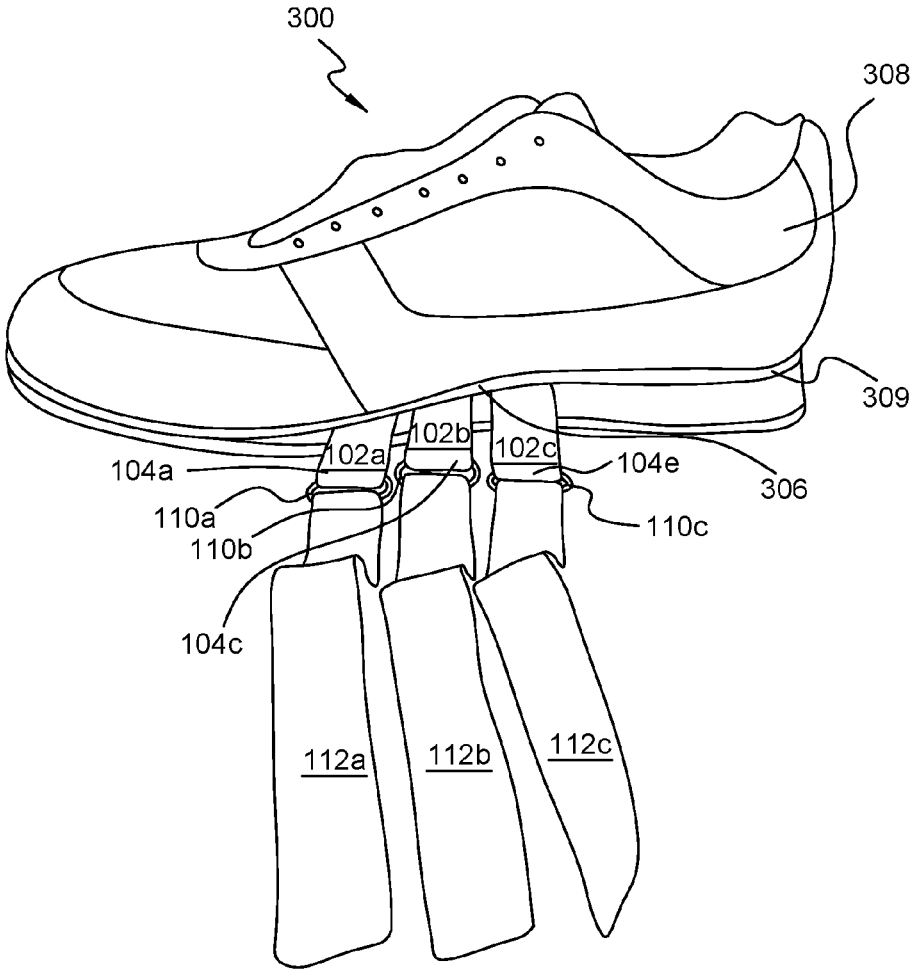
(57) **ABSTRACT**

A foot support assembly provides medial and lateral support to the foot with multiple bands that traverse a dorsal region of the foot, passing through multiple channels in between the midsole and outer sole of a shoe. A fastening mechanism enables length adjustment of the bands, such that shear forces and strain on the foot are reduced. Three spaced-apart bands include a pair of free ends and a longitudinal axis that is sufficient to wrap around the dorsal region of foot. The bands create a taut pressure medially, wrapping laterally across the dorsal region of the foot to help prevent stress fractures and cracks on the foot. A D-ring closure enables length adjustment of the bands. The assembly supports the plantar aspect of the foot, whereby the foot is sandwiched between bands, and the midsole and outer sole of shoe. An alignment tape aligns the foot with the bands.



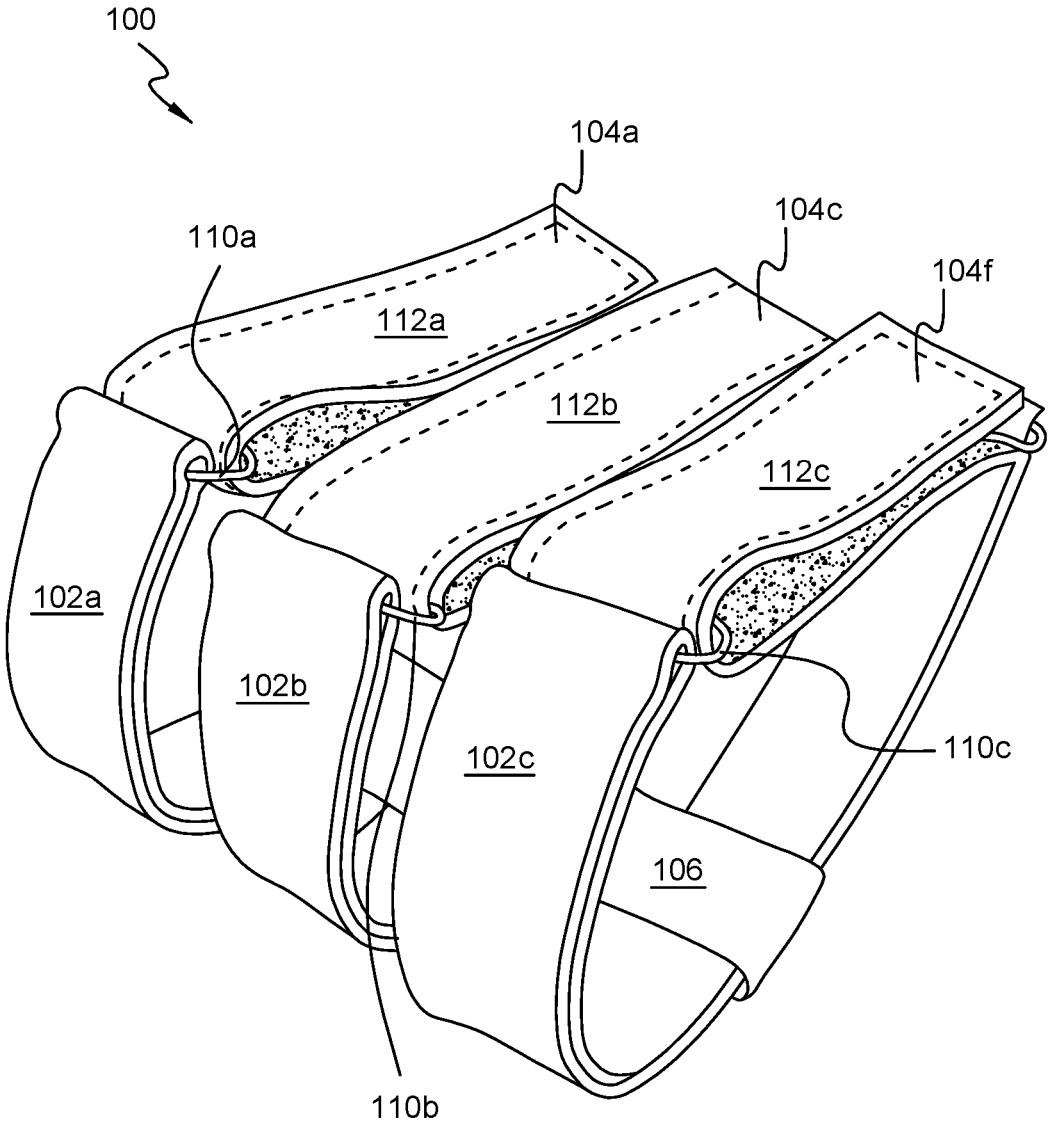

100
104a
104c
104f
110a
112a
112b
112c
102a
102b
102c
110c
106
110b

FIG. 1

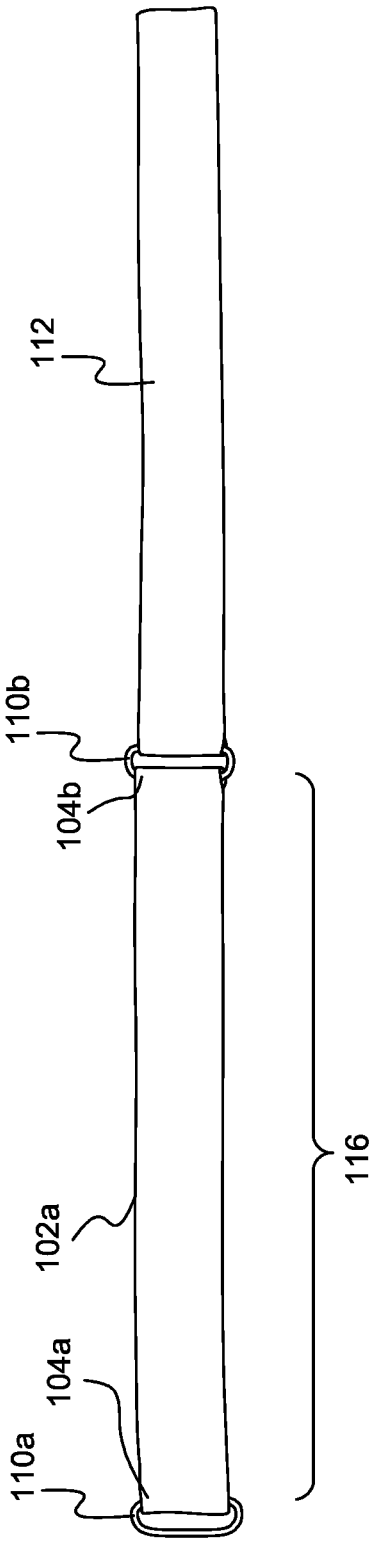


FIG. 2

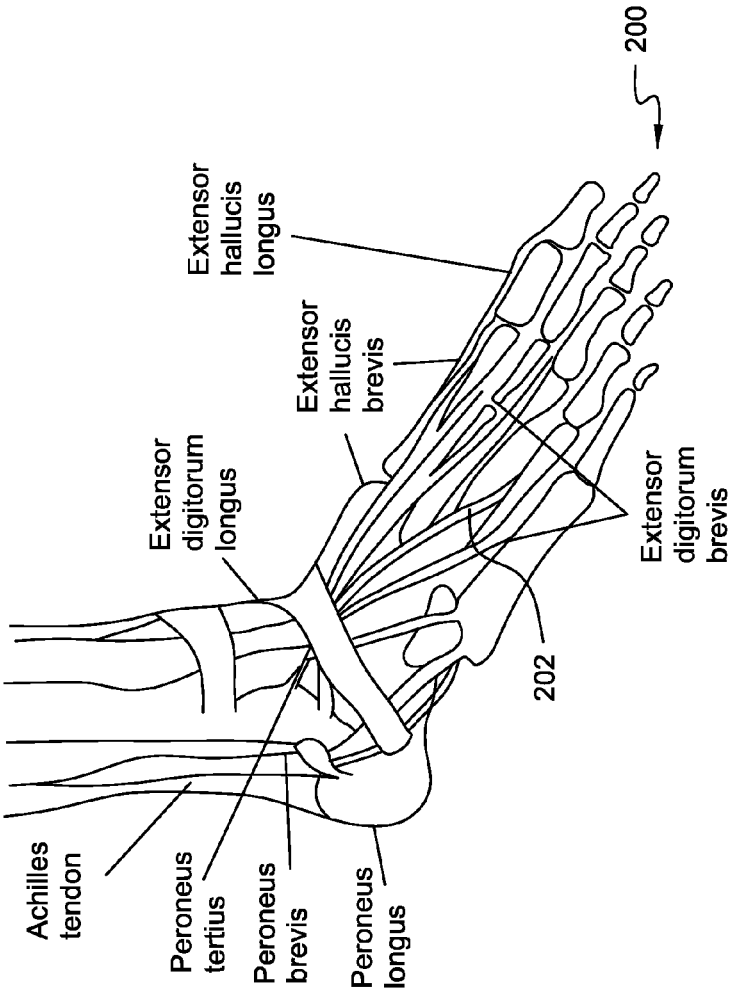

200
Extensor hallucis longus
Extensor hallucis brevis
Extensor digitorum longus
Extensor digitorum brevis
202
Achilles tendon
Peroneus tertius
Peroneus brevis
Peroneus longus

FIG. 3

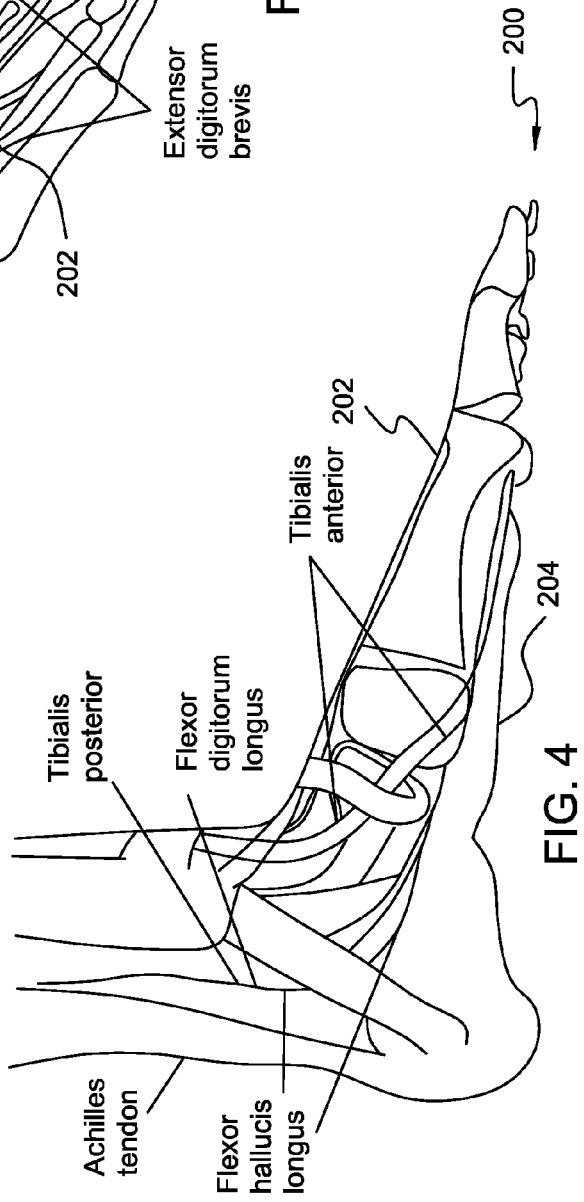

200
202
Tibialis anterior
204
Tibialis posterior
Flexor digitorum longus
Achilles tendon
Flexor hallucis longus

FIG. 4

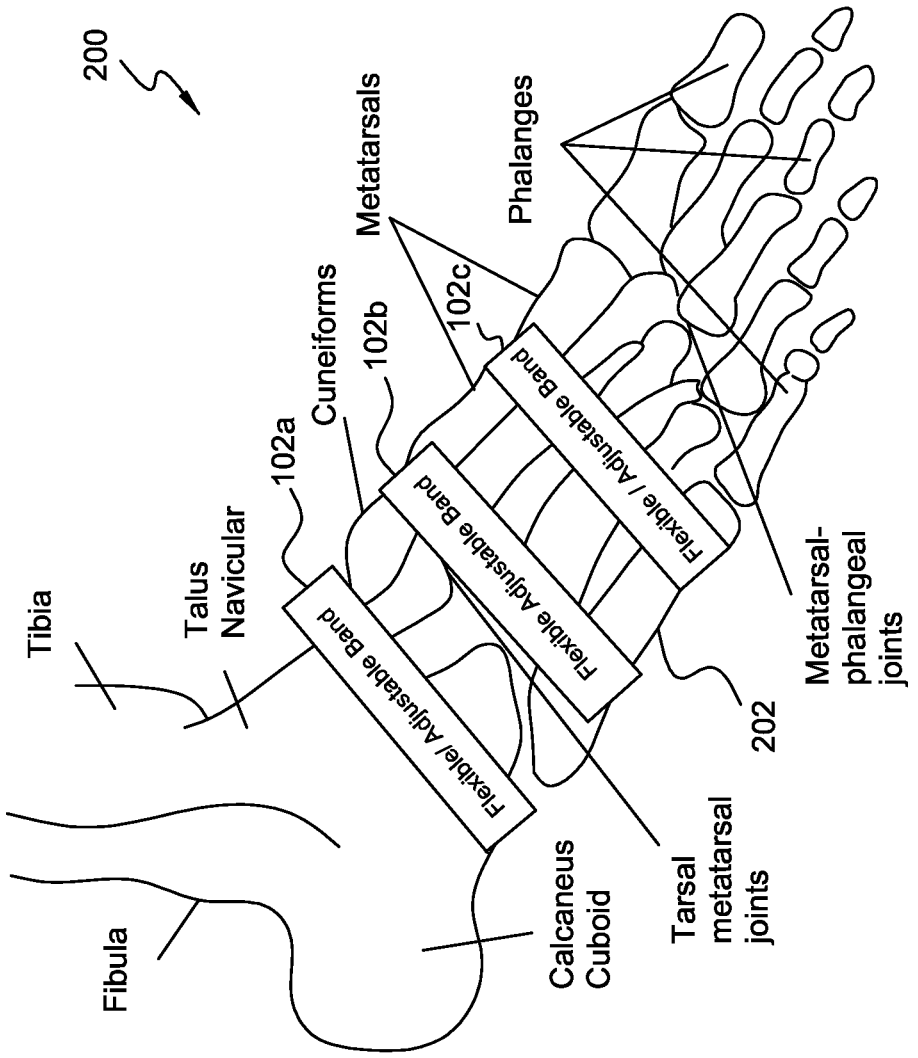

200
Tibia
Talus
Navicular
102a
Cuneiforms
102b
Metatarsals
102c
Phalanges
Flexible/ Adjustable Band
Flexible Adjustable Band
Flexible / Adjustable Band
Fibula
Calcaneus
Cuboid
Tarsal
metatarsal
joints
202
Metatarsal-
phalangeal
joints

FIG. 5

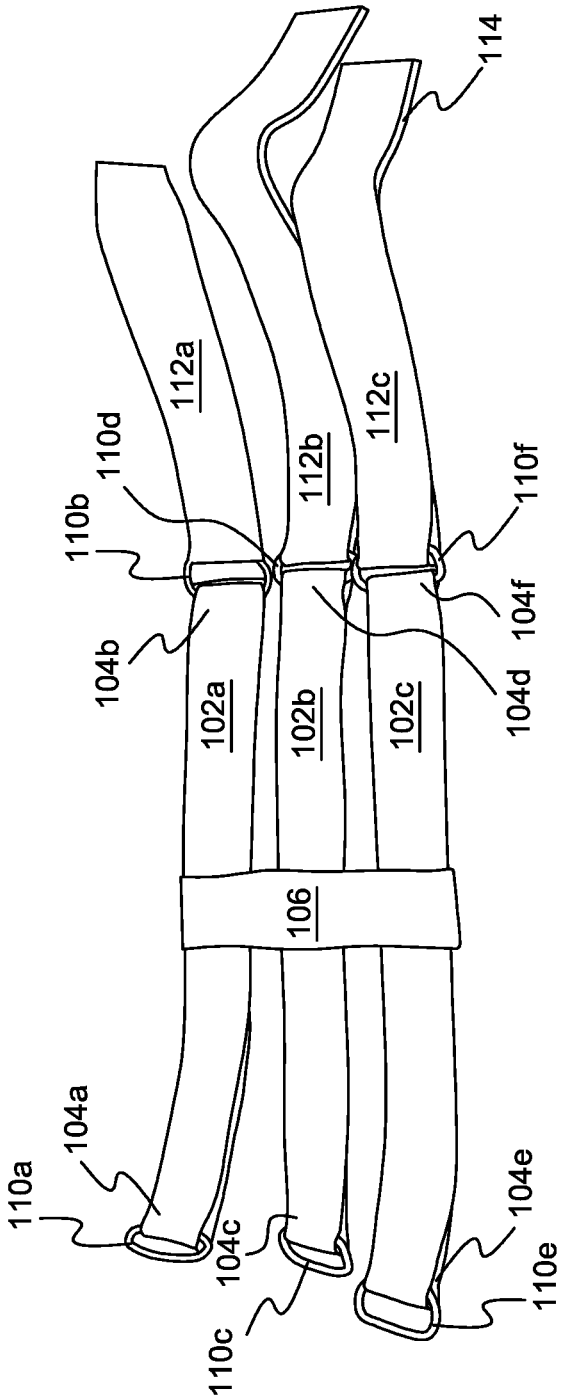

114
112a
112b
112c
110d
110b
110f
104b
104f
104d
102a
102b
102c
106
104a
110a
104c
104e
110c
110e

FIG. 6

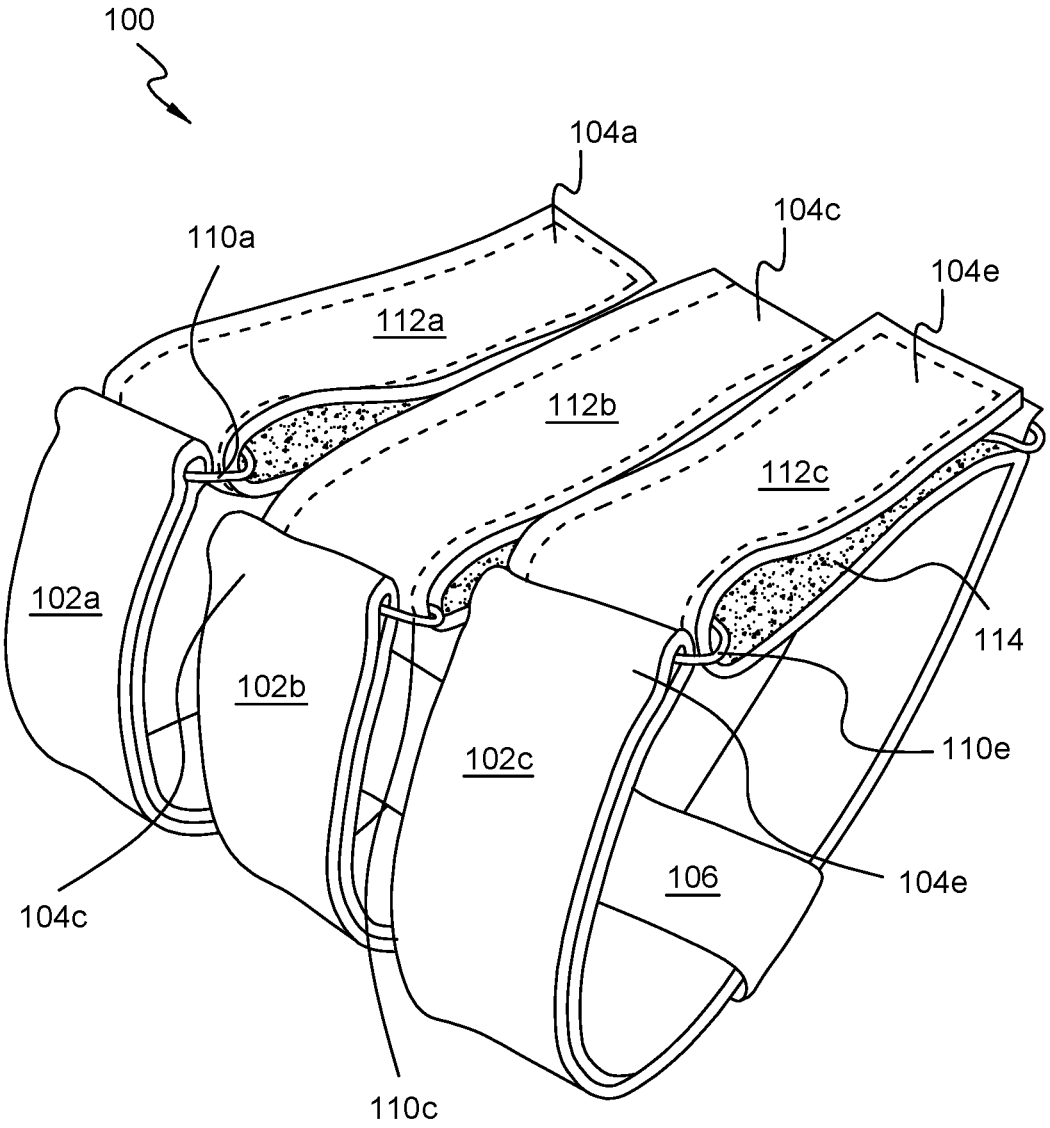

100
104a
104c
104e
110a
112a
112b
112c
102a
102b
102c
114
110e
104e
106
104c
110c

FIG. 7A

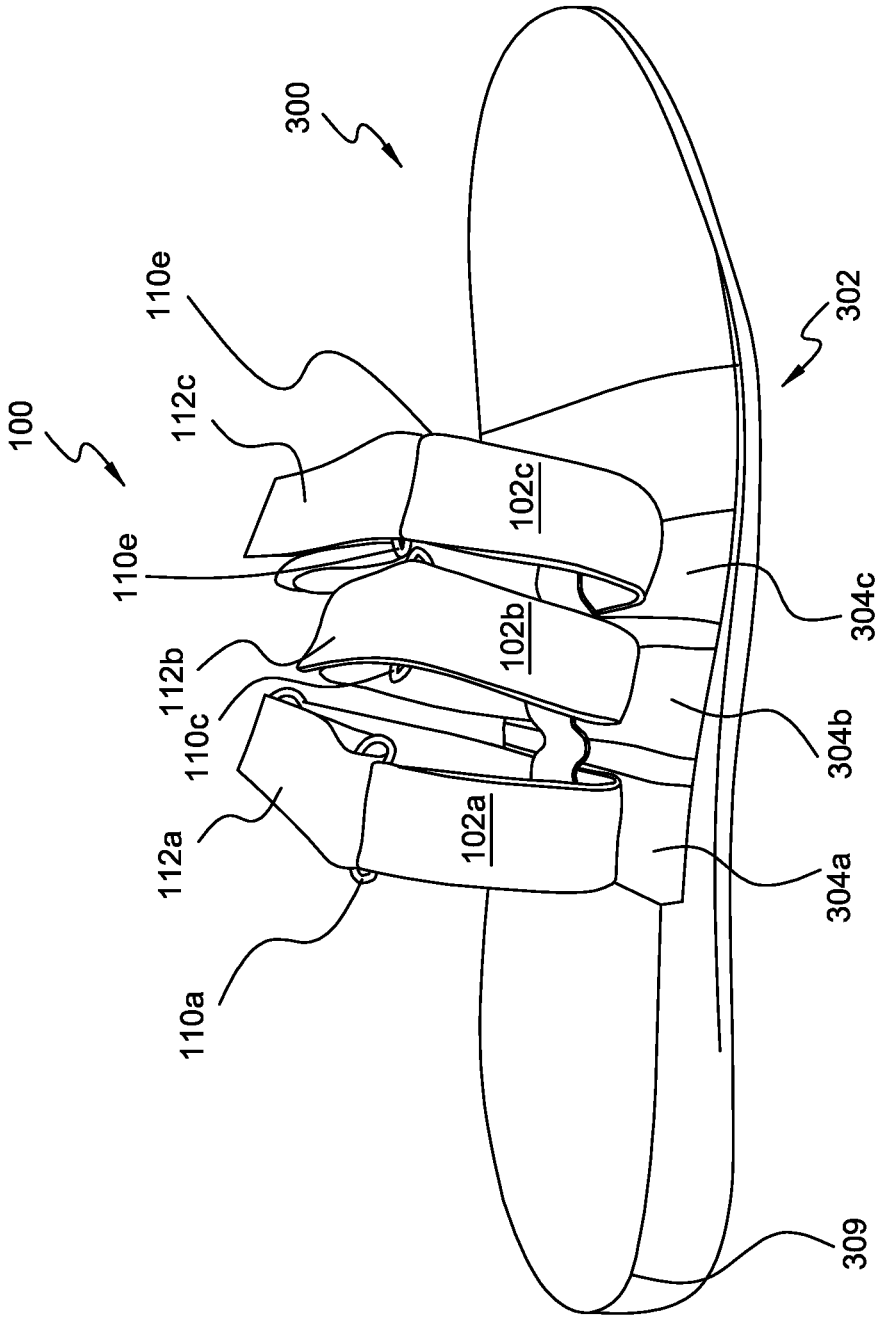

300
110e
112c
100
110e
112b
110c
112a
110a
102c
102b
102a
302
304c
304b
304a
309

FIG. 7B

400

S.N.	PROPERTY	RESULT	CLRI RECOMMEN-DATION	TEST METHOD
1.	Density, g/cc	0.99	-	SATRA TM 68:1992
2.	Tensile strength, N/mm^2 Elongation at break, %	2.28 388	- -	SATRA TM 137:1995
3.	Tear strength, N/mm^2	4.27	-	SATRA TM 218:1999
4.	Flexing resistance, mm/kc Cut growth rate, At 20°C At -5°C	 0.0007 0.0007	 - -	 SATRA TM 60:1992

FIG. 8

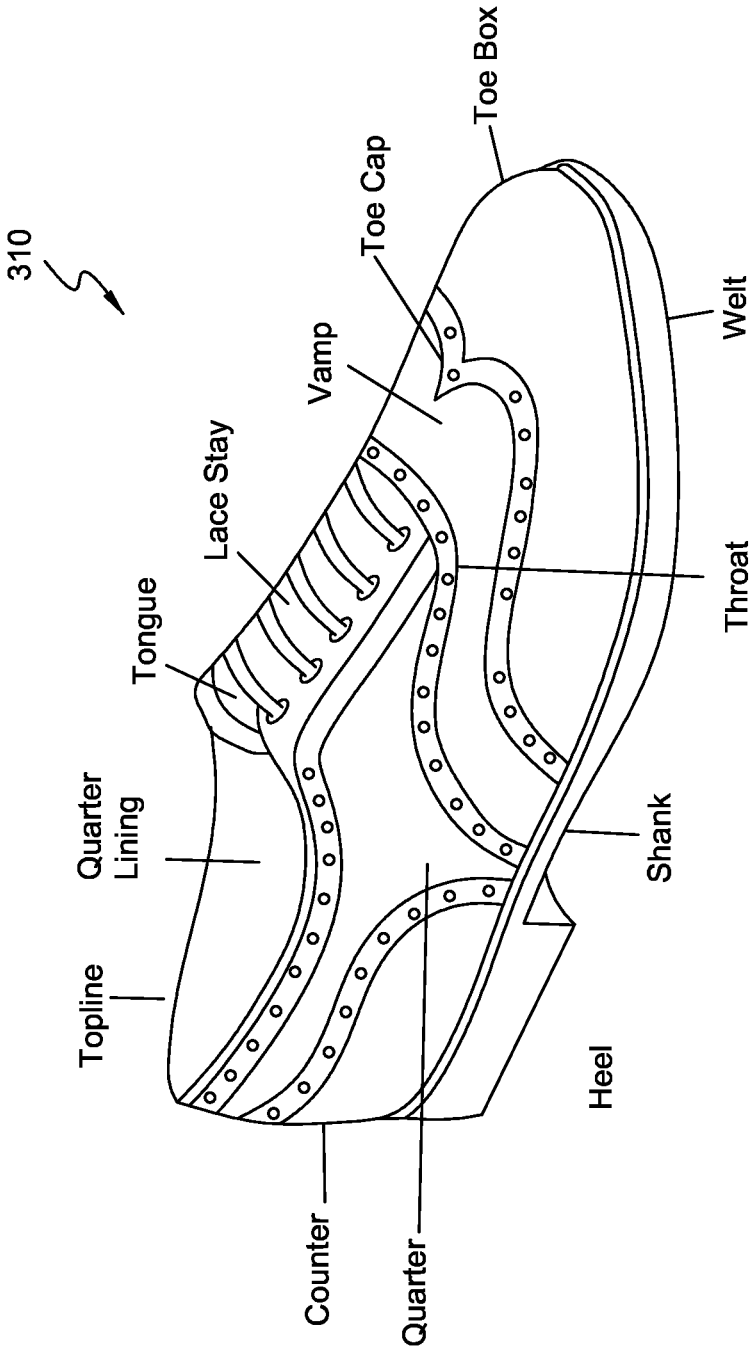

310
Toe Box
Toe Cap
Vamp
Welt
Lace Stay
Tongue
Throat
Quarter Lining
Shank
Topline
Heel
Counter
Quarter

FIG. 9

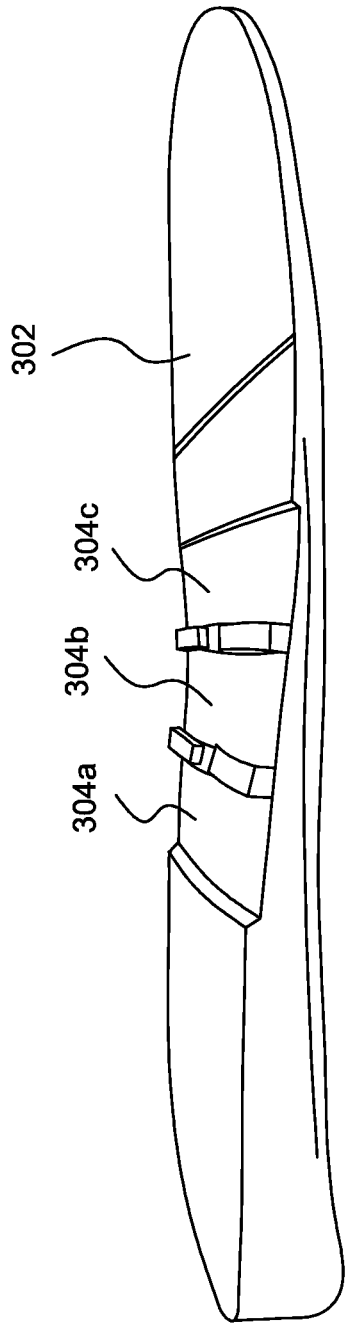


FIG. 10

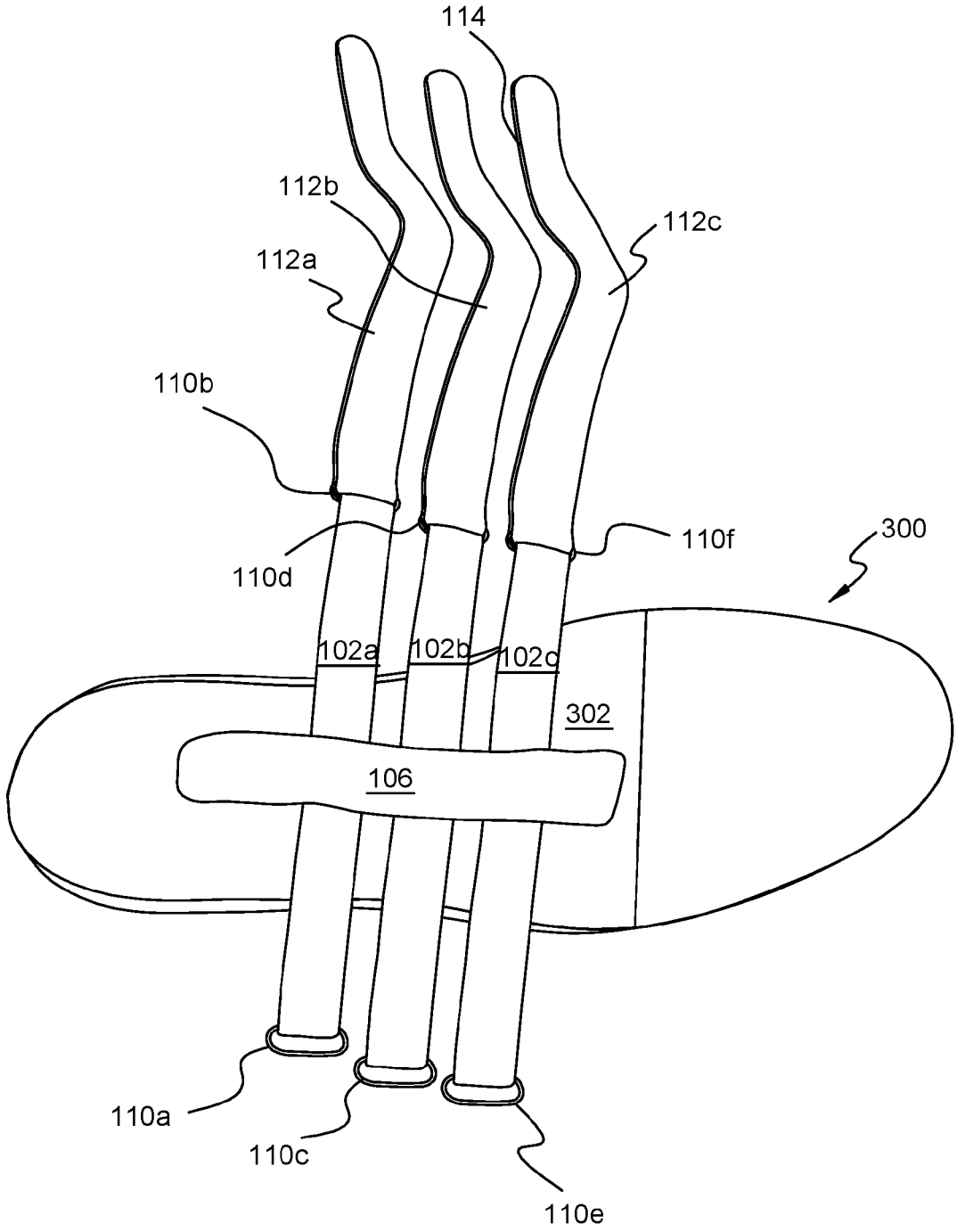

114
112b
112c
112a
110b
110f
300
110d
102a
102b
102c
302
106
110a
110c
110e

FIG. 11

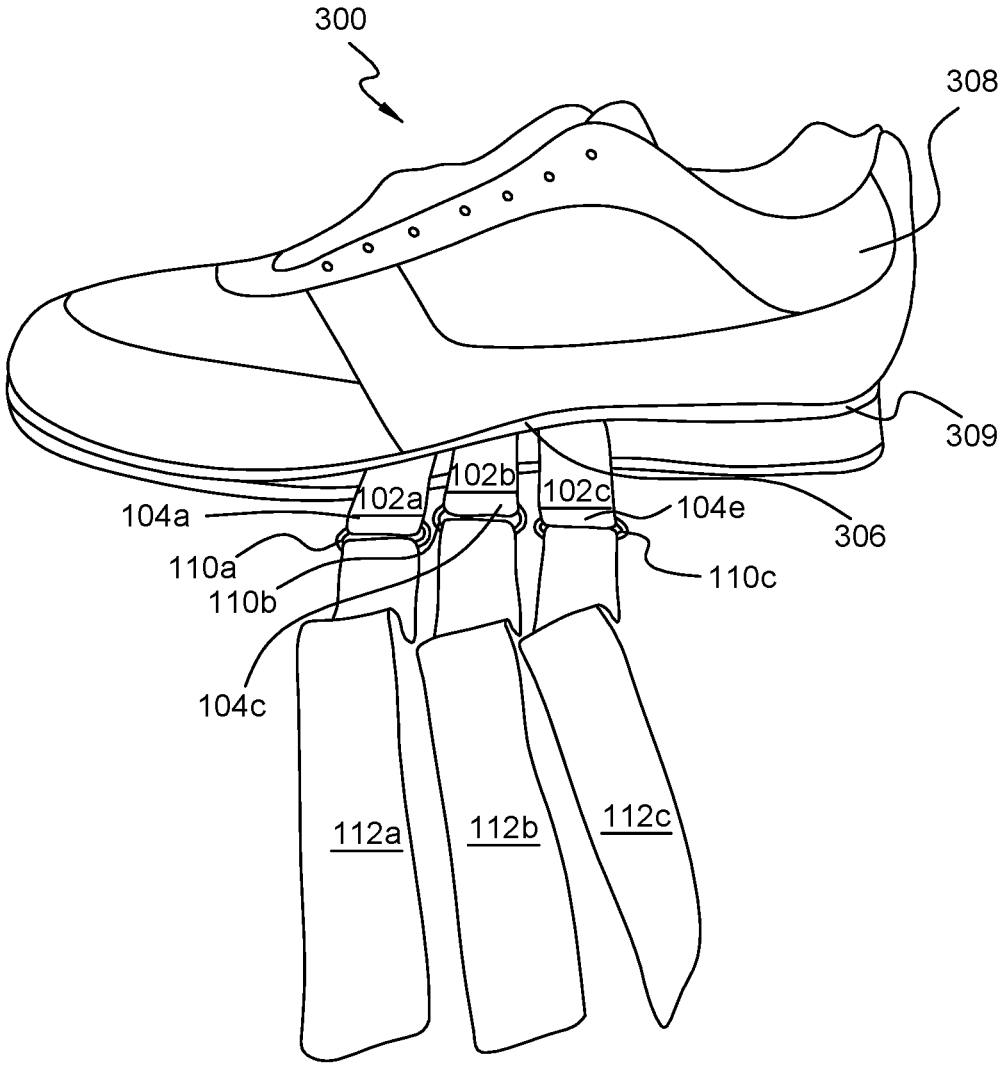

300
308
309
306
102a
102b
102c
104a
104e
110a
110b
110c
104c
112a
112b
112c

FIG. 12

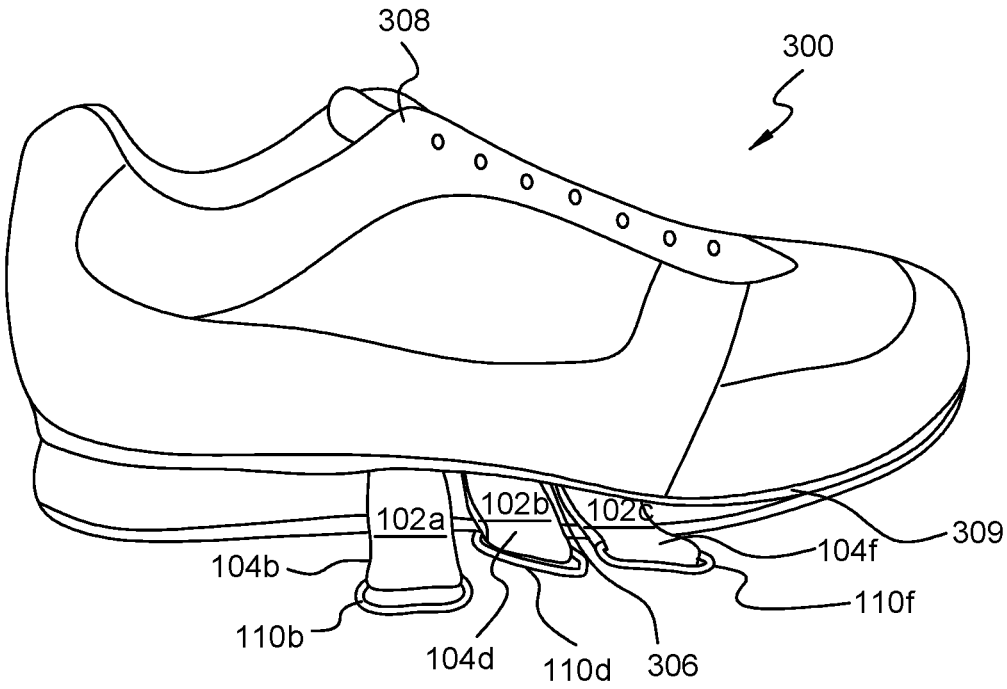


FIG. 13

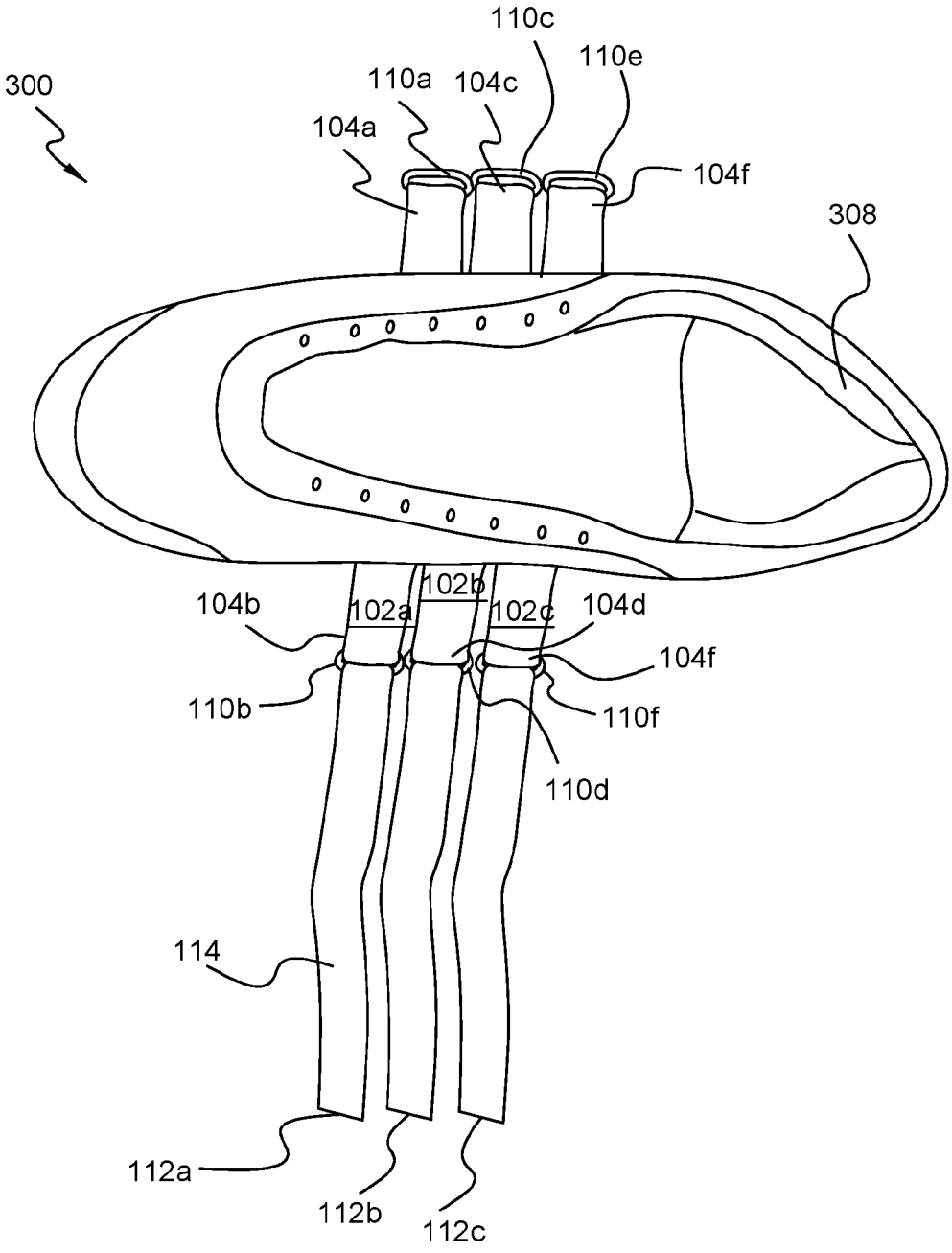

300
110c
110e
110a
104c
104a
104f
308
104b
102b
102a
102c
104d
104f
110b
110f
110d
114
112a
112b
112c

FIG. 14

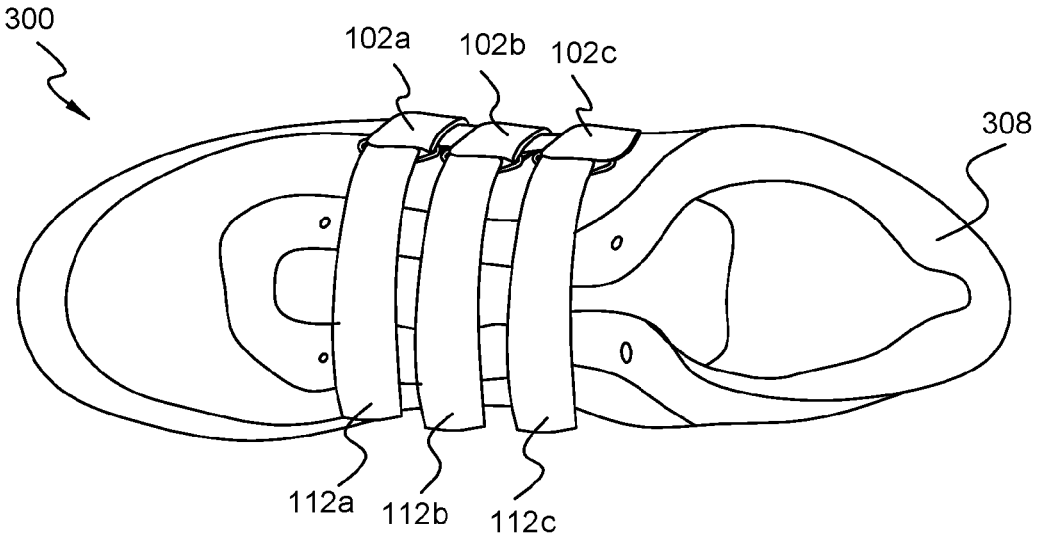


FIG. 15

FOOT SUPPORT ASSEMBLY FOR LATERAL AND MEDIAL STABILITY OF FOOT

CROSS REFERENCE OF RELATED APPLICATIONS

[0001] This application claims the benefits of U.S. provisional application No. 62/216,513, filed Sep. 10, 2015 and entitled FOOT SUPPORT ASSEMBLY FOR LATERAL AND MEDIAL STABILITY, which provisional application is incorporated by reference herein in its entirety.

FIELD OF THE INVENTION

[0002] The present invention relates generally to a foot support assembly for lateral and medial stability of a foot. More so, a foot support assembly integrates with a shoe to provide medial and lateral support to the foot through a plurality of bands that traverse a dorsal region of the foot, and passes through channels in the outer sole of a shoe, and fastening straps that enable length adjustment of the bands around the foot; wherein shear forces and strain on the midfoot, hindfoot, and metatarsus of the foot are substantially inhibited.

BACKGROUND OF THE INVENTION

[0003] The following background information may present examples of specific aspects of the prior art (e.g., without limitation, approaches, facts, or common wisdom) that, while expected to be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein or inferred thereupon.

[0004] It is known that the feet are an anatomical structure found in many vertebrates. The foot is the terminal portion of a limb which bears weight and allows locomotion. The human foot is a strong and complex mechanical structure containing 26 bones, 33 joints, and more than a hundred muscles, tendons, and ligaments.

[0005] The joints of the foot are the ankle and subtalar joint and the interphalangeal articulations of the foot. The human foot has two longitudinal arches and a transverse arch maintained by the interlocking shapes of the foot bones, strong ligaments, and pulling muscles during activity. The muscles acting on the foot can be classified into extrinsic muscles, those originating on the anterior or posterior aspect of the lower leg, and intrinsic muscles, originating on the dorsal (top) or plantar (base) aspects of the foot.

[0006] Typically, the arches of the feet are the critical first step in the kinetic chain of the human body. If the arches are injured or do not support the foot because of hereditary reasons, the human kinetic chain can have dysfunction including feet, ankles, shins, knees, thighs, hips, lower back, mid back, and neck. Various stresses along the arch can occur due to excessive physical exertion on the feet.

[0007] Often, supportive structures, such as elastic bands are used to support the fifth metatarsal of the feet, so as to prevent stress fractures and inhibit growth of stress fractures once they have started. For example, a crack along the metatarsal that runs down the dorsal region of the foot is known in the art as a Jones fracture. The Jones fracture is known in the art to cause severe pain in the side of the foot making the bearing of weight difficult.

[0008] Yet another stress fracture that elastic bands work to alleviate is a navicular stress fracture that occurs in the navicular bone in the center of the foot. The navicular stress fracture may produce vague pain around the middle and sides of the foot. Further, dislocations such a Lisfranc fracture can also cause side of foot pains, depending on the joint that is affected.

[0009] Yet another stress-related foot condition is Plantar fasciitis. This is a condition characterized by a tear in the arch ligament, or plantar fascia, on the bottom of the foot. The plantar fascia extends from the base of the heel bone to each of the toes of the foot. Plantar fascitis results when, either suddenly or gradually, motion and/or lack of arch support causes the flattening of the arch or the spreading of the toes such that sufficient pressure is exerted on the bottom of the foot to tear the plantar fascia.

[0010] Often, these structural supports are worn with foot wear. However, some conventional supports are either too bulky to be easily worn with footwear, or so flimsy that too little support is provided, inadequate adjustment is provided, or the support loses proper adjustment during wear.

[0011] Other proposals have involved elastic bands that support the foot. The problem with these is that they do not sufficiently wrap around the dorsal region of the foot. Also, they do not integrate efficiently with shoes, creating a synergy that leverages the support form shoes and the bands. Even though the above foot support devices meet some of the needs of the market, a foot support assembly that integrates with a shoe to provide medial and lateral support to the foot through a plurality of bands that traverse a dorsal region of the foot, and passes through channels in the outer sole of a shoe, and fastening straps that enable length adjustment of the bands around the foot; wherein shear forces and strain on the midfoot, hindfoot, and metatarsus of the foot are substantially inhibited is still desired.

SUMMARY

[0012] Illustrative embodiments of the disclosure are generally directed to a foot support assembly that integrates with a shoe to provide medial and lateral stability of the foot. Foot support assembly comprises a plurality of bands that traverse a dorsal region of the foot, passing through multiple channels in between the midsole and outer sole of the shoe. Bands are defined by a pair of free ends.

[0013] At least one closure, such as a D-ring, attaches to free ends of bands. A plurality of fastening straps join with the closure at one of the free ends of the bands. Displacement of the fastening straps through the closure enables length adjustment of the bands across the dorsal region of the foot. Changing the length of the band enables conformance to the individual foot size, alignment, and anatomical disposition. This helps reduce shear forces and strain on the foot.

[0014] The foot support assembly is configured to integrate with a shoe to provide medial and lateral support to the foot. The foot support assembly utilizes a plurality of bands that pass between the midsole and outer sole of the shoe. The bands traverse a dorsal region of the foot, before passing through multiple channels in between the midsole and outer sole of the shoe. The fastening straps attached at the free ends of the bands enable length adjustment of the bands, such that shear forces and strain on the foot are substantially reduced.

[0015] In one exemplary version of the assembly, three spaced-apart bands having a resilient characteristic are used. The three bands each include a pair of free ends and a longitudinal axis that is sufficient to wrap around the dorsal region of the foot. The bands create a taut pressure medially and laterally across the dorsal region of the foot to help prevent stress fractures and cracks on the foot. A D-ring closure positions at the free ends of the bands for fastening the bands to the fastening straps, and enabling length adjustment of the bands. \

[0016] Further, a plurality of fastening straps attach to one end of the bands. The fastening straps pass through the D-ring closure to adjust the length of the bands around variously sized and anatomically disposed feet. In this version, the assembly supports the plantar aspect of the foot, whereby the foot is sandwiched between bands, midsole, and outer sole. An alignment tape aligns the foot with the bands.

[0017] One objective of the present invention is to help stabilize the foot inside a shoe.

[0018] Another objective of the present invention is to reduce medial and lateral (side-to-side) movement of the foot inside a shoe.

[0019] Another objective of the present invention is to reduce shearing forces on the foot.

[0020] Yet another objective of the present invention is to reduce pronation and supination on the foot.

[0021] Yet another objective of the present invention is to reduce heel slippage.

[0022] Yet another objective of the present invention is to maintain proper plantar position of the metatarsal heads in relation to the shoe outer sole or a wearer's custom made foot orthotic.

[0023] Yet another objective of the present invention is to maintain proper medial side position of the first metatarsal head and proper lateral side position of the fifth metatarsal head to ensure proper shoe width.

[0024] Yet another objective of the present invention is to form a foot brace within the shoe.

[0025] Yet another objective of the present invention is to provide adjustable D-ring closures that enable the shoe to adapt to swelling by the foot.

[0026] Yet another objective of the present invention is to help prevent cuboid syndrome in the foot by alleviating pressure on the calcaneocuboid joint of the foot.

[0027] Yet another objective of the present invention is to help prevent plantar fasciitis in the foot by tightening the tendons and ligaments that run from the heel to the toes with flexible bands and fastening straps.

[0028] Other systems, devices, methods, features, and advantages will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional systems, methods, features, and advantages be included within this description, be within the scope of the present disclosure, and be protected by the accompanying claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

[0030] FIG. **1** illustrates a perspective view of an exemplary foot support assembly, showing an exemplary three bands, in accordance with an embodiment of the present invention;

[0031] FIG. **2** illustrates a top view of a band joined with a fastening strap through a closure, in accordance with an embodiment of the present invention;

[0032] FIG. **3** illustrates a dorsal view of an exemplary foot, showing ligaments, tendons, and metatarsus of the foot, in accordance with an embodiment of the present invention;

[0033] FIG. **4** illustrates a medial and lateral view of the foot, showing ligaments, tendons, and metatarsus of the foot, in accordance with an embodiment of the present invention;

[0034] FIG. **5** illustrates a dorsal view of the foot with three bands traversing the ligaments, hindfoot, midfoot, tendons, and metatarsus of the foot, in accordance with an embodiment of the present invention;

[0035] FIG. **6** illustrates a perspective view of an exemplary foot support assembly, showing an exemplary alignment tape, in accordance with an embodiment of the present invention;

[0036] FIGS. **7**A and **7**B illustrate perspective views of an exemplary foot support assembly, showing an exemplary closure, in accordance with an embodiment of the present invention;

[0037] FIG. **8** illustrates a table of parameter testing results for the plurality of bands, in accordance with an embodiment of the present invention;

[0038] FIG. **9** illustrates a perspective view of an exemplary shoe, showing an exemplary closure, in accordance with an embodiment of the present invention;

[0039] FIG. **10** illustrates a perspective view of an exemplary outer sole with a plurality of channels, in accordance with an embodiment of the present invention;

[0040] FIG. **11** illustrates a perspective view of an exemplary outer sole with a plurality of channels receiving the bands, in accordance with an embodiment of the present invention;

[0041] FIG. **12** illustrates a perspective view of the shoe showing the fastening straps passing through a plurality of shoe slots, in accordance with an embodiment of the present invention;

[0042] FIG. **13** illustrates a perspective view of the shoe showing the plurality of bands passing through the shoe slots, in accordance with an embodiment of the present invention;

[0043] FIG. **14** illustrates a top view of the shoe showing the plurality of bands and the fastening straps passing through the shoe slots, in accordance with an embodiment of the present invention; and

[0044] FIG. **15** illustrates a top view of the shoe with the bands wrapped around the upper body of the shoe, in accordance with an embodiment of the present invention.

[0045] Like reference numerals refer to like parts throughout the various views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0046] The following detailed description is merely exemplary in nature and is not intended to limit the described embodiments or the application and uses of the described embodiments. As used herein, the word "exemplary" or "illustrative" means "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" or "illustrative" is not necessarily to be construed as preferred or advantageous over other implementations. All of the implementations described below are exemplary implementations provided to enable persons skilled in the art to make or use the embodiments of the disclosure and are not intended to limit the scope of the disclosure, which is defined by the claims. For purposes of description herein, the terms "upper," "lower," "left," "rear," "right," "front," "vertical," "horizontal," and derivatives thereof shall relate to the invention as oriented in FIG. **1**. Furthermore, there is no intention to be bound by any expressed or implied theory presented in the preceding technical field, background, brief summary or the following

detailed description. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the inventive concepts defined in the appended claims. Hence, specific dimensions and other physical characteristics relating to the embodiments disclosed herein are not to be considered as limiting, unless the claims expressly state otherwise.

[0047] At the outset, it should be clearly understood that like reference numerals are intended to identify the same structural elements, portions, or surfaces consistently throughout the several drawing figures, as may be further described or explained by the entire written specification of which this detailed description is an integral part. The drawings are intended to be read together with the specification and are to be construed as a portion of the entire "written description" of this invention as required by 35 U.S.C. §112.

[0048] In one embodiment of the present invention presented in FIGS. **1-15**, a foot support assembly **100**, hereafter "assembly **100**", is configured to integrate with a shoe **300** to provide medial and lateral support to the foot **200**. Assembly creates a synergy with shoe **300** by traversing the dorsal region **202** of the foot **200**, while still supporting the sole **204** of the foot **200**. In one embodiment, foot support assembly **100** integrates with shoe **300** by passing between the midsole **309** and outer sole **302** of shoe **300** and wrapping around the dorsal region **202** of foot **200**.

[0049] In this manner, an active foot is stabilized by both assembly **100** and shoe **300** while performing rigorous activities. As a result of the unique engagement between foot support assembly **100**, shoe **300**, and foot **200**, shear forces and strain on the foot **200** are substantially reduced along the ligaments, hind foot, midfoot, tendons, and metatarsus of the foot **200**. However, in one alternative embodiment, assembly **100** operates separately from shoe **200**; directly wrapping around dorsal region **202** and arch of foot **200**.

[0050] Those skilled in the art will recognize that assembly **100** is especially useful for use by athletes and generally active feet, wherein the feet are subject to unusual strains as a result of strenuous activities. The assembly also provides a useful, self-contained, flexible, elastic appliance or attachment for cushioning, supporting and structurally controlling the foot, thus limiting or preventing secondary compensatory positional deformities in the foot and related physical structure. Assembly **100** works to reduce these shear strains on the foot **200** by partially restricting excessive lateral movement of the foot **200**.

[0051] In one embodiment, illustrated in FIG. **1**, assembly **100** provides medial and lateral support to the foot **200** with a plurality of bands **102***a*, **102***b*, **102***c* that traverse a dorsal region **202** of the foot **200**, passing through multiple channels **304***a*, **304***b*, **304***c* in between the midsole **309** and outer sole **302** of shoe **300**, and wrapping around an upper **308** of shoe **300**.

[0052] Bands **102***a-c* are defined by a longitudinal axis **116** and a pair of free ends **104***a*, **104***b*, **104***c*, **104***d*, **104***e*, **104***f*. Bands **102***a-c* are sufficiently resilient, so as to conform to size and anatomical disposition of foot **200**. At least one closure **110***a-f*, such as a D-ring, attaches to free ends **104***a-f*.

[0053] In other embodiments, a plurality of fastening straps **112***a*, **112***b*, **112***c* join with bands **102***a-c* along longitudinal axis **116**, forming a parallel, coplanar relationship. One end of fastening straps **112***a-c* join with the closure **110***a-f* at a free end **104***a* of band **102***a*. Fastening straps **112***a-c* have a fastening mechanism **114** that detachably attaches to opposite free end **104***b* of band **102***a*. In this manner, manipulation of fastening straps **112***a-c* through the at least one closure **110***a-f* enables length adjustment of the bands **102***a-c* across the dorsal region of the foot **200**. Altering the length of bands **102***a-c* enables length adjustment to conform to the individual foot **200** through displacement of the bands **102***a-c*. This helps reduce shear forces and strain on the foot **200**.

[0054] In one embodiment, at least three spaced-apart bands **102***a-c* include a pair of free ends **104***a-f* and a longitudinal axis **116** that is sufficient to wrap around the dorsal region **202** of the foot **200**. The bands **102***a-c* create a taut pressure medially and laterally across the dorsal region **202** of the foot **200** to help prevent stress fractures and cracks on the foot **200**.

[0055] In one embodiment, fastening mechanism **114** enables length adjustment of bands **102***a-c* across foot **200**. Assembly **100** supports the plantar aspect of the foot **200**, whereby the foot **200** is sandwiched between the bands **102***a-c*, midsole **309**, and outer sole **302**. An alignment tape **106** orients perpendicular to the bands **102***a-c* for aligning the foot **200** with bands **102***a-c*.

[0056] As referenced in FIG. **2**, foot support assembly **100** includes a plurality of spaced-apart bands **102***a-c*. Bands **102***a-c* are defined by a pair of free ends **104***a*, **104***b*, **104***c*, **104***d*, **104***e*, **104***f* and a longitudinal axis that is sufficient to at least partially traverse the dorsal region **202** of the foot **200**. Bands **102***a-c* traverse the foot **200** both medially and laterally across the dorsal region **202**. Bands **102***a-c* are sufficiently resilient, so as to create a taut pressure across the dorsal region **202** of the foot **200**. This is known in the art to help prevent stress fractures and cracks along the metatarsus of the foot **200**.

[0057] In some embodiments, fastening straps **112***a-c* are configured to join with pair of free ends **104***a-f* of bands **102***a-c*. Fastening straps **112***a-c* are defined by a fastening mechanism **114**, such as a hook and loop fastener. Fastening mechanism **114** helps fasten the bands **102***a-c* around the shoe **300** by fixedly attaching to one free end **104***a* of band **102***a* and detachably attaching to opposite free end **104***b* of band **102***a*. Fastening straps **112***a-c* may be adjusted due to their elasticity. Fastening straps **112***a-c* may be tightened or loosened independently of each other.

[0058] Bands **102***a-c* are adjustable through the shoe and the foot **200**. Specifically, the exact position of bands **102***a-c* along the dorsal region **202** of the foot **200** is adjustable, so as to support a wider or narrower region of the foot **200** along the medial and lateral dorsal regions **202**. Thus in one exemplary use, bands **102***a-c* can be spread out away from each other to apply pressure across the length of the foot **200**. In another possible use, bands **102***a-c* are bunched together in a parallel, adjacent relationship to form a single, large band. However, any number of manipulations of the bands **102***a-c* are possible to accommodate the foot **200**.

[0059] Those skilled in the art will recognize that feet come in myriad shapes and sizes. Thus, bands **102***a-c* are slightly pliable while engaged with the foot **200**, so as to mold to the contours of the foot **200**. Bands **102***a-c* also have sufficient rigidity and weight, so as to provide structural support to the foot **200**. Bands **102***a-c*, in essence, act as a foot brace to enhance stability of the foot **200** inside a shoe.

[0060] For example, bands **102***a-c* are configured to enable tightening around the foot **200** during plantar flexion or dorsiflexion. Bands **102***a-c* may be fabricated from a lightweight, strong material, such as, leather, a pliable polymer, a breathable fabric, and a nonwoven material in combination with a strong elastic-like material.

[0061] In one exemplary use of bands **102***a-c,* a first band **102***a* traverses the dorsal region **202** of the foot **200** proximal to the ankle, a second band **102***b* traverses the dorsal region **202** of the foot **200** proximal to the metatarsals, and a third band **102***c* traverses the dorsal region **202** of the foot **200** proximal to the toes, or phalanges. FIG. **3** illustrates a dorsal view of the foot **200** and the accompanying ligaments, tendons, and metatarsus. In one embodiment, bands **102**a-c maintain pressure on the dorsal region **202** of the foot **200** to inhibit stress fractures along the metatarsus.

[0062] In one specific benefit provided by foot support assembly **100**, the bands **102***a-c,* also help to maintain proper medial side position of the first metatarsal head and proper lateral side position of the fifth metatarsal head to ensure a proper shoe width. In this arrangement, bands **102***a-c* help maintain proper plantar position of the metatarsal heads in relation to the shoe insert or a wearer's custom made foot orthotic.

[0063] Those skilled in the art will recognize that bands **102***a-c* are especially effective for supporting the fifth metatarsal of the feet, so as to prevent stress fractures and inhibit growth of stress fractures once they have started. For example, a crack along the metatarsal that runs down the dorsal region **202** of the foot **200** is known in the art as a Jones fracture. The Jones fracture is known in the art to cause severe pain in the side of the foot **200** making the bearing of weight difficult.

[0064] Yet another stress fracture that bands **102***a-c* and the alignment tape **106** work to alleviate is a navicular stress fracture that occurs in the navicular bone in the center of the foot **200**. The navicular stress fracture may produce vague pain around the middle and sides of the foot **200**. Further, dislocations such a Lisfranc fracture can also cause side of foot pains, depending on the joint that is affected.

[0065] FIG. **4** illustrates a medial view of the foot **200**, where the Lisfranc fracture often occurs. Thus, the spaced apart and adjustable arrangement of bands **102***a-c* and fastening straps **112***a-c* are configured to help treat any number of stress fractures throughput the foot **200**.

[0066] Bands **102***a-c* can be manipulated in any number of dispositions along the foot **200**. In one exemplary positioning of bands **102***a-c* illustrated in FIG. **5**, the first band **102***a* extends from the support foundation to a region of the foot **200** that is proximate to the lateral heel counter and provides support. The second band **102***b* extends from the support foundation to a location on the item of footwear proximate to the lateral quarter and provides support. The third band **102***c* extends adjacent to the second band. Though, in alternative embodiments, more or less than three bands may be used, as required. In this manner, a substantial portion of the foot **200** is stabilized by the bands **102***a-c*.

[0067] Turning now to FIG. **6**, foot support assembly **100** further comprises an alignment tape **106** that forms a platform beneath the foot **200**. Alignment tape **106** helps to align the foot **200** with the plurality of bands **102***a-c*. In essence, foot **200** is sandwiched between bands **102***a-c* over the dorsal region **202**, and the midsole and outer sole. Thus, alignment tape **106** ensures proper alignment through all these components.

[0068] As illustrated in FIGS. **7**A and **7**B, foot support assembly **100** may further include at least one closure **110***a-f* that fastens free ends **104***a-f* of the bands **102***a-c* to fastening straps **112***a-c*. The at least one closure **110***a-f* enables length adjustment of bands **102***a-c* around the foot **200**. Thus in one possible use, the diameter of bands **102***a-c* may be increased or decreased by cinching closure **110***a-f* around free ends **104***a-f* of the bands **102***a-c*. Closure **110***a-f* allows fastening strap **112***a* to pass through for length adjustment of band **102***a,* so as to adapt to fluctuations in foot size due to swelling. In one embodiment, closure **110***a-f* is a D-ring closure. Though, any number of clamps, buckles, and frictional closures may be used for closure **110***a-f*.

[0069] Those skilled in the art, in light of the present teachings, will recognize that foot support assembly **100** is especially effective for preventing stress fractures in the foot **200**. The fracture is a stress fracture in the foot **200** caused by repetitive stress. Since the stress fracture generally starts as a small crack in the outer shell (cortex) of the bone. The stress fracture may actually start anywhere on the foot **200**. However, a substantial portion of stress fractures occur in the metatarsal bones of the foot **200**. Thus, support assembly **100** not only serves to inhibit stress fractures, but also prevents growth of the stress fracture once it has started. This is because without proper treatment, the crack may progress to fracture all the way through the bone.

[0070] In some embodiments, foot support assembly **100** may be effective for at least: reducing medial and lateral movement of the foot **200** inside the shoe; reducing shearing of the foot **200**; reducing pronation and supination of the foot **200**; reducing heel slippage; maintaining proper plantar position of the metatarsal heads in relation to the shoe's inserts; and maintaining proper medial side position of the first metatarsal head and proper lateral side position of the fifth metatarsal head.

[0071] FIG. **8** shows Table **400** that references parameter test results of bands **102***a-c*. Table **400** illustrates how bands **102***a-c* are effective for pressuring the ligaments, tendons, and metatarsus of the foot. Bands **102***a-c* may be fabricated from a lightweight, strong material, such as, leather, rubber, a pliable polymer, a breathable fabric, and a nonwoven material. In this embodiment, bands **102***a-c* have a density of 0.99 g/cc. Bands **102***a-c* have a tensile strength of 2.28 N/mm^2. Bands **102***a-c* have an elongation at break percentage of 388. Bands **102***a-c* have a tear strength of 4.27 N/mm. Finally, the bands **102***a-c* have a flexing resistance of 0.0007 mm/kc at 20° Celsius and −5° Celsius.

[0072] FIG. **9** illustrates a perspective view of an exemplary generic shoe **310**, showing an exemplary lace closure. The illustration shown by itself is generally not structurally rigid enough to provide support against stress fractures. This is because the foot **200** is covered and the upper **308** is supported and controlled in only the heel, the dorsal region **202** of the midfoot, and the dorsal region **202** of the five metatarsal bones of the forefoot, as shown in FIGS. **3** and **4**.

[0073] Those skilled in the art will recognize that a heel counter is a shaped stiffener that maintains the counter of the heel. The midfoot and the metatarsals have the shoe **310** secured to it with either a shoelace or a hook and loop fastening mechanism. The overwhelming amount of pressure and holding power that the shoelace or hook and loop

fastening mechanism exerts is to the top of the midfoot and metatarsals. Very little pressure and holding power are applied to the medial and lateral sides of the shoe **310**, thus providing little lateral and medial support. Foot support assembly attempts to compensate for shoe's lack of support.

[0074] Specifically, present shoes do not effectively control the following manipulations: inversion—a turning inward of the foot; eversion—a turning outward of the foot **200**; abduction—the motion of a body part away from the midline of the body; adduction—the motion of the body part toward a midline of the body; pronation—the tri-plane motion of the foot consisting of eversion, dorsiflexion, and abduction; supination—the tri-plane motion of the foot consisting of inversion, plantarflexion, and adduction; and shearing—the anterior-posterior or medial-lateral and even oblique parallel movement or sliding motion that produces stress or tearing of tissue on the plantar surface of the foot **200**.

[0075] FIG. **10** illustrates a perspective view of an exemplary outer sole **302** with a plurality of channels **304***a*, **304***b*, **304***c* for a shoe **300**. In one possible embodiment, shoe **300** includes an outer sole **302**, a shoe heel, and a shoe upper **308**. Outer sole **302** includes a plurality of channels **304***a*, **304***b*, **304***c* that are sized and dimensioned to receive the bands **102***a-c* and the fastening straps **112***a-c*. Channels **304***a*, **304***b*, **304***c* extend cross length across outer sole **302**.

[0076] FIG. **11** illustrates a perspective view of outer sole **302** with a plurality of channels **304***a*, **304***b*, **304***c* receiving the bands **102***a-c*, in accordance with an embodiment of the present invention. In one possible embodiment, bands **102***a-c* wrap around upper **308** of shoe **300** so as to provide medial and lateral support to the foot. The bands **102***a-c* pass over the upper **308** and through a slot **306** that runs through outer sole **302** of shoe **300**. In this manner, bands **102***a-c* can secure the vamp portion of upper **308** around the foot **200** and not just on top of the foot **200**.

[0077] FIG. **12** illustrates a perspective medial view of shoe **300** showing fastening straps **112***a-c* passing through slot **306**. Bands **102***a-c* and the fastening straps **112***a-c* wrapped around shoe **300** may be adjusted not only due to the elasticity of bands **102***a-c*, but also due to fastening straps **112***a-c* that can be tightened or loosened independently of each other.

[0078] FIG. **13** illustrates a perspective lateral view of shoe **300** showing bands **102***a-c* passing through the slot **306** over the outer sole **302**. Fastening straps **112***a-c* are shown extending through the slot **306**. Through simple adjustment of fastening straps **112***a-c*, a wearer can achieve superior support and control of the foot **200** within shoe **300**. The wearer can adapt the shoe **300** to meet the physical and stress for any physical activity, including sports.

[0079] FIG. **14** illustrates a top view of the shoe **300** showing bands **102***a-c* and fastening straps **112***a-c* passing through slot **306** over outer sole **302**. It is significant to note that while foot support assembly **100** is an integral part of the shoe **300**, it is still outside of the shoe **300**. In one possible embodiment, foot support assembly **100** is operable when needed most, such as during an abrupt landing. Foot support assembly **100** may then return to the original position without compromising the comfort of the shoe **300**.

[0080] FIG. **15** illustrates a top view of the shoe **300** with bands **102***a-c* wrapped around upper **308** of the shoe **300**. Foot support assembly **100** provides medial and lateral support to the foot with bands **102***a-c* that traverse dorsal region **202** of foot **200**, and closure **110***a-f* that enables length adjustment of bands **102***a-c*, such that shear forces and strain on the foot **200** are substantially reduced.

[0081] Since many modifications, variations, and changes in detail can be made to the described preferred embodiments of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalence.

What I claim is:

1. A support assembly for medial and lateral support of the foot, the assembly comprising:

a plurality of bands, the plurality of bands defined by a longitudinal axis and a pair of free ends, the plurality of bands arranged in a spaced-apart, parallel relationship;

a plurality of fastening straps, the plurality of fastening straps comprising a fastening mechanism configured to detachably attach to one of the free ends of the plurality of bands; and

at least one closure, the at least one closure configured to join one of the free ends of the plurality of bands with the plurality of fastening straps, the at least one closure further configured to enable passage of the plurality of fastening straps,

whereby displacement of the plurality of fastening straps through the at least one closure enables independent length adjustment of each of the plurality of bands.

2. The assembly of claim **1**, further including an alignment tape.

3. The assembly of claim **2**, wherein the alignment tape is disposed generally perpendicular to the plurality of bands, the alignment tape configured to help align the plurality of bands.

4. The assembly of claim **1**, wherein the plurality of bands comprises multiple spaced-apart, parallel bands.

5. The assembly of claim **1**, wherein the plurality of bands comprises three parallel bands.

6. The assembly of claim **1**, wherein the plurality of bands are resilient.

7. The assembly of claim **1**, wherein the plurality of fastening straps are disposed along the length of the longitudinal axis of the plurality of bands.

8. The assembly of claim **1**, wherein the fastening mechanism comprises a hook and loop fastener.

9. The assembly of claim **1**, wherein the at least one closure comprises a D-ring closure.

10. The assembly of claim **1**, further including a shoe defined by an outer sole, an upper, and a slot.

11. The assembly of claim **10**, wherein the outer sole comprises a plurality of channels, the plurality of channels sized and dimensioned to receive the plurality of bands and the plurality of fastening straps.

12. A support assembly for medial and lateral support of the foot, the assembly comprising:

a plurality of bands, the plurality of bands defined by a longitudinal axis and a pair of free ends, the plurality of bands arranged in a spaced-apart, parallel relationship, the plurality of bands configured to enable traversing a dorsal region of a foot at least in a medial and lateral orientation, the plurality of bands further configured to at least partially conform to the dorsal region of the foot;

a plurality of fastening straps, the plurality of fastening straps comprising a fastening mechanism configured to detachably attach to one of the free ends of the plurality of bands;

at least one closure, the at least one closure configured to join one of the free ends of the plurality of bands with the plurality of fastening straps, the at least one closure further configured to enable passage of the plurality of fastening straps,

whereby displacement of the plurality of fastening straps through the at least one closure independent length adjustment of each of the plurality of bands; and

an alignment tape, the alignment tape disposed generally perpendicular to the plurality of bands, the alignment tape configured to help align the foot with the plurality of bands.

13. The assembly of claim **12**, wherein the plurality of bands comprises multiple spaced-apart, parallel bands.

14. The assembly of claim **12**, wherein the plurality of bands comprises three parallel bands.

15. The assembly of claim **12**, wherein the plurality of fastening straps are disposed along the length of the longitudinal axis of the plurality of bands.

16. The assembly of claim **12**, wherein the fastening mechanism comprises a hook and loop fastener.

17. The assembly of claim **12**, wherein the at least one closure comprises a D-ring closure.

18. The assembly of claim **1**, further including a shoe defined by an outer sole, an upper, and a slot.

19. The assembly of claim **18**, wherein the outer sole comprises a plurality of channels, the plurality of channels sized and dimensioned to receive the plurality of bands and the plurality of fastening straps.

20. A support assembly for medial and lateral support of the foot, the assembly comprising:

a plurality of bands, the plurality of bands defined by a longitudinal axis and a pair of free ends, the plurality of bands arranged in a spaced-apart, parallel relationship, the plurality of bands configured to enable traversing a dorsal region of a foot at least in a medial and lateral orientation, the plurality of bands further configured to at least partially conform to the dorsal region of the foot;

a plurality of fastening straps, the plurality of fastening straps comprising a fastening mechanism configured to detachably attach to one of the free ends of the plurality of bands;

an alignment tape, the alignment tape disposed generally perpendicular to the plurality of bands, the alignment tape configured to help align the foot with the plurality of bands;

at least one closure, the at least one closure configured to join one of the free ends of the plurality of bands with the plurality of fastening straps, the at least one closure further configured to enable passage of the plurality of fastening straps,

whereby displacement of the plurality of fastening straps through the at least one closure enables independent length adjustment of each of the plurality of bands;

an alignment tape, the alignment tape disposed generally perpendicular to the plurality of bands, the alignment tape configured to help align the foot with the plurality of bands; and

a shoe defined by an outer sole, an upper, and a slot, the outer sole comprising a plurality of channels disposed to extend cross length of the outer sole, the plurality of channels sized and dimensioned to receive the plurality of bands and the plurality of fastening straps.

* * * * *