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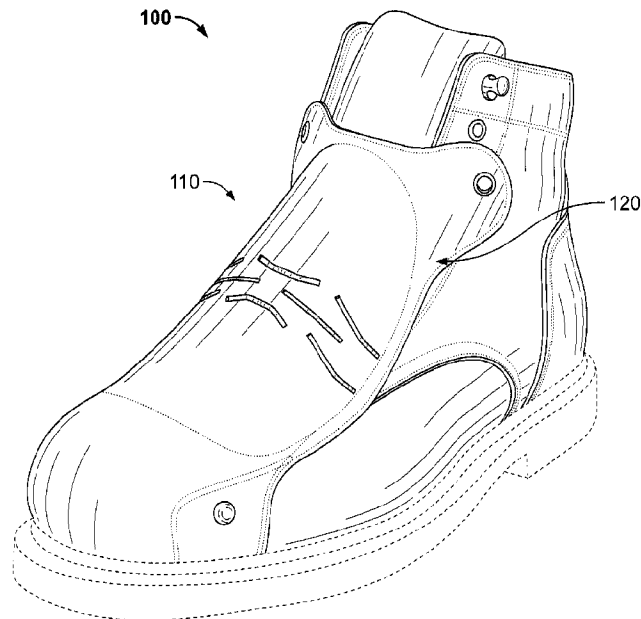
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(54) Titre : PROTEGE-METATARSIEN FLEXIBLE

(54) Title: FLEXIBLE METATARSAL GUARD



(57) Abrégé/Abstract:

A metatarsal guard is provided which is adapted to have improved flexibility while maintaining adequate protection for the metatarsal region of a user's foot. The guard may include a flexible section spanning the width of the guard in a medial-lateral direction and comprising a pattern of perforations extending entirely or partway through the thickness of the metatarsal guard. In some aspects, the pattern of perforations may allow for expansion along the medial and lateral edges of the guard, while resisting deformation caused by outside impact.



ABSTRACT OF THE DISCLOSURE

A metatarsal guard is provided which is adapted to have improved flexibility while maintaining adequate protection for the metatarsal region of a user's foot. The guard may include a flexible section spanning the width of the guard in a medial-lateral direction and comprising a pattern of perforations extending entirely or partway through the thickness of the metatarsal guard. In some aspects, the pattern of perforations may allow for expansion along the medial and lateral edges of the guard, while resisting deformation caused by outside impact.

FLEXIBLE METATARSAL GUARD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of the filing date of U.S. Provisional Application No. 62/747,766 filed October 19, 2018.

FIELD OF THE INVENTION

[0002] Aspects of the present invention relate, in general, to protection devices for use in shoes, and specifically to metatarsal or other protection devices for shielding a user's foot from injury. Protection devices for use in shielding other areas of a user's foot, other portions of the body, or in alternate applications beyond bodily protection are also contemplated.

BACKGROUND OF THE INVENTION

[0003] Protection devices for shielding the metatarsal area of the foot from injury are widely used in various sectors of the footwear industry. Typically, these protection devices are referred to as metatarsal guards, and may be employed as an external guard or integrated into the shoe itself (e.g., an internal guard). Common scenarios in which such metatarsal guards may be necessary are in construction applications, in mining, or in other like fields where the foot may be susceptible to injury due to impact with extraneous objects (e.g., falling rocks, lumber, puncture via nails, etc.) In some cases, while the aforementioned metatarsal guard(s) may provide adequate protection from injury, such guard(s) may restrict comfortable movement of the foot due to the rigidity of the guard(s). Other deficiencies not noted here also exist.

[0004] Beyond protection of the metatarsal area of the foot, other sensitive areas that are susceptible to injury may also require shielding. For example, it may be the case that the foot, in certain scenarios, requires side or heel protection instead of, or in combination with, metatarsal protection. It is not uncommon to provide such protective devices on the side or heel region of a shoe in order to provide shielding. Even these protective mechanisms, however, may suffer from several defects and therefore lack comfort in use. For example, some protective devices are unnecessarily rigid and, thereby, do not adequately absorb the shock resulting from an impact or other injuring event. Stated differently, since such protective devices are unduly rigid, force generated from an impact can travel through the device and be translated to the user, resulting in injury to the user from the impact. Such rigidity also

decreases comfort, and sometimes results in the protective device being overly heavy. This may also be the case for several of the metatarsal protection devices noted above.

BRIEF SUMMARY OF THE INVENTION

[0005] A metatarsal guard according to the present technology is adapted to provide improved flexibility while maintaining adequate protection for the metatarsal region of a user's foot. In some aspects, the guard may include a flexible section spanning the width of the guard in a medial-lateral direction and comprising a pattern of perforations extending entirely through the thickness of the metatarsal guard.

[0006] In one embodiment, a wearable protective device, such as a metatarsal guard, according to the present technology comprises: a bottom surface configured to be positioned adjacent a surface of a user's body and an opposing top surface; a flexible section comprising a pattern of perforations spanning a width of the wearable protective device; a first perforation-free section; a second perforation-free section; wherein the flexible section is disposed between the first perforation-free section and the second perforation-free section in a length direction of the wearable protective device.

[0007] In some embodiments, the flexible section of the wearable protective device further comprises: a first expansion region disposed in a medial region of the wearable protective device, comprising one or more perforations extending through a medial edge of the wearable protective device; a second expansion region disposed in a lateral region of the wearable protective device, comprising one or more perforations extending through a lateral edge of the wearable protective device; and a contraction region disposed between the first and second expansion regions in a width direction of the protective device comprising one or more perforations.

[0008] In some embodiments, the first and second expansion regions are configured to allow for expansion of medial and lateral edges of the wearable protective device when pressure is applied to the bottom surface of the wearable protective device and the contraction region is configured to contract when pressure is applied to the bottom surface of the wearable protective device. In addition, at least one of the perforations extending through the medial edge of the wearable protective device and at least one of the perforations extending through the lateral edge of the wearable protective device may each comprise two corners which are configured to engage with one another when pressure is applied to the top surface of the wearable protective device.

[0009] In use, the metatarsal guard may be positioned within a shoe 100, similar to shoe shown in Fig. 1, and may act to protect the metatarsal area of a user's foot from falling objects or other impact events, while preserving flexibility and comfort for a wearer throughout natural flexion of the foot during a stride.

[0010] Accordingly, some aspects of the technology may include a shoe, comprising: an outsole; an upper comprising an internal surface configured to receive a user's foot and an opposing external surface; and a wearable protective device comprising: a bottom surface configured to be positioned adjacent a surface of a user's body and an opposing top surface; a flexible section comprising a pattern of perforations spanning a width of the wearable protective device; a first perforation-free section; a second perforation-free section; wherein the flexible section is disposed between the first perforation-free section and the second perforation-free section in a length direction of the wearable protective device.

[0011] In some embodiments, the wearable protective device may be an external metatarsal guard, while in others it may be an internal metatarsal guard.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a perspective view of a shoe incorporating the metatarsal guard according to an aspect of the present technology.

[0013] Fig. 2A is a perspective view of a metatarsal guard according to an embodiment of the present technology.

[0014] Fig. 2B is a top view of a metatarsal guard according to an embodiment of the present technology.

[0015] Fig. 3A is a perspective view of an expansion region of a metatarsal guard, in an expanded position, according to an embodiment of the present technology.

[0016] Fig. 3B is a perspective view of an expansion region of a metatarsal guard, in a contracted or closed position, according to an embodiment of the present technology.

[0017] Fig. 4A is a side view of a metatarsal guard according to an embodiment of the present technology.

[0018] Fig. 4B is a top view of a metatarsal guard according to an embodiment of the present technology.

[0019] Fig. 5 is a perspective view of a metatarsal guard according to an embodiment of the present technology.

[0020] Fig. 6 is a top view of a metatarsal guard according to an embodiment of the present technology.

DETAILED DESCRIPTION

[0021] In describing aspects of the present invention(s), specific terminology will be used for the sake of clarity. However, the invention(s) is not intended to be limited to any specific terms used herein, and it is to be understood that each specific term includes all technical equivalents, which operate in a similar manner to accomplish a similar purpose.

[0022] As used in the present application, “length” means the longest dimension of any object or shape. As used in the present application, “width” means the shortest dimension of any object or shape existing in the same plane as the length. “Thickness” means the remaining dimension of a three-dimensional object which is not the length or the width. As used in the present application, “medial” means at, towards, near, or relating to the midline of the human body, i.e. as applied to a shoe as it would be oriented when it is situated on the foot of a wearer. As used in the present application, “lateral” means at, towards, near, or relating to the edge of an object, particularly an edge or end which is away from or opposite the midline (medial region) of the human body. When the terms “medial” and “lateral” are applied to a shoe or other wearable object, they describe portions of the object as they would be oriented when worn by a wearer. As used in the present application, “perforation” means a depression, cut-out, indentation, hole, or the like, extending entirely through or partway through the thickness of a material or object.

Metatarsal Guard

[0023] As shown in Figs. 2A-B, a metatarsal guard 200 according to one embodiment of the present technology is shown, in which the guard is adapted to provide improved flexibility while maintaining adequate protection for the metatarsal region of a user's foot. Guard 200 comprises a top surface 202 and a bottom surface 204. As shown further in Fig. 2A, metatarsal guard 200 may be anatomically contoured to conform to the shape of the foot. In particular, the guard 200, which may be situated against the foot during use, may be convexly shaped in the medial-lateral direction 210, and concavely shaped in the longitudinal 220 direction. Thus, bottom surface 204 of guard 200 may conform to the metatarsal region of a user's foot.

[0024] As shown in Figs. 2A-B and 4A-B, in a preferred embodiment, the metatarsal guard 200 may be generally oval or oblong shaped. However, the shape of the guard is not

particularly limited and may be circular, rectangular, square, polygonal, polygonal with rounded edges, T-shaped, cross-shaped (as are guards 500 and 600, shown in Figs. 5-6), or in any other shape which allows it to cover and conform to the metatarsal region of a wearer's foot. As depicted in Figs. 5-6, a cross-shaped configuration of a guard is particularly advantageous in that it may reduce the amount of material used in the guard, while still providing protection by covering the majority of the area of the foot which is vulnerable to impacts from above. Such a cross-shaped configuration may thereby reduce production costs as well as minimize the weight and profile of the guard in order to provide a safe, light-weight, streamlined, and aesthetically pleasing product to the wearer. In this regard, a cross-shaped configuration is especially preferred for use as an internal metatarsal guard.

[0025] The guard may be ideally formed from a material or material blend which is light-weight and flexible, while maintaining rigidity upon impact. Exemplary materials include but are not limited to rubber, elastomer, nylon, polycarbonate, thermoplastic polyurethane (TPU), and any combination thereof. In a preferred embodiment, the guard comprises TPU. In some embodiments, the guard may additionally comprise a nonwoven material, particularly on the surface of the guard, in order to facilitate bonding and to provide reduction of noise caused by any contacting surfaces of the guard. The thickness of the guard may be in the range of about 1 mm to about 5 mm, more preferably in the range of about 2 mm to about 5 mm, and even more preferably in the range of about 3 mm to about 5 mm. In a preferred embodiment, the thickness of the guard is about 4 mm.

[0026] In some aspects, as exemplified in Figs. 2A-B, the guard may include a flexible section 230 spanning the width of the guard 200 in a medial-lateral direction and comprising a pattern 240 of perforations extending entirely through the thickness of the metatarsal guard 200. The pattern 240 of perforations may include two regions 250, 252 configured for expansion along the medial and lateral edges of the guard respectively and a section 260 configured for contraction disposed between the laterally situated expansion regions.

Flexible Section

[0027] In some embodiments, as exemplified in Figs. 2A-B, the flexible section 230 of the guard 200 is configured to allow for normal movement of the foot within the shoe during a stride, while maintaining rigidity against impact from the outside of the shoe, most particularly from falling objects from above. The flexible section may comprise a pattern 240 of perforations, which allow for an increase in the degree of longitudinal concavity of the guard

200 when pressure is applied along the bottom surface 204 of the guard 200, e.g. during dorsiflexion of the foot during a stride. The perforations may be generally linear, zig-zagged, or curved in shape. The pattern may comprise a single row of perforations, 2 to 3 rows of perforations, 2 to 4 rows of perforations, or greater than four rows of perforations. In a preferred embodiment, the pattern has 3 rows of perforations. In some embodiments, the perforations in adjacent rows may be in line with one another, while in some embodiments the perforations in adjacent rows may be offset from one another, e.g. in a staggered configuration. In a preferred embodiment, the perforations in adjacent rows are in a staggered configuration. The perforations in some rows may have a different shape from the perforations in other rows. In a preferred embodiment having 3 rows, the perforations of the outer two rows may have a curved or zig-zag shape, while the perforations of the center row (disposed between the outer two rows) may have a generally linear shape.

[0028] The flexible section 230 may span the width of the guard, running from the medial edge to the opposing lateral edge. The flexible section may have a width which may be in the range of about 10 % to about 50 % of the length of the guard, more preferably about 20 % to about 40 % of the length of the guard and is most preferably about 30% of the length of the guard, with the perforation-free sections 232 and 234 making up the remainder of the length of the guard. In some aspects, the flexible section 230 may be situated in a central region of the guard, sandwiched between a top section 232 towards the collar of the shoe and a bottom section 234 towards the toe of the shoe, which are free from perforations. It is particularly advantageous to include a top 232 and bottom 234 section free from perforations in order to ensure the guard bends easily and readily at the flexible section in order to allow free movement of the wearer. During use, perforation-free sections 232 and 234 may act as moment arms to the axis created by the flexible section. Therefore, it is advantageous for the width of the flexible section to be within the disclosed preferred ranges in order to provide sufficiently long, rigid moment arms 232, 234 to allow for easy and comfortable bending of the flexible section during the wearer's stride or other dorsiflexion of the foot. In addition, perforation-free sections 232, 234 may help the guard 200 to retain its shape and to provide increased protection relative to a guard which does not contain such perforation-free sections.

[0029] In some embodiments, as shown in Figs. 2A-B, the perforations of the pattern 240 of perforations may extend entirely through the thickness of the guard 200. In other

embodiments, as shown in Figs. 4A-B, one or more of the perforations of the pattern 440 of perforations may extend only partway through the thickness of the guard.

Expansion Regions

[0030] In some embodiments, as exemplified in Figs. 2A-B, the pattern of perforations of the guard 200 may include two regions 250, 252 configured for expansion which lie along the medial 250 and lateral 252 edges of the guard, respectively. Each expansion region 250, 252 comprises a plurality of perforations 254 which extend up to and through the medial and lateral edges of the guard, such that gaps 256 are formed along the edges of the guard between top and bottom corners 258a, 258b. In a preferred embodiment, the perforations 254 of the medial expansion region 250 and the perforations 254 of the lateral expansion region 252 have a zig-zag shape and are mirror images of one another. In such an embodiment, each of the medial and lateral expansion regions 250, 252 may contain two perforations 254 extending through the edges of the guard.

[0031] As shown in Fig. 3A, when pressure is applied to the bottom surface 204 of the guard 200, i.e. during dorsiflexion of the foot of a wearer, the top and bottom corners 258a, 258b move apart, and the gaps 256 along the edges of the guard 200 expand. Such expansion allows the degree of longitudinal concavity of the guard 200 to increase and the top and bottom sections 232, 234 of the guard 200 to move towards one another. By contrast, in some embodiments, as shown in Fig. 3B, when pressure is applied to the top surface 202 of the guard 200, i.e. during impact from a falling object, the gaps 256 along the edges of the guard 200 will contract and the degree of longitudinal concavity of the guard 200 will decrease, until the top and bottom corners 258a, 258b contact and engage with one another. Once this occurs, the guard will maintain rigidity and resist further bending or deformation towards a wearer's foot.

[0032] In other embodiments, as shown in Figs. 4A-B, one or more of the perforations 454 of the medial expansion region 450 and of the lateral expansion region 452 are Y-shaped, such that edges of the perforation run parallel to each other in a direction from the midline of the guard towards an outer edge of the guard, before diverging to form top and bottom inner corners 457a, 457b. The diverging edges of the perforation extend up to and through the outer edge of the guard to form top and bottom outer corners 458a, 458b, such that outer corners 458a, 458b are further apart in distance from inner corners 457a, 457b. Accordingly, when pressure is applied to the top surface 402 of the guard 400, i.e. during impact from a falling object, the top and bottom inner corners 457a, 457b will contact and engage with one another,

so that the guard will maintain rigidity and resist further bending or deformation towards a wearer's foot. Because the top and bottom outer corners 458a, 458b are spaced further apart than the inner corners 457a, 457b, outer corners 458a, 458b will remain spaced apart from one another and resist contact, while the inner corners engage. This may provide advantages such as avoiding noise caused by the contact of the outer corners 458a, 458b.

Contraction Region

[0033] As exemplified in Figs. 2A-B, the pattern of perforations of the guard may further include a contraction region 260 situated between the medial and lateral expansion portions 250, 252. The contraction region may include a plurality of perforations 262 which do not extend through the peripheral edges of the guard.

[0034] In some embodiments, as exemplified in Figs. 2A-B, the perforations 262 may extend entirely through guard 200. In other embodiments, as shown in Figs. 4A-B, one or more of the perforations of the pattern 440 of perforations may extend only partway through the thickness of the guard, such as about 25% to about 90% through the thickness of the guard, more preferably about 35% to 90% through the thickness of the guard, or most preferably about 40% to about 80% through the thickness of the guard. Perforations which extend all the way through the guard may provide advantages such as allowing for relatively easier bending and contraction of the region 260, while avoiding flattening of the shape of the guard 200. At the same time, perforations which extend only partway through the guard may provide advantages such as increasing strength of the guard and resisting deformation caused by impact.

[0035] In a preferred embodiment, as exemplified in Fig. 2B, the contraction region 260 may include three rows of perforations 262, including a top and bottom rows of one or more perforations 262 having zig-zag shapes, and a middle row of linear perforations 262. In some embodiments, the perforations of the contraction region 260 may form a mirror image across a longitudinal line and/or across a medial-lateral line.

[0036] When pressure is applied to the bottom surface 204 of the guard 200, the edges of perforations 262 may draw together, allowing the degree of longitudinal concavity of the guard 200 to increase and the top and bottom sections of the guard 232, 234 to move towards one another. By contrast, when pressure is applied to the top surface 202 of the guard 200, i.e. during impact from a falling object, the perforations of the contraction region 260 of the guard 200 will maintain rigidity and resist further bending or deformation of the guard 200 towards a wearer's foot.

Internal Metatarsal Guard

[0037] In use, in some aspects, embodiments of the metatarsal guard 500, 600 exemplified in Figs. 5-6 may be positioned within a shoe to form an internal guard and may act to protect the metatarsal area of a user's foot. In use as an internal guard, the aforementioned embodiments of the internal metatarsal guard may be situated between outer and inner layers of an upper of a shoe. In particular, in use as an internal guard, the metatarsal guard may be situated beneath a lacing mechanism and in some embodiments may be positioned between outer and inner layers of a tongue portion of a shoe. In such embodiments, the metatarsal guard may extend from a toe region of a shoe to a collar region of a shoe, running beneath a lacing mechanism. In other embodiments, in which a tongue or a lacing mechanism may not be present, the metatarsal guard may be situated in between outer and inner layers of an upper in a vamp region of the shoe. In some configurations, the flexible region of the guard may be positioned between the toe region and the collar region in the area of a user's metatarsophalangeal (MCP) joints, allowing for bending of the joints during a stride. In some embodiments, the guard may additionally include one or more foam or cushioning layers which may be situated to contact a top surface and/or a bottom surface of the guard. Thus, metatarsal guard 500, 600 may be utilized as an internal guard in a shoe to protect a user's foot from falling objects or other impact events, which would otherwise injure the foot, while also maintaining flexibility of the foot and an unobtrusive and attractive visual profile.

External Metatarsal Guard

[0038] In some aspects, as exemplified in Figs. 1, 2A-B, 4A-B, the metatarsal guard 200, 400 may be positioned above and overlies a portion of the upper of a shoe 100 to form an external guard 110. For example, Fig. 1 depicts a shoe 100 which includes an external metatarsal guard 110 according to an embodiment of the invention. Such guard 110 is situated between outer and inner layers of a flap 120 connected to an upper of the shoe 100. In some embodiments, a flap such as the flap 120 may be connected to the upper of the shoe in a toe region, while in other embodiments, the flap may be connected to the upper in other regions, such as at the collar of the shoe and/or in medial or lateral regions of the shoe. In some aspects, the flap may have one point of connection to the upper, while in alternative embodiments, the flap may have multiple points of connection to the upper. In some aspects, one or more of the points of connection may be permanent, such as attachment by stitching, glue, or the like. In additional embodiments, one or more of the points of attachment may be readily removable or

detachable, such as attachment by lacing, hook and loop fasteners, snaps, buttons, or the like. In an embodiment, the external guard may be readily and entirely detachable from the upper of the shoe. In some embodiments, the guard may additionally include one or more foam or cushioning layers which may be situated to contact a top surface and/or a bottom surface of the guard 110. As shown, flap 120 may be situated over the metatarsal area of a user's foot to provide protection therefor and over a lacing component for the shoe 100.

[0039] Additional Embodiments

[0040] As another example, although the metatarsal protection devices detailed herein are predominantly concave in a longitudinal direction and convex in a medial-lateral direction, other curvatures and shapes are contemplated. Such alternate curvatures and/or shapes may also lend themselves to providing protection for other areas of a user's foot, or for other areas of the body. Indeed, it is contemplated that aspects of the aforementioned metatarsal protection devices may be utilized in other areas of a shoe to provide protection for other areas of a user's foot, such as, for example, in the heel or side of the shoe. If used for these purposes, the metatarsal protection devices disclosed herein may be modified in shape and contour to conform to the area of the foot being protected.

[0041] Likewise, it is contemplated that aspects of the aforementioned protection devices may be used to protect other areas of a user's body, such as, for example, the knee, elbow, etc. In particular, protective devices having the different layers of material and varying patterns discussed above may be situated within a housing and be adapted to overly a surface of the user's body, such that the applicable device could protect the relevant portion of the body from injury. An example of this may be a knee or elbow guard, which utilizes at least one of the embodiments discussed above for protective purposes. In this manner, a user may be provided with several protective devices that are usable to shield varying portions of the body (e.g., including, but not limited to, the foot, knee, elbow, etc.)

[0042] Although aspects of the invention(s) herein have been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of aspects of the present invention(s). It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the scope of the present invention(s) as defined by the appended claims.

[0043] It will also be appreciated that the various dependent claims and the features set forth therein can be combined in different ways than presented in the initial claims. It will also be appreciated that the features described in connection with individual embodiments may be shared with others of the described embodiments.

CLAIMS

1. A wearable protective device comprising:
 - a bottom surface configured to be positioned adjacent a surface of a user's body and an opposing top surface; and
 - a flexible section is disposed between a first perforation-free section and a second perforation-free section in a length direction of the wearable protective device, such that the flexible section has a width extending in a length direction of the wearable protective device, and the width of the flexible section is in the range of about 10 % to about 50 % of a length of the wearable protective device, andwherein the flexible section comprises:
 - a first expansion region disposed in a medial region of the wearable protective device, comprising one or more perforations extending through a medial edge of the wearable protective device to provide expansion of a medial edge of the wearable protective device when pressure is applied to the bottom surface;
 - a second expansion region disposed in a lateral region of the wearable protective device, comprising one or more perforations extending through a lateral edge of the wearable protective device to provide expansion of a lateral edge of the wearable protective device when pressure is applied to the bottom surface; and
 - a contraction region disposed between the first and second expansion regions in a width direction of the protective device comprising one or more perforations which contract when pressure is applied to the bottom surface.
2. The wearable protective device of claim 1, wherein the flexible section has a width extending in a length direction of the wearable protective device, and the width of the flexible section is in the range of about 20 % to about 40 % of a length of the wearable protective device.
3. The wearable protective device of claim 1, wherein the flexible section is configured to allow for bending when pressure is applied to the bottom surface of the wearable protective device and to resist deformation when pressure is applied to the top surface of the wearable protective device.

4. The wearable protective device of claim 3, wherein the flexible section is configured to allow the wearable protective device to move along with a surface of a user's body, when pressure is applied to the bottom surface of the wearable protective device.

5. The wearable protective device of claim 1, wherein at least one perforation of the pattern of perforations extends only partway through a thickness of the wearable protective device.

6. The wearable protective device of claim 1, wherein the wearable protective device is convexly shaped in a medial-lateral direction, and concavely shaped in a longitudinal direction.

7. The wearable protective device of claim 1, wherein the wearable protective device comprises a material selected from the group consisting of rubber, elastomer, nylon, polycarbonate, thermoplastic polyurethane (TPU), and any combination thereof.

8. The wearable protective device of claim 7, wherein the one or more perforations extending through the medial and lateral edges of the wearable protective device extend entirely through a thickness of the wearable protective device.

9. The wearable protective device of claim 7, wherein at least one of the perforations of the contraction region extends only partway through a thickness of the wearable protective device.

10. The wearable protective device of claim 7, wherein at least one of the perforations extending through the medial edge of the wearable protective device and at least one of the perforations extending through the lateral edge of the wearable protective device each comprise two corners which are configured to engage with one another when pressure is applied to the top surface of the wearable protective device.

11. The wearable protective device of claim 10, wherein the corners are set inwards from an edge of the wearable protective device.

12. The wearable protective device of claim 11, wherein the at least one perforation extending through the medial edge of the wearable protective device and the at least one perforation extending through the lateral edge of the wearable protective device are each Y-shaped.

13. A shoe, comprising:
an outsole; an upper comprising an internal surface configured to receive a user's foot and an opposing external surface; and a wearable protective device comprising:

a bottom surface configured to be positioned adjacent a surface of a user's body and an opposing top surface;

a flexible section disposed between a first perforation-free section and a second perforation-free section in a length direction of the wearable protective device, such that the flexible section has a width extending in a length direction of the guard, and the width of the flexible section is in the range of about 10 % to about 50 % of a length of the wearable protective device, and

wherein the flexible section comprises:

a first expansion region disposed in a medial region of the wearable protective device, comprising one or more perforations extending through a medial edge of the wearable protective device to provide expansion of a medial edge of the wearable protective device when pressure is applied to the bottom surface;

a second expansion region disposed in a lateral region of the wearable protective device, comprising one or more perforations extending through a lateral edge of the wearable protective device to provide expansion of a lateral edge of the wearable protective device when pressure is applied to the bottom surface; and

a contraction region disposed between the first and second expansion regions in a width direction of the protective device comprising one or more perforations which contract when pressure is applied to the bottom surface.

14. The shoe of claim 13, wherein the wearable protective device is an external metatarsal guard.

15. The shoe of claim 13, wherein the wearable protective device is an internal metatarsal guard.

16. The shoe of claim 14, wherein the external metatarsal guard overlies a portion of the external surface of the upper.

17. The shoe of claim 15, wherein the upper further comprises a first and second layer and the internal metatarsal guard is positioned between the first and second layer.

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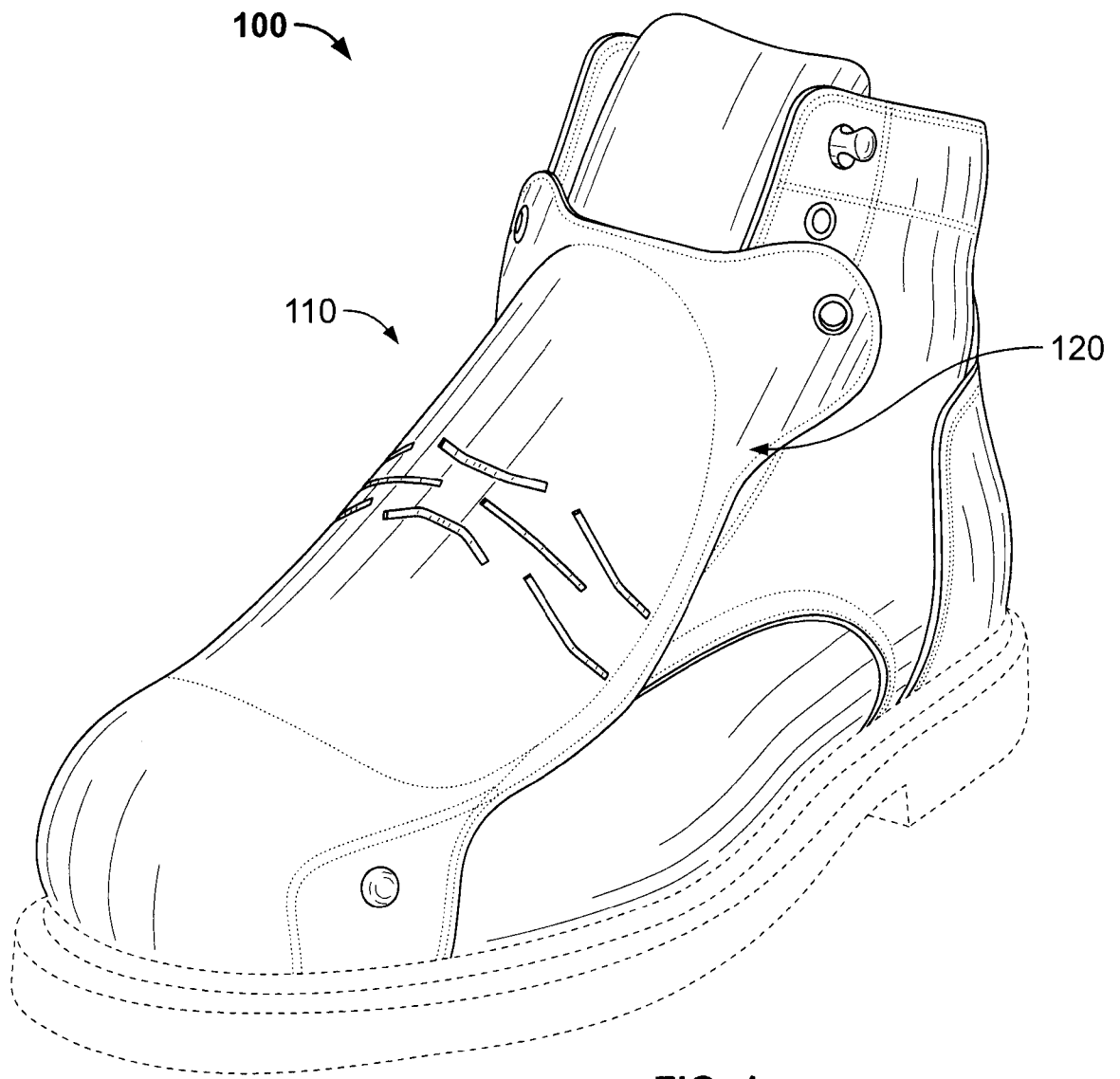


FIG. 1

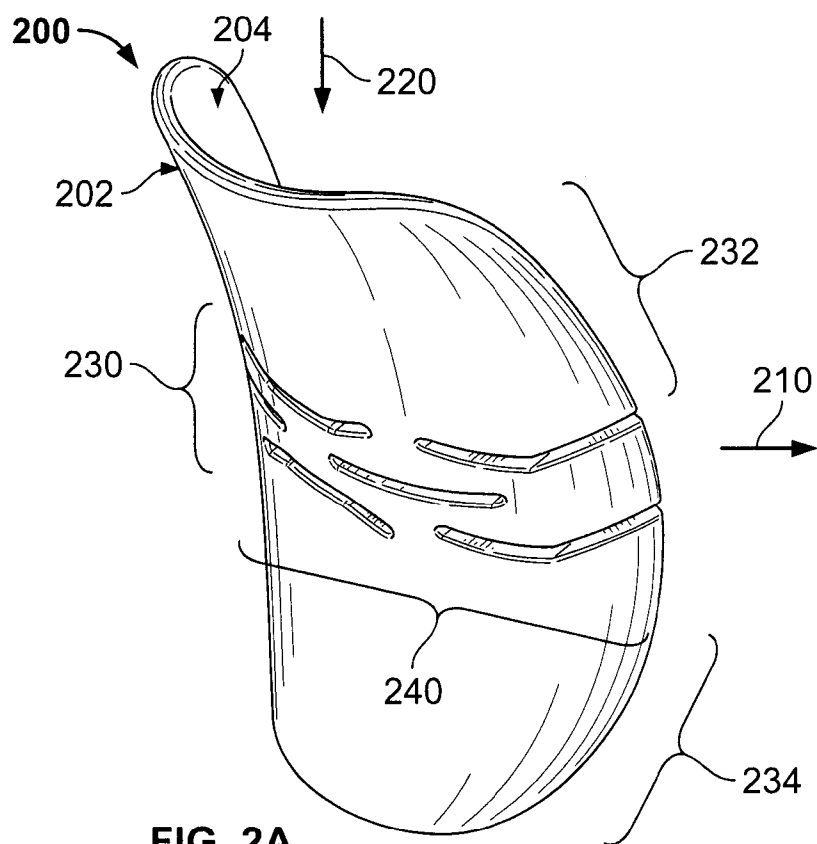


FIG. 2A

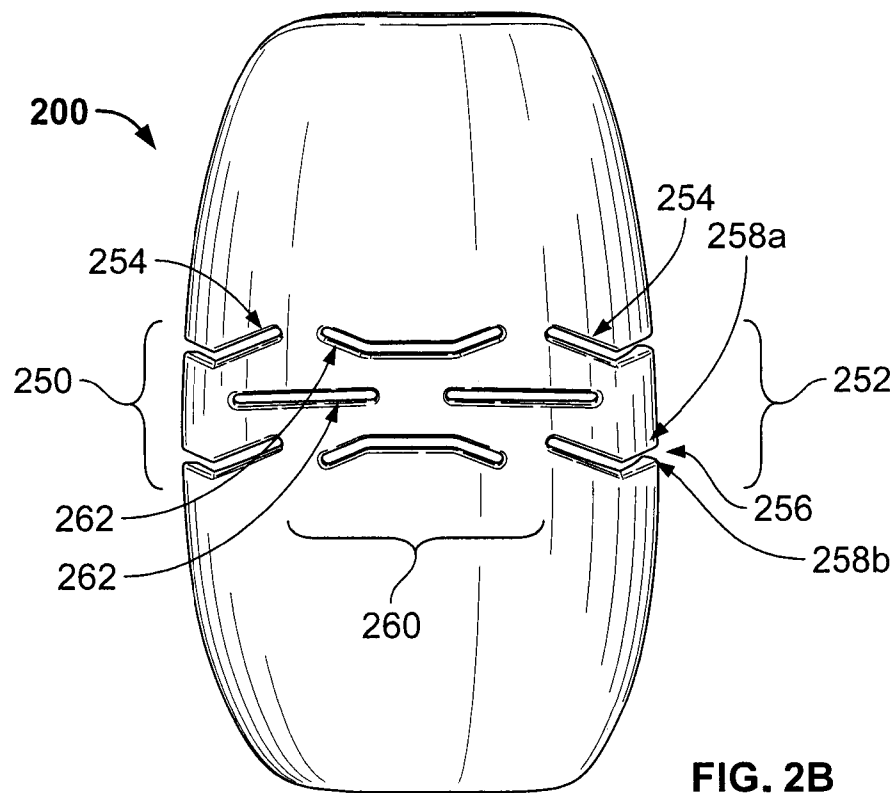
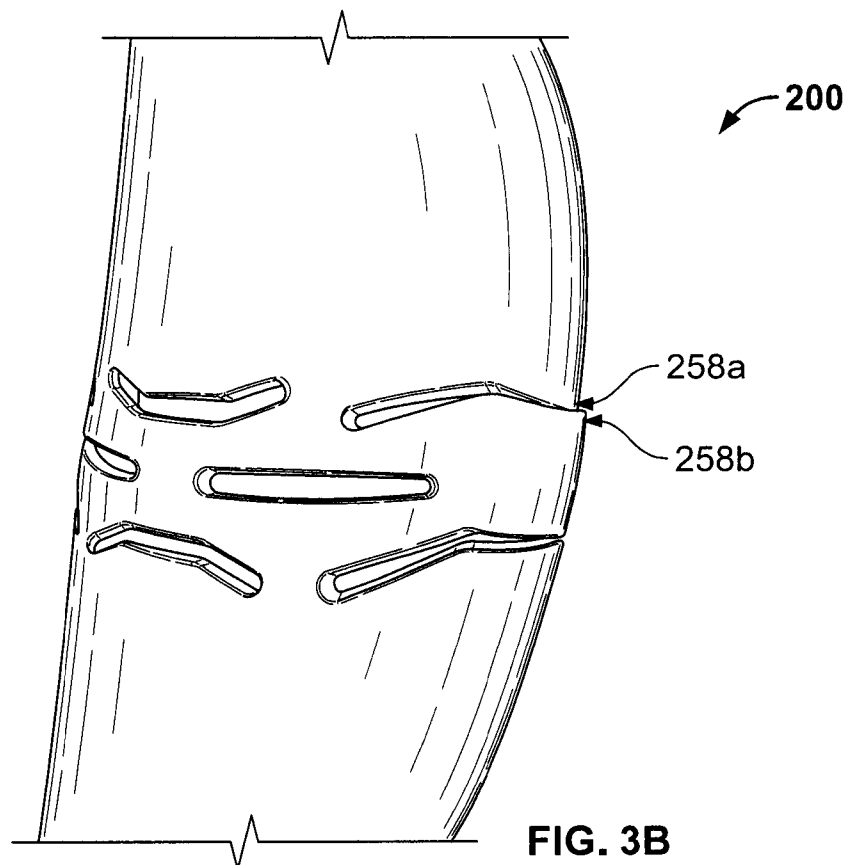
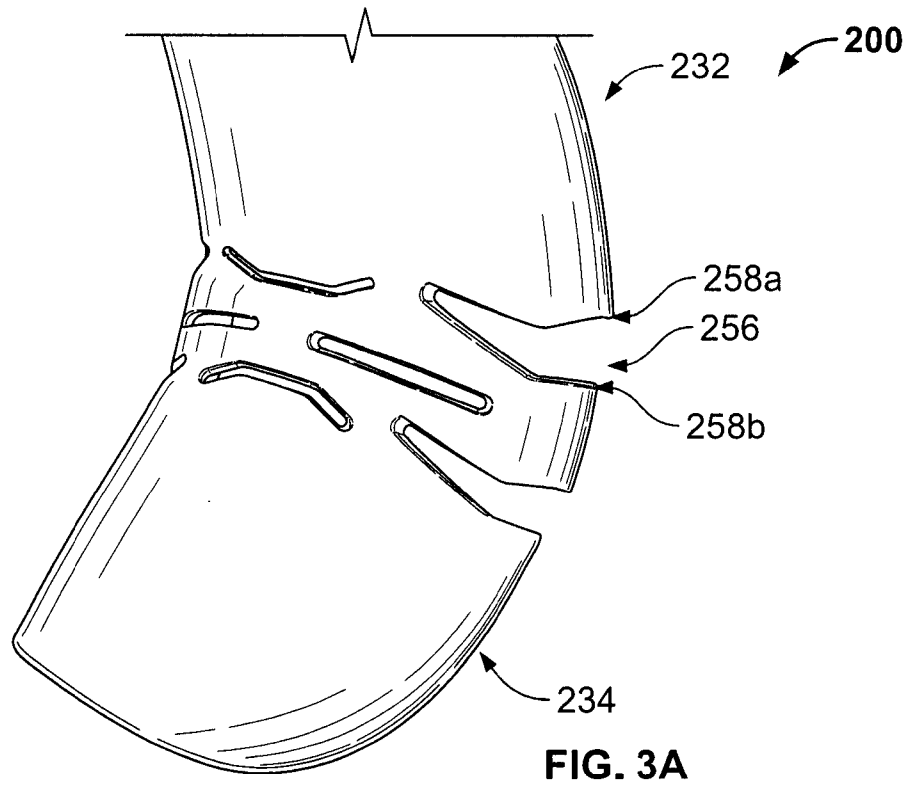


FIG. 2B



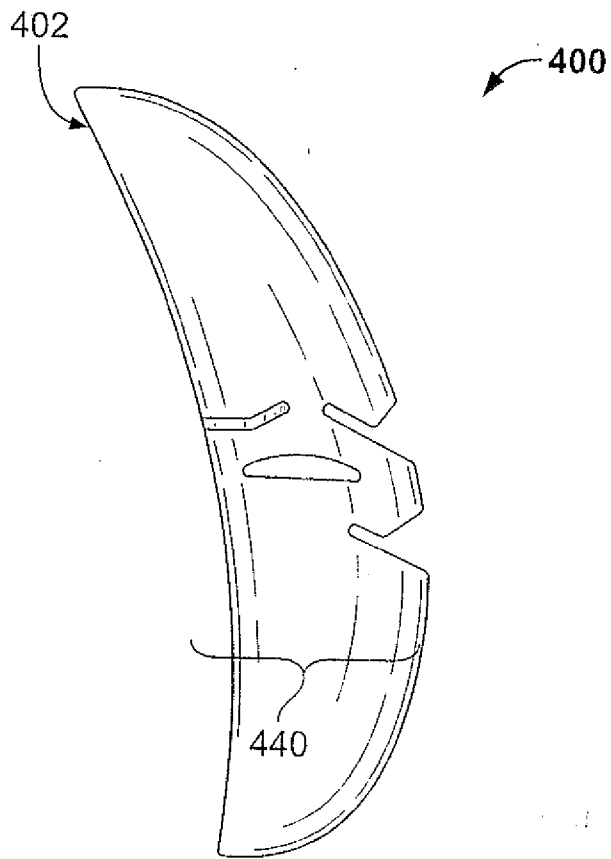


FIG. 4A

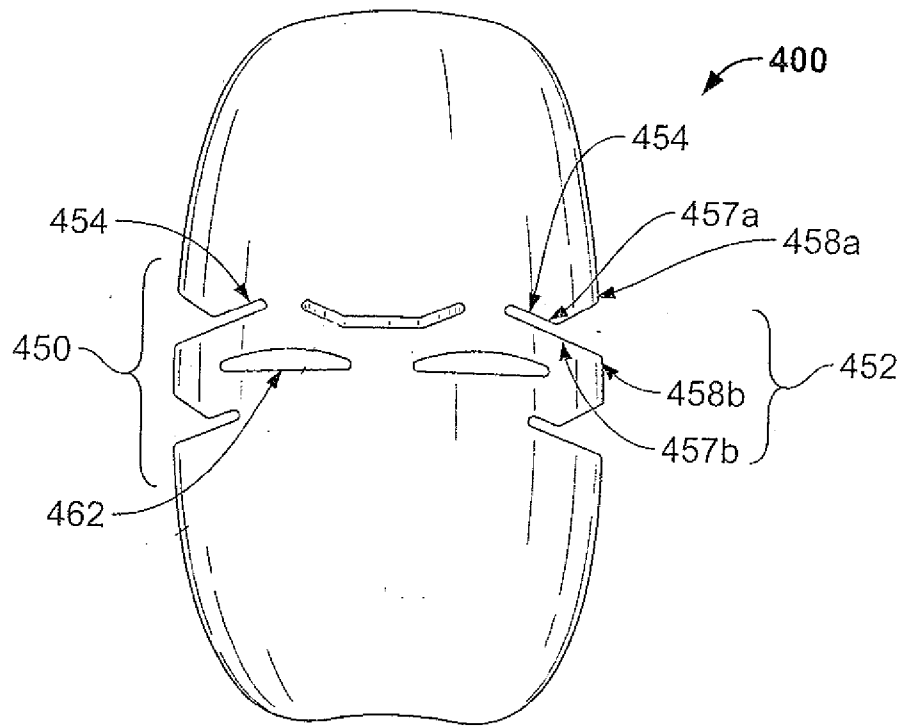


FIG. 4B

