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(54) **ARTICLE OF FOOTWEAR HAVING A REFLECTIVELY SYMMETRICAL FLUID CUSHIONING SYSTEM**

(57) An article of footwear includes an upper and a sole coupled to the upper. The sole includes an upper sole and a plurality of fluid filled bladder modules coupled to a bottom surface of the upper sole. The plurality of fluid-filled bladder modules include a first bladder module disposed in a first region of the sole and a second bladder module disposed in the first region of the sole, where the second bladder module is spatially separated in a trans-

verse direction from the first bladder module and the first and second bladder modules do not extend into a second region of the sole. The first and second bladder modules are each fluidly isolated from remaining bladder modules. The first and second bladder modules are each asymmetrical. The first bladder module is reflectively symmetrical with respect to the second bladder module.

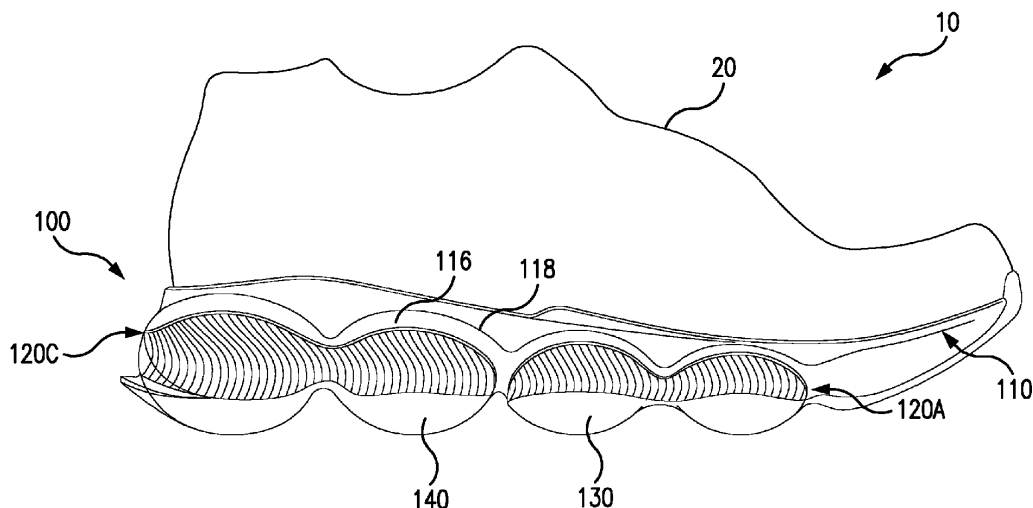


FIG. 1

Description

BACKGROUND

Field

[0001] The present disclosure relates to footwear, and more particularly relate to a sole and article of footwear having a plurality of fluid-filled bladder modules.

Background

[0002] The human foot possesses natural cushioning and rebounding characteristics. However, the foot alone is incapable of effectively overcoming many of the forces encountered during every day activity. Unless an individual is wearing shoes which provide proper cushioning and support, the soreness and fatigue associated with every day activity is more acute, and its onset accelerated. The discomfort for the wearer that results may diminish the incentive for further activity.

[0003] Proper footwear should complement the natural functionality of the foot, in part, by incorporating a sole, which absorbs shocks. Therefore, a continuing need exists for innovations in providing cushioning to articles of footwear.

SUMMARY

[0004] The present disclosure includes various embodiments of a sole for an article of footwear that includes discrete bladder modules to provide a desired cushioning effect to a wearer's foot, while simplifying the sole's manufacturing process.

[0005] In accordance with one embodiment, a sole for an article of footwear comprises an upper sole and a plurality of fluid-filled bladder modules coupled to a bottom surface of the upper sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a first bladder module disposed in a first region of the sole, the first bladder module being fluidly isolated from remaining bladder modules and not extending into a second region of the sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a second bladder module disposed in the first region of the sole and spatially separated in a transverse direction from the first bladder module. In some embodiments, the second bladder module is fluidly isolated from remaining bladder modules and does not extend into the second region of the sole. In some embodiments, the first bladder module is reflectively symmetrical with respect to the second bladder module. In some embodiments, the first region of the sole is a forefoot region or a heel region of the sole. In some embodiments, the second region of the sole is the other of the forefoot region or the heel region of the sole.

[0006] In some embodiments, the first and second bladder modules each comprise a first pod extending be-

low the upper sole and defining a first end of the bladder module. In some embodiments, the first and second bladder modules each comprise a second pod extending below the upper sole and defining a second end of the bladder module. In some embodiments, the first and second bladder modules each comprise a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

[0007] In some embodiments, in each of the first and second bladder modules, the first pod is separated from the second pod in a longitudinal direction.

[0008] In some embodiments, the first and second pods each comprise an upper pod surface engaging the bottom surface of the upper sole. In some embodiments, the first and second pods each comprise a bottom pod surface. In some embodiments, the first and second pods each comprise a pod sidewall extending from the bottom pod surface to the upper pod surface. In some embodiments, the pod sidewall and the pod bottom surface collectively define a convex-shaped wall protruding outward from the bottom surface of the upper sole.

[0009] In some embodiments, the sole comprises a first outsole member disposed below the first and second bladder modules. In some embodiments, the first outsole member includes a plurality of recessed surfaces engaging the bottom surface of a respective pod of the first and second bladder modules.

[0010] In some embodiments, the plurality of fluid-filled bladder modules comprises a third bladder module disposed in a second region of the sole. In some embodiments, the third bladder module is fluidly isolated from remaining bladder modules and does not extend into the first region of the sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a fourth bladder module disposed in the second region of the sole and spatially separated in a transverse direction from the third bladder module. In some embodiments, the fourth bladder module is fluidly isolated from remaining bladder modules and does not extend into the first region of the sole. In some embodiments, the first region is the heel region of the sole, and the second region is the forefoot region of the sole.

[0011] In some embodiments, the third bladder module is reflectively symmetrical with respect to the fourth bladder module.

[0012] In some embodiments, the first, second, third, and fourth bladder modules each comprise a first pod extending below the upper sole and defining a first end of the bladder module. In some embodiments, the first, second, third, and fourth bladder modules each comprise a second pod extending below the upper sole and defining a second end of the bladder module. In some embodiments, the first, second, third, and fourth bladder modules each comprise a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

[0013] In some embodiments, in each of the first, second, third, and fourth bladder modules, the first pod is

separated from the second pod in a longitudinal direction.

[0014] In some embodiments, the first bladder module is laterally aligned with respect to the second bladder module.

[0015] In some embodiments, the third bladder module is laterally offset with respect to the fourth bladder module.

[0016] In some embodiments, the first bladder module and the third bladder module are disposed along a lateral side of the sole, and the second bladder module and the fourth bladder module are disposed along a medial side of the sole.

[0017] In some embodiments, the first and third bladder modules define a lateral sidewall of the sole, and the second and fourth bladder modules define a medial sidewall of the sole.

[0018] In some embodiments, each of the fluid-filled bladder module is formed of a blow-molded thermoplastic material.

[0019] In some embodiments, the upper sole is formed of a foam-based material.

[0020] In some embodiments, the first and second bladder modules are each laterally asymmetrical.

[0021] In accordance with one embodiment, a pair of footwear comprises a right article of footwear and a left article of footwear. In some embodiments, the right and second articles of footwear each comprise an upper and a sole coupled to the upper. In some embodiments, the sole comprises an upper sole and a plurality of fluid-filled bladder modules coupled to a bottom surface of the upper sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a medial bladder module disposed along a medial side of the sole. In some embodiments, the medial bladder module does not extend into the forefoot region of the sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a lateral bladder module disposed along a lateral side of the sole. In some embodiments, the lateral bladder module does not extend into the forefoot region of the sole. In some embodiments, the lateral bladder module is spatially separated from the medial bladder in a transverse direction. In some embodiments, the medial bladder module is reflectively symmetrical with respect to the lateral bladder module such that the medial bladder module of the right article of footwear is identical to the lateral bladder module of the left article of footwear. In some embodiments, the lateral bladder module of the right article of footwear is identical to the medial bladder module of the left article of footwear. In some embodiments, the medial and lateral bladder modules are each laterally asymmetrical.

[0022] In some embodiments, the medial and lateral bladder modules each comprise a first pod extending below the upper sole and defining a first end of the bladder module. In some embodiments, the medial and lateral bladder modules each comprise a second pod extending below the upper sole and defining a second end of the bladder module. In some embodiments, the medial and

lateral bladder modules each comprise a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

[0023] In some embodiments, in each of the medial and lateral bladder modules, the first pod is separated from the second pod in a longitudinal direction.

[0024] In some embodiments, the medial bladder modules are medial heel bladder modules, each disposed in a heel region of its respective sole. In some embodiments, the lateral bladder modules are lateral heel bladder modules, each disposed in the heel region of its respective sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a medial forefoot bladder module disposed in a forefoot region of the sole and along the medial side of the sole. In some embodiments, the medial forefoot bladder module does not extend into the heel region of the sole. In some embodiments, the plurality of fluid-filled bladder modules comprises a lateral forefoot bladder module disposed in the forefoot region of the sole and along the lateral side of the sole. In some embodiments, the lateral forefoot bladder module does not extend into the heel region of the sole. In some embodiments, the lateral forefoot bladder module is spatially separated from the medial forefoot bladder module in a transverse direction. In some embodiments, the medial forefoot bladder module is reflectively symmetrical with respect to the lateral forefoot bladder module such that the medial forefoot bladder module of the right article of footwear is identical to the lateral forefoot bladder module of left article of footwear. In some embodiments, the lateral forefoot bladder module of the right article of footwear is identical to the medial forefoot bladder module of the left article of footwear. In some embodiments, the medial and lateral forefoot bladder modules are each asymmetrical.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The accompanying drawings, which are incorporated herein and form a part of the specification, illustrate the present disclosure and, together with the description, further serve to explain the principles thereof and to enable a person skilled in the pertinent art to make and use the same.

FIG. 1 shows a side view of an article of footwear according to an embodiment.

FIG. 2 shows a bottom view of the article of footwear of FIG. 1.

FIG. 3 shows a top view of a sole of the article of footwear shown in FIG. 1.

FIG. 4 shows a cross-section view of the sole taken along line 4-4 in FIG. 2.

FIG. 5 shows a cross-section view of the sole taken along line 5-5 in FIG. 2.

FIG. 6 shows a schematic bottom view of a sole for a left article of footwear and a sole for a right article of footwear according to an embodiment.

FIG. 7 shows a perspective view of the upper sole for a sole used in the article of footwear shown in FIG. 1 according to an embodiment.

FIG. 8 shows a bottom view of the upper sole shown in FIG. 7.

FIG. 9 shows a bottom view of a plurality of fluid-filled bladder models for an article of footwear shown in FIG. 1.

FIG. 10 shows a perspective view of a plurality of fluid-filled bladder models for an article of footwear shown in FIG. 1.

FIG. 11 shows a cross-sectional view of a bladder module taken along line 11-11 in FIG. 8.

FIG. 12 shows a perspective view of a forefoot outsole member for the article of footwear shown in FIG. 1.

FIG. 13 shows a perspective view of a heel outsole member for the article of footwear shown in FIG. 1.

DETAILED DESCRIPTION

[0026] Representative embodiments will now be described in detail with reference to the accompanying drawings, in which like reference numerals are used to indicate identical or functionally similar elements. References to "one embodiment", "an embodiment", "an example embodiment", etc., indicate that the embodiment described may include a particular feature, structure, or characteristic, but every embodiment may not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is submitted that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

[0027] The following examples are illustrative, but not limiting. Other suitable modifications and adaptations of the variety of conditions and parameters normally encountered in the field, and which would be apparent to those skilled in the art, are within the spirit and scope of the described embodiments.

[0028] One attempt over the years to improve cushioning and resiliency of shoes is incorporating a multi-chamber bladder in the shoe sole so that air is transferred between the heel and forefoot areas of a shoe during the wearer's gait motion. However, there are several difficulties associated with providing and using a multi-chamber bladder filled with pressurized fluid within a shoe sole. Namely, airflow may become restricted at one or more locations within the multi-chamber bladder, rendering it difficult to maintain consistent air pressure within each chamber of the bladder. Adding more chambers to a single bladder may increase the likelihood of fluid flow obstruction. Another disadvantage is the cost and complexity of manufacturing various-sized bladder chambers for a shoe. Typically, bladder chambers are constructed by

molding and sealing two polymeric films together. The molding process may require a mold having a separate cavity dedicated for only one of the chambers of the bladder.

[0029] Accordingly, there is a need for an improved fluid cushioning sole having discrete fluid transfer modules that can be manufactured by a simple mold, while still providing an effective dynamic cushioning support to the wearer's foot during the wearer's gait cycle.

[0030] According to various embodiments described herein, the sole of the present disclosure may overcome one or more of the deficiencies noted above by including multiple fluid-filled bladder modules coupled to a bottom surface of the upper sole, in which each bladder module includes only a pair of fluidly-connected pods that are fluidly isolated from the remaining bladder modules. Limiting each isolated bladder module to two pods ensures that fluid is effectively transferred throughout the entire bladder module in response to the application of force during the wearer's gait cycle. Moreover, the plurality of fluid-filled bladder modules may include a pair of reflectively symmetrical bladder modules that are laterally spaced apart from each other in one region (e.g., a forefoot region or a heel region) of the sole to reduce the number of mold cavities needed for manufacturing the bladder modules for a pair of footwear, ultimately reducing the cost and the complexity of the manufacturing process.

[0031] FIGS. 1-5 illustrate an article of footwear 10 having an upper 20 and a sole 100 coupled to upper 20 according to one embodiment of the present disclosure. Sole 100 may include a heel region 101, a midfoot or arch region 102, and a forefoot region 103 extending between a lateral side 104 and a medial side 105 of sole 100.

[0032] As shown in FIG. 1, for example, sole 100 may include an upper sole 110 coupled to upper 20. Sole 100 may include a plurality of fluid-filled bladder modules 120A-D disposed below and coupled to upper sole 110. Each bladder module 120A-D may be configured to store a fluid (e.g., air) above ambient pressure (e.g., 3 psi to 8 psi) and permit the stored fluid to flow in a manner complementary to the wearer's stride and to the forces applied to the anatomical structure of the wearer's foot, ultimately providing a cushioning effect.

[0033] Sole 100 may include a forefoot outsole member 130 disposed below and coupled to at least one of the bladder modules 120A-B in forefoot region 103 of sole 100. Sole 100 may include a heel outsole member 140 disposed below and coupled to at least one of the bladder modules 120C-D in heel region 101 of sole 100.

[0034] The arrangement, symmetry, and modularity of the bladder modules 120A-D configure the sole 100 to provide a desirable cushioning effect to the wearer, while simplifying its manufacturing process. For example, FIG. 6 shows an arrangement of bladder modules 120A-D for a right article of footwear 30 and bladder modules 120A'-D' in a left article of footwear 40, whereby the right and left articles of footwear 30 and 40 constitute a pair of

footwear. The right and left articles of footwear 30 and 40 may include any of the features of the article of footwear 10 shown in FIGS. 1-5.

[0035] The right article of footwear 30 may include a medial forefoot bladder module 120A disposed in forefoot region 103 of a sole 100A and along medial side 105 of sole 100A. The right article of footwear 30 may include a lateral forefoot bladder module 120B disposed in forefoot region 103 of sole 100A and along lateral side 104 of sole 100A. Lateral forefoot bladder module 120B may be spatially separated from medial forefoot bladder module 120A in a transverse direction X along sole 100A. In the context of the present disclosure, transverse direction X corresponds to a direction extending along a width of the sole, such as, for example, extending between a lateral side and a medial side of the sole. Both medial and lateral forefoot bladder modules 120A-B do not extend into heel region 101 of sole 100A. Both medial and lateral forefoot bladder modules 120A-B are spatially separated from heel bladder modules 120C-D in longitudinal direction Y. In the context of the present disclosure, longitudinal direction Y corresponds to a direction extending along a length of the sole, such as, for example, extending between a forefoot region and a heel region of the sole.

[0036] Medial and lateral forefoot bladder modules 120A-B may each be fluidly isolated from each other and the remaining bladder modules 120C-D, thereby providing two discrete fluid transfer modules exclusively in forefoot region 103 of sole 100A. Being discrete and fluidly isolated, medial and lateral forefoot bladder modules 120A-B are each configured to effectively promote fluid flow throughout its entire length, thereby minimizing the likelihood of fluid flow obstruction within the bladder module that may be exacerbated by connecting other bladder chambers disposed at different regions of the sole to the bladder module. By not extending into the heel region 101 of sole 100A, medial and lateral forefoot bladder modules 120A-B are each configured to keep fluid localized within the forefoot region 103 of sole 100A, thereby providing a more effective cushioning response to any impact upon forefoot region 103 of sole 100A.

[0037] The right article of footwear 30 may include a medial heel bladder module 120C disposed in heel region 101 of sole 100A and along medial side 105 of sole 100A. The right article of footwear 30 may include a lateral heel bladder module 120D disposed in heel region 101 of sole 100A and along lateral side 104 of sole 100A. Lateral heel bladder module 120D may be spatially separated from medial heel bladder module 120C in transverse direction X along sole 100A. Both medial and lateral heel bladder modules 120C-D do not extend into forefoot region 103 of sole 100A. Both medial and lateral heel bladder modules 120C-D are spatially separated from forefoot bladder modules 120A-B in longitudinal direction Y. Medial and lateral heel bladder modules 120C-D may each be fluidly isolated from each other and the remaining bladder modules 120A-B, thereby providing two discrete

fluid transfer modules in heel region 101 of sole 100A. Similar to the discrete, isolated bladder modules 120A-B in forefoot region 103, medial and lateral heel bladder modules 120C-D are each configured to effectively promote fluid flow throughout its entire length by being fluidly isolated. By not extending into the forefoot region 103 of sole 100A, medial and lateral forefoot bladder modules 120C-D are each configured to keep fluid localized within the heel region 101 of sole 100A, thereby providing a more effective cushioning response to any impact upon heel region 101 of sole 100A.

[0038] Similar to the right article of footwear 30, the left article of footwear 40 may include a medial forefoot bladder module 120A' disposed in forefoot region 103' of a sole 100B and along medial side 105' of sole 100B. The left article of footwear 40 may include a lateral forefoot bladder module 120B' disposed in forefoot region 103' of sole 100B and along lateral side 104' of sole 100B. Lateral forefoot bladder module 120B' may be spatially separated from medial forefoot bladder module 120A' in a transverse direction X along sole 100B. Both medial and lateral forefoot bladder modules 120A'-B' do not extend into heel region 101' of sole 100B. Both medial and lateral forefoot bladder modules 120A'-B' are spatially separated from heel bladder modules 120C'-D' in longitudinal direction Y. Medial and lateral forefoot bladder modules 120A'-B' may each be fluidly isolated from each other and the remaining bladder modules 120C'-D'. Being discrete and fluidly isolated, medial and lateral heel bladder modules 120A'-B' are each configured to effectively promote fluid flow throughout its entire length to reduce the likelihood of fluid flow obstruction and keep fluid localized in forefoot region 103' of sole 100B to respond effectively to any impact upon forefoot region 103' of sole 100B.

[0039] The left article of footwear 40 may include a medial heel bladder module 120C' disposed in heel region 101' of sole 100B and along medial side 105' of sole 100B. The left article of footwear 40 may include a lateral heel bladder module 120D' disposed in heel region 101' of sole 100B and along lateral side 104' of sole 100B. Lateral heel bladder module 120D' may be spatially separated from medial heel bladder module 120C' in transverse direction X along sole 100B. Both medial and lateral heel bladder modules 120C'-D' do not extend into forefoot region 103' of sole 100B. Both medial and lateral heel bladder modules 120C'-D' are spatially separated from forefoot bladder modules 120A'-B' in longitudinal direction Y. Medial and lateral heel bladder modules 120C'-D' may each be fluidly isolated from each other and the remaining bladder modules 120A'-B'. Being discrete and fluidly isolated, medial and lateral heel bladder modules 120C'-D' are each configured to effectively promote fluid flow throughout its entire length to reduce the likelihood of fluid flow obstruction and keep fluid localized in heel region 101' of sole 100B to respond effectively to any impact upon heel region 101' of sole 100B..

[0040] In some embodiments, each bladder module

120A-D and 120A'-120D' may be asymmetrical so that the shape of each bladder module 120A-D and 120A'-120D' corresponds to a particular location of a sole to provide a tailored localized cushioning effect. Each bladder module 120A-D and 120A'-120D' may be laterally asymmetrical such that compressibility and stiffness of the bladder module 120A-D and 120A'-120D' is anisotropic. For example, as shown in FIGS. 4 and 5, the height of pods (e.g., pods 122A-D) in bladder modules 120A-D generally decreases along the transverse direction X from its midpoint toward each of its outer edges (e.g., ends 212 and 214), thereby reinforcing the perimeter of the pods (e.g., 122A-D) of bladder modules 120A-D, which prevents bladder modules 120A-D from collapsing abruptly upon the application of force.

[0041] While each bladder module 120A-D and 120A'-D' itself may be asymmetrical to provide localized cushioning, the bladder modules 120A-D and 120A'-D' located on opposite sides (e.g., lateral and medial) of the sole in one of the regions (e.g., forefoot or heel) of the sole may be reflectively symmetrical with respect to each other. In the context of the present disclosure, a pair of reflectively symmetrical bladder modules corresponds to a first bladder module being a mirror image of a second bladder module about a line of symmetry that extends entirely between the first and second bladder modules. For example, in an article of footwear, a bladder module located along a medial side of the sole may be a mirror image of a bladder module located along a lateral side of the sole.

[0042] By providing reflectively symmetrical bladder modules 120A-D and 120A'-D' on opposite sides of the sole, a first bladder module (e.g., bladder module 120B) located on a lateral side of sole (e.g., sole 100A) of a right article of footwear (e.g., right article of footwear 30) may be identical to a second bladder module (e.g., bladder module 120A') located on a medial side of sole (e.g., sole 100B) of a left article of footwear (e.g., left article of footwear 40), thereby configuring the first and second bladder modules to be interchangeable. Because the first bladder module of the right article of footwear is identical to and interchangeable with the second bladder module of the left article of footwear, the same mold cavity may be used for forming the first and second bladder modules, thereby reducing the number of mold cavities needed for manufacturing the bladder modules for a pair of footwear, while still providing a tailored cushioning effect to particular locations of the sole.

[0043] For example, as shown in FIG. 6, in each of the right and left articles of footwear 30 and 40, medial forefoot bladder module 120A, 120A' may be reflectively symmetrically with respect to lateral forefoot bladder module 120B, 120B' such that medial forefoot bladder module 120A of the right article of footwear 30 is identical to lateral forefoot bladder module 120B' of left article of footwear 40 and lateral forefoot bladder module 120B of the right article of footwear 30 is identical to the medial forefoot bladder module 120A' of the left article of foot-

wear 40. And in each of the right and left articles of footwear 30 and 40, medial heel bladder module 120C, 120C' may be reflectively symmetrical with respect to lateral heel bladder module 120D, 120D' such that medial heel bladder module 120C of the right article of footwear 30 is identical to the lateral heel bladder module 120D' of the left article of footwear 40 and lateral heel bladder module 120D of the right article of footwear 30 is identical to the medial heel bladder module 120C' of the left article of footwear 40.

[0044] FIGS. 9 and 10 illustrate a plurality of bladder modules 120A-D that are implemented in the articles of footwear 10, 30, and 40 shown in FIGS. 1-6. Each bladder module 120A-D may be formed of an elastomeric, resilient material and filled with a fluid such that each bladder module 120A-D is configured to compress upon the application of force and expand with the delivery of a fluid, thereby providing continuous cushioning support for wearer's foot.

[0045] In some embodiments, each bladder module 120A-D may be filled with air set at a pressure above ambient pressure, such as, for example, in a range from 3 psi to 7 psi above ambient pressure. In some embodiments, each bladder module 120A-D may be filled with other types of gases, such as helium or nitrogen. In some embodiments, each bladder module 120A-D may further be filled with other compressible materials, such as, for example, a gel, a paste, foam, a plurality of particles (e.g., polymer particles, eTPU particles, foam particles, cellulose particles, rock, or rubber particles), or a combination thereof. Being filled with a pressurized fluid (e.g., air) and/or compressible materials (e.g., polymer particles), each bladder module 120A-D may provide continuous cushioning to the wearer's foot such that a wearer's stride forces the fluid (e.g., air) or material (e.g., polymer particles) within bladder module 120A-D to flow in a manner complementary to the wearer's stride.

[0046] In some embodiments, each bladder module 120A-D may be formed of a thermoplastic elastomer or a thermoplastic polyurethane. In other embodiments, each bladder module 120A-D may be formed of other materials suitable for providing elastomeric, resilient properties, such as, for example, thermoplastic olefins, thermoplastic vulcanates, rubber, or a combination thereof.

[0047] In some embodiments, each bladder module 120A-D may be formed by an extrusion blow-molded technique such that all the elements of each bladder module 120A-D, as described herein, are provided as a unitary "one-piece" component. In some embodiments, the blow-molded technique for forming each bladder module 120A-D may include injection blow molding, stretch blow molding, or frame blow molding. In other embodiments, each bladder module 120A-D may be formed by other processes, such as, for example, thermoforming and sealing, injection molding and sealing, vacuum forming and sealing, or radio frequency/high frequency welding.

[0048] Each bladder module 120A-D may include a

plurality of pods 122A-D and 124A-D extending below upper sole 110. In some embodiments, each bladder module 120A-D may include only a pair of fluidly-connected pods 122A-D and 124A-D that are arranged in a longitudinal direction Y. For example, each bladder module 120A-D may include a first pod 122A-D extending below upper sole 110 and defining a first end of the bladder module 120A-D. Each bladder module 120A-D may include a second pod 124A-D extending below upper sole 110 and defining a second end of the bladder module 120A-D. Each bladder module 120A-D may include a passage 126A-D extending from first pod 122A-D to second pod 124A-D such that first pod 122A-D is fluidly connected to second pod 124A-D, thereby allowing fluid (e.g., air) to be diffused between first and second pods 122A-D and 124A-D upon the application of force against sole 100. The maximum width of passage 126A-D may be less than the maximum width of first pod 122A-D or the maximum width of second pod 124A-D to promote effective fluid flow between first and second pods 122A-D and 124A-D. First pod 122A-D of each bladder module 120A-D may be separated from second pod 124A-D in a longitudinal direction Y such that each bladder module 120A-D is oriented from forefoot region 103 to heel region 101 of sole 100.

[0049] The plurality of pods 122A-D and 124A-D of each bladder module 120A-D may be exposed along either lateral side 104 or medial side 105 of sole 100. For example, first pod 122A, 122C and second pod 124A, 124C of medial forefoot and heel bladder modules 120A, 120C may be exposed along medial side 105 of sole 100 and define a medial sidewall of sole 100. First pod 122B, 122D and second pod 124B, 124D of lateral forefoot and heel bladder modules 120B, 120D may be exposed on lateral side 104 of sole and define a lateral sidewall of sole 100.

[0050] The shape of each pod 122A-D and 124A-D of the fluid bladder modules 120A-D may be adapted to provide a desired cushioning effect. For example, with reference to FIGS. 4, 5, and 11, each pod may include an upper pod surface 210 disposed against a bottom surface 113 of an upper sole 110, a bottom pod surface 220 disposed below the upper pod surface 210, and a pod sidewall 230 extending from upper pod surface 210 to bottom pod surface 220. In some embodiments, upper pod surface 210 defines a substantially oval shape. In other embodiments, upper pod surface 210 may define other round shapes tailored to provide localized cushioning. In some embodiments, bottom pod surface 220 and pod sidewall 230 collectively defines a convex-shaped wall protruding away from bottom surface 113 of upper sole 110, thereby promoting pod 122A-D and 124A-D to collapse gradually under pressure. By collapsing gradually under pressure, pod 122A-D and 124A-D forces stored fluid to flow to the other pod of the bladder module. Bottom surface 220 and pod sidewall 230 also define an asymmetrical shaped pod that provides greater rigidity along the perimeter of pods 122A-D and 124A-D, thereby

preventing pods 122A-D and 124A-D from collapsing abruptly under pressure.

[0051] The size and shape of pod sidewall 230 may be adapted to reinforce the structural integrity of pod 122A-D and 124A-D. For example, as one option, pod sidewall 230 may include a plurality of ribs 234 protruding outward and extending generally in a vertical direction to increase the rigidity of pod sidewall 230. By increasing the rigidity of pod sidewall 230, ribs 234 may be configured to minimize any collapsing of pod sidewall 230, as other sections (upper pod surface 210 and/or bottom pod surface 220) of the pod compress during an application of force that results from the wearer's foot striking the ground. In some embodiments, pod sidewall 230 of each pod 122A-D and 124A-D of bladder module 120A-D may be exposed between an outer edge (e.g., outer medial edge 117A and outer lateral edge 117B) of upper sole 110 and one of the forefoot and heel outsole members 130 and 140 to form a sidewall (e.g., a medial sidewall or a lateral sidewall) of sole 100.

[0052] The shape of pods 122A-D and 124A-D may be adapted to promote snug contact with bottom surface 113 of upper sole 110, thereby ensuring a secure connection between each bladder module 120A-D and upper sole 110. For example, as shown in FIGS. 4 and 5, upper pod surface 210 may include a first end 212 merging with pod sidewall 230 and a second end 214 merging with bottom surface 220. Upper pod surface 210 may slope downward from first end 212 to second end 214 such that a portion of upper sole 110 engaging upper pod surface 210 is contained by pod sidewall 230. Upper pod surface 210 further includes convex and concave portions to reinforce the perimeter of pods 122A-D and 124A-D. The height of pod sidewall 230 for each pod 122A-D and 124A-D may vary along longitudinal direction Y such that first and second pods 122A-D and 124A-D for each bladder module 120A-D collectively define a corrugated-shaped upper edge 238.

[0053] The size and shape of the first and second pods 122A-D and 124A-D of each bladder module 120A-D may be tuned to provide the desired ride characteristics. For example, first and second pods 122C-D and 124C-D of bladder modules 120C-D located in heel region 101 are larger in volume than first and second pods 122A-B and 124A-B of bladder modules 120A-B located in forefoot region 103. Pods 122A-D and 124A-D of bladder modules 120A-D may gradually increase in volume from forward-most pod 122A-B to rearward-most pod 124C-D along lateral and medial sides 104 and 105 of sole 100. By providing larger volume pods in heel region and gradually increasing volume of pods from forefoot region 103 to heel region 101 of sole 100, the plurality of bladder modules 120A-D collectively provide added support and cushioning in heel region 101 to account for larger downward force applied by wearer during the heel strike.

[0054] FIGS. 7 and 8 illustrate an embodiment of upper sole 110 implemented in the article of footwear 10 shown in FIGS. 1-5. Upper sole 110 may include a top surface

112 generally shaped to accommodate the contours of the wearer's foot. Top surface 112 may be attached to the upper 20 by adhesive bonding, welding, or any other suitable technique. In some embodiments, sole 100 may include an insole and/or sockliner disposed on top surface 112 of upper sole 110.

[0055] The shape of bottom surface 113 of upper sole 110 may be adapted to promote intimate contact with upper surface 210 of each pod 122A-D and 124A-D of bladder modules 120A-D. For example, upper sole 110 may include a plurality of recesses 114A-D shaped to partially receive a respective bladder module 120A-D. Upper sole 110 may include a first recess 114A disposed in forefoot region 103 of sole 100 and along medial side 105 of sole 100 such that first recess 114A partially receives medial forefoot bladder module 120A. Upper sole 110 may include a second recess 114B disposed in forefoot region 103 of sole 100 and along lateral side 104 of sole 100 such that second recess 114B partially receives lateral forefoot bladder module 120B. Upper sole 110 may include a third recess 114C disposed in heel region 101 of sole 100 and along medial side 105 of sole 100 such that third recess 114C partially receives medial heel bladder module 120C. Upper sole 110 may include a fourth recess 114D disposed in heel region 101 of sole 100 and along lateral side 104 of sole 100 such that fourth recess 114D partially receives lateral heel bladder module 120D.

[0056] The perimeter of upper sole 110 may be tuned to increase stability along lateral and medial sides 104 and 105 of sole 100. For example, upper sole 110 may include a plurality of bulges 116 disposed along lateral side 104 and medial side 105 of sole 100. Each bulge 116 may protrude outward from sole 100, where bulges 116 disposed along lateral side 104 of sole 100 define an exposed outer lateral edge 117B and bulges 116 disposed along medial side 105 of sole 100 define an exposed outer medial edge 117A. Bulges 116 may define a corrugated-shaped upper edge 118 extending from heel region 101 to forefoot region 103 of sole 100 that corresponds to the upper edge 238 of bladder modules 120A-D.

[0057] Upper sole 110 may be comprised of a foam material, such that the upper sole 110 is configured to absorb shock and provide cushion to wearer's foot. In some embodiments, upper sole 110 may be comprised of a foam-based material that includes ethylene vinyl acetate (EVA). In some embodiments, upper sole 110 comprises thermoplastic urethane (TPU). In some embodiments, upper sole 110 comprises expanded thermoplastic foam, such as, for example, expanded thermoplastic urethane (eTPU). In embodiments, upper sole 110 may be comprised of a foam-based material that includes materials, such as elastomers, thermoplastic elastomers, foam-like plastic, and gel-like plastics. In some embodiments, upper sole 110 may be comprised of an open-cell foam-based material or a closed-cell foam-based material.

[0058] FIG. 12 illustrates an embodiment of forefoot outsole member 130 implemented in the article of footwear 10 shown in FIGS. 1-5, and FIG. 13 illustrates an embodiment of heel outsole member 140 implemented in the article of footwear 10 shown in FIGS. 1-5. Forefoot and heel outsole members 130 and 140 may each be coupled to selected portions of bladder modules 120A-D and/or bottom surface 113 of upper sole 110. For example, forefoot outsole member 130 may be coupled to bottom surface 220 of pods 122A-B and 124A-B of bladder modules 120A-B located in forefoot region 103 of sole 100, and heel outsole member 140 may be coupled to bottom surface 220 of pods 122C-D and 124C-D of bladder modules 120A-B located in heel region 101 of sole 100.

[0059] The shape of forefoot and heel outsole members 130 and 140 may be adapted to promote intimate contact with bottom surface 210 of pods 122A-D and 124A-D of bladder modules 120A-D. For example, forefoot outsole member 130 may include a plurality of recesses 132 that each partially receives a respective pod 122A-B and 124A-B of bladder modules 120A-B, and heel outsole member 140 may include a plurality of recesses 142 that each partially receives a respective pod 122C-D and 124C-D of bladder modules 120C-D. Forefoot outsole member 130 may comprise a plurality of ridges 134 protruding downward away from sole 100 to enhance the traction capability of sole 100, and heel outsole member 140 may comprise a plurality of ridges 144 protruding downward away from sole 100 to enhance the traction capability of sole 100.

[0060] Forefoot and heel outsole members 130 and 140 may each comprise a wear-resistant material to maintain the integrity of sole 100. For example, wear-resistant material for forefoot and heel outsole members 130 and 140 may include synthetic or natural rubber, thermoplastic polyurethane, a wear-resistant foam, or a combination thereof.

[0061] The foregoing description of the specific embodiments will so fully reveal the general nature of the invention(s) that others can, by applying knowledge within the skill of the art, readily modify and/or adapt for various applications such specific embodiments, without undue experimentation, without departing from the general concept of the present invention(s). Therefore, such adaptations and modifications are intended to be within the meaning and range of equivalents of the disclosed embodiments, based on the teaching and guidance presented herein. It is to be understood that the phraseology or terminology herein is for the purpose of description and not of limitation, such that the terminology or phraseology of the present specification is to be interpreted by the skilled artisan in light of the teachings and guidance.

[0062] The breadth and scope of the present invention should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the claims and their equivalents.

Claims

1. A sole for an article of footwear, the sole comprising:

an upper sole;
a plurality of fluid-filled bladder modules coupled to a bottom surface of the upper sole, the plurality of fluid-filled bladder modules comprising:

a first bladder module disposed in a first region of the sole, the first bladder module being fluidly isolated from remaining bladder modules and not extending into a second region of the sole;

a second bladder module disposed in the first region of the sole and spatially separated in a transverse direction from the first bladder module, the second bladder module being fluidly isolated from remaining bladder modules and not extending into the second region of the sole;

wherein the first bladder module is reflectively symmetrical with respect to the second bladder module, and

wherein the first region of the sole is one of a forefoot region or a heel region of the sole, and wherein the second region of the sole is the other of the forefoot region or the heel region of the sole.

2. The sole of claim 1, wherein the first and second bladder modules each comprise:

a first pod extending below the upper sole and defining a first end of the bladder module,
a second pod extending below the upper sole and defining a second end of the bladder module, and
a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

3. The sole of claim 2, wherein in each of the first and second bladder modules, the first pod is separated from the second pod in a longitudinal direction.

4. The sole of claim 2, wherein the first and second pods each comprise:

an upper pod surface engaging the bottom surface of the upper sole,
a bottom pod surface, and
a pod sidewall extending from the bottom pod surface to the upper pod surface,
wherein the pod sidewall and the pod bottom surface collectively define a convex-shaped wall protruding outward from the bottom surface of

the upper sole.

5. The sole of claim 4, further comprising:

a first outsole member disposed below the first and second bladder modules, the first outsole member including a plurality of recessed surfaces engaging the bottom surface of a respective pod of the first and second bladder modules.

6. The sole of claim 1, wherein the plurality of fluid-filled bladder modules comprises:

a third bladder module disposed in the second region of the sole, the third bladder module being fluidly isolated from remaining bladder modules and not extending into the first region of the sole;
a fourth bladder module disposed in the second region of the sole and spatially separated in a transverse direction from the third bladder module, the fourth bladder module being fluidly isolated from remaining bladder modules and not extending into the first region of the sole, wherein the first region is the heel region of the sole, and the second region is the forefoot region of the sole.

7. The sole of claim 6, wherein the third bladder module is reflectively symmetrical with respect to the fourth bladder module.

8. The sole of claim 7, wherein the first, second, third, and fourth bladder modules each comprise:

a first pod extending below the upper sole and defining a first end of the bladder module,
a second pod extending below the upper sole and defining a second end of the bladder module,
a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

9. The sole of claim 8, wherein in each of the first, second, third, and fourth bladder modules, the first pod is separated from the second pod in a longitudinal direction.

10. The sole of claim 7, wherein the first bladder module is laterally aligned with respect to the second bladder module.

11. The sole of claim 7, wherein the third bladder module is laterally offset with respect to the fourth bladder module.

12. The sole of claim 7, wherein the first bladder module and the third bladder module are disposed along a lateral side of the sole and the second bladder mod-

ule and the fourth bladder module are disposed along a medial side of the sole.

13. The sole of claim 12, wherein the first and third bladder modules define a lateral sidewall of the sole, and the second and fourth bladder modules define a medial sidewall of the sole. 5
14. The sole of claim 1, wherein each of the fluid-filled bladder modules is formed of a blow-molded thermoplastic material. 10
15. The sole of claim 1, wherein the upper sole is formed of a foam-based material. 15
16. The sole of claim 1, wherein the first and second bladder modules are each laterally asymmetrical.
17. A pair of footwear, comprising: 20
 - a right article of footwear; and
 - a left article of footwear,wherein the right and left articles of footwear each comprise an upper and a sole coupled to the upper, each of the soles comprising: 25
 - an upper sole, and
 - a plurality of fluid-filled bladder modules coupled to a bottom surface of the upper sole, the plurality of fluid-filled bladder modules comprising: 30
 - a medial bladder module disposed along a medial side of the sole,
 - a lateral bladder module disposed along a lateral side of the sole, the lateral heel bladder module being spatially separated from the medial bladder in a transverse direction, 35wherein the medial bladder module is reflectively symmetrical with respect to the lateral bladder module such that the medial bladder module of the right article of footwear is identical to the lateral bladder module of the left article of footwear, and the lateral bladder module of the right article of footwear is identical to the medial bladder module of the left article of footwear, and wherein the medial and lateral bladder modules are each laterally asymmetrical. 40
18. The pair of footwear of claim 17, wherein the medial and lateral bladder modules each comprise: 45
 - a first pod extending below the upper sole and defining a first end of the bladder module;
 - a second pod extending below the upper sole 50

and defining a second end of the bladder module; and

a passage extending from the first pod to the second pod such that the first pod is fluidly connected to the second pod.

19. The pair of footwear of claim 18, wherein in each of the medial and lateral bladder modules, the first pod is separated from the second pod in a longitudinal direction.
20. The pair of footwear of claim 17, wherein the medial bladder modules are medial heel bladder modules, each disposed in a heel region of its respective sole,

wherein the lateral bladder modules are lateral heel bladder modules, each disposed in the heel region of its respective sole,

wherein the plurality of fluid-filled bladder modules of each sole further comprises:

a medial forefoot bladder module disposed in a forefoot region of the sole and along the medial side of the sole; and

a lateral forefoot bladder module disposed in the forefoot region of the sole and along the lateral side of the sole, the lateral forefoot bladder module being spatially separated from the medial forefoot bladder module in a transverse direction,

wherein the medial forefoot bladder module is reflectively symmetrical with respect to the lateral forefoot bladder module such that the medial forefoot bladder module of the right article of footwear is identical to the lateral forefoot bladder module of left article of footwear, and the lateral forefoot bladder module of the right article of footwear is identical to the medial forefoot bladder module of the left article of footwear, wherein the medial and lateral forefoot bladder modules are each laterally asymmetrical.

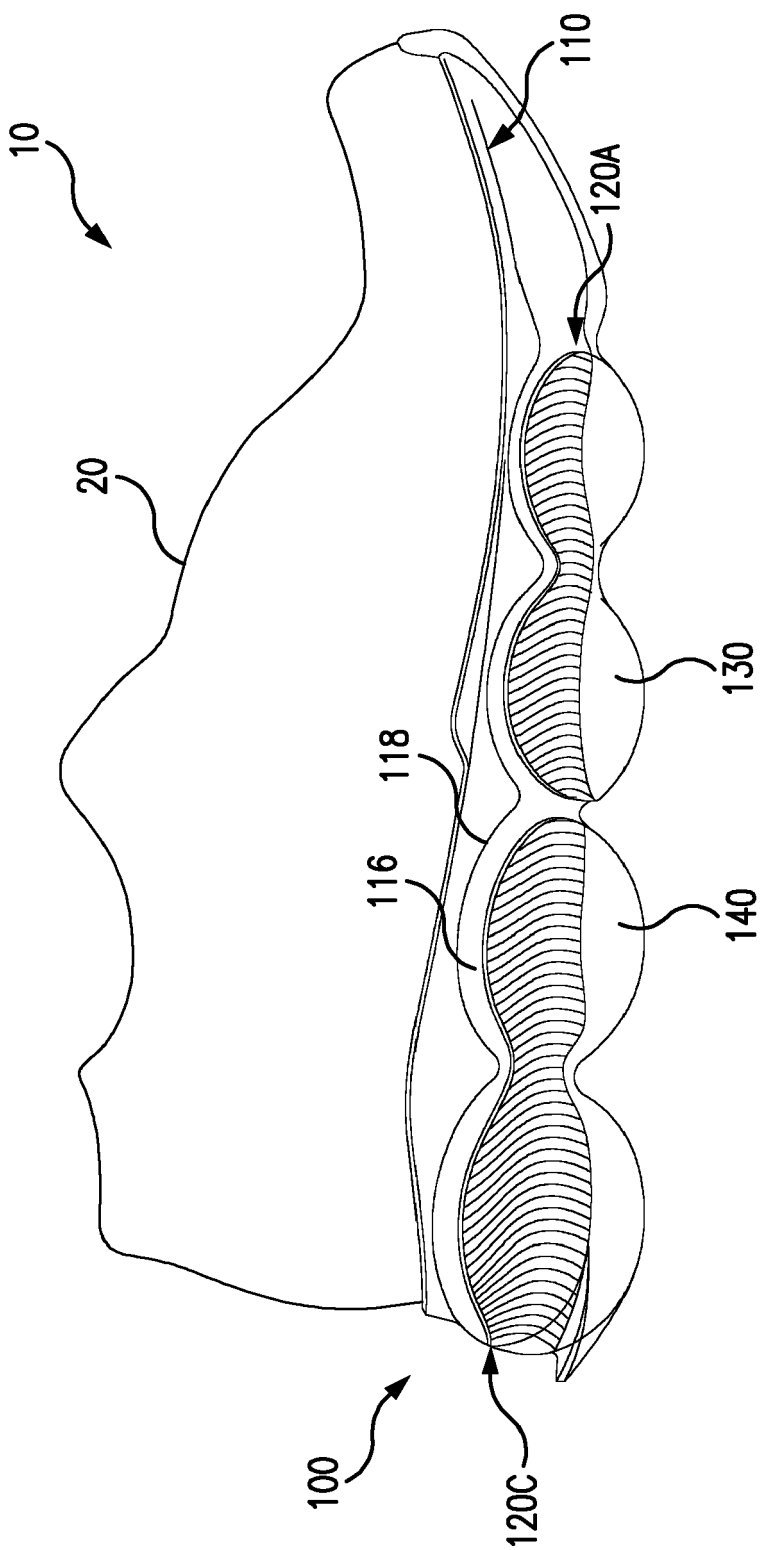


FIG. 1

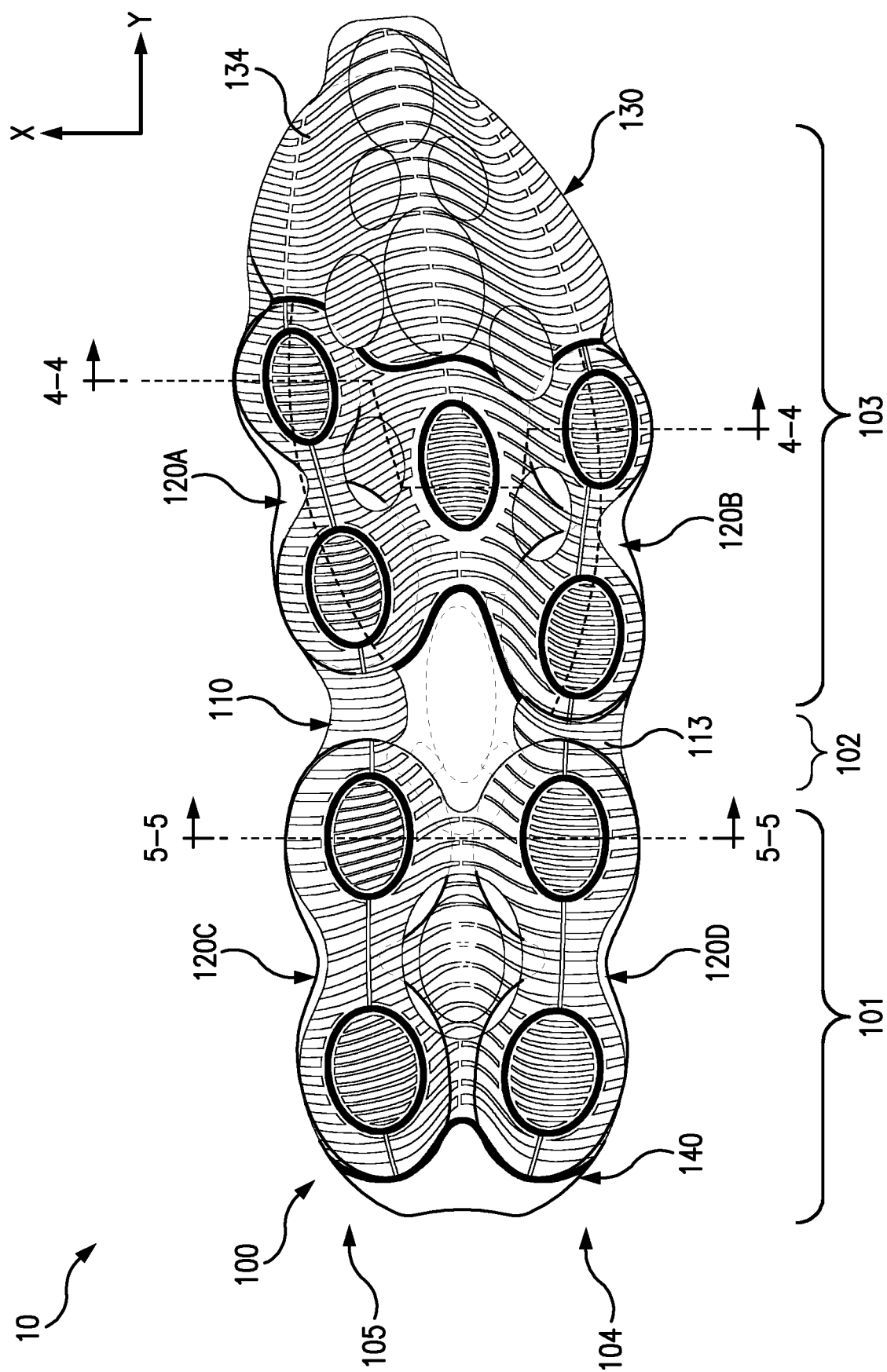


FIG. 2

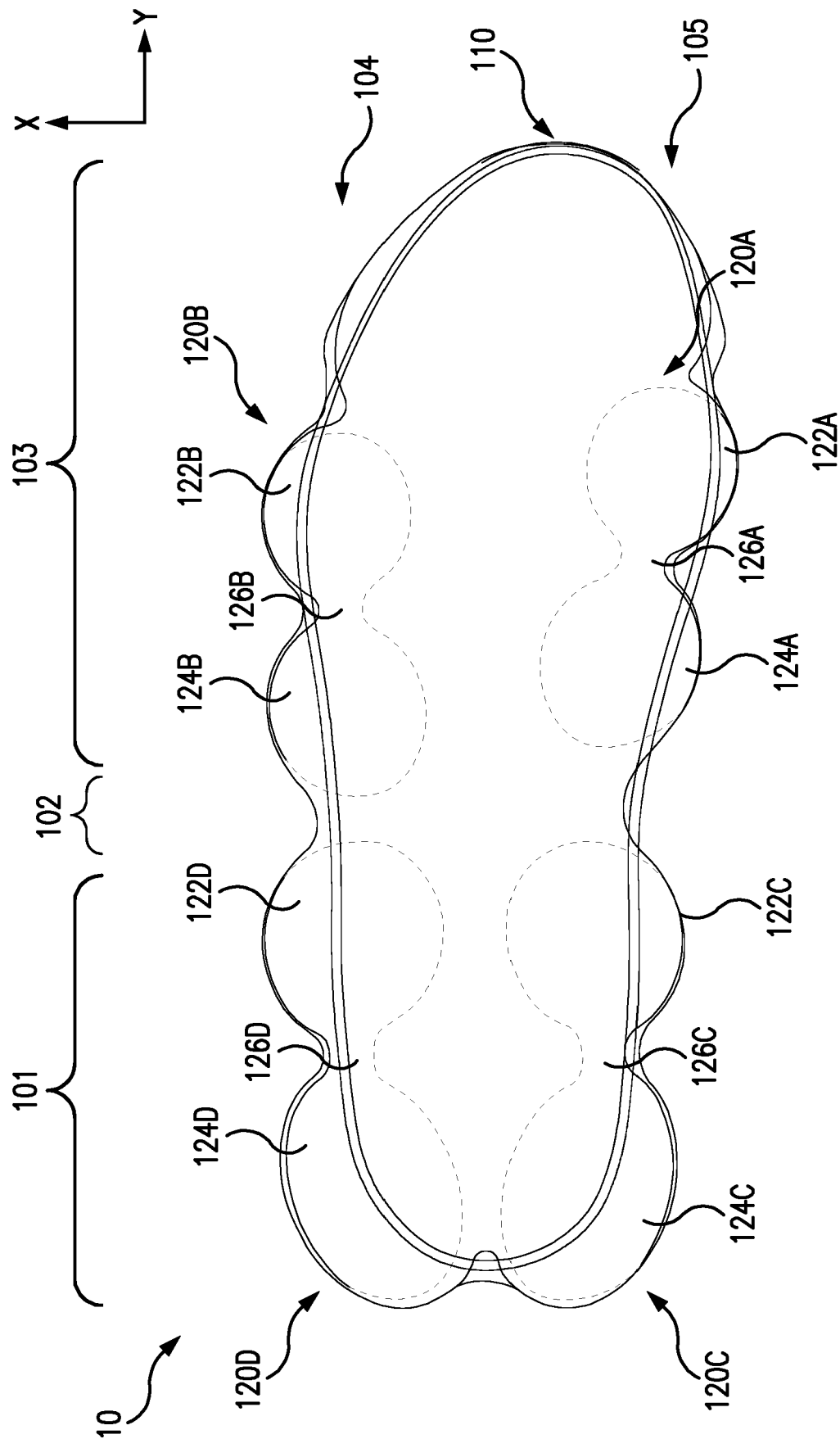


FIG. 3

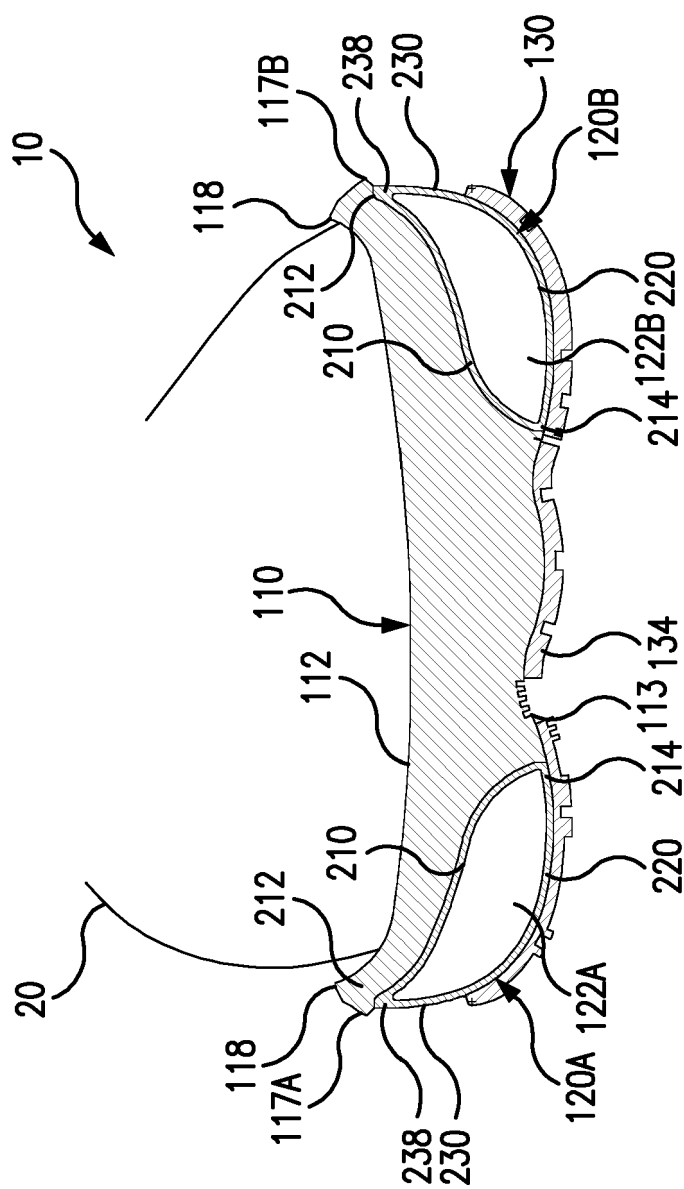
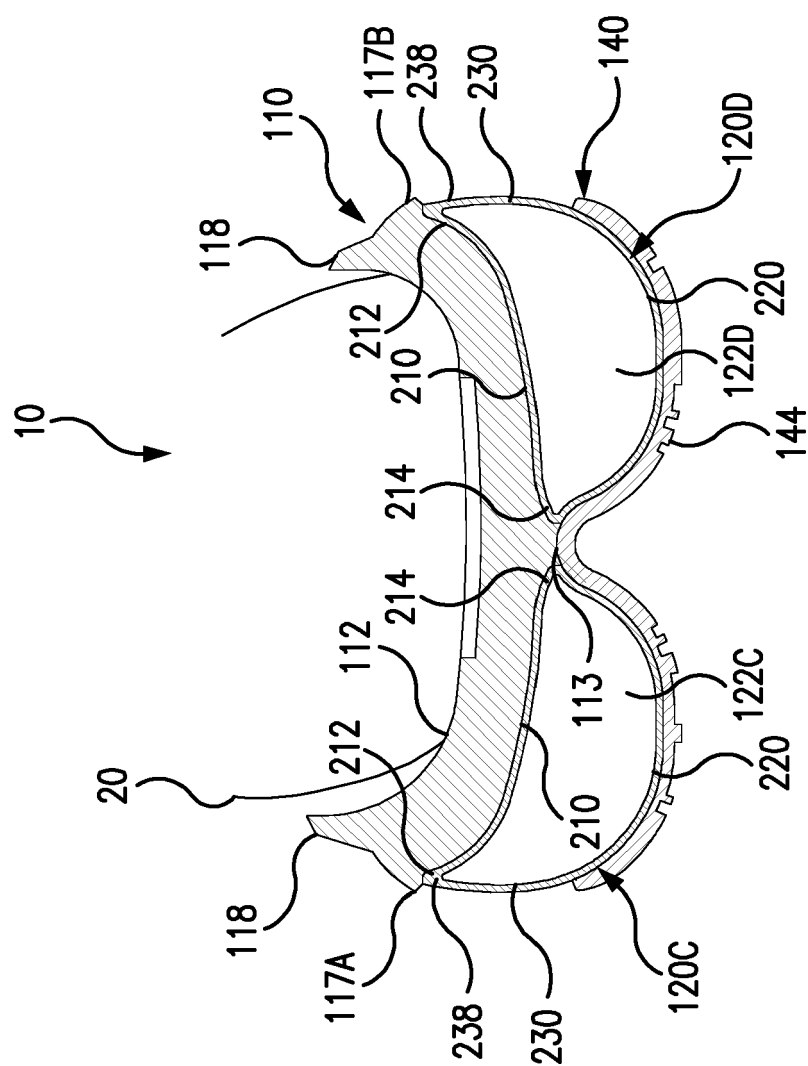


FIG. 4



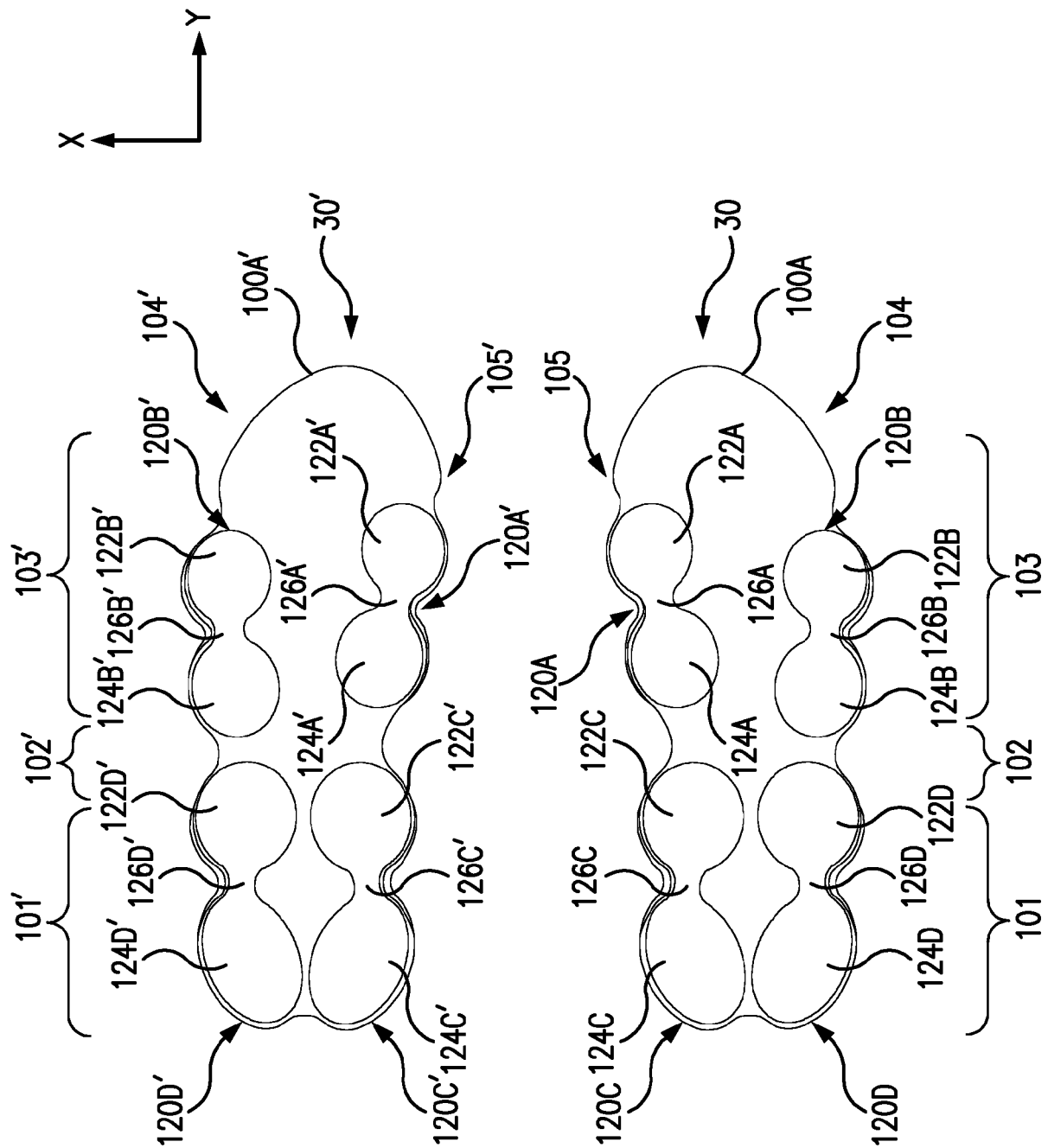
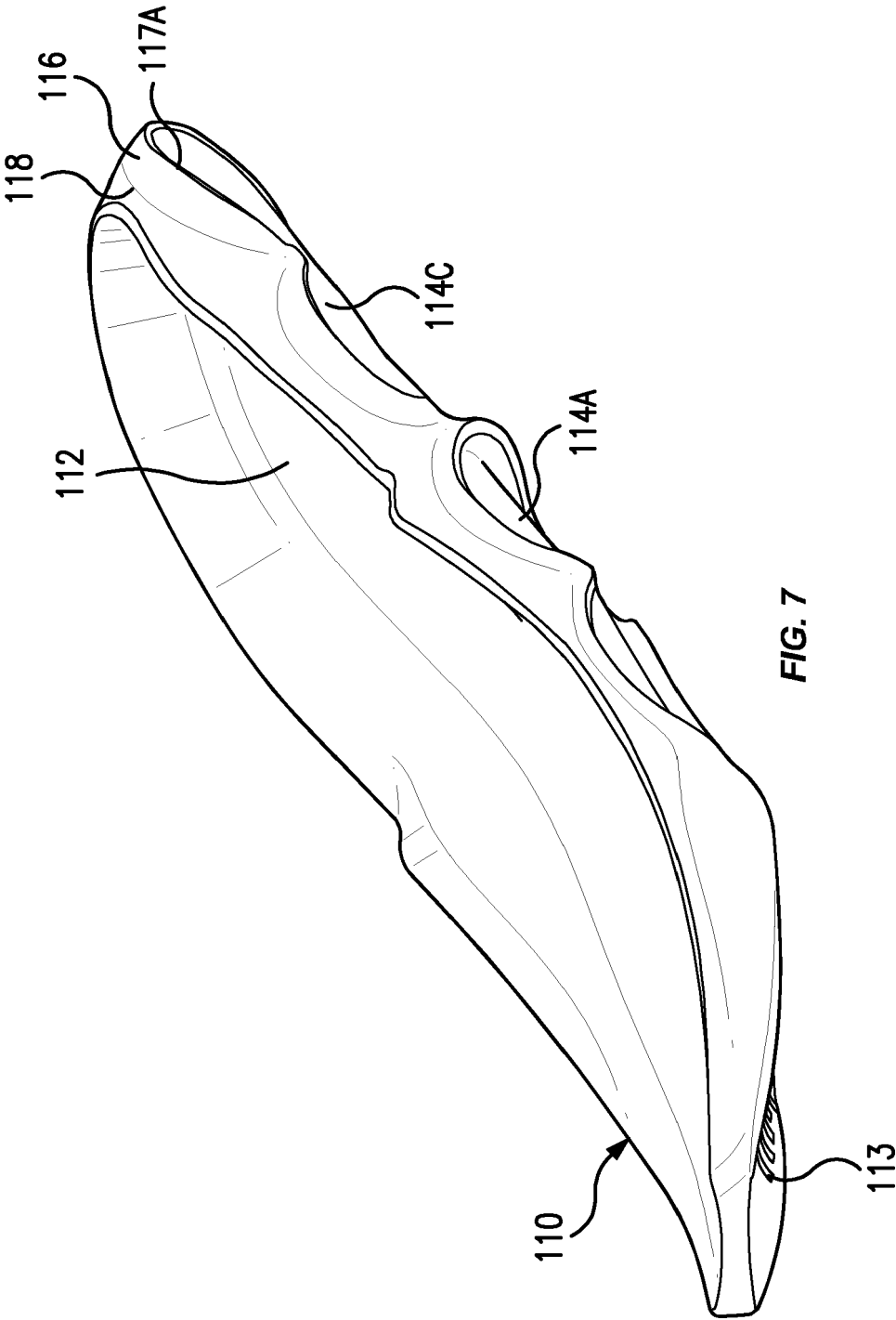
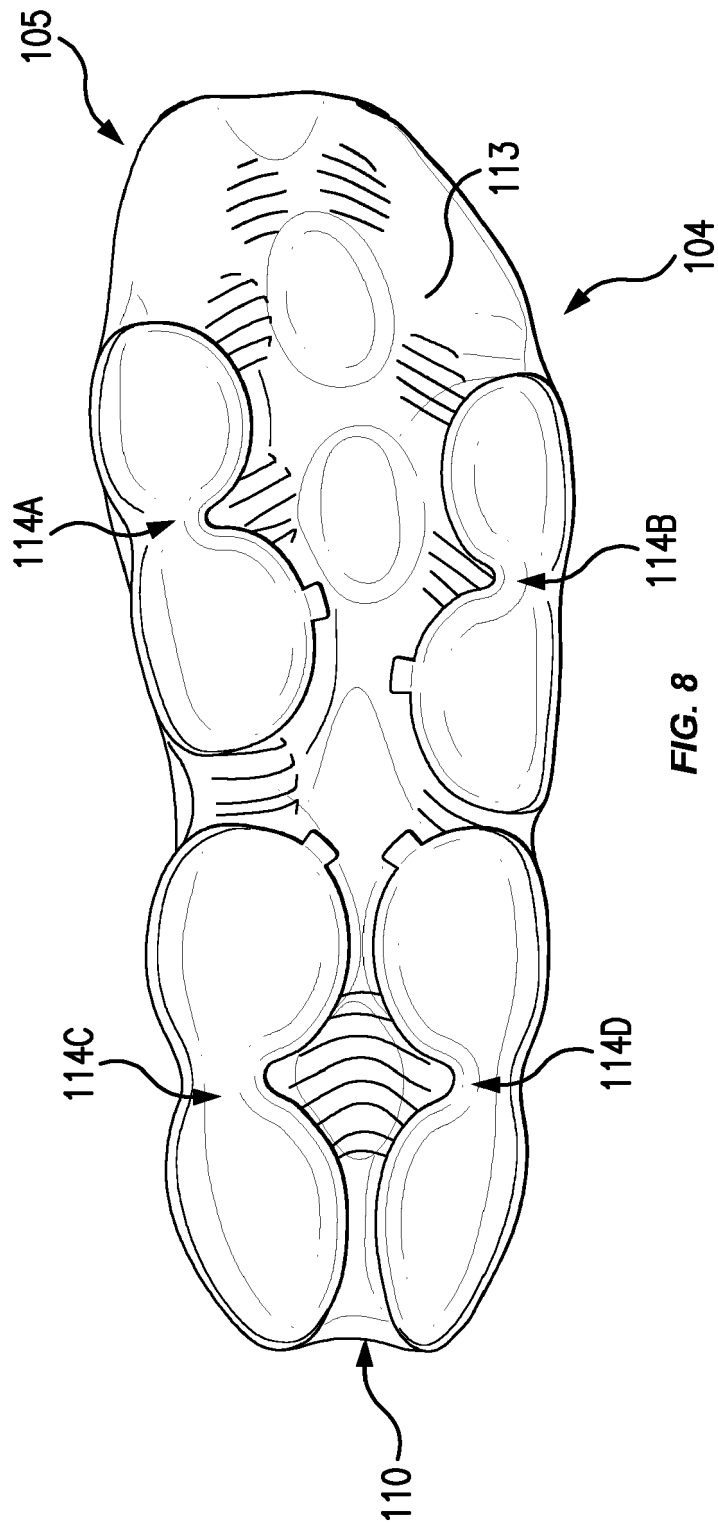


FIG. 6





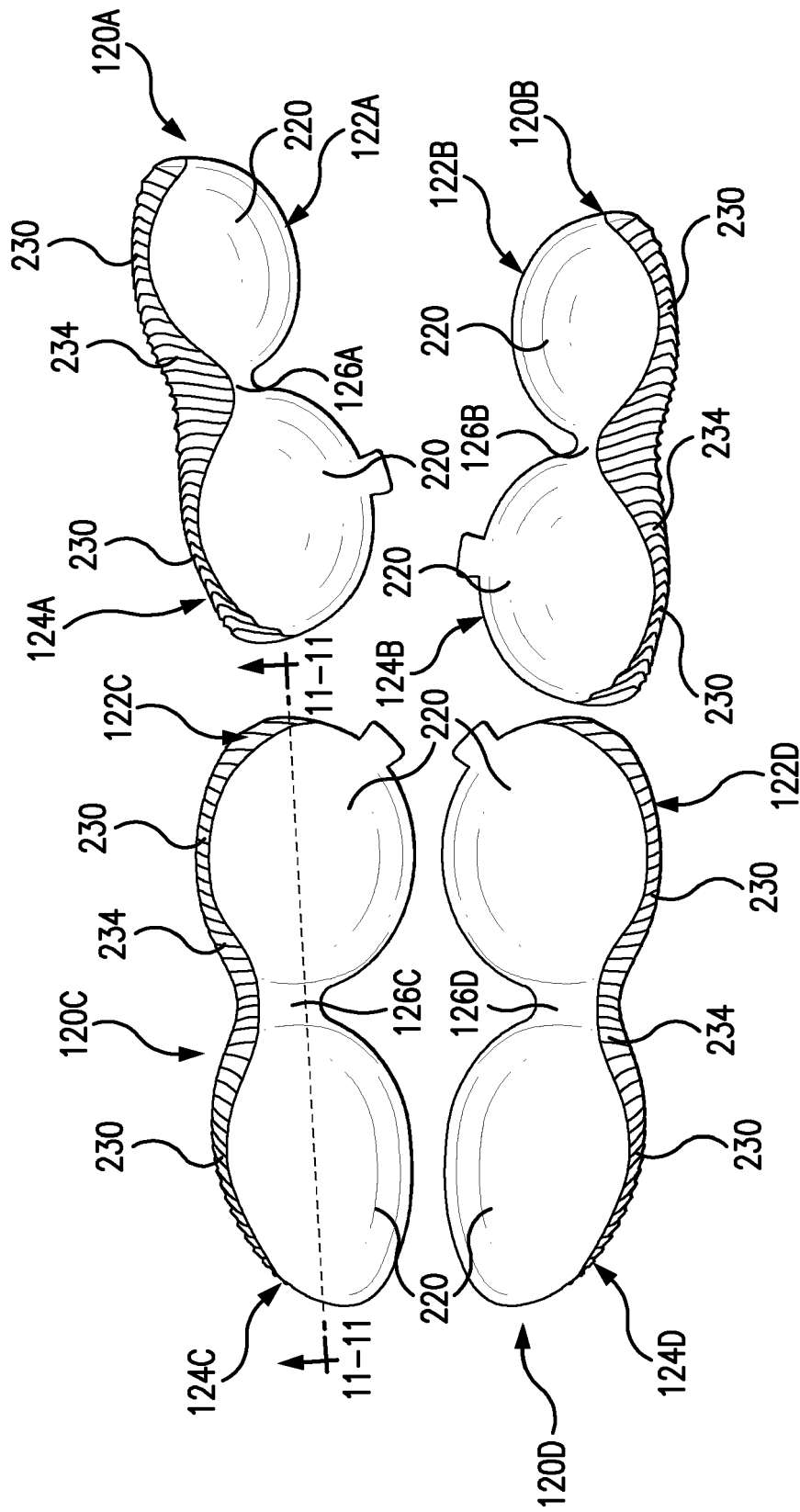


FIG. 9

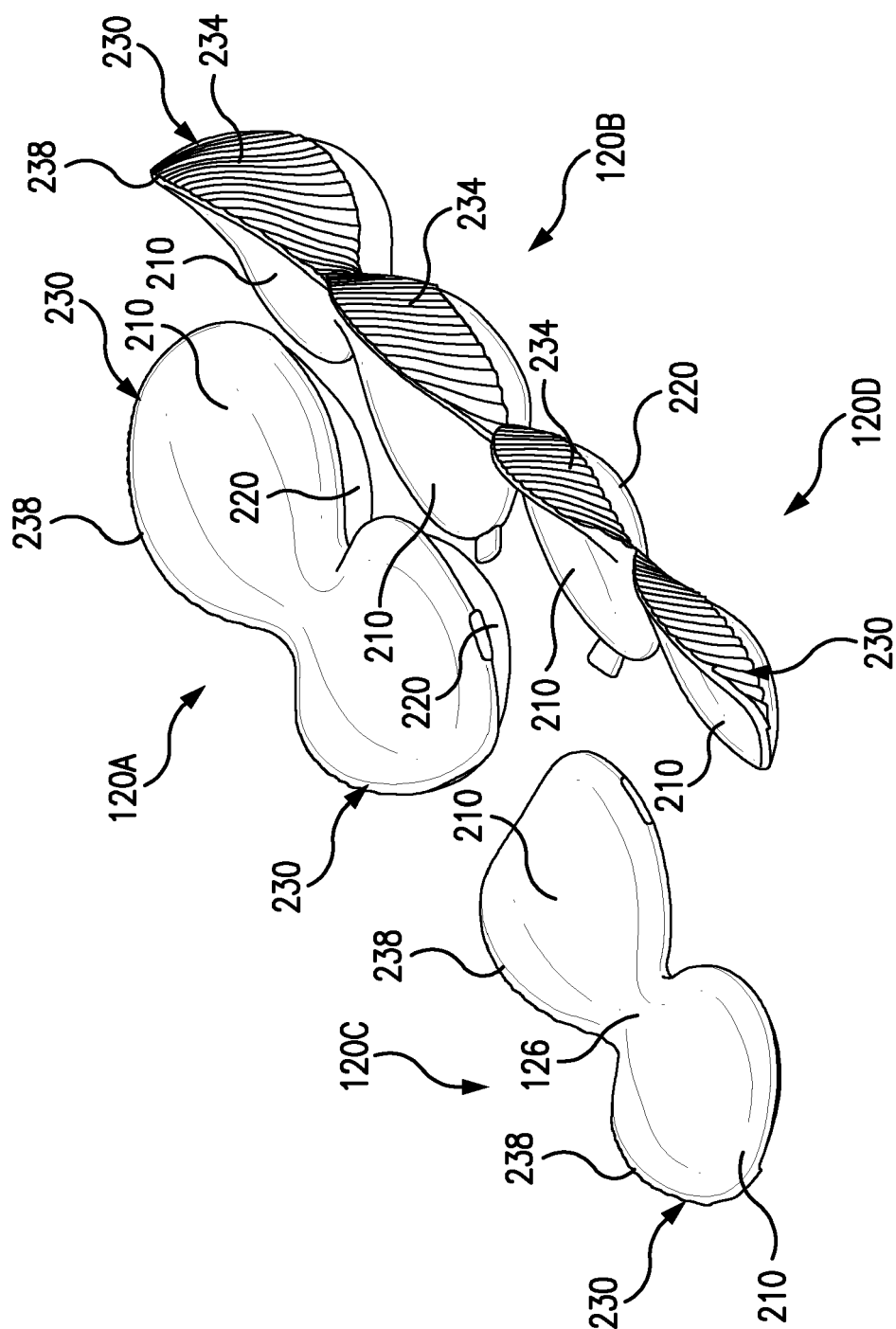


FIG. 10

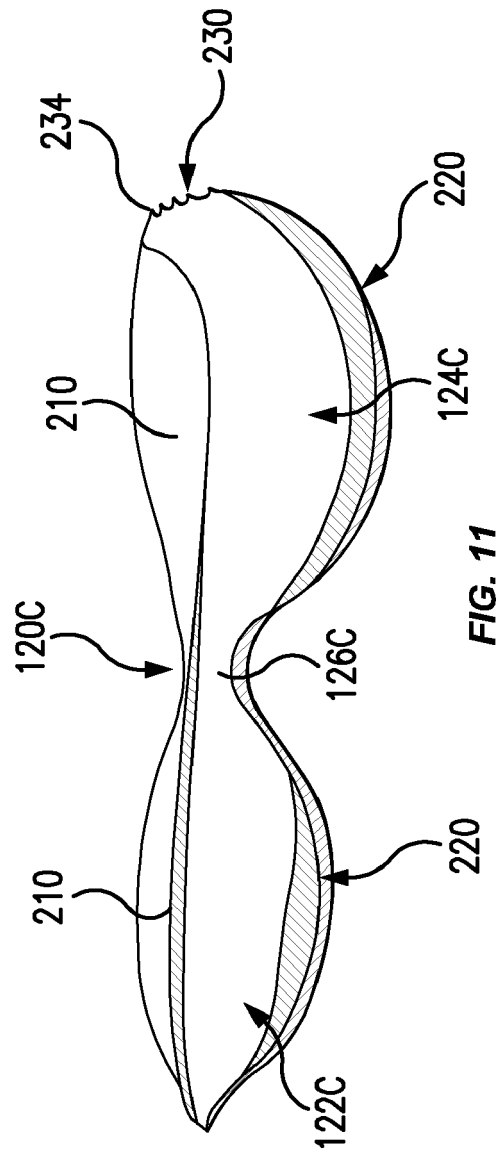


FIG. 11

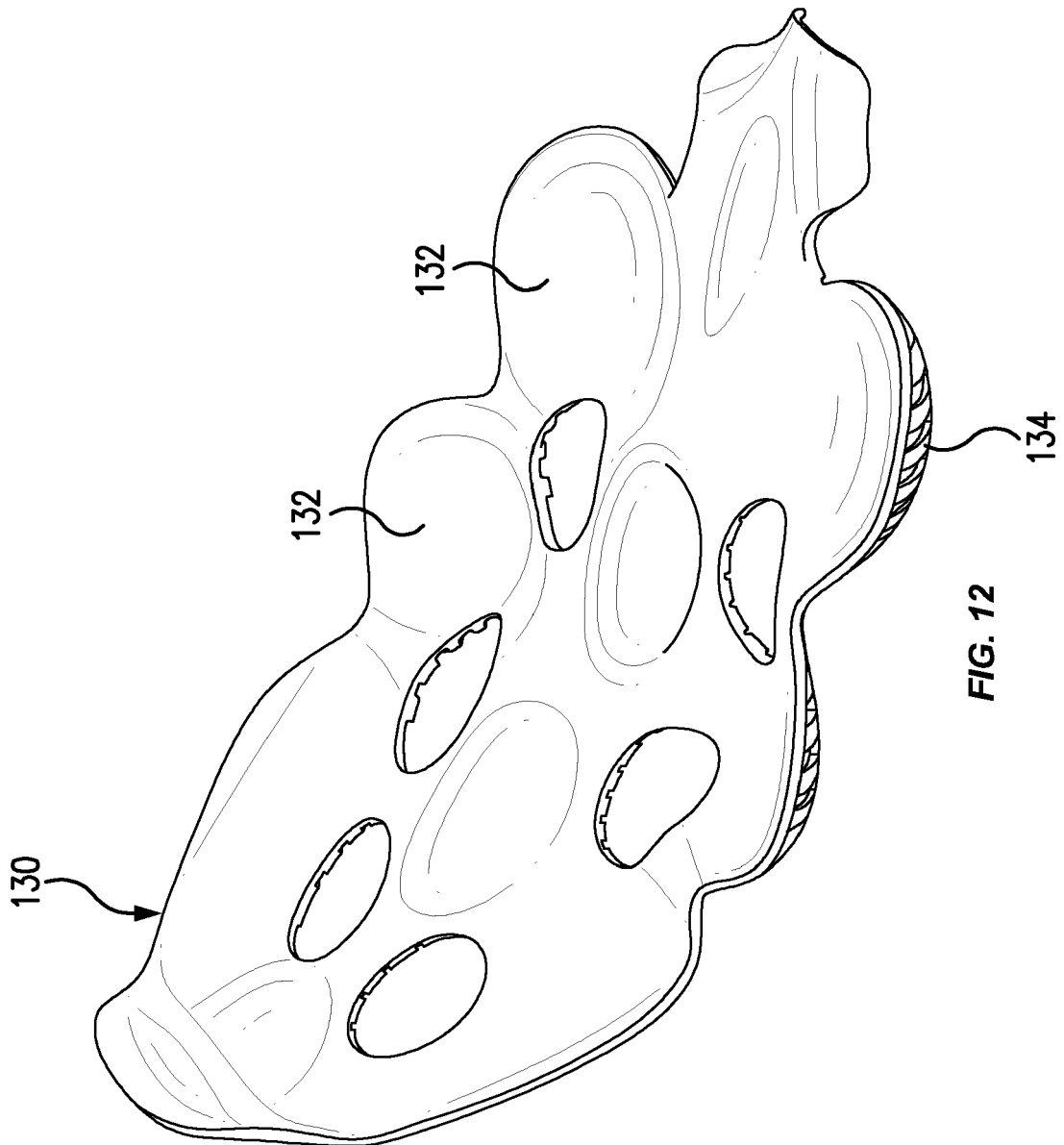
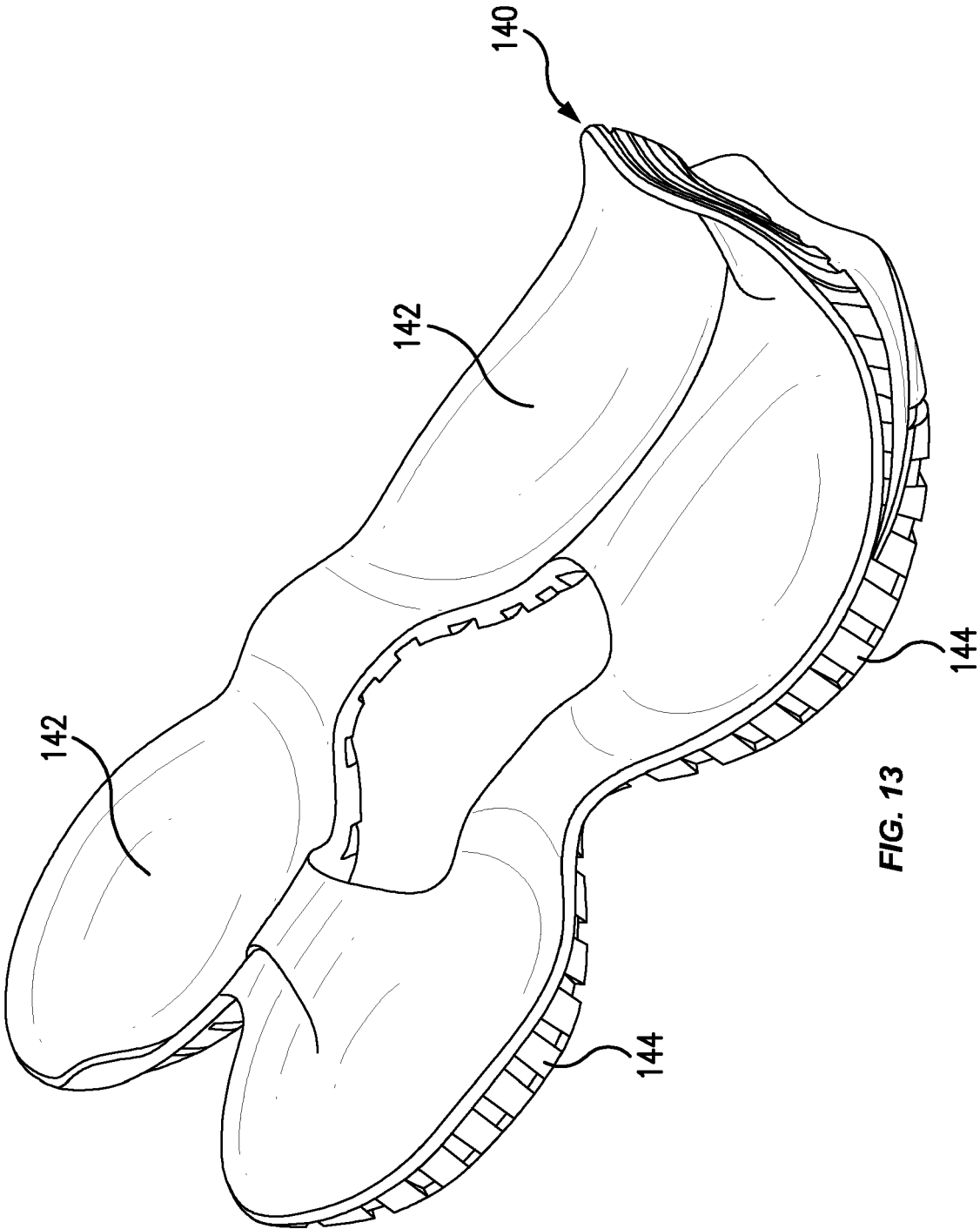


FIG. 12





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Application Number

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A	figures *	5, 8, 9, 11, 15-20	A43B13/20
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Place of search		Date of completion of the search	Examiner
The Hague		15 February 2024	Gkionaki, Angeliki
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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		& : member of the same patent family, corresponding document	

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