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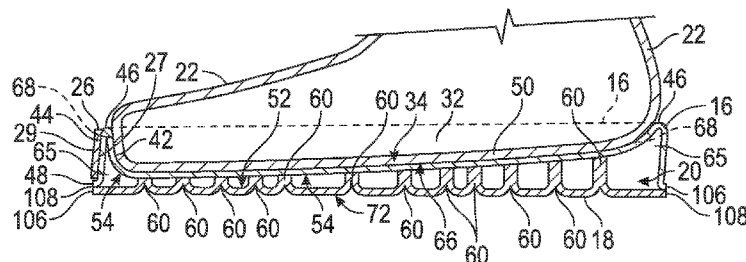


FIG. 6

(57) Abstract: A sole assembly for an article of footwear includes a bladder element having a first polymeric sheet attached to a second polymeric sheet. The first polymeric sheet has an outer surface defining a recess and that has a heel region, a midfoot region, and a forefoot region in the recess. The first polymeric sheet has a peripheral outer wall portion extending around the recess. The second polymeric sheet is attached to the first polymeric sheet at the outer wall portion such that the first and second polymeric sheets define an interior cavity. A method of manufacturing the article of footwear is provided.

SOLE ASSEMBLY WITH BLADDER ELEMENT HAVING A PERIPHERAL OUTER WALL PORTION AND METHOD OF MANUFACTURING SAME

TECHNICAL FIELD

[0001] The present teachings generally include a sole assembly with a bladder element for an article of footwear, and a method of manufacturing an article of footwear.

BACKGROUND

[0002] Footwear typically includes a sole configured to be located under a wearer's foot to space the foot away from the ground or floor surface. Soles can be designed to provide a desired level of cushioning. Athletic footwear in particular sometimes utilizes polyurethane foam or other resilient materials in the sole to provide cushioning. One traditional style of athletic shoe has a rubber sole bonded to a footwear upper in an autoclave process. The rubber sole of such footwear has generally vertical sides that surround and are secured to a lower portion of the sides of the footwear upper, as well as to the bottom of a strobil unit of the footwear upper. The rubber sole also generally has a flat outsole.

SUMMARY

[0003] An article of footwear has a sole assembly that includes a bladder element formed from a first and a second polymeric sheet. The sole assembly can be configured to have a similar shape as a traditional athletic shoe with a rubber sole formed in an autoclave. The bladder element can be at least partially transparent, which allows the footwear upper to be visible through the outer wall portions from the exterior of the article of footwear.

[0004] More specifically, a sole assembly for an article of footwear includes a bladder element having a first polymeric sheet attached to a second polymeric sheet to form an interior cavity, which can be a fluid-filled chamber. The first polymeric sheet has an outer surface defining a recess. The outer surface has a heel region, a midfoot region, and a forefoot region in the recess. The first polymeric sheet has a peripheral outer wall portion extending around the recess. The second polymeric sheet is attached to the first polymeric sheet at the outer wall portion such that the first and second polymeric sheets define the interior cavity. The first polymeric sheet defines a ridge between the recess and the outer wall portion, and the outer wall portion is

substantially perpendicular to a peripheral edge of the second polymeric sheet. An outsole can be secured to the bladder element. The outsole can be at least partially transparent thermoplastic polyurethane, or can be rubber or another suitable material. Optionally, a toe bumper is secured to the bladder member. The toe bumper can be at least partially thermoplastic polyurethane or can be rubber or another suitable material. In an embodiment in which a thermoplastic polyurethane outsole and toe bumper are used, the entire sole assembly can be at least partially transparent. Accordingly, in some embodiments, the sole assembly can be configured without any foam or rubber.

[0005] A method of manufacturing the article of footwear with the bladder element includes providing the bladder element formed from the first and second polymeric sheets configured with the recess and peripheral wall portion as described, and may include thermoforming the bladder element. Optionally, the method includes attaching a footwear upper to the first polymeric sheet at the recess so that the footwear upper is visible through the sidewall portion. Optionally, the method also includes securing an outsole to an outer surface of the second polymeric sheet of the bladder element, and securing a toe bumper to the sidewall portion.

[0006] “A,” “an,” “the,” “at least one,” and “one or more” are used interchangeably to indicate that at least one of the item is present; a plurality of such items may be present unless the context clearly indicates otherwise. All numerical values of parameters (e.g., of quantities or conditions) in this specification, including the appended claims, are to be understood as being modified in all instances by the term “about” whether or not “about” actually appears before the numerical value. “About” indicates that the stated numerical value allows some slight imprecision (with some approach to exactness in the value; approximately or reasonably close to the value; nearly). If the imprecision provided by “about” is not otherwise understood in the art with this ordinary meaning, then “about” as used herein indicates at least variations that may arise from ordinary methods of measuring and using such parameters. In addition, a disclosure of a range is to be understood as specifically disclosing all values and further divided ranges within the range.

[0007] The terms “comprising,” “including,” and “having” are inclusive and therefore specify the presence of stated features, steps, operations, elements, or components, but do not preclude the presence or addition of one or more other

features, steps, operations, elements, or components. Orders of steps, processes, and operations may be altered when possible, and additional or alternative steps may be employed. As used in this specification, the term "or" includes any one and all combinations of the associated listed items.

[0008] Those having ordinary skill in the art will recognize that terms such as "above," "below," "upward," "downward," "top," "bottom," etc., are used descriptively for the figures, and do not represent limitations on the scope of the invention, as defined by the claims.

[0009] The above features and advantages and other features and advantages of the present teachings are readily apparent from the following detailed description of the best modes for carrying out the present teachings when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIGURE 1 is a schematic side view illustration of an article of footwear with a sole assembly having a bladder element.

[0011] FIGURE 2 is a schematic illustration in perspective view showing the article of footwear with a toe bumper and an outsole secured to the bladder element.

[0012] FIGURE 3 is a schematic illustration in perspective view showing an outer surface of a thermoformed first polymeric sheet of the bladder element.

[0013] FIGURE 4 is a schematic illustration in perspective view showing an inner surface of the thermoformed first polymeric sheet of FIG. 3.

[0014] FIGURE 5 is a schematic illustration in bottom view of the article of footwear of FIG. 1 with the outsole removed to show an outer surface of a thermoformed second polymeric sheet.

[0015] FIGURE 6 is a schematic illustration in cross sectional fragmentary view of the article of footwear of FIG. 5 taken at lines 6-6 in FIG. 5.

[0016] FIGURE 7 is a schematic illustration in cross-sectional view of the outsole.

[0017] FIGURE 8 is a schematic fragmentary illustration of one embodiment of a texture pattern of an outer surface of the toe bumper of FIGS. 1 and 2.

[0018] FIGURE 9 is a schematic cross-sectional illustration of a mold assembly for thermoforming the bladder element of FIG. 6 taken at lines 9-9 in FIGS. 10 and 11 shown with the first and second polymeric sheets in the mold portions of FIGS 10-11.

[0019] FIGURE 10 is a schematic illustration in bottom view of a first mold portion of the mold assembly of FIG. 9.

[0020] FIGURE 11 is a schematic illustration in plan view of a second mold portion of the mold assembly of FIG. 9.

[0021] FIGURE 12 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 with a graphic laser-etched on an outward-facing side.

[0022] FIGURE 13 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 with a graphic laser-etched on an inward-facing side.

[0023] FIGURE 14 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 with a graphic laser-etched on an outward-facing side and dyed two different colors.

[0024] FIGURE 15 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 with a graphic laser-etched on an inward-facing side and dyed two different colors.

[0025] FIGURE 16 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 with a polymeric film having a graphic thereon attached to an inward-facing side.

[0026] FIGURE 17 is a schematic illustration in exploded perspective view showing the thermoplastic polyurethane component and the polymeric film of FIG. 16.

[0027] FIGURE 18 is a schematic illustration in perspective view showing a thermoplastic polyurethane component for the article of footwear of FIG. 1 dyed two different colors and with a polymeric film having a graphic thereon attached to an inward-facing side.

[0028] FIGURE 19 is a schematic illustration in exploded perspective view showing the thermoplastic polyurethane component and the polymeric film of FIG. 18.

[0029] FIGURE 20 is a schematic illustration in perspective view of a double-coated adhesive film used to attach a toe bumper or an outsole to the midsole of FIG. 1.

[0030] FIGURE 21 is a flow diagram of a method of manufacturing the article of footwear of FIG. 1.

DETAILED DESCRIPTION

[0031] Referring to the drawings, wherein like reference numbers refer to like components throughout the views, FIG. 1 shows an article of footwear 10 that has a sole assembly 12 with a bladder element 14. The bladder element 14 is a fluid-filled, airtight chamber, as further described herein. The bladder element 14 can be inflated and can resiliently retain a fluid such as air or another gas, and can be at an ambient pressure or pressurized. If the bladder element 14 is inflated with air, it may be referred to as an airbag.

[0032] The bladder element 14 is formed from two polymeric sheets, including a first polymeric sheet 16, and a second polymeric sheet 18. The first polymeric sheet 16 is also referred to herein as the upper polymeric sheet 16, and the second polymeric sheet 18 is also referred to herein as the lower polymeric sheet 18. The polymeric sheets 16, 18 are attached to one another as described herein to define a sealed interior cavity 20 that retains the fluid. FIG. 3 shows a tube 17 formed in the upper polymeric sheet 16. The tube 17 is used to fill the bladder element 14. The opening in the tube 17 is then plugged and the tube 17 is trimmed. As further described herein, the bladder element 14 is cooperatively configured to interfit with a footwear upper 22, an outsole 24, and an optional toe bumper 26 to provide the general shape of a traditional athletic shoe with a rubber sole as manufactured according to an autoclave process. In other embodiments, the article of footwear 10 could be for a dress shoe, a work shoe, a sandal, a slipper, a boot, or any other category of footwear. The bladder element 14 provides desirable resiliency and cushioning characteristics and may be lighter in weight than a traditional rubber sole. Moreover, as the bladder element 14, the outsole 24, and the toe bumper 26 can be formed from at least partially transparent materials, the article of footwear 10 has unique characteristics, such as the visibility of the shoe upper 22 through the bladder

element 14 from the exterior of the article of footwear 10. The bladder element 14 serves the function of a midsole, and can be referred to as a midsole.

[0033] Referring to FIG. 3, the upper polymeric sheet 16 has an outer surface 30 that defines a downwardly-extending recess 32. More specifically, a portion of the outer surface 30 is an upward-facing surface 34 that is generally the shape of a human foot. The surface 34 is configured as a foot support surface with a heel region 36, a midfoot region 38, and a forefoot region 40 generally correlating with a heel, an arch, and a forefoot of a human foot. The foot need not directly contact the upward-facing surface 34, but is supported by the upward-facing surface 34. For purposes of discussion, the heel region 36, the midfoot region 38, and the forefoot region 40 are defined as the rearmost third, the middle third, and the foremost third of the upward-facing surface 34. Heel region 36 generally includes portions of the upper polymeric sheet 16 corresponding with rear portions of a human foot of a size corresponding with the article of footwear 10, including the calcaneus bone. Forefoot region 40 generally includes portions of the upper polymeric sheet 16 corresponding with the toes and the joints connecting the metatarsals with the phalanges of a human foot of a size corresponding with the article of footwear 10. Midfoot region 38 generally includes portions of the upper polymeric sheet 16 corresponding with an arch area of a human foot of a size corresponding with the article of footwear 10. In light of the upward-facing surface 34 having a heel region 36, a midfoot region 38, and a forefoot region 40, the bladder element 14 can be referred to as a full-length bladder element, as the heel region 36, midfoot region 38, and forefoot region 40 together extend the full length of a human foot having dimensions for which the article of footwear 10 is sized.

[0034] In the embodiment shown, the upper polymeric sheet 16 is formed from a single, flat sheet, such as by thermoforming, to attain the relatively complex, contoured shape shown in FIGS. 3 and 4. The upper polymeric sheet 16 has an inner wall portion 42, a peripheral outer wall portion 44, and a ridge 46 between the inner wall portion 42 and the outer wall portion 44. The ridge 46 forms the uppermost extent of the sheet 16. The inner wall portion 42 extends generally downward to the upward-facing surface 34 so that the inner wall portion 42 and the upward-facing surface 34 together define the recess 32. The outer wall portion 44 extends generally downward from the ridge 46 further than the recess 32 and the inner wall portion 42,

so that a continuous terminal edge 48 of the outer wall portion 44 is below a lowest extent 50 of the recess 32, and extends around an entire periphery of the recess 32. In other words, the portion of the first polymeric sheet 16 forming the upward-facing surface 34 is elevated relative to the edge 48 in the assembled article of footwear 10. The outer wall portion 44 is also referred to as a sidewall portion.

[0035] The bladder element 14 also includes the lower polymeric sheet 18 attached to the upper polymeric sheet 16 by bonding at a flange 106 near the terminal edge 48 of the outer wall portion 44 as further described herein. The upper and lower polymeric sheets 16, 18 define the interior cavity 20. As best shown in FIGS. 5 and 6, an inner surface 52 of the lower polymeric sheet 18 is joined to an inner surface 54 of the upper polymeric sheet 16 at multiple bonds 60 extending transversely and only partway across the interior cavity 20 from a medial side 62 of the outer wall portion 44 to a lateral side 64 of the outer wall portion 44. As used herein, a lateral side of a component for an article of footwear 10, such as the lateral side 64 of the outer wall portion 44 of the upper polymeric sheet 16, is a side that corresponds with an outside area of the foot of the wearer of the article of footwear 10 that is generally further from the other foot of the wearer (i.e., the side closer to the fifth toe of the wearer). The fifth toe is commonly referred to as the little toe. A medial side of a component for an article of footwear, such as the medial side 62 of the outer wall portion 44 of the upper polymeric sheet 16, is the side that corresponds with an inside area of the foot on which the article of footwear 10 is worn and that is generally closer to the other foot of the wearer (i.e., the side closer to the hallux of the foot of the wearer). The hallux is commonly referred to as the big toe.

[0036] The recess 32, the ridge 46, and the outer wall portion 44 define an inverted channel 65 at the inner surface 54 of the upper sheet 16. The inverted channel 65 is part of the interior cavity 20. Because the bonds 60 do not extend completely between the lateral side 64 of the outer wall portion 44 and the medial side 62 of the outer wall portion 44, the inverted channel 65 is in fluid communication with the interior cavity 20 and is a peripheral portion of the interior cavity 20.

[0037] The upper polymeric sheet 16 and the lower polymeric sheet 18 are at least partly thermoplastic polyurethane. Examples of polymer materials for the bladder element 14 include thermoplastic polyurethane, polyester, polyester polyurethane, and polyether polyurethane. Moreover, each of the polymeric sheets 16, 18 of the bladder

element 14 can be formed of layers of different materials. In one embodiment, the polymeric sheets 16, 18 of the bladder element 14 are each formed from thin films having one or more thermoplastic polyurethane (TPU) layers with one or more barrier layers of a copolymer of ethylene and vinyl alcohol (EVOH) that is impermeable to the pressurized fluid contained therein as disclosed in U.S. Patent No. 6,082,025 to Bonk et al., which is incorporated by reference in its entirety. The polymeric sheets 16, 18 may also be formed from a material that includes alternating layers of thermoplastic polyurethane and ethylene-vinyl alcohol copolymer, as disclosed in U.S. Patent Nos. 5,713,141 and 5,952,065 to Mitchell et al. which are incorporated by reference in their entireties. Alternatively, the layers may include ethylene-vinyl alcohol copolymer, thermoplastic polyurethane, and a regrind material of the ethylene-vinyl alcohol copolymer and thermoplastic polyurethane. The polymeric sheets 16, 18 of the bladder element 14 may also be flexible microlayer membranes that include alternating layers of a gas barrier material and an elastomeric material, as disclosed in U.S. Patent Nos. 6,082,025 and 6,127,026 to Bonk et al. which are incorporated by reference in their entireties. Additional suitable materials for the bladder element 14 are disclosed in U.S. Patent Nos. 4,183,156 and 4,219,945 to Rudy, which are incorporated by reference in their entireties. Further suitable materials for the bladder element 14 include thermoplastic films containing a crystalline material, as disclosed in U.S. Patent Nos. 4,936,029 and 5,042,176 to Rudy, and polyurethane including a polyester polyol, as disclosed in U.S. Patent Nos. 6,013,340, 6,203,868, and 6,321,465 to Bonk et al. which are incorporated by reference in their entireties.

[0038] In selecting materials for the bladder element 14, engineering properties such as tensile strength, stretch properties, fatigue characteristics, dynamic modulus, and loss tangent can be considered. The thicknesses of polymeric sheets 16, 18 used to form the bladder element 14 can be selected to provide these characteristics. The bladder element 14 is resilient and provides cushioning and flexibility that can be tuned such as by selecting a level of pressurization. In the embodiment shown in FIG. 2, the bladder element 14 is at ambient pressure. Optionally, tensile members and/or reinforcing structures can be integrated with the bladder element 14 to provide desired responsiveness, such as disclosed in U.S. Patent Nos. 4,906,502 to Rudy et al., and 8,061,060 to Swigart et al., which are incorporated by reference in their entireties.

[0039] Referring to FIG. 6, the footwear upper 22 has a lower surface 66 secured to the upper surface 34 of the upper polymeric sheet 16 in the recess 32. The footwear upper 22 is also secured to the inner wall portion 42. The outer wall portion 44 surrounds a periphery 68 of the footwear upper 22. The periphery 68 of the footwear upper 22 is indicated in FIGS. 1 and 7 and generally by a hidden line in FIG. 5. Stated differently, the footwear upper 22 is nested in the recess 32 inward of the inner wall portion 42. The upper polymeric sheet 16 is at least partially transparent. A lower extent of the footwear upper 22 is thus visible from an exterior of the article of footwear 10 through the outer wall portion 44 and the inner wall portion 42 to the nested footwear upper 22.

[0040] Like the upper polymeric sheet 16, the lower polymeric sheet 18 is also an at least partially transparent material. The outsole 24 provides the ground contact surface of the article of footwear 10, and can be a thermoplastic polyurethane with a greater hardness and thickness than the lower polymeric sheet 18 to provide durability, traction and abrasion resistance. An upper surface 70 of the outsole 24 is secured to a lower surface 72 of the lower polymeric sheet 18 after bladder element 14 is formed and inflated. The outsole 24 can be configured so that when it is secured to the lower polymeric sheet 18, the peripheral edge 73 of the outsole 24 is substantially perpendicular to the outer wall portion 44. The outsole 24 is an at least partially transparent TPU. In this case, the outsole 24 is secured to the bladder element 14 with adhesives or by radio frequency welding. Alternatively, the outsole 24 can be a rubber material, in which case a two-sided film, such as double-coated adhesive film 150 shown and described with respect to FIG. 20, is used to secure the outsole 24 to the bladder element 14. The pattern of the bonds 60 of the lower polymeric sheet 18 to the upper sheet 16 is visible through the outsole 24. The pattern of the bonds 60 may be selected to serve both a mechanical function and to be aesthetically pleasing through the outsole 24.

[0041] The optional toe bumper 26 is secured to a portion of the upper polymeric sheet 16 that is the outward-facing surface 78 of the outer wall portion 44. Specifically, the toe bumper 26 is secured to the outward-facing surface 78 at the sidewall portion 44 adjacent the forefoot region 40. Like the outsole 24, the toe bumper 26 may also be an at least partially transparent material, and can be a thermoplastic polyurethane with a greater hardness and thickness than the lower

polymeric sheet 18 to provide durability and abrasion resistance. In this case, the toe bumper 26 is secured to the bladder element 14 with adhesives or by radio frequency welding. Alternatively, the toe bumper 26 can be a rubber material, in which case a two-sided film, such as double-coated adhesive film 150 shown and described with respect to FIG. 20, is used to secure the toe bumper 26 to the bladder element 14.

[0042] As shown in FIG. 2, a ground contact side 74 of the outsole 24 may be formed with a herringbone pattern, if desired. In other embodiments, a variety of patterns, textures, fonts, or images can be laser engraved on the outsole 24. Figure 8 shows one embodiment of a surface texture of the toe bumper 26 having alternating sets of short peaked ridges 80, 82 in a pattern generally referred to as a herringbone pattern. As further described with respect to FIGS. 12 to 19, if either or both of the outsole 24 and the toe bumper 26 are thermoplastic polyurethane, a variety of patterns, textures, fonts, or graphical images can be attained by laser engraving, molding, or dyeing the toe bumper 26, and/or applying patterned films to the toe bumper 26.

[0043] In the embodiment of FIGS. 1-2, the sole assembly 12 includes the bladder element 14, the outsole 24, and the toe bumper 26. The outsole 24 and toe bumper 26 of FIGS. 1 and 2 are thermoplastic polyurethane. Accordingly, the sole assembly 12 does not include foam, foam layers, or rubber.

[0044] FIG. 9 is a cross-sectional view of a mold assembly 90 in which the bladder element 14 is formed using a twin sheet thermoforming process. An upper mold portion 92 has a mold cavity 94 that shapes the upper polymeric sheet 16 to provide the outer wall portion 44, ridge 46, inner wall portion 42, and foot-support surface 34. The mold cavity 94 is shown in FIG. 10 without the upper polymeric sheet 16 placed therein. Vacuum passages 96 run through the mold portion 92 to a vacuum source in order to pull the upper polymeric sheet 16 against the mold portion 92. The vacuum passages 96 may leave a dimpled pattern on the outer surface 30 of the upper polymeric sheet 16, as shown in FIG. 2, but the dimples do not penetrate through the entire upper polymeric sheet 16.

[0045] FIG. 11 shows elongated slots 98 in a lower mold portion 100 used to shape the lower polymeric sheet 18. Pins or other forming tools can extend upward through the slots 98 to press the lower polymeric sheet 18 against the upper polymeric sheet 16 during the thermoforming process to create the bonds 60 shown in FIG. 6. A

phantom line 102 in FIG. 11 indicates where the upper polymeric sheet 16 will bond to the lower polymeric sheet 18 at flange 106. Lip 104 of the mold portion 100 is the edge of a shallow recess 105 that helps form a flange 106 at which the polymeric sheets 16, 18 will bond when the mold portions 92, 100 are pressed together with sufficient pressure in a press, while supplying heat and vacuum to the mold portions 92, 100. The polymeric sheets 16, 18 will be subsequently trimmed at the flange 106. The outer wall portion 44 is substantially perpendicular to a peripheral edge 108 of the lower polymeric sheet 18 after thermoforming.

[0046] The upper and lower polymeric sheets 16, 18 are originally planar, but take on the shapes of the mold cavity 94 and recess 105 via vacuuming and heating steps included in the thermoforming process. The bladder element 14 can then be cooled, inflated to a predetermined pressure, and sealed to retain pressure. FIGS. 3 and 4 show a tube 17 formed in the upper polymeric sheet 16. The tube 17 is used to fill the bladder element 14. The opening in the tube 17 is then plugged and the tube 17 is trimmed. Various thermoforming techniques may be used, such as are described in Patent No. U.S. 6,119,371, which is hereby incorporated by reference. The pressure and heat between the mold portions 92, 100 will cause the polymeric sheets 16, 18 to bond to one another at the peripheral flange 106. Excess material is then removed by trimming. Trimming may be automated and may occur at a separate steel roll die trim. Alternatively, trimming could be accomplished manually.

[0047] FIG. 12 shows a transparent TPU component 120A that has a laser-etched graphic 123A on a first side 125A. A second side 127A does not have a graphic thereon. FIG. 13 shows a similar transparent TPU component 120B that has the laser-etched graphic 123A on a second side 127B. A first side 125B does not have a graphic thereon. Because the TPU material is at least partially transparent, the laser-etched graphic 123A is visible when viewed through the material of the component 120B from the first side 125B.

[0048] When the material of the component 120A of FIG. 12 is used for the toe bumper 26, the first side 125A is an outward-facing side, i.e., outward-facing side 29 of FIG. 6, and the second side 127A is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120A is used for the outsole 24, the first side 125A is an outward-facing side, i.e., outward-facing side 25 of FIG. 7, and the second side 127A is an inward-

facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 7. In each of these embodiments, the laser-etched graphic 123A is on the outward-facing side.

[0049] When the material of the component 120B of FIG. 13 is used for the toe bumper 26, the first side 125B is an outward-facing side, i.e., outward-facing side 29 of FIG. 6, and the second side 127B is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120B is used for the outsole 24, the first side 125B is an outward-facing side, i.e., outward-facing side 25 of FIG. 6, and the second side 127B is an inward-facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 6. In each of these embodiments, the laser-etched graphic 123A is on the inward-facing side 21 or 27. However, because the TPU material is transparent, the laser-etched graphic 123A is visible when looking through the toe bumper 26 or the outsole 24 from the outward-facing side 29 or 25. In FIGS. 12 and 13, the edges of the TPU components 120A, 120B on portions facing away from the perspective view are shown with hidden lines for purposes of clarity in the drawings. In FIG. 13, the graphic 123A is shown with hidden lines for purposes of clarity in the drawings. It should be appreciated, however, that because the TPU material is transparent, the edges and the graphic 123A shown in hidden lines are actually visible from the perspective shown in the drawings.

[0050] FIGS. 14 and 15 show embodiments of transparent TPU components 120C, 120D that combine laser-etching and dyeing. FIG. 14 shows a transparent TPU component 120C that has a laser-etched graphic 123B on a first side 125C. A second side 127C does not have a graphic thereon. Alternatively, both sides 125C, 127C may have the same or different laser-etched graphics thereon. FIG. 15 shows a similar transparent TPU component 120D that has a laser-etched graphic 123B on a second side 127D. A first side 125D does not have a graphic thereon. Because the material is transparent, the laser-etched graphic 123B is visible when viewed through the material of the component 120D from the first side 125D. In FIGS. 14 and 15, the edges of the TPU components 120C, 120D on portions facing away from the perspective view are shown with hidden lines for purposes of clarity in the drawings. In FIG. 15, the graphic 123B is shown with hidden lines for purposes of clarity in the drawings. It should be appreciated, however, that because the TPU material is

transparent, the edges and the graphic 123B shown in hidden lines are actually visible from the perspective shown in the drawings.

[0051] The TPU component 120C of FIG. 14 is dyed a first color extending to approximately a first portion T1 of the thickness T of the component 120C. The TPU component is dyed a second color extending to approximately a remaining portion T2 of the thickness T. Dyeing can be accomplished in stages. First, the undyed TPU component 120C can be placed with the first side 125C down in a first container of dye of the first color, with the dye in the container at a depth T1. The TPU component 120C will remain in the first container until the dye of the first color is absorbed in the portion of the thickness T1. The TPU component 120C can be allowed to dry, and then can be placed with the second side 127C face down in a second container of dye that is the second color, with the dye in the container at a depth T2. The TPU component 120C will remain in the second container until the dye of the second color is absorbed in the portion of the thickness T2. The portion dyed the first color is untouched and unaffected by the dye of the second color. The TPU component 120D of FIG. 14 is dyed in an identical manner as described with respect to the TPU component 120C. The dyeing process can occur either before or after the laser-etching of the graphic 123B on the first side 125C of the TPU component 120C, and either before or after the laser-etching of the graphic 123B on the second side 127D of the TPU component 120D. When looking through the component 120C or 120D from the first side 125C, 125D to the second side 127C, 127D, the second color may affect the appearance as the components 120C, 120D are at least partially transparent.

[0052] When the material of the component 120C of FIG. 14 is used for the toe bumper 26, the first side 125C is an outward-facing side, i.e., outward-facing side 29 of FIG. 6, and the second side 127C is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120C is used for the outsole 24, the first side 125C is an outward-facing side, i.e., outward-facing side 25 of FIG. 6, and the second side 127C is an inward-facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 6. In each of these cases, the laser-etched graphic 123B is on the outward-facing side.

[0053] When the material of the component 120D of FIG. 15 is used for the toe bumper 26, the first side 125D is an outward-facing side, i.e., outward-facing side 29

of FIG. 6, and the second side 127D is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120D is used for the outsole 24, the first side 125D is an outward-facing side, i.e., outward-facing side 25 of FIG. 6, and the second side 127D is an inward-facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 6. In each of these cases, the laser-etched graphic 123B is on the inward-facing side 21 or 27. However, because the TPU material is transparent, the laser-etched graphic 123B is visible when looking through the toe bumper 26 or the outsole 24 from the outward-facing side 29 or 25.

[0054] FIG. 16 shows a TPU component 120E that is dyed a single color throughout its thickness T. Additionally, the TPU component 120E has a polymeric film 129 adhered or otherwise secured to a second side 127E thereof. The polymeric film 129 has a graphic 131, such as a graphical design, text or image, thereon. The TPU component is transparent even when dyed. Therefore the graphic 131 of the polymeric film 129 is visible through the TPU component 120E even when viewed from the first side 125E. FIG. 17 shows the film 129 being moved toward the TPU component 120E in the direction of arrows 133. An upper surface 135 of the polymeric film 129 can have adhesive thereon.

[0055] When the material of the component 120E of FIG. 16 is used for the toe bumper 26, the first side 125E is an outward-facing side, i.e., outward-facing side 29 of FIG. 6, and the second side 127E is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120E is used for the outsole 24, the first side 125E is an outward-facing side, i.e., outward-facing side 25 of FIG. 6, and the second side 127E is an inward-facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 6. In each of these cases, the polymeric film 129 with the graphic 131 is on the inward-facing side 21 or 27. However, because the TPU material is transparent, the graphic 131 is visible when looking through the toe bumper 26 or the outsole 24 from the outward-facing side 29 or 25. In FIGS. 16 and 17, the edges of the TPU component 120E on portions facing away from the perspective view are shown with hidden lines for purposes of clarity in the drawings. In FIG. 16, the graphic 131 on the film 129 is shown with hidden lines for purposes of clarity in the drawings. It should be appreciated, however, that because the TPU material is transparent, the

edges and the graphic 131 shown in hidden lines are actually visible from the perspective shown in the drawings.

[0056] FIG. 18 shows a TPU component 120F that is dyed two different colors according to the dyeing process described with respect to FIG. 14. The TPU component 120F is dyed a first color extending to approximately a first portion T1 of the thickness T of the component 120F. The TPU component 120F is dyed a second color extending to approximately a remaining portion T2 of the thickness T. Additionally, the TPU component 120F has the polymeric film 129 described with respect to FIG. 16 adhered or otherwise secured to a second side 127F thereof. The polymeric film 129 has the graphic 131 thereon. The film 129 can be secured such as by adhesives, as described with respect to FIG. 17, after the dyeing process. The TPU component 120F is transparent even when dyed. Therefore the graphic 131 of the polymeric film 129 is visible through the TPU component 120F even when viewed from the first side 125F. FIG. 19 shows the film 129 being moved toward the TPU component 120F in the direction of arrows 133. An upper surface 135 of the polymeric film 129 can have adhesive thereon.

[0057] When the material of the component 120F of FIG. 18 is used for the toe bumper 26, the first side 125F is an outward-facing side, i.e., outward-facing side 29 of FIG. 6, and the second side 127F is an inward-facing side secured to the midsole 14, correlating with inward-facing side 27 of FIG. 6. When the material of component 120F is used for the outsole 24, the first side 125F is an outward-facing side, i.e., outward-facing side 25 of FIG. 3, and the second side 127F is an inward-facing side secured to the midsole 14, correlating with inward-facing side 21 of FIG. 6. In each of these cases, the polymeric film 129 with the graphic 131 is on the inward-facing side 21 or 27. However, because the TPU material is transparent, the graphic 131 is visible when looking through the toe bumper 26 or the outsole 24 from the outward-facing side 29 or 25. In FIGS. 18 and 19, the edges of the TPU component 120F on portions facing away from the perspective view are shown with hidden lines for purposes of clarity in the drawings. In FIG. 18, the graphic 131 on the film 129 is shown with hidden lines for purposes of clarity in the drawings. It should be appreciated, however, that because the TPU material is transparent, the edges and the graphic 131 shown in hidden lines are actually visible from the perspective shown in the drawings.

[0058] FIG. 20 shows double-coated adhesive film 150 that can be used in an embodiment in which the toe bumper 26 or the outsole 24 is rubber. In such an embodiment, the double-coated adhesive film 150 is used to attach the rubber toe bumper 26 to the midsole 14, and is used to attach the rubber outsole 24 to the midsole 14. Specifically, the double-coated adhesive film 150 has a carrier 152. The carrier 152 has a first side 154 and a second side 156. A first adhesive 158 is applied on the first side 154. A second adhesive 160 is applied on the second side 156. The first adhesive 158 is specifically formulated to bond to rubber, such as a rubber toe bumper 26 or a rubber outsole 24. The second adhesive 160 is specifically formulated to bond to thermoplastic polyurethane materials, such as the midsole 14, and may bond during heating by thermal bonding. The double-coated adhesive film 150 is placed between the toe bumper 26 and the midsole 14 so that the first adhesive 158 is in contact with and bonds to the rubber of the toe bumper 26 or outsole 24. The second adhesive 160 is in contact with and bonds to the thermoplastic polyurethane of the midsole 14. Similarly, the double-coated adhesive film 150 is used to bond the outsole 24 to the bottom surface 33 of the midsole 14 by placing the first adhesive 158 in contact with the outsole 24 and the second adhesive 160 in contact with the midsole 14. The double-coated adhesive film 150 can be applied first to the midsole 14 and then to the respective rubber component, toe bumper 26 or outsole 24, or the double-coated adhesive film 150 can be applied first to the respective rubber component, toe bumper 26 or outsole 24, and then to the midsole 14. The double-coated adhesive film 150, including the adhesives 158, 160 and the carrier 152, is transparent. Accordingly, the double-coated adhesive film 150 does not affect the aesthetics of the toe bumper 26 or the outsole 24.

[0059] FIG. 21 is a flow diagram of one method of manufacturing 200 the article of footwear 10 as described herein. Under the method 200, the thermoformed bladder element 14 is provided in step 202. Optionally, providing the bladder element 14 in step 202 of the method 200 may also include preparing the bladder element in sub-steps 204 to 206. Sub-step 204, thermoforming the bladder element 14 by a twin sheet thermoforming process, includes compressing, heating, and vacuuming the sheets 16, 18 in a mold assembly, such as in mold assembly 90. If sub-step 204 is carried out under the method 200, then sub-step 206, trimming the sheets 16, 18 to create the peripheral flange 106 and edge 48 may also follow. Alternatively, the

bladder element 14 can be obtained and provided after it has been prepared by a separate entity, in which case sub-steps 204, 206 would not be carried out in step 202.

[0060] Next, the footwear upper 22 is attached to the outer surface 30 of the upper sheet 16 in the recess 32 in step 208 so that a portion of the upper 22 is visible through the outer wall portion 44. The attachment can be by adhesives, a hot melt of a TPU layer adhered to the upper 22, radio frequency welding, or other suitable manner.

[0061] In step 210, the outsole 24 is secured to the lower surface 72 of the lower sheet 18 by adhesives, hot melt, radio frequency welding, or other suitable manner. In step 212, the toe bumper 26 is secured to the outward-facing surface 78 of the outer wall portion 44 by adhesives, radio frequency welding, or other suitable manner. Steps 208-212 can be performed in any order.

[0062] Accordingly, under the method 200, the article of footwear 10 is manufactured having a sole assembly including a bladder element, and is configured to have an outer wall portion 44 surrounding a periphery 68 of the upper 22, and a substantially flat outsole 24 generally perpendicular to the outer wall portion 44. The article of footwear 10 thus has an overall shape substantially like that of an athletic shoe with a traditional rubber sole formed in an autoclave.

[0063] While the best modes for carrying out the many aspects of the present teachings have been described in detail, those familiar with the art to which these teachings relate will recognize various alternative aspects for practicing the present teachings that are within the scope of the appended claims.

CLAIMS

1. A sole assembly for an article of footwear comprising:

a bladder element having:

a first polymeric sheet having an outer surface defining a recess; wherein the outer surface has a heel region, a midfoot region, and a forefoot region in the recess; wherein the first polymeric sheet has a peripheral outer wall portion extending around the recess; and

a second polymeric sheet attached to the first polymeric sheet at the outer wall portion such that the first and second polymeric sheets define an interior cavity.
2. The sole assembly of claim 1, wherein the first polymeric sheet defines a ridge between the recess and the outer wall portion; and wherein the outer wall portion is substantially perpendicular to a peripheral edge of the second polymeric sheet.
3. The sole assembly of claim 2, wherein the recess, the ridge, and the outer wall portion define an inverted channel at an inner surface of the first polymeric sheet; and wherein the inverted channel is a peripheral portion of the interior cavity.
4. The sole assembly of any of claims 1-3, wherein an inner surface of the first polymeric sheet is bonded to an inner surface of the second polymeric sheet at multiple bonds extending transversely and only partway across the interior cavity between a medial side of the outer wall portion and a lateral side of the outer wall portion.
5. The sole assembly of any of claims 1-4, wherein the first and second polymeric sheets are at least partially thermoplastic polyurethane (TPU).

6. The sole assembly of claim 5, wherein each of the first and second polymeric sheets is a multi-layer sheet having at least a first layer including polyurethane and at least a second layer including a copolymer of ethylene and vinyl alcohol.

7. The sole assembly of any of claims 1-6 in combination with a footwear upper secured to the first polymeric sheet in the recess so that the outer wall portion surrounds a periphery of the footwear upper.

8. The sole assembly and footwear upper of claim 7, wherein the first and second polymeric sheets are at least partially transparent so that a portion of the footwear upper in the recess is visible through the outer wall portion.

9. The sole assembly of any of claims 1-8, further comprising:

an outsole secured to an outer surface of the second polymeric sheet; wherein the outsole is substantially perpendicular to the outer wall portion.

10. The sole assembly of claim 9, wherein the outsole is an at least partially transparent thermoplastic polyurethane material.

11. The sole assembly of claim 10, wherein the outsole is at least partially dyed.

12. The sole assembly of any of claims 9-11, wherein the outsole has an outer surface with an etched pattern.

13. The sole assembly of any of claims 9-11, further comprising:

a polymeric film with a graphic appearing thereon; wherein the polymeric film is attached to the outsole.

14. The sole assembly of claim 9, wherein the outsole is rubber.

15. The sole assembly of any of claims 1-14, further comprising:

a toe bumper secured to an outer surface of the outer wall portion adjacent the forefoot region.
16. The sole assembly of claim 15, wherein the toe bumper is an at least partially transparent thermoplastic material.
17. The sole assembly of claim 16, wherein the toe bumper is at least partially dyed.
18. The sole assembly of any of claims 16-17, wherein the toe bumper has an outer surface with an etched pattern.
19. The sole assembly of any of claims 16-17, further comprising:

a polymeric film with a graphic appearing thereon; wherein the polymeric film is attached to the toe bumper.
20. The sole assembly of claim 15, wherein the toe bumper is rubber.
21. The sole assembly of any of claims 1-13 and 15-19, wherein the sole assembly is configured without foam or rubber.
22. A sole assembly comprising:

a midsole formed from a bladder element having a heel region, a midfoot region, and a forefoot region;

wherein the bladder element has a first polymeric sheet forming a recess and a peripheral outer wall portion extending around the recess;

wherein the bladder element has a second polymeric sheet extending underneath the first polymeric sheet and below the recess; and wherein the second polymeric sheet is bonded to the first polymeric sheet to thereby define a fluid-tight cavity between the first polymeric sheet and the second polymeric sheet;

wherein the first polymeric sheet defines a ridge between the recess and the outer wall portion; and wherein the outer wall portion is substantially perpendicular to a peripheral edge of the second polymeric sheet; and

wherein an inner surface of the first polymeric sheet is bonded to an inner surface of the second polymeric sheet at multiple bonds extending transversely and only partway across the interior cavity between a medial side of the outer wall portion and a lateral side of the outer wall portion.

23. The sole assembly of claim 22, wherein the recess, the ridge, and the outer wall portion define an inverted channel at an inner surface of the first polymeric sheet; and wherein the inverted channel is a peripheral portion of the interior cavity.

24. The sole assembly of any of claims 22-23, wherein the first and second polymeric sheets are at least partially thermoplastic polyurethane (TPU).

25. The sole assembly of claim 24, wherein each of the first and second polymeric sheets is a multi-layer sheet having at least a first layer including polyurethane and at least a second layer including a copolymer of ethylene and vinyl alcohol.

26. The sole assembly of any of claims 22-25 in combination with a footwear upper having a lower surface secured to the first polymeric sheet in the recess so that the outer wall portion surrounds a periphery of the footwear upper.

27. The sole assembly and footwear upper of claim 26, wherein the first and second polymeric sheets are at least partially transparent so that a portion of the footwear upper in the recess is visible through the outer wall portion.

28. The sole assembly of any of claims 22-27, further comprising:

an outsole secured to an outer surface of the second polymeric sheet; wherein the outsole is substantially perpendicular to the outer wall portion; wherein the outsole is an at least partially transparent thermoplastic polyurethane material.

29. The sole assembly of any of claims 22-27, further comprising:

an outsole secured to an outer surface of the second polymeric sheet; wherein the outsole is substantially perpendicular to the outer wall portion; wherein the outsole is rubber.

30. The sole assembly of any of claims 22-29, further comprising:

a toe bumper secured to an outer surface of the outer wall portion adjacent the forefoot region; wherein the toe bumper is an at least partially transparent thermoplastic material.

31. The sole assembly of any of claims 22-29, further comprising:

a toe bumper secured to an outer surface of the outer wall portion adjacent the forefoot region; wherein the toe bumper is rubber.

32. The sole assembly of any of claims 22-28 and 30, wherein the sole assembly is configured without foam or rubber.

33. A method of manufacturing an article of footwear comprising:

providing a bladder element formed from a first polymeric sheet and a second polymeric sheet;

wherein the first polymeric sheet has an outer surface defining a recess; wherein the outer surface has a heel region, a midfoot region, and a forefoot

region in the recess; wherein the first polymeric sheet has a peripheral outer wall portion extending around the recess; and

wherein the second polymeric sheet is attached to the first polymeric sheet at the outer wall portion such that the first and second polymeric sheets define an interior cavity.

34. The method of claim 33, further comprising:

thermoforming the first and second polymeric sheets in a mold assembly to thereby form the bladder element.

35. The method of claim 34, wherein said thermoforming includes compressing peripheries of the first polymeric sheet and the second polymeric sheet together during said thermoforming to attach the first polymeric sheet to the second polymeric sheet.

36. The method of claim 35, further comprising:

trimming the attached first polymeric sheet and second polymeric sheet at a peripheral flange.

37. The method of any of claims 34-36, wherein said thermoforming includes vacuuming the first polymeric sheet to conform to the mold assembly.

38. The method of any of claims 33-37, further comprising:

attaching a footwear upper to the outer surface of the first polymeric sheet at the recess so that the footwear upper is visible through the outer wall portion.

39. The method of any of claims 33-38, further comprising:

securing an outsole to an outer surface of the second polymeric sheet.

40. The method of claim 39, wherein said securing is so that the outsole is substantially perpendicular to the outer wall portion.

41. The method of any of claims 33-40, further comprising:

securing a toe bumper to an outer surface of the outer wall portion.

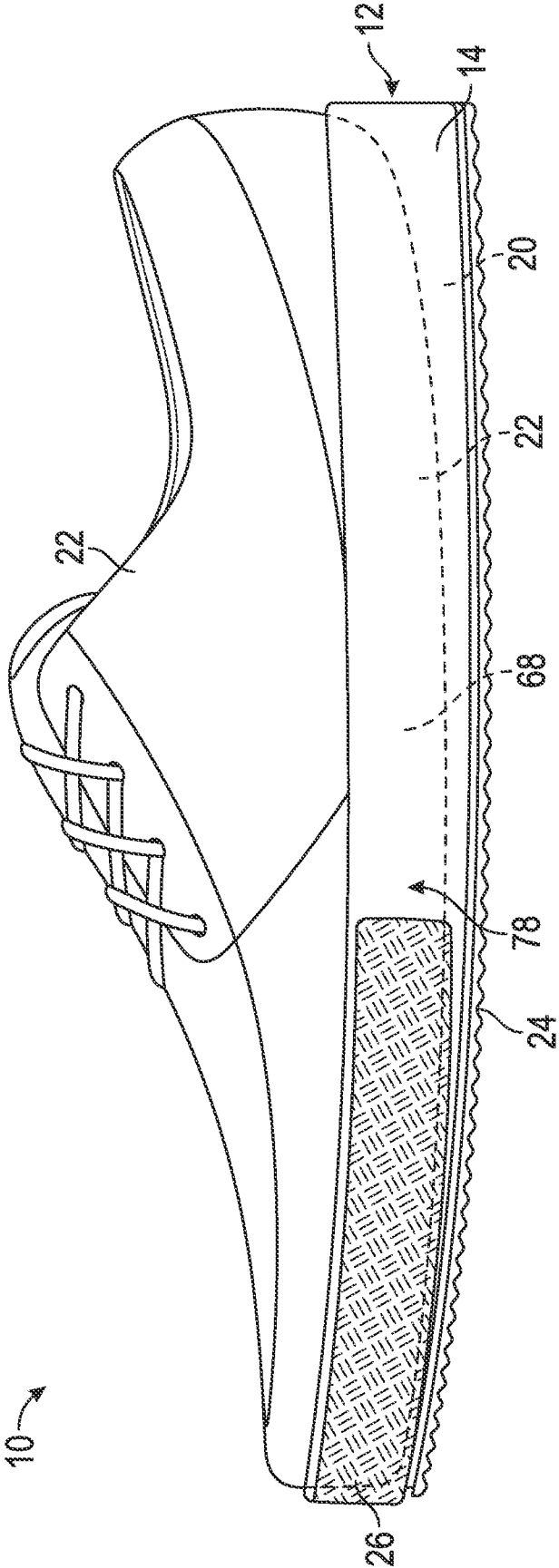


FIG. 1

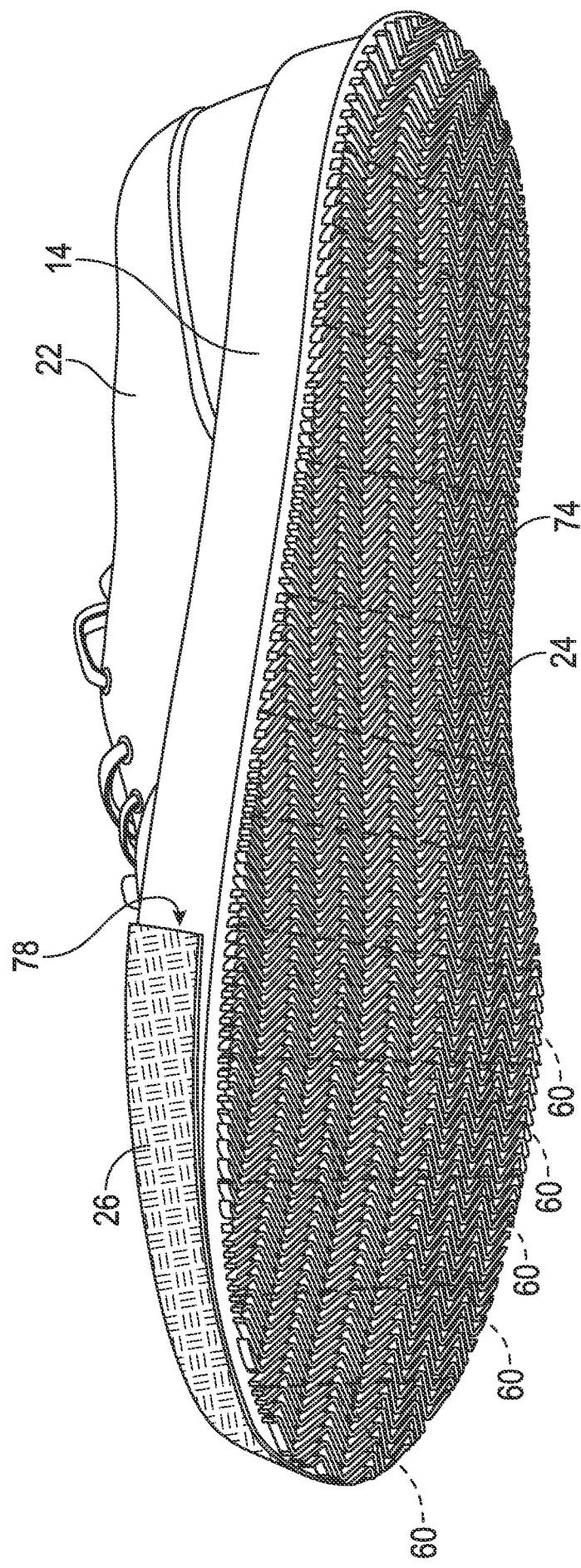
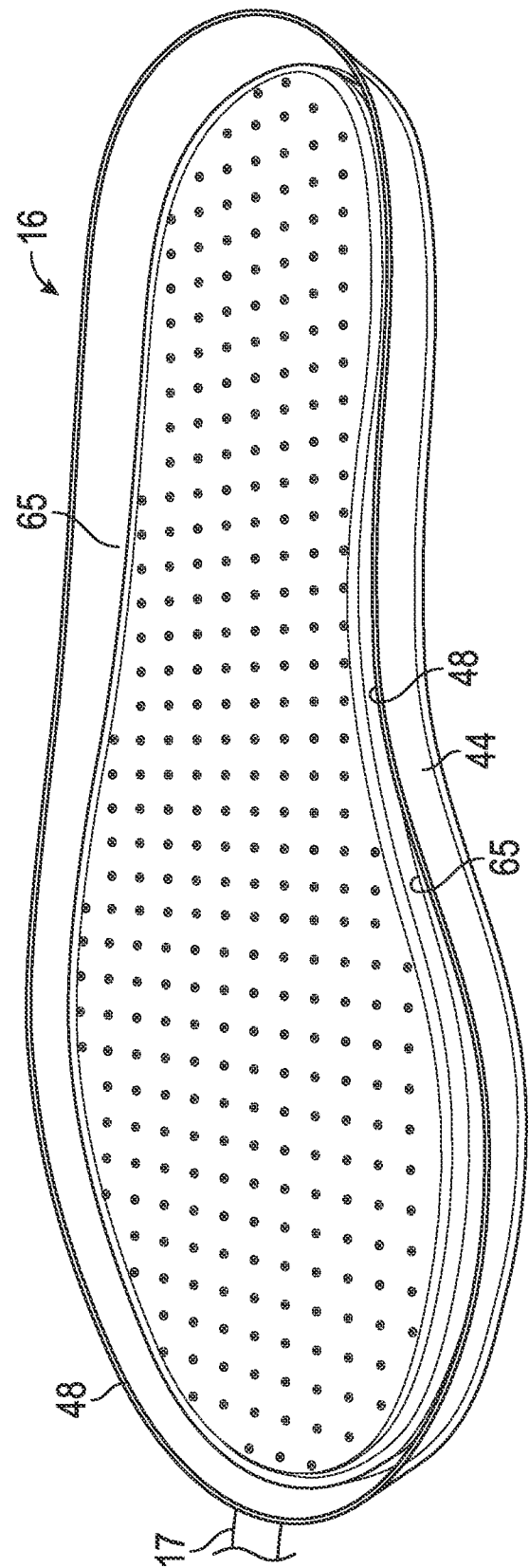
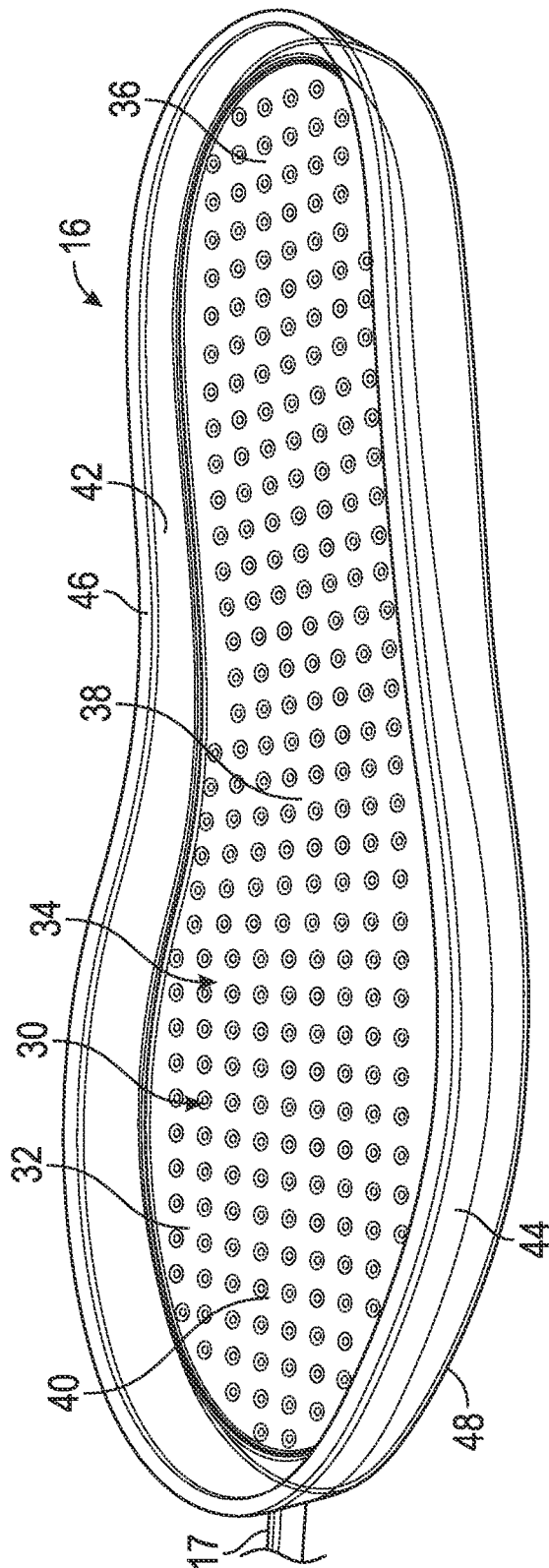


FIG. 2



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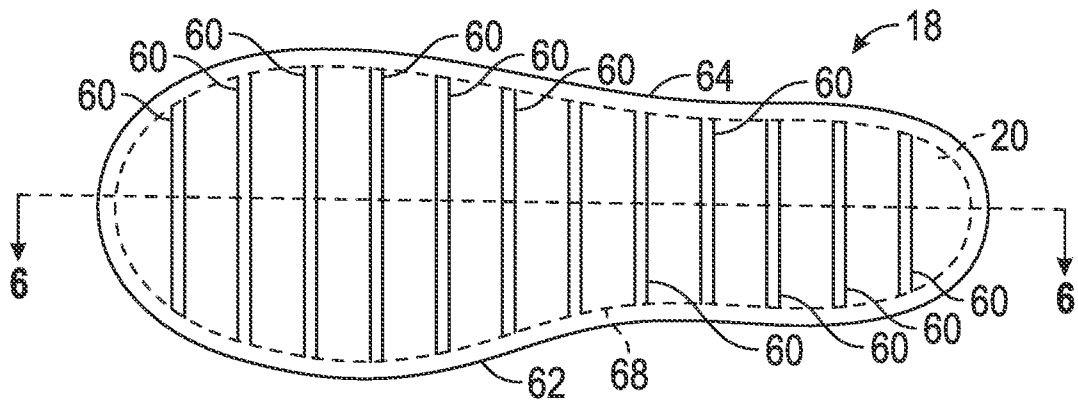


FIG. 5

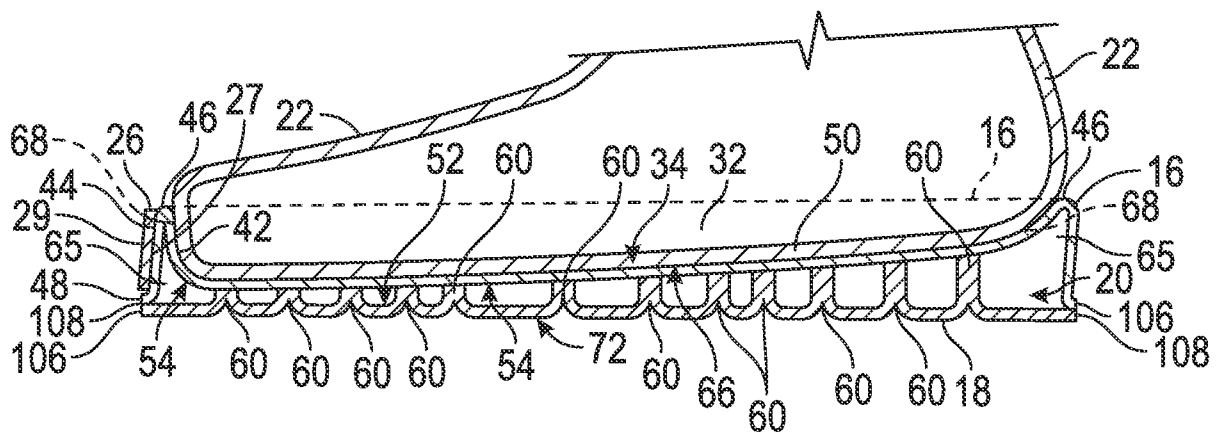


FIG. 6

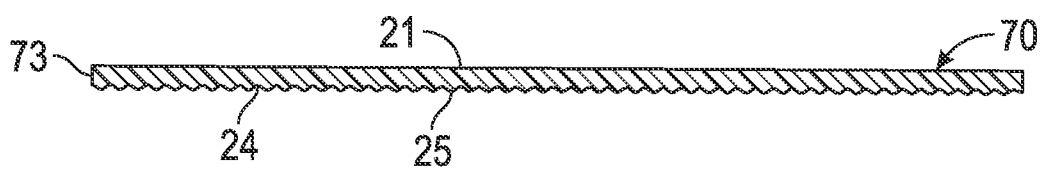


FIG. 7

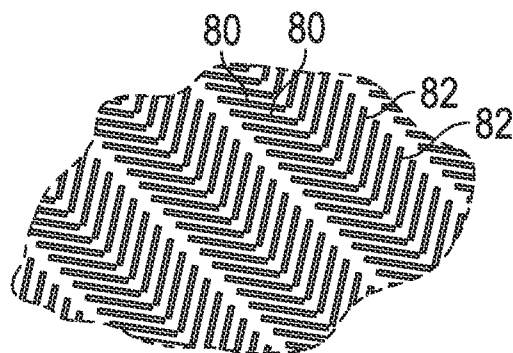


FIG. 8

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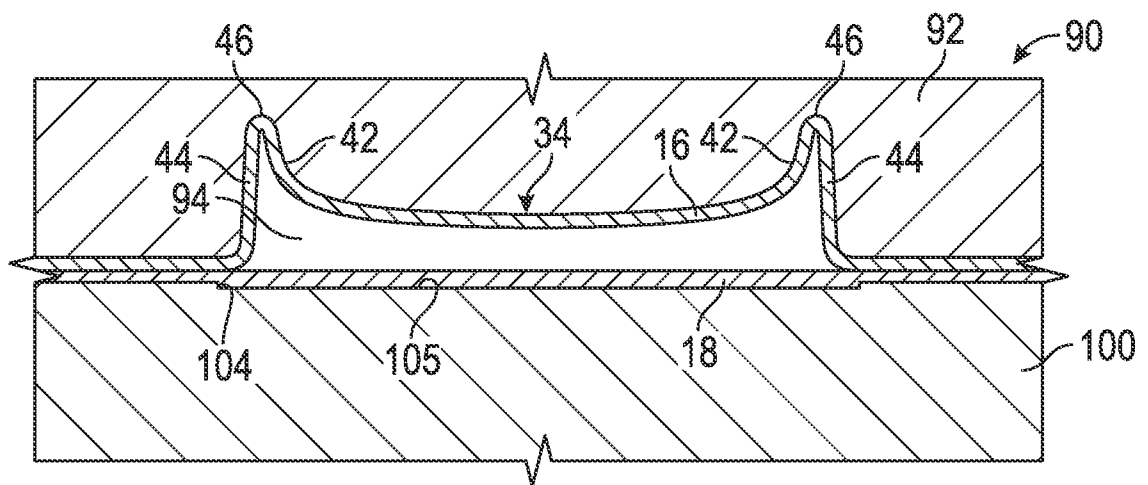


FIG. 9

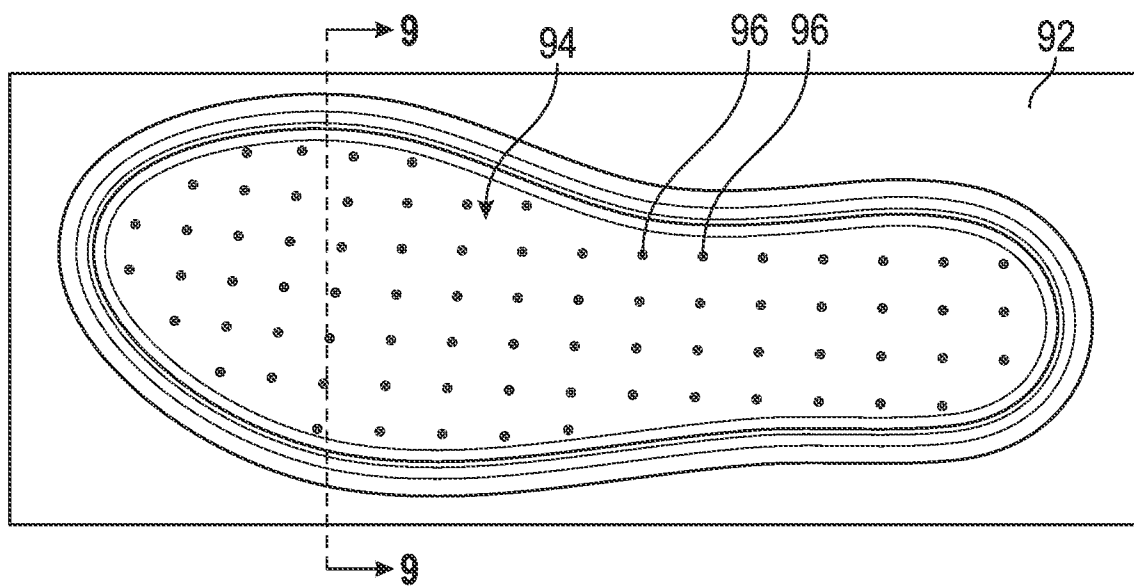


FIG. 10

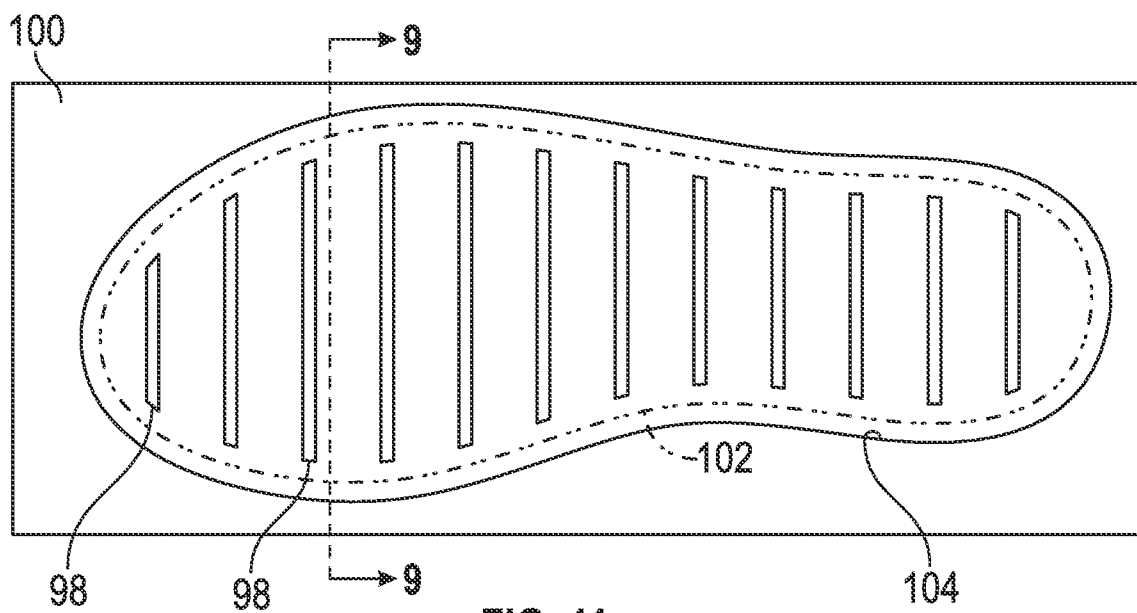


FIG. 11

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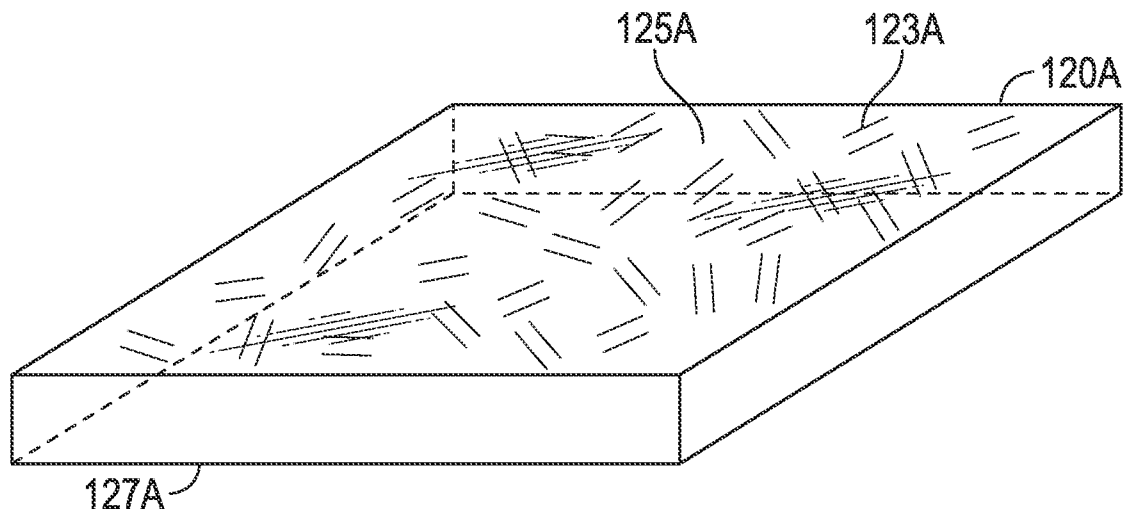


FIG. 12

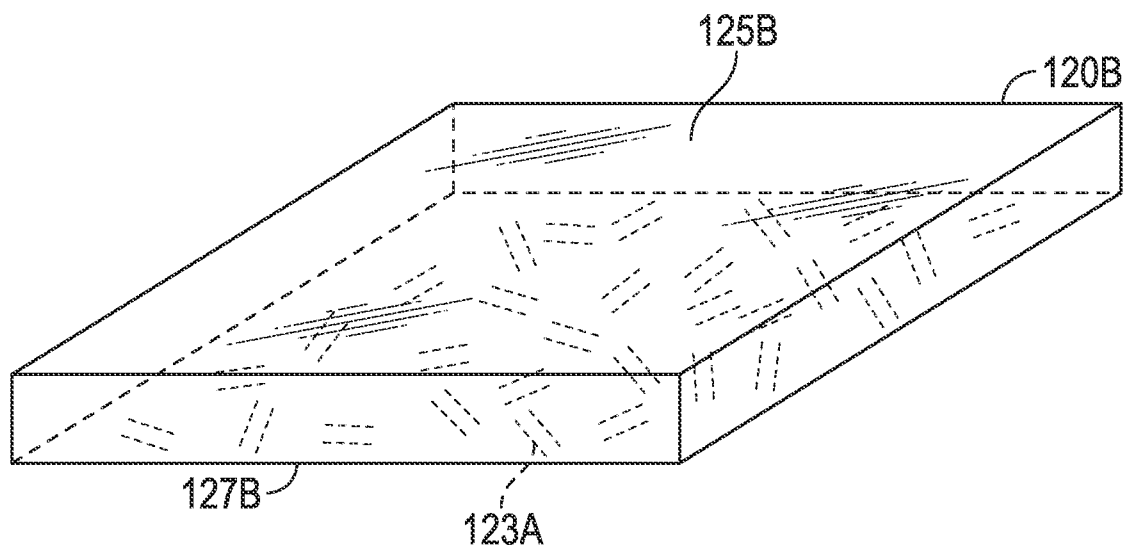


FIG. 13

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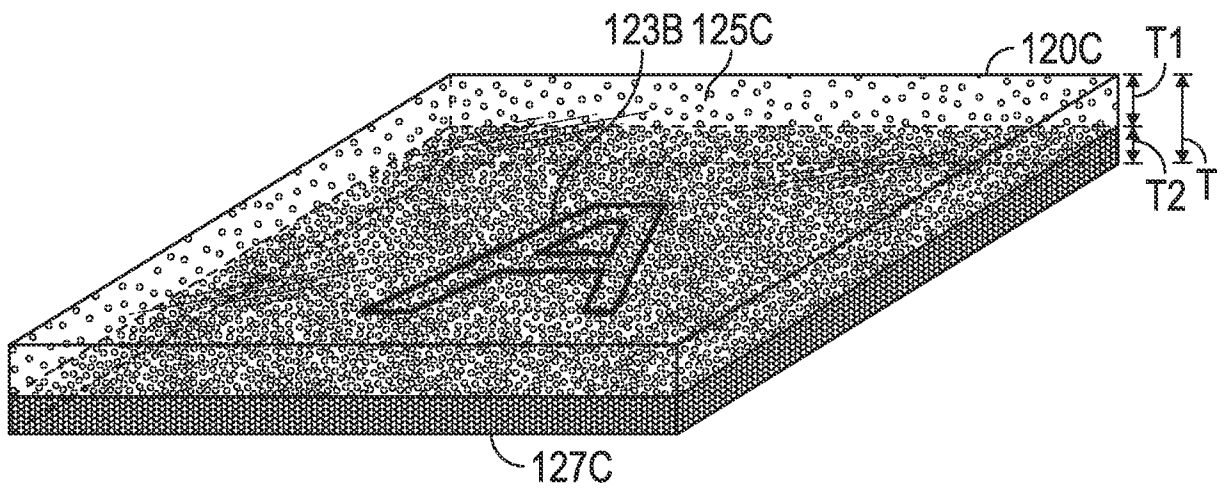


FIG. 14

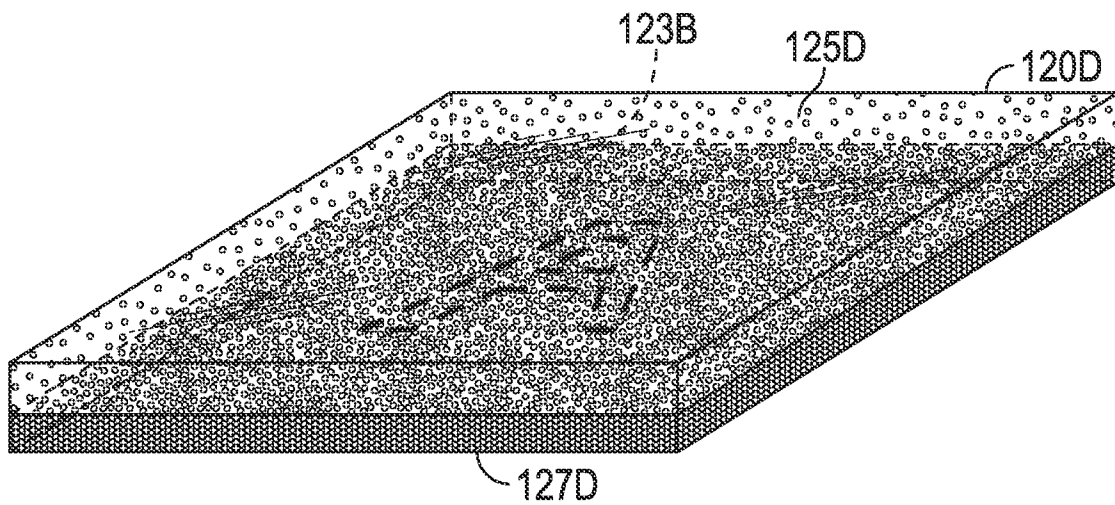


FIG. 15

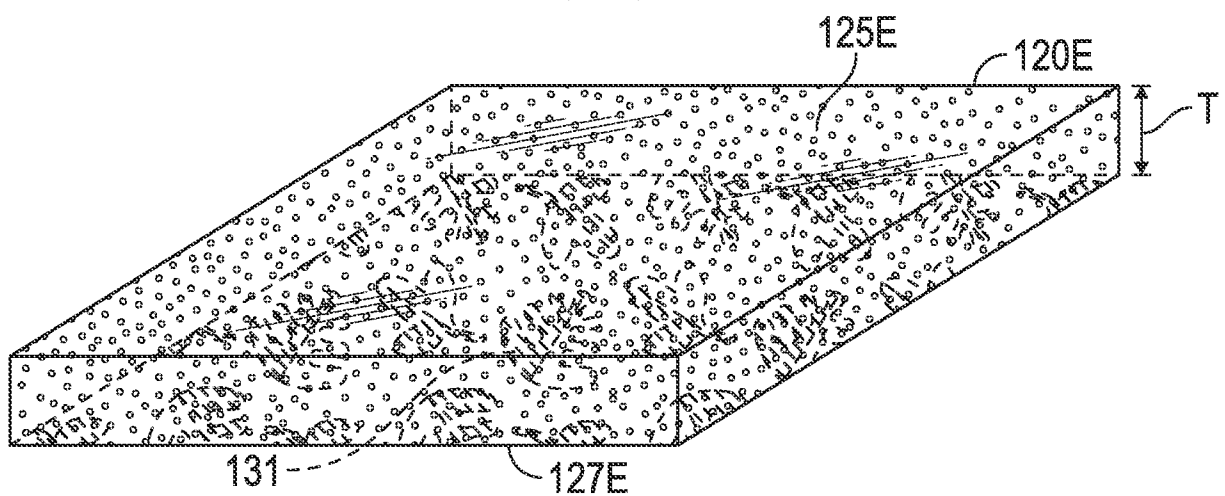


FIG. 16

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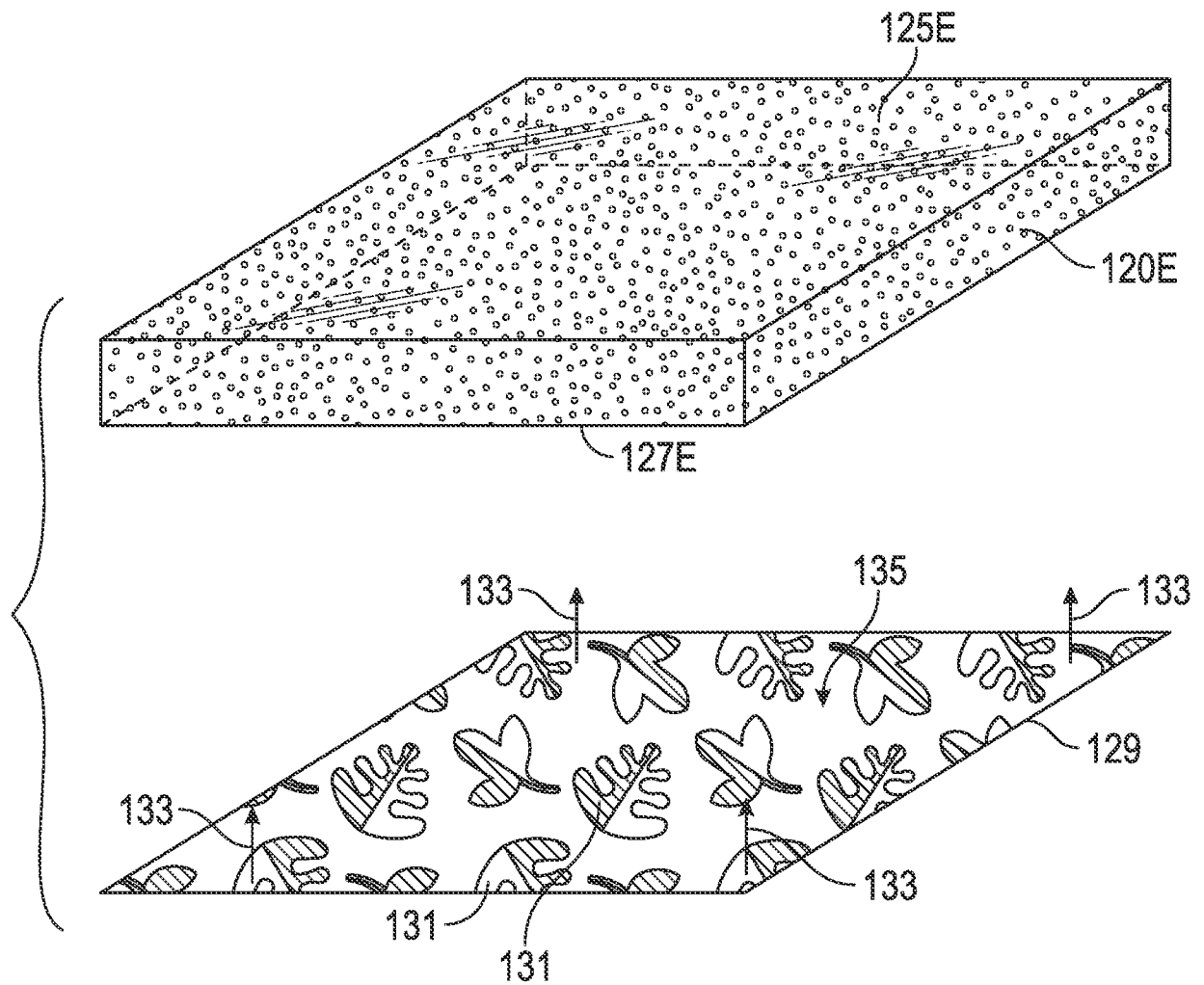


FIG. 17

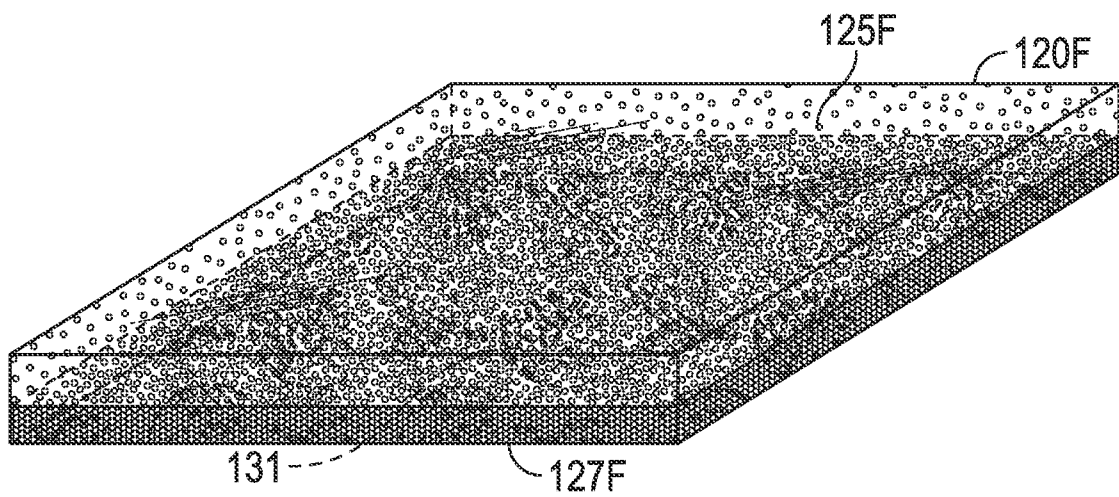


FIG. 18

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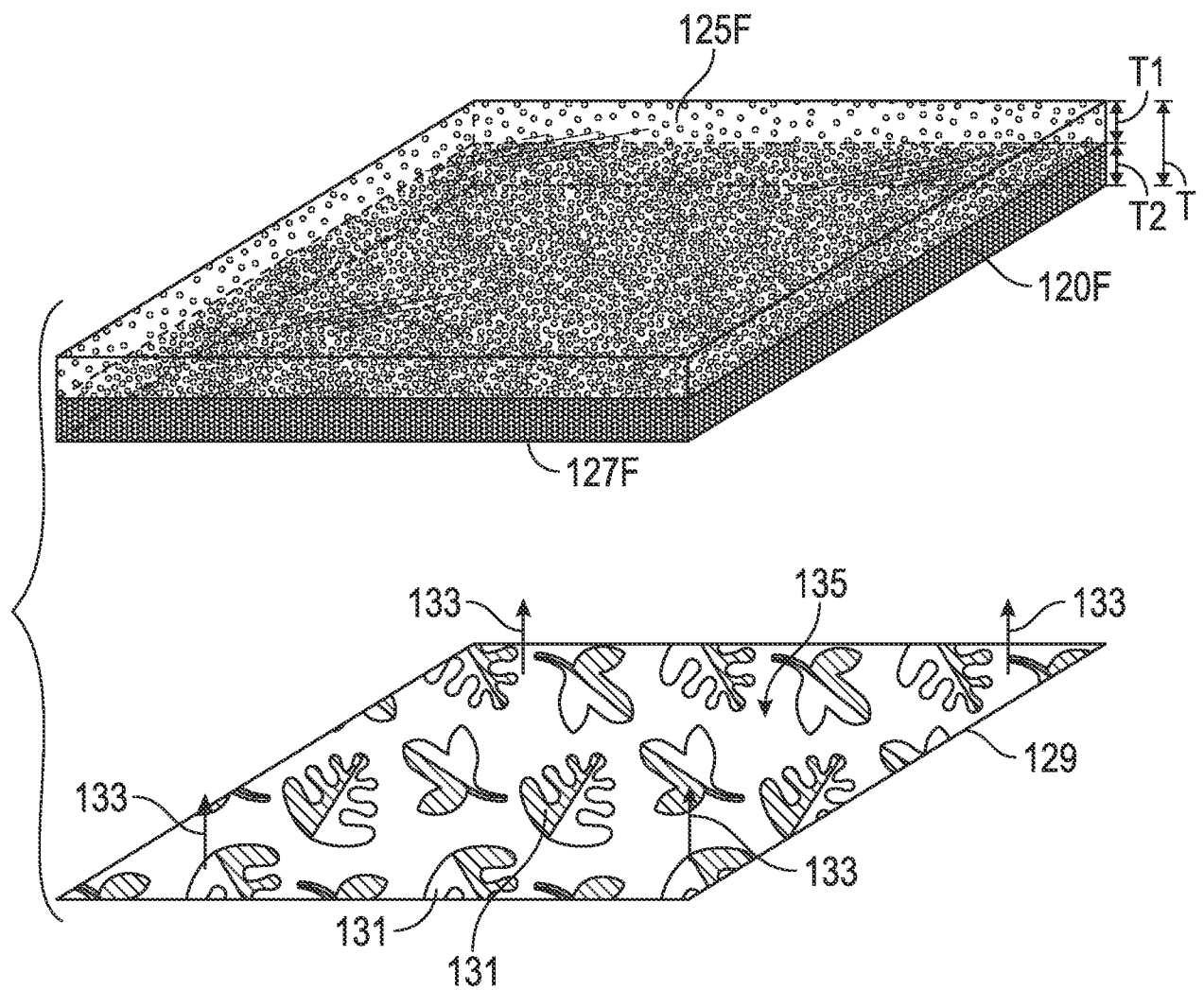


FIG. 19

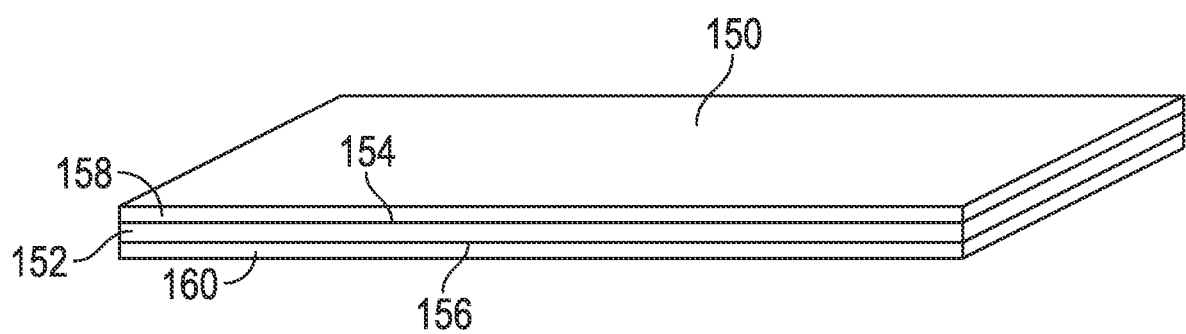


FIG. 20

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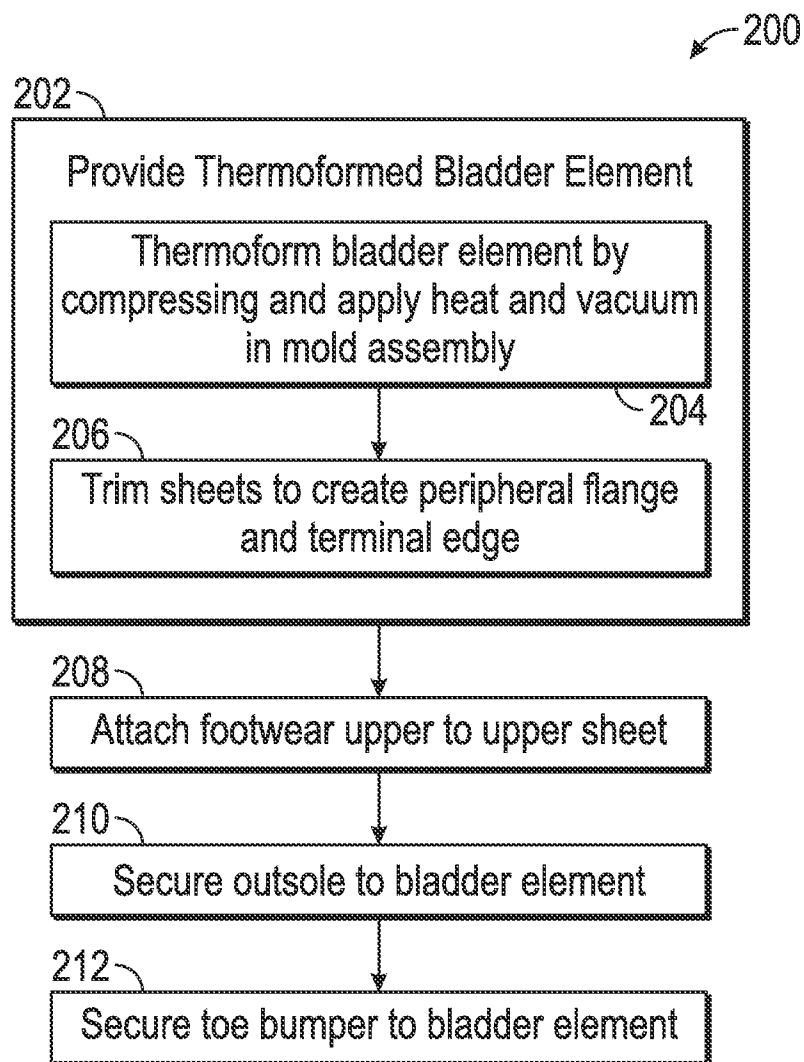


FIG. 21

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2015/016547

A. CLASSIFICATION OF SUBJECT MATTER
INV. A43B13/20 A43B3/00 A43B1/00 B29D35/14
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A43B B29D

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/283640 A1 (ELDER ZACHARY [US] ET AL) 31 October 2013 (2013-10-31) paragraphs [0031], [0034]; claims; figures 7a, 7b, 8 -----	1,3-5, 9-41
X	EP 0 472 110 A2 (CASIO COMPUTER CO LTD [JP]) 26 February 1992 (1992-02-26) column 3, lines 34-59; claims; figures 2,3 -----	1-3
X	US 2005/132610 A1 (FOXEN THOMAS [US] ET AL) 23 June 2005 (2005-06-23) paragraphs [0085], [0120] -----	1,2,5-8
A	US 2011/197470 A1 (CARON PAUL E [US] ET AL) 18 August 2011 (2011-08-18) paragraphs [0041], [0044], [0047] -----	13



Further documents are listed in the continuation of Box C.



See patent family annex.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

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

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

8 May 2015

Date of mailing of the international search report

18/05/2015

Name and mailing address of the ISA/

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Fax: (+31-70) 340-3016

Authorized officer

Claudel, Benoît

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/016547

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