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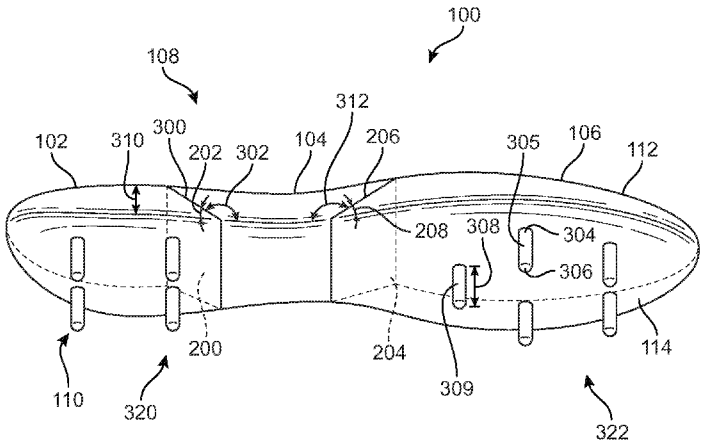


FIG. 3

(57) Abstract: A pressing fixture includes discrete pieces that may be used in the manufacture of an article of footwear. The pressing fixture may include alignment features which align a partially completed article with a sole. The pressing fixture may be pressed into the sole thereby aligning the partially completed article with the sole.

PRESSING FIXTURE FOR USE IN MAKING ARTICLES OF FOOTWEAR

BACKGROUND

[0001] The present embodiments relate generally to footwear and a method for making footwear. Articles of footwear generally include two primary elements: an upper and a sole structure. The upper is often formed from a plurality of material elements (e.g., textiles, polymer sheet layers, foam layers, leather, synthetic leather) that are stitched or adhesively bonded together to form a void in the interior of the footwear for comfortable and securely receiving a foot. More particularly, the upper forms a structure that extends over instep and toe areas of the foot, along medial and lateral sides of the foot, and around a heel area of the foot. The upper may also include a strobel to which a plurality of elements may be attached.

[0002] The sole structure is secured to a lower portion of the upper so as to be positioned between the foot and the ground. The strobel further may be secured to the sole structure. In athletic footwear, for example, the sole structure may include a midsole and an outsole. The outsole forms a ground-contacting element of the footwear and is usually fashioned from a durable and wear-resistant rubber material that includes texturing to impart traction.

SUMMARY

[0003] In one aspect, the invention provides a pressing fixture for the manufacture of an article of footwear includes a first section, a second section, and a third section, each section is distinct and separable from the other. The first section has a first surface, the second section has a second surface and a third surface, and the third section has a fourth surface. The first surface of the first section is configured to engage the second surface of the second section and the third surface of the second section is configured to engage the fourth surface of the third section. The first surface forms a first angle with a lower surface of the first section, the second surface forms a second angle with a lower surface of the second section, the third surface forms a third angle with the lower surface of the second section and the fourth surface forms a fourth angle with a lower surface of the third section. The first angle and the second angle are substantially supplementary angles, and the first angle is different from ninety degrees and the second angle is different from ninety degrees. The third angle and the fourth angle are substantially supplementary angles. The third angle is different from ninety degrees and the fourth angle is different from ninety degrees. The first section has a first alignment feature and the third section has a second alignment feature. Additionally, the second section is wedged shaped.

[0004] In another aspect, a pressing fixture for the manufacture of an article of footwear includes a first section, a second section, and a third section, each section is distinct and separable from the other. The first section has a thickness extending between an upper surface of the first section and a lower surface of the first section. The thickness is a maximum thickness of the first section. The first section corresponds to a forefoot portion of the foot, the second section corresponds to a midfoot portion of the foot, and a third section corresponds to a heel portion of a foot. The first section has an alignment feature that extends away from the lower surface of the first section and the alignment

feature has a length. The length of the alignment feature is greater than twenty-five percent of the thickness of the first section.

[0005] In another aspect, a method of manufacturing an article of footwear includes placing a first section into an assembly comprised of an upper and a strobel, the first section having a plurality of alignment features. The method further includes placing a third section into the assembly, the third section having a plurality of alignment features. Further the method includes placing a second section into the assembly and applying a force to the second section such that the first section and the third section translate longitudinally and such that the plurality of alignment features of the first section and the plurality of alignment features of the second section extend through a plurality of alignment apertures in the strobel. The method further includes inserting the plurality of alignment features of the first section and the plurality of alignment features of the second section into a plurality of acceptors in a sole structure.

[0006] Other systems, methods, features and advantages of the embodiments will be, or will become, apparent to one of ordinary skill in the art upon examination of the following figures and detailed description. It is intended that all such additional systems, methods, features and advantages be included within this description and this summary, be within the scope of the embodiments, and be protected by the following claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The invention can be better understood with reference to the following drawings and description. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views.

[0008] FIG. 1 is a top isometric view of an embodiment of a pressing fixture;

[0009] FIG. 2 is an exploded isometric view of an embodiment of a pressing fixture;

[0010] FIG. 3 is a bottom isometric view of an embodiment of a pressing fixture;

[0011] FIG. 4 is an isometric view of an embodiment of a partially formed upper and a strobel;

[0012] FIG. 5 is an isometric view of an embodiment of a partially formed upper and a strobel assembled together;

[0013] FIG. 6 is a view of portion of an embodiment of a pressing fixture being placed into a partially completed article;

[0014] FIG. 7 is a view of another portion of an embodiment of a pressing fixture being placed into the partially completed article;

[0015] FIG. 8 is a view of another portion of an embodiment of a pressing fixture being placed into the partially completed article;

[0016] FIG. 9 is a side view of portions of an embodiment of a pressing fixture within the partially completed article;

[0017] FIG. 10 is a side view of an embodiment of a pressing fixture within the partially completed article;

[0018] FIG. 11 is an isometric view of an embodiment of a partially completed article being placed on a sole structure;

[0019] FIG. 12 is a side view of an embodiment of a partially completed article and sole with the pressing fixture placed within the partially completed article;

[0020] FIG. 13 is a view of a force exerted on an embodiment of a pressing fixture;

[0021] FIG. 14 view of an embodiment of a pressing fixture removed from an article of footwear;

[0022] FIG. 15 is an isometric view of an embodiment of an article of footwear;

[0023] FIG. 16 is a bottom view of an embodiment of a pressing fixture;

[0024] FIG. 17 is an isometric exploded view of an alternate embodiment of a pressing fixture;

[0025] FIG. 18 is an isometric view of the alternate embodiment of the pressing fixture in an unextended state; and

[0026] FIG. 19 is an isometric view of the alternate embodiment of the pressing fixture in an extended state.

DETAILED DESCRIPTION

[0027] For consistency and convenience, directional adjectives are employed throughout this detailed description corresponding to the illustrated embodiments. The term "longitudinal direction" as used throughout this detailed description and in the claims refers to a direction extending from heel to toe, which may be associated with the length, or longest dimension, of an article of footwear, components of an article of footwear, or components used in manufacturing of an article of footwear. Also, the term "lateral direction" as used throughout this detailed description and in the claims refers to a direction extending from side to side (e.g., lateral side and medial side) or the width of an article of footwear, components of an article of footwear, or components used in manufacturing of an article of footwear. The lateral direction may generally be perpendicular to the longitudinal direction. The term "vertical direction" as used with respect to an article of footwear throughout this detailed description and in the claims refers to the direction that is normal to the plane of the sole of the article of footwear. Moreover, the vertical direction may generally be perpendicular to both the longitudinal direction and the lateral direction.

[0028] The term "sole" as used herein shall refer to any combination that provides support for a wearer's foot and bears the surface that is in direct contact with the ground or playing surface, such as a single sole; a combination of an outsole and an inner sole; a combination of an outsole, a midsole and an inner sole; and a combination of an outer covering, an outsole, a midsole and an inner sole.

[0029] In FIGS. 1-3 various views of a pressing fixture are shown. Referring to FIG. 1, an isometric view of a pressing fixture 100, also simply referred to as fixture 100 is shown. Fixture 100 includes an upper surface 112 and a lower surface 114. In some embodiments, lower surface 114 may be curved or shaped in a similar manner as a foot. Fixture 100 may include multiple discrete

members or sections. In some embodiments fixture 100 may include three members. As shown, fixture 100 includes heel member 102, midfoot member 104, and forefoot member 106. Heel member 102, midfoot member 104 and forefoot member 106 may collectively be referred to as members 108. In other embodiments, however, fixture 100 may include a first member, a second member, and a third member. In such embodiments, the members of fixture 100 need not correspond to distinct regions of a foot.

[0030] In some embodiments, fixture 100 may include multiple members. In some embodiments, fixture 100 may include two members. In other embodiments, fixture 100 may include three members or four members. In still further embodiments, fixture 100 may include a greater number of members.

[0031] In some embodiments, members 108 may generally correspond to portions of a foot in relative shape and location. In other embodiments, members 108 may be differently shaped. For example, members 108 may be oval or rectangular shaped.

[0032] Additionally, in some embodiments, lower surface 114 may be shaped in a similar manner as to the bottom of a foot or last. That is, lower surface 114 may follow or correspond to the contours or a foot or last.

[0033] Fixture 100 may be composed of a relatively stiff or hard material. In some embodiments, fixture 100 may be composed of a metal. In other embodiments, fixture 100 may be composed of a plastic. In still further embodiments, fixture 100 may composed of organic material, such as wood. In other embodiments, fixture 100 may be composed of carbon fiber or the like.

[0034] In some embodiments, fixture 100 may largely correspond to the shape of the bottom of a foot. In other embodiments, fixture 100 may deviate from the outline of a foot. For example, in some embodiments, fixture 100 may have a more rectangular shape than shown. In other embodiments, fixture 100 may correspond to the shape of an article of footwear. In still further embodiments, fixture 100 may correspond to the shape of parts of an article of footwear, for example, a strobel. In some embodiments, the outline or perimeter portion of

fixture 100 may be slightly smaller than the perimeter of a strobel. That is, when fixture 100 is placed adjacent a strobel, a portion of the strobel may extend out outwardly from the perimeter of fixture 100.

[0035] In some embodiments, fixture 100 may have a uniform thickness, depth, or a distance in the vertical direction. In other embodiments, members 108 of fixture 100 may have varying thickness. For example, midfoot member 104 may have a thickness that is greater than heel member 102 or forefoot member 106. In other embodiments, the thickness of members 108 may vary throughout each member. That is, for example, midfoot member 104 may be thicker in a location closer to forefoot member 106 than in a location closer to heel member 102.

[0036] In some embodiments, the thickness of members 108 may be varied for certain purposes. In some embodiments, midfoot member 104 may be thicker than forefoot member 106 and/or heel member 102 such that a portion of midfoot member 104 extends above these other members. The difference in thickness may allow for midfoot member 104 to be pressed or placed to different degrees, thereby spacing heel member 102 and forefoot member 106 closer or further away from one another. In other embodiments, heel member 102 and forefoot member 106 may be thinner or thicker than other members for ease of assembly of fixture 100 as well as space constraints in assembling an article of footwear.

[0037] In some embodiments, members 108 may include alignment features. In some embodiments, alignment features may include magnets. In other embodiments, alignment features may include projections. As shown, fixture 100 includes projections 110. The layout of projections 110 may be seen clearly in FIG. 3.

[0038] In some embodiments, fixture 100 may include one projection as an alignment feature. In other embodiments, fixture 100 may include more than one projection. As shown, fixture 100 includes nine projections arranged in a particular layout or pattern. In other embodiments, there may be more or fewer

projections than shown in order to align the fixture with a strobel or a sole. For example, in some embodiments, a single projection may extend from heel member 102 and a single projection may also extend from forefoot member 106. In embodiments utilizing a single projection on each member, a single projection may be shaped in order to restrict rotation of members 108. For example, the single projection may be rectangular as opposed to circular. Further, in some embodiments, the layout or pattern of projections 110 may vary.

[0039] As best seen in FIG. 3, in some embodiments, alignment features may be organized into sets or groups. In some embodiments, the alignment feature groups may correspond to members of fixture 100. For example, projections 110 may comprise alignment group 320 and alignment group 322. Alignment group 320 may correspond to projections located on heel member 102 and alignment group 322 may correspond to projections located on forefoot member 106. Additionally, other groups of alignment features may be located throughout fixture 100.

[0040] Referring to FIG. 3, a bottom oblique view of fixture 100 is shown. In some embodiments, projections 110 extend from lower surface 114. In some embodiments, projections 110 extend from heel member 102 and forefoot member 106. In other embodiments, midfoot member 104 may also include projections 110. In still further embodiments, projections 110 may be located on one or more of each of members 108.

[0041] In some embodiments, fixture 100 may include magnetic alignment features. In some embodiments, the magnetic alignment features may not extend from fixture 100. That is, lower surface 114 may not have projections. For example, in some embodiments, magnetic alignment features may be imbedded within fixture 100. In other embodiments, lower surface 114 may have magnetic projections that extend from fixture 100.

[0042] In some embodiments, the layout of magnetic alignment features may be similar to the layout of projections 110. In other embodiments, the number of magnetic alignment features and layout may be different. For example, in some

embodiments, a single magnetic alignment feature may be located in heel member 102 and forefoot member 106.

[0043] In some embodiments, projections 110 may be arranged in a variety of configurations. As shown, alignment group 320 of projections 110 are arranged on heel member 102 in a square-shaped configuration. Further, alignment group 322 of projections 110 located on forefoot member 106 are oriented in a pentagonal configuration. The orientation and placement of projections 110 may be altered or changed to allow for alignment of pressing fixture 100 with a sole or a strobel.

[0044] In some embodiments, projections 110 may be independently attached to fixture 100. In some embodiments, projections 110 may be secured with an adhesive. In other embodiments, projections 110 may be secured with a tack, nail, screw, or other fastener. In still further embodiments, projections 110 may include a screw-shaped edge that may be inserted into an accepting portion in fixture 100. In still further embodiments, projections 110 may be of unitary construction with fixture 100.

[0045] In some embodiments, projections 110 may be composed of the same material as fixture 100. In other embodiments, projections 110 may be composed of a different material than fixture 100. In some embodiments, projections 110 may be harder than fixture 100. In other embodiments, fixture 100 may be harder than projections 110.

[0046] In some embodiments, projections 110 may be cylindrical in shape. In other embodiments, projections 110 may be different shapes, including pyramidal, regular, and irregular shapes. For purposes of describing an exemplary shape for some projections, FIG. 3 illustrates an exemplary projection 305, which includes a base portion 304 and a head portion 306. In some embodiments, base portion 304 may be a different shape or size that head portion 306. In other embodiments, base portion 304 and head portion 306 may be the same shape and size. In some embodiments, the shape of projections 110 may be a unique shape such that when projections 110 are inserted into an accepting

portion of a similar shape to projections 110, projections 110 may be limited from rotating or spinning. For example, a circular-shaped head portion 306 may rotate when head portion 306 is inserted into a similarly shaped opening. A triangular shaped head portion, however, may be restricted from rotating within a similarly shaped opening, because the edges of the head portion may contact edges of the opening. It will be understood that the descriptions of the exemplary projection 305 may also apply to some or all of the remaining projections of projections 110 in some embodiments.

[0047] In some embodiments, the length 308 of projections 110 may relate to the thickness 310 of fixture 100. For purposes of characterizing the length of one or more of projections 110, the length of an exemplary projection 309 is discussed and shown in FIG. 3. The length of a projection, in this case, refers to a distance in the vertical direction. In this case, the length is defined as the distance from base portion 304 to head portion 306 of a projection. Additionally, thickness of fixture 100 relates to a distance in the vertical direction. In this case, thickness of fixture 100 relates to the distance between upper surface 112 and lower surface 114 of fixture 100. In some embodiments, the distance between upper surface 112 and lower surface 114 may be different depending on the location within fixture 100. In some embodiments, the variation of thickness may be minimal. In such embodiments, the thickness of fixture 100 may relate to the average thickness of fixture 100. In some embodiments, a small portion of fixture 100 may have a much greater thickness than a larger portion of fixture 100. In such embodiments, the thickness of the larger portion may be considered the thickness of fixture 100.

[0048] In some embodiments, length 308 of projection 309 may be greater than thickness 310 of fixture 100. In other embodiments, length 308 of projection 309 may be less than thickness 310 of fixture 100. In some embodiments, length 308 of projection 309 may be approximately one-third of thickness 310 of fixture 100. In still further embodiments, length 308 of projection 309 may be substantially similar to thickness 310 of fixture 100. In other

embodiments, the length of projection 309 may be a smaller percentage or ratio of thickness 310. For example, length 308 of projection 309 may be approximately ten percent of thickness 310 of fixture 100. In other embodiments, length 308 may be fifteen percent of thickness 310. In still further embodiments, length 308 may be twenty percent or twenty-five percent. In other embodiments, length 308 may be greater between ten percent and twenty-five percent of thickness 310. In still further embodiments, length 308 may be less than ten percent or greater than twenty-five percent of thickness 310. In some embodiments, thickness 310 may be about twenty-five millimeters. In some embodiments, length 308 may be about five millimeters. In other embodiments, length 308 and thickness 310 may be larger or smaller than the values discussed. The length of projection 309 may be varied for ease of use in manufacturing an article of footwear. In some embodiments, it may be easier to insert fixture 100 into a partially completed article with a thinner fixture 100 and smaller projection 309, as opposed to a thicker fixture 100 and larger projection 309. It will be understood that the descriptions of the exemplary projection 309 may also apply to some or all of the remaining projections of projections 110 in some embodiments.

[0049] Referring now to FIGS. 2-3, in some embodiments, members 108 of fixture 100 may align with each other. In some embodiments, members 108 may be shaped such that a surface of one member aligns with another member. For example, contact surface 200 of heel member 102 may align with contact surface 300 of midfoot member 104. As heel member 102 and midfoot member 104 are brought together, contact surface 200 may press against or engage contact surface 300. In some embodiments, contact surface 200 and contact surface 300 may largely correspond in shape. Further, in some embodiments, angle 202 of contact surface 200 (relative to lower surface 114) and angle 302 of contact surface 300 (relative to lower surface 114) may be substantially supplemental angles. That is, the sum of angle 202 and angle 302 may be approximately 180 degrees. Contact surface 204 of forefoot member 106 and contact surface 206 of midfoot member 104 may align and engage in the same or

similar manner as contact surface 200 and contact surface 300. That is, in some embodiments, angle 208 (between contact surface 204 and lower surface 114 of forefoot member 106) and angle 312 (between contact surface 206 and lower surface 114 of midfoot member 104) may be substantially supplemental angles. Further, in some cases, the angle 312 at which contact surface 206 is oriented may be similar to angle 302. Additionally, in some cases, the angle 208 at which contact surface 204 is oriented may be similar to angle 202.

[0050] In embodiments in which heel member 102 and midfoot member 104 are of the same thickness, upper surface 112 of heel member 102 and midfoot member 104 may be flush or even. Additionally, upper surface 112 of midfoot member 104 and upper surface 112 of forefoot member 106 may be flush or even. Further, lower surface 114 of members 108 may be flush or even. In other embodiments, the thicknesses of members 108 may vary such that when members 108 are aligned, lower surface 114 or upper surface 112 of members 108 may not be flush or even. Additionally, in some embodiments, the angle of contact surface 200 and contact surface 300 may not be supplementary angles. In such cases, when midfoot member 104 and heel member 102 are aligned, the upper surface 112 and lower surface 114 may not be flush or even.

[0051] In some embodiments, midfoot member 104 may be shaped such that when force is exerted along the vertical direction, midfoot member 104 may direct the force along the longitudinal direction. In some embodiments, midfoot member 104 may be wedged shape. In some embodiments, the wedge shape of midfoot member 104 may align with forefoot member 106 and heel member 102. With this configuration for midfoot member 104, a vertical force upon midfoot member 104 of fixture 100 may cause a longitudinal force to be exerted upon heel member 102 and forefoot member 106 (see FIG. 13).

[0052] Referring to FIG. 4, upper 400 is attached to strobel 402. In some embodiments, upper 400 may be pre-formed. That is, portions of upper 400 may largely retain the portions' shape without an exterior force or object shaping the upper (i.e. without the presence of a last). In some embodiments, upper 400

may be formed using heat. In other embodiments, upper 400 may be covered with a material that cures to secure upper 400 in a particular shape. Other embodiments may use uppers that are secured using different techniques. In still further embodiments, upper 400 may be unsecured, or unformed. That is, upper 400 may not have a pre-defined shape without the presence of an exterior force.

[0053] As shown in FIG. 4, upper 400 may be formed using last 450. In some embodiments, upper 400 may be pressed or stretched around last 450 to form the shape of upper 400. That is, in some embodiments, last 450 may be used to form a cavity or opening within upper 400.

[0054] In some embodiments, upper 400 may be attached to strobel 402. Strobel 402 and upper 400 may be attached by mechanical means. In some embodiments, strobel 402 and upper 400 may be attached using stitching. In other embodiments, upper 400 and strobel 402 may be attached using an adhesive. In still further embodiments, upper 400 and strobel 402 may be attached by other means.

[0055] In some embodiments, upper 400 may be attached to strobel 402 along a perimeter portion 404 of upper surface 406 of strobel 402. In other embodiments, upper 400 may be secured across substantially all of upper surface 406 of strobel 402. As shown, upper 400 may be secured to strobel 402 along perimeter portion 404.

[0056] In some embodiments strobel 402 may include alignment guides. In some embodiments, the alignment guides may be used to orient the alignment mechanisms of fixture 100. In some embodiments, the alignment guides may include apertures such as alignment apertures 408 in FIG. 4.

[0057] In some embodiments, alignment apertures 408 may be spaced within strobel 402. In some embodiments, alignment apertures 408 may be arranged into groups or sets. In some embodiments, alignment apertures 408 may be concentrated in the forefoot region 410 of strobel 402, depicted as aperture group 422. In other embodiments, alignment apertures may be located in midfoot region 412. In still further embodiments, alignment apertures may be

located in heel region 414, depicted as aperture group 420. Additionally, in some embodiments, alignment apertures 408 may be located in one or more regions. The regions are not intended to demarcate precise areas of footwear. Rather, forefoot region 410, midfoot region 412, and heel region 414 are intended to represent general areas of strobel 402 to aid in the following discussion. In addition to strobel 402, forefoot region 410, midfoot region 412 and heel region 414 may also be applied to article of footwear 1400, upper 400, and individual elements thereof.

[0058] Referring to FIGS. 3-4, in some embodiments, alignment apertures 408 may be similarly spaced to projections 110 of fixture 100. That is, in some embodiments, projections 110 may coincide with alignment apertures 408 when aligned. In some embodiments, projections 110 may be able to pass through alignment apertures 408 when aligned. For example, in some embodiments, alignment group 320 may correspond to aperture group 420. Additionally, in some embodiments, alignment group 322 may correspond to aperture group 422. As such, the projections in each alignment group may pass through corresponding apertures of each aperture group.

[0059] Referring to FIG. 5, partially completed article 500 is shown as last 450 is removed. Partially completed article 500 may be an assembly comprising of upper 400 and strobel 402. In some embodiments, partially completed article 500 may retain a shape similar to an article of footwear. Partially completed article 500 may have an opening 502 which may allow access to a void within partially completed article 500.

[0060] Referring to FIGS. 6-8, members 108 may be inserted into partially completed article 500 through opening 502. Initially, in FIG. 6, forefoot member 106 may be inserted through opening 502 and into a void within partially completed article 500. In the configuration of FIG. 7, forefoot member 106 may be located within partially completed article 500 as heel member 102 is inserted through opening 502. As shown, projections 110 of forefoot member 106 may rest upon upper surface 406 of strobel 402. As forefoot member 106 is inserted into

partially completed article 500, projections 110 may be offset from alignment apertures 408. In other embodiments, projections 110 may extend through alignment apertures 408 upon forefoot member 106 being placed within partially completed article 500.

[0061] Referring to FIG. 8, heel member 102 and forefoot member 106 may be located within partially completed article 500. Midfoot member 104 is placed within partially completed article 500 through opening 502. In some embodiments, the order of inserting members 108 may differ.

[0062] Referring to FIG. 9, members 108 are located within partially completed article 500, however, in some embodiments midfoot member 104 may not align with heel member 102 and forefoot member 106. In other embodiments, midfoot member 104 may align with heel member 102 and forefoot member 106. In some embodiments, projections 110 may not immediately align with alignment apertures 408. That is, in some embodiments, projections 110 of heel member 102 and forefoot member 106 may rest upon upper surface 406 of strobel 402. In such embodiments, midfoot member 104 may assist in aligning projections 110 with alignment apertures 408 discussed below.

[0063] Referring to FIG. 10, a force 600 may be placed upon midfoot member 104. As shown, midfoot member 104 may be oriented such that force 600 is able to extend through an ankle opening to midfoot member 104. In some embodiments, the force 600 upon midfoot member 104 may cause heel member 102 and forefoot member 106 to extend away from midfoot member 104. As midfoot member 104 is laid in place between heel member 102 and forefoot member 106, midfoot member 104 may press against heel member 102 and forefoot member 106. Moreover, the angled surfaces between midfoot member 104 and heel member 102 create a longitudinally oriented force 602 that acts to push heel member 102 in a rearward direction so that projections 110 on heel member 102 may be aligned with apertures 408 in heel region 414 of strobel 402. Likewise, the angled surfaces between midfoot member 104 and forefoot member 106 create a longitudinally oriented force 604 that acts to push forefoot member

106 in a forward direction so that projections 110 on forefoot member 106 may be aligned with alignment apertures 408 in forefoot region 410 of strobel 402. As projections 110 and alignment apertures 408 align, projections 110 may pass though alignment apertures 408. As such, upper surface 406 of strobel 402 may contact lower surface 114 of fixture 100.

[0064] In some embodiments, upper surface 112 of fixture 100 may be substantially unimpeded by upper 400, and may only generally contact strobel 402. That is, in some embodiments, when fixture 100 is placed within the void of partially completed article 500, substantially all of fixture 100 may be free from contact from upper 400. For example, in some embodiments, there may be a space between upper 400 and fixture 100. In other embodiments, upper 400 may contact fixture 100, however, fixture 100 may be easily placed within partially completed article 500 and removed from partially completed article 500 with minimal resistant or pressure from upper 400. Additionally, in some embodiments, the distance from the strobel to the upper may be greater than the thickness 310 of fixture 100 and length 308 of projections 110 combined. That is, before projections 110 pass through alignment apertures 408, upper surface 112 of fixture 100 may remain free from contact with upper 400.

[0065] Referring to FIG. 11, partially completed article 500 with fixture 100 (not visible), is placed on a sole structure 1100 also referred to simply as sole 1100. Sole 1100 may include a midsole and/or outsole. The midsole may be formed from a compressible polymer foam element (e.g., a polyurethane or ethylvinylacetate foam) that attenuates ground reaction forces (i.e., provides cushioning) when compressed between the foot and the ground during walking, running, or other ambulatory activities. In other configurations, the midsole may incorporate fixtures, moderators, fluid-filled chambers, lasting elements, or motion control members that further attenuate forces, enhance stability, or influence the motions of the foot. In still other cases, the midsole may be primarily formed from a fluid-filled chamber that is located within an upper and is positioned to extend under a lower surface of the foot.

[0066] In some embodiments, sole 1100 may be formed to correspond to the shape and size of lower surface 114 of fixture 100. That is, in some embodiments, sole 1100 may have curves and slopes that align with the curves and slopes of fixture 100.

[0067] In some embodiments, sole 1100 may include alignment acceptors for accepting or receiving protrusions or other alignment features. In some embodiments sole 1100 may include alignment holes 1102. In some embodiments, alignment holes 1102 may be similarly spaced to projections 110 of fixture 100. In some embodiments, alignment holes 1102 may be spaced to accept projections 110 of fixture 100. In some embodiments, alignment acceptors may be through holes that pass from an upper surface of sole 1100 to a ground engaging surface. In other embodiments, sole 1100 may include alignment magnets. In some embodiments, alignment magnets may be similarly spaced to magnets located within fixture 100. In some embodiments, the magnets within sole 1100 may be spaced such that when aligned with magnets of fixture 100, strobel 402 may be placed in a particular location on sole 1100.

[0068] In some embodiments, projections 110 may be spaced within strobel 402 such as to align strobel with sole 1100. That is, strobel 402 may be placed in a precise location against sole 1100 through the use of projections 110. In some embodiments, the use of projections may allow for sole 1100 to be aligned with partially completed article 500 in an easier manner than in previous techniques. Projections 110 may also assist in creating consistent placement of partially completed article 500 on sole 1100. The consistent placement of completed article 500 on sole 1100 may create uniformly completed articles of footwear, thereby enhancing the ability to quality control. In some embodiments, the quantity of time necessary to align sole 1100 with partially completed article 500 may thereby decrease. Further, in some embodiments, the precise placement of partially completed article 500 on sole 1100 may reduce waste from mislaid soles that may occur using other techniques.

[0069] In some embodiments, alignment holes 1102 may be arranged into groups or sets. In some embodiments, alignment hole group 1120 may be located in heel region 414. Additionally, in some embodiments, alignment hole group 1122 may be located in forefoot region 410. In some embodiments, alignment hole group 1120 may be arranged similarly to alignment group 320 as well as aperture group 420 (see FIG. 4). As such, projections 110 of alignment group 320 may extend into alignment hole group 1120 and align heel member 102 with sole 1100. Similarly, projections 110 of alignment group 322 may extend into alignment hole group 1122 and align forefoot member 106 with sole 1100.

[0070] In some embodiments, the combination of sole 1100 and partially completed article 500 may be done automatically. In some embodiments, a robot may be used to align sole 1100 with partially completed article 500. Further, in some embodiments, fixture 100 may be interchangeable so as to be easily moved from one article to another. As fixture 100 may be easily removed and inserted into other partially completed articles, a robot or other automated system may easily transfer fixture 100 from one partially completed article to another.

[0071] In some embodiments, sole 1100 and strobel 402 may be interlocked. In some embodiments an adhesive may be used to combine sole 1100 and strobel 402. In some embodiments, an adhesive may be placed upon sole 1100. In other embodiments, an adhesive may be placed on strobel 402. In some embodiments, the adhesive may be heat cured, while in other embodiments the adhesive may be cured by other techniques.

[0072] Referring to FIG. 12, fixture 100 is shown adjacent to strobel 402. Strobel 402 is shown adjacent to sole 1100. As depicted, projections 110 extend through alignment apertures 408 and extend partially into alignment holes 1102. In some embodiments, projections 110 may not fully align with alignment holes 1102. Additionally, in some embodiments, projections 110 may require an additional force to extend fully into alignment holes 1102.

[0073] Referring to FIG. 13, a vertical force 1300 may be exerted on fixture 100. Force 1300 may assist in pressing projections 110 into alignment

holes 1102 of sole 1100. In some embodiments, force 1300 may be exerted on midfoot member 104. Due to the geometry of the contact surfaces of members 108, a portion of the magnitude of the vertical force exerted on midfoot member 104 may be translated to a longitudinal force that extends along heel member 102 and forefoot member 106. A component of force 1300 that is exerted on midfoot member 104 may transfer to heel member 102 in a longitudinal direction represented by force 1302. Additionally, another component of force 1300 may extend through forefoot member 106 represented by force 1304. Force 1302 and force 1304 therefore represent a longitudinal or horizontal component of force 1300. In some embodiments, the longitudinal force exerted along heel member 102 and forefoot member 106 may assist in aligning projections 110 with alignment holes 1102 as well as alignment apertures 408.

[0074] In some embodiments, vertical force 1300 exerted upon midfoot member 104 may assist in creating an even distribution of force from fixture 100 to sole 1100. In some embodiments, a vertical component of force 1300 may transfer through members 108. As depicted, force 1308 extends in a vertical direction through heel member 102. Force 1306 extends through forefoot member 106. In some embodiments, the vertical components of force 1300 may assist in aligning projections 110 with alignment holes 1102 and pressing projections 110 further into alignment holes 1102. In some embodiments, force 1300 along with force 1308, force 1306, force 1304 and force 1302 may press fixture 100 to sole 1100 and may also create a uniform contact area between strobel 402 and sole 1100. In some embodiments, force 1300 may be exerted until a bond is formed between sole 1100 and strobel 402. In some embodiments, a bond may be formed using adhesive as discussed above. In other embodiments, a force may be exerted until some other step of manufacturing is completed. In this manner, a vertical force may be used to align projections 110 with alignment holes 1102 as well as force strobel 402 to sole 1100 to form a complete seal.

[0075] In some embodiments, members 108 may form an approximately uniform structure when compressed. That is, in some embodiments, the gaps

between members 108 may be minimal or minimized such that the junction between heel member 102 and midfoot member 104 may be smooth or minimal. Additionally, the junction between midfoot member 104 and heel member 102 may be smooth or minimal. By forming a smooth junction between members 108 a uniform force may be used to press fixture 100 toward sole structure 1100. By providing even force along fixture 100, a binding agent such as glue may be fully pressed between strobel 402 and sole structure 1100. In contrast, other embodiments may include gaps or uneven junctions between members 108. These gaps or junctions may allow for areas of a binding agent or glue to not be fully compressed between strobel 402 and sole structure 1100 or provide uneven binding or junctions between strobel 402 and sole structure 1100.

[0076] In some embodiments, the shape of fixture 100 may correspond to the shape or sole 1100. For example, as shown in FIG. 13, forefoot member 106 may be contoured to align with the forefoot region of sole 1100. Additionally, as shown, the depth or thickness of fixture 100 may vary along the length of article 500. For example, heel member 102 may have a different overall thickness than forefoot member 106. Additionally, heel member 102, midfoot member 104 and forefoot member 106 may be contoured to align with the shape of sole 1100 such that an even force may be distributed to all areas of sole 1100. By providing a similarly shaped fixture 100 and sole 1100 complete or even pressing may be achieved.

[0077] Referring to FIG. 14, members 108 may be removed from article of footwear 1400. In some embodiments, members 108 may be removed after force is exerted upon members 108. In some embodiments, members 108 may be removed after combining partially completed article 500 and sole 1100. The combination of upper 400, strobel 402 (not visible) and sole 1100 may create article of footwear 1400. In some embodiments, a sockliner be inserted. In other embodiments, additional pieces or decals may be attached to article of footwear 1400.

[0078] In some embodiments, members 108 may be reused in the manufacture of another article of footwear. As discussed above, members 108 may be removed from one article and placed in another by automatic or manual means.

[0079] Referring to FIG. 15, article of footwear 1400 is shown with members 108 removed. As shown, alignment apertures 408 are located adjacent to alignment holes 1102. In some embodiments, alignment holes 1002 may be filled with another material. In some embodiments, alignment holes 1002 may be filled with a material that is the same or includes similar properties to that of the midsole. In some embodiments, a sockliner may be inserted into article of footwear 1400. In some embodiments, the sockliner may cover any openings or cavities that may exist, such as alignment apertures 408 or alignment holes 1102.

[0080] Referring to FIG. 16, an alternate embodiment of a pressing fixture is depicted. As shown, pressing fixture 1600 includes a forefoot member 1602, a midfoot member 1604, and a heel member 1606 similar in configuration to that of fixture 100 discussed previously. In some embodiment, pressing fixture 1600 may have a particular layout of projections. In some embodiments, projections may be placed along a heel center line and a last center line.

[0081] In this detailed description, a heel centerline refers a line that extends from heel edge 1608 to forefoot edge 1610. As shown, heel centerline 1612 extends from heel edge 1608 to forefoot edge 1610. Additionally, a lateral line 1614 is displayed. Lateral line 1614 is located a distance 1615 away from heel edge 1608. In some embodiments, distance 1615 is approximately 30% of the total length of pressing fixture 1600. In some embodiments, heel centerline 1612 bisects lateral line 1614. Additionally, as shown, heel centerline 1612 may also bisect heel edge 1608. As such, area 1616 and area 1617 that are located between lateral line 1614 and heel edge 1608 have approximately the same surface area. Although a heel region 14 may be approximately bisected by heel centerline 1612, as shown in FIG. 16, forefoot region 10 may not be evenly bisected by heel centerline 1612.

[0082] In some embodiments, another line may be used for reference. In some embodiments, last centerline 1618 may refer to a line that extends from heel edge 1608 to forefoot edge 1610. In some embodiments, last centerline 1618 may approximately bisect pressing fixture 1600. In contrast to heel centerline 1612, last centerline 1618 approximately bisects the entire structure of pressing fixture 1600. That is, the area of lateral side 16 may be approximately the same as the area of medial side 18.

[0083] In some embodiments, projections may be placed along heel centerline 1612 and last centerline 1618. In some embodiments, projection 1630 may be placed at the intersection of last centerline 1618 and heel centerline 1612. In some embodiments, the intersection may be approximately 33 millimeters radially away from heel edge 1608. In other embodiments, the intersection may be between 15 and 40 millimeters radially away from heel edge 1608. In still further embodiments, the intersection may be located a larger or smaller distance away from heel edge 1608.

[0084] In some embodiments, projections may be located along heel centerline 1612 and last centerline 1618 in forefoot region 10. In some embodiments, projection 1631 may be located a distance 1640 away from heel edge 1608. In some embodiments, distance 1640 may be approximately 67% of the total length of pressing fixture 1600. In other embodiments, distance 1640 may be between 60 and 75% of the total length of pressing fixture 1600.

[0085] In some embodiments, projection 1632 may be located a distance 1641 away from heel edge 1608. In some embodiments, distance 1641 may be approximately 67% of the total length of pressing fixture 1600. In other embodiments, distance 1641 may be between 60 and 75% of the total length of pressing fixture 1600.

[0086] As discussed with relation to FIG. 16, it should be recognized that a sole structure may include alignment holes that are configured to receive projection 1630, projection 1631 and projection 1632. Additionally, a strobel may include alignment apertures that may also align with the projections of sole

structure 1600 in similar relation to the manner in which sole structure 1100 and strobel 402 are configured to receive projections from fixture 100. By placing alignment holes along the heel centerline and the last centerline, the stress on the upper is evenly distributed during the manufacturing process. Additionally, by using holes within the sole structure, the stress within the sole structure may be evenly distributed during the manufacturing process.

[0087] Referring to FIGS. 17-19, an alternate embodiment of a pressing fixture is depicted. As shown, fixture 1700 includes forefoot member 1702, midfoot member 1704 and forefoot member 1706. FIG. 17 shows and exploded view of the parts of fixture 1700. FIG. 18 shows fixture 1700 in an unextented state and FIG. 19 shows fixture 1700 in an extended state. In some embodiments, fixture 1700 may include provisions for aligning the members of fixture 1700. In some embodiments, fixture 1700 may include protrusions and sockets to assist in aligning the members of fixture 1700. In still further embodiments, a sliding dovetail may be used to align members of fixture 1700.

[0088] As shown, midfoot member 1704 includes first alignment portion 1708 and second alignment portion 1710. In some embodiments, first alignment portion 1708 and second alignment portion 1710 have a similar shape. In other embodiments, first alignment portion 1708 and second alignment portion 1710 have different shapes. As shown in FIGS. 17-19, first alignment portion 1708 and second alignment portion 1710 have similar shapes.

[0089] In some embodiments, first alignment portion 1708 and second alignment portion 1710 may have a rectangular-shaped upper surface. In other embodiments, first alignment portion 1708 and second alignment portion 1710 may have upper surfaces of different shapes. As shown in FIGS. 17-19, the upper surface of first alignment portion 1708 and second alignment portion 1710 has a trapezoidal shape.

[0090] In some embodiments, members of fixture 100 may have sockets or depressions that correspond to the shape of first alignment portion 1708 and second alignment portion 1710. As shown in FIGS. 17-19, socket 1718 of forefoot

member 1702 may correspond to the shape of first alignment portion 1708 of midfoot member 1704. Additionally, socket 1720 of heel member 1706 may correspond to the shape of second alignment portion 1710 of midfoot member 1704. As shown in FIGS. 17-19, socket 1720 and second alignment portion 1710 along with socket 1718 and first alignment portion 1708 interact with one another and may slide relative to one another. As shown in FIG. 19, first alignment portion 1708 and second alignment portion 1710 align with their corresponding sockets to form a fully extended fixture 1700.

[0091] In some embodiments, fixture 1700 may include provisions for securing the members of fixture 1700 to one another. As shown in FIG. 17, midfoot member 1704 optionally includes a first securing mechanism 1728 and a second securing mechanism 1730. In some embodiments, first securing mechanism 1728 may extend through first alignment portion 1708. Additionally, second securing mechanism 1730 may extend through second alignment portion 1710. In other embodiments, the securing mechanisms may extend through other areas of midfoot member 1704 or other members of fixture 1700. In other embodiments, fixture 1700 may not include securing mechanisms.

[0092] In some embodiments, the securing mechanisms may be adjustable. In some embodiments, first securing mechanism 1728 and second securing mechanism 1730 may be threaded. In other embodiments, the securing mechanisms may be fixed in place. As shown in FIGS. 17-19, the securing mechanism may be adjustable. As shown, first securing mechanism 1728 and second securing mechanism 1730 may be retracted as the alignment portions are placed within the sockets. Once the alignment portions are in the sockets, first securing mechanism 1728 and second securing mechanism 1730 may be extended into the corresponding slots as described below.

[0093] In some embodiments, the securing mechanisms may align with corresponding slots. As shown in FIG. 17, first securing mechanism 1728 may align with first slot 1738. Additionally, second securing mechanism 1730 may align with second slot 1740. As midfoot member 1704 is aligned with heel

member 1706 and forefoot member 1702, first securing mechanism 1728 may be extended into first slot 1738 and second securing mechanism 1730 may be extended into second slot 1740. By extending the securing mechanisms into the corresponding slots, midfoot member 1704 may be slidably secured to one another. In this state, midfoot member 1704 may slide relative to forefoot member 1702 and heel member 1706. Midfoot member 1704, however, may not be separated from heel member 1706 and forefoot member 1702 without retracting first securing mechanism 1728 or second securing mechanism 1730. By utilizing securing mechanism, slots, and alignment portions, fixture 1700 may be able to be moved and placed in partially completed articles as a single unit. That is, forefoot member 1702, midfoot member 1704, and heel member 1706 may be secured to one another.

[0094] In some embodiments, fixture 1700 may be designed to change in length in different configurations. In FIG. 18 and FIG. 19, fixture 1700 is in an extended state and an unextended state. In FIG. 18, forefoot member 1702 and heel member 1706 are pressed toward one another. This motion forces midfoot member 1704 to extend above heel member 1706 and forefoot member 1702. As discussed previously, however, first slot 1738 and second slot 1740 in conjunction with first securing mechanism 1728 and second securing mechanism 1730 may prevent midfoot member 1704 from being separated from heel member 1706 and forefoot member 1702. In other embodiments, fixture 1700 may not include slots.

[0095] As shown in FIG. 18, the length from forefoot toe edge 1800 to heel edge 1802 is represented by distance 1804. Referring to FIG. 19, the length from forefoot edge 1800 to heel edge 1802 is represented by distance 1900. In some embodiments, distance 1804 may be approximately twenty-five percent smaller or less than distance 1900. In other embodiments, distance 1804 may be forty percent less than distance 1900. In still further embodiments, distance 1804 may be greater or less than twenty five percent less than distance 1900. By reducing distance 1804, fixture 1700 may be more easily placed within a partially completed article during manufacturing.

[0096] While various embodiments have been described, the description is intended to be exemplary, rather than limiting and it will be apparent to those of ordinary skill in the art that many more embodiments and implementations are possible. Accordingly, the invention is not to be restricted except in light of the attached claims and their equivalents. Also, various modifications and changes may be made within the scope of the attached claims.

WHAT IS CLAIMED IS:

1. A pressing fixture for the manufacture of an article of footwear comprising:

a first section, a second section, and a third section, each section being distinct and separable from the other;

the first section having a first surface, the second section having a second surface and a third surface, and the third section having a fourth surface;

wherein the first surface of the first section is configured to engage the second surface of the second section and wherein the third surface of the second section is configured to engage the fourth surface of the third section;

the first surface forming a first angle with a lower surface of the first section, the second surface forming a second angle with a lower surface of the second section, the third surface forming a third angle with the lower surface of the second section and the fourth surface forming a fourth angle with a lower surface of the third section;

the first angle and the second angle being substantially supplementary angles, wherein the first angle is different from ninety degrees and wherein the second angle is different from ninety degrees;

the third angle and the fourth angle being substantially supplementary angles, wherein the third angle is different from ninety degrees and wherein the fourth angle is different from ninety degrees;

the first section having a first alignment feature and the third section having a second alignment feature; and

wherein the second section is wedged shaped.

2. The pressing fixture according to claim 1, wherein the first section includes a third alignment feature.

3. The pressing fixture according to claim 2, wherein the third section includes a fourth alignment feature.

4. The pressing fixture according to claim 1, wherein the second angle is an obtuse angle.

5. The pressing fixture according to claim 4, wherein the third angle is an obtuse angle.

6. The pressing fixture according to claim 1, wherein the pressing fixture comprises a thickness having a first value, wherein the first alignment feature has a length having a second value, and wherein the second value is at least half of the first value.

7. A pressing fixture for the manufacture of an article of footwear comprising:

a first section, a second section, and a third section, each section being distinct and separable from the other;

the first section having a thickness extending between an upper surface of the first section and a lower surface of the first section, the thickness being a maximum thickness of the first section;

the first section corresponding to a forefoot portion of the foot, the second section corresponding to a midfoot portion of the foot, and a third section corresponding to a heel portion of a foot;

the first section having an alignment feature extending away from the lower surface of the first section;

wherein the alignment feature has a length; and

wherein the length of the alignment feature is greater than twenty-five percent of the thickness of the first section.

8. The pressing fixture according to claim 7, wherein the second section is wedge shaped.

9. The pressing fixture according to claim 7, wherein the first section has a first surface, the second section has a second surface and a third surface, and the third section has a fourth surface;

wherein the first surface of the first section is configured to engage the second surface of the second section and wherein the third surface of the second section is configured to engage the fourth surface of the third section;

the first surface forming a first angle with a lower surface of the first section, the second surface forming a second angle with a lower surface of the second section, the third surface forming a third angle with the lower surface of the second section and the fourth surface forming a fourth angle with a lower surface of the third section;

the first angle and the second angle being substantially supplementary angles, wherein the first angle is different from ninety degrees and wherein the second angle is different from ninety degrees; and

the third angle and the fourth angle being substantially supplementary angles, wherein the third angle is different from ninety degrees and wherein the fourth angle is different from ninety degrees.

10. The pressing fixture according to claim 7, wherein the alignment feature has a cylindrical shape.

11. The pressing fixture according to claim 7, wherein the alignment feature is a first alignment feature, and wherein the third member includes a second alignment feature.

12. The pressing fixture according to claim 11, wherein the second alignment feature has a length and wherein the third section has a thickness wherein the length of the second alignment feature is greater than twenty-five percent of the thickness of the third section.

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

placing a first section into an assembly comprised of an upper and a strobel, the first section having a plurality of alignment features;

placing a third section into the assembly, the third section having a plurality of alignment features;

placing a second section into the assembly,

applying a force to the second section such that the first section and the third section translate longitudinally and such that the plurality of alignment features of the first section and the plurality of alignment features of the second section extend through a plurality of alignment apertures in the strobel; and

inserting the plurality of alignment features of the first section and the plurality of alignment features of the second section into a plurality of acceptors in a sole structure.

14. The method according to claim 13, wherein the first section has a first surface, the second section has a second surface and a third surface, and the third section has a fourth surface;

wherein the first surface of the first section is configured to engage the second surface of the second section and wherein the third surface of the second section is configured to engage the fourth surface of the third section;

the first surface forming a first angle with a lower surface of the first section, the second surface forming a second angle with a lower surface of the second section, the third surface forming a third angle with the lower surface of the second section and the fourth surface forming a fourth angle with a lower surface of the third section;

the first angle and the second angle being substantially supplementary angles, wherein the first angle is different from ninety degrees and wherein the second angle is different from ninety degrees; and

wherein the third angle and the fourth angle being substantially supplementary angles, wherein the third angle is different from ninety degrees and

wherein the fourth angle is different from ninety degrees.

15. The method according to claim 14, wherein the first section has a first thickness extending between an upper surface of the first section to the lower surface of the first section, the plurality of alignment features have a first length, and wherein the length of the plurality of alignment features is greater than twenty-five percent of the thickness of the first section.

16. The method according to claim 13, wherein the plurality of alignment features have a cylindrical shape.

17. The method according to claim 13, wherein applying the force further comprises applying the force to the second section in a direction approximately perpendicular to a plane of the sole structure. .

18. The method according to claim 13, further comprising pressing the strobel against the sole structure.

19. The method according to claim 13, wherein the method further includes removing the first section, the second section, and the third section from the assembled article of footwear comprised of the upper, the strobel and the sole structure.

20. The method according to claim 13, wherein the method further includes joining the sole structure with the assembly using an adhesive.

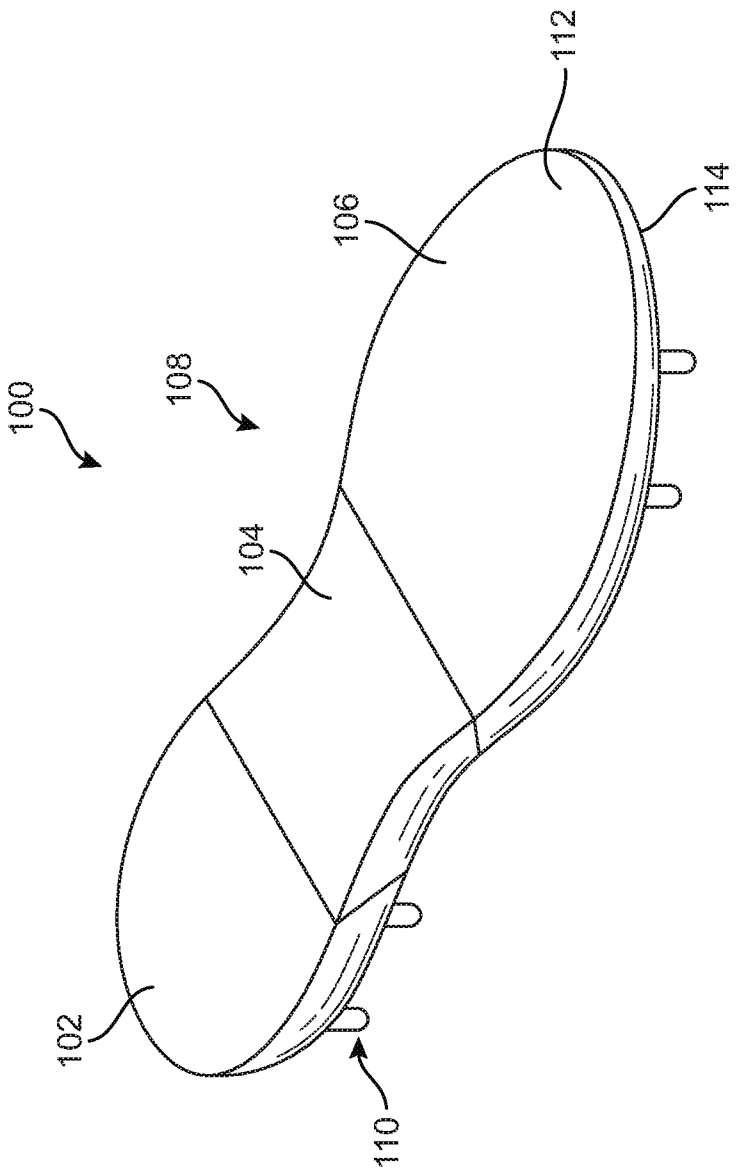


FIG. 1

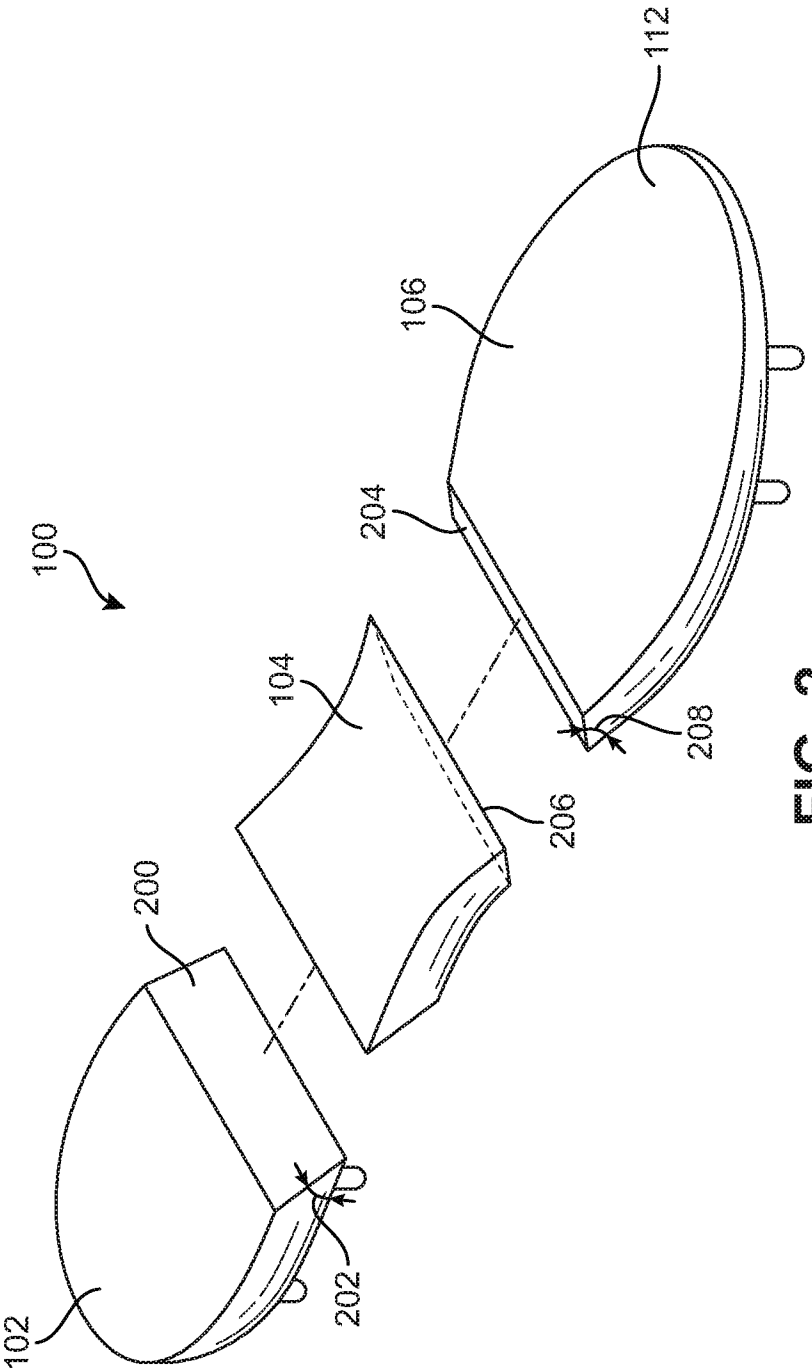


FIG. 2

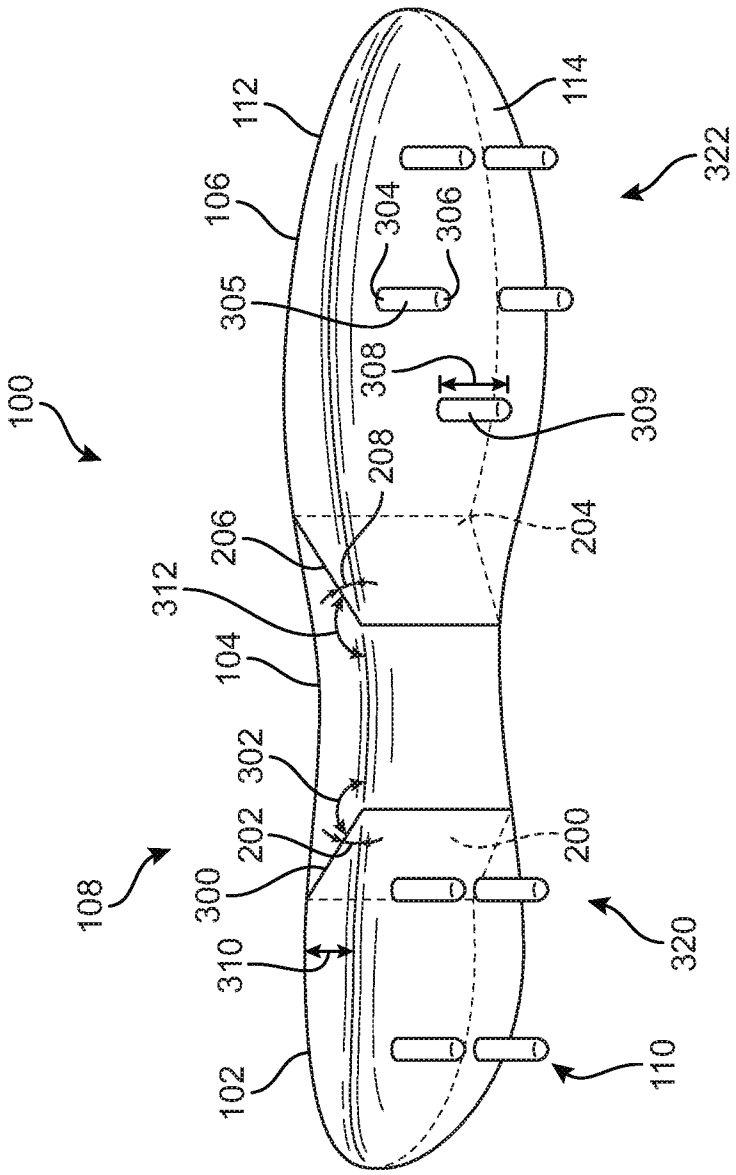

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FIG. 3

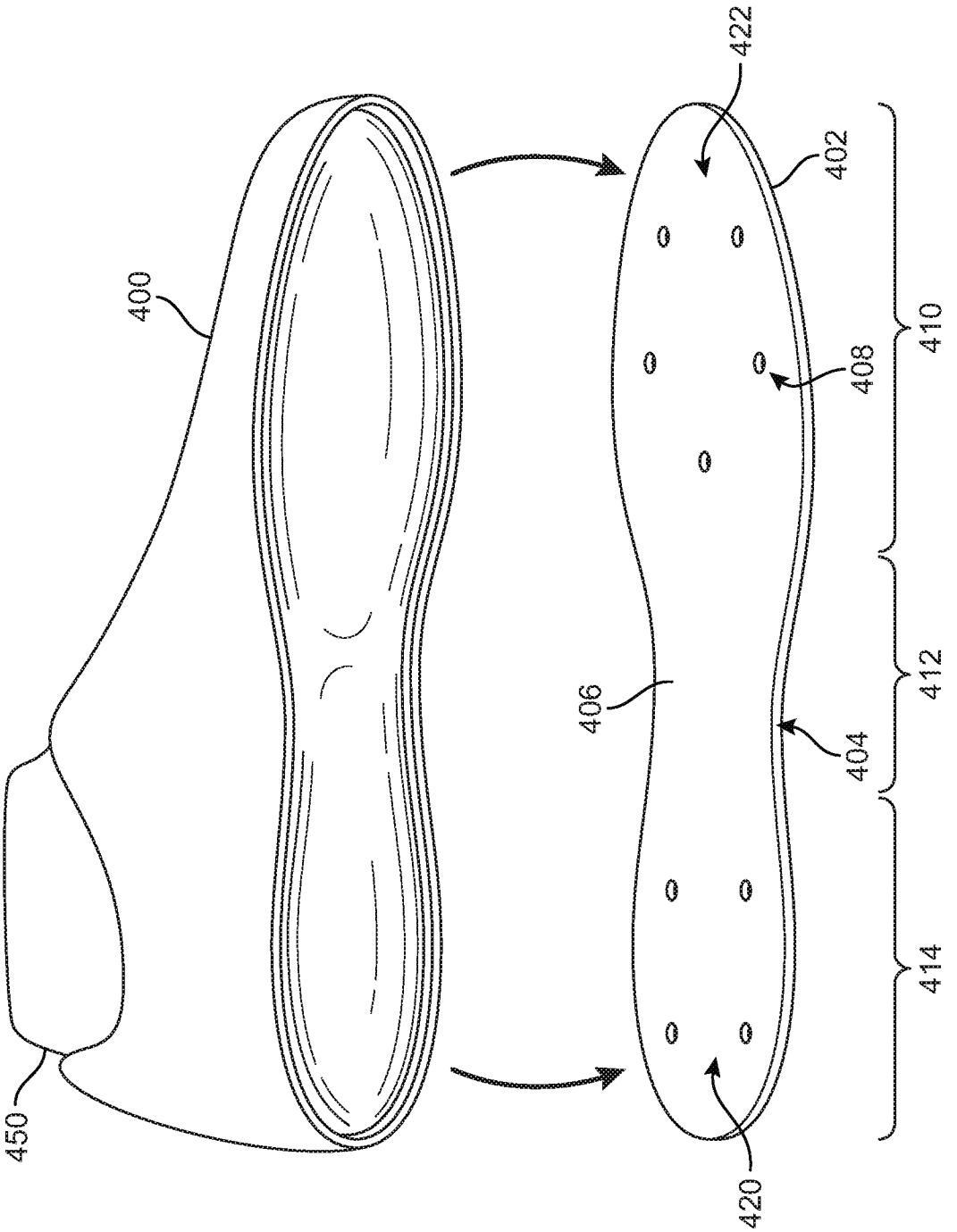


FIG. 4

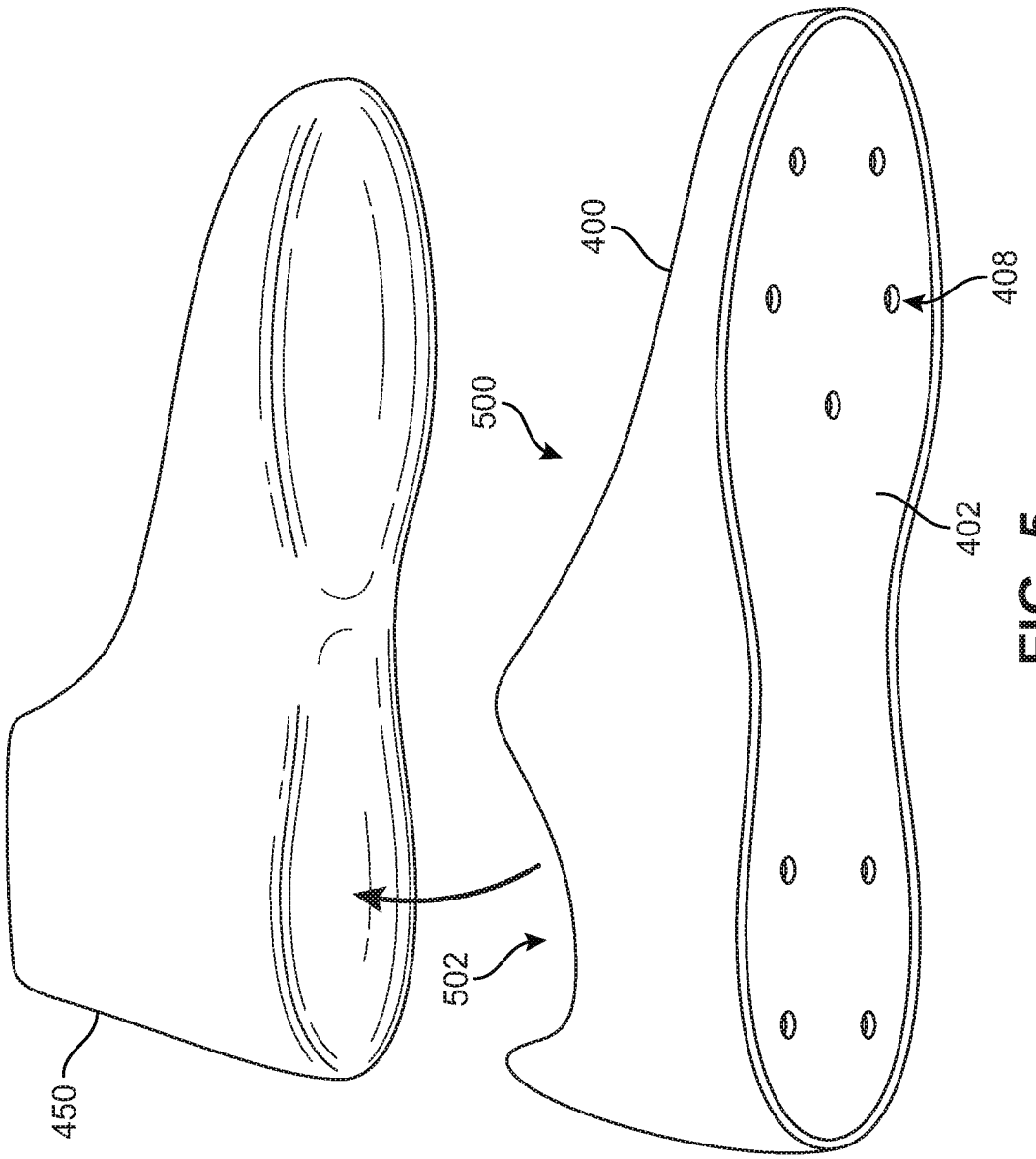


FIG. 5

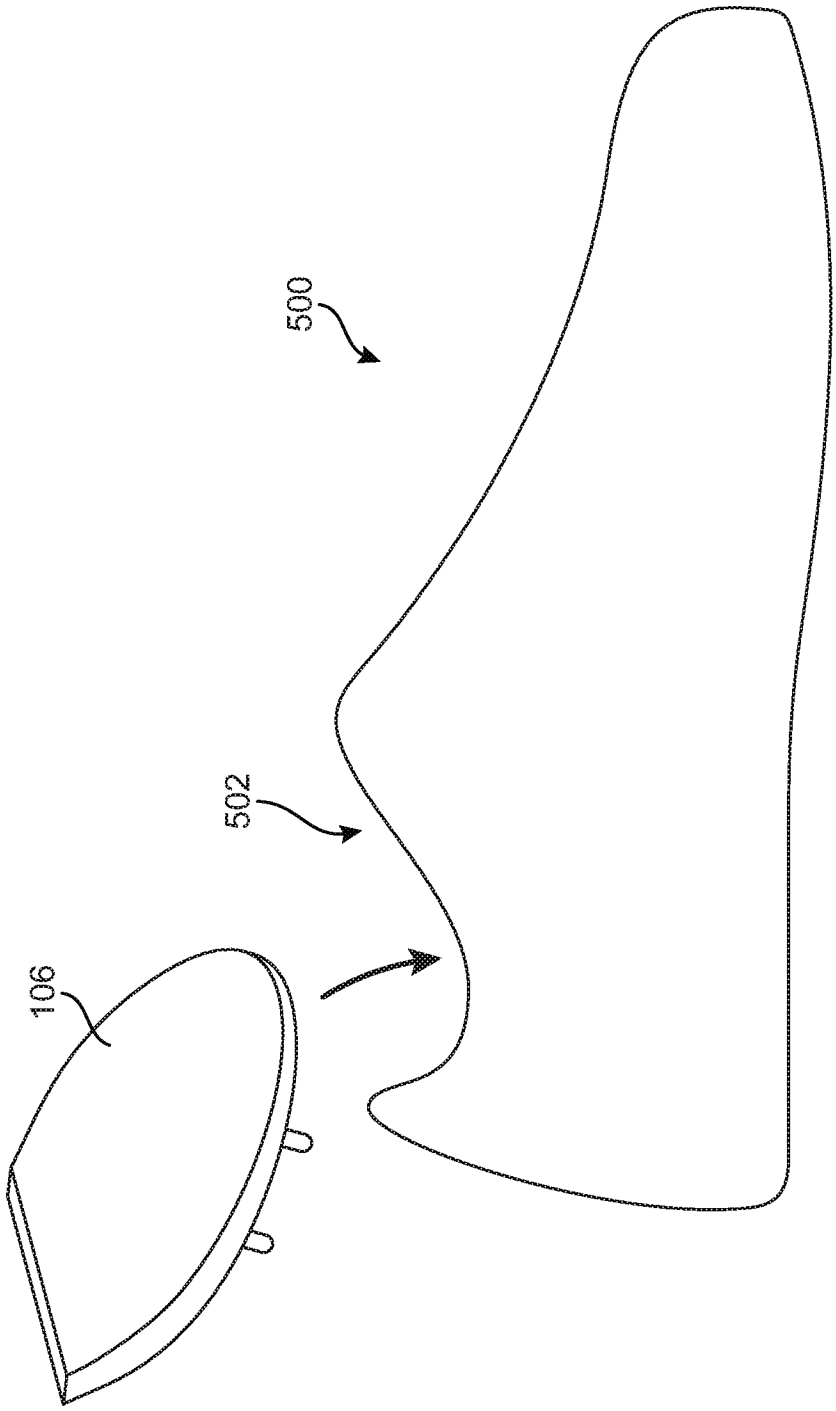


FIG. 6

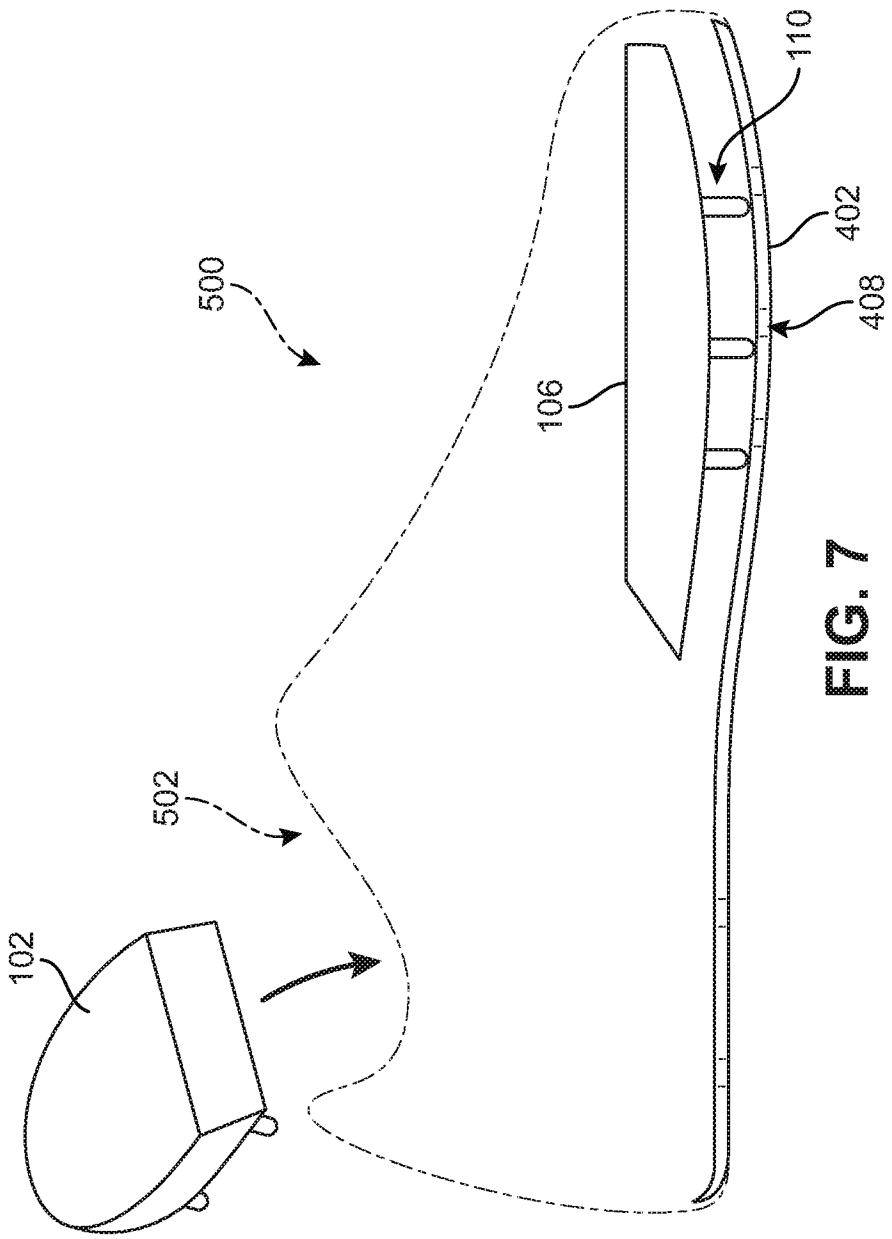


FIG. 7

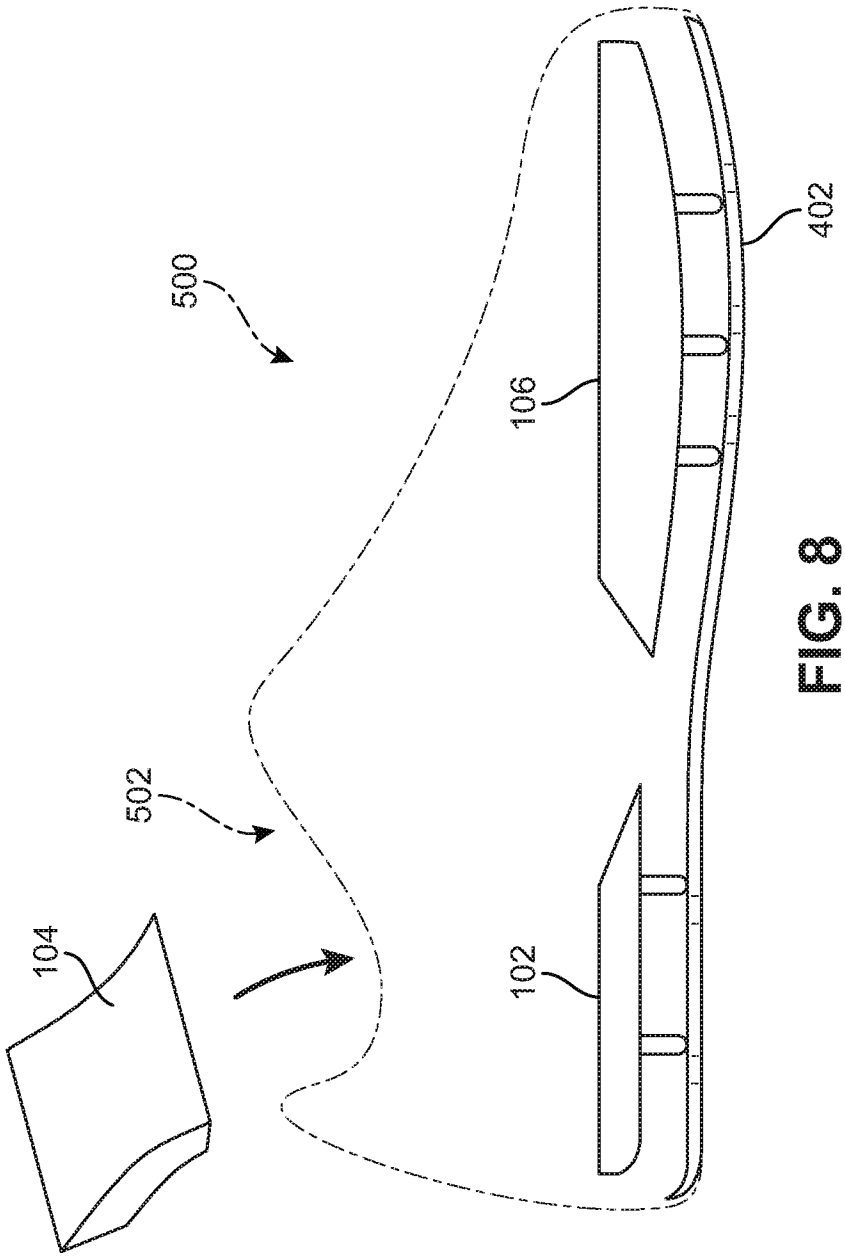


FIG. 8

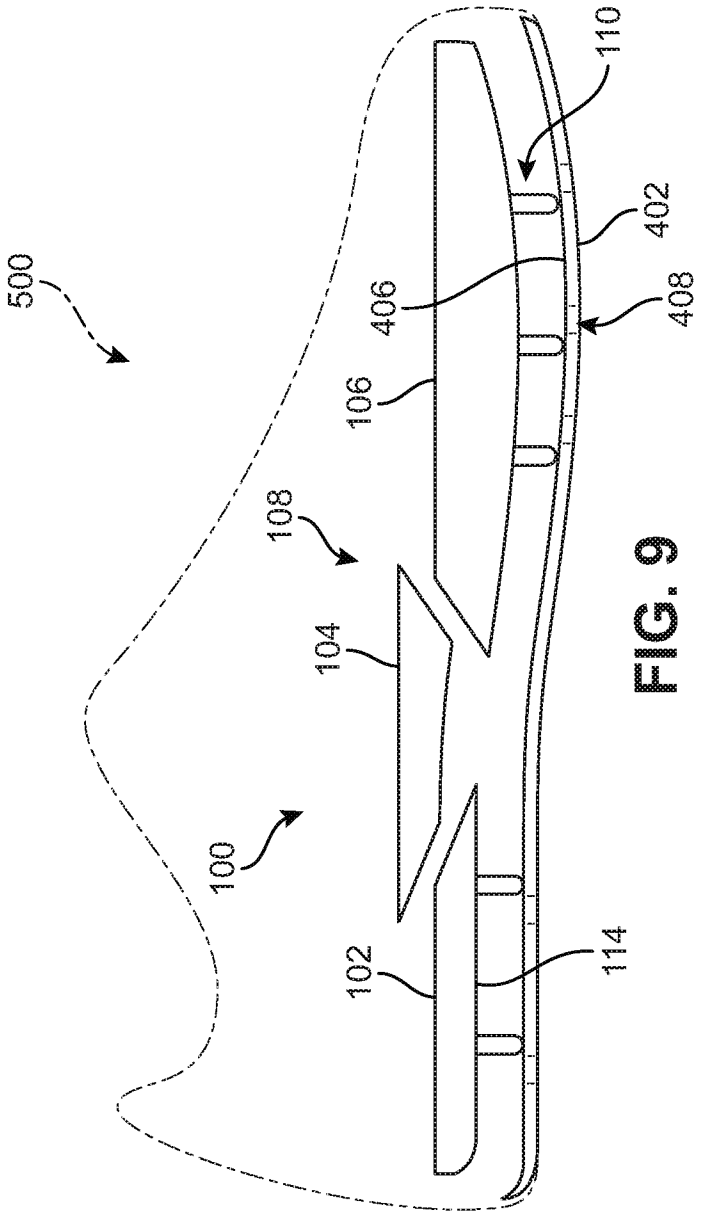


FIG. 9

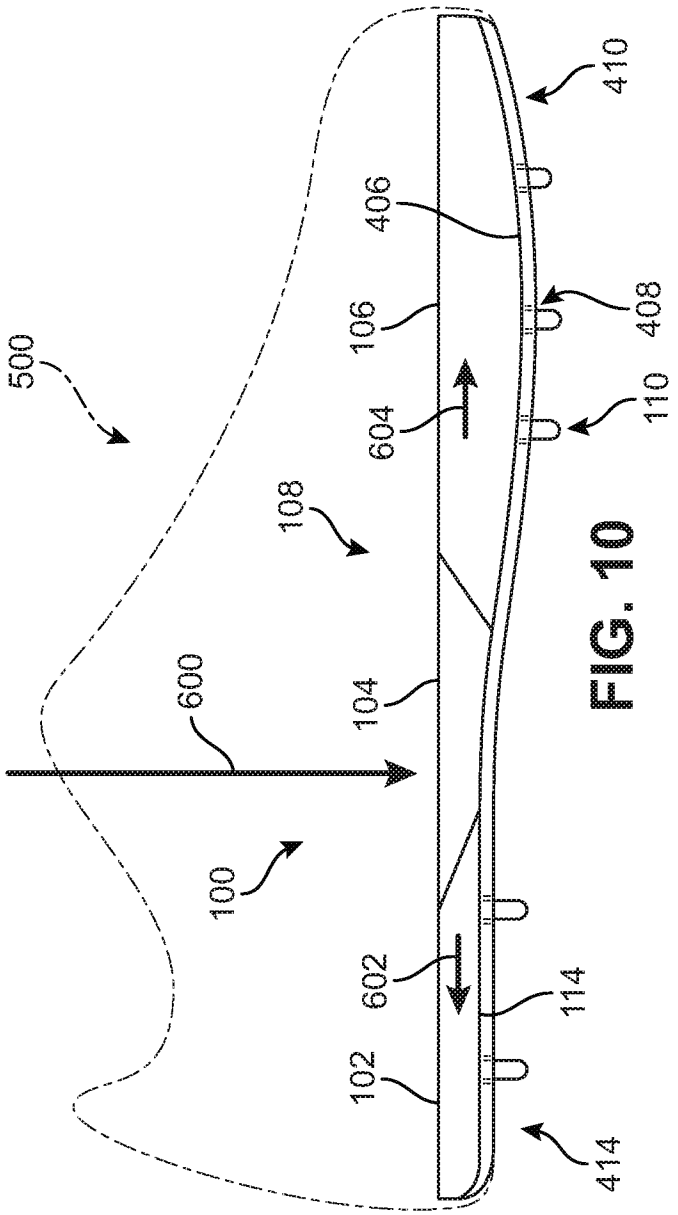


FIG. 10

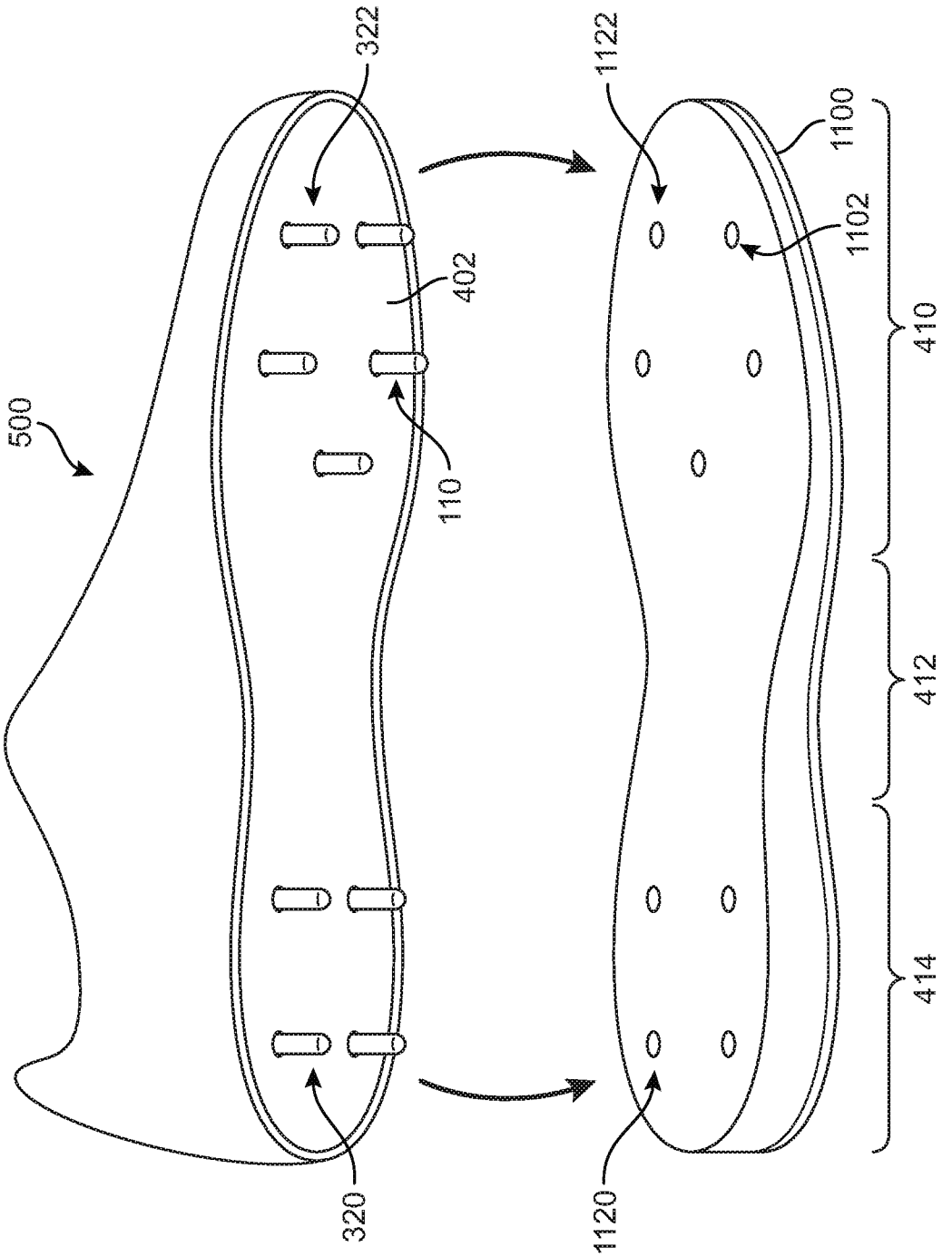


FIG. 11

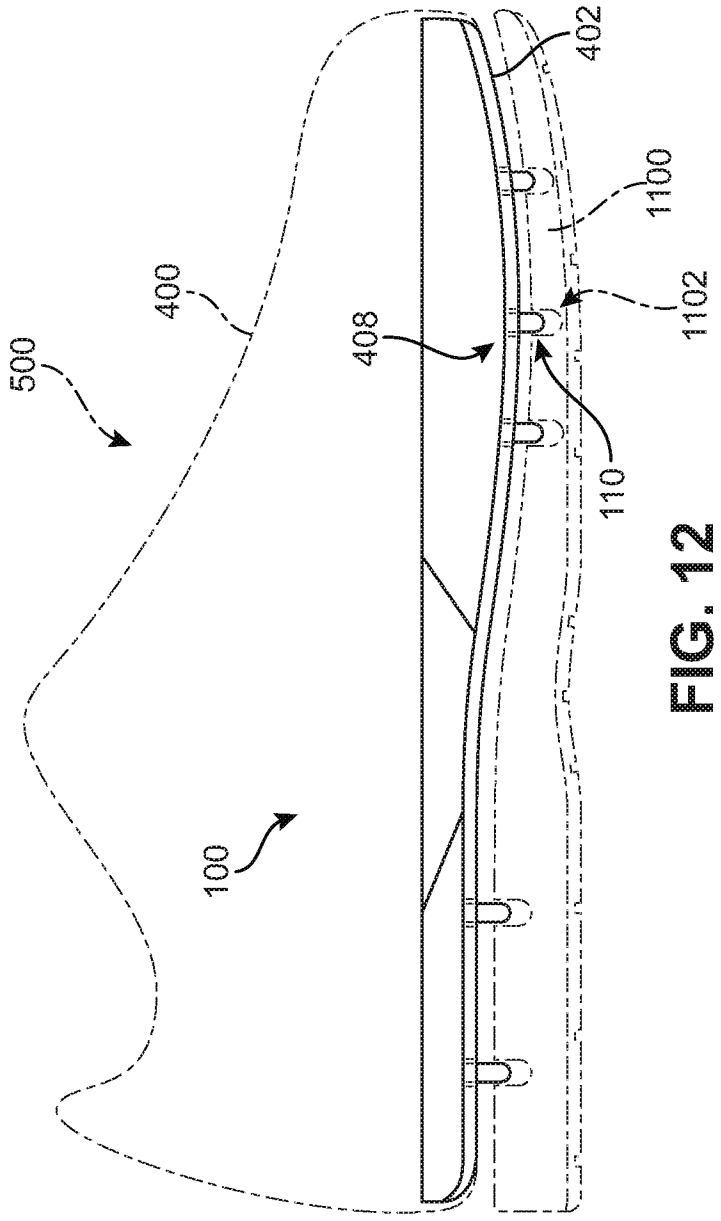


FIG. 12

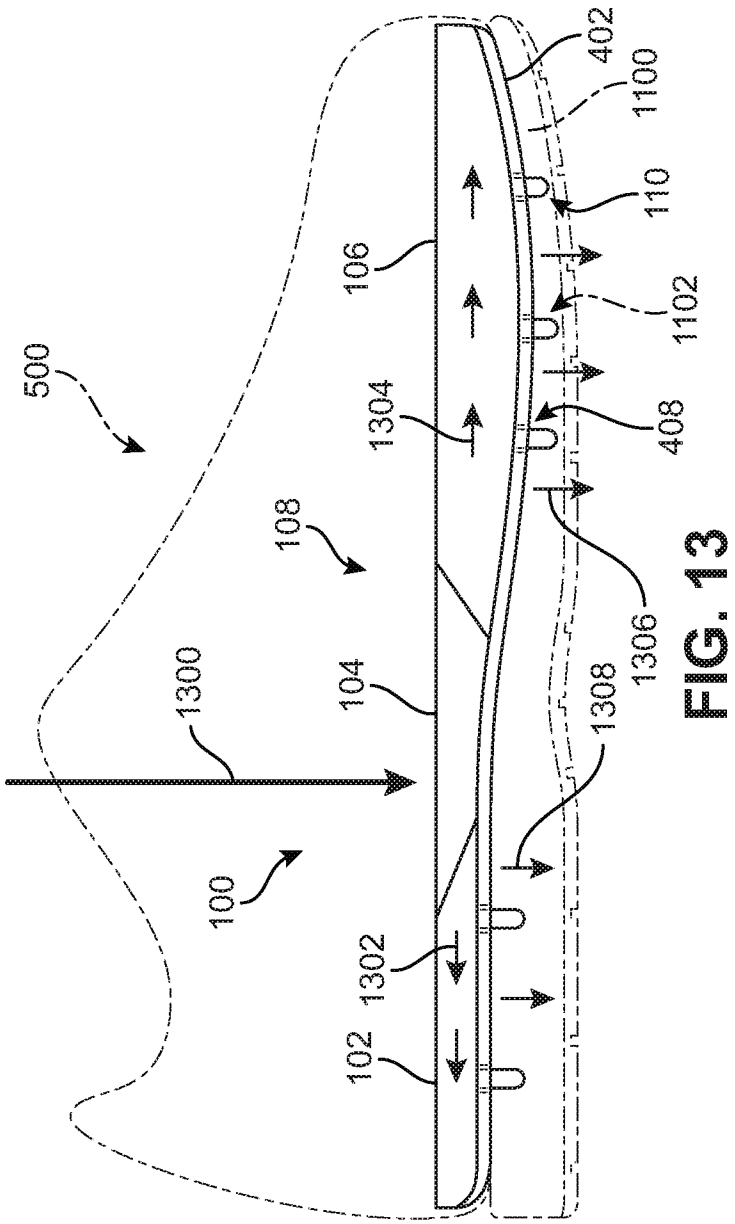

500
100
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104
106
108
110
1100
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1300
1302
1304
1306
1308
402
408

FIG. 13

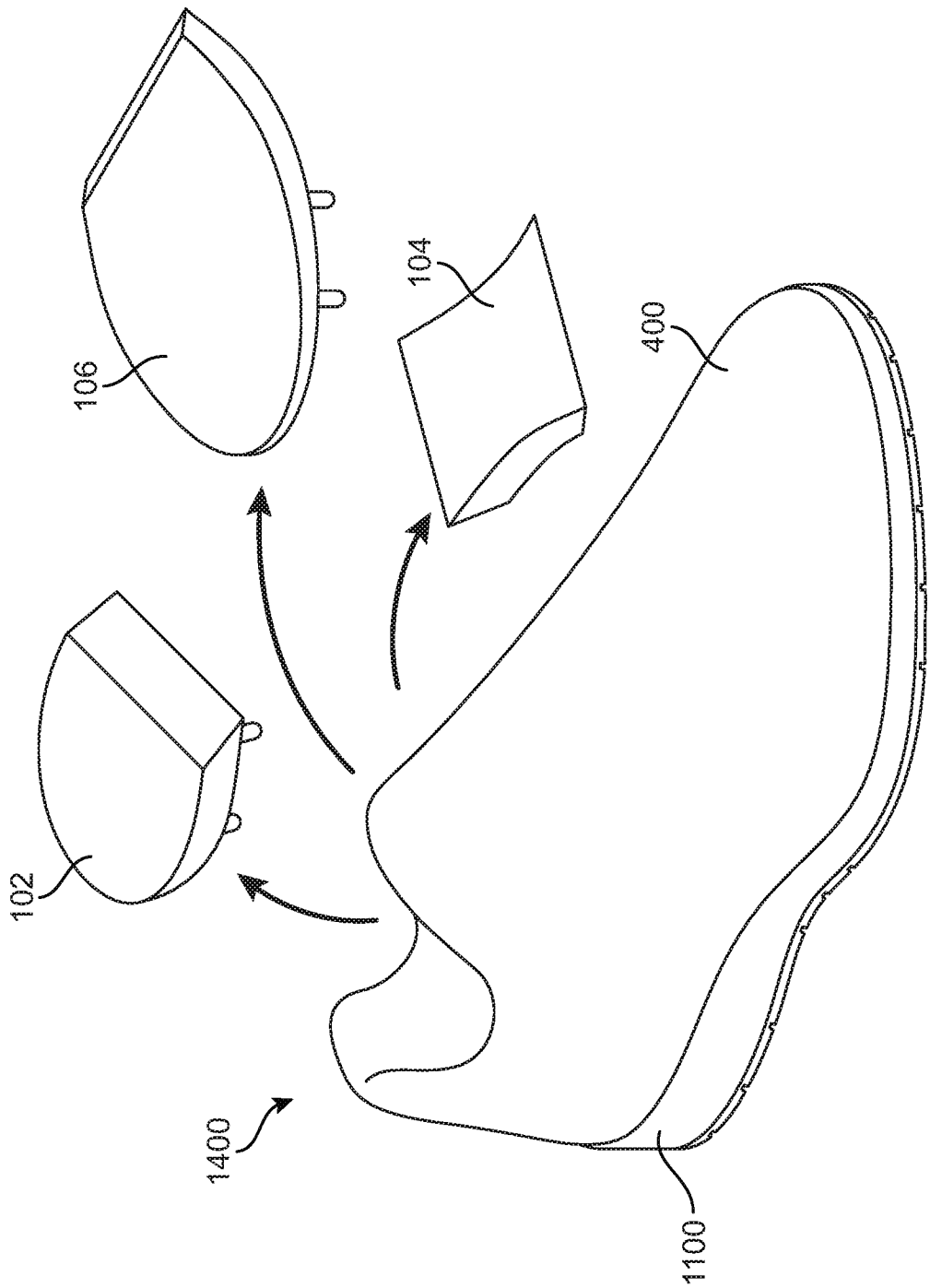


FIG. 14

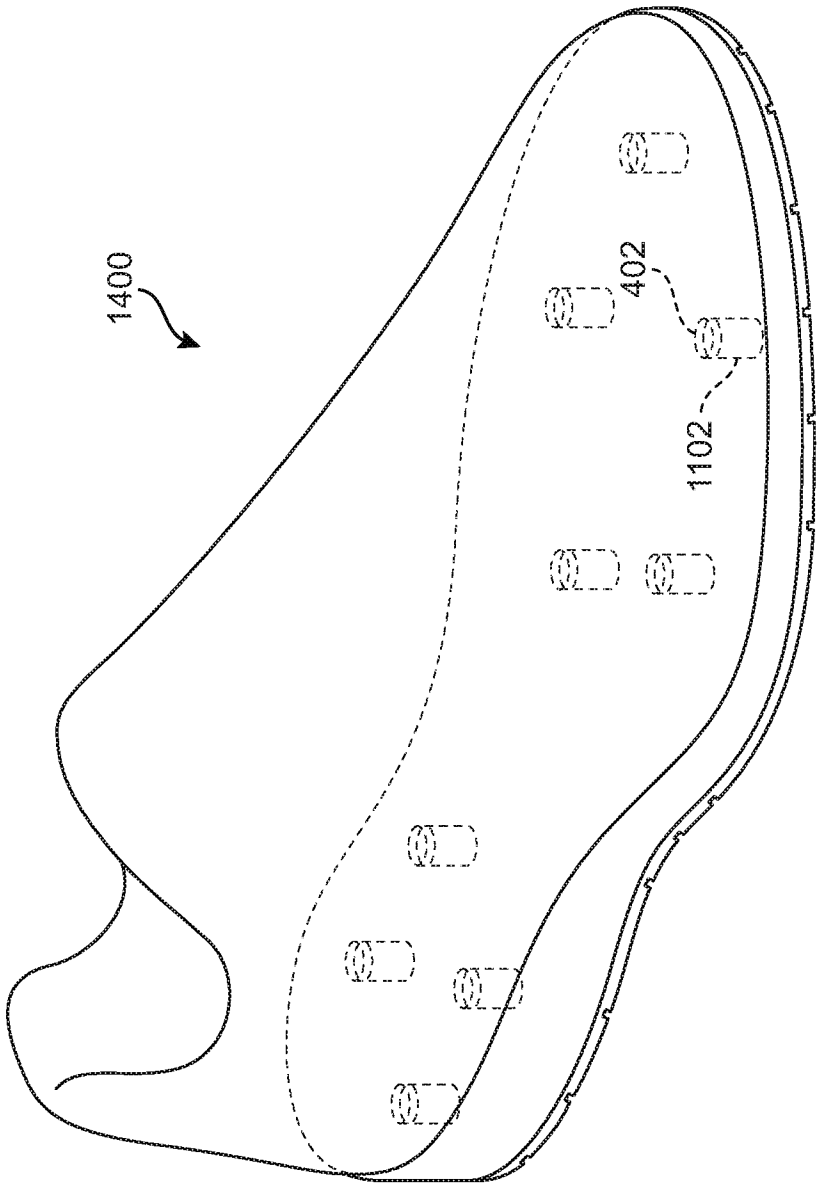


FIG. 15

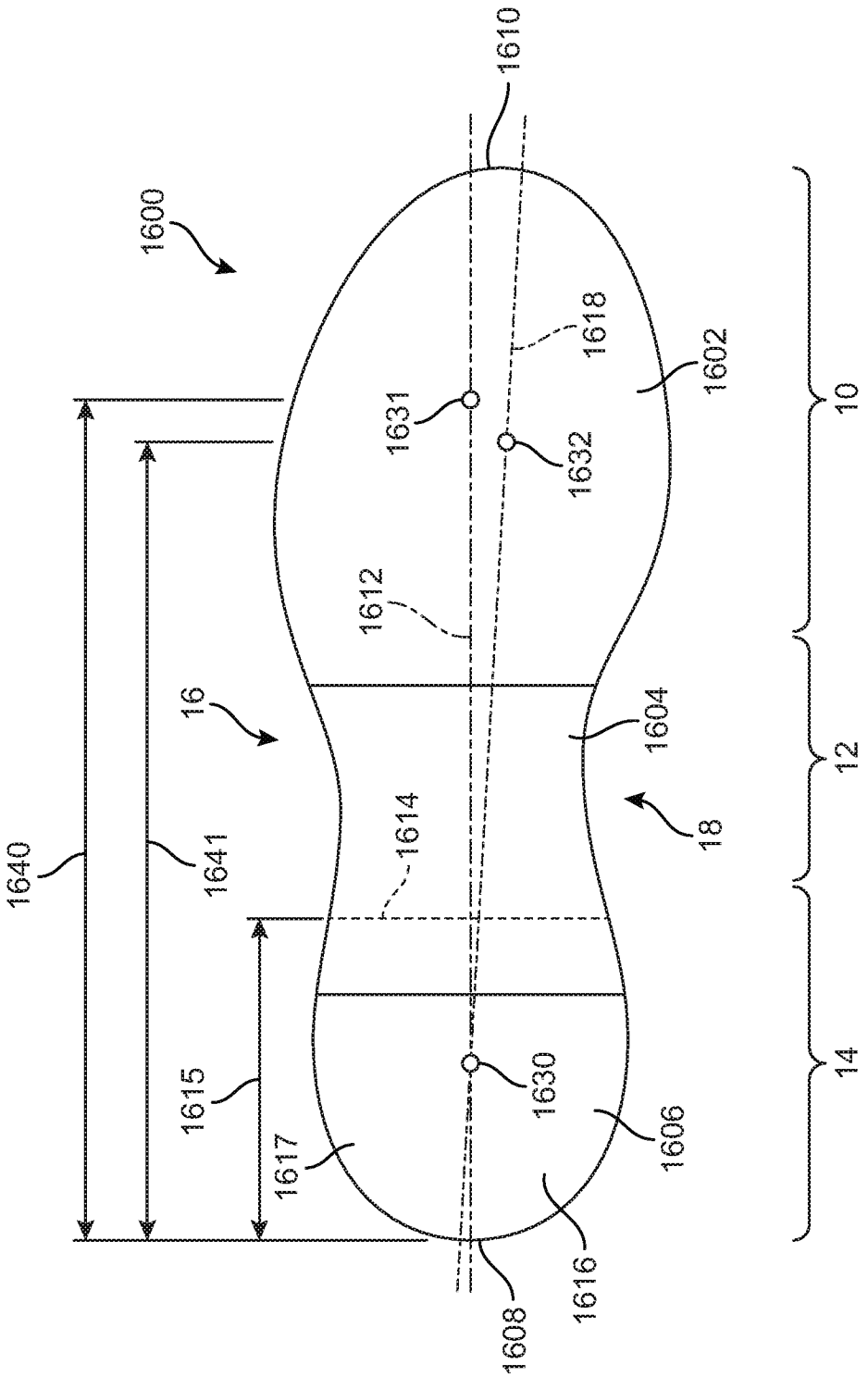

1600
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1617
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1608
1616
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12
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FIG. 16

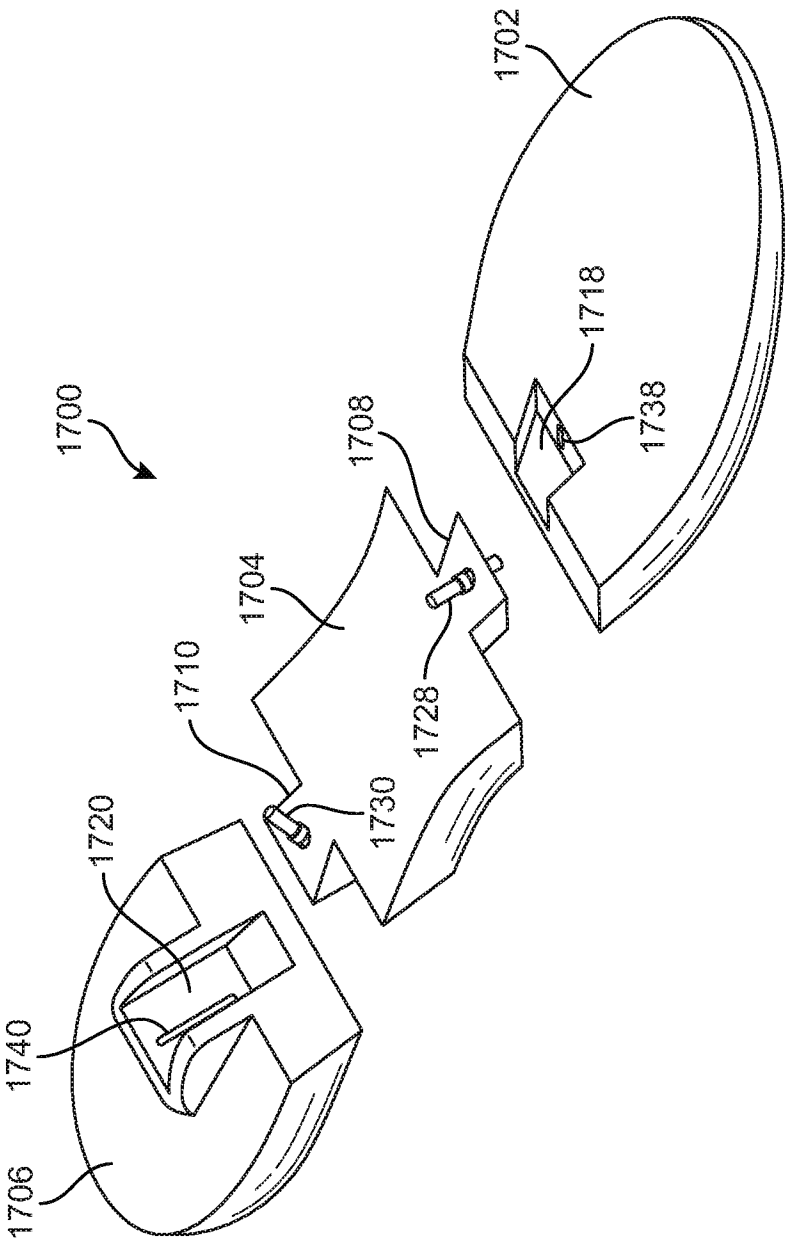


FIG. 17

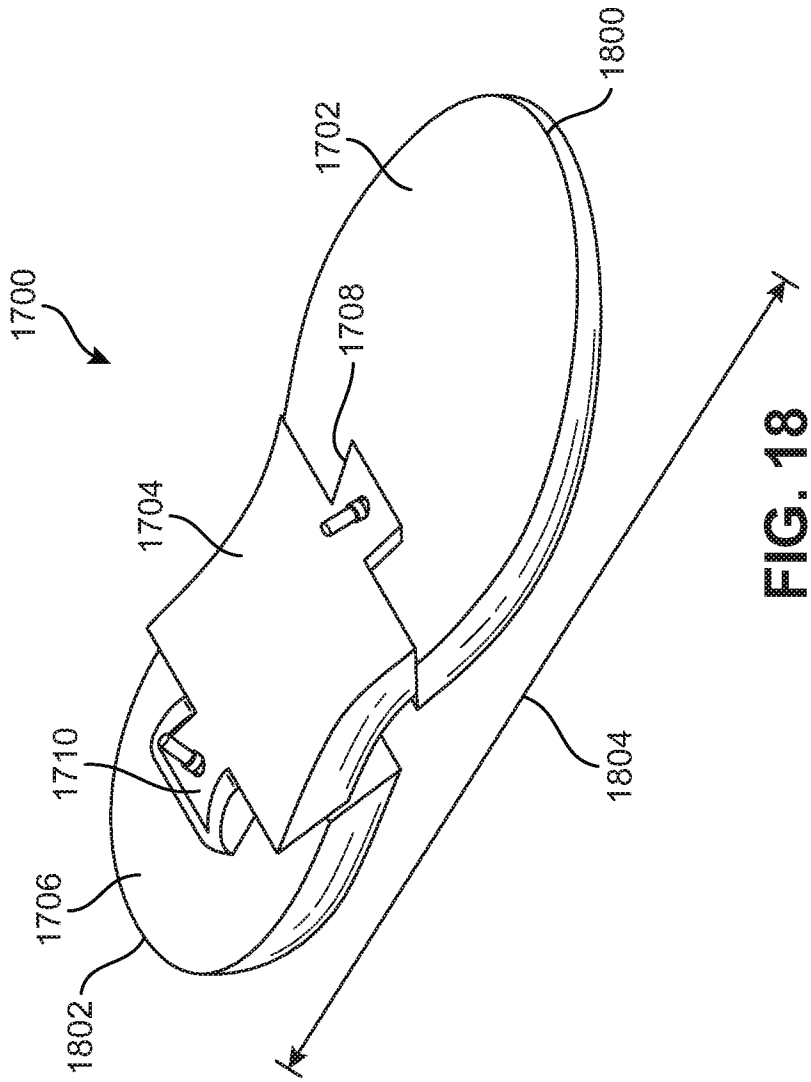


FIG. 18

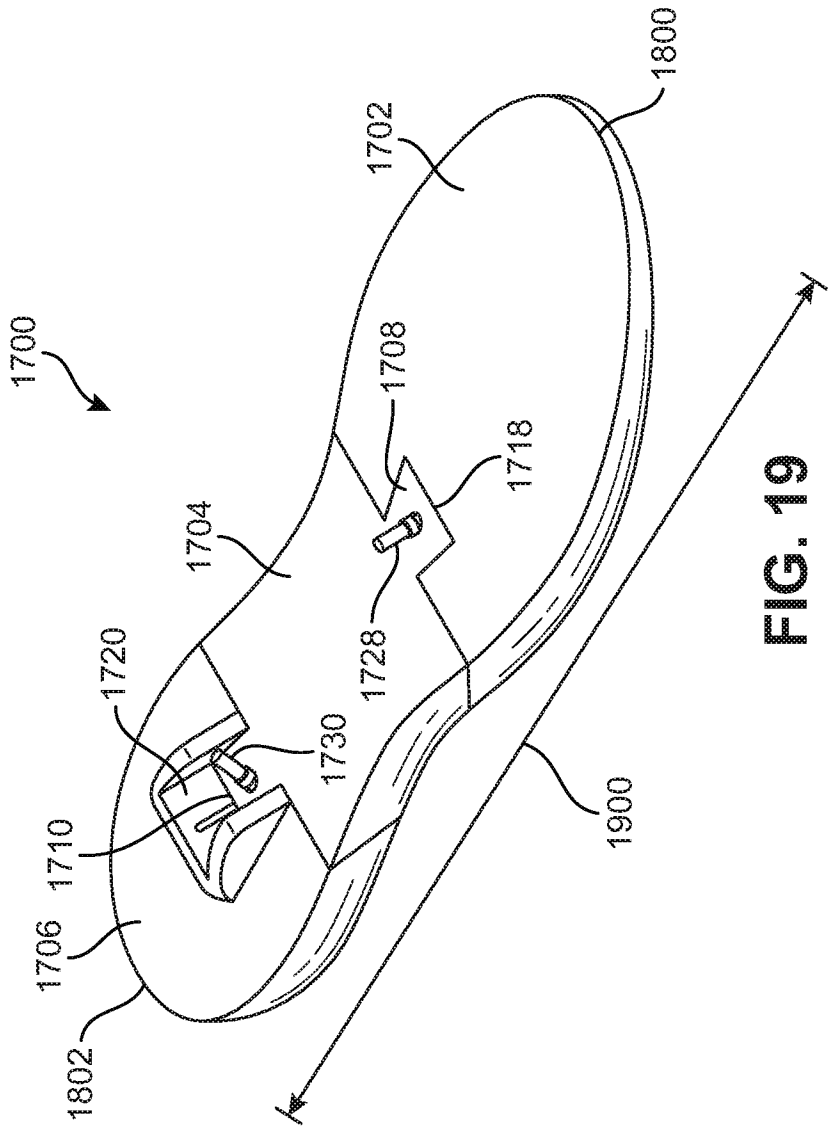

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FIG. 19

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/032059

A. CLASSIFICATION OF SUBJECT MATTER
INV. A43B13/38 A43D3/02 A43D3/06
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 A43D

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 994 637 A1 (BOURDIER HENRI JOSEPH [FR]) 28 February 2014 (2014-02-28)	1-6
A	the whole document	13-20
A	DE 80 00 603 U1 (CLASSER WERNER) 26 June 1980 (1980-06-26) page 3, lines 22-26; figure 3	1-6, 13-20
A	US 2007/062068 A1 (LI PEI S [TW]) 22 March 2007 (2007-03-22) figures 3,4	1-6, 13-20
A	US 2006/123665 A1 (COVATCH CHARLES E [US]) 15 June 2006 (2006-06-15) paragraphs [0026], [0040], [0041]; figures 1,2	1-6

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"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	Date of mailing of the international search report
25 August 2016	05/09/2016

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Duquénoy, Alain

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2016/032059

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CH 580 400 A5 (ODERMATT ALOIS) 15 October 1976 (1976-10-15) column 1, lines 28-32,39-42 column 2, lines 1-3 -----	13-20
A	BE 392 450 A (LIPMAN) 31 December 1932 (1932-12-31) figures 1-3 -----	13-20
A	JP 2001 299407 A (REGAL CORP) 30 October 2001 (2001-10-30) abstract -----	1-6

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/032059

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 7-12
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 7-12

Item III

Reasoned statement with regard to incomplete search

1 In view of the large number of independent claims (4 independent product claims and one independent method claim) and also the wording of the claims presently on file, which render it difficult, if not impossible, to determine the matter for which protection is sought, the present application fails to comply with the clarity and conciseness requirements of Article 6 PCT (see also Rule 6.1(a) PCT) to such an extent that a meaningful search is impossible.

2 In the present case and prima facie, the claimed subject-matters are so numerous and different that they simply preclude the detailed analysis necessary to come to a firm conclusion regarding to the essential technical features of the invention and also the unity of the present application.

3 Independent claim 7 differs from independent claim 1, in that it is drafted by means of removing features and/or adding features , thus lacking conciseness and clarity about the subject-matter to be searched.

4 Consequently, the complete search can be carried out only for those parts of the application which do appear to be clear and concise (Art. 6 PCT), namely independent claim 1 (product claim), independent method claim 13 and their dependent claims 2-6, 14-20.

*****

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2016/032059

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2994637 A1	28-02-2014	NONE	
DE 8000603 U1	26-06-1980	NONE	
US 2007062068 A1	22-03-2007	NONE	
US 2006123665 A1	15-06-2006	NONE	
CH 580400 A5	15-10-1976	AT 339774 B CH 580400 A5	10-11-1977 15-10-1976
BE 392450 A	31-12-1932	NONE	
JP 2001299407 A	30-10-2001	JP 4614498 B2 JP 2001299407 A	19-01-2011 30-10-2001