Footwear sole assemblies including a midsole plate and a heel insert and associated methods are disclosed herein. In one embodiment, for example, a sole assembly includes an outsole coupled to a midsole plate. The midsole plate can include a first plate portion and a second plate portion spaced apart from one another to define a cavity at a heel portion of the midsole plate. The cavity can be configured to receive an insert. The second plate portion can be proximate to the outsole, and the first plate portion can be spaced apart from the outsole. The first plate portion can include an opening extending through the heel portion. The sole assembly can further include a midsole pad coupled to the midsole plate and configured to contact the insert via the opening.
FIG. 2
FOOTWEAR WITH SOLE ASSEMBLY HAVING MIDSOLE PLATE AND HEEL INSERT AND ASSOCIATED METHODS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a U.S. Non-Provisional Patent Application that claims the benefit of and priority to US Provisional Patent Application No. 61/534,328, titled Footwear With Sole Assembly Having Midsole Plate And Heel Insert And Associated Methods, filed Sep. 13, 2011, and which is incorporated herein by reference thereto.

TECHNICAL FIELD

[0002] The present disclosure is directed generally to footwear, and more particularly to sole assemblies that include a midsole plate and a heel insert, and associated methods.


[0004] Articles of footwear have been designed for use in a wide variety of physical activities including walking, running, hiking, trekking, hunting, backpacking, and other indoor and outdoor activities. Footwear is typically constructed from an upper connected to a sole assembly. The sole assembly has an outsole, a midsole, and an insole made from materials that provide a comfortable, durable, and stable platform for a particular activity. For example, hiking boots are typically designed to provide a wearer with suitable comfort and support for hiking or walking on uneven or rough terrain.

[0005] 2. Summary

[0006] The present disclosure is directed generally to footwear with a sole assembly that overcomes drawbacks of the prior art and provide other benefits. At least one embodiment of the disclosure provides a footwear assembly system for use in manufacturing articles of footwear. The system has a plurality of inners, including a first upper and a second upper, and a plurality of midsole plates each having a midsole arch portion between a midsole footport portion and a midsole heel portion. Each midsole plate has top and bottom plates in at least the midsole heel portion and is spaced apart from each other to define a cavity with open sides. The top and bottom plates are connected to each other at a forward end and diverging away from each other as the top and bottom plates extend rearwardly relative to the midsole arch portion. The top and bottom plates are configured to elastically move toward each other under compressive forces applied to the midsole plate during use of the footwear. The system has a plurality of midsole inserts each having a shape corresponding to the shape of the cavity. The inserts include first and second inserts, where the first insert has first absorptive and energy-return characteristics for a first range of activities that apply first compressive loads to the midsole plate. The second insert has second absorptive and energy-return characteristics different than the first absorptive and energy-return characteristics and for a second range of activities that apply second compressive loads to the midsole plate. The first and second inserts are interchangeably positionable in the cavity of each midsole plate during manufacture of footwear designed for the first or second ranges of activities.

[0007] Another embodiment of the disclosure provides a sole assembly for footwear comprising an outsole and a midsole plate coupled to the outsole. The midsole plate has a first plate portion and a second plate portion spaced apart from each other to define a cavity at a heel portion of the midsole plate. The second plate portion is proximate to the outsole, and the first plate portion is spaced apart from the outsole. The first plate portion includes an opening extending through the heel portion, and the cavity is configured to receive an insert. A midsole pad is coupled to the midsole plate and is configured to contact the insert via the opening in the first plate portion.

[0008] Another embodiment of the disclosure provides an article of footwear comprising an upper and a sole assembly connected the upper. The sole assembly has a midsole assembly and an outsole connected to the midsole assembly opposite the upper. The outsole has an outsole footport portion with a toe bumper, and the outsole footport portion has an upper portion facing the midsole assembly. The upper portion has a stepped configuration that provides a shoulder positioned rearward of the toe bumper. The midsole assembly is positioned atop the outsole and has a midsole arch portion between a midsole footport portion and midsole heel portion. The midsole footport portion is supported by the upper portion of the outsole footport portion. The midsole footport portion has a leading edge that abuts the shoulder of the outsole’s upper portion, wherein the leading edge has a thickness substantially the same as a thickness of the shoulder to provide a smooth transition between the upper portion of the outsole and the midsole footport portion.

[0009] The midsole assembly comprises a midsole plate and a midsole insert. The midsole plate has top and bottom plates in at least the midsole heel portion and spaced apart from each other to define a cavity. The top and bottom plates are connected to each other at a forward end and diverging away from each other as the top and bottom plates extend rearwardly relative to the midsole arch portion. The top plate has an aperture therethrough in communication with the cavity, wherein the top and bottom plates are biased away from each other. The midsole insert is disposed in the cavity between the top and bottom plates. The midsole insert has a shape that corresponds to the cavity. The midsole insert has a bottom surface engaging the top plate and a top surface engaging the top plate. The midsole insert is made of a deformable material with selected absorption and energy-return characteristics. The contoured top pad is disposed atop the midsole plate. The contoured top pad has a protrusion disposed in the aperture of the midsole top plate and in engagement with the midsole insert.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 is an isometric view of an article of footwear configured in accordance with an embodiment of the present technology.

[0011] FIG. 2 is an isometric exploded view of a sole assembly configured in accordance with an embodiment of the present technology.

[0012] FIG. 3 is a side cross-sectional view of the sole assembly of FIG. 2.

[0013] FIG. 4 is a back cross-sectional view of the sole assembly of FIG. 2.

DETAILED DESCRIPTION

[0014] Footwear with sole assemblies having a midsole plate and a heel insert, and associated methods for using and making such assemblies are described in detail herein in accordance with embodiments of the present disclosure. In one embodiment, for example, the sole assembly includes a
midsole plate that receives a heel insert to enhance impact absorption and energy return in the heel portion. Certain details are set forth in the following description and in FIGS. 1-4 to provide a thorough understanding of various embodiments of the disclosure. One skilled in the art, however, will understand that the present technology may have additional embodiments, and that other embodiments of the technology may be practiced without several of the specific features described below, while still other embodiments of the disclosure may be practiced with additional details and/or features. Other details describing well-known structures and components often associated with footwear and methods of forming footwear, however, are not set forth below to avoid unnecessarily obscuring the description of various embodiments of the disclosure. Moreover, one of ordinary skill in the art will appreciate that any relative positional terms such as above, below, over, under, etc., do not necessarily require a specific orientation of the footwear assemblies as described herein. Rather, these or similar terms are intended to describe the relative position of various features of the disclosure described herein.

[0018] Many of the details, dimensions, angles, relative sizes of components, and/or other features shown in FIGS. 1-4 are merely illustrative of particular embodiments of the disclosure. Accordingly, other embodiments can have other details, dimensions, angles, sizes, and/or features without departing from the spirit and scope of the present disclosure.

[0019] FIG. 1 is an isometric view of an article of footwear configured in accordance with an embodiment of the present technology. As will be appreciated by one of ordinary skill in the art, the footwear 100 can include any article of footwear (e.g., a shoe, sandal, etc.) and is not limited to the boot shown in FIG. 1. In the illustrated embodiment, the footwear 100 includes an upper 102 attached to a sole assembly 104. The sole assembly 104 includes an outsole 106 coupled to a midsole 108. The sole assembly 104 also includes an arch portion 110 positioned between a heel portion 112 and a forefront portion 114. As described in detail below, the sole assembly 104, and in particular the midsole 108, is configured to enhance stability, impact absorption, and energy return.

[0020] FIG. 2 is an exploded view of the sole assembly 104 of FIG. 1, and FIGS. 3 and 4 are schematic side and back cross-sectional views, respectively, of the sole assembly 104. Referring to FIG. 2, the sole assembly 104 includes the outsole 106 and the midsole 108. The outsole 106 can be made from elastomeric materials (e.g., natural rubber, synthetic rubber, etc.), leather, and/or other suitable footwear materials or combinations of materials. In the illustrated embodiment, the outsole 106 includes an outsole arch portion 214 between an outsole heel portion 216 and an outsole forefront portion 218. The outsole 106 has an exterior tread portion 220 that can have any suitable tread pattern for providing traction while walking or running on various terrains. The outsole forefront portion 218 of the illustrated embodiment includes a toe bumper 222 made from an extension of the outsole 106. The toe bumper 222 can be an integral portion to the outsole material, or it can be a separate component permanently attached to the toe portion of the outsole 106. The illustrated outsole forefront portion 218 has a shoulder 224 positioned rearward of the toe bumper 222 so that the top surface of the outsole is stepped up just rearward of the toe bumper 222.

[0021] In the illustrated embodiment, the midsole 108 is positioned atop the outsole 106 and secured in place using adhesive or other conventional joining techniques. The midsole 108 has a midsole arch portion 230 between a midsole forefront portion 234 and a midsole heel portion 232. In the illustrated embodiment, the midsole forefront portion 234 of the plate 226 includes a leading edge 236 that abuts the shoulder 224 of the outsole 106. The thickness of the midsole 108 at the leading edge 236 is substantially the same as the height of the shoulder 224, such that there is a smooth transition between the midsole forefront portion 234 and the outsole forefront portion 218 at the leading edge 236. This abutting interface acts to help orient the plate 226 with respect to the outsole 106 and/or to securely retain the plate 226 in position on the outsole 106. In other embodiments, the outsole forefront portion 218 has a flat top surface along its full length and it does not have the stepped configuration defined by a shoulder portion. In this embodiment, the leading edge of the midsole forefront portion is immediately adjacent to the toe bumper 222 and/or the forward most end of the outsole forefront portion 218.

[0022] The midsole 108 is a multi-component assembly with a midsole plate 226 ("plate 226") with a split-tail configuration that defines a cavity 242, and a separate midsole insert 244 is contained in the receptacle area of the split-tail arrangement. As shown in FIGS. 2 and 3, the midsole plate 226 is a unitary structure, wherein the split-tail arrangement of the plate 226 is formed by a top plate portion 238 and a bottom plate portion 240 integrally connected to each other and that diverge away from each other as they extend rearwardly from the arch portion 230. In the illustrated embodiment, for example, the top and bottom plate portions 238 and 240 project rearward away from one another at an angle θ to form the substantially wedge-shaped cavity 242. In other embodiments, however, the top and bottom plate portions 238 and 240 can form a cavity having different shapes (e.g., circular, rectangular, etc.) or sizes. In addition, the plate 226 can include additional portions or structures proximate to the heel portion 232 to further define the cavity 242. In further embodiments, the cavity 242 can extend further toward the forefront portion 234 of the plate 226. In still further embodiments, the cavity 242 can extend partially into the heel portion 232.

[0023] The plate 226 can be made from substantially rigid material that can maintain the separation between the top and bottom plate portions 238 and 240. For example, the plate 226 can be formed from stiff plastic, composites, carbon fiber, stiff rubber, metal, metallic alloy, combinations thereof, and/or other suitable footwear materials. In selected embodiments, the top and bottom plate portions 238 and 240 can be formed integrally with the arch and/or forefront portions 230 and/or 234 of the plate 226. In other embodiments, the top and bottom plate portions 238 and 240 can be separate structures permanently joined together using adhesives, welds, molds, and/or other suitable attachment mechanisms to provide a unitary plate structure with the split tail configuration.

[0024] The midsole plate 226 can be constructed to act as a spring plate that has flexibility and that provides efficient energy return to the wearer during the gait cycle. In various embodiments, the first and second portions 238 and 240 of the plate 226 can be spring biased away from one another such that at least one of the portions 238 and 240 can bend and store energy during heel strike and/or during the transition between the flat foot stage and the toe-off stage of the gait cycle. This
stored energy can be used to propel the heel portion 238 of the plate 226 forward as the wearer advances through the gate cycle.

[0022] The insert 244 contained in the cavity 242 of the plate 226 has a shape that corresponds to the shape of the cavity 242, so the insert substantially fills the cavity 242 and connects to the top and bottom plate portions 238 and 240. The insert 244 is formed from a deformable material that can absorb impacts and provide energy return, such as closed-cell foam materials (e.g., ethylvinylacetate (“EVA”)), polyurethane foams, carbon fiber composites, other composites, other suitable footwear materials, and/or combinations of selected materials. In various embodiments, the insert 244 can be configured as a chamber or bladder filled with gases (e.g., air), liquids, and/or other suitable materials or combinations of materials.

[0023] In one embodiment, multiple different inserts 244 can be used with the same midsole plate 226, wherein each insert is configured with the same shape to fit in the cavity 242, but with different characteristics, such as performance characteristics. Accordingly, a midsole 108 can be constructed to provide specified performance characteristics by selecting and inserting the desired insert 244 into the plate’s cavity 242 during manufacturing of the footwear 100 (FIG. 1). For example, the impact absorption, energy return, and/or other characteristics of the insert 244 can be selected for a particular activity. A firmer insert 244 may be selected for a hiking boot than for a walking shoe to provide sufficient energy absorption and return for the higher impact activity.

[0024] Additionally, the structure and properties of the insert 244 may be configured for particular characteristics of the user. For example, the insert 244 can be canted outwardly toward the lateral side of the sole assembly 104 to reduce over pronation. In other embodiments, a substantially deformable insert 244 may be selected for a lighter user to obtain the desired impact absorption upon heel strike, while a less deformable insert may be selected for a heavier user. In further embodiments, the insert 244 may be omitted from the midsole 108 such that the first plate portion 238 can bend freely into the cavity 242 to reduce the stiffness of the heel portion 232 while providing the energy return from the plate 226.

[0025] In various embodiments, the cavity 242 and the insert 244 can have standardized shapes and sizes, such that plates 226 can receive various inserts 244 with different properties and/or structures (e.g., firm inserts, soft inserts, solid inserts, gas-filled inserts, etc.). The standardized plate 226 and insert 244 can be used in sole constructions for a variety of different activities and users. Accordingly, multiple models, styles, or versions of footwear with different performance characteristics can be constructed using the same midsole plate, but with different inserts that match the intended performance characteristics of the footwear. This use of a common part amongst multiple types of footwear can help decrease manufacturing cost of the footwear. In addition, achieving different performance characteristics by selecting and inserting a different insert 244 into the plate’s cavity 246 can greatly simplify portions of the manufacturing process, as well as reducing the cost of the footwear.

[0026] In one embodiment, performance characteristics of the footwear can also be provided by features of the midsole plate 226. For example, the arch portion 230 of the plate 226 can include a plurality of ribs 248 that add stiffness to the plate 226. The plate 226 in the illustrated embodiment, for example, includes five elongated ribs 248 that extend between the forefoot portion 234 and the heel portion 232. In other embodiments, however, the plate 226 can include a greater or fewer number of ribs 248 and/or the ribs 248 can be longer or shorter. The ribs 248 can be raised structures integrally formed (e.g., molded) and made from the same material as the plate 226. In other embodiments, the ribs 248 can be otherwise formed on the plate 226 and/or include different materials than the plate 226 to provide additional rigidity. For example, the ribs 248 can be formed from a plastic that is more rigid than the plate 226.

[0027] In the illustrated embodiment, the midsole 108 includes a contoured top pad 228 that sits atop the midsole plate 226. The pad 228 has a contoured upper surface configured to connect to the upper 102 of the footwear 100 (FIG. 1). In one embodiment, the pad 228 is a full-length foot pad cemented, molded, or otherwise securely connected to the top surface of the full-length plate 226. The pad 228 is constructed of a durable midsole material such as EVA, other foam or rubber material, or other suitable material. The pad 228 provides support and cushioning to the wearer’s foot.

[0028] The pad 228 includes a heel portion 232 positioned atop the top plate portion 238 of the plate 226. In one embodiment, the top plate portion 238 includes an opening 246 that allows a portion of the pad 228 to engage a portion of the insert 244. As shown in FIG. 3, the midsole 108 can be configured such that the pad 228 contacts the underlying insert 244 via the opening 246 to provide impact absorption and energy return at the heel portion 232. In the illustrated embodiment, for example, the pad 228 includes a protrusion 250 that extends downwardly from the lower surface of the pad 228 and through the opening 246 of the top plate portion 238 and contacts the top surface of the insert 244. In selected embodiments, the protrusion 250 can also engage the edges of the opening 246 to securely attach the pad 228 to the plate 226. In other embodiments, the insert 244, rather than the pad 226, includes a protrusion that projects into the opening 246 to contact the pad 228 and, optionally, secure the insert 244 to the plate 226. In further embodiments, the protrusion 250 can be omitted such that the heel portion 232 of the pad 228 contacts the insert 244 under compression (e.g., during heel strike).

[0029] In the illustrated embodiment, the protrusion 250 positioned in the cavity has substantially the same shape as the opening 246 and the same height as the thickness of the top plate portion 238. Accordingly, the surface of the protrusion 250 is substantially coplanar with the surface of the top plate portion 238. The opening 246 can have any suitable shape. In various embodiments, for example, the opening 246 can have a generally circular or tear drop shape that generally corresponds with the impact area of the wearer’s heel during a heel strike. In other embodiments, the plate 226 can include additional openings in the heel portion 232 in other portions of the plate 226 (e.g., in the forefoot portion 234). The direct interface between the pad 228 and the insert 244 through the opening 246 can provide additional impact absorption at the high impact areas of the heel. In yet another embodiment, the opening 246 in the plate’s top plate portion 238 may be omitted.

[0030] Referring to FIG. 4, in various aspects of the illustrated embodiment, the insert 244 includes concave sidewalls 252. These concave sidewalls 252 can bow inwardly in the direction of the arrows when placed under compression (e.g., heel strike), and thereby prevent the insert 244 from project-
ing beyond the perimeter of the plate 226 or sole assembly 104. Accordingly, the concave sidewalls 252 can reduce the footprint of the sole assembly 104 and keep the sidewalls 252 from pressing or rubbing against adjoining sole structures during the gate cycle. In other embodiments, the sidewalls 252 can be angled inwardly and/or otherwise configured to reduce outward bowing of the insert 244.

[0031] From the foregoing, it will be appreciated that specific embodiments of the technology have been described herein for purposes of illustration, but that various modifications may be made without departing from the spirit and scope of the technology. Further, while various advantages associated with certain embodiments of the disclosure have been described above in the context of those embodiments, other embodiments may also exhibit such advantages, and not all embodiments need necessarily exhibit such advantages to fall within the scope of the disclosure.

I/we claim:

1. A footwear assembly system for use in manufacturing articles of footwear, comprising:
   a plurality of uppers, including a first upper and a second upper;
   a plurality of midsole plates each having a midsole arch portion between a midsole forefoot portion and a midsole heel portion, each midsole plate having top and bottom plates in at least the midsole heel portion and being spaced apart from each other to define a cavity with open sides, the top and bottom plates being connected to each other at a forward end and diverging away from each other as the top and bottom plates extend rearwardly relative to the midsole arch portion, the top and bottom plates being configured to elastically move toward each other under compressive forces applied to the midsole plate during use of the footwear; and
   a plurality of midsole inserts each having a shape corresponding to the shape of the cavity, the plurality of inserts including first and second inserts, the first insert having first absorptive and energy-return characteristics for a first range of activities that apply first compressive loads to the midsole plate, and the second insert having second absorptive and energy-return characteristics different than the first absorptive and energy-return characteristics and for a second range of activities that apply second compressive loads to the midsole plate, the first and second inserts being interchangeably positionable in the cavity of each midsole plate during manufacture of footwear designed for the first or second ranges of activities.

2. The system of claim 1 wherein each midsole plate has an aperture in the top plate in communication with the cavity, and further comprising a plurality of contoured top pads, each top pad having a projection configured to substantially fill the aperture in the top plate and to engage an insert in the cavity.

3. The system of claim 1, further comprising a plurality of outsoles attachable to the midsole plates, wherein each outsole having an outsole forefoot portion with a toe end area and having an upper portion with a stepped configuration that provides a shoulder positioned rearward of the toe end area, and each midsole plate having a leading edge and being positionable on the upper portion of the outsole with the leading edge abutting the shoulder to position the midsole plate on the outsole.

4. The system of claim 1 wherein the shoulder of each outsole having a thickness substantially the same as a thickness of the shoulder to provide a smooth transition between the upper portion of the outsole and the forefoot portion of the midsole plate.

5. The system of claim 1 wherein each of the inserts have a wedge shape.

6. The system of claim 1 wherein each of the inserts have sidewalls extending between the top and bottom plates when the insert is positioned in the cavity, and the sidewalls are concave.

7. The system of claim 1 wherein the top and bottom plates of each midsole plate are integrally connected to each other rearward of the forefoot portion.

8. The system of claim 1 wherein the first insert has a cant configuration to reduce pronation or supination of a wearer's foot.

9. The system of claim 1 wherein the midsole plates each have a plurality of stiffening features positioned in at least one of the forefoot or arch portions.

10. A sole assembly for footwear, comprising:
   an outsole,
   a midsole plate coupled to the outsole, the midsole plate having a first plate portion and a second plate portion spaced apart from one another to define a cavity at a heel portion of the midsole plate, wherein the second plate portion is proximate to the outsole, the first plate portion is spaced apart from the outsole and includes an opening extending through the heel portion, and the cavity is configured to receive an insert; and
   a midsole pad coupled to the midsole plate and configured to contact the insert via the opening in the first plate portion.

11. The sole assembly of claim 10, further comprising the insert positioned in the cavity, and wherein the midsole pad has a projection extending through the opening and engaging a top surface of the insert.

12. The sole assembly of claim 10 wherein the opening in the heel portion has a tear-drop shape.

13. The sole assembly of claim 10 wherein the outsole has a forefoot portion with a toe end and an upper portion facing the midsole assembly, and the upper portion has a stepped configuration that provides a shoulder positioned rearward of the toe end, and the midsole plate has a leading edge abutting the shoulder to position the midsole plate on the outsole.

14. The sole assembly of claim 13 wherein the shoulder of each outsole having a thickness substantially the same as a thickness of the shoulder to provide a smooth transition between the upper portion of the outsole and the forefoot portion of the midsole plate.

15. The sole assembly of claim 10 wherein the cavity is open on medial and lateral sides and further comprising the insert positioned in the cavity, the insert having concave sidewalls extending between the top and bottom plates adjacent to the medial and lateral sides of the cavity.

16. The sole assembly of claim 10 wherein the first and second plate portions are integrally connected to each other rearward of a forefoot portion of the midsole plate.

17. The sole assembly of claim 10 wherein the midsole plate has a plurality of stiffening features positioned in at least one of a forefoot portion or an arch portion of the midsole plate.
18. An article of footwear, comprising:

- an upper and a sole assembly connected to the upper, the sole assembly having a midsole assembly and an outsole connected to the midsole assembly opposite the upper;
- the outsole comprising an outsole forefoot portion with a toe bumper, the outsole forefoot portion having an upper portion facing the midsole assembly, the upper portion having a stepped configuration that provides a shoulder positioned rearward of the toe bumper;
- the midsole assembly being positioned atop the outsole and having a midsole arch portion between a midsole forefoot portion and a midsole heel portion, the midsole forefoot portion being supported by the upper portion of the outsole forefoot portion, the midsole forefoot portion having a leading edge that abuts the shoulder of the outsole’s upper portion, wherein the leading edge has a thickness substantially the same as a thickness of the shoulder to provide a smooth transition between the upper portion of the outsole and the midsole forefoot portion;
- the midsole assembly comprising a midsole plate and a midsole insert;
- the midsole plate having top and bottom plates in at least the midsole heel portion and being spaced apart from each other to define a cavity, the top and bottom plates being connected to each other at a forward end and spaced apart from each other at the top and bottom plates extend rearwardly relative to the midsole arch portion, the top plate having an aperture therethrough in communication with the cavity;
- the midsole insert being disposed in the cavity between the top and bottom plates, the midsole insert having a shape that corresponds to the cavity, the midsole insert having a bottom surface engaging the bottom plate and a top surface engaging the top plate, the midsole insert being made of a deformable material with selected absorption and energy-return characteristics; and
- a contoured top pad disposed atop the midsole plate, the contoured top pad having a protrusion disposed in the aperture of the midsole top plate and in engagement with the midsole insert.

19. The article of footwear of claim 18 wherein the midsole insert is a first midsole insert having a first absorptive and energy-return characteristic selected for a first range of activities, and further comprising a second midsole insert having a second absorptive and energy-return characteristics different from the first absorptive and energy-return characteristics and selected for a second range of activities, wherein the first and second midsole inserts are interchangeably positionable in the cavity during manufacture of the article of footwear to provide the article of footwear designed for a respective one of the first and second range of activities.

20. The article of footwear of claim 18 wherein the insert has concave sidewalls adjacent to edge portions of the top and bottom plates.