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(54) Footwear with protective function against melted metal projection

(57) Apparatus and associated methods relate to a metal splatter protective boot having an upper that includes a one-piece forefoot shield. The one-piece forefoot shield may have an exterior surface made of a flame-resistant woven fabric coated with a rubber and an interior layer made of a non-woven material. The one-piece forefoot shield may have a vamp region and an exterior tongue. The vamp region may cover the entire upper forefoot from the tarsometatarsal joint forward. The exterior tongue may cover the forward facing instep region of the boot's upper. A flexible flame-resistant outsole may attach to the upper. The rubber coated flame-resistant woven fabric may be both flexible and metal-splatter-resistant.

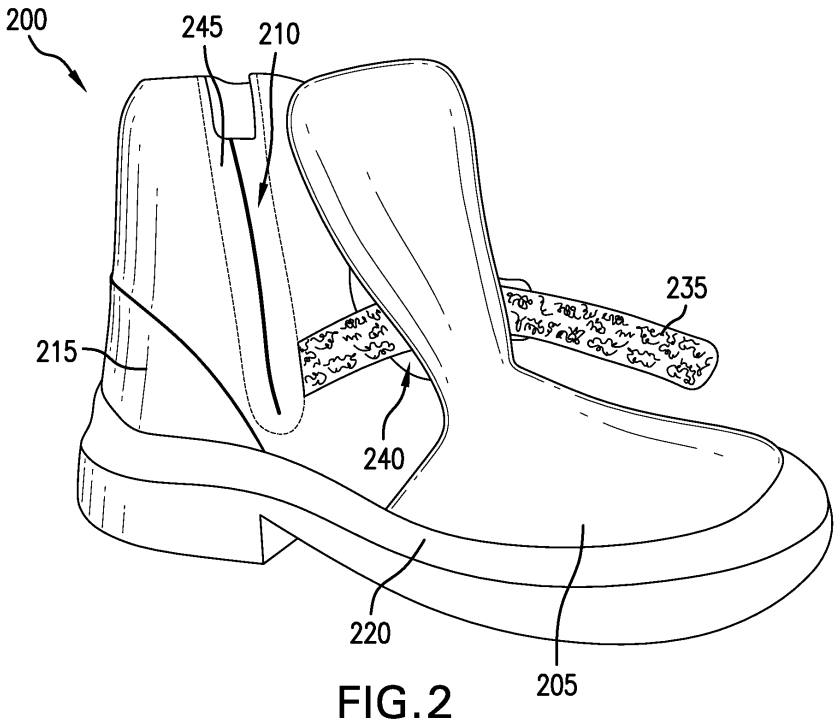

FIG.2

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Description

TECHNICAL FIELD

[0001] Various embodiments relate generally to protective footwear, and specifically to metal-splatter protection.

BACKGROUND

[0002] Many occupations require safety protection. Some of these occupations expose workers to dangerous chemicals. Some of the occupations expose workers to heat or cold. One such occupation is that of welding or metal working. Welders often generate hot metal particles as an undesirable side effect to welding. Sometimes these particles are molten when the strike the ground or other object. These particles can bum combustible materials on contact. Molten splatter can cause damage to clothing and can even cause serious bums to the skin. Welders may wear protective clothing and eyewear to prevent injuries arising from molten metal pieces. Metal workers may also generate hot metal particles. When a metal worker grinds a metal object, tiny shards of hot metal may be projected from the grinding wheel. These hot pieces of metal can similarly cause damage to clothing and can bum the skin.

SUMMARY

[0003] Apparatus and associated methods relate to a metal splatter protective boot having an upper that includes a one-piece forefoot shield. The one-piece forefoot shield may have an exterior surface made of a flame-resistant woven fabric coated with a rubber and an interior layer made of a non-woven material. The one-piece forefoot shield may have a vamp region and an exterior tongue. The vamp region may cover the entire upper forefoot from the tarsometatarsal joint forward. The exterior tongue may cover the forward facing instep region of the boot's upper. A flexible flame-resistant outsole may attach to the upper. The rubber coated flame-resistant woven fabric may be both flexible and metal-splatter-resistant.

[0004] Various embodiments may achieve one or more advantages. For example, some embodiments may provide improved flexibility of the foot. Some exemplary protective footwear may be light in weight. In an exemplary embodiment, a welder's boot may be comfortable when working in a kneeling position. The boot may, for example, readily flex at a toe-joint of a wearer. In some embodiments, a protective shield may prolong a shoe's life by preventing hot particles from burning the shoe. In some embodiments, the protective shield may be inexpensive to manufacture. In some embodiments, the wearer may easily clean metal particles from the boot.

[0005] The details of various embodiments are set forth in the accompanying drawings and the description below. Other features and advantages will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. 1 depicts an exemplary welding application for metal-splatter protective boots.

[0007] FIG. 2 depicts an exemplary metal-splatter protective boot.

[0008] FIG. 3 depicts an exemplary metal-splatter protective boot with extended protective vamp.

[0009] FIG. 4 depicts a worker flexing an exemplary metal-splatter protective boot.

[0010] FIG. 5 depicts a cross-section of exemplary protective layers used in the protective vamp of a metal-splatter protective boot.

[0011] FIG. 6 depicts a schematic of the skeletal bones of the foot in relation to an exemplary metal-splatter protective shield.

[0012] Like reference symbols in the various drawings indicate like elements.

DETAILED DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0013] To aid understanding, this document is organized as follows. First, an exemplary metal-splatter resistant boot is introduced with reference to FIG. 1. In this figure an exemplary welding application of such a metal-splatter resistant boot is shown. Second, with reference to FIGs. 2-3, exemplary embodiments that illustrate various aspects of metal-splatter protection are discussed. Then, with reference to FIG. 4, comfort and flexibility of exemplary protective materials are described. Finally, with reference to FIG. 5, explanatory discussion of various exemplary materials used in metal-splatter protection is described.

[0014] FIG. 1 depicts an exemplary welding application for metal-splatter protective boots. In FIG. 1, a welding scene 100 includes a welder 105 who is generating a spray of hot metal 110. The hot metal 110 is falling to the floor 115 nearby shoes 120 worn by the welder 105. The welder's shoes 120 have a protective shield 125 which may prevent the hot metal from damaging the shoes 120. The protective shield may have a vamp region 127 and an external tongue 130. The vamp region may protect the upper forefoot of the shoe from damage from the molten metal spray 110. The external tongue 130 may prevent the hot metal 110 from damaging an instep region 135 of a shaft 140 of the boot. The external tongue 130 may be cinched to the shoe 120 by a closure strap 145. The closure strap 145 may be received by the external tongue 130 via an aperture (not depicted in FIG. 1). In this way, the closure strap 145 may be protected from the spray of hot metal 110 by the external tongue 130 which it secures. Any stitching that may be used within the protective shield 125 or to attach the protective shield 125 to the shoe 120 may be covered by a molded outsole

150 or by the protective shield 125 itself. The protective shield 125 may have a flexible and yet durable construction of rubber coated woven aramid fibers upon inner non-woven heat isolative fibers. The welder's shoes 120 may be both metal-splatter protective and yet comfortable to wear.

[0015] FIG. 2 depicts an exemplary metal-splatter protective boot. In FIG. 2, an exemplary metal-splatter protective boot 200 includes a protective shield 205, a shank 210, a heel counter 215, and an outsole 220. The protective shield 205 may be constructed of a material that protects the wearer from hot metal sparks. The protective shield 205 may have an external layer of woven fibers, which may provide flexibility, coated with a rubber, for example. The protective shield may have an internal layer of a non-woven fabric of heat-isolative material, for example. The protective layer may have a vamp region 225 attached to an external tongue 230. The vamp region 225 may completely cover the forefoot of a wearer from the medial side of the foot to the lateral side of the foot. The vamp region 225 may have not exposed stitching. The external tongue 230 may be secured to the boot 200 using a cinch strap 235. The external tongue 230 may be part of the unitary protective shield 205. The external tongue may present a securing aperture 240 through which the cinch strap 235 may travel. The protective boot 200 may have means for securing a foot, such as for example a zipper 245. In some embodiments, the means for securing a foot may include laces. In some embodiments the means for securing a wearer's foot may include buckles. In various embodiments, the means for securing a wearer's foot may be located behind the external tongue 230 of the protective shield 205, for example. In some embodiments, the means for securing the foot may be located on the side of the protective boot 200, for example.

[0016] FIG. 3 depicts an exemplary metal-splatter protective boot with extended protective vamp. In FIG. 3, an exemplary hot-metal protective boot 300 includes an upper 302 and an outsole 307. The upper may include a protective shield 305. The protective shield 305 depicted has an extended vamp region 310. The protective shield 305 may provide protection from hot metal shards which may be incident upon the boot 300. The protective shield includes the vamp region 310 and an external tongue 315. The external tongue 315 in this embodiment may present a wider front profile to offer more protective coverage to an instep region 320 of the protective boot 300. The outsole 307 may be molded to the upper 302. The outsole 307 may be made of a flexible material to permit a wearer to flex the foot. The outsole 307 may cover stitching and thereby may shield stitching from incident particles of molten metal, for example. The protective shield 305 may be stitched to a shank 325 of the upper 302. In some embodiments, the protective shield 305 may be glued to the shank 325 of the upper 302. In some embodiments, the entire upper may be made of a rubber coated metal-splatter protective material.

[0017] FIG. 4 depicts a worker flexing an exemplary metal-splatter protective boot. In FIG. 4, a welder 400 is depicted in a kneeling position. The welder 400 is shown wearing welder's shoes 402, each shoe 402 having a protective shield 404. A back foot 405 is flexing as the welder 400 kneels. The welder 400 may need to remain in this kneeling position for as long as the work takes, for example. The flexed foot may require a toe joint region 410 of a shoe 402 to flex with the foot. The toe joint region 410 may have both a flexible sole 420 and a flexible vamp 425. In various embodiments, the protective shield may have a rubber coated exterior layer. In some embodiments, the rubber coating may be a silicone rubber. In some embodiments, the rubber coating may be a nitrile rubber. In some embodiments, the exterior layer may be rubber impregnated.

[0018] FIG. 5 depicts a cross-section of exemplary protective layers used in the protective vamp of a metal-splatter protective boot. In FIG. 5, a protective shield 500 is depicted in a cross-sectional view. The protective shield 500 has an exterior layer 505 of material and an interior layer 510 of material. The exterior layer 505 may include a woven fabric 515 and a rubber coating 520. The woven fabric 515 may use synthetic fibers, for example. In various embodiments, the synthetic fiber used in the exterior layer 505 may be an aramid fiber. In some embodiments, an aromatic polyamide fiber may be used. In some embodiments, an ultra-high molecular weight polyethylene fiber may be used. The woven fabric 515 may use various fibers that exhibit good fabric integrity at elevated temperatures, for example. In some embodiments, para-aramid fibers may be used in the exterior layer 505. The woven fabric 515 may use various fibers that exhibit good resistance to abrasion, thereby improving the durability of the protective shield. The woven fabric 515 may have around thirty-five yarns in the warp direction. In some embodiments, the woven fabric 515 may have around twenty-five yarns in the warp direction. The woven fabric 515 may have forty-five yarns or more in the warp direction, in some embodiments. The woven fabric 515 may have thirty-five yarns in the weft direction. In some embodiments, the woven fabric515 may have fifty yarns in the weft direction. In an exemplary embodiment, the woven fabric 515 may have twenty yarns in the weft direction.

[0019] The exterior layer 505 may then be coated with a rubber coating. In some embodiments the exterior layer 505 may be immersed or impregnated with a synthetic rubber. In some embodiments, the synthetic rubber may by Nitrile rubber. In some embodiments, the synthetic rubber may be a carboxylated Nitrile rubber, for example. Various embodiments may use a silicone rubber. The surface weight of the synthetic rubber coating may be around 150 grams per square meter. In some embodiments, the surface weight may be only 50 grams per square meter. In an exemplary embodiment the surface weight of the synthetic rubber coating may be 250 grams per square meter or more.

[0020] The interior layer 510 of the protective shield 500 may include a non-woven fabric 525. The non-woven fabric 525 may use synthetic fibers, for example. In various embodiments, the synthetic fiber used in the interior layer 510 may be a polyester fiber. In some embodiments, the synthetic fiber may be a polyamide fiber. In some embodiments, the synthetic fiber may be an aramid fiber. For example, an exemplary embodiment may use Polyethylene fibers in the non-woven fabric 525. Various embodiments may use Polyethylene Terephthalate fibers for the non-woven fabric 525. The non-woven fabric 525 may provide good heat insulation properties. The non-woven fabric 525 may add to a thickness of the protective shield 500. The thickness of the protective shield may be an appropriate thickness for injection molding of an outsole to the protective shield 500. The non-woven fabric 525 may have a weight of 150 grams per meter squared. In some embodiments, the non-woven fabric 525 may be thinner or thicker. In some embodiments, for example the non-woven fabric 525 may have a weight of 250 grams per meter squared.

[0021] FIG. 6 depicts a schematic of the skeletal bones of the foot in relation to an exemplary metal-splatter protective shield. In FIG. 6 a left foot 600 and a right foot 605 are shown in skeletal form. The outline of a welding boot 610 is shown superimposed upon the left and right feet 600, 605. A metal-splatter shield 615 covers the phalanges 620 and the metatarsals 625 completely. The metal-splatter shield 615 may even substantially cover the cuneiform bones 630. A joint 635 between the metatarsals 625 and the cuneiform bones 630 may be called the tarsometatarsal joint 635.

[0022] Although various embodiments have been described with reference to the Figures, other embodiments are possible. For example, exemplary protective layers may be used for shoes or boots. In some embodiments, Nitrile coated woven aramid materials may be used for pants or smocks. In one exemplary embodiment, an article of footwear is completely covered with a protective fabric. In some embodiments, the synthetic rubber coating is applied after stitching so as to protect the stitching itself. In some embodiments, welder's gloves may be made of a metal-splatter protective material. In an exemplary embodiment, a metal-splatter protective shield may cover a steel toed boot, for example.

[0023] A number of implementations have been described. Nevertheless, it will be understood that various modification may be made. For example, advantageous results may be achieved if the steps of the disclosed techniques were performed in a different sequence, or if components of the disclosed systems were combined in a different manner, or if the components were supplemented with other components. Accordingly, other implementations are within the scope of the following claims.

Claims

1. An article of footwear configured to receive a wearer's foot, the article of footwear comprising:

   an upper boot comprising:

   a leather rear upper substantially encircling the ankle;
   a metal-splatter-resistant front upper stitched to the leather rear upper, the splatter resistant front upper having an exterior layer comprising a flame-resistant woven fabric comprising aramid fibers coated with a Nitrile rubber and an interior layer comprising a non-woven fabric of heat-resistant fibers; and,
   an exterior tongue fastener configured to fasten the exterior tongue to the rear upper; and,

   a flexible outsole molded to the upper boot,
   wherein the metal-splatter-resistant front upper has a vamp region and an exterior tongue, the vamp region covering substantially the entire forefoot from approximately the tarsometatarsal joint forward, the exterior tongue shielding a forward facing ankle region of the rear upper from metal splatter,
   wherein the exterior tongue has a securing-strap aperture extending from a lateral side to a medial side of the exterior tongue.

2. The article of footwear of claim 1, wherein the non-woven fabric comprises Polyethylene fibers.

3. The article of footwear of claim 1, wherein the non-woven fabric comprises Polyethylene Terephthalate fibers.

4. The article of footwear of claim 1, wherein the Nitrile rubber coating has a surface weight of greater than 50 gr/m^2.

5. The article of footwear of claim 1, wherein the Nitrile rubber coating has a surface weight of greater than 150 gr/m^2.

6. A article of footwear configured to receive a wearer's foot, the article of footwear comprising:

   an upper boot comprising:

   a rear upper substantially encircling the ankle; and,
   a metal-splatter-resistant front upper stitched to the rear upper, the splatter resistant front upper having an exterior layer

comprising a flame-resistant woven fabric coated with a synthetic rubber and an interior layer comprising a non-woven fabric; and,

a flexible outsole attached to the upper,
wherein the metal-splatter-resistant front upper has a vamp region and an exterior tongue, the vamp region covering the entire forefoot from approximately the tarsometatarsal joint forward, the exterior tongue shielding a forward facing ankle region of the rear upper from metal splatter.

7. The article of footwear of claim 6, further comprising a securing strap for securing the exterior tongue to the rear-upper.

8. The article of footwear of claim 6, wherein the exterior tongue comprises a securing-strap aperture from a medial side to a lateral side of the exterior tongue.

9. The article of footwear of claim 6, wherein the woven fabric comprises aramid fibers.

10. The article of footwear of claim 6, wherein the woven fabric comprises para-aramid fibers.

11. The article of footwear of claim 6, wherein the woven fabric comprises Nomex fibers.

12. The article of footwear of claim 6, wherein the synthetic rubber coating has a surface weight of greater than 50 gr/m^2.

13. The article of footwear of claim 6, wherein the synthetic rubber coating has a surface weight of greater than 150 gr/m^2.

14. The article of footwear of claim 6, wherein the synthetic rubber comprises Nitrile rubber.

15. The article of footwear of claim 6, wherein the synthetic rubber comprises Silicone rubber.

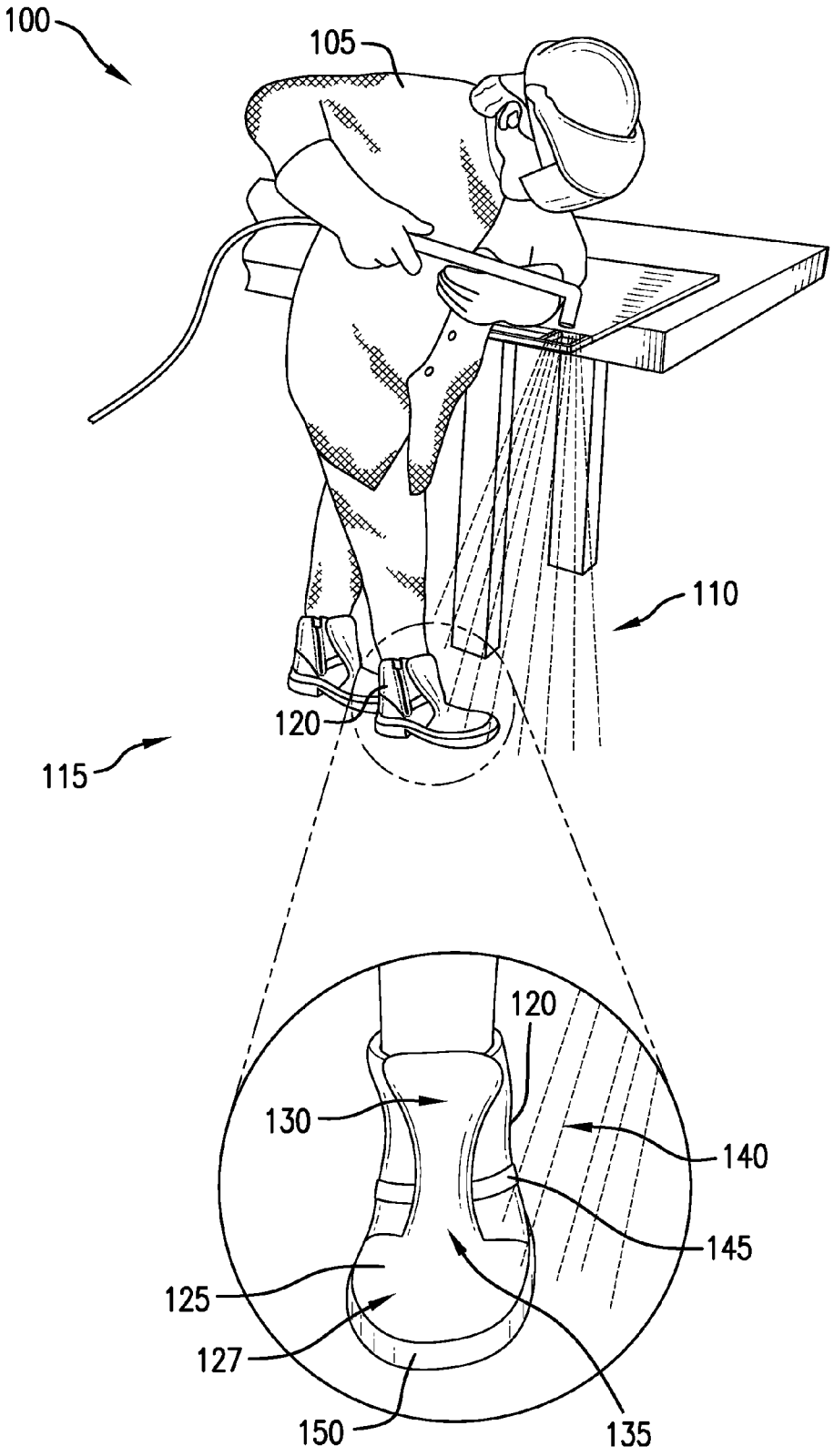

FIG. 1

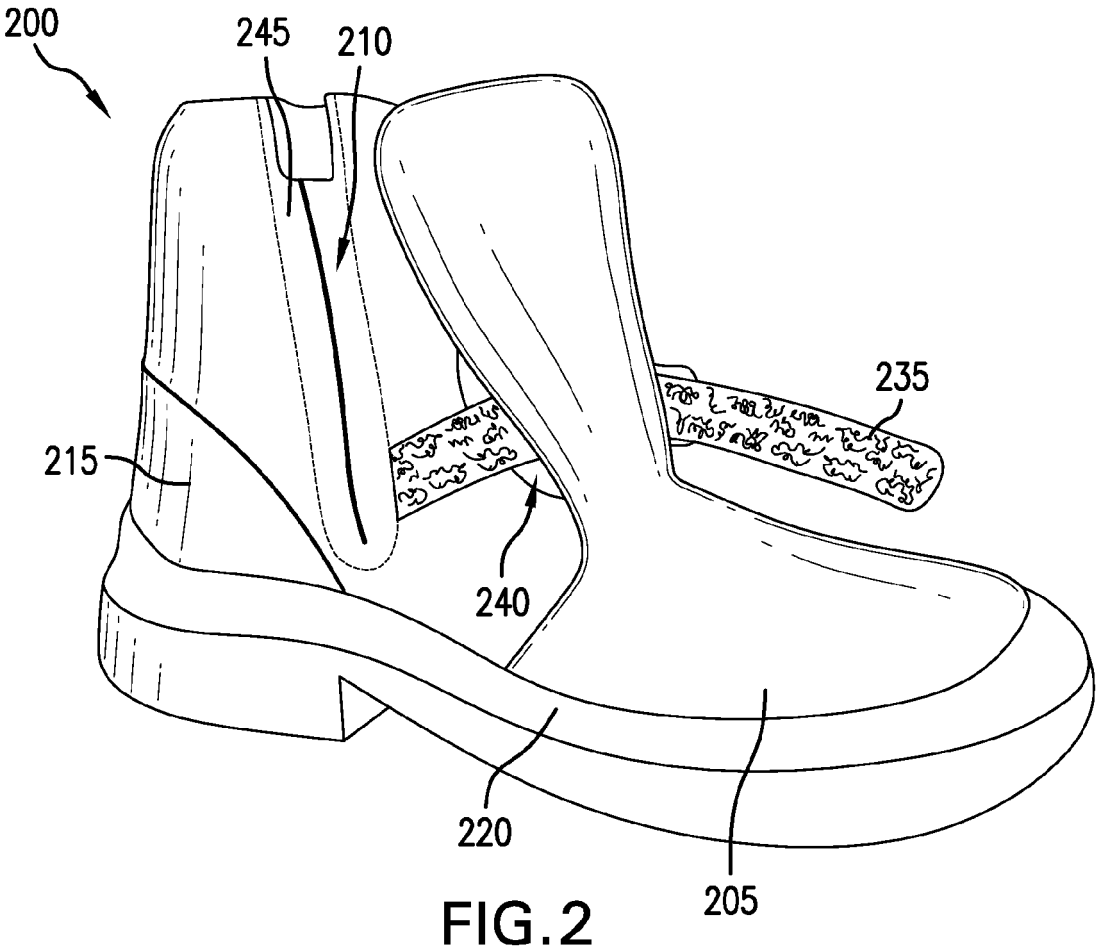

FIG.2

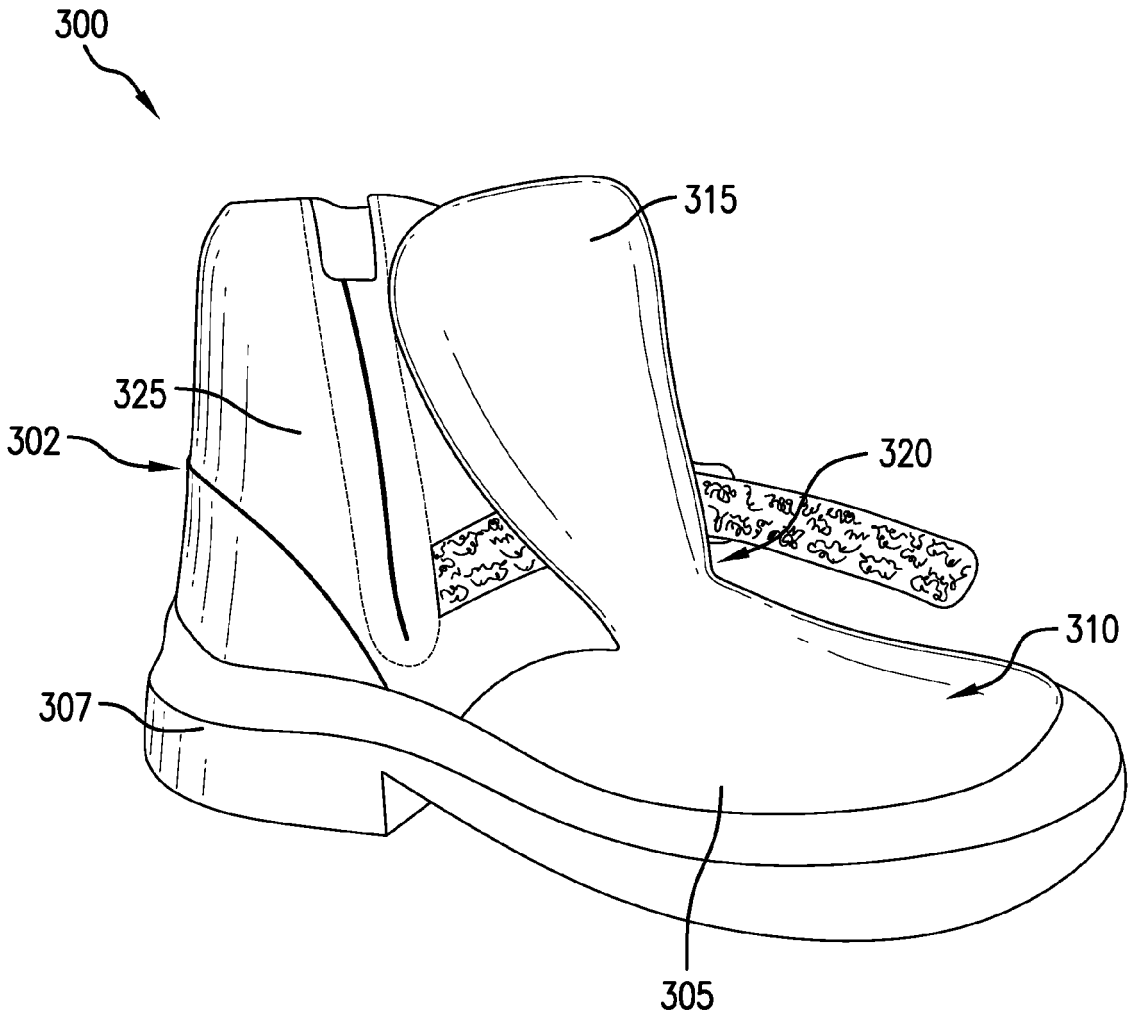

FIG.3

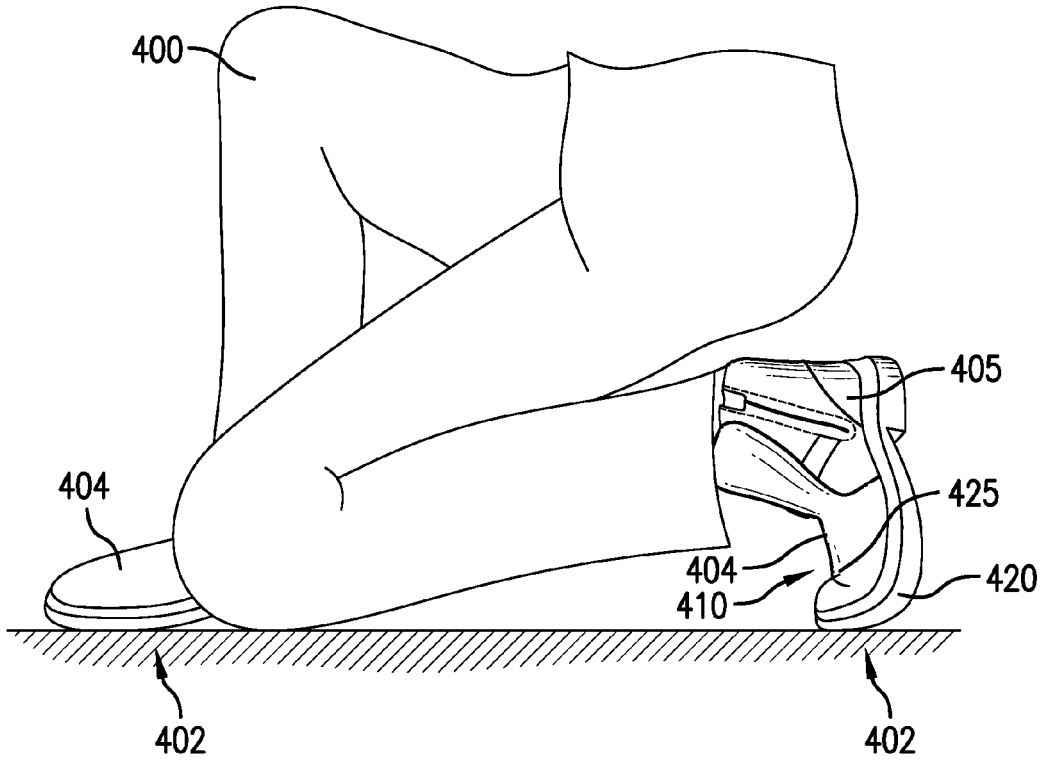

FIG.4

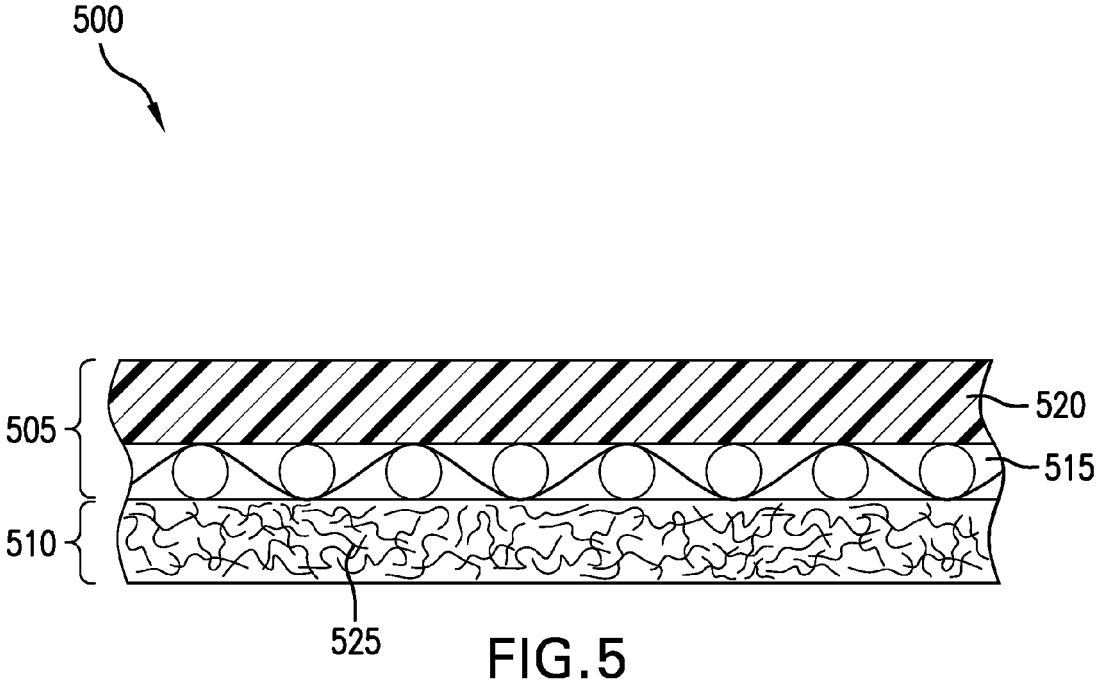

FIG.5

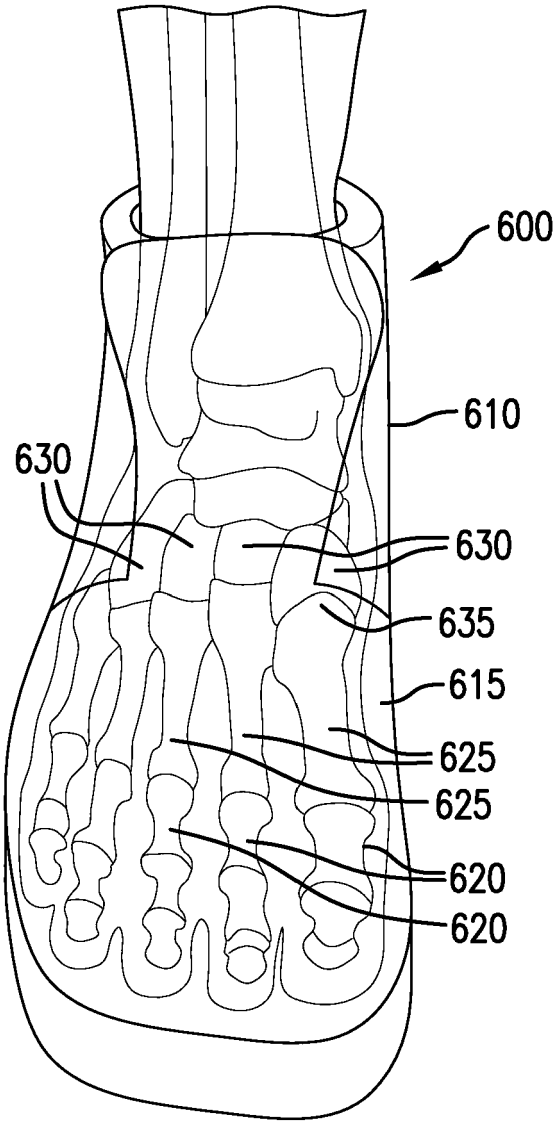

FIG.6A

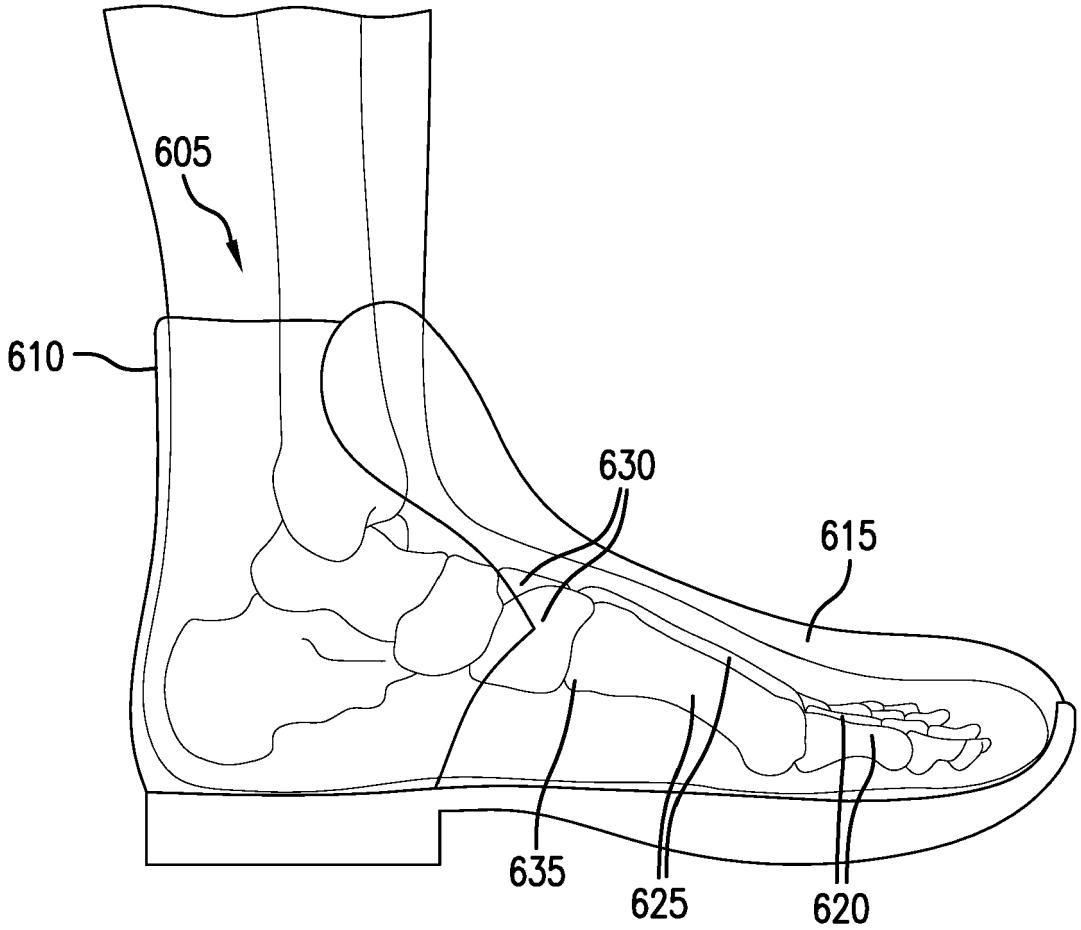

FIG.6B

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PARTIAL EUROPEAN SEARCH REPORT

under Rule 62a and/or 63 of the European Patent Convention. This report shall be considered, for the purposes of subsequent proceedings, as the European search report

Application Number
EP 13 18 3623

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2005/257404 A1 (DAZA JAMES A [US]) 24 November 2005 (2005-11-24) * paragraph [0001] - paragraph [0032]; figures 1-4B *	1	INV. A43B7/34 A43B23/02 A43B9/18 A43C13/14 A43B23/26 A43B7/32
A	US 3 841 004 A (GRAY B ET AL) 15 October 1974 (1974-10-15) * column 1 - column 4, line 48; figures 1-4 *	1	
A	US 3 334 427 A (EDWARDS ROBERT G ET AL) 8 August 1967 (1967-08-08) * column 1 - column 3, line 20; figures 1-5 *	1	
A	WO 00/64292 A1 (NORMAC AGENCIES PTY LTD [AU]; MACLEOD NORMAN WILLIAM [AU]) 2 November 2000 (2000-11-02) * pages 1-10; figures 1-9 *	1	
A	DE 10 2005 026837 B3 (BLUECHER GMBH [DE]) 10 August 2006 (2006-08-10) * paragraph [0001] - paragraph [0065]; figures 1, 2 *	1-3	TECHNICAL FIELDS SEARCHED (IPC) A43B A41D A43C

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INCOMPLETE SEARCH

The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.

Claims searched completely :

Claims searched incompletely :

Claims not searched :

Reason for the limitation of the search:

see sheet C

Place of search	Date of completion of the search	Examiner
The Hague	22 April 2014	Oelschläger, Holger

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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PARTIAL EUROPEAN SEARCH REPORT

Application Number
EP 13 18 3623

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US 2007/039210 A1 (CLARK DOUGLAS E [US] ET AL) 22 February 2007 (2007-02-22) * paragraph [0001] - paragraph [0135]; figures 1-19B * -----	1	TECHNICAL FIELDS SEARCHED (IPC)

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INCOMPLETE SEARCH
SHEET C

Application Number
EP 13 18 3623

Claim(s) completely searchable:
1-5

Claim(s) not searched:
6-15

Reason for the limitation of the search:

No reply to the Invitation pursuant Rule 62a(1) EPC has been received. Hence, the search has been carried out in accordance with Rule 62a(1) EPC, i.e. based on the first group of claims in each category.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 18 3623

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82