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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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(54) **Title**: CUSHIONING SOLE FOR FOOTWEAR

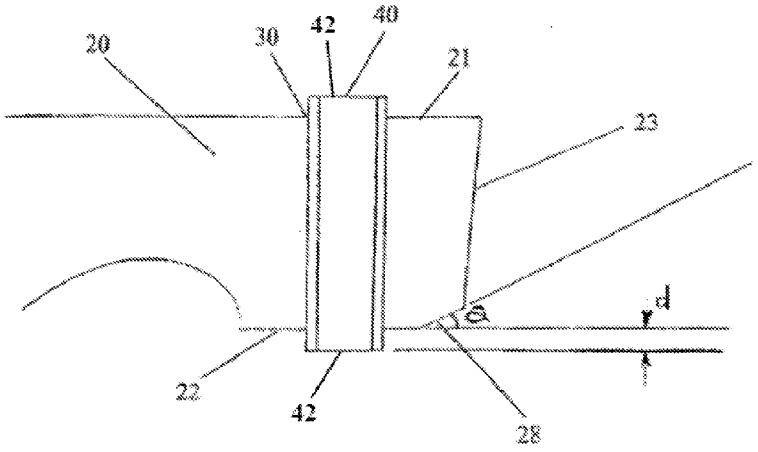


FIG. 2

(57) **Abstract**: A cushioning sole for footwear includes a heel portion, an opening, and a cushioning slide. The heel portion includes a top surface and a bottom surface. The opening extends vertically through the heel portion from the bottom surface to the top surface. The cushioning slide is disposed in the opening and extends out from the top surface and out from the bottom surface.

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CUSHIONING SOLE FOR FOOTWEAR

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is being filed on July 17, 2014, as a PCT International Patent application and claims priority to Serial No. 201410141084.0, filed on April 10, 2014 in China, titled CUSHIONING SOLE FOR FOOTWEAR. To the extent appropriate, a claim of priority is made to the above-disclosed application. Also, to the extent appropriate, the above-disclosed application is hereby incorporated by reference in its entirety.

BACKGROUND

[0002] Gait varies from person to person depending on the biomechanical characteristics or other factors. FIG. **1** shows three typical manners in which the foot contacts the ground, from left to right, pronated, neutral/normal, and supinated. Briefly, in pronation the foot takes on a position in which most of the body weight is loaded onto the inner edge of the foot. On the contrary, in supination the foot takes on a position in which the body weight is loaded onto the outer edge of the foot.

[0003] From the biomechanical viewpoint, it is correct to rest the foot on the ground in the neutral manner. Excessive pronation or supination is the source of many lower extremity problems, including muscle tiredness, knee joint pain, tendinitis, ligament strain, and even neurological damage.

SUMMARY

[0004] The present disclosure relates to correction of excessive pronation/supination. Some embodiments provide a cushioning sole which can be used in any kind of footwear. The sole comprises a heel portion having an opening for receiving a support element in a manner that the heel portion will not touch the ground until the support element is compressed.

[0005] In one embodiment, a cushioning slide, made of a durable material, is inserted in the opening and extends a distance beyond the top surface and the bottom surface of the heel portion, so as to withstand the pressure of the body when walking and running.

[0006] In another embodiment, two cushioning slides are arranged in the opening and are separated by a flexible substrate.

[0007] In an alternate embodiment, the cushioning slide can be made with open ends such that it can be filled with a flexible material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is an illustrative example of a foot in pronated, neutral, and supinated positions.

[0009] FIG. **2** illustrates a side view of the heel portion of the sole.

[0010] FIG. **3** is a rear view of the sole.

[0011] FIG. **4** is a cross section view of a cushioning slide, comprising an upper part and a lower part connected by a strip.

[0012] FIG. **5** illustrates a side view of the heel portion of the sole according to another embodiment of the present disclosure.

DETAILED DESCRIPTION

[0013] Various embodiments will be described in detail with reference to the drawings, wherein like reference numerals represent like parts and assemblies throughout the several views. Reference to various embodiments does not limit the scope of the claims attached hereto. Additionally, any examples set forth in this specification are not intended to be limiting and merely set forth some of the many possible embodiments for the appended claims.

[0014] FIG. **1** is an illustrative example of a foot in pronated, neutral, and supinated positions. In pronation the foot takes on a position in which most of the body weight is loaded onto the inner edge of the foot. On the contrary, in supination the foot takes on a position in which the body weight is loaded onto the outer edge of the foot. In a neutral position the body weight is distributed more evenly across the entire bottom of the foot.

[0015] FIG. **2** illustrates a side view of the heel portion **20** of the sole of one embodiment of the present disclosure. In one embodiment, the sole comprises a heel portion **20** in which an opening **30** is formed, preferably at the center of the heel portion **20**. A cushioning slide **40** is inserted in the opening **30** in a manner that the slide extends a distance beyond the bottom **22** and top **21** surfaces of the heel portion **20**. In a preferred embodiment, during walking, the extended cushioning slide **40** always contacts the ground first. The sole bottom **22** begins to contact the ground only after the cushioning slide **40**

has been compressed. In this way, flexible material is allowed to be used in footwear while retaining stability and durability of the sole. The cushioning slide **40**, when contacting the ground and being compressed, changes the downward pressure applied by the wearer's weight to upward pressure which assists in walking and running. More importantly, the cushioning slide **40** ensures the foot always contacts the ground at the correct location, thereby resisting pronation/supination.

[0016] A person having excessive pronation/supination problem repeatedly puts his/her body weight on a side of the foot. As a result, the periphery of the heel portion **20** of the sole wears out quickly, causing a more severe problem. In preferred embodiments, to avoid this, the heel section **28** is formed at an angle α in the periphery of the heel portion **20** with respect to its bottom surface **22**. It is desirable to incorporate an angle α in the whole back **23** lower end of the heel portion **20**. The angle α is an angle greater than 0 degrees and less than 90 degrees. In some embodiments the angle α is in a range from about 10 degrees to about 60 degrees. In other embodiments the angle α is in a range from about 20 degrees to about 50 degrees.

[0017] In alternative embodiments, the heel lacks a support element and does not contain an opening for receiving that element. In these embodiments, the sole still contains the heel section **28** formed at an angle α in the periphery of the heel portion **20** with respect to its bottom surface **22**. Without wishing to be bound to any particular theory, it is believed that heel section **28** can correct excessive pronation/supination problem all by itself, and that a support element, e.g., cushioning slide **40**, is optional.

[0018] The distance **d** of the cushioning slide **40** beyond the bottom **22** surface of the heel portion **20** should be within a suitable range. If the distance **d** is too small, the cushioning slide **40** may not be able to separate the heel portion **20** of the sole from the ground after a long period of walking . If the distance **d** is too large, the wearer may experience an uncomfortable feeling. In one embodiment, the distance **d** is in a range from about 1/16 inch and 1/4 inch, or about 1/8 inch to retain the cushioning slide's **40** function for a long period without causing an uncomfortable feeling.

[0019] The cushioning slide **40** in some embodiments is made of plastic, rubber or other cushioning materials. The cushioning slide **40** can be formed into different shapes, which can include, but are not limited to, a cylinder, prism or cone. The example shown in FIG. 2 includes a cylindrically shaped cushioning slide. Other embodiments include,

for example, rectangular or elliptical cross-sectional shapes. The opening **30** typically has a cross-sectional shape that matches the cross-sectional shape of the cushioning slide **40**. In some embodiments corners and edges are rounded to reduce pressure points and to reduce the chance of catching on another object.

[0020] In some embodiments, the cushioning slide **40** is slideably retained in the heel portion **20** and is not permanently secured to the heel portion **20**. In this way the cushioning slide is slidable within the opening **30** and can be replaced when worn out. Additionally, in some embodiments the cushioning slide **40** can be made with open ends **42** so that it can be filled with a flexible material to absorb shock in a more efficient way.

[0021] As can be seen from FIG. 2, the upper end of the cushioning slide **40** also extends beyond the top surface **21** of the heel portion **20**. The resistant force of the compressed cushioning slide **40** acts on the wearer's heel, helping the wearer to walk easily.

[0022] FIG. 3 is a rear view of the sole. In some embodiments, the left rear wall **24** and the right rear wall **25** of the heel portion **20** are also angled with an angle α in a tapered configuration with respect to the bottom **22** surface to avoid wear of the sole. In one embodiment, the tapered configuration **29** is applied around the whole bottom **22** heel portion **20** of the sole, including the front portion, so that the edges of the footwear do not touch the ground. In other embodiments, the tapered configuration is applied to whole bottom **22** heel portion **20** of the sole and also to the front portion of the sole.

[0023] FIG. 4 is a cross section view of one embodiment of the cushioning slide **40**, comprising an upper slide portion **51** and a lower slide portion **52** connected by a substrate. In this example, the substrate is a strip **50**. In some embodiments, the strip **50** has at least one cross-sectional dimension greater than the upper slide portion **51** and the lower slide portion **52** extending into sides of the opening. The strip **50** is used to support the cushioning slide **40** and prevent it from moving. In some embodiments the upper slide portion **51** and the lower slide portion **52** are formed of a cushioning material, while the strip **50** is formed of either a cushioning material or a rigid material. In other embodiments, the upper slide portion **51** and the lower slide portion **52** are formed of a rigid material, while the strip **50** is formed of a cushioning material to provide the cushioning for the cushioning slide. The cushioning material is at least a material with greater flexibility than the rigid material.

[0024] FIG. **5** is a side view of another embodiment of the present disclosure. The cushioning slide **41** comprises two slide portions **61** separated by a substrate **60**. In some embodiments, the substrate **60** is a flexible substrate. The upper and lower slides **61** respectively extend beyond the top surface **21** and the bottom surface **22** of the heel portion **20**. The physical property of the flexible substrate **60** can be adjusted according to different ground conditions. The use of flexible substrate **60** increases the compact resistance in a controlled way and further stabilizes the foot.

[0025] Some embodiments include a plurality of flexible substrates having different flexibilities. Also, in some embodiments at least one of the upper and lower portions are removable. The flexible substrates are replaceable within the opening to permit selective insertion of a flexible substrate having a desired flexibility according to the conditions or preferences of the wearer.

[0026] The distance **d** of the cushioning slide **41** beyond the bottom **22** surface of the heel portion **20** should be within a suitable range. If the distance **d** is too small, the cushioning slide **41** may not be able to separate the heel portion **20** of the sole from the ground after a long period of walk. If the distance **d** is too large, the wearer may experience an uncomfortable feeling. In one embodiment, the distance **d** is in a range from about 1/16 inch and 1/4 inch, or about 1/8 inch to retain the cushioning slide's **41** function for a long period without causing an uncomfortable feeling.

[0027] The various embodiments described above are provided by way of illustration only and should not be construed to limit the claims attached hereto. Those skilled in the art will readily recognize various modifications and changes that may be made without following the example embodiments and applications illustrated and described herein, and without departing from the true spirit and scope of the following claims.

WHAT IS CLAIMED IS:

1. A cushioning sole for footwear, the cushioning sole comprising:

a heel portion having a top surface and a bottom surface;

an opening extending vertically through the heel portion from the bottom surface to the top surface; and

a cushioning slide disposed in the opening and extending out from the top surface and the bottom surface.

2. The cushioning sole of claim 1, wherein the cushioning slide is configured such that the heel portion will not touch ground until the cushioning slide is compressed.

3. The cushioning sole of claim 1, wherein when the cushioning slide is worn by a person for one of walking and running, the cushioning slide is configured such that the heel portion will not touch ground until the cushioning slide is compressed.

4. The cushioning sole of claim 1, wherein at least a portion of the cushioning slide is slidably retained within the opening.

5. The cushioning sole of claim 1, wherein a lower end of a back edge of the heel portion is tapered at an angle with respect to a bottom surface of the heel portion.

6. The cushioning sole of claim 5, wherein a periphery of the heel portion is tapered at the angle with respect to a bottom surface of the heel portion.

7. The cushioning sole of claim 6, wherein the angle is greater than 0 degrees and less than 90 degrees.

8. The cushioning sole of claim 6, wherein the angle is in a range from 10 degrees to about 60 degrees.

9. The cushioning sole of claim 6, wherein the angle is in a range from about 20 degrees to about 50 degrees

10. The cushioning sole of claim 1, wherein the cushioning slide extends a distance in a range from 1/16 inch to 1/4 inch beyond the top surface and the bottom surface of the heel portion.

11. The cushioning sole of claim 10, wherein the distance is about 1/8 inch.

12. The cushioning sole of claim 10, wherein the distance is in about 1/8 inch.

13. The cushioning sole of claim 1, wherein the cushioning slide comprises:
an upper portion extending through the top surface;
a bottom portion extending through the bottom surface; and
a substrate disposed in the opening between the upper portion and the bottom portion.

14. The cushioning sole of claim 13, wherein the substrate is a strip configured to retain the cushioning slide within the opening.

15. The cushioning sole of claim 14, wherein the strip has greater rigidity than the upper portion and the lower portion, and wherein the upper portion and the lower portion have greater flexibility than the strip.

16. The cushioning sole of claim 13, wherein the strip has greater flexibility than the upper portion and the lower portion, and wherein the upper portion and the lower portion have greater rigidity than the strip.

17. The cushioning sole of claim 16, further comprising a plurality of flexible substrates having different flexibilities, wherein the at least one of the upper and lower portions are removable, and wherein the flexible substrates are replaceable within the opening to permit selective insertion of a flexible substrate having a desired flexibility.

18. The cushioning sole of claim 1, wherein the cushioning slide has one or more ends that are configured to be filled with a flexible material.

19. A sole for footwear, the sole comprising:

a heel portion having a top surface and a bottom surface, wherein a periphery of the heel portion, including at least side edges and a rear edge, is tapered at an angle with respect to a bottom surface of the heel portion.

20. The sole of claim 19, wherein the angle is in a range from 10 degrees to about 60 degrees.

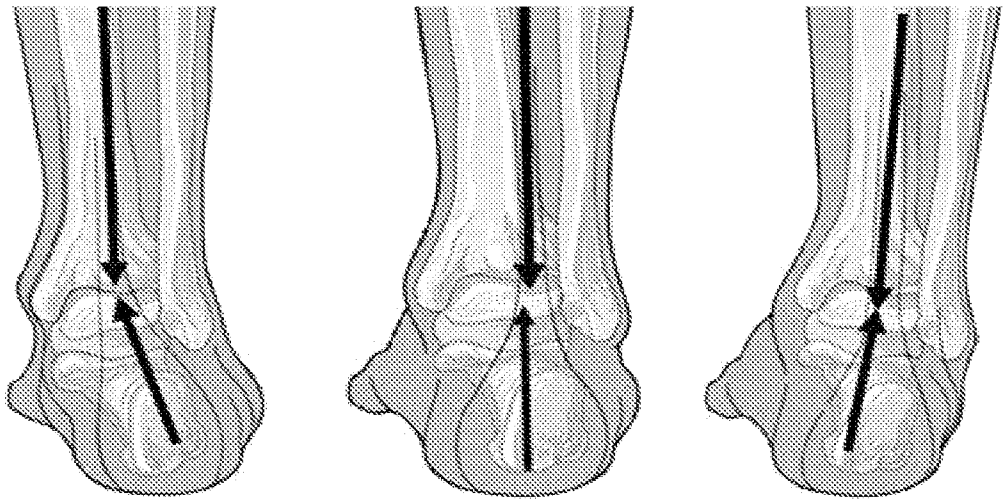

PRONATED
(right foot)
NEUTRAL
(right foot)
SUPINATED
(right foot)

FIG. 1

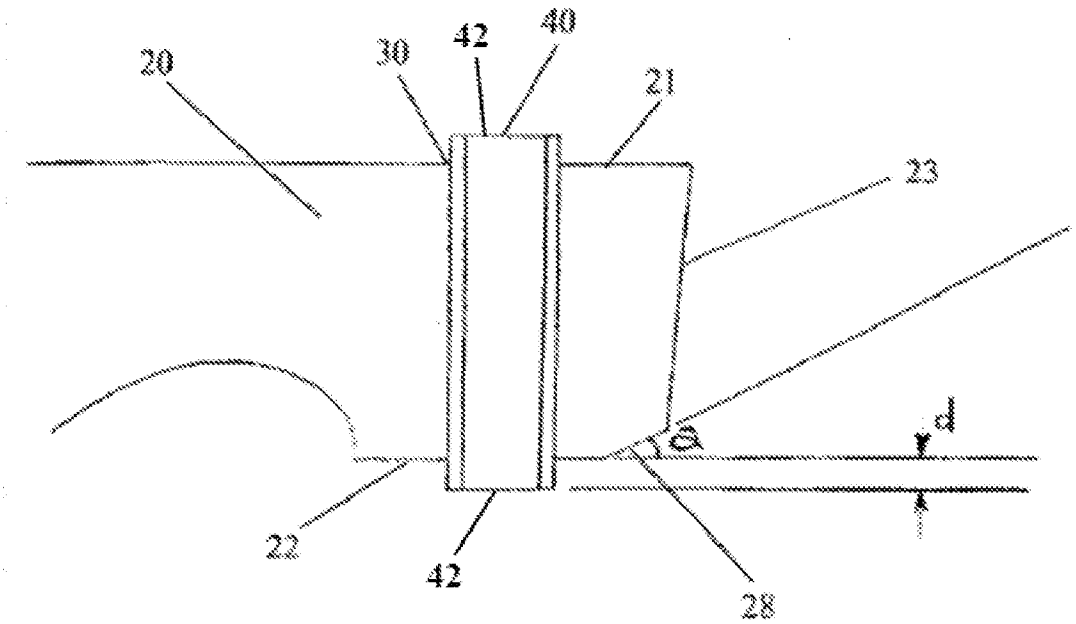

20
30
42
40
21
23
d
22
42
28

FIG. 2

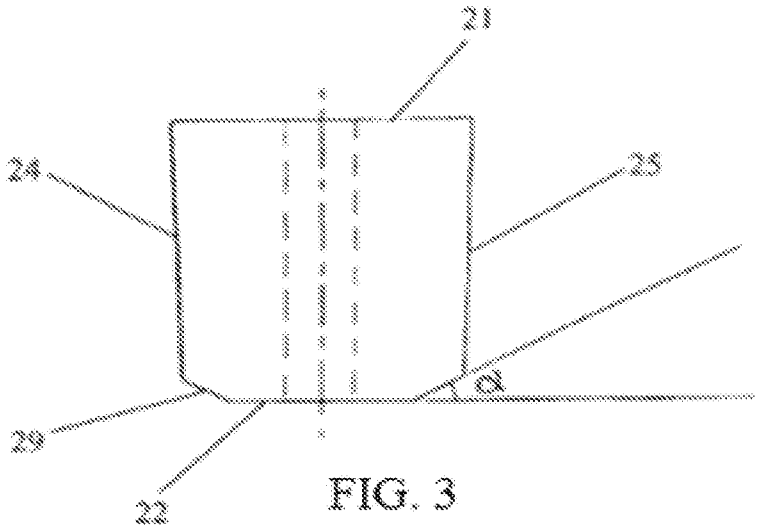


FIG. 3

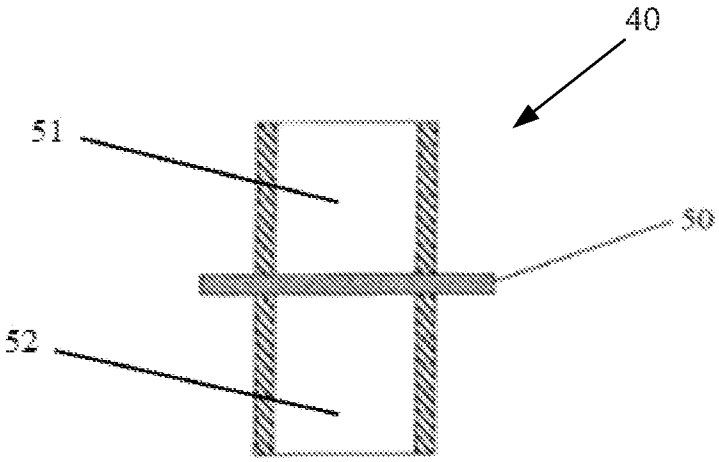


FIG. 4

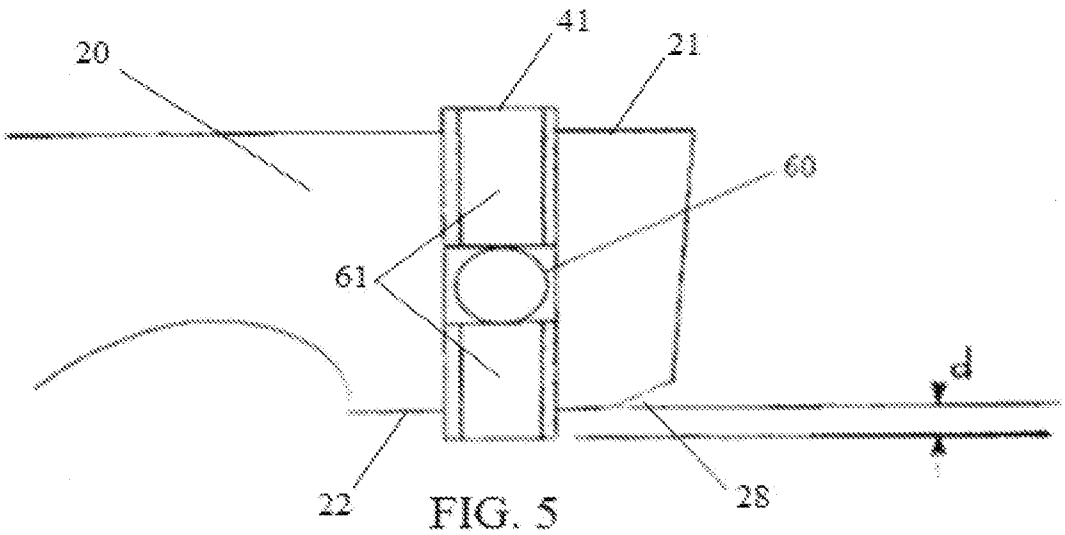


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US14/47081

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A43B 7/06, 13/18, 13/20 (2014.01)
CPC - A43B 7/142, 7/144, 13/181
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)
IPC(8): A43B 7/06, 13/18, 13/20, 13/38 (2014.01)
CPC: A43B 7/142, 7/144, 13/181, 21/26: USPC: 36/28, 44

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)
MicroPatent (US Granted, US Applications, EP-A, EP-B, WO, JP, DE-G, DE-A, DE-T, DE-U, GB-A, FR-A); Google.com,scholar.google.com; DialogPro (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); KEYWORDS: shoe, foot, sole, insole, insert, cushion, shock absorb, plug, knob, retract, spring, compress

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010/0139120 A1 (MANZ G. R. et al.) June 10, 2010; figures 5-6; paragraph [0041]	1, 4, 13-14, 16-17
X — Y	US 2,863,230 A (CORTINA J.) December 08, 1958; figure 6; column 2, lines 35-40	1-3, 10-12, 18 — 5-9
X — Y	US 2006/0117603 A1 (PARK M.) June 08, 2006; figure 4; paragraphs [0012], [0034]	19-20 — 5-9
A	US 1,165,235 A (EMERY E. J.) December 21, 1915; entire document	1-20
A	US 2,844,833 A (ODERMATT A.) July 29, 1958; entire document	1-20
A	US 4,887,367 A (MACKNESS T. et al.) December 19, 1989; entire document	1-20
A	US 5,367,791 A (GROSS A. I. et al.) November 29, 1994; entire document	1-20
A	US 5,493,791 A (KRAMER H.) February 27, 1996; entire document	1-20
A	US 5,860,229 A (MORGENSTERN E.) January 19, 1999; entire document	1-20
A	US 6,205,684 B1 (SNYDER D. C.) March 27, 2001; entire document	1-20
A	US 6,874,251 B2 (MORETTI M. P.) April 05, 2005; entire document	1-20
A	US 7,000,334 B2 (GILLESPIE K. H.) February 21, 2006; entire document	

☒ Further documents are listed in the continuation of Box C. ☐

* 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
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"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
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"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
28 October 2014 (28.10.2014)	21 NOV 2014
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Shane Thomas PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US14/47081

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2003/0061733 A1 (KARSTEN) April 03, 2003; figures 1, 3	1-20