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(54) **ARCH SUPPORT REINFORCEMENT DEVICE**

(76) Inventor: **Kiyong Kim**, Sandy, UT (US)

Correspondence Address:
THORPE NORTH & WESTERN, LLP.
8180 SOUTH 700 EAST, SUITE 200
P.O. BOX 1219
SANDY, UT 84070 (US)

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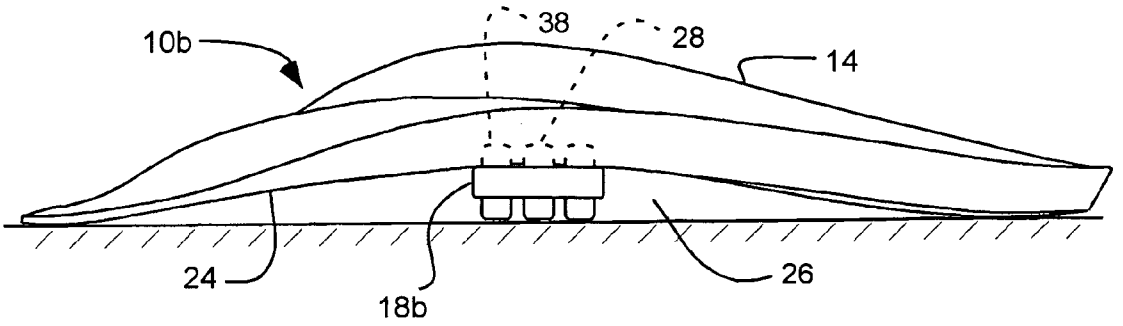
(57) **ABSTRACT**

An arch support device supports an arch of a user's foot. An arch member forms a substantial arc disposed under the arch of the user's foot, and formed of a resilient material defining a spring capable of deflecting under an applied force. An arch reinforcement member is disposed under the arch member, and is formed of a compressible and elastic material capable of compressing during deflection of the arch member.



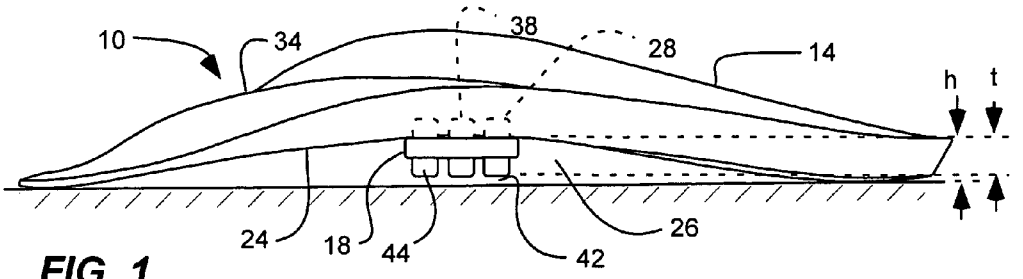


FIG. 1

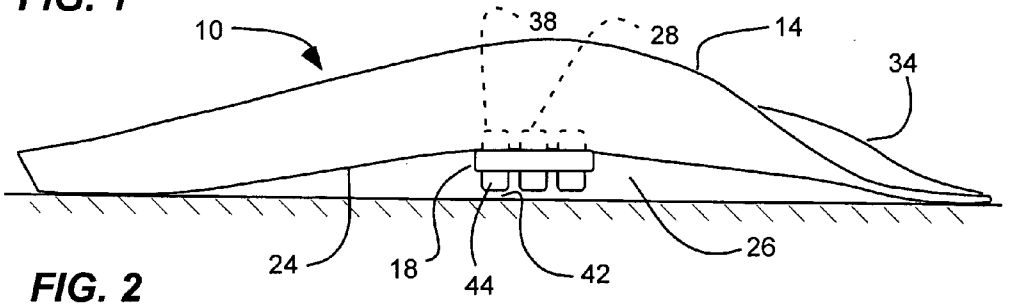


FIG. 2

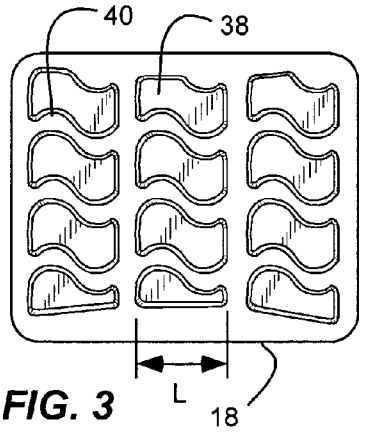


FIG. 3

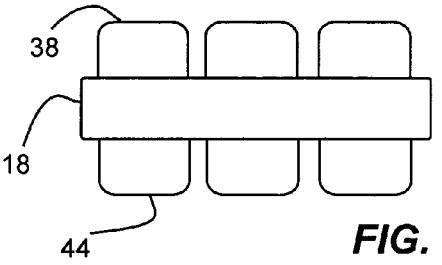


FIG. 4

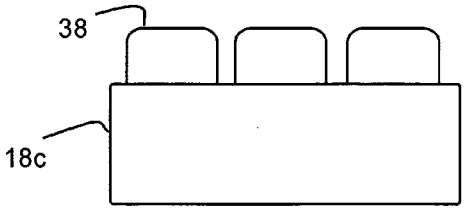


FIG. 6

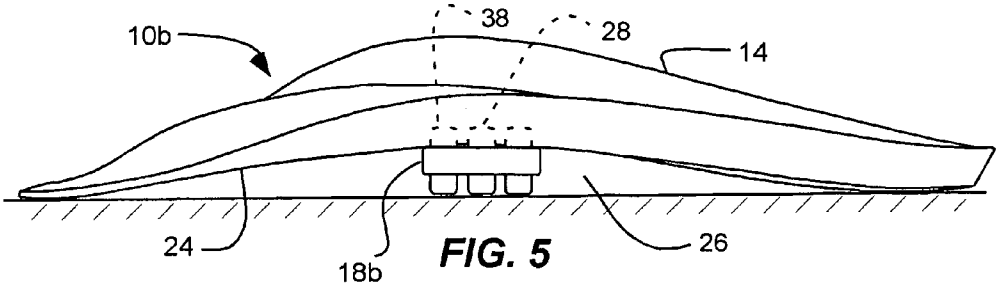


FIG. 5

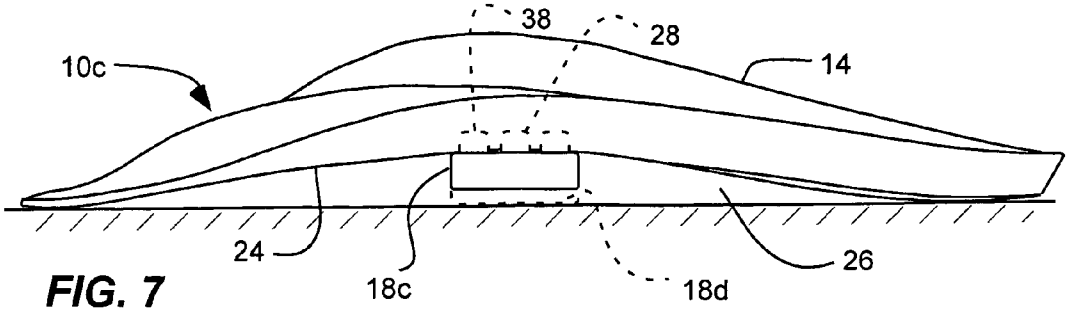


FIG. 7

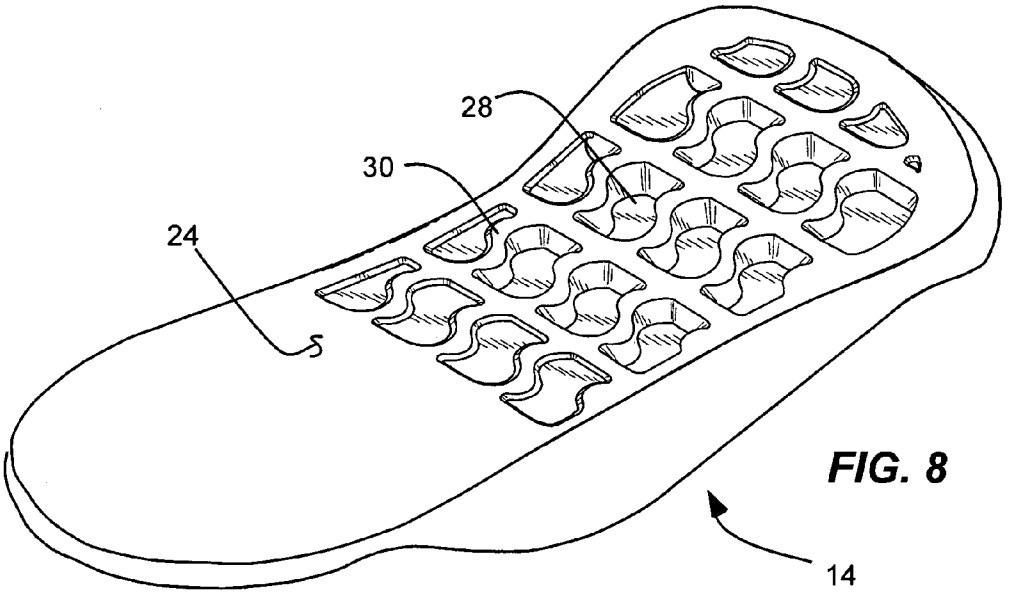


FIG. 8

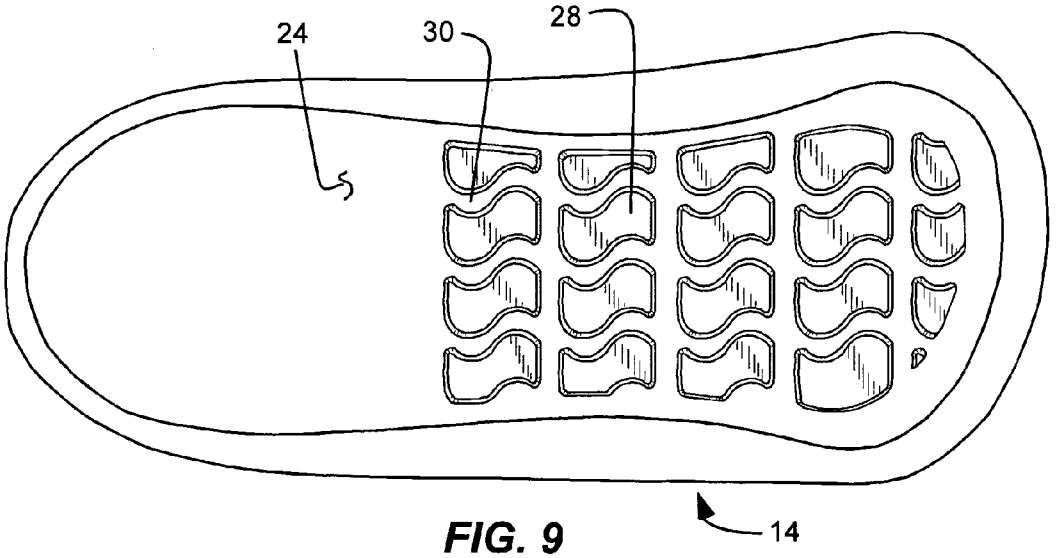


FIG. 9

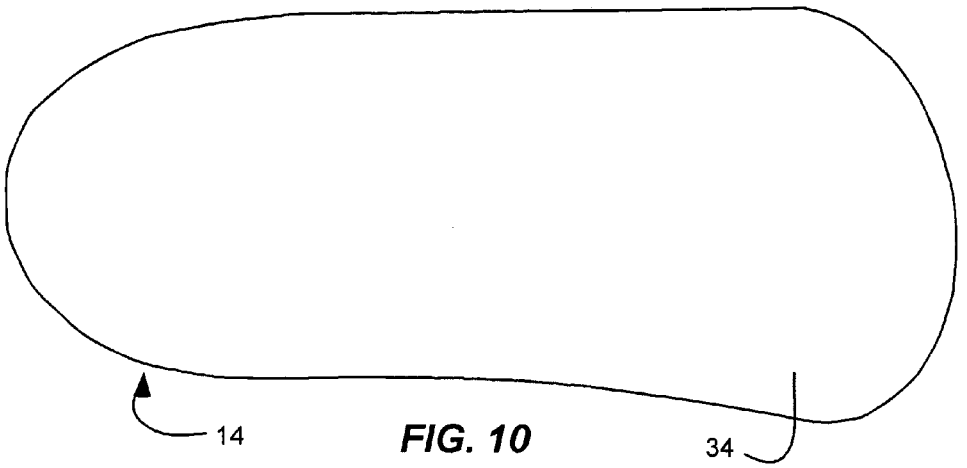


FIG. 10

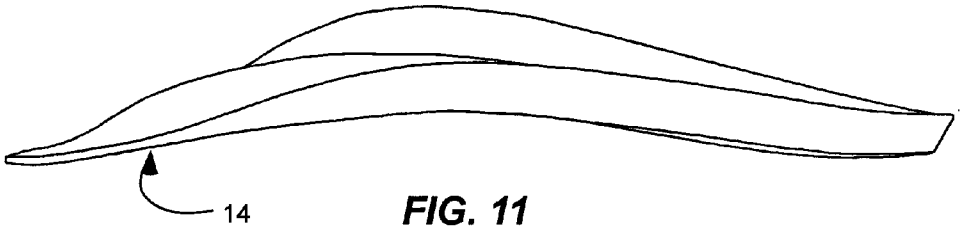


FIG. 11

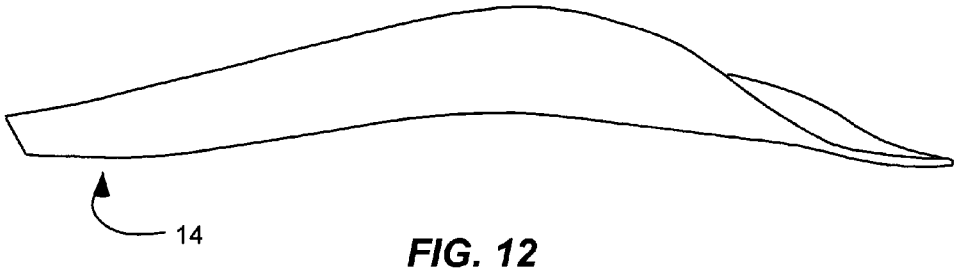


FIG. 12

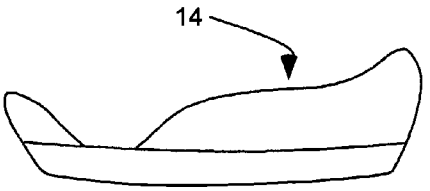


FIG. 13

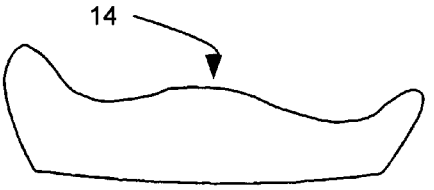


FIG. 14

ARCH SUPPORT REINFORCEMENT DEVICE

PRIORITY CLAIM

[0001] Priority is claimed of U.S. Provisional Patent Application Ser. No. 60/559,795, filed Apr. 5, 2004, which is herein incorporated by reference.

BACKGROUND

[0002] 1. Field of the Invention

[0003] The present invention relates generally to arch supports, shoe inserts, shoe insoles, shoe cushions, orthotics, and the like.

[0004] 2. Related Art

[0005] Arch supports, as well as orthotics, shoe inserts, shoe cushions, etc., can be inserted into a shoe for the purpose of supporting the arch of a user's foot. The use of arch supports can alleviate many types of foot pain associated with poorly supported arches, such as plantar fasciitis. Often, however, these arch supports can have limited effectiveness because of a flattening effect caused by the force applied to the top of the arch support by a person using them. Frequent occurrence of this flattening effect can cause an arch support to weaken and lose its original contoured shape and shorten its effective product life. Improvement of arch supports or orthotics is an ongoing effort.

SUMMARY OF THE INVENTION

[0006] It has been recognized that it would be advantageous to develop an improved arch support. In addition, it has been recognized that it would be advantageous to develop a device for effectively reinforcing an arch support. It has also been recognized that it would be advantageous to develop a device for strengthening and increasing the effectiveness of an arch support. It has also been recognized that it would be advantageous to develop a device for increasing the product life of an arch support.

[0007] The invention provides an arch support device configured to support an arch of a user's foot. An arch member forming a substantial arc can be configured to be disposed under the arch of the user's foot, and can be formed of a resilient material defining a spring capable of deflecting under an applied force. An arch reinforcement member can be disposed under the arch member, and can be formed of a compressible and elastic material capable of compressing during deflection of the arch member.

[0008] In accordance with another more detailed aspect of the invention, the arch member can define an arch cavity underneath the arch member. The arch reinforcement member can have an effective height less than a height of the cavity defining a gap between the arch reinforcement member and a support surface. The arch member can be compressible between: 1) a first position, in response to a relatively smaller applied force, wherein the arch support member deflects under the applied force without engaging the arch reinforcement member; and 2) a second position, in response to a relatively larger applied force, wherein the arch support member deflects under the applied force engaging the arch reinforcement member to compress the arch reinforcement member. The arch member and the arch reinforcement member can have a double resistance response including: 1) a first resistance force due to deflection of the arch member, and 2) a second resistance force due to deflection of the arch member and compression of the arch reinforcement member.

[0009] In accordance with another more detailed aspect of the present invention, matching indentations and protrusions can be formed between the arch support and arch reinforcement member. A plurality of indentations can be formed in a bottom surface of the arch member. A plurality of protrusions can be formed in an upper surface of the arch reinforcement member.

[0010] In accordance with another more detailed aspect of the present invention, the plurality of indentations and protrusions can have a size and walls with a shape longer than the size.

[0011] In accordance with another more detailed aspect of the present invention, the arch reinforcement member can have a second plurality of protrusions, opposite the first plurality of protrusions. The arch reinforcement member can have two orientations with respect to the arch member including: 1) a first orientation with the first plurality of protrusions inserted into the plurality of indentations, and 2) a second orientation with the second plurality of protrusions inserted into the plurality of indentations.

[0012] In addition, the invention provides an arch support device configured to support an arch of a user's foot. An arch member can be configured to be disposed under the arch of the user's foot, and can be formed of a resilient material and capable of deflecting under an applied force, and defining a spring capable of storing energy during deflection. A plurality of indentations can be formed in a lower surface of the arch member, and can have a length. A plurality of walls can be disposed between adjacent indentations, and can have a length greater than a length of the indentations.

[0013] In accordance with another more detailed aspect of the present invention, an arch reinforcement member can be disposed under the arch member, and can including a first plurality of protrusions extending into the plurality of apertures in the arch member. The arch member can define an arch cavity underneath the arch member. The arch reinforcement member can have an effective height less than a height of the cavity defining a gap between the arch reinforcement member and a support surface. The arch member can be compressible between: 1) a first position, in response to a relatively smaller applied force, wherein the arch support member deflects under the applied force without engaging the arch reinforcement member; and 2) a second position, in response to a relatively larger applied force, wherein the arch support member deflects under the applied force engaging the arch reinforcement member to compress the arch reinforcement member. The arch member and the arch reinforcement member can have a double resistance response including: 1) a first resistance force due to deflection of the arch member, and 2) a second resistance force due to deflection of the arch member and compression of the arch reinforcement member. The plurality of indentations and protrusions can have a size and walls with a shape longer than the size. A second plurality of protrusions can be opposite the first plurality of protrusions. The arch reinforcement member can have two orientations with respect to the arch member including: 1) a first orientation with the first plurality of protrusions inserted into the plurality of inden-

tations, and 2) a second orientation with the second plurality of protrusions inserted into the plurality of indentations.

[0014] Furthermore, the invention provides an arch support reinforcement device. A partially compressible and elastic material can be configured to be secured to a bottom of an arch support and in a gap formed between the arch support and a support surface. A plurality of protrusions can extend upwardly configured to be received within a plurality of indentations in the arch support. A second plurality of protrusions can extend downwardly.

[0015] In accordance with another more detailed aspect of the present invention, the plurality of protrusions can have a size and walls with a shape longer than the size.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] Additional features and advantages of the invention will be apparent from the detailed description which follows, taken in conjunction with the accompanying drawings, which together illustrate, by way of example, features of the invention; and, wherein:

[0017] **FIG. 1** is a side view of an arch support with an arch reinforcement in accordance with an embodiment of the present invention;

[0018] **FIG. 2** is an opposite side view of the arch support with the arch reinforcement of **FIG. 1**;

[0019] **FIG. 3** is a top view of the arch reinforcement of **FIG. 1**;

[0020] **FIG. 4** is a side view of the arch reinforcement of **FIG. 1**;

[0021] **FIG. 5** is a side view of the arch support with another arch reinforcement in accordance with an embodiment of the present invention;

[0022] **FIG. 6** is a side view of the arch reinforcement of **FIG. 5**;

[0023] **FIG. 7** is a side view of the arch support with another arch reinforcement in accordance with an embodiment of the present invention;

[0024] **FIG. 8** is a perspective bottom view of the arch support of **FIG. 1**;

[0025] **FIG. 9** is a bottom view of the arch support of **FIG. 1**;

[0026] **FIG. 10** is a top view of the arch support of **FIG. 1**;

[0027] **FIG. 11** is a side view of the arch support of **FIG. 1**;

[0028] **FIG. 12** is an opposite side view of the arch support of **FIG. 1**;

[0029] **FIG. 13** is an end view of the arch support of **FIG. 1**; and

[0030] **FIG. 14** is an opposite end view of the arch support of **FIG. 1**.

[0031] Reference will now be made to the exemplary embodiments illustrated, and specific language will be used herein to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENT(S)

[0032] As illustrated in the Figures, various embodiments of an arch support device **10** including an arch support member **14** and an arch reinforcement member **18** are shown. The arch support can be a shoe insert, shoe insole, shoe cushion, orthotic, and the like. The arch support member can form a broad substantial arc, and can be formed of a resilient elastic material that flexes or bends during use, or as the user's weight is applied thereon. The arch reinforcement member can be comprised of a partially compressible and elastic material, and can be configured for placement between the bottom of the arch support member and a support surface (or shoe or upper inner surface thereof). The arch reinforcement member can be configured for being secured to the bottom of the arch support member. The arch reinforcement member can also be removed from the arch support member and replaced. The arch reinforcement member can be configured for limiting a flattening effect of the arch support member caused by a force that is applied to the top of the arch support member by a user's foot. Furthermore, the arch support and arch reinforcement can provide a double response or cushioning effect, as described below.

[0033] As illustrated in **FIGS. 1-4**, an arch support device, indicated generally at **10**, in accordance with the present invention is shown with an arch support member **14** that is disposable in a shoe forming a spring capable of storing energy during deflection. The arch support member **14** can include a bottom surface **24**, and can define a cavity **26** between the bottom surface and a support surface. The bottom surface **24** can have a plurality of indentations **28** **(FIGS. 8 and 9)** that can extend into the bottom surface **24**. The plurality of indentations **28** can be arrayed or disposed in a matrix across at least a portion of the bottom surface **24**. A plurality of walls **30** can be formed between the indentations **28**. The indentations **28** and walls **30** form a structure that allows the arch support member **14** to be resilient and deflect under an applied load, such as the user's or wearer's weight.

[0034] The indentations **28** can have a size or length L taken along a longitude of the arch support member **14**. (Alternatively, the indentations can have a size or width taken laterally on the arch support member.) The walls **30** can have a length greater than a size or length L of the indentations **28**. Thus, as the arch support member **14** deflects inwardly walls **30** can elongate, with the resilient material of the walls providing resistance and spring effect. Furthermore, the longer walls **30** have an increased surface area, the use of which is described below. The indentations **28** and walls **30** can have various different shapes and sizes. For example, the shapes can be curved or have straight segments. The shapes can be longer or shorter than those shown. There can be more or fewer indentations than those shown. There walls can be aligned longitudinally (as shown), laterally, or diagonally.

[0035] Referring to **FIGS. 1, 2** and **8-14**, the arch support member **14** forms a broad arc that is compressible or

deflectable under an applied load, and which defines a spring capable of storing and returning energy. The arch support member **14** can be formed of a material that is resilient and elastic, such as plastic. The arch support member can be formed by injection molding. An upper surface **34** of the arch support member **14** can be contoured or shaped to receive a user's or wearer's foot, and can include a heel indentation to receive the heel, an arched protrusion to receive the arch, a ball protrusion to receive the ball of the foot, etc. In addition, the arch support member can include a perimeter wall extending substantially around the perimeter of the member to form an indentation to receive the foot. The arch support member can form a primary spring providing a first or primary response or resistance force when deflected. The cavity **26** can be formed below the arch support member or arch portion, and can have a height h.

[**0036**] The arch reinforcement member **18** can be disposed in the cavity **26**, below the arch support member **14** and against the bottom surface **24**. The arch reinforcement member can be formed of a compressible and elastic material, such as a rubber or urethane, capable of compressing during deflection of the arch member. The arch reinforcement member **18** can form a secondary spring, and can provide a secondary response or resistance force when compressed.

[**0037**] The arch reinforcement member **18** can include a first plurality of protrusions **38** that are shaped to match the indentations **28** in the arch support member **14**. Thus, the protrusions **38** can have a shape to match the indentations **28**, and can have an increased surface area so that the arch reinforcement member **18** can be retained on the bottom of the arch support member **10** by a friction fit between the indentations **28** and protrusions **38**. Channels **40** can be formed between the protrusions **38** to receive the walls **30**. Alternatively, the arch reinforcement member **18** can be coupled to the arch support by any appropriate means, including adhesive, hook-and-loop type fasteners, mechanical fasteners, etc.

[**0038**] The arch reinforcement member has an effective height or thickness t defined between the bottom of the arch reinforcement member **18** and the bottom of the arch support member **14**. The height or thickness t of the arch reinforcement member **18** can be less than the height h of the cavity **26** and defining a gap **42** between the arch reinforcement member **18** and a support surface. Thus, the arch support member **14** can be compressible between first and second positions. In the first position, the arch support member **14** deflects a relatively smaller amount in response to a relatively smaller applied force, and without engaging the arch reinforcement member **18**. In the second position, the arch support member **14** deflects a relatively larger amount in response to a relatively larger applied force, and engages the arch reinforcement member to compress the arch reinforcement member. Thus, the arch member and the arch reinforcement member have a double resistance response including a first resistance force due to deflection of the arch member, and a second resistance force due to deflection of the arch member and compression of the arch reinforcement member.

[**0039**] In addition, the arch reinforcement member **18** can include a second plurality of protrusions **44**. The first plurality of protrusions **38** can extend upwardly and can fit into the plurality of indentations **28** in the bottom surface **24** of the arch support member **14**, thereby securing the arch reinforcement member in the space **34**. The second plurality of protrusions **44** can be disposed under the first plurality of protrusions **38** and can extend downwardly toward the support surface. The second plurality of protrusion **44** can also match the indentations **28**. Thus, the arch reinforcement member can be reversible, or have two orientations. The second plurality of protrusions **44** can provide a softer response during use, and may become worn during use, while the first plurality of protrusions **38** can be protected in the indentations **28**. Thus, the arch reinforcement member **18** can be reversed after use. Alternatively, the first and second plurality of protrusions **38** and **44** can be different in size, shape, thickness, number, etc., so that each can provide a different stiffness or response. Thus, the arch reinforcement member **18** can be inverted to customize the softness or stiffness desired.

[**0040**] The protrusions **38** or **44** formed of compressible and elastic material, and the channels **40** therebetween, allow the protrusions to compress. As the protrusions compress, they can expand outwardly into the channels.

[**0041**] Referring to **FIG. 5**, the arch reinforcement member **18***b* described above can have a thickness that substantially equals the height of the cavity **26**, thus eliminating any gap **42**.

[**0042**] Referring to **FIGS. 6 and 7**, the arch reinforcement member **18***c* described above can include only a first plurality of protrusions **38**, but still provide for a gap **42**. Referring to **FIG. 7**, the arch reinforcement member **18***d* described above can include only a first plurality of protrusions **38**, and can have a thickness substantially equal to the height of the cavity to eliminate any gap **42**. The bottom of the arch reinforcement member **18***c* can be flat. Alternatively, the bottom can be shaped to accommodate the surface of the shoe with which it contacts.

[**0043**] The use of a partially compressible material can allow the arch reinforcement member **18** to compress to some degree allowing the arch support member **14** to partially flex and absorb impact when force is applied to the arch support member **14**. However, a partially compressible material can prevent the arch support member from flattening by an undesired amount, defined herein as the "flattening effect." When the flattening effect occurs, the arch support member can loose its ability to properly support the arch of a foot. Excessive occurrence of the flattening effect can stress the material of the arch support member, thereby reducing the effectiveness of the arch support member to provide support to the arch of a user's foot, as well as shortening the effective product life of the arch support member. The arch reinforcement member, with its partially compressible properties, can reduce stress and fatigue in the materials of the arch support, which can increase the arch support member's effectiveness and lengthen the effective product life of the arch support member. The use of an elastic material can allow the arch support member and the arch reinforcement member to spring back from its compressed state after the force applied to the arch support member is removed.

[**0044**] Through repeated use, materials can lose their ability to maintain their original compressible and elastic properties. Accordingly, the partially compressible and elas-

tic material can be made such that it is inexpensive and disposable. Thereby, the arch reinforcement member can be configured such that a user can remove and replace the partially compressible and elastic material **14**. Since the material forming the arch support member can also lose its ability to maintain its original compressible and elastic properties, the user can save costs by replacing the partially compressible and elastic material of the arch reinforcement member instead of replacing the arch support member. Alternatively, the entire arch support device **10** can also be configured to be inexpensive and disposable such that it can be removed and replaced.

[**0045**] Through the use of a partially compressible and elastic material, the arch reinforcement member **18** can help prevent the arch support member **14** from losing its original contoured shape. By helping to maintain the arch support member's **14** shape, the arch reinforcement member **18** can prevent the arch support member **14** from losing effectiveness in the support of the arch of a user's foot. Additionally, by maintaining the arch support member's **14** shape, its effective product life can be lengthened by reducing stress and fatigue in the materials in the arch support member.

[**0046**] The arch reinforcement member and the partially compressible and elastic material can be comprised of various materials and types of construction in order to obtain desired properties. For example, the partially compressible and elastic material can have various degrees of compressibility and elasticity affecting the firmness of the arch support device **10**. The material can be configured to be extremely firm so as to be effectively non-compressible, or it can be configured to be very compressible to allow for a large amount of flexibility in the arch support. Other materials can be used that might absorb fewer odors. Furthermore, the arch support member and the arch reinforcement member can be of various shapes and sizes to accommodate multiple sizes of shoes and arch supports. Alternatively, they can be configured for being cut to size.

[**0047**] The arch support member and/or the arch reinforcement member can also include means for ventilation. For example, holes can be formed through the arch support member and/or the arch reinforcement member for ventilation. The partially compressible and elastic material can also be made of a breathable material that allows the passage of air through the partially compressible and elastic material.

[**0048**] While the forgoing examples are illustrative of the principles of the present invention in one or more particular applications, it will be apparent to those of ordinary skill in the art that numerous modifications in form, usage and details of implementation can be made without the exercise of inventive faculty, and without departing from the principles and concepts of the invention. Accordingly, it is not intended that the invention be limited, except as by the claims set forth below.

What is claimed is:

1. An arch support device configured to support an arch of a user's foot, comprising:

a) an arch member forming a substantial arc, configured to be disposed under the arch of the user's foot, formed of a resilient material defining a spring capable of deflecting under an applied force; and

b) an arch reinforcement member, disposed under the arch member, formed of a compressible and elastic material capable of compressing during deflection of the arch member.

2. An arch support device in accordance with claim 1, wherein the arch member defines an arch cavity underneath the arch member; wherein the arch reinforcement member has an effective height less than a height of the cavity defining a gap between the arch reinforcement member and a support surface.

3. An arch support device in accordance with claim 2, wherein the arch member is compressible between:

a) a first position, in response to a relatively smaller applied force, wherein the arch support member deflects under the applied force without engaging the arch reinforcement member; and

b) a second position, in response to a relatively larger applied force, wherein the arch support member deflects under the applied force engaging the arch reinforcement member to compress the arch reinforcement member.

4. An arch support device in accordance with claim 2, wherein the arch member and the arch reinforcement member have a double resistance response including a first resistance force due to deflection of the arch member and a second resistance force due to deflection of the arch member and compression of the arch reinforcement member.

5. An arch support device in accordance with claim 1, further comprising:

matching indentations and protrusions formed between the arch support and arch reinforcement member.

6. An arch support device in accordance with claim 1, further comprising:

a plurality of indentations formed in a bottom surface of the arch member; and

a plurality of protrusions formed in an upper surface of the arch reinforcement member.

7. An arch support device in accordance with claim 6, wherein the plurality of indentations and protrusions have a size and walls with a shape longer than the size.

8. An arch support device in accordance with claim 6, wherein the plurality of protrusions is a first plurality of protrusions; and further comprising:

a second plurality of protrusions, opposite the first plurality of protrusions, the arch reinforcement member having two orientations with respect to the arch member including a first orientation with the first plurality of protrusions inserted into the plurality of indentations and a second orientation with the second plurality of protrusions inserted into the plurality of indentations.

9. An arch support device configured to support an arch of a user's foot, comprising:

a) an arch member, configured to be disposed under the arch of the user's foot, formed of a resilient material and capable of deflecting under an applied force, and defining a spring capable of storing energy during deflection; and

b) a plurality of indentations formed in a lower surface of the arch member; and

c) the indentations having length; and

d) a plurality of walls, disposed between adjacent indentations; and

e) the walls having a length greater than the length of the indentations.

10. An arch support device in accordance with claim 9, further comprising:

an arch reinforcement member, disposed under the arch member, including a first plurality of protrusions extending into the plurality of apertures in the arch member.

11. An arch support device in accordance with claim 10, wherein the arch member defines an arch cavity underneath the arch member; wherein the arch reinforcement member has an effective height less than a height of the cavity defining a gap between the arch reinforcement member and a support surface.

12. An arch support device in accordance with claim 11, wherein the arch member is compressible between:

a) a first position, in response to a relatively smaller applied force, wherein the arch support member deflects under the applied force without engaging the arch reinforcement member; and

b) a second position, in response to a relatively larger applied force, wherein the arch support member deflects under the applied force engaging the arch reinforcement member to compress the arch reinforcement member.

13. An arch support device in accordance with claim 10, wherein the arch member and the arch reinforcement member have a double resistance response including a first resistance force due to deflection of the arch member and a second resistance force due to deflection of the arch member and compression of the arch reinforcement member.

14. An arch support device in accordance with claim 10, further comprising:

a second plurality of protrusions, opposite the first plurality of protrusions, the arch reinforcement member having two orientations with respect to the arch member including a first orientation with the first plurality of protrusions inserted into the plurality of indentations and a second orientation with the second plurality of protrusions inserted into the plurality of indentations.

15. An arch support reinforcement device, comprising:

a) a partially compressible and elastic material configured to be secured to a bottom of an arch support and in a gap formed between the arch support and a support surface;

b) a plurality of protrusions extending upwardly configured to be received within a plurality of indentations in the arch support; and

c) a second plurality of protrusions extending downwardly.

16. An arch support reinforcement device in accordance with claim 15, wherein the plurality of protrusions have a size and walls with a shape longer than the size.

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