7-9-2015

REMOVABLE SHOE SPIKE SYSTEM

Alex Adams
University of Nebraska-Lincoln

NUtech Ventures, Inc.,

US 20150189950A1

(19) **United States**

(12) **Patent Application Publication**

Adams

(10) **Pub. No.: US 2015/0189950 A1**

(43) **Pub. Date: Jul. 9, 2015**

(54) **REMOVABLE SHOE SPIKE SYSTEM**

(71) Applicant: **NUtech Ventures, Inc.**, Lincoln, NE (US)

(72) Inventor: **Alex Adams**, Hickman, NE (US)

(21) Appl. No.: **14/416,197**

(22) PCT Filed: **Jul. 26, 2013**

(86) PCT No.: **PCT/US2013/052313**

§ 371 (c)(1),
(2) Date: **Jan. 21, 2015**

Related U.S. Application Data

(60) Provisional application No. 61/676,077, filed on Jul. 26, 2012.

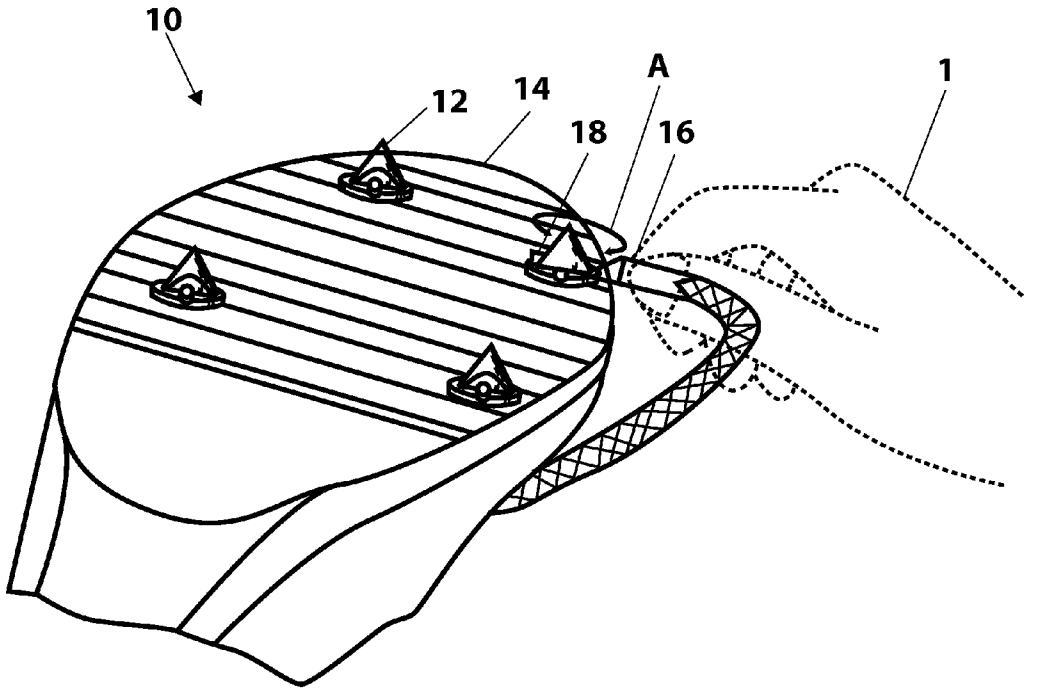
Publication Classification

(51) **Int. Cl.**
A43C 15/16 (2006.01)
A43B 5/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A43C 15/161*** (2013.01); ***A43B 5/00*** (2013.01)

(57) **ABSTRACT**

The present system, method and apparatus are adapted for the quick and easy exchange of spikes on athletic shoes. More specifically, the system, apparatus and methods comprise a spike having an opening, an aglet adapted for coupling to the shoe, for example by way of a shoelace, and a coupling head affixed to the aglet which is adapted to couple with the opening on the spike so as to allow a user to quickly and easily replace, remove or install spikes in the athletic shoe. The disclosure thus allows the user to have the tool attached to their shoe at all times so as to avoid carrying additional equipment while wearing the shoe.



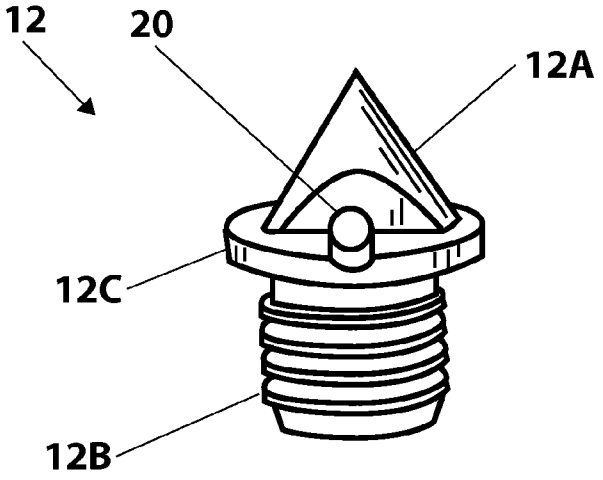


Figure 1

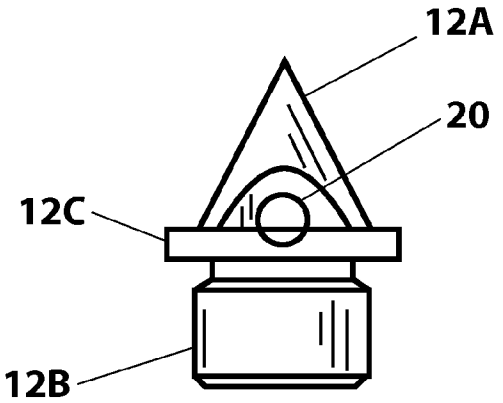


Figure 2

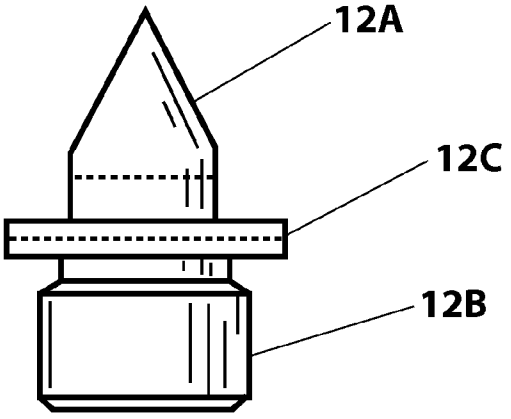


Figure 3

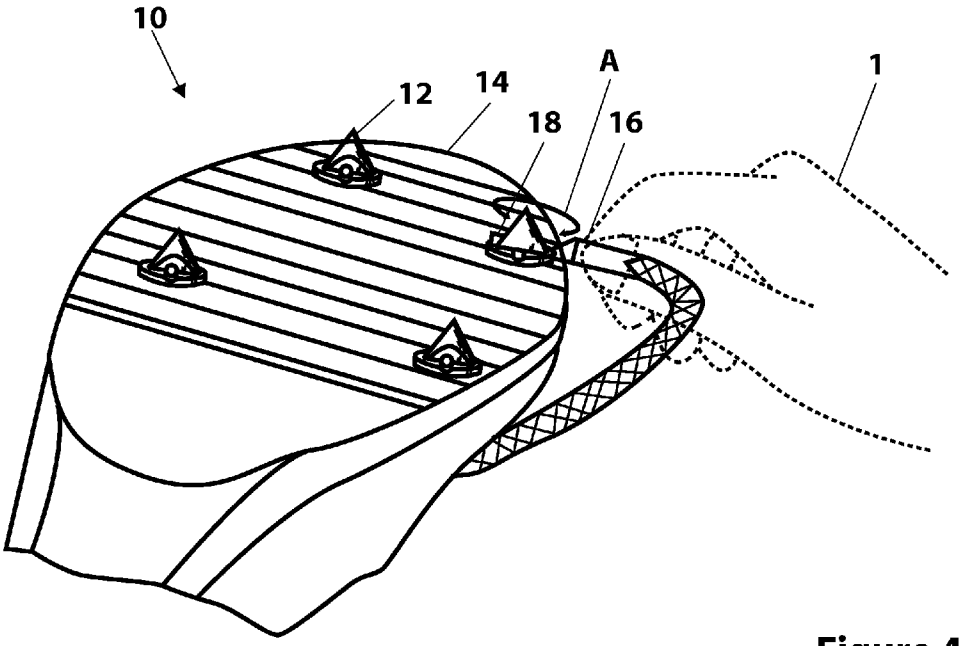


Figure 4

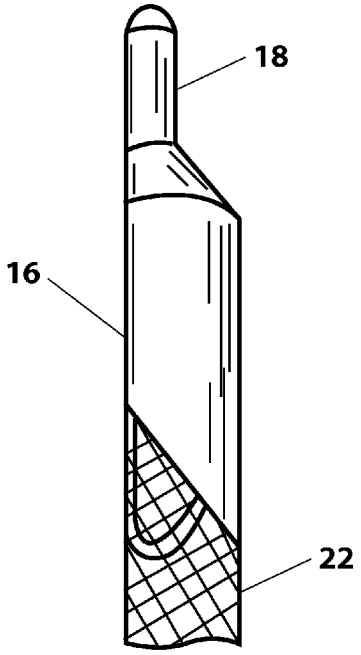


Figure 5

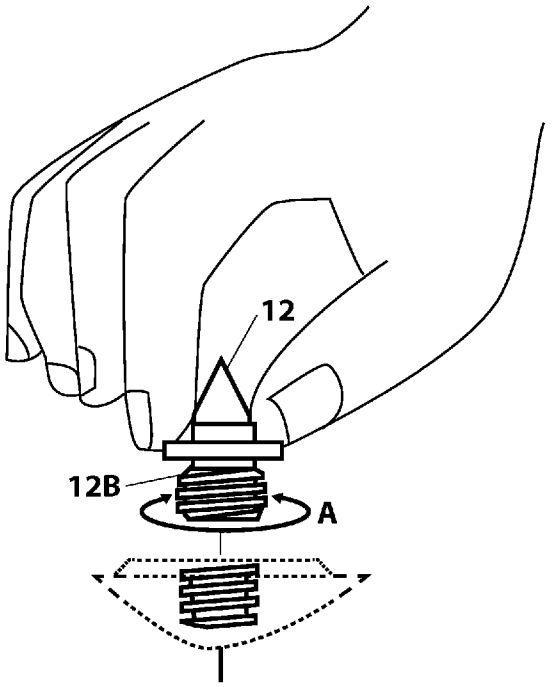


Figure 6

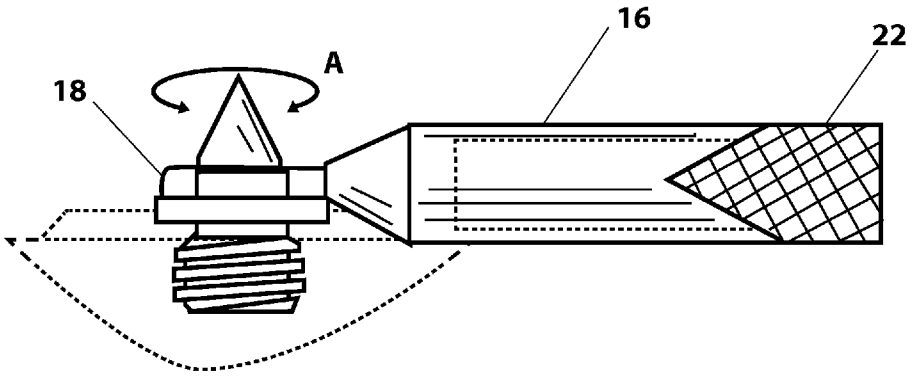


Figure 7

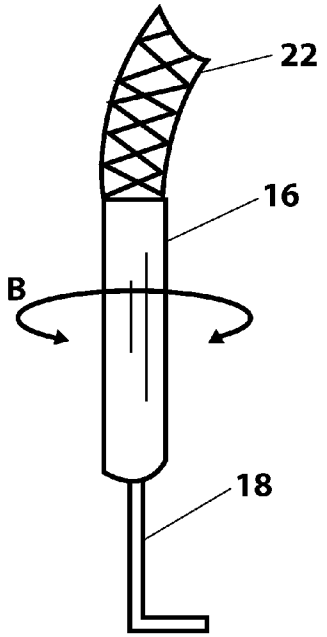


Figure 8

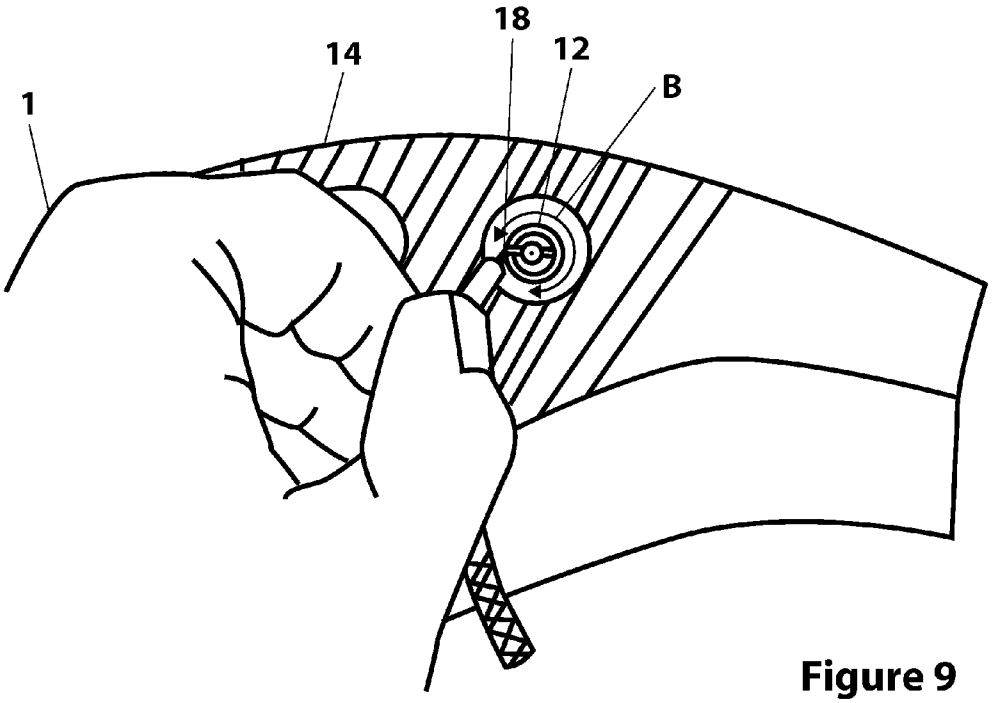


Figure 9

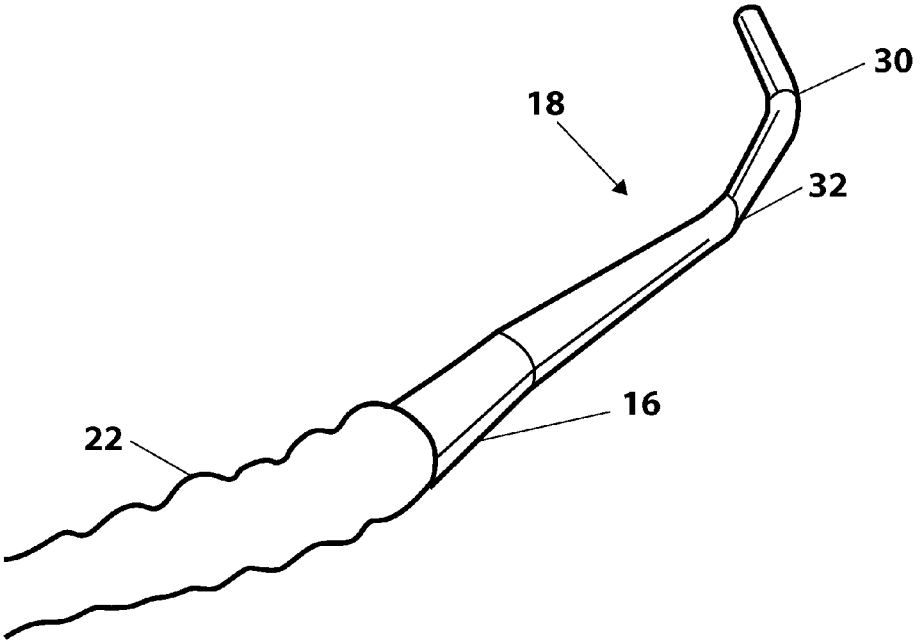


Figure 10

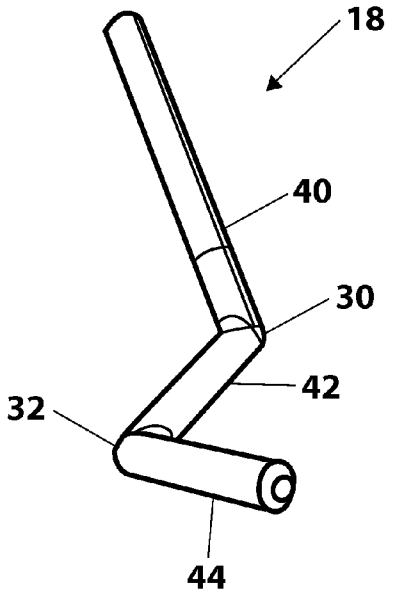


Figure 11

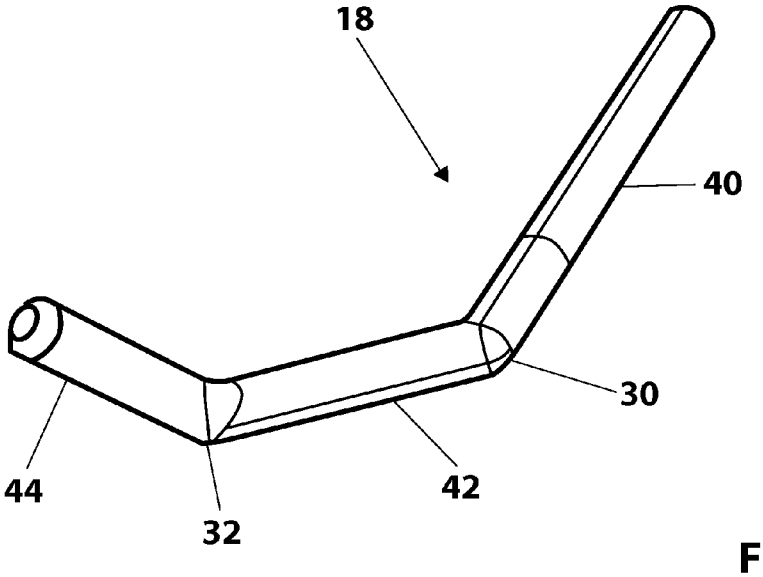


Figure 12

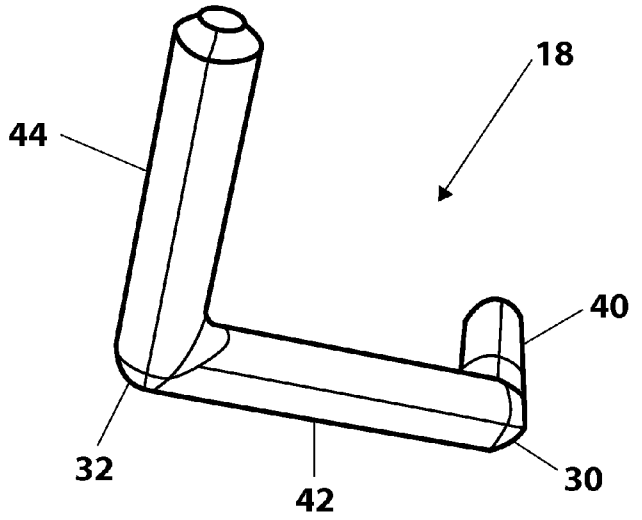


Figure 13

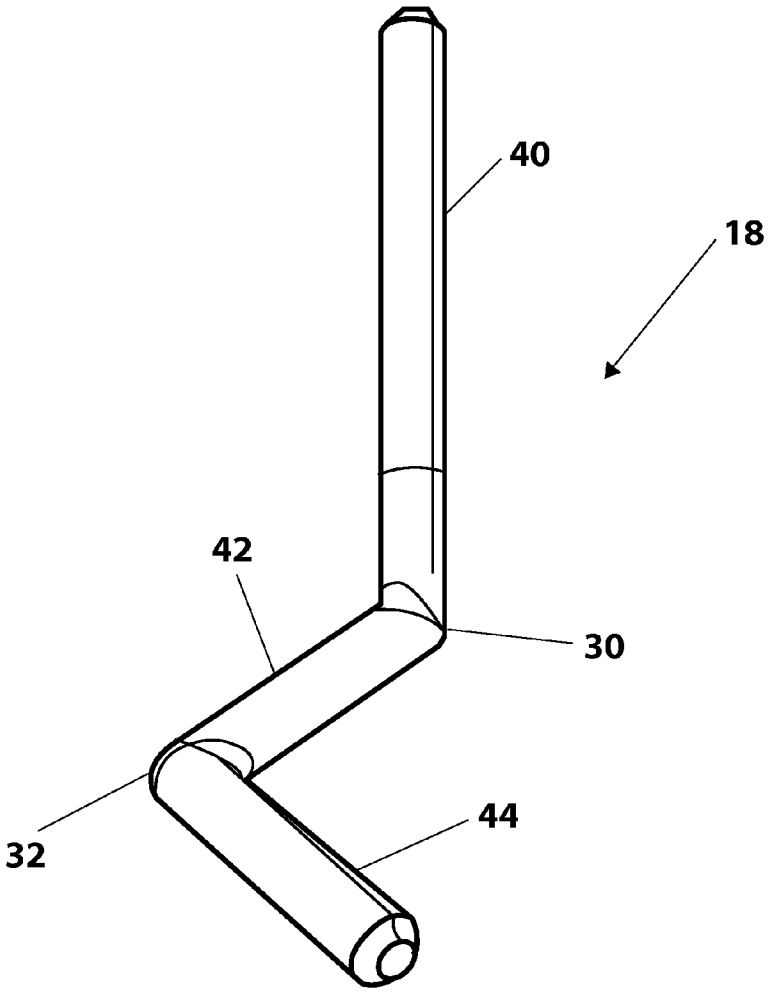


Figure 14

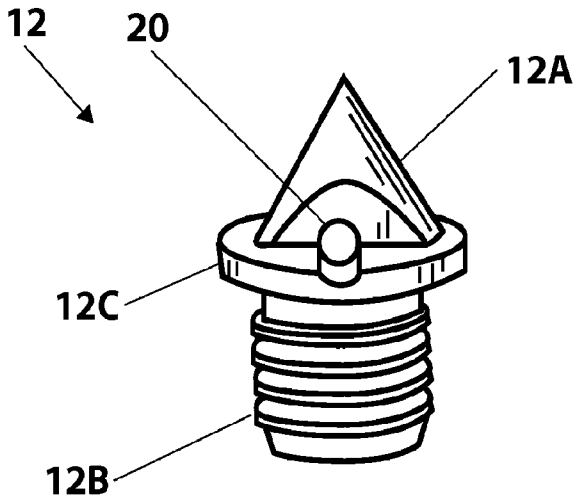


Figure 1

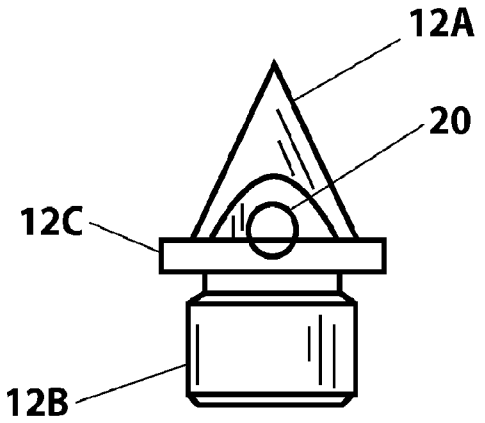


Figure 2

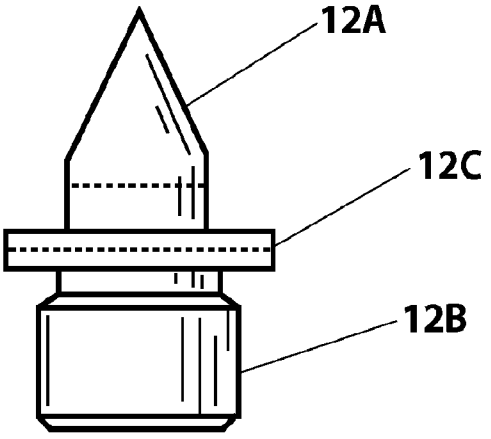


Figure 3

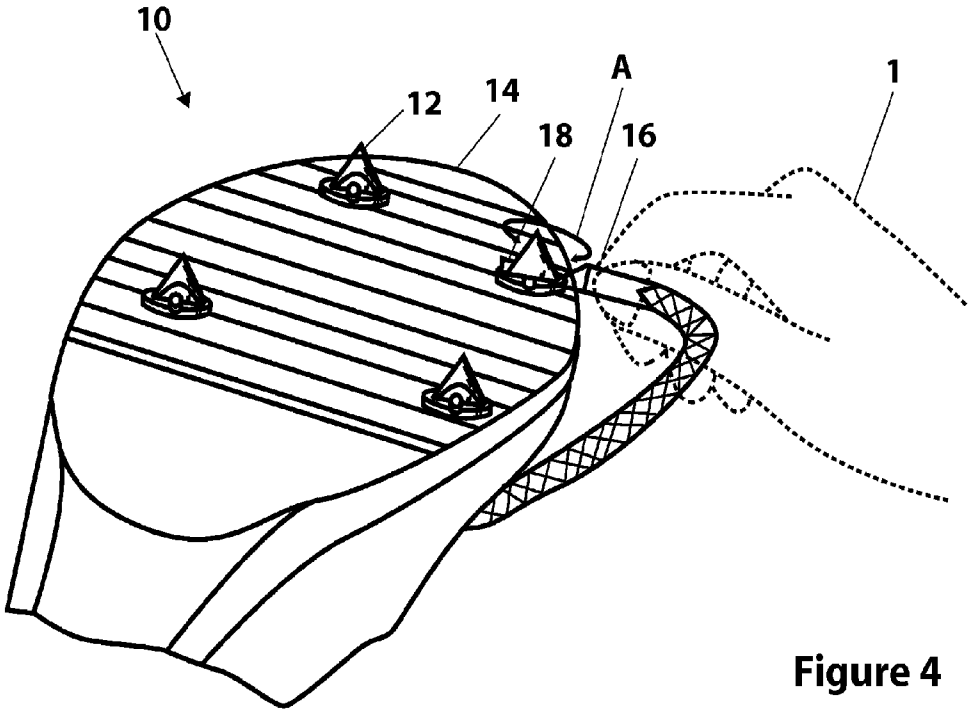


Figure 4

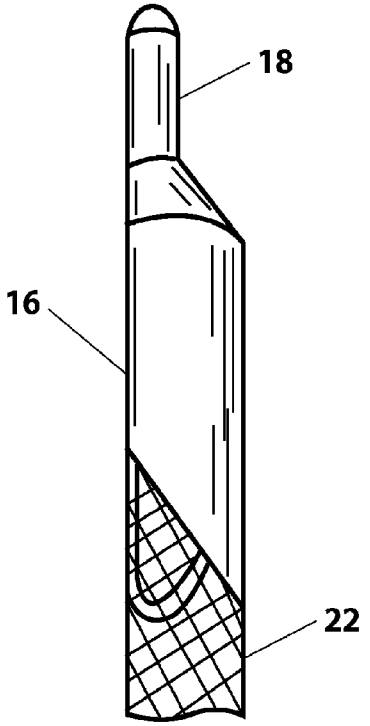


Figure 5

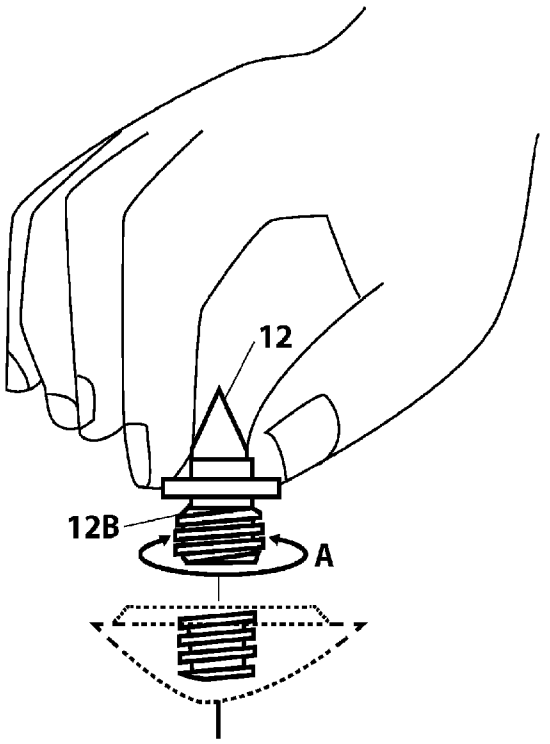


Figure 6

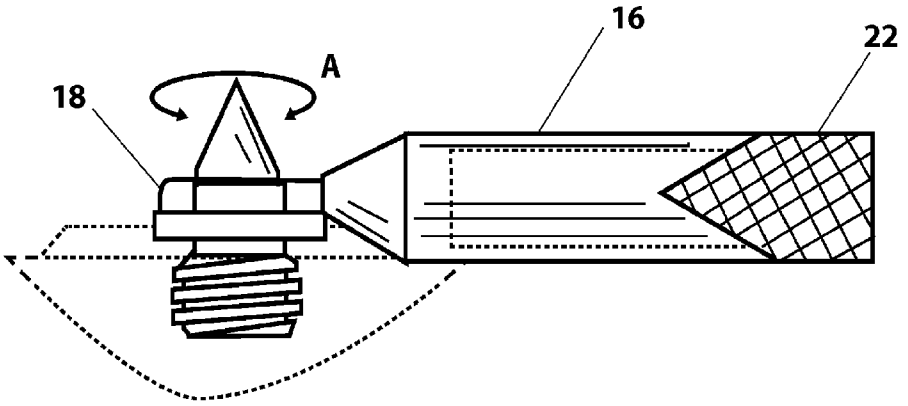


Figure 7

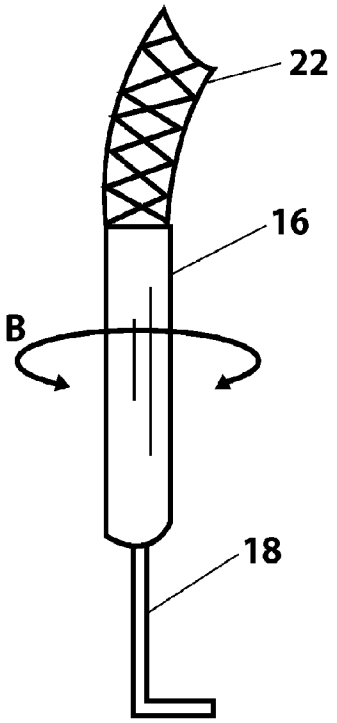


Figure 8

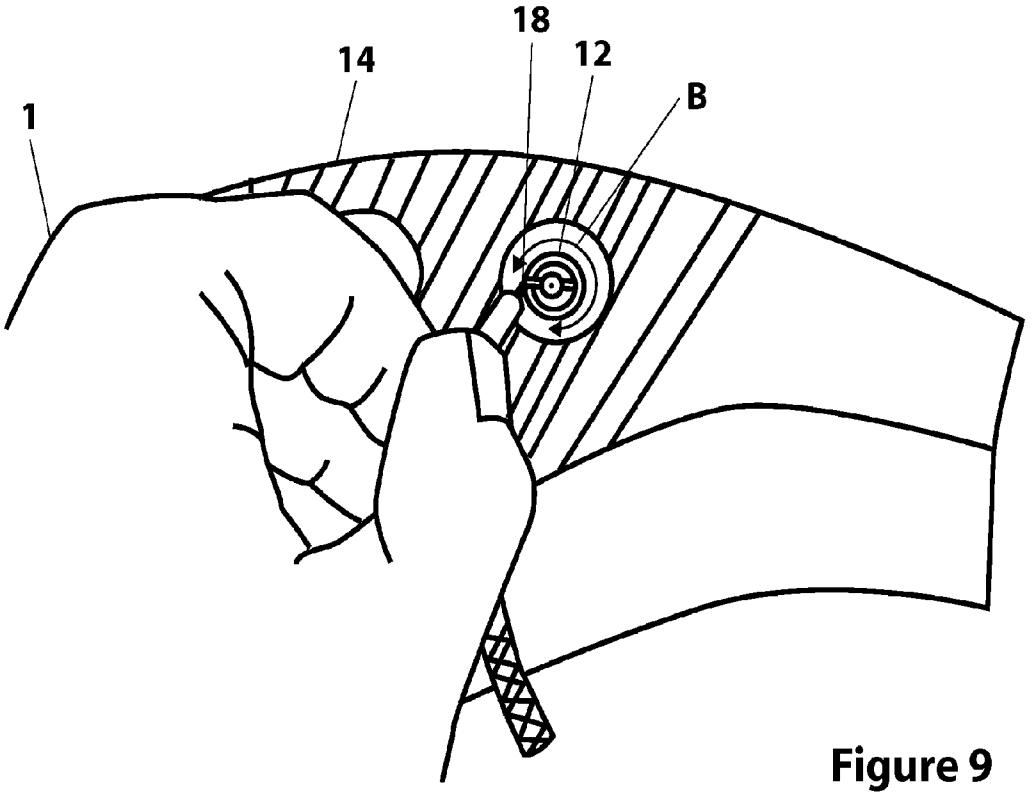


Figure 9

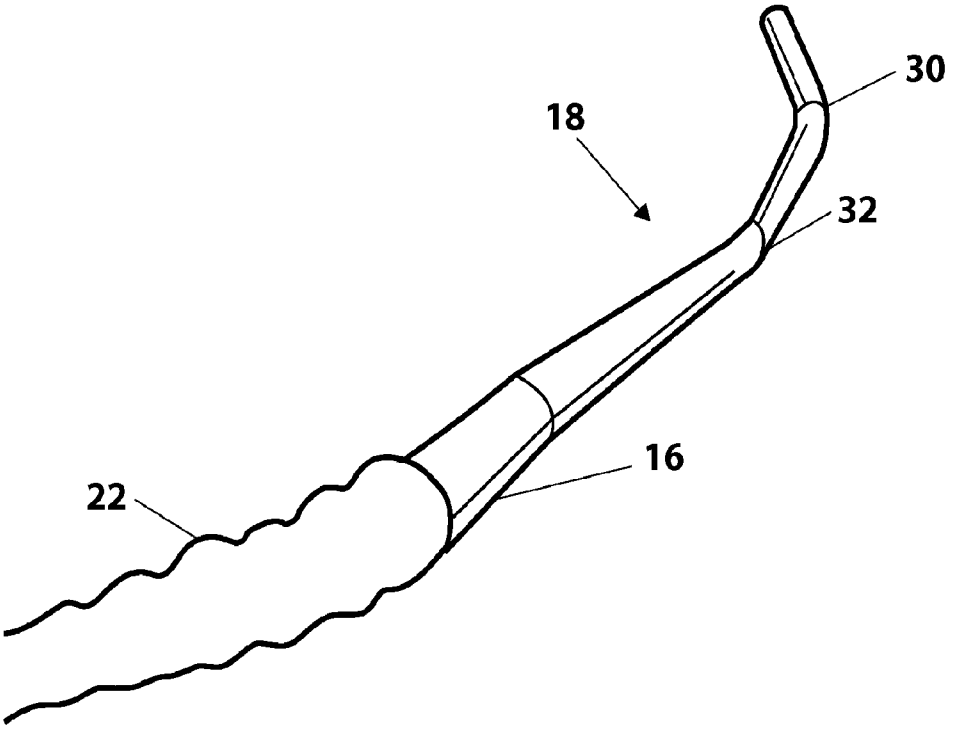


Figure 10

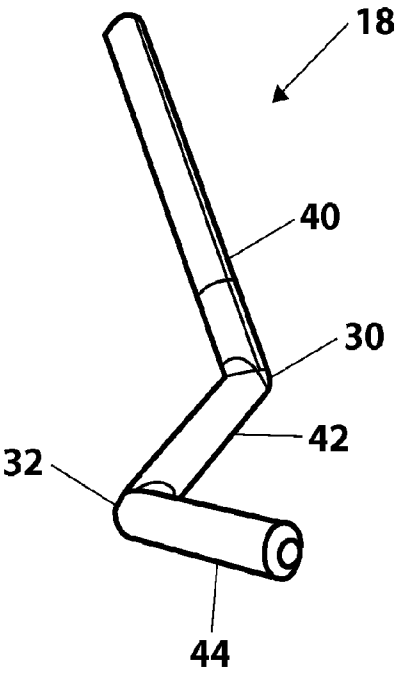


Figure 11

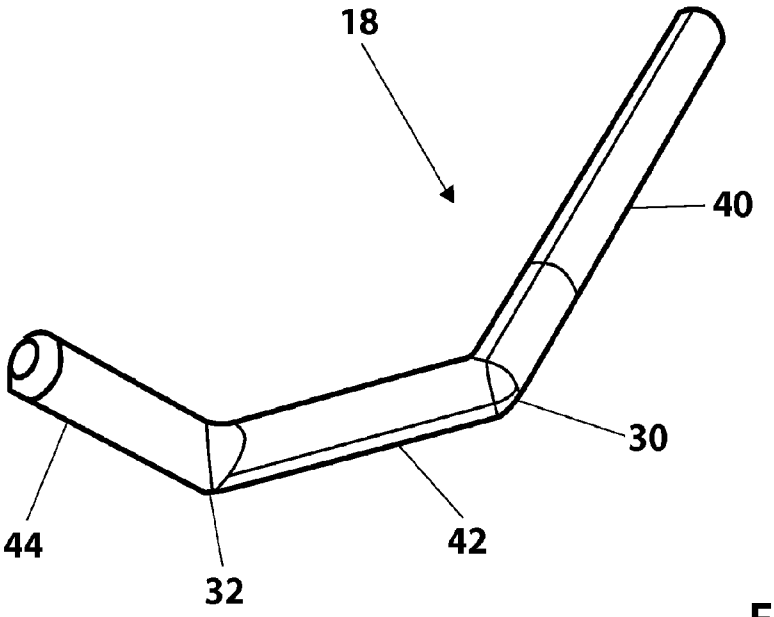


Figure 12

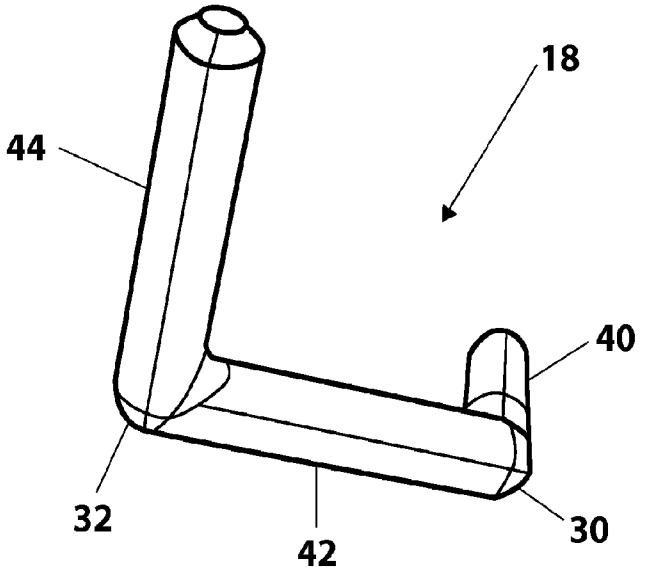


Figure 13

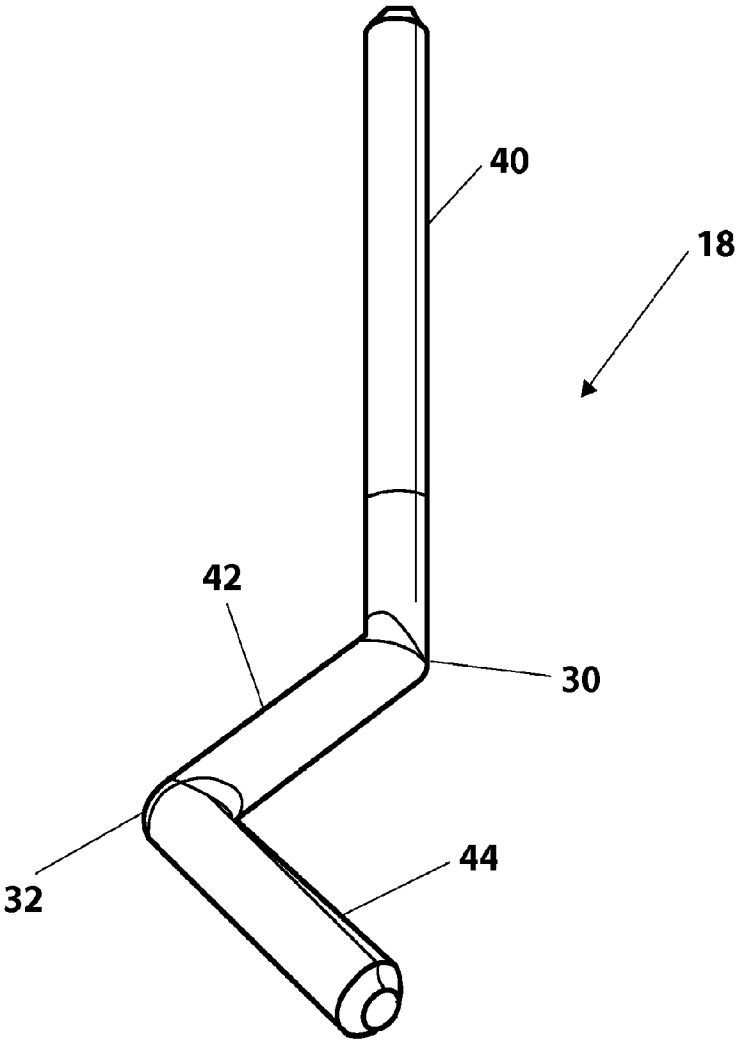


Figure 14

REMOVABLE SHOE SPIKE SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims priority from U.S. Provisional Application No. 61/676,077, filed Jul. 26, 2012 and entitled "Shoe Spike," and PCT Application No. US13/52313, filed on Jul. 26, 2013 and entitled "Removable Shoe Spike System," which are hereby incorporated herein by reference in their entirety.

TECHNICAL FIELD

[0002] The embodiments disclosed herein relate to various systems, apparatus and methods for changing the spikes on shoes. Certain embodiments relate to spikes, aglets and other components of certain shoes. Further embodiments relate to methods of using the above components.

BACKGROUND

[0003] Many forms of athletic shoes benefit from the use of spikes or cleats on the intended surface, as a way to increase the user's traction, stability, grip, and the like. Such surfaces can include grass, rubberized track, ice, artificial turf, sand, dirt, mud, and a variety of other athletic and other playing fields or terrains. For example, track and field athletes, runners of all distances, tri-athletes, golfers, and a variety of team sport athletes engaged in football, soccer, baseball, rugby, and the like all may use cleats or spikes as a way to increase their performance in both practice and competition.

[0004] In certain applications, the need to change or replace the spikes is common. The spikes or cleats may wear out, as is common with runners, or a need to be changed for other reasons, such as a change in weather or to get a different benefit or "feel," as is common for football and soccer players.

[0005] There is a need in the art for improved apparatus, systems and methods for changing spikes and cleats on shoes.

BRIEF SUMMARY OF THE INVENTION

[0006] Discussed herein are various embodiments relating to a novel shoe spike system, comprising apparatus and methods of use.

[0007] While multiple embodiments are disclosed, still other embodiments of the system will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various obvious aspects, all without departing from the spirit and scope of the system. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a perspective view of a spike, according to an exemplary embodiment.

[0009] FIG. **2** is a side view of a spike, according to a second exemplary embodiment.

[0010] FIG. **3** is yet another a side view of a spike, according to a second exemplary embodiment.

[0011] FIG. **4** is a perspective view of the system in use on a shoe, according to an exemplary embodiment.

[0012] FIG. **5** is a perspective view of an aglet and coupling head, according to an exemplary embodiment.

[0013] FIG. **6** is a side view of a spike being removed by hand.

[0014] FIG. **7** is a side view of the system, according to an exemplary embodiment.

[0015] FIG. **8** is a side view of an aglet featuring an angled coupling head, according to an exemplary embodiment.

[0016] FIG. **9** shows the embodiment of FIG. **8** in use, according to the system and method.

[0017] FIG. **10** is a perspective view of an aglet featuring another embodiment of an angled coupling head.

[0018] FIG. **11** is a perspective view of an aglet featuring the angled coupling head of the embodiment of FIG. **11**.

[0019] FIG. **12** is a perspective view of an aglet featuring the angled coupling head of the embodiment of FIG. **11**.

[0020] FIG. **13** is a perspective view of an aglet featuring the angled coupling head of the embodiment of FIG. **11**.

[0021] FIG. **14** is a front view of an aglet featuring the angled coupling head of the embodiment of FIG. **11**.

DETAILED DESCRIPTION

[0022] Various exemplary embodiments of the shoe spike system are disclosed herein. As seen generally throughout the figures, the present system **10** generally relates to a novel spike **12** that can be attached to and removed from certain shoes **14**. Also disclosed herein are a variety of methods and apparatus used for attaching and removing the disclosed spikes, including a specialized aglet **16**, as is best shown in FIGS. **5**, **8** and **10-14**. In certain embodiments, the aglet **16** further comprises a coupling head **18** which is adapted to couple to the spike by way of an opening **20** in the spike. For purposes of this application, "spike" is meant to include any kind of spike or cleat that attaches to the bottom of a shoe, including without limitation a shoe used in athletics, and aglet is meant to include any kind of attachment to the end of a shoelace, drawstring, or the like.

[0023] Turning to the figures in detail, FIGS. **1-14** depict various embodiments of the shoe spike system. As seen in the exemplary embodiment depicted in FIG. **4**, certain exemplary embodiments of the system **10** comprise at least one spike **12** set in a shoe **14** and at least one aglet **16** further comprising a coupling head **18** adapted so as to allow a user **1** to loosen and tighten the spikes **12** easily and without carrying any extra equipment. As best depicted in FIGS. **1-2**, certain exemplary embodiments comprise spikes **12** having an opening or other female mating region **20** formed to accept a corresponding male region mounted on the aglet. Other coupling means are possible, as would be apparent to one of skill in the art.

[0024] Continuing with FIGS. **1-2**, in certain exemplary embodiments, the system comprises a spike **12** having a first end **12**A and a second end **12**B connected by a solid portion **12**C. In these embodiments, the first end **12**A of the spike **12** can be tapered to a point, so as to aid the spike **12** in facilitating traction between the shoe and the surface the shoe is used on. In such embodiments, the spike **12** can be constructed from any kind of material typically used for a spike, including without limitation metal, plastic, rubber, other synthetic polymers or combinations thereof.

[0025] In these embodiments, the second end **12**B of the spike **12** has a connection that can be coupled to the shoe (as shown fitted in FIG. **4**). This connection can be a threaded male connector (as best shown in FIG. **1**). On the second end **12**B of the spike that is sized to mate with a female connection

on the shoe (as is shown in FIG. **6**), however other connections are possible. These other connections include a magnetic connection between the spike and shoe, a peg and slot type connection, a twist and lock connection, or any other equivalent apparatus or method adapted for connecting a spike to a shoe, as would be readily apparent to one of skill in the art. Certain alternative embodiments can also utilize a male threaded connector on the shoe connecting to a female threaded connector on the spike **12**.

[0026] As depicted in FIGS. **1-2**, in certain exemplary embodiments, the spike also has an opening **20** defined into the solid portion of the spike **12**. This opening **20** is adapted to mate with the coupling head **18** of the aglet **16**. This opening **20** could be defined either partially or completely through the solid portion. One advantage of an opening completely through is that it can be accessed by the aglet from either direction, but this is in no way necessary to the function of the system. In certain exemplary embodiments, the opening **20** may be defined substantially perpendicular to an axis connecting the first and second ends of the spike, though, again, this is not required for the system to function.

[0027] As can be seen in FIGS. **1-3**, this axis between the first **12**A and second **12**B spike ends is generally a substantially straight line. The cross-section of the spike can be any shape, including without limitation circular, triangular, rectangular, hexagonal, or circular with two flattened sides defined by parallel chords through the circle.

[0028] In certain exemplary embodiments, a spike **12** that has a threaded connector (for example, as depicted in FIGS. **1** & **6**) as its connection to the shoe can have certain materials applied to the threads on the second end **12**B to assist the second end in forming a tight mate with the female threaded connection on the shoe. In certain embodiments, these materials can include nylon, Teflon, tape, plastic or other equivalent materials that accomplish the goal of facilitating a tight male-female connection. This material could be applied anywhere threads exist for connecting the spike to a shoe, including internally or externally on either the spike or the shoe.

[0029] In other exemplary embodiments, certain materials can be applied to the threaded connector **12**B on a second end of a spike that assist in enabling the spike to be screwed into the shoe. The materials may then contribute to resistance against being unscrewed. These materials include grease, oil, and other kinds of lubricants that would make it easier to screw the spike into the shoe, and then after the spike is in the shoe would help the spike resist being unscrewed.

[0030] The opening **20** that is otherwise defined in the side of the solid portion of the spike in the embodiment described above allows a person to insert an object into the spike, and then exert pressure on the object in such a way as to create a force in a clockwise or counterclockwise direction around the axis between the first and second ends of the spike **12**. This facilitates attachment or removal of the spike by way of the coupling head **18**. In certain embodiments, the object inserted into the opening **20** in the spike can also be anything with a small enough cross-section to fit into the opening **20**—it need not necessarily be the coupling head **18**.

[0031] As shown in FIGS. **4-7**, certain exemplary embodiments of the system also comprise an aglet **16**, further comprising a coupling head **18** that is adapted so as to be inserted into the opening **20** in the side of a spike **12**. In certain embodiments, this is a male-female coupling, as described above, though other methods of coupling would be apparent to one of skill in the art. In certain exemplary embodiments, the aglet **16** is coupled to the end or ends of a shoelace **22** opposite the coupling head **18**, so as to allow it to be kept with the user without adding substantially any weight or further equipment to the user.

[0032] As shown in FIGS. **5** and **7-14**, in certain exemplary embodiments, the aglet **18** comprises a coupling head **18** that is generally cylindrical. As will be discussed herein, many other shapes are possible. By way of example, the aglet **16** may be adapted so as to have a first end **24** having an opening region adapted for the accommodation of a shoelace **22** or other connection means and a second end **26** adapted for securing the coupling head **18**. While the aglet **16** and coupling head **18** shown in FIG. **5** appear to be generally rigid forged unit, such as a steel, aluminum, alloy, or hard plastic, in certain embodiments the aglet **16** can be comprised of more malleable material such as shrink wrap plastic, polymer, polyolefin, PVC, biaxially oriented polypropylene, fiber, yarn, titanium or any other suitable material which would facilitate the placement and fastening of the coupling head **18** and shoelace **22** inside opposite ends of the aglet **16**. In certain embodiments, the aglet **16** and coupling head can be formed from the same material, while in alternate embodiments the aglet **16** and coupling head are comprised of different materials. In certain embodiments, the coupling head **18** can be made of metal such as stainless steel, spring steel, titanium, carbon fiber, any number of allows or combinations thereof, plastic, ceramic, rubber, or any other material capable of substantially withstanding a rotational force applied to the aglet **16** in order to rotate the spike **12** by way of the coupling head **18**.

[0033] FIG. **6** generally depicts the manual removal of a spike **12**, as is done in the prior art and as may be done in the current system following the initial loosening of the spike **12**. FIG. **7** depicts the insertion of the coupling head **18** into the opening **20** of the spike **12**, so as to ease rotation (shown as A) and increase leverage around the axis of the spike **12**.

[0034] As shown generally in FIGS. **8-14**, in certain exemplary embodiments, the coupling head **18** can be specifically adapted to fit into the opening **20**. This can be achieved by a variety of structures and methods. In certain embodiments, the diameter of the aglet **16** and coupling head **18** may differ, though this is by no means necessary. Further, a variety of other shapes may be employed, such as a cubic, hexagonal, or other polygonal shape, as would be best adapted for the particular opening **20** in the spike.

[0035] In certain exemplary embodiments, and as depicted in FIGS. **8-14**, the coupling head **18** can take a non-linear form to assist in removing the spikes **12** from a shoe **14**. For example, the coupling head **18** may comprise a steel extruded rod, having at least one angle in it, and be capable of removing a spike with an opening **20** in its side, as described above.

[0036] As depicted in FIGS. **8-9**, in certain embodiments, the aglet comprises an L-shaped for removing a spike having an opening. In these embodiments, coupling head **18** can be specifically adapted to avoid difficulties in accessing the opening **20**, as would be apparent to one of skill in the art. As shown in FIGS. **8-9**, and for simplicity, the coupling head **18** having at least a first angle **30** can be inserted into the opening **20** so as to prevent the aglet and shoelace from being substantially in line with the opening and also allow the user to loosen or tighten the spike **12**, as shown by B.

[0037] As shown in FIG. **10-14**, in certain exemplary embodiments the coupling head **18** can comprise more than one angle **30**, **32** so as to facilitate the removal of the spike and

avoid any problems with tangling or catching that may occur with certain combinations of shoes, shoelaces, and coupling heads having angles of approximately 90 degrees. FIG. **10** also depicts an aglet **16** comprising shrink-wrap plastic and a shoelace **22**.

[0038] As shown for a variety of views in FIGS. **11-14**, in certain exemplary embodiments the coupling head **18** can comprise a plurality of angles **30**, **32** and a plurality of segments **40**, **42**, **44**, which can be set in a variety of X- Y- and Z-planes or axis from one another. By way of example, and as shown in FIGS. **11-14**, the plurality of coupling head **18** segments **40**, **42**, **44** are set in differing axis from one another, such that a first angle **30** of less than 90 degrees is set between the first **40** and second **42** segments, and a second angle **32** of less than 90 degrees is set between the second **42** and third **44** segments, such that the plurality of angles **30**, **32** are set in distinct axis from one another and the plurality of segments **40**, **42**, **44** are set in distinct planes from one another. As would be apparent to one of skill in the art, additional angles and segments are possible, and the present system encompasses angles of any size and orientation. This embodiment is in no way limiting to a specific number of angles or segments, nor is it limiting as to the axis, orientations, planes, or other configurations.

[0039] Certain shoes do not have laces or algets, and are instead retained on a user's foot with the help of a zipper, snaps, or other mechanisms. In these cases, the system can be adapted for attachment to the zipper or snap by similar means as those disclosed above, such that, for example, the aglet can be fitted to couple to the zipper or snap.

[0040] In other exemplary embodiments, a tool for removing a traditional spike could be attached to the aglet **16** in addition to the coupling head **18**, or to another part of the shoe. This tool may be configured to fit around any traditional type of spike, including circular spikes, hexagonal spikes, or substantially circular spikes with two flattened sides. These tools are well-known in the art.

[0041] Another embodiment is a kit comprising other embodiments described above, comprising one or more of: spikes with openings in the side, aglets configured to be inserted into the openings in the spikes, aglets connected to tools used to attach or remove spikes, or objects used to insert into the openings in spikes and attach or remove them.

[0042] In addition to other materials mentioned herein, any or all elements of the system and/or device or apparatuses described herein can be made from, for example, a single or multiple stainless steel, spring steel, titanium, carbon fiber, hard plastic, aluminum, metal, alloy, PVC, polymer, stainless steel alloy, nickel titanium alloy, nickel cobalt alloy, molybdenum alloy, tungsten-rhenium alloy, a polymer, polyethylene teraphathalate (PET), polyester, poly ester amide (PEA), polypropylene, aromatic polyester, a liquid crystal polymer, ultra high molecular weight polyethylene, polytetrafluoroethylene (PTFE), expanded PTFE (ePTFE), polyether ketone (PEK), polyether ether ketone (PEEK), poly ether ketone ketone (PEKK), poly aryl ether ketone ketone), nylon, polyether-block co-polyamide polymer, aliphatic polyether polyurethane, polyvinyl chloride (PVC), polyurethane, thermoplastic, fluorinated ethylene propylene (FEP), absorbable or resorbable polymers such as polyglycolic acid (PGA), poly-L-glycolic acid (PLGA), polylactic acid (PLA), poly-L-lactic acid (PLLA), polycaprolactone (PCL), polyethyl acrylate (PEA), polydioxanone (PDS), and pseudo-polyamino tyrosine-based acids, silicone, zinc, zinc oxide, nickel-titanium alloy, tantalum and gold.

[0043] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various obvious aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

[0044] Although the system has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

What is claimed is:

1. A system for fitting to a shoe with a spike, comprising:

a. a shoe spike further comprising an opening; and

b. an aglet further comprising a coupling head, wherein the coupling head is adapted to couple to the spike opening so as to replace the spike.

2. The system of claim **1** wherein the shoe spike is an athletic shoe spike.

3. The system of claim **1**, wherein the opening transects the diameter of the shoe spike.

4. The system of claim **1**, wherein the shoe spike comprises at least one material selected from the group consisting of rubber, plastic, and metal.

5. The system of claim **1**, wherein the aglet comprises at least one material selected from the group consisting of steel, aluminum, alloy, plastic, hard plastic, shrink wrap plastic, polymer, polyolefin, PVC, biaxially oriented polypropylene, fiber, yarn, and titanium.

6. The system of claim **1**, wherein the coupling head comprises at least one material selected from the group consisting of stainless steel, spring steel, titanium, carbon fiber, hard plastic, aluminum, metal, alloy, PVC, polymer, stainless steel alloy, nickel titanium alloy, nickel cobalt alloy, molybdenum alloy, tungsten-rhenium alloy, a polymer, polyethylene teraphathalate (PET), polyester, poly ester amide (PEA), polypropylene, aromatic polyester, a liquid crystal polymer, ultra high molecular weight polyethylene, polytetrafluoroethylene (PTFE), expanded PTFE (ePTFE), polyether ketone (PEK), polyether ether ketone (PEEK), poly ether ketone ketone (PEKK), poly aryl ether ketone ketone), nylon, polyether-block co-polyamide polymer, aliphatic polyether polyurethane, polyvinyl chloride (PVC), polyurethane, thermoplastic, fluorinated ethylene propylene (FEP), absorbable or resorbable polymers such as polyglycolic acid (PGA), poly-L-glycolic acid (PLGA), polylactic acid (PLA), poly-L-lactic acid (PLLA), polycaprolactone (PCL), polyethyl acrylate (PEA), polydioxanone (PDS), and pseudo-polyamino tyrosine-based acids, silicone, zinc, zinc oxide, nickel-titanium alloy, tantalum and gold.

7. A method for changing the spikes on a shoe, comprising:

a. providing a spike further comprising an opening;

b. providing a device adapted to attach to the shoe, said device further comprising a coupling region adapted to couple to the spike for tightening or loosening, wherein the device is connected to the shoe.

8. The method of claim **7**, further comprising an aglet, wherein the device is connected to the shoe by way of the aglet.

9. The method of claim **8**, wherein the aglet is connected to the shoe by way of a shoelace.

10. The method of claim **8**, wherein the aglet comprises at least one material selected from the group consisting of steel, aluminum, alloy, plastic, hard plastic, shrink wrap plastic, polymer, polyolefin, PVC, biaxially oriented polypropylene, fiber, yarn, and titanium.

11. The method of claim **7**, wherein the coupling region comprises at least one material selected from the group consisting of wherein the head coupling comprises at least one material selected from the group consisting of stainless steel, spring steel, titanium, carbon fiber, hard plastic, aluminum, metal, alloy, PVC, polymer, stainless steel alloy, nickel titanium alloy, nickel cobalt alloy, molybdenum alloy, tungsten-rhenium alloy, a polymer, polyethylene teraphathalate (PET), polyester, poly ester amide (PEA), polypropylene, aromatic polyester, a liquid crystal polymer, ultra high molecular weight polyethylene, polytetrafluoroethylene (PTFE), expanded PTFE (ePTFE), polyether ketone (PEK), polyether ether ketone (PEEK), poly ether ketone ketone (PEKK), poly aryl ether ketone ketone), nylon, polyether-block co-polyamide polymer, aliphatic polyether polyurethane, polyvinyl chloride (PVC), polyurethane, thermoplastic, fluorinated ethylene propylene (FEP), absorbable or resorbable polymers such as polyglycolic acid (PGA), poly-L-glycolic acid (PLGA), polylactic acid (PLA), poly-L-lactic acid (PLLA), polycaprolactone (PCL), polyethyl acrylate (PEA), polydioxanone (PDS), and pseudo-polyamino tyrosine-based acids, silicone, zinc, zinc oxide, nickel-titanium alloy, tantalum and gold.

12. The method of claim **7**, wherein the spike comprises at least one material selected from the group consisting of rubber, plastic, and metal.

13. A shoe spike replacement device, comprising:

a. a spike, further comprising a defined opening;

b. a coupling head, wherein the aglet is coupling head is adapted to couple to the opening and is attached to the shoe so as to allow for adjustment of the spike.

14. The device of claim **13**, further comprising an aglet adapted to affix the coupling head to the shoe.

15. The device of claim **14**, further comprising a shoelace, wherein the aglet affixes the coupling head to the shoelace.

16. The device of claim **14**, wherein the opening transects the diameter of the shoe spike.

17. The device of claim **14**, wherein the aglet comprises at least one material selected from the group consisting of steel, aluminum, alloy, plastic, hard plastic, shrink wrap plastic, polymer, polyolefin, PVC, biaxially oriented polypropylene, fiber, yarn, and titanium.

18. The device of claim **13**, wherein the coupling head comprises at least one material selected from the group consisting of stainless steel, spring steel, titanium, carbon fiber, hard plastic, aluminum, metal, alloy, PVC, polymer, stainless steel alloy, nickel titanium alloy, nickel cobalt alloy, molybdenum alloy, tungsten-rhenium alloy, a polymer, polyethylene teraphathalate (PET), polyester, poly ester amide (PEA), polypropylene, aromatic polyester, a liquid crystal polymer, ultra high molecular weight polyethylene, polytetrafluoroethylene (PTFE), expanded PTFE (ePTFE), polyether ketone (PEK), polyether ether ketone (PEEK), poly ether ketone ketone (PEKK), poly aryl ether ketone ketone), nylon, polyether-block co-polyamide polymer, aliphatic polyether polyurethane, polyvinyl chloride (PVC), polyurethane, thermoplastic, fluorinated ethylene propylene (FEP), absorbable or resorbable polymers such as polyglycolic acid (PGA), poly-L-glycolic acid (PLGA), polylactic acid (PLA), poly-L-lactic acid (PLLA), polycaprolactone (PCL), polyethyl acrylate (PEA), polydioxanone (PDS), and pseudo-polyamino tyrosine-based acids, silicone, zinc, zinc oxide, nickel-titanium alloy, tantalum and gold.

19. The device of claim **13**, wherein the shoe spike comprises at least one material selected from the group consisting of rubber, plastic, and metal.

* * * * *