# MODULAR PROSTHETIC FOOT

This is a U.S. national stage application of PCT international application PCT/US2006/062472 filed on 21 Dec. 2006 and claims priority of U.S. provisional application Ser. No. 60/756,623 filed on 22 Dec. 2005.

## I. FIELD OF THE INVENTION

This invention relates to a modular prosthetic foot. The modular prosthetic foot may be utilized worldwide in a variety of climates or terrains. The simple and durable design of the modular prosthetic foot makes it useful for almost any lower extremity amputee.

## II. BACKGROUND OF THE INVENTION

Prosthetic ankles and feet are known. For example, U.S. Pat. No. 5,030,239 discloses a biomechanical ankle which imitates the three primary categories of movement in a human foot. Parallel sole and limb supporting plates are held in spaced relationship by an upright post. The limb supporting plate is connected to the post with a ball and socket joint. A helical spring is fixed between the plates to provide resilient support to the anterior portion of the foot in imitation of normal muscular control. The ball and socket joint, in cooperation with the spring, permits the biomechanical ankle to imitate the inversion-eversion, plantar flexion-dorsiflexion, and lateral rotation found in a normal human foot.

U.S. Pat. No. 7,108,723 B2 discloses a prosthesis for improving the gait and comfort qualities of the amputee that participates in walking, running and jumping activities. A foot and an ankle of the prosthesis are monolithically formed as a resilient member including a strut which forms an ankle joint. A hole extends through the resilient member with the periphery of the hole forming an anterior side surface of the strut. The resilient member anterior to the hole includes a gap to permit motion about the ankle joint axis while providing a stop in dorsiflexion. The hole is elongated upwardly such that the strut is upstanding and anterior convexly curved.

However, there remains a need for a modular prosthetic foot, in particular, a modular prosthetic foot that mimics the subtalar joint of a human foot.

## III. SUMMARY OF THE INVENTION

In an aspect of the invention, a modular prosthetic foot is provided characterized by an ankle component; a forefoot component having a circular part with a rounded top surface and at least one flat side surface, said circular part being connected to a rear part of the forefoot component; a forefoot cushion bumper positioned around the circular part; and a heel component.

In another aspect of the invention, a front part of the ankle component is about 5° to about 20° higher than a rear part of the ankle component.

In another aspect of the invention, the ankle component further comprises an orifice for connection to part of a prosthesis or to a pylon.

In another aspect of the invention, the prosthetic foot is provided with a microprocessor device.

Given the following enabling description of the drawings, the apparatus should become evident to a person of ordinary skill in the art.

## IV. BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic side view of a human foot showing the subtalar joint.



FIG. **2** is a side view of a modular prosthetic foot according to an embodiment of the invention connected to pylon.

FIG. **3** is a perspective view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **4** is a side view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **5** is a front view of the forefoot component of the modular prosthetic foot according to an embodiment of the invention.

FIG. **6**A is a top view of the forefoot component of the modular prosthetic foot according to an embodiment of the invention.

FIG. **6**B is a side view of the ankle component and heel component of the modular prosthetic foot according to an embodiment of the invention.

FIG. **6**C is a bottom view of the ankle component of the modular prosthetic foot according to an embodiment of the invention.

FIG. **6**D is a top view of the forefoot cushion bumper of the modular prosthetic foot according to an embodiment of the invention.

FIG. **7** is a bottom view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **8** is a top view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **9** is a front view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **10** is a rear view of the modular prosthetic foot according to an embodiment of the invention.

FIG. **11** is a block diagram of a microprocessor and forefoot cushion bumper according to an embodiment of the invention.

## V. DETAILED DESCRIPTION OF THE DRAWINGS

FIGS. **1-11** illustrate a modular prosthetic foot according to the invention. The invention is an anatomically-based modular prosthetic foot. The prosthetic foot was designed based on the kinesiology of the anatomical foot. In particular, the structure of the prosthetic foot is focused on mimicking the subtalar joint **100**, as shown in FIG. **1**. Anatomically, if the tibia internally rotates the subtalar joint everts (pronates). Conversely, if the tibia is externally rotated, the subtalar joint inverts (supinates). Thus, in theory, the subtalar joint functions as an elliptical hinge.

In this detailed description, references to "one embodiment", "an embodiment", or "in embodiments" mean that the feature being referred to is included in at least one embodiment of the invention. Moreover, separate references to "one embodiment", "an embodiment", or "in embodiments" do not necessarily refer to the same embodiment; however, neither are such embodiments mutually exclusive, unless so stated, and except as will be readily apparent to those skilled in the art. Thus, the invention can include any variety of combinations and/or integrations of the embodiments described herein.

The prosthetic foot of the invention is modular, thereby accommodating variability in individual subjects and the required functions. As shown in FIG. **2**, prosthetic foot **200** comprises three basic components: (1) a middle section, referred to as an ankle component **205**; (2) a toe section, referred to as the forefoot component **210**; and (3) a heel section, referred to as the heel component **215**. The forefoot component **210** has a front part **210***a* and a rear part **210***b*. The heel component **215** has a front part **215***a* and a rear part **215***b*.