HEATED SHOE INSOLE

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Appl. No.: 11/481,878
Filed: Jul. 6, 2006

The invention relates to an apparatus for warming feet. The invention includes a flexible and compressible insole that can be removable or integral to boots, shoes, or other footwear. The entire apparatus is battery powered allowing it to be portable and lightweight enough to be comfortable. The battery can be mounted in many possible locations including but not limited to on the footwear, in the footwear, or on the user’s lower leg.
FIG. 5
HEATED SHOE INSOLE
CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and incorporates by reference in its entirety U.S. Provisional Application No. 60,696,527 filed Jul. 6, 2005, titled “HEATED SHOE INSOLE”.

TECHNICAL FIELD

[0002] The following relates to an apparatus and method for providing heating in shoe insoles.

BACKGROUND

[0003] In cold environmental conditions, the extremities, such as toes, are particularly susceptible to losing body temperature and becoming uncomfortably cold. To provide insulation from cold temperatures, shoe uppers typically are made of leather or cloth, shoe soles are made of leather or rubber materials, and shoe insoles and liners include padding and other materials. The insulating properties of these materials help to retain heat from blood circulation through the foot. For example, hunting boots or snow boots are designed with thick rubber soles and a significant amount of padding to help retain body heat while shoveling, hiking, or performing other activities during freezing weather conditions.

[0004] In some circumstances, it is beneficial or necessary to supplement the human body’s natural capabilities of temperature regulation by providing a heat source within a shoe or boot. For example, while snow boots or hiking boots may be effective for keeping a person comfortable outside in sub-freezing conditions for several minutes, a person’s body temperature may begin to fall after several hours outdoors and the insulation in the boot may no longer be adequate. Once a person’s feet become cold, there is a risk of numbness, frostbite, or even hypothermia. For persons with poor blood circulation, it may be beneficial to include heating mechanisms within shoes or boots even if the person does not intend to remain in a cold environment for a long period of time.

[0005] Known mechanisms exist for applying heat within a shoe or boot. As one example, chemical hot packs can be inserted into socks or shoes to help retain heat and adequate body temperature within the shoe or boot. These packs create heat through a chemical reaction that can last up to several hours in some applications. The chemical heat pack must be replaced with a new one for each usage. Other known heating mechanisms use electrical wiring within a sock or shoe or boot to apply resistive heat through the wiring. These conventional electrical heating mechanisms are somewhat vulnerable to failure, however, because a puncture or disconnect at a single point within the wiring can completely disable the electrical circuit that generates the heat. Further, such electrical heaters commonly are powered by nickel cadmium batteries, which are toxic.

SUMMARY

[0006] A shoe insole apparatus is disclosed that includes a flexible semi-conductive heater element adapted for insertion within a shoe to be in proximate contact with at least a portion of a foot when the shoe is worn. The apparatus also includes a battery in electrical communication with the heater element. The heater element provides warm to a portion of a wearer’s foot upon receiving current from the battery.

[0007] The shoe insole may also include a sole. The shoe’s space for receiving a foot is above the sole.

[0008] The apparatus may be a warming slipper that includes a footpad with a heater element. The slipper also includes a toe cup that curls over the footpad to cover less than half of the footpad. A battery provides electricity to the heater element for the slipper.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Additional embodiments will be more apparent upon consideration of the following detailed description, taken in conjunction with the accompanying drawings, in which like reference characters refer to like parts throughout, and in which:

[0010] FIG. 1A is an illustration of a heated insole within a shoe according to an exemplary embodiment of the present invention;

[0011] FIG. 1B is an illustration of the shoe in FIG. 1A in a side-view.

[0012] FIG. 2A is an illustration of a heated insole within a shoe according to an alternative embodiment of the present invention;

[0013] FIG. 2B is an illustration of the shoe in FIG. 2A in a side-view.

[0014] FIG. 3 is a simplified illustration of a heater assembly that may be utilized within the shoe as illustrated in FIG. 1;

[0015] FIG. 4 is a simplified illustration of a heater-enclosed insole and battery assembly that may be utilized within the shoe as illustrated in FIG. 1 and may include the heater assembly as illustrated in FIG. 3;

[0016] FIG. 5 is a simplified circuit schematic for an insole circuit according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION

[0017] The invention provides for a battery powered heated shoe insole. The insole may be an integral part of a shoe, slipper, or boot or may be a removable insert. The insole can be sized to fit various styles and sizes of shoes or boots. In some embodiments, the heater portion of the insole includes a cup over the wearer’s toes, providing more heat to the toe area by enclosing it more.

[0018] In accordance with the following, a heater assembly is provided in the insole or footpad of a shoe, boot, or slipper that provides electrical heating. Preferably, the heating is done by using one or more flexible, semi-conductive, electrically resistive heating elements powered by a rechargeable battery pack. This heater assembly is preferred because it withstands the stresses that can break and disconnect an electrical wire-based heater and efficiently provides long-lasting heating capability with reduced power.
requirements. Further, the rechargeable battery enables frequent use and re-use without having to replace the heating assembly.

[0019] FIGS. 1A and 1B illustrate a heated insole within a shoe according to an exemplary embodiment of the present invention. Insole 10 (shown with crossed-lines) is located within the boot 14, above the sole 12, such that it will directly contact the bottom portion of a sock when a foot is placed within the shoe. As can be seen, the insole 10 is substantially flat inside the shoe, extending from substantially along the toe area to substantially along the heel. In some embodiments, the insole 10 may be placed atop an existing insole as an insert that can be removed when the application of heat within the shoe is unnecessary or undesirable. In the exemplary embodiment illustrated in FIG. 1B, the insole includes wiring 18 that traces beneath the stitching and within a seam along the rear of the boot, toward where the heel and the back of the ankle fit within the rearmost section of the boot. The electrical wiring connects the heater 16 (illustrated as the darkened area at the front of the insole in the toe area of the shoe) in the insole 10 to a power source 19. As shown in FIG. 1B, the power source 19 is a battery pack that attaches to the upper rear section of the boot above the ankle. In other embodiments, the battery pack attaches directly to the ankle or leg of the wearer by use of a strap.

[0020] Although the embodiment depicted in FIGS. 1A and 1B is of a work boot, the insole 10 may be utilized in a boot for duty (for military or police use) or for leisure (such as a ski boot, an ice skating boot, a hiking boot, or cowboy boot), a shoe, or a slipper. Of course, the shoe upper may be leather, canvas, or any other material and the sole may be rubber, leather, or any other material, but for safety purposes, the shoe preferably should be constructed of materials, or those materials should be treated such that they are not flammable. If the power source 19 is to be affixed to the boot 30, it may instead be affixed within the boot. The power source may be removable for re-charging, or there may be terminals that can be exposed to connect the power source to an AC outlet or another charging source to re-charge the power source.

[0021] FIGS. 2A and 2B depict an alternative embodiment for the heated insole. As can be seen, the insole 20 includes the substantially flat portion shown in FIGS. 1A and 1B, but additionally includes a front covering section 22 that substantially encloses the toes of the foot when inserted into a shoe. Although the front covering section is identified separately from the flat portion of the insole, the two may be of the same material and may be part of the same continuous fabric or sheet. As in FIGS. 1A and 1B, the insole is connected via an electrical wire 24 to a power source 26. In FIG. 2B, the wiring 24 can be stitched within the seam at the rear of the shoe.

[0022] As a further alternative, the insole 20 and integrated covering 22, depicted in FIG. 2A, may be further integrated with a slipper-type shoe to be worn indoors. In this embodiment, the fabric covering of the insole 20 and toe covering 22, to be described in further detail below, can be sewn or otherwise affixed to a sole for contact with flooring as a user walks in the slipper. The wiring 24 and power source 26 may be attached to the user’s ankle via a strap, or in a further embodiment, the power source may be located within the sole of the slipper itself. An advantage to placing the power source in the sole is to avoid any exposure of the wiring 24.

[0023] The insole of FIGS. 1 and 2 includes a heater that is intended to fit beneath (in FIG. 1) or around (in FIG. 2) the toes of the foot when worn in a shoe. In this manner, the insole provides localized heat to the toes, where the foot is the most susceptible to losing desired body temperature. Preferably, the heater portion of the insole includes a broad area semiconductor material on its upper surface. This material may be a semiconductor fabric, such as a graphite fabric or a carbonized fabric, or a felt-type material comprised of graphite, carbon, or one or more other semiconductor materials. The fabric or felt is particularly suitable for use in an insole because it is flexible, stretchable, and compressible. The fabric tends to heat quickly when provided with electrical energy from a power source and heats uniformly. If one point within the felt or fabric is damaged, broken, torn or punctured, the electrical circuit is still made such that heat continues to be created to warm the toes of the foot. This stands in marked contrast with a resistance wire heater, which is more vulnerable to failure in this regard.

[0024] The heater may be configured as a circuitous serpentine configuration of a flexible graphite heating element with two electrical contacts. It is noted that, according to various embodiments, the use of a configuration in which the ends of the heating element are in close proximity to each other may be desired, e.g., to facilitate connection to the positive and negative terminals of the power source being used. According to the invention, the particular dimensions and configuration of the heating element being used may be chosen such that specific desired heater resistance requirements are met.

[0025] FIG. 3 illustrates a heater within an insole in accordance with an exemplary embodiment of the present invention. The heater 30 includes metallic contacts 32a and 32b and dielectric insulation 34. Two metallic electrodes are included to establish an electrical circuit. Electrical wires 36a and 36b connect to a power source. The electrical wiring is insulated so as not to expose a user to stray voltage.

[0026] FIG. 4 illustrates an enclosed insole, heater, and power source assembly in accordance with an exemplary embodiment of the present invention. The insole 40 is enclosed in a flame retardant material, along with the heater fabric or felt and other electrical connections as described with reference to FIG. 3. At the rear side portion of the insole 40 is attached an enclosed cord 42 that contains electrical wiring to an enclosed battery pack 44 as a power source. An enclosed strap 46 is optionally provided for wrapping the battery pack around an ankle.

[0027] FIG. 5 is a circuit schematic for a heated insole in accordance with an exemplary embodiment of the present invention. Heater 50 is the felt, fabric, or other resistive material that applies heat under or around the toe area in the insole or in-steam of a shoe, as described above. Battery 54 is a power source in accordance with one embodiment of the invention. The battery 54 may be one or more batteries, which are preferably rechargeable to allow for efficient reuse. The battery or batteries may be charged either through a stand-alone charger or by connecting the battery pack to an AC or DC power supply. The overall system voltage may be less than 5 volts. Although nickel cadmium batteries may be
used, these are toxic. A preferred implementation uses nickel metal hydride batteries or non-toxic lithium batteries.

5. The shoe insole apparatus of claim 1 further comprising a power controller; and
   a sensor, wherein the sensor communicates with the power controller to control heat generated by the semiconductive heater element.

6. The shoe insole apparatus of claim 1 further comprising a power selector electrically interposed between the battery and the semiconductive heater element, having at least two settings that regulate an amount of heat generated by the semiconductive heater element.

7. The shoe insole apparatus of claim 1, wherein semiconductive heater element further comprises a toe portion that is cupped to fit around a user’s toes.

8. A warming footwear apparatus comprising:
   a sole;
   a sensor for detecting whether a foot is placed within the interior area above the sole; and,
   an interior area above the sole having a heating element, the interior area having space for receiving a foot;
   a battery in electrical communication with the heating element and the sensor,
   wherein the battery is connected to or disconnected from heating element based on output from the sensor and wherein the heating element provides heat to the interior area upon receiving current from the battery.

9. The warming footwear apparatus of claim 8, wherein the sensor communicates with a controller to control heat generated by the heating element.

10. The warming footwear apparatus of claim 8, wherein the battery is mounted on an upper located above the interior area.

11. The warming footwear apparatus of claim 8, wherein the battery is mounted on a user’s lower leg.

12. The warming footwear apparatus of claim 8, wherein the battery is rechargeable.

13. The warming footwear apparatus of claim 8, wherein the battery is located within the sole.

14. The warming footwear apparatus of claim 8, wherein the battery provides less than 5 V DC to the heating element.

15. The warming footwear apparatus of claim 8, wherein the interior area further comprises a toe cupping area, and where the heating element substantially surrounds the toe cupping area.

16. A warming slipper apparatus comprising:
   a footpad;
   a toe cup; and
   a battery;
   wherein the toe cup curls over the footpad to cover less than half of the footpad, a heater element covers part of the footpad and the toe cup; and
   the battery provides electricity to the heater element to produce heat.

17. The warming slipper apparatus of claim 16, wherein the heater element is comprised substantially of graphite felt or graphite fabric.
18. The warming slipper apparatus of claim 16 further comprising a sole, and the battery is positioned within the sole.

19. The warming slipper apparatus of claim 16, wherein the battery is attached to a user’s lower leg.

20. The warming slipper apparatus of claim 16, further comprising interconnecting wires that complete an electrical circuit between the heater element and the battery, wherein the interconnecting wires exit the footpad substantially near a wearer’s heel.

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