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(54) **DISPOSABLE FOOTWEAR COVER**

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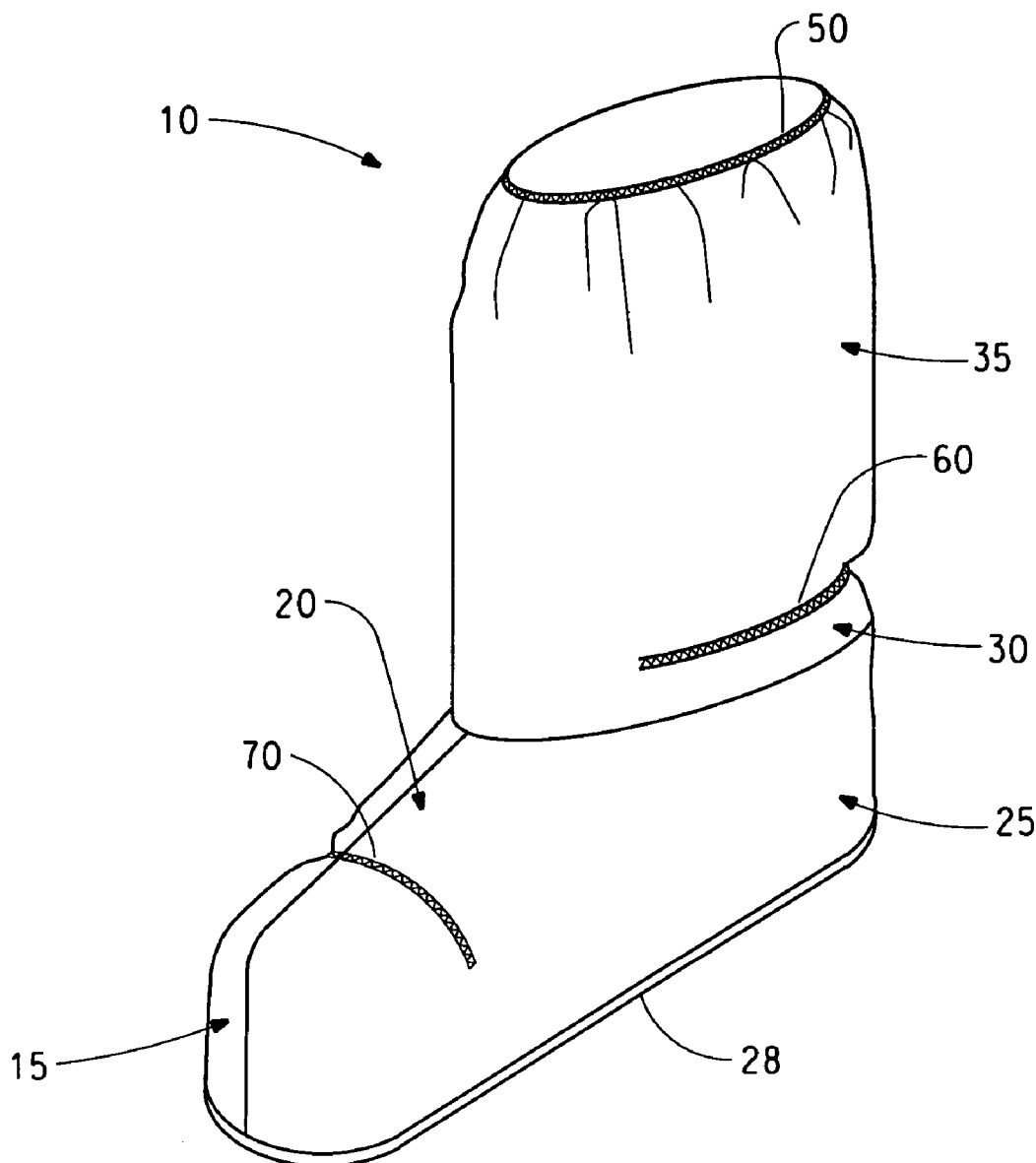
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(57) **ABSTRACT**

The present invention relates to disposable protective footwear covers suitable for use in sterile environments, critically controlled environments, medical facilities, and industrial clean rooms.

(21) Appl. No.: **11/215,592**



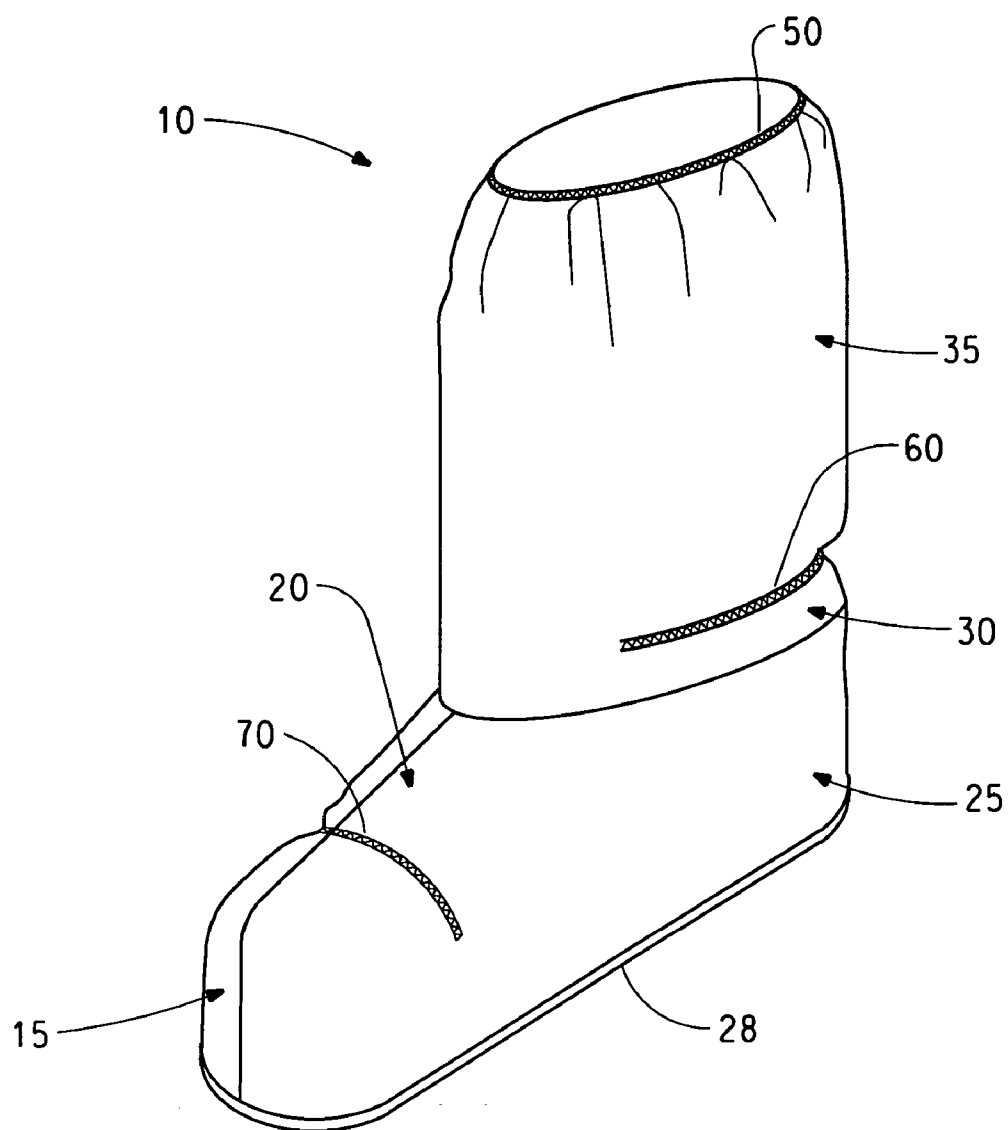


FIG. 1

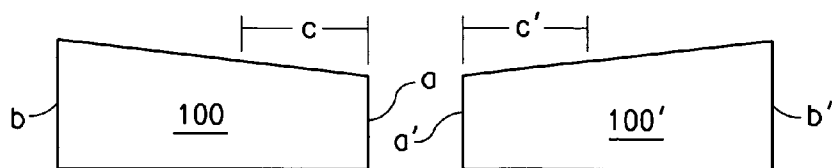


FIG. 2A

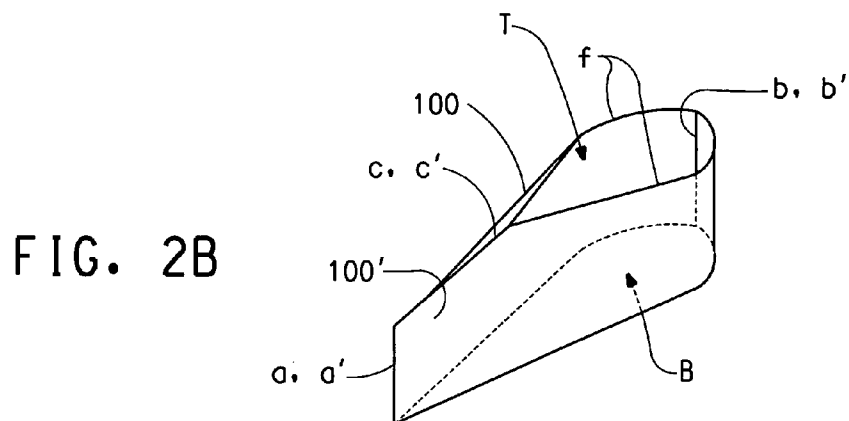


FIG. 2B

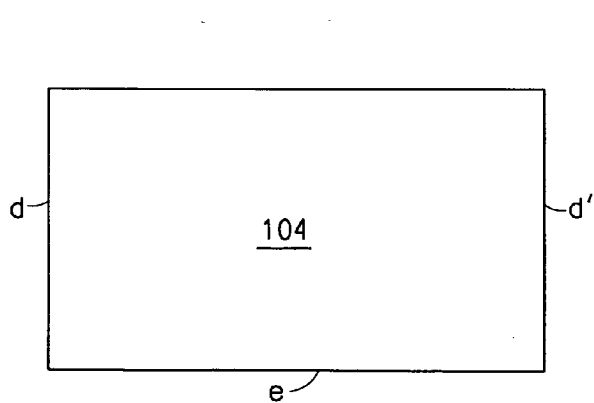


FIG. 2C

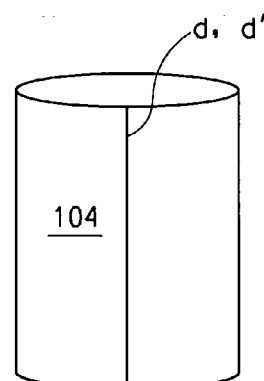
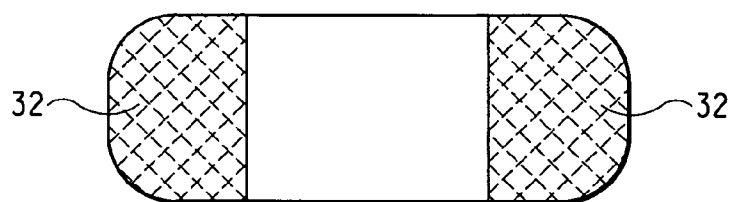
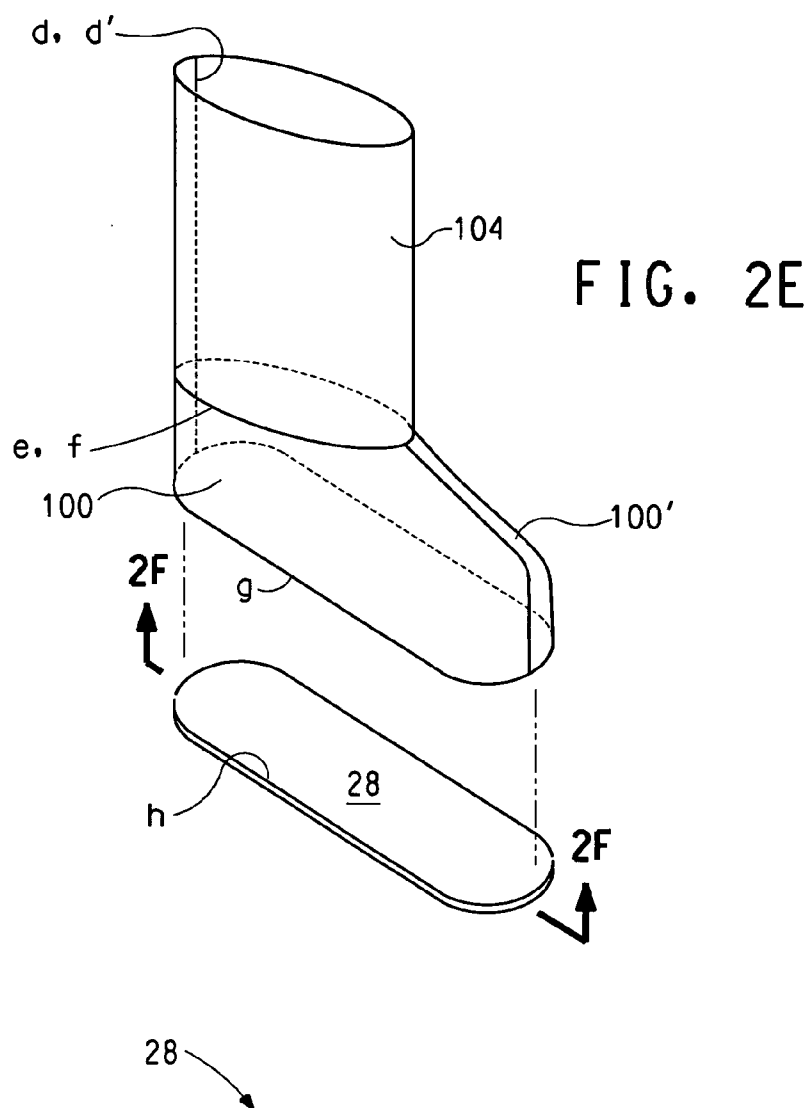


FIG. 2D



DISPOSABLE FOOTWEAR COVER**BACKGROUND OF THE INVENTION****[0001] 1. Field of the Invention**

[0002] The present invention relates to disposable protective footwear covers suitable for use in sterile environments, critically controlled environments, medical facilities, and industrial clean rooms.

[0003] 2. Description of Related Art

[0004] Workers entering critically controlled areas need to don apparel to prevent substances released from the wearer's body from contaminating the environment. The apparel should not shed particles or fibers from the fabric. The apparel can further offer the worker protection from light liquid splash or dry particulates.

[0005] Boot and shoe covers are important to prevent tracking particles throughout critically controlled areas. Disposable footwear covers are used in the semiconductor and life science industries to prevent product contamination and exposure of the wearer to hazardous pathogens or materials.

[0006] Current footwear covers introduce additional hazards to the wearer such as slipping and tripping as a result of excess material contacting the floor. During use, current footwear covers can sag allowing material to drag on the floor creating a tripping hazard. Typical areas in which such material commonly contacts the floor and creates a hazard include the ankle area and metatarsal area.

[0007] U.S. Pat. No. 5,983,526 discloses a shoe cover of liquid impervious material with an elastic band completely encircling the ankle of the wearer. The patent does not teach the reduction of slipping and tripping hazards associated with the use of a shoe cover.

[0008] What is therefore needed is a disposable footwear cover that snugly gathers excess material away from the floor to prevent slips, trips, and falls.

BRIEF SUMMARY OF THE INVENTION

[0009] This invention relates to a disposable footwear cover having an inner surface, an outer surface, a lower leg region, an ankle region, a metatarsal region, a toe region, and a sole region the cover comprising:

[0010] a flexible polymer sheet;

[0011] an elastic gather in the lower leg region;

[0012] an elastic gather in the metatarsal region;

[0013] an elastic gather in the ankle region; and

[0014] a non-slip polymer coating covering at least 25 percent of the surface area of the sole region.

[0015] This invention also relates to a process for making the disposable footwear cover.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 represents a side view of a footwear cover.

[0017] FIGS. 2A-2F represent steps in a process for making a footwear cover.

DETAILED DESCRIPTION OF THE INVENTION

[0018] This invention relates to a disposable footwear cover for use in sterile environments, medical facilities, industrial clean rooms and the like that employs elastic gathers and a non-slip coating to provide the wearer additional protection against slips, trips, and falls.

[0019] The disposable footwear cover of this invention is prepared from flexible sheet materials, having an inner surface toward the wearer's foot or footwear and an outer surface away from the wearer's foot or footwear, formed into the general shape of a shoe, boot, or foot. The flexible sheet materials can be woven or nonwoven. Preferably, the flexible sheet materials are nonwoven. The flexible sheet materials can optionally include a coating over part or all of the surface to provide additional functionality, such as providing barrier properties. Further, the flexible sheet materials can optionally include bicomponent fibers to provide additional functionality, such as stability to gamma radiation for sterilization purposes. The bicomponent fibers are typically made of two distinct polymers and can be combinations of polyethylene, polypropylene or polyester. However, bicomponent fibers can be made from the same polymer having different properties. The bicomponent fibers can have sheath/core or side-by-side arrangement of the polymers. The flexible sheet materials useful in the present invention are typically liquid impervious and are chosen preferably to additionally act as a barrier to protect the wearer from such hazards as blood and chemicals.

[0020] Preferably, the flexible sheet material additionally acts as a barrier to the transmission of particles. More preferably, the flexible sheet material is able to prevent the transmission of greater than 85 percent of particles larger than 0.5 micrometers. Most preferably, the flexible sheet material is able to prevent the transmission of greater than 93 percent of particles larger than 0.5 micrometers.

[0021] Flexible sheet materials suitable for use in the present invention include but are not limited to microporous films, polyester and polyolefins. Preferably, the flexible sheet material comprises polypropylene or polyethylene. Polyethylene is preferred, for example TYVEK®, available from E. I. du Pont de Nemours and Co., Wilmington, Del. Flexible sheet materials suitable for use in the present invention can be produced by methods known in the art such as hydroentangling, carded thermal bonding, spunbonding, or meltblowing.

[0022] The invention as depicted in FIG. 1, is a disposable footwear cover **10** having an inner surface, an outer surface, a lower leg region **35**, an ankle region **30**, a metatarsal region **20**, a toe region **25**, and a sole region **28**. The disposable footwear cover **10** includes elastic material to gather excess sheet material and provide a snug and improved fit. The term "elastic gather" as used herein refers to elastic bands, threads or the like that are attached to the flexible sheet material. Referring to FIG. 1, elastic gathers **50**, **60** and **70** are typically located respectively on the inner or outer surface of the footwear cover in each of the lower leg region **35** which encompasses the region about 2 cm below the knee to about 2 cm above the ankle, the ankle region **30** which encompasses the region about 2 cm above the ankle to about 2 cm below the ankle, and the metatarsal region **20** which encompasses the region of about the balls of the feet to the heel.

The elastic gather **50** located in the lower leg region is typically placed surrounding the boot cover opening. The elastic gathers are typically less than about 2 cm wide. Preferably, the elastic gathers are less than about 1 cm wide. Most preferably, the elastic gather is an elastic thread. The elastic gathers are typically made from materials such as spandex, natural rubber, polyurethanes, and combinations thereof. The elastic gathers can be attached to or incorporated into the flexible sheet material of the footwear cover. Typical means for the attachment or incorporation of the elastic gathers include stitch bonding, adhesives, sewing and tunnelization (enclosing an elastic in a strip of like flexible sheet material and sewing the strip to the footwear).

[0023] The elastic gather of the lower leg region **50** typically encircles at least a portion of the leg of the wearer and can completely encircle the wearer's leg. The elastic gather of the lower leg region **50** can extend around all or a fraction of the circumference of the lower leg region. The elastic gather of the lower leg region **50** preferably encircles only a portion of the wearer's leg to allow for ease of donning. More preferably, the elastic gather of the lower leg region **50** encircles a portion of the back of the wearer's leg. Most preferably, the elastic gather of the lower leg region **50** encircles about 30 to 80 percent of the circumference of the wearer's leg at the area of contact.

[0024] The elastic gather of the ankle region **60** is typically placed as to gather excess material of the footwear cover and provide a snug fit. The elastic gather of the ankle region **60** can extend around all or a portion of the circumference of the ankle region **30**. Preferably, the elastic gather of the ankle region **60** extends around 25 to 80 percent of the circumference of the ankle region **30** of the footwear cover. More preferably, the elastic gather of the ankle region **60** additionally extends around the back of the ankle. Most preferably, the elastic gather of the ankle region **60** extends around 25 to 60 percent of the circumference of the ankle region **30** of the footwear cover including the back of the ankle.

[0025] The elastic gather of the metatarsal region **70** is typically placed as to gather excess material of the footwear cover to reduce the possibility of tripping and provide a snug fit. The elastic gather of the metatarsal region **70** typically extends across the metatarsal region **20** from about one edge the sole to about the opposite edge of the sole.

[0026] A method for making the disposable foot cover is depicted in FIGS. 2A-2F. In FIG. 2A, two tapered sheets **100** and **100'** are provided, having narrow edges a and a' and wide edges b and b', respectively. Each sheet can measure about 35 cm long, about 9 cm at its narrow edge and about 12 cm at its wide edge. As depicted in FIG. 2B, the sheets **100** and **100'** can be aligned and fastened together along narrow edges a and a' and also fastened along the long edges for a distance c and c', thereby forming at the top a small opening T and at the bottom a large opening B. The distance of c or c' can be about 15 cm. As depicted in FIGS. 2C and 2D, a third sheet **104** having edges d and d' and an edge e (which can be about 35 and about 30 cm, respectively) is shaped into a cylinder by fastening edges d and d' together. As depicted in FIG. 2E, the now circumferential edge e of cylinder **104** can then be fastened to edge f of small opening T to form a substantial portion of foot cover **10** including the lower leg region **35** and ankle region **30**. A suitably shaped

and sized piece of sheet material (for example an oval of about 33 cm×15 cm) with rounded edge h is fastened to edge g of large opening B to form a sole sheet **28**. As depicted in FIG. 1, loose footwear cover material is gathered and elastic gather **70** is positioned across the metatarsal region in a direction extending from one edge of the sole to the other edge of the sole. Elastic gather **60** is positioned around the back of the ankle area **30** and elastic gather **50** is positioned around the circumference toward the top of the lower leg portion **35**. Elastic gather **60** or **70** can be incorporated either before or after the attachment of sole sheet **28**.

[0027] Referring to FIG. 2F, disposable footwear covers of the present invention incorporate a polymer coating **32** on a portion of the outer surface of sole region **28** that commonly contacts the floor to provide a high coefficient of friction in an effort to minimize the risk of slipping and falling. It is desirable that the polymer coating have a high coefficient of friction on both wet and dry surfaces. The polymer coating can be continuous, discontinuous, patterns, islands, dots, and combinations thereof. As depicted in FIG. 2F, preferably the polymer coating **32** is applied to regions that support the most weight during use such as the balls of the feet and heel. More preferably, the polymer coating **32** covers at least about 25 percent of the area of the sole region, more preferably, the polymer coating covers at least about 50 percent of the sole region, most preferably, the polymer coating **32** covers at least about 80 percent of the sole region. The polymer coating **32** typically comprises materials such as polyester, polyolefins (e.g., polyethylene or polypropylene), polyvinyl chloride, polyurethane, rubber, and combinations thereof. Preferably, the polymer coating comprises polyethylene, polyvinyl chloride, or rubber. Suitable embodiments of the coated portion of the sole of the footwear cover include polyvinyl chloride-coated polyester scrim, polyethylene-coated polyethylene sheet, and rubber-coated polyethylene sheet. The polymer coating typically has a coefficient of static friction greater than about 1.5. Preferably, the polymer coating has a coefficient of static friction greater than about 2.5. Most preferably, the polymer coating has a coefficient of static friction of greater than about 3.0.

Test Methods

[0028] Coefficient of Friction is the dimensionless ratio of the friction force (F) between two bodies to the normal force (N) pressing these bodies together. The coefficient of friction is determined in accordance with ASTM D1894.

[0029] Coefficient of Static Friction is the coefficient of friction corresponding to the maximum friction force that must be overcome to initiate macroscopic motion between two bodies. The coefficient of static friction is determined in accordance with ASTM D1894.

What is claimed is:

1. A disposable footwear cover having an inner surface, an outer surface, a lower leg region, an ankle region, a metatarsal region, a toe region, and a sole region, the cover comprising:

- a flexible polymer sheet;
- an elastic gather in the lower leg region;
- an elastic gather in the metatarsal region;

- an elastic gather in the ankle region; and
- a non-slip coating covering at least 25 percent of the surface area of the sole region.
- 2. The disposable footwear cover of claim 1, wherein the flexible polymer sheet comprises a material selected from the group consisting of polyolefin and polyester.
- 3. The disposable footwear cover of claim 2, wherein the flexible polymer sheet comprises polyethylene.
- 4. The disposable footwear cover of claim 1, wherein the flexible polymer sheet is nonwoven.
- 5. The disposable footwear cover of claim 1, wherein the flexible polymer sheet is woven.
- 6. The disposable footwear cover of claim 1, wherein the polymer coating has a coefficient of static friction greater than about 1.5.
- 7. The disposable footwear cover of claim 1, wherein the non-slip coating comprises a material selected from the group consisting of polyvinyl chloride, polyolefins, polyester, rubber, polyurethane and combinations thereof.
- 8. The disposable footwear cover of claim 7, wherein the non-slip coating comprises polyester.
- 9. The disposable footwear cover of claim 8, wherein the polyester is coated with polyvinyl chloride.
- 10. The disposable footwear cover of claim 1, wherein the flexible sheet material blocks transmission of greater than about 85 percent of particles having an average diameter of greater than about 0.5 micrometers.

11. The disposable footwear cover of claim 10, wherein the flexible sheet material blocks transmission of greater than about 93 percent of particles having an average diameter of greater than about 0.5 micrometers.

12. A process for making a footwear cover of claim 1, comprising the steps of

- providing two sheets of polymer each having two long sides and a taper from a wide end to a narrow end,
- attaching the two sheets together at the narrow end of the taper,
- attaching the two sheets together for a partial distance on each of the long sides, thereby forming a small opening and an opposite large opening,
- providing a third sheet,
- forming the third sheet into a cylindrical shape,
- attaching the cylindrical third sheet to the small opening,
- providing a sole sheet,
- attaching the sole sheet to the large opening,
- attaching an elastic gather in the lower leg region,
- attaching an elastic gather in the metatarsal region,
- attaching an elastic gather in the ankle region.

* * * * *