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S. ARRON

3,392,264

ELECTRICALLY HEATED FOOTWEAR

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Fig. 1

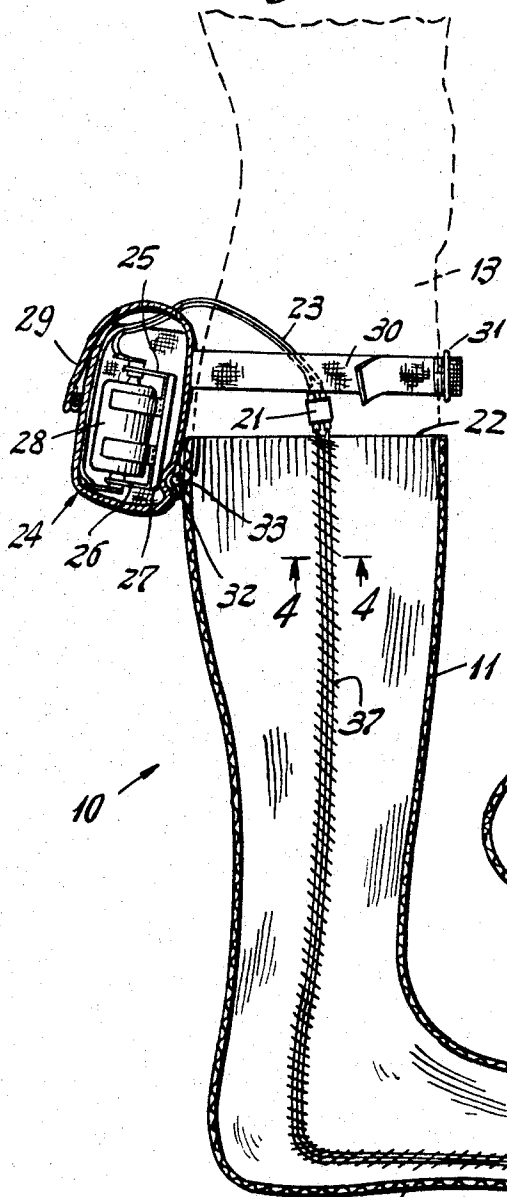


Fig. 3

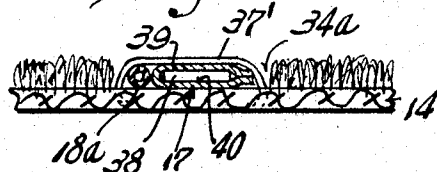


Fig. 4

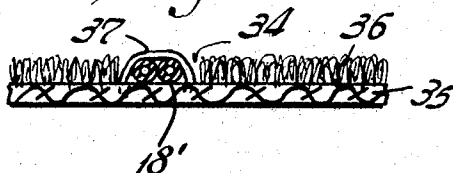


Fig. 5

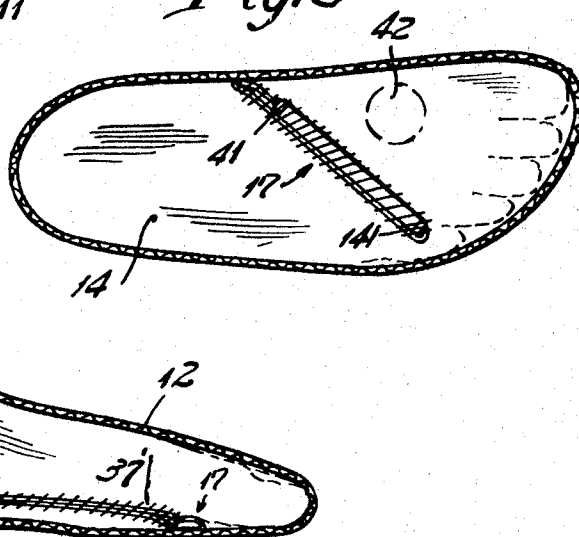
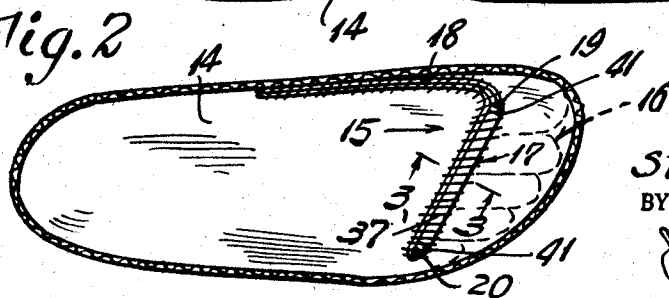


Fig. 2



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ELECTRICALLY HEATED FOOTWEAR

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ABSTRACT OF THE DISCLOSURE

An electrically heated footwear having a flat thin resistance ribbon secured on the sole to underlie the base of the wearer's toe with a flexible covering thereover and wires connecting the ribbon to batteries carried by the sock.

In many outdoor activities in cold weather it has been found that the extremities of a human body, particularly the feet, do not have sufficient body heat to maintain them comfortable. While it has been heretofore suggested that footwear, whether shoes or stockings, should have heating elements for supplying heat to said extremities, such heretofore suggested heated footwear has not been found completely satisfactory. One objection has been the employment of heating elements which have not been capable of being utilized without discomfort to the user. Another objection has been created by the necessity of using bulky sources of electrical energy, such as large batteries, which are required to be not only inconveniently located on and carried by the wearer but also have awkwardly extending connections between it and the heating element. Furthermore, the use of relatively large storage batteries has required specific types of heating elements which have been found to render such heated footwear quite expensive thereby limiting the usage thereof.

It is accordingly an object of the present invention to provide an article of apparel which supplies heat to the wearer and in which there is a minimum of discomfort and inconvenience, if any at all, to the wearer even when engaged in physical activities.

Another object of the present invention is to provide a stocking in which the heat is supplied by the conversion of electrical energy and in which the source of electrical energy may be conveniently, comfortably and unobtrusively carried by the user.

A further object of the present invention is to provide an article of apparel in which the heating element which converts electrical energy into heat is flexible, easily secured to the apparel, comfortable to the touch of the wearer and is shaped to provide a relatively large exterior area for its size.

A still further object of the present invention is to provide a heating stocking which is extremely economical to manufacture, is durable in use and which may be washed in a conventional washing machine.

In carrying out the present invention, a feature thereof resides in providing an article of apparel, specifically a stocking, in which there is secured an electric heating element. The heating element consists of a length of electrical resistance ribbon that is disposed on the interior of the sole portion of the stocking in a location that enables it to supply heat to specific areas of the foot. The resistance ribbon is prevented from direct contact with the foot of the wearer by there being secured on its exterior, a covering of pervious material, such as fibrous material, which permits heat to pass therethrough but yet which insulates the wearer's foot from actual contact with the warmer heating element.

In the present invention, the heating element includes a length of flat thin ribbon of electrical resistance material. The ribbon is configured to be many times wider than it is thick and thus by its thinness is flexible and by its

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width provides a large area over which heat may be dissipated as compared to other cross-sectional shapes.

The stocking is preferably made of relatively bulky material and formed to provide a channel on its interior surface which extends along the instep covering portion and the leg covering portion of the stocking. The heating element and a pair of electrical conducting wires are contained within the channel with the conducting wires terminating preferably in a detachable electric connector. Also secured to the detachable electric connector is a source of electrical energy, such as a battery through a pair of leads such that the battery may provide electrical energy to the heating element which is mechanically and electrically connected to the wires.

In order to enable the battery to be conveniently carried by the wearer, it is contained within a pouch that includes a strap by which the pouch may be secured about the leg of the wearer. Also, detachable connectors on the pouch and the exterior upper portion of the stocking provide additional securing thereof. Thus, the battery is mounted closely adjacent the heating element but yet is conveniently accessible and comfortably positioned.

Other features and advantages will hereinafter appear.

In the drawing:

FIG. 1 is a view, partly in section, showing the heated footwear of the present invention.

FIG. 2 is a section showing the inner surface of the sole portion of the stocking.

FIG. 3 is an enlarged view taken on the line 3-3 of FIG. 2.

FIG. 4 is an enlarged view taken on the line 4-4 of FIG. 1.

FIG. 5 is a view similar to FIG. 2 showing a further embodiment of the present invention.

Referring to the drawing, the heated footwear of the present invention is generally indicated by the reference numeral 10 and is specifically a stocking having a leg portion 11 and a contiguous foot portion 12. The footwear 10 is shown in FIG. 1 in the shape which it would assume when it is being worn, with a leg 13 of a wearer being shown in dotted lines. The foot portion 12 includes a sole part 14 whose inner surface is adapted to engage the sole of the wearer with the sole part having a portion 15 adapted to be positioned at about the base of the toes of the wearer, the latter being shown in dotted lines and being indicated by the reference numeral 16. Secured in the area 15 is an elongate heating element 17 which when energized provides heat to the foot of the wearer.

For conducting energy to the heating element a pair of insulated conducting wires 18 are connected, as by crimp connectors 19 and 20, to opposite ends thereof. The wires 18 are secured to the inside of the stocking along the portions thereof adapted to overlie the upper instep and the inner leg portion and terminate at their outer end in a releasable connector 21 adjacent the upper end 22 of the leg portion 12. Also, releasably connected to the connector 21 is an additional pair of insulated conducting wires 23 that extend from a pouch 24 where they are connected to opposite terminals 25 and 26 of a battery holder 27 having a battery 28. Thus electrical energy may be conducted from the battery to the wires 23, the releasable connector 21 and the wires 18 to the heating element 17.

The pouch 24 is preferably formed of fabric to have a releasably securable flap 29 which permits access to its interior in order to remove and replace the battery. Secured on the exterior of the pouch is a strap 30 which is adapted to be wrapped about the upper calf portion of the leg of the user. While the strap 30 may be endless and elastic, it is in the specific embodiment shown formed with separable ends that are secured together as by a buckle 31. In addition to being supported by the strap 30, the

pouch is secured to the stocking by means of a releasable connector 32 carried thereby that cooperates with a mating connector 33 mounted on the stocking. As shown, the connectors are of the snap type in which the connector 33 is a male button while the connector 32 forms a female cavity to receive it. Though the pouch is shown located on the back of the wearer's leg 13, it is within the scope of the present invention to position it at other locations on the leg, such as the inner side or outer side, if desired.

The leg and foot portions 11 and 12 of the stocking are preferably formed of relatively bulky material and in order to minimize the protrusion of the wires 18 from the inner surface of the stocking, the wires 18 are sewed or otherwise secured within a channel 34 that is formed in the material in any convenient manner. Thus if the stocking is made from terry cloth, the channel 34 may be formed by retaining the thread loops in the base fabric 35 rather than pulling them out, as indicated by the reference numeral 36 to form the terry cloth. The wires 18 are each provided with an insulating covering 18' to insulate them from each other and the wearer and are secured to the fabric 35 as by overcast stitching 37 though other securing means, such as adhesives, may be employed, if desired. The channel 34 includes a length 34a which is in the embodiment shown in FIG. 2 adapted to be positioned at the base of the toes of the wearer. Secured in the length 34a, as by overcast stitching 37', is the heating element 17.

As shown in the enlarged view, FIG. 3, the heating element includes a length of electrical resistance ribbon 38 which has its periphery completely covered by a piece of pervious material 39 which is preferably secured thereto as by an adhesive 40. The stitching 37' extends over the heating element and a portion 18a of one of the leads 18 for securing the heating element and lead in the channel 34a. The ends of the wires 18 and the ends of the heating ribbon where they are secured together by crimp connectors may be covered by an insulating tape 41, if desired.

In accordance with the present invention, the battery 28 is a low voltage cell of the rechargeable type, such as the alkaline type or a nickel-cadmium type. Such batteries only have a low voltage, on the order of 1½ volts and the resistance ribbon 38 is selected to have a resistance which limits the current to a value that provides sufficient heat but yet does not become too hot during use to be uncomfortable. Moreover, the value of the current flow is small enough to enable even a small C, D or F size of battery to provide current for a few hours of warmth.

The resistance ribbon 38 which may be formed of a nickel, chromium and iron alloy is obtainable from the Hoskings Manufacturing Company, Detroit, Mich., and called "Chromel C." One specific configuration thereof consists of a length of approximately 3½ inches long by ¼ of an inch wide by about .004 thousandths of an inch thick. The large width to thickness ratio affects for the amount of ribbon a relatively large peripheral area over which heat is developed while at the same time being extremely flexible by reason of its thinness.

The covering 39 may be secured to the heating element 38 as by adhesive 40 which is capable of withstanding the temperature of the heating element and also washing conditions. Such a covering is made of fibrous material, such as nylon fibers, that have been matted together to form a fabric and one such fabric which may be employed is sold under the name "Pelon." The covering material is not only comfortable to the user when in contact therewith but in the present embodiment serves to prevent direct contact of the user with the heating element while enabling the heating element to retain its flexibility and yet permit convection and/or conduction of heat from the heating element to the user.

In the embodiment shown in FIGS. 1-4, the heating element 17 is adapted to be located adjacent the base of the toes of the wearer. It has also been found that the heating element 17 may be secured on the inner surface

of the sole of the stocking to be positioned adjacent the ball of the foot. Thus, as in a further embodiment of the invention shown in FIG. 5, the heating element 17 extends from adjacent the base of the little toe towards the instep, somewhat adjacent the ball of the foot, indicated by the reference character 42. The heating element 17 may be secured to the stocking in the same manner disclosed in the previous embodiment, have the same structure and in a channel 43 formed in the sole of the stocking.

It will accordingly be appreciated that there has been disclosed a stocking which supplies heat to a wearer by the conversion of electrical energy into heat. The energy is supplied by a rechargeable battery which is capable of being supported on the wearer's leg, comfortably and unobtrusively adjacent the top of the stocking. The heating element is secured on the inner surface of the stocking and consists of a length of thin, flat resistance ribbon covered with fibrous material. By such a shape, not only is the heating element rendered relatively flexible but it provides a large surface area in which heat is developed while also having sufficient resistance to limit the current flow to a value which maintains it comfortable.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A stocking adapted to supply heat to the foot of a wearer comprising a foot covering portion and a contiguous leg covering portion, said foot covering portion including a sole having a part adapted to underlie the base of the wearer's toes, a heating element secured on the sole part and including an essentially straight length of electrical resistance ribbon having a size to be sufficiently thin to be flexible, a covering of flexible, non-metallic material on said ribbon, said heating element extending only on the part that is adapted to underlie the base of the wearer's toes, said covering material having low heat conductivity to decrease spreading heat from the ribbon to localize the heat at the base of the wearer's toes, a pair of conducting wires secured to the ends of the ribbon and means for connecting the wires to a low voltage source of electrical energy.

2. The invention as defined in claim 1 in which the covering is of textile, fibrous material.

3. The invention as defined in claim 1 in which the source of electrical energy is a low voltage battery, there is provided a pouch for containing the battery and securing means for securing the pouch to the stocking.

4. The invention as defined in claim 1 in which adhesive means secures the covering material on said heating element and in which the said covering material is made of textile fibers.

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