Dec. 20, 1966 R. J. COSTANZO 3,293,405

ELECTRICALLY HEATED FOOTWEAR

Filed Sept. 13, 1965

Fig. 1

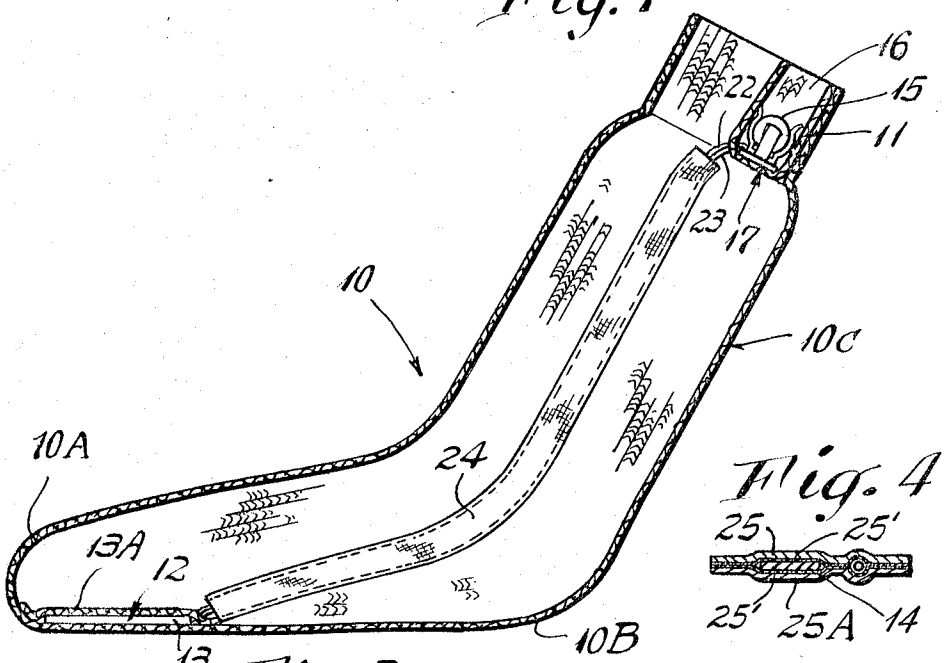


Fig. 4

Fig. 3

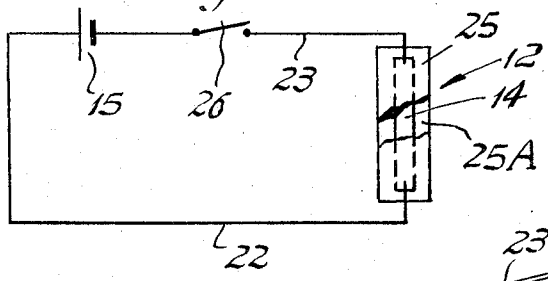
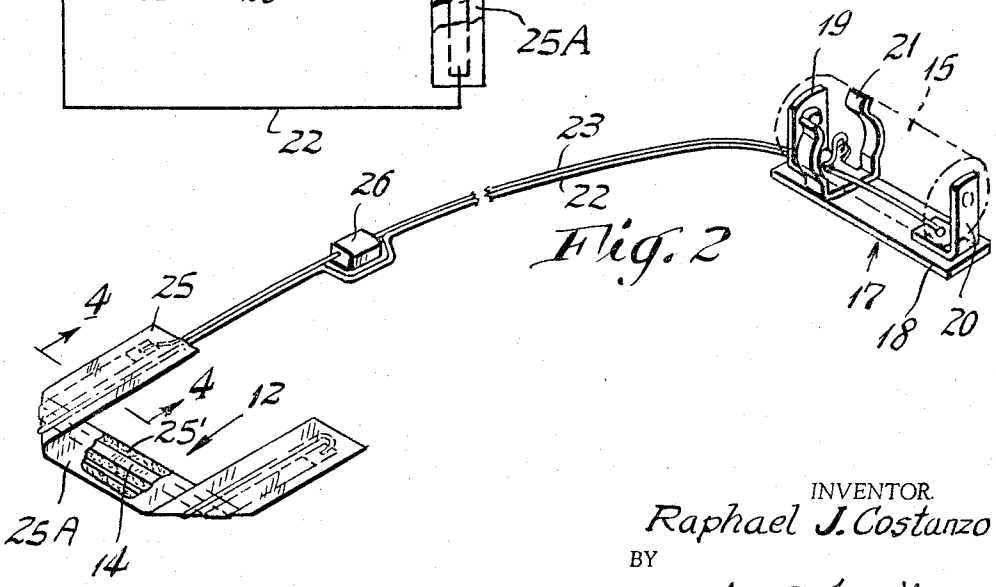


Fig. 2



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ELECTRICALLY HEATED FOOTWEAR

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This invention relates in general to an electrically heated footwear, and more specifically to an electrically heated sock having a circuit including an electric power source and electric heater operatively connected thereto wholly contained within the sock.

Considerable efforts have been made to attain a highly efficient electrically heated footwear as for example, a sock to keep one's feet warm. Heretofore all the known efforts to electrically heat such a sock required a source of electrical power which was extraneous or remotely disposed from the sock itself, e.g., a fixed source, such as household or vehicle power, or a portable power pack carried on the person's body. When the line current from a fixed source of electrical power was utilized, e.g. in a home or vehicle, the mobility of the person wearing such heated sock or footwear was necessarily limited to the length of cord or wire required for conducting the current from the fixed power source to the sock. Consequently, such socks had only limited application, as for example when sleeping, resting or when flying an airplane or operating some other vehicle wherein movement of the wearer was necessarily confined and where sufficient power was available to energize the heater of such socks.

To obviate the mobility handicap of such electrically heated footwear socks, efforts have been made to provide a portable power pack by which the heater of such socks or footwear may be energized. Because of the energy heretofore required to energize the heater used in such socks, such efforts resulted in utilizing a relatively large sized battery or power pack which had to be worn by the wearer about his waist. For this reason long conductors or wires were required to extend along the body of the wearer to connect the power pack to the heating means disposed within the sock or footwear. Such power packs, however, due to the size requirements of the battery necessary to energize such heaters, were relatively bulky, heavy and cumbersome to wear. Also, the wires required to extend from the power pack and the sock greatly interferred with the mobility of the person wearing such sock and associated power pack unit.

It is, therefore, an object of this invention to provide a heated footwear, sock or the like with an improved type electrical heating means capable of operating on very low voltages, whereby the power source to energize the same comprises a small, low voltage battery which can be concealed wholly within the footwear or sock itself.

Another object of this invention is to provide an improved heated sock which is completely immersible in water and consequently can be either machine or hand-washed with ease and without adversely affecting the electrical portion of the sock.

Another object of this invention is to provide a heated sock which is long lasting and non-allergic to the wearer.

Another object of this invention is to provide an improved heated sock in which the distribution of heat can be located where most desirable.

Another object of this invention is to provide a heated sock which is relatively simple in construction, inexpensive to fabricate, and which is positive in operation.

Another object of this invention is to provide a heated footwear or sock having an improved heater construction.

Another object of this invention is to provide an electrically heated sock having an entirely self-contained source of electrical energy and heater energized thereby.

Another object of this invention is to provide in an electrically heated wear a circuit including a low voltage, battery and connected heater with provisions for conserving the useful like of the battery to its maximum extent.

The foregoing objects and other features and advantages are attained by an electrically energized footwear as for example, a sock which may be of conventional construction, i.e. it may be either woven or knitted, and comprising essentially of a toe portion, a heel portion and a connected leg portion with the usual elastic top or band adjacent the upper end thereof. In accordance with this invention an electrical heating means is located within the sock. The heating means is preferably located adjacent to toe portion of the sock and it is energized entirely by a low voltage battery which is also carried within the sock itself. Accordingly, a means is located adjacent to the upper end or band of the sock to define a pocket for containing a holder to which a small low voltage battery is detachably secured. In the toe portion of the footwear there is formed a pocket for receiving the heating means. In accordance with this invention the heating means comprises an electrical resistor form of a flat strip of high electrical resistant material, as for example Nichrome. The resistor is operatively connected in circuit to the battery by means of conductors which run along the inside of the sock. To enhance the heating characteristic of the heating means, a radiating surface is operatively connected to the electrical resistor in heat transfer relationship. The radiation surface comprises flat metallic sheet material or foil which is electrically insulated but in an heat conducting relationship with the electrical resistor. Accordingly, the arrangement is such that the heating means can be shaped to conform to any desired shape. By utilizing a flat element added comfort is attained to the wearer of such footwear.

To conserve the useful life of the battery, a circuit breaking means is interposed in the circuit between the heating means and the battery, which in effect operates as a thermostat, intermittently breaking and making the circuit, as determined by the power requirements thereof.

A feature of this invention resides in an electrically heated footwear or sock having a self-contained electrical power source and heating means operatively connected thereto.

Another feature of this invention resides in electrically heated sock which is readily washable.

Another feature of this invention resides in the provision of utilizing the heater construction which includes an electrical resistor with connected heat radiating surfaces so as to expand the heating area of the heater.

Another feature of this invention resides in the provision of an improved heating element which can be energized by a very low voltage battery.

Another feature of this invention resides in the provision of an improved electrically heated sock or the like which can be worn with all the comfort and convenience of ordinary sock or footwear.

Other features and advantages will become more readily apparent when considered in view of the description and drawings in which:

FIGURE 1 illustrates a sectional side view of a sock construction embodying the instant invention.

FIGURE 2 illustrates a prospective view of the improved electrical heater and source of power necessary to energize the same, as utilized in the sock construction of FIGURE 1.

FIGURE 3 is a schematic illustration of the electrical circuit utilized in the sock construction of FIGURE 1.

FIGURE 4 is a sectional view of the heating means taken along line 4—4 on FIGURE 2.

Referring to the drawings there is shown therein an improved footwear construction **10** embodying the instant invention, which is herein illustrated as a sock. The sock **10** may be conventionally formed, i.e. woven or knitted, and comprises generally of a toe portion **10A**, a heel portion **10B**, and a connected leg portion **10C** having an elastic band **11** or the like adjacent the upper end thereof.

In accordance with this invention the sock **10** is electrically heated by means of a low voltage heating means **12** suitably positioned within the sock **10**. In the illustrated form of the invention, the heating means **12** is located adjacent the toe portion **10A** of the sock. To accommodate the heating means **12** within the sock there is formed an internal pocket **13** in the toe portion **10A**.

The heating means **12** as best seen in FIGURE 2 is readily inserted into the pocket **13** which is defined by the sole or bottom portion of the sock and a layer of material **13A** which is sewn adjacent thereto on the inside surface of the sock. The heating means **12** comprises a flat strip of electrical resistance material **14**, as for example Nichrome. The Nichrome strip or resistor **14** in turn is connected in circuit with a suitable source of electrical power as for example, a low voltage battery **15** which is adapted to be carried in the sock **10** itself.

In the illustrated form of the invention the battery **15** is carried in the pocket **16** formed in the upper end of the sock; and preferably in the band portion **11** thereof. The size of the pocket **16** is such that it can readily accommodate the battery holder **17** and a small low voltage battery **15** for energizing the heater **12** as will be hereinafter described. The holder **17** is constructed so that the battery can releasably attach thereto.

As best seen in FIGURE 2, the battery holder **17** comprises a base member **18** which has connected thereto a pair of spring finger or terminals **19, 20** which are arranged to engage with the terminal portions of the battery **15**. Connected to or integrally formed with the front finger or terminal **19**, is a resilient clip **21** which serves to embrace the side portions of the battery **15** as shown. Accordingly, the battery **15** can be readily releasably attached to the holder **17** by positioning the same between the terminal fingers **19, 20** and associated clip **21**. Accordingly the battery is frictionally retained against longitudinal movement by means of the spring finger terminals **19, 20**, and against lateral movement by the spring clip portion **21**.

Suitable conductors **22, 23** connect the battery into circuit with the heater **12**. Accordingly the ends of one conductor **23** are connected between the Nichrome strip **14** and the battery terminal **20**. The other conduit or wire **23** is connected to the other battery terminal **19** and the other end of the Nichrome strip **14**. With the resistors so connected, it is placed in circuit with the battery when the battery is placed in the holder **17**. A suitable binding **24** conceals or covers the conductors **22, 23** against the leg portion of the sock.

The heating surface of the Nichrome strip **14** is enhanced by radiation means connected in heat transfer relationship therewith. In the illustrated form of the invention, the heat radiating means comprises a sheet of heat conducting material, as for example, metallic foil **25**, such as aluminum foil or the like which is connected in heat transfer relationship to the Nichrome strip **14**. In the illustrated embodiment, two similar strips **25, 25A** may be disposed in back to back relationship on either side of the resistant element so as to be secured theerto in heat transfer relationship with it and each other. A suitable means for securing the foil to the resistor **14** may be by applying an adhesive coating **25'** to the back of the foil. Accordingly the adhesive coating **25'** also functions to electrically insulate the electrical resistor from the foil

while at the same time securing the foil **25, 25A** in heat transfer relationship to the resistor **14**. The foil **25, 25A** may be also electrically insulated by anodizing the foil.

As shown, the heating area or surface of the resistor **14** can be expanded to any desired width or shape depending upon the shape and form of the radiating strips **25, 25A**. Thus, with a very narrow resistor, the heat therefrom can be effectively distributed over a relatively large area. Consequently the heat generated is not confined to a single point, but is comfortably distributed for uniform heating.

In the illustrated form of the invention it will be readily noted that the heating means **12** was initially formed as an elongated member which was subsequently folded to define the U-shape heater **12** which is readily inserted into the toe pocket **13** of the sock **10**.

In operation, it will be noted that whenever the battery **15** is interposed between the terminals **19, 20** of the battery holder, the circuit to the heater will become energized.

If desired, a suitable switching means (not shown) may be connected in series between the battery **15** and the heating element **12** so as to control the operation of the circuit.

In accordance with this invention a means is provided for extending the life of the battery. Experience has shown that the temperature required to be generated by the heater need be only slightly greater than that of normal body temperature to keep one's feet warm. For this reason the power requirement to energize the heater need not be constant. For this reason the heater circuit can be intermittently operated, as may be required by the body temperature or demand of the wearer. This is attained by interposing an automatically operating circuit breaker **26** of known construction in the line between the battery **15** and the heater. Accordingly the circuit breaker is constructed so that it will function as a thermostat for intermittently making and breaking the circuit to the heater according to the power requirements. Accordingly by utilizing intermittent operation, it has been discovered that the useful life of the battery **15** can be substantially extended.

The heating means **12** described is arranged and constructed to operate with very low voltage battery. For example, three to four 1½ volt batteries may be utilized to energize the heater, or a 3 volt battery can satisfactorily energize the heater **12**. Also 2 D cell batteries can be used to energize the heater **12**.

From the foregoing it will be readily noted that the heated footwear **10** described comprises a wholly contained unit in which the source of power **15** and the heater **12** can be wholly disposed within the makeup of the sock **10** itself. The entire sock **10** is relatively light in weight and which when worn can be worn with the convenience and luxury of an ordinary sock. Consequently, the wearer is not required to wear any bulky power pack unit which is rendered readily apparent to another person. With the invention described, the footwear is given all the appearance and has all the comfort of a conventional footwear, but with the added provision that a source of heat is provided to add additional comfort in extreme cold. Accordingly, the heated sock has particular application as sport wear, e.g. hunting and/or fishing in the cold, or cold climates, and can be worn so as to not interfere in any manner with the movements of the wearer. Also, the overall weight thereof is reduced to a minimum.

While the instant invention has been particularly defined as applied to an electrically heated sock it will be readily noted that the novel heating means may be readily applicable to other body heating garments and/or applications. Therefore, while the instant invention is disclosed and described with reference to a heated sock, it will be readily understood and appreciated that variations and modifications may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. In combination:

(a) a woven sock having a toe portion, a heel portion and a connected leg portion,

(b) means defining a pocket adjacent the upper end of said leg portion,

(c) a holder adapted to releasably secure a low voltage battery in said pocket,

(d) electrical non-conductive means defining a pocket in the toe portion of said sock,

(e) a heater disposed in said toe pocket,

(f) said heater including a flat resistor strip of electrical resistance material,

(g) radiation means connected in heat transfer relationship to said flat resistor strip for defining an expanded radiation surface for said heater,

(h) said radiation means including a pair of heat conducting sheets of material for sandwiching said resistor strip in heat transfer relationship therebetween,

(i) means joining said heat conducting strips together and electrically insulating said strips from said resistor strip,

(j) electrical conductors connecting said resistor strip in circuit to said battery,

(k) means for maintaining said conductors against the leg portion of said sock,

(l) and a circuit breaker connected in circuit with said heater to intermittently make and break the circuit.

2. In combination

(a) a woven sock having a toe portion, a heel portion and a connected leg portion,

(b) means defining a pocket adjacent the upper end of said leg portion adapted to receive a low voltage battery of less than 6 volts,

(c) electrical non-conductive means defining a pocket in the toe portion of said sock,

(d) a heater disposed in said toe pocket,

(e) said heater including a flat resistor strip of electrical resistance material,

(f) radiation means connected in heat transfer relationship to said flat resistor strip for defining an expanded radiation surface for said heater,

(g) said radiation means including a pair of heat conducting sheets of material for sandwiching said resistor strip in heat transfer relationship therebetween,

(h) means joining said heat conducting strips together and electrically insulating said strips from said resistor strip,

(i) electrical conductors connecting said resistor strip in circuit to said battery, and

(j) means maintaining said conductors against the leg portion of said sock.

3. The invention as defined in claim 2 wherein said heat conducting sheets of material comprise metallic foil connected in heat transfer relationship to said resistor strip.

4. The invention as defined in claim 2 wherein said means joining said heat conducting strips comprises an adhesive coating on one side of said heat conducting strips whereby said heat conducting strips of material are adhesively secured in back to back relationship to sandwich said resistor strip therebetween in heat transfer relationship therewith.

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Disclaimer

3,293,405.—*Raphael J. Constanzo*, Bridgeport, Conn. ELECTRICALLY HEATED FOOTWEAR. Patent dated Dec. 20, 1966. Disclaimer filed Jan. 17, 1977, by the inventor.

Hereby enters this disclaimer to claims 1 through 4 of said patent.

[*Official Gazette March 22, 1977.*]