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Gross et al.

[11] **3,906,185**

[45] **Sept. 16, 1975**

[54] **HEATED INSOLE CONSTRUCTION**

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[73] Assignee: **Comfort Products, Inc.**, Aspen, Colo.

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[52] **U.S. Cl.** **219/211**; 36/2.6; 128/383; 219/523; 219/529; 219/536

[51] **Int. Cl.**[2] **H05B 1/00**; H05B 3/16

[58] **Field of Search** 219/211, 523, 528, 529, 219/536; 128/383; 36/2.6, 43–44

[56] **References Cited**

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1,430,404	9/1922	Radford	219/211 UX
2,028,347	1/1936	Pelosi	36/2.6
2,206,029	7/1940	Daniels	36/2.6 X
2,692,326	10/1954	Crowell	36/2.6 X
3,621,191	11/1971	Cornwell	219/211

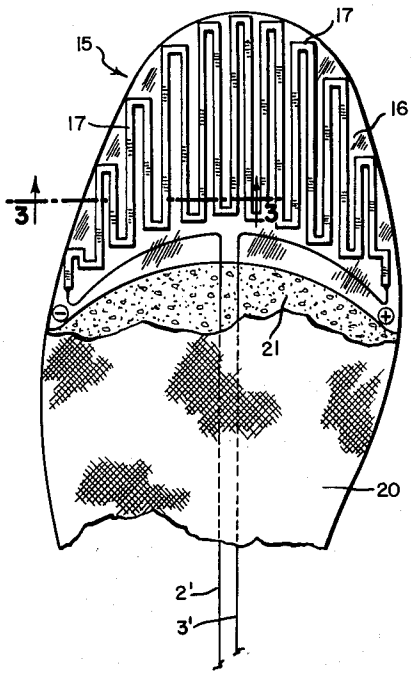
Primary Examiner—C. L. Albritton

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[57] **ABSTRACT**

An electrically heated insole construction adapted to be fitted into a shoe or boot, the insole having a layer of plastic mesh material with the openings in the mesh providing air insulation spaces, and a layer of plastic electrically insulated material overlying the mesh material in a toe portion of the insole and having an electrically conductive circuit printed thereon.

7 Claims, 5 Drawing Figures



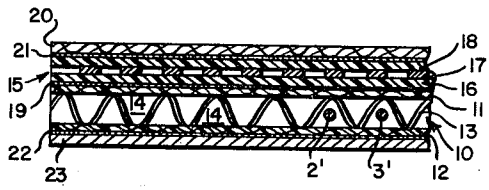


FIG. 1

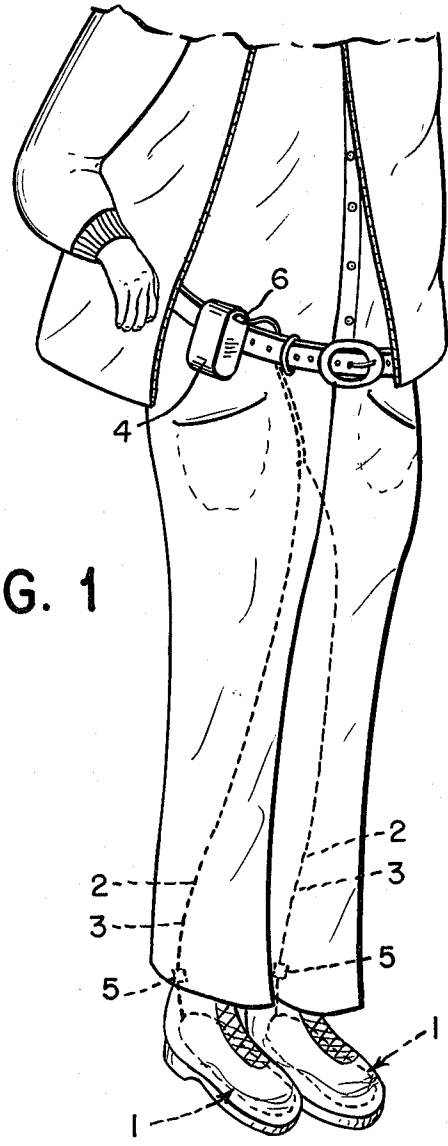


FIG. 2

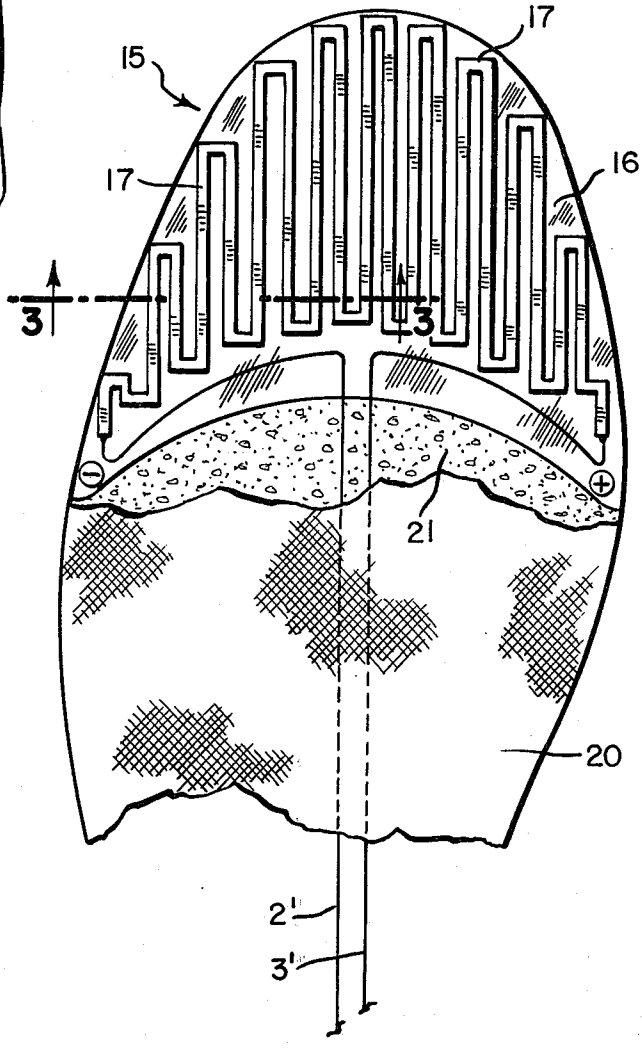


FIG. 3

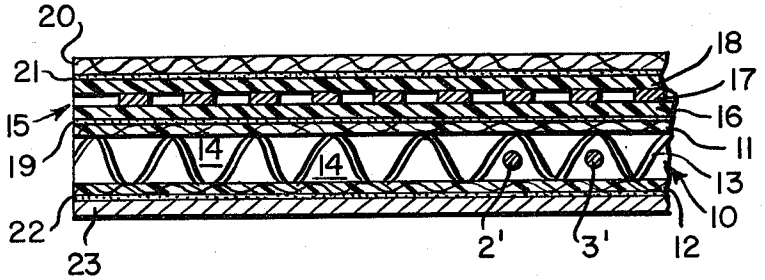


FIG. 4

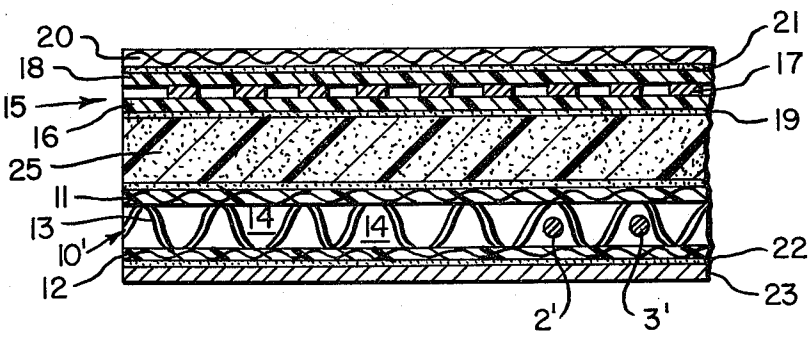
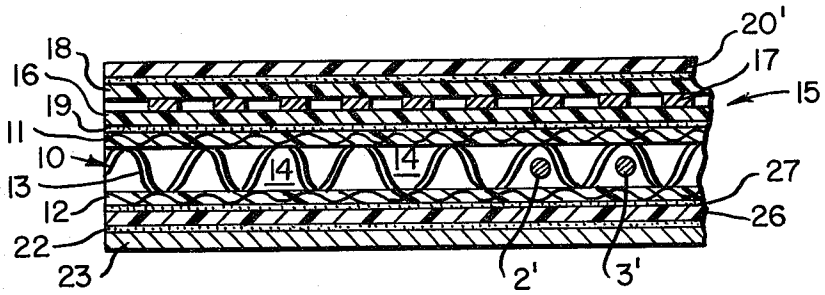

20
18
15
16
25
11
13
10'
12
14
14
21
17
19
22
23
2'
3'

FIG. 5


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16
19
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23
14
14
20'
17
15
27
26
2'
3'

HEATED INSOLE CONSTRUCTION

BACKGROUND OF THE INVENTION

Various forms of insole constructions have been proposed in order that boots, shoes and other footwear may be electrically heated. Examples of such structures are illustrated in the following U.S. Pat. Nos. **1,275,451, 1,430,404, 2,028,347, 2,692,326** and **3,621,191.** Prior art constructions as exemplified in these patents for the most part provide for electrical resistance elements in the form of conventional wiring to be embedded in insoles with the result that heat, in addition to being directed to the bottom of the user's foot, is also directed to the sole of the shoe such that this heat is for the most part wasted. Since the prior art constructions depend upon power packs for the source of electric power and because the power packs have a limited capacity, the heat wasted in heating the sole of the shoe represents a substantial drain on the limited capacity of the power pack. The use of plastic insulation layers in heated insole constructions has been proposed in order to reduce the flow of heat to the sole of the shoe. See for example application Ser. No. **416,209** filed Nov. **15, 1973.** Such constructions utilize conventional electrical wiring which wiring allows heat to be radiated evenly around the circumference of the wiring such that only a small part of the heat is directed towards the user's foot.

It is an object of our invention to provide for an electrically heated insole which assures that heat will be directed primarily towards the foot of the user rather than towards the bottom sole of the shoe into which the insole is fitted thus making the best use of the limited capacity of the power pack.

GENERAL DESCRIPTION OF THE INVENTION

Broadly, our invention comprises an electrically heated insole having a heel area and a toe area which may be fitted into the bottom of a shoe, boot, or other footwear. The insole comprises in part a layer of plastic mesh material where the openings of the mesh form air insulation spaces. A layer of electrically insulative plastic material overlies the layer of mesh material in the toe area of the insole and has an electrically conductive circuit printed on the side of the plastic layer opposite the plastic mesh material. In this manner heat generated in the printed circuit when it is connected to a power source by electrical wiring will be directed towards the foot of the user and prevented by the air insulation spaces of the mesh material from being conducted to the sole of the shoe. Preferably the mesh-like material comprises two layers of a fabric-like material knitted or woven from a plastic monofiliment which layers are separated by corrugated monofiliment material. The monofiliment material extends across the width of the insole and forms grooves running the length of the insole through which electrical wiring may extend from the printed circuit to the heel portion of the insole. A layer of a protective lining material may overlie the mesh material and the printed circuit to give a smooth protective surface. A layer of pressure-sensitive adhesive is applied to the mesh-like material in order that the insole may be affixed into the shoe.

In a further form of the invention an additional foam-like plastic material is interposed between the mesh material and the electrically insulative layer having the printed circuit to provide a further layer of insulation between the printed circuit and the sole of the shoe into which the insole is to be fitted.

In a still further form of the invention, a film of a heat sealable material is interposed between the mesh-like material and the layer of pressure-sensitive adhesive and is heat sealed about its periphery to the protective lining material which may also comprise a heat sealable material. In this manner the mesh-like material is encased by the heat sealable materials and thus further increases the insulation properties of the air spaces.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagrammatical view of an electrically heated insole constructed according to the invention illustrating the connection between the insole and a power pack carried by a user;

FIG. **2** is a partial sectional top view of a heated insole construction according to the invention;

FIG. **3** is an enlarged side sectional view of FIG. **2** taken along lines **3—3**;

FIG. **4** is a view similar to FIG. **3** of a second embodiment of a heated insole; and

FIG. **5** is a view similar to FIG. **3** of a third embodiment of a heated insole.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **1,** there is illustrated a heated insole **1** constructed according to the invention connected by electrical wiring **2** and **3** to a power pack **4** adapted to be mounted by a clip or other means to the belt of a user. As shown the electrical wires **2** and **3** extend down the inside of the legs of the user's trousers and are joined by means of a conventional plug and socket arrangement **5** to wiring connecting with the insole. The batteries contained in the power pack **4** are of the rechargeable type which may be conveniently recharged by mounting on a charging unit. When the power pack is to be recharged, it is detached from the wires **2** and **3** by removing a connecting plug **6** and moved to the charging unit. The amount of power withdrawn from the power pack and thus the amount of heat to be generated by the heated insole is regulated by disconnecting and connecting the plug **6.** Batteries which are commercially available may be recharged **250** times or more and are sufficient to provide power for approximately eight hours, the length of a working day during which the heated insoles would be operable.

The novel insole constructed according to the invention comprises a plastic mesh-like layer **10** preferably made of saran fiber comprising two layers of fiber-like material **11** and **12** which are separated by a corrugated monofiliment **13.** As shown, a plurality of air pockets **14** are formed which reduce the convection flow of air between the layers **11** and **12.**

An electrically insulative plastic layer **15** overlies layer **10** on the top portion of the insole and comprises a plastic layer **16** which may be of a polyester material having printed thereon a conductive circuit **17** over which a further layer **18** which is of the same material as layer **16** extends. Circuit **17** in turn connects with lead wires **2'** and **3'**. The layer **15** is affixed to the layer **10** by an adhesive **19.** By utilizing a conductive circuit which is printed on the film **16** rather than conventional resistance wiring, a greater effective surface area of the resistance circuit is created which improves the transfer of heat in vertical directions.

A protective lining **20** is applied to the layer **15** by an adhesive **21.** The lining **20** may comprise a cloth material having a moisture-absorbing capacity or a vinyl material having a moisture-absorbing capacity and including a fungus retardant. The lining increases the comfort to the user by providing moisture-absorbing capacity and also by providing sufficient friction for foot stabiltiy when engaged by the foot of the user. In addition the lining provides a degree of protection to the printed circuit, a degree of rigidity to the insole and serves to improve the appearance of the insole.

The mesh-like layer **10** has a pressure-sensitive adhesive **22** on the lower side thereof over which a protective layer of paper **23** extends. When the insole is to be applied in a shoe, the protective layer of paper **23** is peeled off of the adhesive **22** and the insole applied to the interior of a shoe. Pressure of the user's foot on the insole will be sufficient to then affix the insole to the shoe.

As shown in FIG. **2** the electrically insulative layer **15** is shaped to cover only the toe area of the insole. This is because in practice it has been found that under cold weather conditions discomfort arises mainly from one's toes becoming too cold rather than other areas of the foot, such as the heel or arch. It has been found that if the toes are heated, this is usually sufficient to provide the degree of heat necessary to give the required degree of comfort while at the same time eliminating any unnecessary heating of other areas of the foot which would result in excess draining of the capacity of the power pack.

The use of the layer of mesh-like material besides providing the air chambers **14** which improve the insulative effect of the material also provides channels through which the wires **2'** and **3'** extend along the length of the insole thus providing protection for the wiring. The wires extend to the heel area of the insole and for a short exposed area beyond the heel area and are adapted to be taped to the inside heel of the shoe. A short portion extends outside the shoe and is connected by the plug assembly **5** to the wires **2** and **3.**

FIG. **4** illustrates a further embodiment of the invention which is generally similar to that of FIG. **3** with the exception that a further layer of plastic foam material **25** is interspersed between the layer of mesh material **10'** and the layer **15** of electrically insulative plastic material. This particular construction provides still greater insulation between the printed resistance portions **17** supplying the heat and the sole portion of a shoe which need not be heated.

Referring to FIG. **5** a further form of an insole constructed according to the invention is shown which differs from the constructions of FIGS. **3** and **4** in that the lining **20'** comprises a layer of vinyl plastic and in that a further vinyl layer **26** is interspersed between the mesh-like layer **10** and the pressure-sensitive adhesive layer **22.** Layer **26** and lining **20'** are heat sealed together along their peripheries such that the mesh-like layer **10** and spaces **14** are encased between the vinyl layer **26** and the lining **20'.** This construction increases the insulative properties of the layer **10** by preventing flow of air into and out of the chambers **14** around the edges of the insole. At the same time, the vinyl layer **26** and lining **20'** provide additional structure for holding the complete insole in assembled relation. A layer of adhesive **27** affixes the vinyl layer **26** to the mesh-like layer **10.**

We claim:

1. An electrically heated insole construction having a heel area and a toe area adapted to be fitted into a shoe, said insole construction comprising a layer of plastic mesh material with the openings in the mesh material providing air insulation spaces, a layer of electrically insulative plastic material overlying said layer of mesh material in the toe area of the insole, an electrically conductive circuit printed on the side of said insulation material opposite said layer of plastic mesh, and electrical wiring connected to said printed circuit and adapted to extend to a source of electric power.

2. An electrically heated insole construction according to claim **1** wherein said plastic mesh material comprises two layers of fabric-like material separated by a spacing material and wherein said electrical wiring extends between said layers of fabric-like material.

3. An electrically heated insole construction according to claim **2** wherein said spacing material comprises a corrugated monofiliment extending across the width of said insole and wherein said electrical wiring extends lengthwise of said insole in grooves formed by the corrugation of the monofiliment.

4. An electrically heated insole construction according to claim **1** having in addition a protective lining overlying said mesh material and said insulative material to provide a lining for said insole.

5. An electrically heated insole construction according to claim **4** having in addition a layer of pressure-sensitive adhesive on the side of said plastic mesh opposite said insulation material whereby said insole may be affixed in a shoe.

6. An electrically heated insole construction according to claim **5** having in addition a layer of plastic foam material affixed to the side of said electrically insulative material opposite said conductive circuit.

7. An electrically heated insole construction according to claim **5** wherein said lining layer comprises a heat sealable plastic film and having in addition a further heat sealable plastic film interposed between said layer of pressure-sensitive adhesive and said layer of mesh material and wherein the heat sealable plastic films are sealed together about their peripheries.

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