ABSTRACT

The disclosure provides for the construction of electrically heated panels and a method of manufacturing wearing apparel incorporating such panels for operation by a portable power supply. The panels are constructed by attaching parallel electrodes to a flexible electrically conductive resistance element formed by a coating of polymer containing carbon on textile material. The electrodes being in the form of tinned braided electrical conductors stitched to the textile material by an axial row of stitches through the braided conductor. In one embodiment the polymer coating is applied to the textile material before the electrodes are attached thereto while in an alternative embodiment the polymer coating is applied after the braided conductor is secured to the textile material. The method of connecting the conductor to the coating provides for good electrical conductivity.

3 Claims, 3 Drawing Figures
FIG. 3

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METHOD OF FORMING ELECTRICAL HEATING PANELS FOR TEXTILE ARTICLES

This invention relates to methods of forming electrical heating panels for textile articles and of manufacturing wearing apparel incorporating such panels.

More specifically the invention provides for methods of manufacturing mittens, gloves, jackets and like wearing apparel with flexible electrical conductive resistance elements forming heating panels incorporated therein and methods of forming such heating panels for heating upholstery, baby bottles, seat covers and the like.

Flexible electrically conductive resistance elements of the type formed by a conductive silicone rubber coating on a lamina are known to provide a suitable heating element when spaced electrodes connected to a source of electrical power are mounted in electrical conductivity with the element.

Resistance elements of the type referred to are obtainable with coatings of different resistance. Varying the distance between the positive and negative electrodes varies the resistance and therefore the current through the resistance element when a given voltage is applied to the electrodes.

The use of heating panels in articles of wearing apparel etc. has been restricted because of the difficulty in maintaining good conductivity between electrodes and resistance elements and because of the poor conductivity such panels have been inefficient when operated from portable batteries which were cumbersome.

Heating panels constructed according to the present invention overcome or mitigate these disadvantages by providing good conductivity between electrodes and resistance elements and are operable from a small portable battery.

A 6.8 Volt battery capable of providing a current of 2 amps when connected to the electrodes on a panel of resistance material of 40 ohms per sq. inch will provide a heated panel at approximately 112° F and maintain the temperature for approximately 4 to 5 hours.

According to one embodiment of the invention a method of forming electrical heating panels comprises coating a blank of textile material with an electrically conductive polymer to form a flexible electrically conductive resistance element, attaching to said element two continuous electrodes by means of an axial row of stitches through each electrode, said electrodes each formed by a braided electrical conductor and said electrodes arranged in a plurality of substantially parallel lines spaced from one another a predetermined distance to form electrically conductive paths over a major portion of the element and electrically isolating the electrodes from one another where they cross or lie adjacent one another by insulating material.

According to another embodiment of the invention a method of forming electrical heating panels comprises attaching two continuous electrodes by means of an axial row of stitches through each electrode to a blank of textile material, said electrodes each formed by a braided electrical conductor, said electrodes arranged in a plurality of substantially parallel lines spaced from one another a predetermined distance, applying to the blank and attached electrodes a coating of electrically conductive polymer to form a flexible electrically conductive resistance element, said spaced parallel lines of electrodes forming electrically conductive paths over a major portion of the element and said electrodes isolated from one another where they cross or lie adjacent one another by insulating material attached by stitching to the blank.

Embodiments of the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 shows a blank for the inner lining of a mitten with heating elements attached thereto;

FIG. 2 shows a glove blank with heating elements attached thereto;

FIG. 3 shows an arrangement of heating elements for a jacket, coat or the like.

Referring to FIG. 1 of the drawings 1 denotes a blank for the inner lining of a mitten with electrically conductive resistance elements 2 and 3 laid on the blank 1, the element 2 providing a heating panel for the hand portion 2a of the mitten and the element 3 providing a heating panel for the thumb portion 3a of the mitten.

The flexible electrically conductive resistance elements 2 and 3 are formed in known manner by an electrically conductive polymer coating on a sheet of textile material.

Strips 4 of polyvinylchloride are placed around the edge portions 11, 12, 14 and 15a of the panel 2 and held to the panel and blank 1 by sewing.

The thread used for sewing all the elements referred to herein is TERYLENE (Registered Trade Mark).

An electrode 9 in the form of a braided electrical conductor, tinned to prevent rusting and to provide good electrical conductivity between its surface and the resistance panel 2 is secured by an axial row of stitches illustrated by the dotted line 10 around the perimeter portions 11 of the panel 2 commencing at the side 14 of the panel, extending beyond the side 12 of the panel, down the blank 1 adjacent the side 12 of the panel, across approximately the central portion of the panel 2 as at 13, extending beyond the side 14 and down the blank 1 adjacent the side 14 of the panel, across the bottom edge portion of the panel as at 15, and extending beyond the edge 12 of the panel on to the thumb portion 3a of the blank, across the central portion of the panel 3 as at 16 and extending down the thumb portion 3a of the blank as at 17 to the wrist portion of the blank where it is provided with a connector for connection to one terminal of an electrical power supply.

A second electrode 20, identical to the electrode 9 is secured by an axial row of stitching 21 to the panels and blank commencing at 22 adjacent the edge 12 of the panel 2 and extending across the upper portion of the panel as at 23 substantially parallel to the portion 13 of the electrode 9, and extends beyond the edge 14 of the panel, down the side of the blank adjacent the edge 14 as at 24 and across the panel 2 as at 25 intermediate the portions 13 and 15 of the electrode 9 and substantially parallel thereto, extending into the thumb portion 3c of the blank, across the uppermost end portion of the panel 3 as at 26, down the side of but out with the panel 3 and across the lower portion of the panel 3 substantially parallel to the portion 16 of the electrode 9, then on to the wrist portion of the blank as at 28 where it is provided with a connector for connection to the opposite terminal of an electrical power supply.

The electrodes 9 and 20 when connected to the power supply will be of opposite polarity and are sub-
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An electrode 46 is secured at one end adjacent the bottom end of the element 42 and extends substantially centrally thereof to the opposite end of the element and along one edge of the panel 44 on to one end of the element 41 where it is laid in a series of spaced parallel paths across the element 41 and extending beyond the element on each side thereof on to the panel 41a and strips of P.V.C. 50 are laid across the portions of the electrode extending beyond the element. The electrode 46 continues from the opposite end of the element 41 on to the panel 45 then to the panel 43a where it extends down an edge portion of the element 43 along the bottom of the panel 43a and up the opposite edge portion of the element 43 and is then led down the side of the panel 43 where the free end of the electrode is adapted to be connected to one pole of a power supply.

A second electrode 48 is secured at one end of the element 42, extends down the edge portion of the element beyond the element and across the bottom of the panel 42a and up the opposite edge portion of the element to the panel 44 parallel with the electrode 46 then on to one end of the panel 41a in a series of paths spaced from and substantially parallel to the electrode 46. The electrode 48 continues in a path parallel to the electrode 46 across the panel 45 on to the panel 43a across the element 43 substantially centrally thereof and beyond the element 43 to terminate in a free end adapted to be connected to the opposite pole of a power supply.

The electrode 48 is secured on top of the strips 50 of P.V.C. covering the portions of the electrode 46 which extend beyond the elements and where the electrodes cross one another.

The panels 41a, 42a, 43a, 44 and 45, when constructed are sewn on to the inside of the lining of a jacket coat or the like to provide heating panels.

A further panel arranged substantially the same as panel 41 may also be provided as a kidney panel to be arranged on the lower back portion of a jacket or the like.

In an alternative embodiment of the invention the heating panels are constructed by sewing the braided electrical conductor on to a blank of textile material by means of a row of axial stitches through the electrode and the blank is thereafter coated with an electrically conductive polymer to form a resistance element thus providing a good conductive path between the electrode and the polymer.

The blank which forms a heating panel is then stitched in position on to a garment, article of furniture, seat cover or the like by rows of stitches.

The free ends of the electrodes are cramped or moulded to conductors attachable to a source of electrical power.

Electrical heating panels formed by the methods above described may be used for baby bottle warmers, the warmer being of textile material in the form of a pouch or mitten into which a bottle may be inserted.

The polymer resistance elements may have a resistance of from 40 ohms to 250 ohms per sq. inch depending on the power supply available and the temperature to be obtained. Polymer resistance elements having a resistance of 40 or 80 ohms per sq. inch have been found satisfactory for operation with a 6.8 Volt battery to supply power for 4 to 5 hours to maintain a temperature of approximately 112° F.
Polymer resistance elements having a resistance of 180 or 250 ohms per sq. inch have been found satisfactory for operation from a 12 Volt battery or mains transformer to maintain a temperature of approximately 112°F.

A thermostat control may be provided for controlling the temperature of the panel.

The distance between parallel electrodes of different polarity determines the resistance of the electrical paths between the electrodes.

Although polyvinylchloride has been found to be suitable as an insulating material, it will readily be appreciated that other suitable electrically insulating materials can also be used.

What is claimed is:

1. A method of forming electrical heating panels comprising coating a blank of textile material with an electrically conductive polymer to form a flexible electrically conductive resistance element, arranging two continuous electrodes of braided electrical conductor on said element, a major portion of one of said electrodes being in spaced parallel relation to a major portion of the other electrode, said electrodes arranged sinuously to form electrically conductive paths between said electrodes and over a major portion of the element, securing said electrodes to said element by means of an axial row of stitches through each electrode, and electrically isolating the electrodes from one another where they cross or lie adjacent one another by strips of insulating material.

2. A method of forming electrical heating panels comprising the steps of arranging two continuous electrodes of braided electrical conductor on a blank of textile material, said electrodes arranged sinuously with a major portion of one of said electrodes in spaced parallel relation to a major portion of the other electrode, securing said electrodes to said blank by means of axial row of stitches through each electrode, isolating said electrodes from one another where they cross or lie adjacent one another by strips of insulating material stitched to the blank and coating said blank and electrodes with electrically conductive polymer to form a flexible electrically conductive resistance element and to provide electrically conductive paths between said electrodes and over a major portion of said blank.

3. A method as defined in claim 2 and in which at least one of said electrodes is arranged on the blank of textile material to form at least three sides of a parallelogram.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,768,156
Dated October 30, 1973

Inventor(s) Robin Demsey Caird and John Robertson Smith

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the ABSTRACT OF DISCLOSURE:

Line 5, after "parallel", insert --arranged--.

Signed and sealed this 21st day of May 1974.

(SEAL)
Attest:
EDWARD H. FLETCHER, JR. C. MARSHALL DARN
Attesting Officer Commissioner of Patents
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