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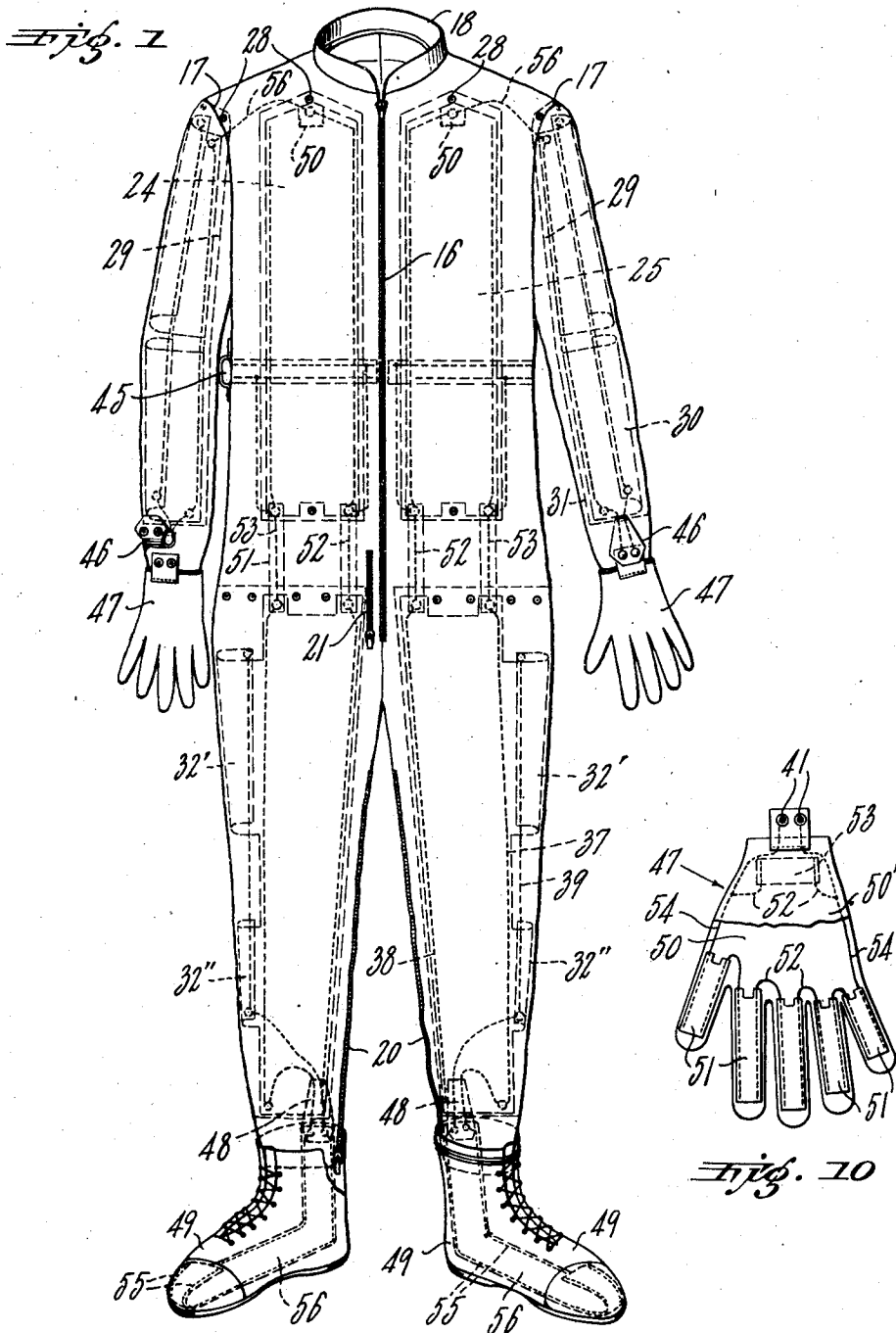
L. MARICK

2,277,772

ELECTRICALLY HEATED WEARING APPAREL

Filed March 8, 1941

3 Sheets-Sheet 1



INVENTOR.

LOUIS MARICK

BY *Arthur J. Panchy*

ATTORNEY

March 31, 1942:

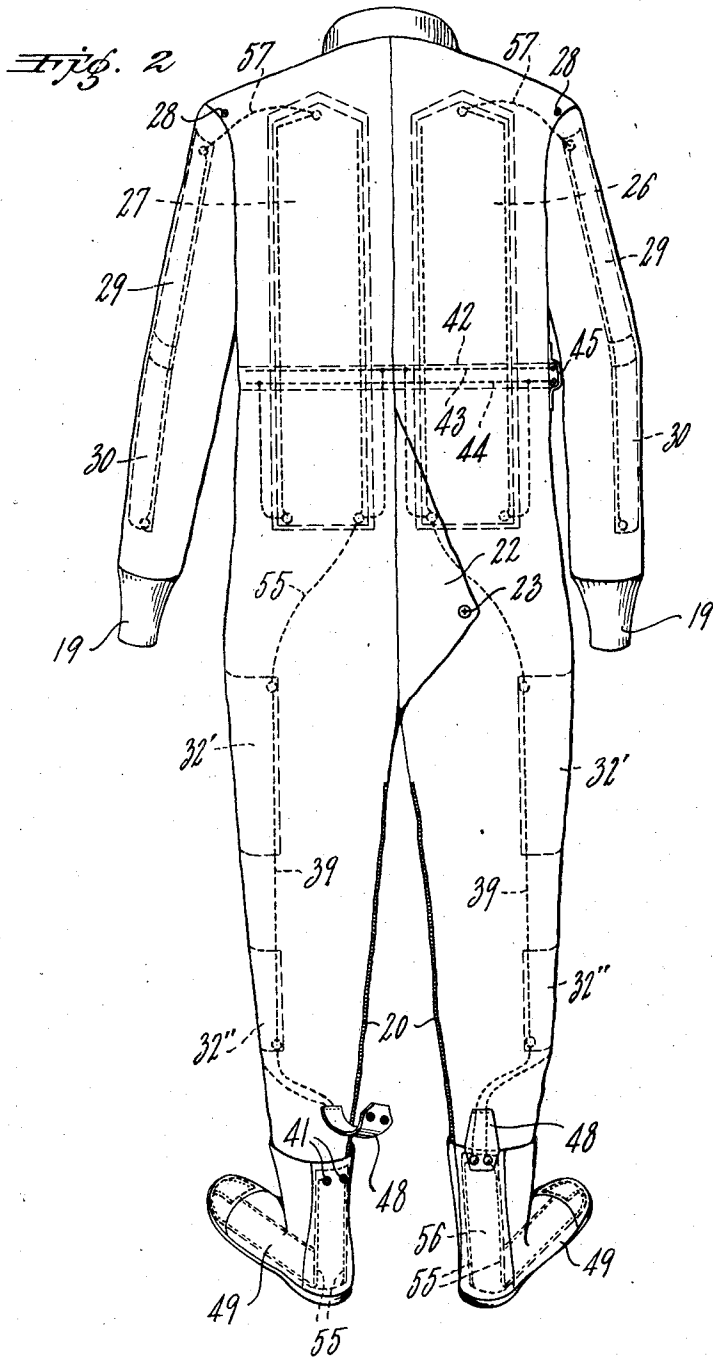
L. MARICK

2,277,772

ELECTRICALLY HEATED WEARING APPAREL

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3 Sheets-Sheet 2



INVENTOR.  
LOUIS MARICK  
BY *Lester E. Buckley*  
ATTORNEY

March 31, 1942.

L. MARICK

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ELECTRICALLY HEATED WEARING APPAREL

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3 Sheets-Sheet 3

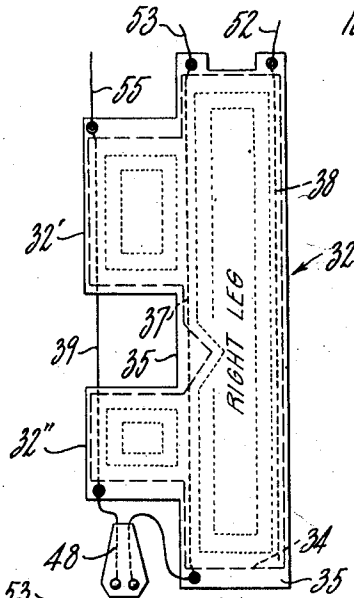
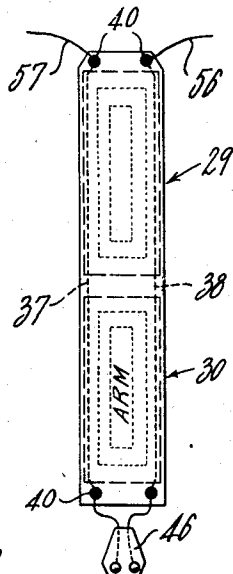
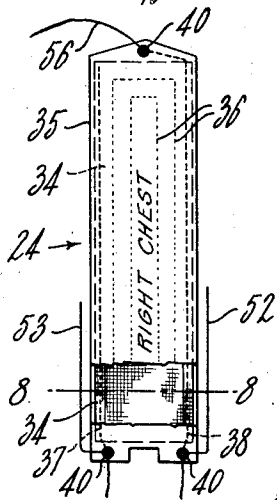
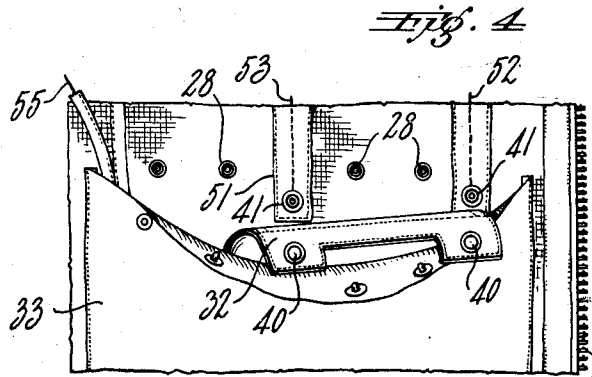
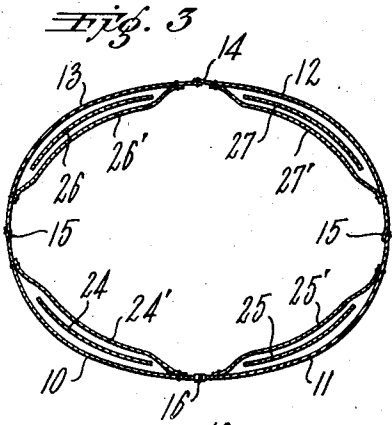
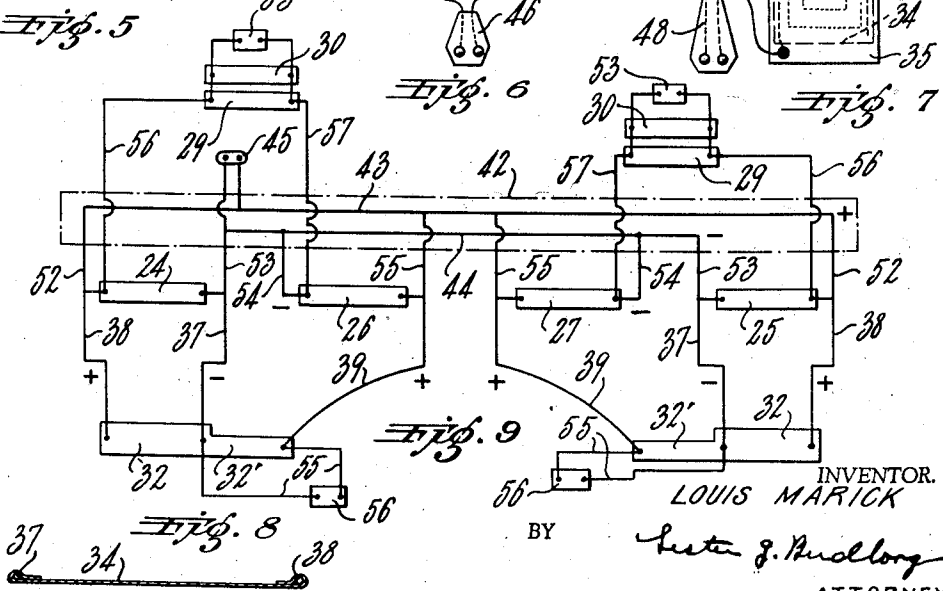


Fig. 5

Fig. 6

Fig. 7



INVENTOR.  
LOUIS MARICK  
BY *Arthur G. Audlong*  
ATTORNEY

# UNITED STATES PATENT OFFICE

2,277,772

## ELECTRICALLY HEATED WEARING APPAREL

Louis Marick, Grosse Pointe Farms, Mich., assignor to United States Rubber Company, New York, N. Y., a corporation of New Jersey

Application March 8, 1941, Serial No. 382,373

17 Claims. (Cl. 219—46)

This invention relates to electrically heated wearing apparel that is particularly well adapted for use by aviators.

This application is a continuation-in-part of my prior application Serial No. 352,347, filed August 13, 1940.

It has been proposed heretofore to provide various type of garments with electrically heated units employing electrical wires as the heating elements. The use of electrically heated wires in clothing, however, is open to a number of objections. One is that it is necessary to operate such wires at a temperature that is sufficiently high to burn the wearer of the garment or possibly his clothing if a heated wire becomes exposed from its protecting covering; another is that if the wire breaks at any point it will put the entire heating element out of operation; still another is that heated wires will not produce heat uniformly over a selected area but produce heat only along the paths where the wires extend, and rely upon radiation and conduction to heat the space between adjacent wires. All of these objections are overcome by the present invention.

Heretofore aviators flying at high altitudes have relied largely upon thick heavy clothing to protect them from the extreme cold, but such heavy clothing interferes seriously with the freedom of the movements of the wearer and adds to the weight which must be carried by the plane. Furthermore, if it becomes necessary for an aviator to bail-out of his plane the added weight of the heavy clothing will greatly increase the shock to which he is likely to be subjected when his parachute opens and checks his fall.

One feature of the present invention resides in an electrically heated garment adapted to cover practically the entire body and limbs and having electrically heated pads extending over a large portion thereof, and which garment is so flexible and light in weight that it may be worn as underwear or possible as an overall in place of the usual coat and trousers, and thereby provide a garment for supplying electrical heat to the major portions of the body and limbs of the wearer, and which garment and heating pads together do not weigh much more than the ordinary business suit.

Another feature of the present invention resides in the novel construction of the electrical heating units employed in the different portions of the garment, each of which may consist of a sheet of supporting material such as woven fabric having deposited thereupon a sufficient amount of current conductive rubber composition to ren-

der the sheet capable of generating heat energy when a different electrical potential is maintained between spaced portions of the sheet. Since such a heating unit generates heat uniformly throughout its area and will supply the desired amount of heat to the body when maintained at a temperature not in excess of 130° F., danger of burning the wearer is avoided. Furthermore, the unit is of light weight and is soft and flexible so that it will be comfortable to the wearer even when worn close to the body, and will not appreciably interfere with the freedom of his movement. The operating current may be supplied to such conductive sheet by securing the marginal side edges of the sheet to or around conductor wires so that current will flow across the sheet from one wire to the other.

A further feature of the present invention resides in the construction in which the heating sheet just described is sandwiched between two textile sheets that protect the heating sheet from injury and from coming in direct contact with the fabric of which the garment may be made. This constitutes a soft flexible heating pad that is admirably adapted for heating wearing apparel. Another feature resides in snap fasteners having conductor wires secured to the male and female elements of the snap fasteners to supply electric current thereto. One of these elements is secured to the heating sheet and the other to the garment so that these snap fasteners perform the double function of removably securing the heating sheet in place upon the garment and of supplying the operating current to the spaced conductor wires of the sheet.

A further feature of the present invention resides in a conductor belt extending around a substantial portion of the garment and which is provided with current supply wires that are connected by lead wires to the different heating elements or pads, and still another feature resides in long wide pockets in different portions of the garment adapted to receive heating pads in their extended condition to conceal the pads and hold them in place when the garment is in use, and at the same time facilitate the ready removal of the pads when, for example, the garment is to be laundered, cleaned or replaced.

Other features of the invention and novel arrangement of parts in addition to the above will be hereinafter described in connection with the accompanying drawings which illustrate good practical embodiments of the invention.

In the drawings:

Fig. 1 is a front elevation of an entire garment

of the one-piece underwear type embodying the present invention; and also shows the electrically heated gloves and shoes;

Fig. 2 is a rear view of the garment of Fig. 1;

Fig. 3 is a transverse sectional view taken through the central portion of the garment of Fig. 1 and shows the disposition of the electrically heated pads around the body of the garment;

Fig. 4 on a larger scale is a plan view of the inner face of the left hand front portion of the garment, taken just below the waist line;

Fig. 5 is a plan view with part in section of the electrically heated pad for the right chest;

Fig. 6 is a plan view of the electrically heated pads for the upper and lower portions of an arm;

Fig. 7 is a plan view of the electrically heated pads for the right leg;

Fig. 8 is a section taken on the line 8-8 of Fig. 5 through the heating sheet;

Fig. 9 is a diagram of the wiring for supplying electric current to the pads for heating the body and limbs of the wearer; and

Fig. 10 shows one of the electrically heated gloves with the back thereof partly broken away.

It will be understood that various features of the invention may be embodied in other types of garments and articles of clothing than herein shown, and that garments embodying the present invention may be worn by various persons that remain near a suitable source of electric energy. The invention, however, has been developed more particularly for use by aviators in garments of the general type herein illustrated.

In the particular embodiment of the invention from which the drawings were made the entire suit shown in Figs. 1 and 2 was constructed of a light weight woven one-way stretch satin fabric, with the exception of the collar and lower ends of the sleeves which were made of knitted goods. This constitutes a soft comfortable light weight suit which will stretch and contract transversely through to allow free movement of the body and limbs and conform to the shape of the body and thereby position the heating elements more advantageously.

The body portion of the garment illustrated is formed of the front sections 10 and 11 and rear sections 12 and 13 constructed of said one-way stretch woven elastic fabric arranged to stretch around the body. The back sections are secured together by the seam 14 extending down the center of the back of the garment and the front and rear panels are connected by the side seams 15. The sections 10 and 11 are preferably provided with the slide fastener 16 extending from the collar downwardly to a point below the waistline of the garment as shown in Fig. 1.

The sleeves may be constructed as usual, preferably of the elastic fabric just mentioned, and are secured to the main portion of the garment by the shoulder seam 17. The collar 18 and cuffs 19 are preferably knitted, as above stated, to cause these portions of the garment to fit snugly and comfortably. The legs of the garment preferably extend downwardly nearly to the ankle and a slide fastener 20 is provided at the inseam of each leg to extend upwardly from the lower end of the leg nearly to the crotch. These slide fasteners 16 and 20 enable the wearer to get quickly into and out of the snug fitting garment. In the construction shown a short slide fastener 21 is provided to form a fly opening, and at the rear of the garment a seat opening

is provided which is closed by the flap 22 that is held in the closed position by the button 23.

The garment so far described might well be worn as a one-piece union suit. The means herein contemplated for electrically heating various portions of the suit will now be described.

The front portion of the body of the garment is provided with the elongated "right chest" pad 24, which is best shown in Fig. 5, and a similar left chest pad 25. These pads are long enough to extend from adjacent the collar bone downwardly to approximately the waist line of the garment so as to keep the entire front portion of the body of the wearer warm, but terminates short of the waist line so as not to be uncomfortable when the wearer is in a sitting position. The rear portion of the body of the garment is provided with the rear heating pads 26 and 27 which may be about the same size and shape as the front pads just described. Each of these pads is entirely enclosed in a pocket made of the same elastic material above described and which pockets are indicated by the numerals 24', 25', 26' and 27'. It will be seen that since both the main portion of the garment and pockets are capable of stretching laterally, the pockets will not prevent the garment from stretching in the body encircling direction. These pockets are preferably opened at each end to facilitate the introduction of the relatively long wide pads therein and the front pockets 24' and 25' are preferably closed at their upper end by any suitable means such as the ordinary snap fastener 28 so that the wearer will not accidentally stick his hand in the pocket when he is getting into the garment.

Each sleeve is preferably provided with a pair of connected heating pads which are best shown in Fig. 6 wherein the pad for heating the upper portion of the arms is indicated by 29 and that for heating the lower portion of the arm by 30. These two pads terminate a short distance from each other at the elbow of the garment and are connected by a covering fabric to be described. The entire heating unit shown in Fig. 6 consisting of the aligned pads 29 and 30 is adapted to be inserted in a pocket 31 formed inside of each sleeve, which pocket is open at each end but may be closed at its upper end by the snap fasteners 28.

The right leg of the garment is provided with the heating pad best shown in Fig. 7 consisting of the main portion of the pad 32 of rectangular shape and having extending laterally therefrom a pad portion 32' and the second pad portion 32''. The portions 32' and 32'' are adapted to extend around a substantial portion of the leg above and below the knee to heat the thigh and calf respectively. The left leg of the garment is provided with a similar shaped pad. It will be apparent that the pad shown in Fig. 7 is considerably wider than those shown in Figs. 5 and 6. It is therefore necessary to provide each leg portion of the garment with a long wide pocket 33 adapted to receive this large pad. The upper end portion of this pad 32 and pocket 33 are clearly shown in Fig. 4 wherein it will be seen that the upper edge of this pocket is provided with four snap fasteners 28 adapted to hold the pocket closed so that the person using the garment will not accidentally insert his foot in the pocket in putting on the garment.

Each of the electric pads above described is preferably formed of a piece of woven fabric such as ordinary woven cotton material 34, see Fig. 5,

having deposited upon the fabric a sufficient amount of conductive rubber or conductive plastic material to conduct electric current across the pad and thereby generate the desired amount of heat uniformly over the surface of the sheet 34. The conductivity of the treated sheet 34 may be made as great as desired by calendering, spreading or otherwise depositing on the sheet, rubber containing different amounts of conductive carbon black, or by increasing the amount of conductive rubber deposited thereupon.

One example of a good practical electrically conductive cement which may be used to coat the fabric heating element 34 is as follows:

Rubber	100
Conducting carbon black	85
ZnO	15
Antioxidant	.75
Accelerator	2.00
Deodorant	.10
Softener	7.00
Vulcanizing agent	.75
Gasoline	1500

Each conductive rubber sheet 34 is preferably sandwiched between two protecting sheets 35 of fabric such for example as ordinary woven cotton goods, to thereby protect the conductive rubber material from wear and from coming in direct contact with the garment. These covering sheets 35 are preferably sewed together and may be sewed to each other through the conductive sheet 34 as indicated at 36 without substantially interfering with the current conducting or heating properties of the sheet 34.

Electric current is supplied to the pad of Fig. 5 for example by providing the same with the conductor wires 37 and 38 extending longitudinally of the sheet 34 adjacent its marginal side edges and having these edges folded over the wire and adhesively secured about the wire in the folded condition to form the heating unit of Fig. 8. After the sheet 34 and wires have been thus assembled the conductive rubber material may be vulcanized. The sheet 34 of each pad may be heated by a current of 12 volts and its conductive properties should be such as to heat its entire face to a temperature between 90° and 130° F.

All of the pads employed in the present garment may have the construction just described except that since portions of the leg pads are approximately twice as wide as the other pads it is found desirable to provide the leg pad with three current supply wires disposed in spaced parallel relation to each other in place of the two wires 37 and 38. Therefore the pad of Fig. 7 is shown as having the current supply wires 37 and 38 and also an added current supply wire 39. In this construction the wires 38 and 39 may be maintained at the same potential energy while the wire 37 is maintained at a different potential energy to thereby produce a flow of current across the pad 32 and auxiliary pad portions 32' and 32''.

When the sheet 34 treated with the conductive rubber is relatively large it may tend to sweat the portion of the body which it covers if the entire sheet is impervious to air. This difficulty may, however, be readily avoided by omitting the rubber from spaced portions of the sheet for ventilating purposes. For example the rubber may be omitted from spaced narrow strips extending across sheet 34 without appreciably affecting its heating properties or this sheet may

be provided at intervals with small ventilating apertures.

In accordance with the present invention each pad is removably secured to that portion of the garment in which it is to operate, so that the pads may be readily removed when it is desired to launder or cleanse the garment or to renew a pad. To this end in the construction shown, each of the pads has secured to each conductor wire at one or both ends of the pad, the male element 40 of a special snap fastener which is adapted to cooperate with a female snap fastener element 41 secured to the desired portion of the garment. Each of these male elements 40 is firmly secured to the pad covering material 35 and has connected thereto one of the conductors 37, 38 or 39. The corresponding female element of the snap fastener may have a current supply wire secured thereto and leading from the current supply belt to be described. It will therefore be seen that the snap fasteners consisting of the elements 40 and 41 serve to hold the pads in place upon the garment and to supply current thereto.

Inside of the garment at some distance above the waist thereof, there is provided a current supply conductor belt 42 extending around the back of the garment and towards the front thereof. This belt is provided with the conductor wires 43 and 44 which are supplied with current by the plug-in terminal 45, located in the present instance, under the right arm. This plug-in terminal may be supplied with current by conductor wires, not shown, leading from the airplane battery or other source of electric energy.

The present garment is preferably provided with tab-like means 46 near the lower ends of the sleeves for supplying current to electrical heating elements, to be described, within the gloves 47, and similar tabs 48 are provided near the lower ends of the legs of the garment for supplying current to the electrically heated elements, to be described, within the shoes 49.

The wiring arrangement of the present suit for supplying electric current to all of the heating pads will now be described. The right chest pad 24 has secured to the portion 35 thereof below the heating sheet 34 the snap fastener elements 40 one of which is connected to the wire 37 and the other to the wire 38 and these elements are positioned to be snapped into the female elements 41 secured to the garment inside the pocket to hold the pad in the position in which it is shown in dotted lines in Fig. 1. This pad is also provided at its upper end with the element 40 connected to the wire 38.

The female elements of the snap fasteners 28 which serve merely to hold the pockets closed are exposed at the exterior of the garment, but the female elements 41 which are supplied with electric current are not exposed at the exterior of the garment but are secured to small pieces of fabric which are sewed to the inner face of the garment as at 50, or they are secured to the fabric strips 51 (see Fig. 4), which are sewed to the garment and enclose a conductor wire.

It will be noted that in the pads shown, the male elements 40 of the snap fasteners are secured at both ends of the pads. This is because the wires 37 and 38 of the pads serve not only to heat the sheet 34 but also to conduct current to other electrically heated units. In the case of the chest pads 24 and 25 the snap fastener element at the upper end thereof serves to sup-

ply current to one wire of a sleeve pad and the other wire of such sleeve pad receives current in a similar manner from a back pad 26 or 27. These sleeve pads are provided at their upper ends with the elements 48 to receive current and at their lower ends with similar elements for supplying current to the tabs 46. The leg pads are similarly constructed to supply current to the leg tabs 48.

The glove 47 is shown in Fig. 10 as a lined glove having the heating elements placed between the lining 50 and outer material 50', and this outer material is partly broken away to show the finger heating elements 51 in full lines. Each element may be formed of conductive rubber sheet material having its marginal edges folded around wires 52 similar to that above described and substantially as shown in Fig. 8. In addition to the heating elements 51 for each finger and thumb, a wider heating element 53 is preferably provided in the front of the glove in the wrist area thereof. The finger heating elements 51 are shown as connected in series by the wires 52, and are connected to the snap fastener elements 41 upon the tab of the glove by the wires 54. The wrist heating element 53 is connected to these wires 54 by the wires 52. The finger heating elements 51 are cut away slightly at their upper ends, as shown, as this lessens the tendency of the wires to break due to flexing.

Each shoe 49 is provided with snap fastener elements 41 at the rear upper portion thereof, and to these elements 41 are secured the spaced conductor wires 55 which supply current to the conductive rubber heating material 56 which may be similar to that used in the gloves. This material 56 having the wires 55 secured to its side edges is shown as extending down the back of the shoe, along the sole and upwardly around the toes of the wearer to heat the corresponding portions of the foot.

The wiring arrangement of the entire garment is shown in Fig. 9 wherein current is supplied to the wires 43 and 44 of the belt 42 from the plug-in terminal 45.

The chest pads 24 and 25 receive current from this belt through the lead wires 52 and 53, and the back pads 26 and 27 receive current from the belt through similar lead wires 54 and 55. The sleeve pads receive current through the pads 24 and 26 and the lead wires 56 and 57 and supply current to the gloves. The leg pads receive current from the lead wires 52 and 53 and also from the wire 55 and supply current to the shoes through the wires 37 and 39.

The pad arrangement is such that each pad has three or more of the male snap fastener elements 40 secured thereto and connected to the conductor wires so that any pad may be readily secured in place in the garment and at the same time connected to the proper electrical connections by simply engaging these elements 40 with the corresponding female elements 41 secured to the garment. The various lead wires above mentioned are preferably covered with piping or other protecting fabric which is sewed to the inside of the garment as shown.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. A garment having secured thereto an electrically heated sheet unit adapted to supply heat uniformly over a substantial surface area of the person wearing the garment, comprising a sheet carrying throughout its area a sufficient quantity

of electrically conductive plastic composition to render such area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors contacting said composition along a substantial length thereof whereby to cause a current to flow from one conductor to the other throughout said area when a different electric potential is maintained between said conductors.

2. An article of clothing having secured thereto an electrically heated sheet unit adapted to supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet of textile fabric carrying a sufficient quantity of electrically conductive plastic composition to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors contacting said treated portion of the fabric along a substantial length thereof whereby to cause a current to flow from one conductor to the other throughout said area when a different electric potential is maintained between said conductors.

3. An article of clothing having secured thereto an electrically heated sheet unit adapted to supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet of textile fabric carrying a sufficient quantity of electrically conductive plastic composition to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors having conductive edge portions of the fabric folded over and adhesively secured about substantial lengths of the conductors whereby to cause a current to flow from one conductor to the other throughout the conductive area of the fabric when a different electric potential is maintained between said conductors.

4. An article of clothing having secured thereto an electrically heated sheet unit adapted to supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet of textile fabric coated substantially throughout with a conductive rubber composition to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors contacting said composition along a substantial portion of the fabric whereby to cause a current to flow from one conductor to the other throughout said area when a different electrical potential is maintained between said conductors.

5. An article of clothing having secured thereto an electrically heated sheet unit adapted to supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet of textile fabric coated substantially throughout with a rubber composition containing sufficient current conductive carbon to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors contacting said composition along a substantial portion of the fabric whereby to cause a current to flow from one conductor to the other throughout said area when a different electrical potential is maintained between said conductors.

6. An article of clothing having secured thereto an electrically heated sheet unit adapted to

supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet carrying over its area a plastic composition containing a sufficient amount of current conductive carbon to render said area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors secured along a substantial portion of said conductive area whereby to cause current to flow from one conductor to the other throughout said area when a different electrical potential is maintained between said conductors.

7. An article of clothing having secured thereto an electrically heated sheet unit adapted to supply heat uniformly to a substantial surface area of the person wearing the clothing, comprising a sheet carrying over its area a plastic composition containing a sufficient amount of non-metallic current conductive particles to render said area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, and spaced metal conductors secured along a substantial portion of said conductive area whereby to cause current to flow from one conductor to the other throughout said area when a different electrical potential is maintained between said conductors.

8. A garment having secured thereto an electrically heated pad adapted to supply heat uniformly to a substantial surface area of the person wearing the garment, comprising a textile sheet treated substantially throughout with a current conductive rubber to render the treated area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, spaced metal conductors secured along a substantial length of said area to cause current to flow throughout said area when a different electric potential is maintained between said conductors, and said sheet being sandwiched between two covering sheets of fabric that are sewed to the conductive area of the central sheet.

9. A garment adapted to enclose a substantial portion of the body and provided with an electrically heated pad removably secured thereto to extend over the portion of the garment to be heated, comprising a sheet treated with a current conductive rubber to render the major portion of its area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, spaced metal conductors secured along said area to cause current to flow throughout said area when a different electric potential is maintained between the conductors, and cooperating snap fastener elements secured to the pad and to the garment and to the metal conductors and adapted to retain the pad in place upon the garment and supply current thereto.

10. A garment adapted to enclose a substantial portion of the body and provided with an electrically heated pad removably secured thereto to extend over the portion of the garment to be heated, comprising a sheet treated with a current conductive rubber to render the major portion of its area conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, spaced metal conductors secured along said area to cause current to flow throughout said area when a different electric potential is maintained between the conductors, a protecting covering sheet

of fabric secured to said pad, and cooperating snap fastener elements secured to the covering sheet and to the garment and also to the metal conductors and adapted to retain the pad in place upon the garment and supply current thereto.

11. A garment adapted to enclose a substantial portion of the body and provided with a pad large enough to heat a substantial portion of the garment and with a pocket adapted to receive the extended pad, said pad comprising a sheet treated with a current conductive rubber to render its area conductive and capable of liberating heat energy when generated therein by conversion of electric energy into heat, and spaced wires secured along said area to cause current to flow across said area when a different electric potential is maintained between said wires.

12. A body enclosing garment provided with electrically heated pads secured to different portions of the garment, each pad comprising a sheet treated with a current conductive rubber to render the treated area conductive and capable of liberating heat energy when generated therein by conversion of electric energy into heat, spaced wires secured along said area to cause current to flow throughout said area when a different electric potential is maintained between the wires, and a current supply conductor belt secured to the garment and provided with lead wires connecting the different pad wires to said belt.

13. An electrically heated glove having secured in the fingers thereof electrically heated sheet units, each unit comprising a sheet of fabric carrying a sufficient quantity of conductive rubber to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, spaced conductor wires secured to the rubberized portion of said fabric along its edges whereby to cause a current to flow from one wire to the other across said fabric to heat the same, and electrical connections for supplying current to said wires.

14. An electrically heated glove having secured in the fingers thereof electrically heated sheet units, each unit comprising a sheet of fabric carrying a sufficient quantity of conductive rubber to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of electrical energy into heat, spaced conductor wires secured to the rubberized portion of said fabric along its edges whereby to cause a current to flow from one wire to the other across said fabric to heat the same, and electrical connections for connecting said units in series and for supplying current thereto.

15. An electrically heated glove provided with an area heating sheet unit secured thereto and comprising a sheet having a surface of electrically conductive plastic composition, and metal conductors extending along the opposite sides of the sheet to supply electric current thereto and cause current to flow across the sheet from one conductor to another to generate heat over its surface.

16. An electrically heated article of footwear provided with an area heating sheet unit secured thereto and comprising a sheet having a surface of electrically conductive plastic composition, and metal conductors extending along the opposite sides of the sheet to supply electric current thereto and cause current to flow across the



sheet from one conductor to another to generate heat over its surface.

17. An electrically heated shoe having secured therein an electrically heated sheet unit, comprising a sheet of fabric carrying a sufficient quantity of conductive rubber to render the fabric conductive and capable of liberating heat energy when generated therein by conversion of

electrical energy into heat, spaced conductor wires secured to the rubberized portion of said fabric along its edges whereby to cause a current to flow from one wire to the other across said fabric to heat the same, and electrical connections for supplying current to said wires.

LOUIS MARICK.