Aug. 18, 1970 S. ARRON 3,524,965

ELECTRIC HEATING ELEMENT FOR APPAREL

Filed March 4, 1969 2 Sheets-Sheet 1

Fig. 1

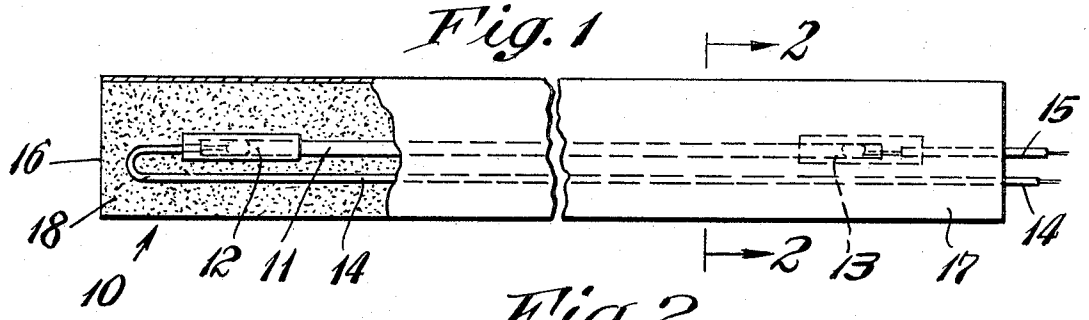


Fig. 2

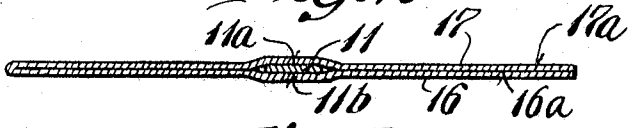


Fig. 3

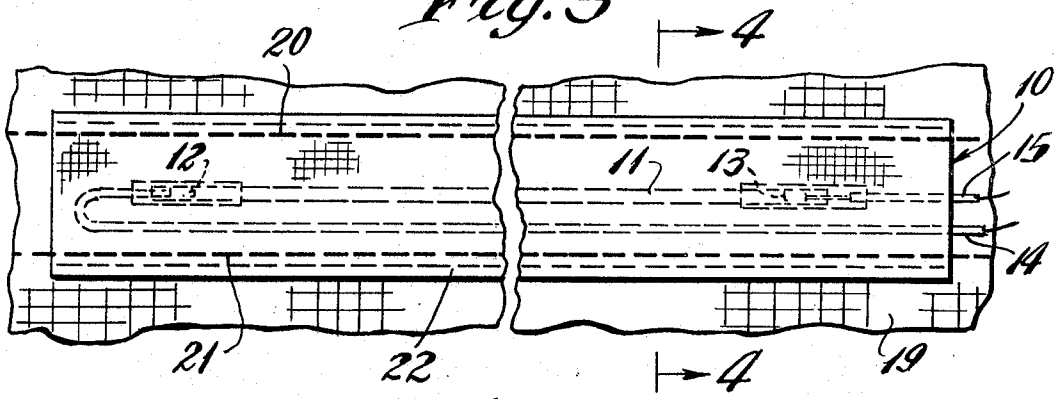


Fig. 4

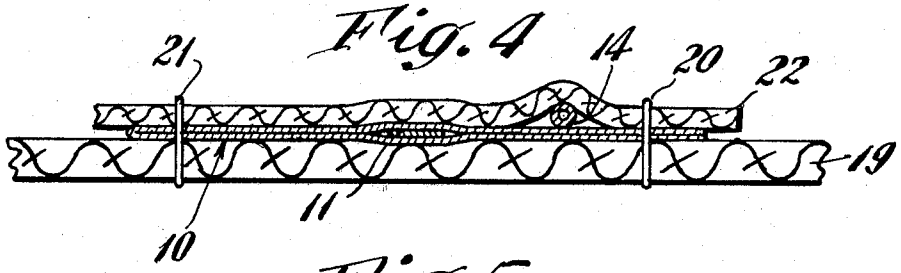
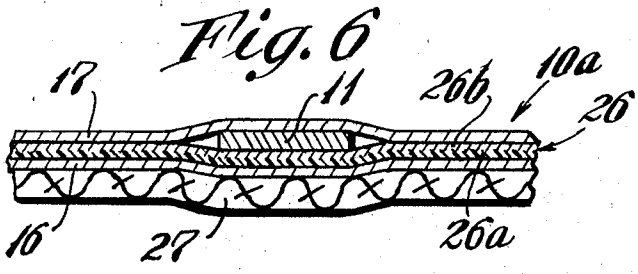


Fig. 5

Fig. 6



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Filed March 4, 1969 2 Sheets-Sheet 2

Fig. 8

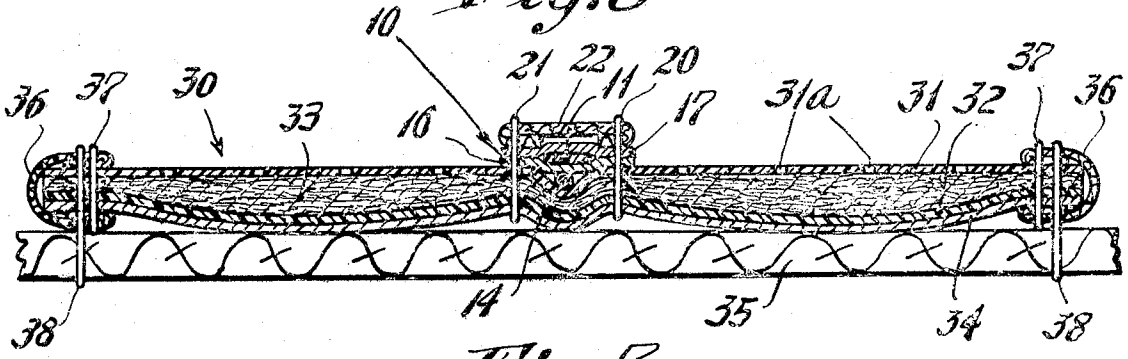
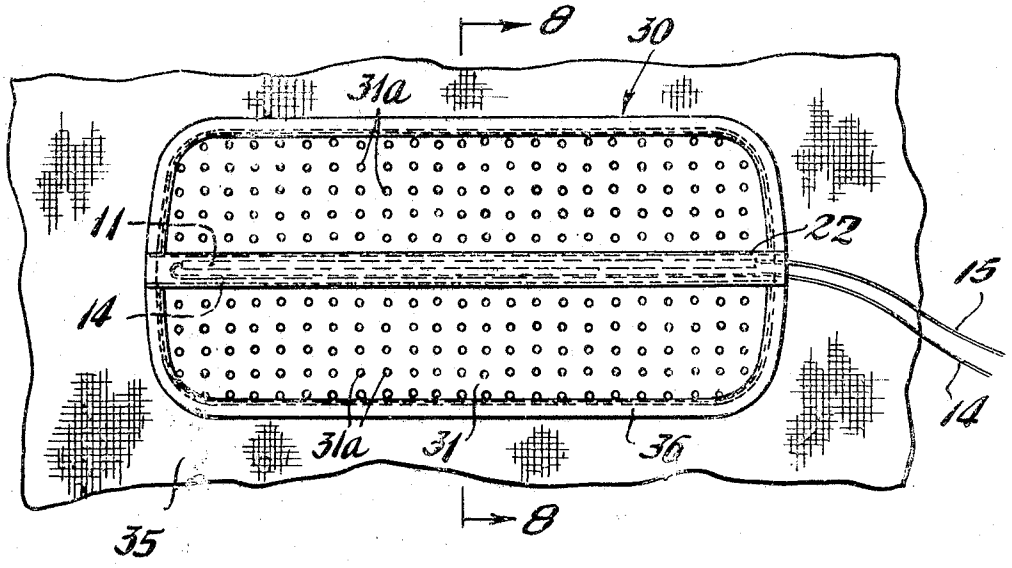


Fig. 7



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ELECTRIC HEATING ELEMENT FOR APPAREL

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Continuation-in-part of application Ser. No. 597,634, Nov. 29, 1966. This application Mar. 4, 1969, Ser. No. 804,148

Int. Cl. H05b 3/36

U.S. Cl. 219—211 10 Claims

ABSTRACT OF THE DISCLOSURE

A heating element for use with a body garment having a length of resistance ribbon that is adhesively secured between a pair of flexible strips with the strips being wider than the ribbon and with a row of stitching securing only the outer edge portions of the strips to a garment. The stitching may also secure a tape covering for the strips and an insulating layer underlying the strips to the garment. The heating element may also be part of an insulated heating pad of larger size with the heating element being secured to the pad and the pad being secured along its edges to a garment.

This application is a continuation-in-part of my copending application Ser. No. 597,634 filed Nov. 29, 1966, now forfeited.

In my Pat. No. 3,392,264 granted July 9, 1968, there is disclosed an article of apparel, specifically a stocking, in which an electric heating element is secured. The element includes a ribbon of electric resistance material having a large width to thickness ratio that is positioned on the inner surface of the toe portion of the stocking. In this position, while in use and during washing, it is subject to considerable movement and this movement has been capable of causing the ribbon to twist, crinkle or otherwise present an other than flat, wide surface to the foot of the wearer to cause discomfort. Moreover, during the manufacturing operation the heretofore disclosed manner of securing the ribbon to the stocking by using overcast stitching has been found to be extremely slow, difficult and relatively expensive.

It is accordingly an object of the present invention to provide an electric heating element that includes a length of electric resistance ribbon which may be secured in a garment and even though subjected to considerable movement, maintains the presenting of a flat side to the user.

Another object of the present invention is to provide an electric heating element of the above type in which the heating element resists twisting, crinkling, etc., even when in use and during laundry operations.

A further object of the present invention is to provide an electric heating element that achieves the above object and yet which is so constructed and arranged as to be easily, effectively and economically incorporated into a garment.

Still another object of the present invention is to provide an electric heating element which is attached to an insulated pad of a larger size than the element and in which the pad is secured to the garment.

In carrying out the present invention, there is provided an elongate ribbon of electrical resistance material which has a relatively large, on the order of 20 to 30 times, width to thickness ratio. The wire is energized by a battery and the passage of current therethrough increases the temperature of the ribbon to thereby supply heat. The ribbon in addition to having a resistance which controls the quantity of current therethrough is also required to be quite flexible and hence is quite thin, on the order of only a few thousandths of an inch. The heating element

is positioned to present its wide side to the user at all times as twisting or crinkling could present sharp edges which may create discomfort.

In accordance with the present invention the ribbon is secured or sandwiched between a pair of relatively wide flexible strips. The abutting surfaces of the strips and the ribbon are secured together, as by an adhesive to thus form a unitary heating element. The element is then secured to an article of apparel by parallel rows of stitching which pass through the outer edge portions of the two strips. The rows of stitching are preferably spaced sufficiently apart such that they inherently prevent twisting or crinkling of the strips with respect to the garment. Accordingly, even though the stitching is at the outer edge portions of the strips, the strips are made to be substantially wider than the width of the ribbon to provide the desired spacing between the wide strips of fabric which are then secured to the garment.

If desired, the heating element may be covered by a length of fabric tape, such as bias tape, and the same lines of stitching that secure the heating element to the garment also secure the tape thereto. In such a construction it has been found desirable to have the tape and fabric of substantially the same width. In addition, if desired, an insulating layer may be positioned between the heating element and the garment and also held in place by the parallel rows of stitching. Such an insulating layer may be both resistant to the passage of heat towards the outer portion of the garment by conduction and/or radiation.

While the heating element may be secured directly to the garment, the present invention also provides for the securing of the heating element to an insulating pad in the same manner as if it were secured to a garment. The pad is formed of a plurality of layers of highly heat insulating material, is of a much larger size than the heating element and is secured along its edges to the garment. The pad has substantially less heat loss than the adjacent portions of the garment to thereby decrease loss of heat from the heating element outwardly and also serves to decrease the loss of body heat from the area thereby enhancing the sensible effect of the heating element.

Other features and advantages will hereinafter appear.

In the drawing:

FIG. 1 is a view of the electric heating element of the present invention.

FIG. 2 is a section taken on the line 2—2 thereof and somewhat enlarged.

FIG. 3 is a view of the heating element secured to a garment and in which bias tape is also employed to cover the heating element.

FIG. 4 is a cross-section taken on the line 4—4 of FIG. 3 and somewhat enlarged.

FIG. 5 is a view similar to FIG. 4 in which an insulating layer is provided.

FIG. 6 is a view similar to FIG. 5 in which the insulating layer is positioned between the strip.

FIG. 7 is a plan of a heating element mounted on an insulating pad and the pad being secured to a garment,

FIG. 8 is a section, substantially enlarged, taken on the line 8—8 of FIG. 7.

Referring to the drawing, the heating element is generally indicated by the reference numeral **10** and includes an elongate resistance ribbon **11** formed of electrical resistance material. One type of material which may be used, as set forth in my above-noted patent, is "Chromel." The ribbon has a relatively large width to thickness ratio and one example that has been found satisfactory is a ribbon having a width of 1/16 of an inch and a thickness of .003 to provide a width to thickness ratio of about 20:1. The length of the ribbon may be of any desired size pro-

vided that its shape is such that it provides sufficient resistance to limit the temperature which it attains upon energization. Connectors **12** and **13** are secured to the end portions of the ribbon **11** and insulated wire conductors **14** and **15** are secured to the connectors **12** and **13** respectively to enable electric current to pass through the wire **14**, through the ribbon, and the other wire **15**.

In carrying out the present invention the ribbon is disposed between a pair of strips **16** and **17**. While the strips may be individual, it is preferred, as shown, that they be formed by a single strip that has been folded upon itself. The inner abutting surfaces **17***a* and **16***a* of the strips are adhesively secured together by an adhesive **18** substantially throughout their abutting length. Moreover, the adhesive **18** substantially secures the wide surfaces **11***a* and **11***b* of the ribbon to the strips. With this construction it will be appreciated that the strips **16** and **17** and the ribbon **11** are adhesively secured together to form a unitary structure and that the ribbon is normally incapable of shifting with respect to the strips.

Upon forming the heating element in the manner above described the heating element may then be secured to a garment **19** by parallel rows of stitching **20** and **21** that extend through the outer edegs of the strips and also the garment. As shown, the strips are substantially wider than the heating element and one width that has been found acceptable is ½ to ⅝ of an inch. Thus the rows of stitching may be spaced perhaps ⅜ of an inch apart. In this manner, the stitching rows **20** and **21** by securing the heating element to the garment at lines relatively widely spaced prevents the heating element from twisting, crinkling or otherwise substantially shifting with respect to the body garment. As the ribbon **11** of the heating element is secured to the strips, the ribbon is thus prevented from also shifting and thus will continually present its flat wide side **11***a* to the user.

The material from which the strips **16** and **17** are formed is preferably relatively thin flexible fabric. One specific example which has been found satisfactory is a matted fabric sold under the registered trade name "Staflex." Also, the adhesive **18** that secures the surfaces **16***a* and **17***a* together and the ribbon thereto preferably is of the heat activated type such that it is only cohesive at temperatures substantially higher than environmental temperatures. The temperature produced by an electric sadiron has been found satisfactory so that merely ironing the strips and ribbon is sufficient to effect the adhesion therebetween. For convenience, the adhesive **18** may be applied to one or both of the surfaces **16***a* and **17***a*. The use of heat activated adhesives prevents the energized heating element from decreasing its bond as the cohesive temperature is above the temperature that the ribbon achieves. Also, during the stitching operation, the adhesive is not tacky and the sewing machine needles that form the stitching lines **19** and **20** pass therethrough without the adhesive becoming lodged on the needle to thereby cause the needle to malfunction.

While the heating element may be used as shown in FIGS. 1 and 2 and directly contacted by a user, it has been found desirable to overlay the heating element with a length of fabric **22** such as bias tape. The tape **22** is specifically shown as being held in place by the stitching **20** and **21** and as such has a width which is greater than the distance between the rows of stitching **20** and **21**. The tape **22** is also, as shown, at least as wide as the strips **16** and **17** and accordingly serves to somewhat conceal and protect said strips. In addition, the conductor **14** is placed between the tape **22** and the garment **18** so that the conductor **14** is disposed within the channel formed by these two elements and the row of stitching. Thus both conductors **14** and **15** may extend to be enclosed within a tunnel formed by, for example, a continuation of the tape **22** secured to the garment.

Though both conductors **14** and **15** are not secured to the garment but only retained in the tunnel formed by the tape **22**, a pulling force on the conductors is capable of being transferred to the heating element. However, as the heating ribbon is secured to the strips **16** and **17**, it tends to resist displacement by such a pulling force.

While a substantial portion of the heat produced by the heating element **10** is utilized by the user, in some instances, in order to decrease the heat loss through the garment **18**, it may be desirable to provide between the garment **18** and the heating element **10** a length of insulating material **23**. This material may be of the type such as is well known in the trade that has a reflective layer **24** and an insulating layer **25**. The layer **24** may be formed of aluminum to decrease radiant heat loss to the garment while the layer **25** may be made of insulating batting, foam plastic having air pockets or a thin plastic film. Preferably the insulating material **23** is of a width sufficient to enable the stitching **20** and **21** to extend to the outer portions thereof.

FIG. 6 discloses a further embodiment of the present invention in which insulating material is incorporated directly with the heating element. This insulated heating element **10***a* includes not only the ribbon **11** and strips **16** and **17** of the heating element **10** but also a strip **26** of insulating material positioned between the element **11** and the inner surface of the strip **16**. The outer surface of the strip **16** is designed to be positioned against a garment **27** with the insulating material **26** reducing heat loss to the garment. It has been found that the strip **26** may be formed of thin (.003–5″) polyester backing film **26***a* such as "Mylar" on which is vacuum deposited a layer of aluminum **26***b*. Thus the layer **26***b* serves to decrease heat loss by radiation while the layer **26***a* decreases conduction heat losses.

It has been found preferable to have the strip **26** extend substantially coextensive with the strips **16** and **17** so as to have lines of stitching **20** and **21** pass therethrough. Also, it has been found advantageous to unite the contacting surfaces of the strips **26** and **16** to prevent relative movement therebetween as by the adhesive **16***a* with or without a pressure sensitive adhesive on the contacting layer of the strip **26**. The adhesive **17***a* on the layer **17** unites to the top surface of the strip **26** to maintain a unitary heating element.

While the heating element **10** may be directly secured to a garment as shown, it has been found that its sensible heating effect may be enhanced if an insulating pad, such as a pad **30** is utilized. As shown in FIGS. 7 and 8, the heating element **10** may be secured to the pad by lines of stitching **20** and **21** as if the pad were the garment. The pad, however, is substantially larger than the heating element with one embodiment having a heating element of about 10″ long and pad dimensions of 11 inches and 4 inches while another embodiment had the same length heating element and a pad of 11 x 8½ inches.

The pad has a pair of layers **31** and **32** formed from thin plastic film such as "Mylar" on which a thin reflected coating of aluminum has been vacuum deposited. The film may be provided with reinforcing lengths of nylon or other thread (not shown). Also, the inner layer **31** is perforated by forming small apertures **31***a* therein at regularly spaced intervals such as on 5/16 inch centers. Interposed between the two layers of film is a layer **33** of interlining material such as fibrous fiber glass or other batting, though if desired, a thin layer of insulating foam may be used instead. The outer layer **34**, i.e., the layer which is placed against the inner surface of the garment **35** is formed from one or more thicknesses of "Staflex" to provide some stiffening for the pad.

An edge binding **36** completely circumscribes the edges of the pad and is secured to the edge portions as by stitches **37**.

In use, the heating element is sewed to the pad by the lines of stitching **20** and **21**, and the pad is sewed to the garment **35** by a line of stitching **38** which extends about the periphery of the pad and preferably passes through

the edge binding **36**. Thus, the pad is free from the garment except along its edge portions while the heating element is only secured to the pad.

The heating ribbon **11** may be disposed longitudinally of the pad as indicated in FIG. 7 and the wire **14** extends between the pad and the layer **16**. The two wires **14** and **15** extend from a pad to a source of electrical energy such as a battery (not shown). If desired a binding tape may form a tunnel for the wires. It will be understood that the heating element may have a different shape and the pad shaped differently depending on the area of the body desired to be heated and the layer **25** utilized.

The reflective layer of the pad serves to reflect the body heat to decrease its loss while the interlining material minimizes heat loss by conduction. The apertures enable, however, the pad to breathe." Accordingly, in the area of the body where the pad is located, which may be a sensuous area such as the small of the back, the kidney area, the extremities, etc., the insulating pad effects to the user a larger area of warmth as opposed to the rest of the garment while the heating element supplies a concentrated area of warmth.

The use of the two rows of stitching to hold the heating element to the garment enables the element to be secured to flexible, stretchable garments without determent to the heating element or any noticeable loss of stretchability of the garment and limit its stretching only where the heating element is located. As this is only a small part of the garment, it does not interfere with the stretching of the rest of the garment. Also by securing the heating element to the pad and only securing the pad along its outer edges to the garment, the stretching of a garment such as a knit sweater, is not noticeably altered but yet the heating element and pad will not be harmed. Thus, with the present construction, the heating element and the pad may be applied to garments which are desired to stretch with little or no interference with the stretching.

It will accordingly be appreciated that there has been disclosed a heating element for a garment which even though subjected to considerable forces and/or laundry operations does not cause discomfort to the user or decrease the area of contact with the user. The heating element includes a length of thin wide resistance ribbon which is sandwiched between a pair of flexible strips. The strips and ribbon are adhesively secured together to form a unitary assembly. The strips are substantially wider than the ribbon and only have their outer edge portions secured to the garment. Thus even though the garment may move or flex, the strips will flex therewith but the ribbon will continue to present a flat wide side to the user and not be subjected to twisting or crinkling. Moreover, to enhance the sensible heating effect both by minimizing heat loss from the ribbon and from the body, an insulating pad may be employed with the heating element secured only to the pad and the pad being secured to the garment.

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 body garment having a heating element to supply heat to a user comprising an elongate strip of electrical resistance ribbon, two strips of flexible material with each strip being elongate and at least as long as said ribbon and having a width larger than the width of the ribbon, one of said strips being positioned on one side of said ribbon and the other strip being positioned on the other side of said ribbon, means adhesively securing together the abutting surfaces of the ribbon and the strips, electrical connecting means connected to said ribbon and extending outwardly from said strips, said strips being substantially wider than the ribbon, stitching means securing only the outer edge portions of the strips to a garment and including a row of stitching extending along each outer edge portion of the strips, said rows being spaced from and on either side of the ribbon, a fabric covering overlaying said element with the rows of stitches also securing said covering to said garment and in which the electrical connecting means includes a length of wire attached to each end of the ribbon, one of said wires being disposed between the fabric covering, the garment and the rows of stitching.

2. A body garment having a heating element to supply heat to a used comprising an elongate strip of electrical resistance ribbon, two strips of flexible material with each strip being elongate and at least as long as said ribbon and having a width larger than the width of the ribbon, one of said strips being positioned on one side of said ribbon and the other strip being positioned on the other side of said ribbon, means adhesively securing together the abutting surfaces of the ribbon and the strips, electrical connecting means connected to said ribbon and extending outwardly from said strips, said strips being substantially wider than the ribbon, stitching means securing only the outer edge portions of the strips to a garment and including a row of stitching extending along each outer edge portion of the strips, said rows being spaced from and on either side of the ribbon and in which there is provided a length of flexible plastic insulating material positioned between said garment and said ribbon with the rows of stitching securing said length to the garment.

3. The invention as defined in claim **2** in which the length of insulating material includes a heat reflective layer and a heat insulating layer with the heat reflective layer being positioned against said heating element.

4. The invention as defined in claim **2** in which the strip of thin insulating material is positioned between the ribbon and one strip and secured to at least said one strip.

5. The invention as defined in claim **4** in which the strip of thin insulating material includes a length of thin flexible plastic material having a reflective layer, said layer being positioned against said ribbon.

6. A body garment having a heating element to supply heat to a user comprising an elongate strip of flat electrical resistance ribbon with said ribbon being substantially wider than thick, two strips of flexible material with each strip being elongate and at least as long as said ribbon and having a width substantially wider than the width of the ribbon, said flexible material being of thin, heat insulating material to decrease spreading of heat from the ribbon, one of said strips being positioned on one flat side of the ribbon and the other strip being positioned on the other flat side of the ribbon to sandwich the ribbon therebetween means adhesively securing the abutting surfaces of the ribbon and the strips, electrical connecting means connected to said ribbon and extending outwardly from the strips and means securing said strips to the body garment and including a row of stitching extending along one edge portion of said strips and another row of stitching extending along the other edge portion of said strips whereby said heating element is secured to the body garment by said spaced rows of stitching and is free of the garment between the rows.

7. The invention as defined in claim **6** in which the body garment is an insulating pad substantially larger than said heating element, said two rows of stitching extending only through said pad and additional stitching securing said pad to another larger body garment, said additional stitching being substantally spaced from the rows of sttching to secure the pad to the another body garment.

8. The invention as defined in claim **7** in which the additional stitching only extends about the peripheral portion of the pad and passes through the pad and at least a part of the another body garment.

9. The invention as defined in claim **7** in which the insulating pad includes at least one layer of plastic film having a reflective surface and a layer of interlining material.

10. The invention as defined in claim 6 in which a strip of fabric tape overlies the two strips of flexible material and in which the rows of stitching pass through the edge portions of the fabric tape.

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U.S. Cl. X.R.

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