

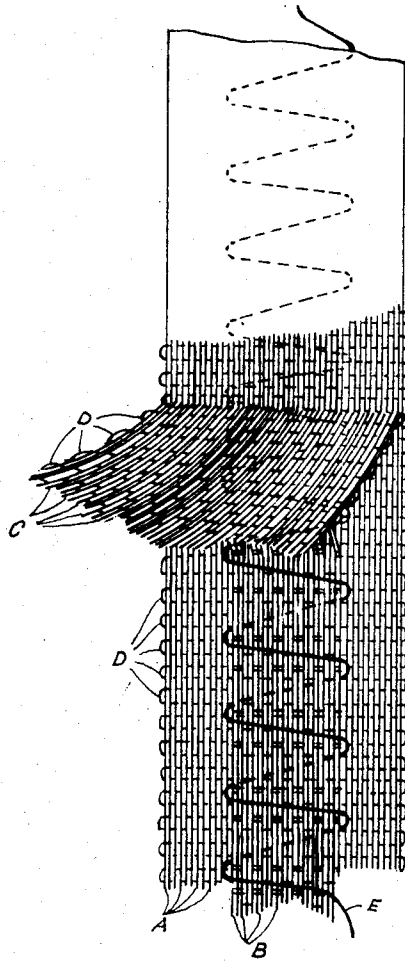
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ELECTRICAL HEATING ELEMENTS

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ELECTRICAL HEATING ELEMENTS

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4 Claims. (Cl. 219-46)

This invention concerns electrical heating elements.

When it is desired to heat clothing, blankets and other flexible articles by means of electrical heating elements of the resistance type incorporated in the article, then the element must preferably be so arranged that it is capable of working with full effectiveness although folded or bent according to the position of the article and does not deteriorate when continuously subjected to such folding or bending.

It is the principal object of the invention to provide a heating element suitable for use in articles of the kind just referred to, and other objects are that the element should be simple to manufacture and adapted for numerous other uses.

According to the present invention an electrical heating element consists of a flexible multi-ply narrow fabric having electrically insulating properties, between the plies of which binder warps are arranged in cross-over formation so as to constitute partitions extending between, and connecting the plies together, and at the same time dividing the space between the plies into compartments, and a resistance wire laid as a weft through at least some of said compartments in endless substantially zigzag formation.

More particularly, an electrical heating element according to the invention consists of a narrow fabric woven on a three-tier or four-tier loom, having two woven plies, of electrically insulating properties there being an additional set of binder warps between the adjacent plies, woven-in alternately with said plies, the crossover portions of this set of warps serving to separate the successive picks of a wire weft, so as to hold the wire weft in endless substantially zigzag formation.

Preferably the binder warps are of such gauge and proximity that over the short length extending between the two plies they form an insulating transverse partition virtually impenetrable to the wire weft.

The plies preferably extend at each edge beyond the ends of the partitions so that the wire weft is covered.

The invention also includes articles, such as of clothing or blankets when incorporating one or more such heating elements.

The invention will now be described further, by way of example, with reference to one practical heating element especially adapted for sewing into clothing or blankets and manufactured on a three-tier narrow fabric loom in the manner now to be described.

The element is illustrated in the accompanying drawing in which the single figure is a perspective view thereof, the lower end being somewhat exploded to show the weave structure more clearly.

There are three sets of warps A, B, C, which for convenience will be referred to respectively as upper, binder, and lower, and three shuttles. Each of these upper and lower sets of warps A, C, consists of 44 ends of glass yarn whilst the binder warps B comprise 11 ends of glass yarn aligned with the central 12 ends of the other sets of warps A, C. Two shuttles carry glass

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yarn D whilst the third carries nickel chrome steel wire E, 43 S. W. G., having a resistance per yard of 250 ohms.

During weaving the shuttles carrying the glass yarn D co-operate respectively with the upper and lower warps A, C, to plain-weave the two plies of a double-ply fabric. The additional set of binder warps B is woven-in first with one ply, over three picks extent, and then with the other ply, over three picks extent. The shuttle carrying the wire E will effectively pick only once between each binding-in so that a pick of wire E is held at intervals between the plies, the picks being separated by the cross-over parts of the middle warps B. The intermediate passes of the wire E are ineffective because there has been no change of the shed formed by the binder warps B. The free edges of the two plies may conveniently be sewn together, if desired, after the fabric has been waterproofed by the application, for example, of a plastic coating.

In use the woven fabric may conveniently be cut into 10 foot lengths (the width of the fabric being .85 inch). The length of resistance wire per foot of tape is about 2 feet 3 inches. Each 10 foot length of fabric therefore will take about 28 watts at 230 volts.

For a blanket, for instance, a suitable number of such lengths sewn thereto may be connected in parallel with two insulated conducting ends brought out to a plug for connection to the source of power.

The ratio of wire length to tape length may be varied by arranging for the binder warps to be woven-in over more than three picks. Furthermore the number of picks may be varied so that the wire weft is not laid in every compartment but, for instance, in each alternate compartment. Thus, if the shedding were changed to arrange for the binder warp threads to cross over at pick intervals 3, 2, 3, 2, etc., then the wire would lie in the 3 pick spaces only. Two transverse partitions defining an empty compartment would be provided between each effective pass of the wire shuttle and the risk of short circuit between lengths of wire in adjacent partitions would correspondingly be reduced. By arranging that the binder warps are woven-in by a given number of picks with one ply and by a different number with the other ply the formation of the wire weft can be further varied.

A heating element as described has numerous favourable features. The conducting wires, for example, are completely and effectively insulated, although the fabric may be twisted, doubled, bent or otherwise flexed without causing a short-circuit or causing deterioration of the element.

Another interesting application of the fabric particularly described is for soil heating, the glass yarn being unaffected when buried in soil for long periods. The fabric may also be used for clothing, radiator muffs, pipe wrappings, gun barrel heating, aircraft deicing, laboratory purposes of various kinds, and indeed, in any situation where a robust, flexible heater is required.

I claim:

1. An electrical heating element comprising a flexible narrow fabric woven from a yarn having electrically insulated properties, two plies in said fabric, binder warps between said plies, said binder warps being woven-in alternately with said plies to form insulating cross-over portions, and a wire weft, the successive picks of said wire weft being separated by cross-over portions of said binder warps and each terminating at both its ends a substantial distance inwardly from the edges of said plies whereby no wire weft is exposed.

2. An electrical heating element comprising a flexible narrow fabric woven from a yarn having electrically insulated properties, two plies in said fabric, binder warps, extending only over the central part of the fabric

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width, between said plies, said binder warps being woven-
in alternately with said plies to form insulating cross-
over portions, and a wire weft, the successive picks of
said wire weft being separated by cross-over portions of
said binder warps and said successive picks of said wire weft each being substantially shorter than the width of
said plies.

3. An electrical heating element comprising a flexible
narrow fabric woven from a yarn having electrically
insulating properties, two plies in said fabric, binder
warps, extending only over the central part of the fabric
width, between said plies, said binder warps being woven-
in alternately with said plies to form insulating cross-
over portions, and a wire weft, the successive picks of
said wire weft being separated by cross-over portions of

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said binder warps, and means for securing the edges of
said plies together so that said wire weft is completely
covered.

4. An electrical heating element according to claim 2
in which said successive picks of said wire weft are each,
however, longer than the width of said cross-over por-
tions of said binder warps.

References Cited in the file of this patent

UNITED STATES PATENTS

2,203,918	Moberg	June 11, 1940
2,307,231	Neff	Jan. 5, 1943
2,385,577	Jacob	Sept. 25, 1945