

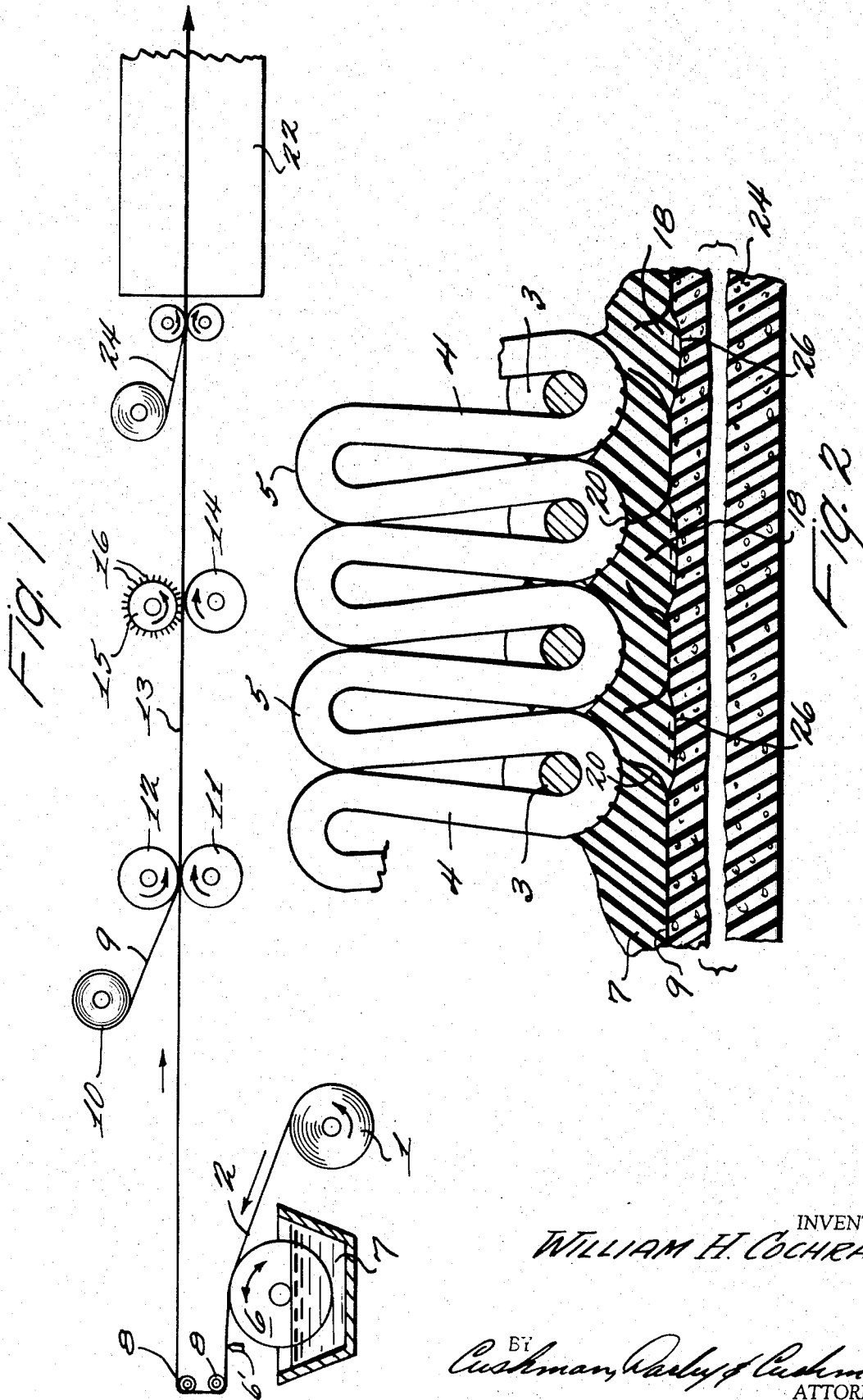
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TEXTILE PRODUCT AND PROCESS FOR MAKING SAME

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**TEXTILE PRODUCT AND PROCESS FOR
MAKING SAME****William H. Cochran II, P.O. Box 32,
Stonington, Conn. 06378****Continuation-in-part of application Ser. No. 765,267,
Oct. 4, 1968. This application Mar. 17, 1970,
Ser. No. 20,200****Int. Cl. D03d 27/00; D04h 11/00****U.S. Cl. 161—66****11 Claims****ABSTRACT OF THE DISCLOSURE**

An antistatic and flame retardant textile product having a base and a pile surface of yarn which is susceptible to the generation and/or accumulation of static charge and/or having the quality of allowing flame spread, an adhesive on the opposite surface of the textile product and an electrically and thermally conducting, static-dissipating metal foil bonded to the opposite surface of the product by means of the adhesive.

The present application is a continuation-in-part of Ser. No. 765,267, filed Oct. 4, 1968 and now abandoned, the subject matter of which is incorporated herein by reference.

In said application Ser. No. 765,267, I have described and claimed a textile product, e.g. a tufted or woven carpet, which is provided with unique means for dissipating static charges. This is accomplished, according to the invention described in Ser. No. 765,267, by bonding aluminum foil or other electrically conducting metal foil, to the bottom of the textile in direct electrically conducting contact with the surface yarns, the bonding means comprising an open, unitary network or web of overlapping and/or intersecting, hot-meltable thermoplastic, preferably polyester, fibers or filaments. The hot-melted fibers or filaments of the web penetrate into yarns with which they are in contact to give an extremely strong bond between the aluminum foil and the textile but without otherwise significantly changing the interfacial relationship between the foil and the textile. In other words, the bonding web on hot melting simply penetrates into the fabric which is adjacent to it, i.e., it does not flow together to form a continuous film, the openings or voids initially therein remaining as is. This gives the desired bonding effect, the melted filaments of the web penetrating well into the fabric, while at the same time, the foil and fabric are maintained in electrically conductive relationship in those areas opposite the openings or voids in the web. In this way, static developing on the surface yarn of the carpet or like product is discharged through the foil notwithstanding the adhesive bonding between the foil and textile.

As indicated in Ser. No. 765,267, the failure to provide for both effective bonding and electrical contact between the textile and conductive foil has been one of the reasons why aluminum foil had not previously been successfully used to dissipate static charge. Other difficulties encountered in prior efforts to use foil are also listed in Ser. No. 765,267, e.g. tearing or breaking of the foil by the tufting needles in the case of products tufted through unsupported foil and difficulty in removing the water and/or other vehicle employed in drying a latex or other like adhesive binder used to bond the foil to the textile, the foil having a low vapor-permeability and, therefore, causing the liquid vaporized during drying to pass through the body proper of the textile. The invention described in Ser. No. 765,267, obviates the aforementioned disadvantages and makes possible the highly effective use of aluminum foil for

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dissipating static charge in carpeting or other textile products normally faced with a static charge problem.

The principal object of the present invention is to provide a further process and product involving the use of aluminum foil in carpet or like textile product for the purpose of dissipating static charge. Another object of the invention is to provide a product having antistatic properties and which is further characterized by the fact that, by virtue of the use of foil as described herein, it is also flame retardant. Other objects and advantages of the invention will be apparent from the following detailed description of the invention and the accompanying drawings wherein:

FIG. 1 is a flow sheet diagrammatically showing the present process; and

FIG. 2 is a fragmented perspective view, with parts in section for clarity, illustrating features of the present product.

Broadly stated, the product of the invention comprises a carpet having a pile yarn surface, or other textile whose surface yarns are normally susceptible to the generation and/or accumulation of static charges, and an electrically conducting metal foil, preferably aluminum, bonded to the back of the carpet or like product through an appropriate adhesive, e.g. a latex formulation, the foil and adhesive being pierced lengthwise and widthwise of the back so as to provide slits or holes in the foil enabling vapor to escape through the foil and thereby obviating the necessity for the water or other vaporizing component of any adhesive to escape from the back of the fabric through the body of the fabric and out the pile side thereof, the foil either being in direct contact with surface yarns adjacent the slits or holes or in sufficient proximity thereto to permit electrical discharge.

Generally speaking, the more direct contact between the foil and pile yarn, the better the degree of static control. The degree of static control also varies with the chemical and physical make-up of the pile yarn, the quantity of moisture present, the quantity and quality of foreign matter (usually "dirt") present, the density of the yarn, the pile height, the conductivity of the adhesive, the quantity of adhesive, the thickness of the adhesive and the quantity of void areas in the adhesive film. Piercing of the foil while the foil is in place on the carpet forces the foil closer to or into direct contact with the pile yarn, rearranges the location of the adhesive mass thereby causing more area of voids and/or thin adhesive, and promotes mechanical adhesion to the foil. In order to reduce static to the point where humans using the carpet are unaware of the generation and/or accumulation of static electricity, approximately 2.2 kv., it is usually necessary to have every one inch length of pile yarn have at least one point where it is within .01" of the foil. It may be desirable to join the foil to an external ground although this may not be necessary.

The product of the invention may also include a foam or other secondary backing material bonded to the foil, and at least a part of the desired bonding between the foil and the secondary backing may be obtained by adhesive which extrudes or otherwise passes from between the carpet backing and foil through the slits or holes to the back of the foil.

Referring more particular to the drawings, the numeral 1 in FIG. 1 represents a supply roll of carpet 2 or a similar type of textile product which tends to generate and/or accumulate static charge. For purposes of illustration, the carpet may be a tufted product comprising, as shown in FIG. 2, a primary backing 3 with pile yarn 4 tufted back and forth through the backing to give the pile surface 5. It will be appreciated that pile surface 5 may be cut or looped as desired and the backing 3 may

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be woven fabric or it may be a non-woven fabric comprising natural and/or synthetic fibers, usually jute or polypropylene, while the pile yarn may be spun or filament nylon, acrylic, polyester, polypropylene, rayon, wool and/or other fiber or fiber blend (such as nylon and stainless steel mixtures) normally employed for this purpose. A further example of a backing suitable for use herein is one prepared as described in my co-pending U.S. application S.N. 872,657, filed Oct. 30, 1969.

According to the embodiment of the present process shown in FIG. 1, the carpet 2 is taken from supply roll 1 and contacted on its back side with a roller coater 6 or the equivalent, latex adhesive formulated to provide the desired adhesion being thus applied to the carpet from a pan 7. The carpet then may pass over a knife 6' to control the quantity of adhesive coated onto the fabric and/or to achieve the desired penetration into the fabric by the adhesive, and it thereafter goes around a further pair of rolls 8 which serve to turn the carpet 2 over so that the side with the adhesive thereon faces upwardly and the pile surface 5 faces downwardly. Aluminum foil 9 is fed from supply roll 10 onto the adhesive-coated surface of the carpet just before the resulting composite passes into the nip of a pair of rolls 11 and 12. Of these latter rolls, roll 11 may be advantageously a smooth roll while roll 12 is preferably padded, the foil being forced firmly against the carpet by the rolls 11 and 12 so that the foil tends to assume the contour of the carpet. Typically, rolls 11 and 12 exert a pressure of 1-10 pounds per inch, for example, on the foil-carpet composite although obviously other pressures may be used.

From rolls 11 and 12, the composite 13 is passed between rolls 14 and 15. Preferably roll 14 is padded while roll 15 is provided with a series of equally spaced metal pins 16 extending along the full width and circumference of the roll. Typically, pins 16 are on 1/8" to 1" centers. They serve to pierce the foil thus forming a plurality of approximately equi-spaced slits or holes extending across the foil and preferably inwardly all the way to the carpet backing 3. These slits or holes, represented by the numeral 18 in FIG. 2, serve several purposes. For one thing, the openings in the foil permit moisture vapor and the like to pass through the foil. This greatly facilitates drying since it thus is not necessary for moisture or other carrier in the adhesive to pass through the body of the carpet during drying.

Furthermore, the piercing of the foil permits some of the latex adhesive to pass through the holes and serves, at least in part, as a bonding medium for any secondary backing that might be applied to the foil side of the carpet. Additionally, the pins, in piercing the adhesive and foil, tend to push the pierced edges of the holes in the foil inwardly through the adhesive and into contact with, or in close proximity to, the yarns 4 making up the pile surface 5 so as to facilitate discharge of static charge through the bases of these yarns and the foil. Also, the pins tend to form discontinuous areas in the adhesive 7 thereby enhancing electrical discharge to and through the foil. FIG. 2 shows in one instance contact between the bottom portion of pile yarn 4 and an inwardly turned edge 20 of the foil 9 while other edges 20 are spaced from but in close proximity to the pile yarn. It will be appreciated that contact between the foil 9 and yarns 4 is not essential since the adhesive layer is usually so thin that the pierced foil and carpet yarns are sufficiently close to facilitate the discharge of static therebetween.

Following passage between rolls 14 and 15 and the piercing of the foil as described above, the composite is dried and cured as generally shown by the numeral 22. Conventional drying and curing conditions may be used and generally it is preferred to carry these operations out using a tentor. Typical drying and curing conditions comprise heating at 230-350° F. for 10-30 minutes although it will be appreciated that such conditions can be widely

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varied and will be dependent on the nature of the carpet involved and other operating factors.

The adhesive composition used to bind the foil to the carpet backing or the like may be any convenient adhesive which will bond effectively. Typically such composition comprises a latex or polyvinyl acetate, natural rubber, butadiene-styrene copolymer and/or butadiene-acrylonitrile copolymer; or an ethylene-vinyl acetate copolymer hot-melt solid adhesive. One such adhesive is available commercially as "Elvax" (E. I. du Pont) hot-melt formulation. Obviously, a conductive and/or flame retardant adhesive may be used advantageously.

Apart from the antistatic properties which are realized with the present invention, important further advantages of the product are its flame retardant and fire resistant characteristics because of the use of the foil. These latter characteristics are obviously of considerable importance from the standpoint of safety in use. The foil, because it is an excellent thermal conductor, serves as a heat sink and, because it is a nonporous substance, serves as a convection barrier and, because of its physical properties, is a heat reflector.

It will be recognized that various modifications may be made in the invention as described above. For example, if desired, a foam cushioning material or other secondary backing 24 may be adhered to the foil side after the piercing operation as noted earlier, and part of the binder or adhesive for bonding the secondary backing to the foil may be spots 26 of the adhesive 7 at the slits or holes in the foil. Alternatively the foil may be coated with or laminated to a material on its back side which is more easily adhered to a secondary backing material than plain foil. An example of this is to adhere a foil/paper laminate to the carpet and then apply latex foam on top of the paper. Another example is to coat the foil with hot-melt adhesive so that it may be heat-sealed to a floor or secondary backing material. Still another modification is to apply foil which has been prelaminated to a secondary backing material, such as woven jute or "Loktuft."

In another modification, a hot-melt adhesive web, as employed in Ser. No. 765,267, may be used with the latex adhesive composition. In such event, the system shown in FIG. 1 may be modified to include feeding such adhesive web onto the back of the carpet either before or after application of the latex adhesive but, in any event, before the foil is applied to the backing.

In still another modification, on fabrics where additional flame retardance is desired at the expense of a lesser degree of control over static generation and/or accumulation, an adhesive with residual tack after drying, curing and/or activating may be applied to a fabric in the conventional manner; then dried, cured and/or activated; and then the foil may be laid or nipped onto the adhesive either alone or pre-laminated to a secondary backing material. The foil may or may not be pierced. Leaving the foil unpierced provides a more flame resistant product because the convection barrier provided by the foil is continuous, the heat sink effect is maximized, and reflectance of heat by the foil is maximized; but provides less static control because there tends to be a greater distance between pile yarn and foil, and because the adhesive may have set before the foil is laid or nipped on, the adhesive may tend to be thicker on high points on the back of the fabric.

The characteristics of the aluminum or other metal foil are important to the success of the invention. In particular, the foil should not only be electrically and thermally conducting but it should also be sufficiently ductile to tend to conform to the bottom surface of the carpet fabric and yield therewith in use without fracturing. Thickness of the foil may be widely varied as illustrated in the case of aluminum, where typical foil thickness range is, for example, from .0002" up to .002" or even higher or lower. Actually it has been found that the thinnest available aluminum foil possesses an adequate amount of conductive capacity to dissipate static charge. Hence, in the case of aluminum foil, the key criteria are the absence of proc-

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essing oils or other contaminants, ease of handling, ability to withstand flexing, and conformability to the contour of the carpet fabric and any cushioning material that might be used therewith.

Preferably the foil used in the present invention has the same width as the carpet but this is not essential because less-than-full-width strips of foil, either, overlapping at their edges or separated by strips not covered by foil, extending lengthwise of the carpet, may be used.

External grounds may also be employed with the foil as indicated above.

For convenience of description, the invention has been described above in connection with the processing of tufted carpet. However, it will be appreciated from the foregoing that the invention is also applicable to other types of carpet, e.g. woven carpet such as the Wilton and Axminster types, as well as other types of textile products where antistatic and flame retardant properties, for instance, upholstery and wall covering fabrics, are important.

The scope of the invention is defined in the following claims.

I claim:

1. An antistatic and flame retardant textile product having a fabric base with two opposed surfaces, one of said surfaces comprising yarn which is susceptible to the generation or accumulation of static charge or having the quality of allowing flame spread, an adhesive on the other surface of said base and an electrically and thermally conducting, static-dissipating metal foil of about .0002" to .002" thickness bonded to said other surface of said base by means of said adhesive and pressure such that the foil and said other surface of said base tend to have a common contour and the foil is positioned so as to be in direct electrically conductive contact with respect to said yarn.

2. A product according to claim 1 wherein said textile product is a carpet.

3. A product according to claim 1 wherein said foil is aluminum foil.

4. A product according to claim 1 wherein said foil is laminated to a secondary backing material.

5. A product according to claim 1 wherein said foil is joined to another material on its back side to render it better for later adhesion to a floor or secondary backing material.

6. A product according to claim 1 wherein the adhesive has residual tack.

7. A product according to claim 1 wherein a hot-melt web adhesive is one of two or more adhesives used.

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8. The process for making the product of claim 1 which comprises applying adhesive to the opposite surface of said textile product, then applying the foil against said adhesive and pressing the resulting composite together so that the foil tends to conform to the contour of the textile product of said surface and then drying and curing.

9. An antistatic and flame retardant textile product having a fabric base with two opposed surfaces, one of said surfaces comprising yarn which is susceptible to the generation or accumulation of static charge or having the quality of allowing flame spread, an adhesive on the other surface of said base and an electrically and thermally conducting, static-dissipating metal foil of about .0002" to .002" thickness bonded to said other surface of said base by means of said adhesive and pressure such that the foil and said other surface of said base tend to have a common contour and the foil is positioned in electrically conductive relationship with respect to said yarn, said foil having slits or holes therein.

10. A product according to claim 9 wherein the foil is pierced to provide positioning thereof in close proximity to said pile yarns.

11. The process for making the product of claim 9 which comprises applying adhesive to the opposite surface of said textile product, then applying the foil against said adhesive and pressing the resulting composite together so that the foil tends to conform to the contour of the textile product, thereafter piercing the foil and adhesive layer to form a plurality of slits or holes therein lengthwise and widthwise of said surface and then drying and curing.

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