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3,702,797

ANTISTATIC TEXTILE PRODUCT

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Fig. 1

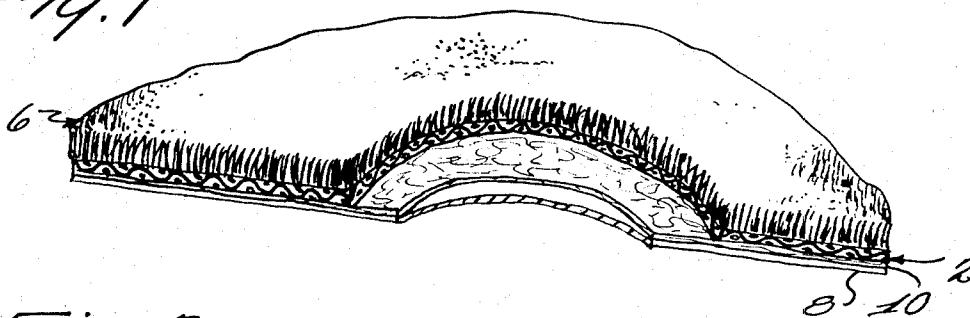


Fig. 2

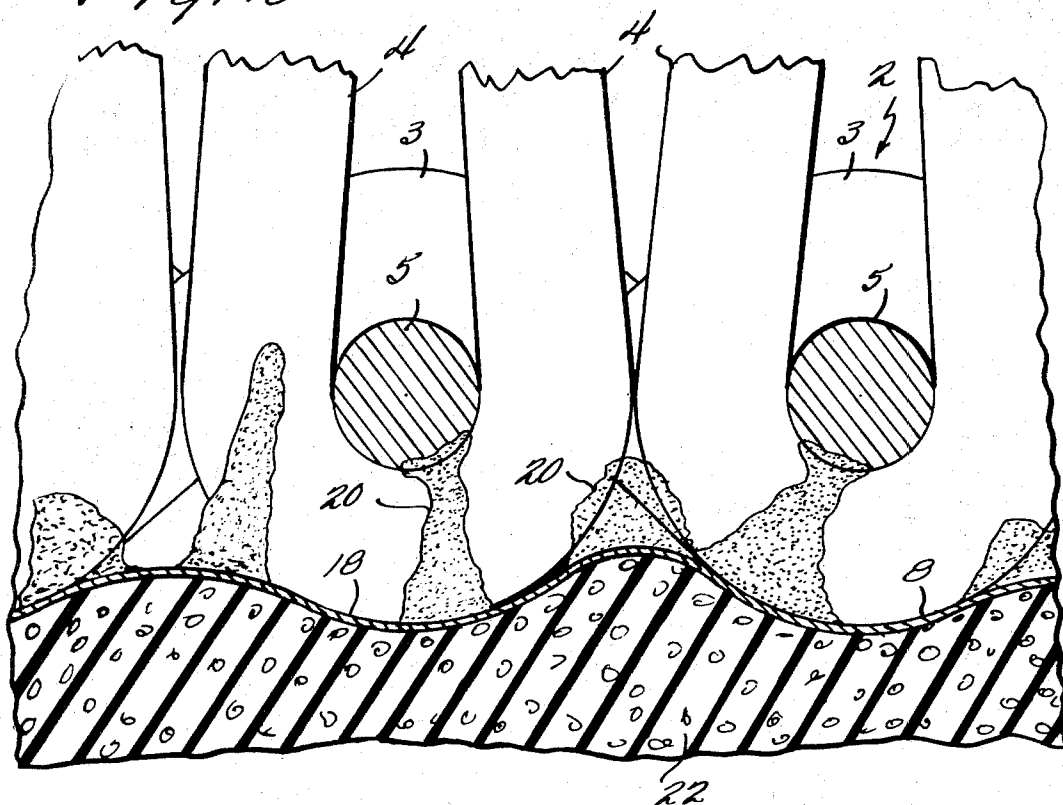
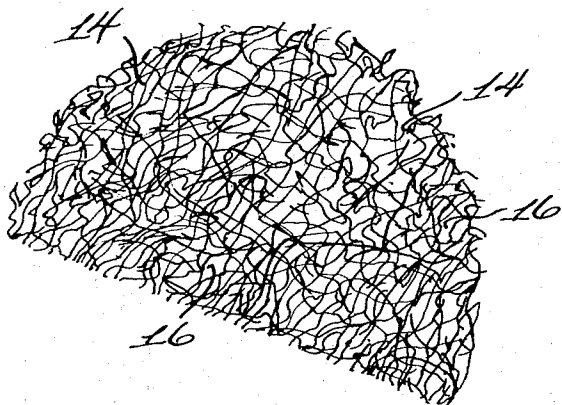


Fig. 3

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ANTISTATIC TEXTILE PRODUCT
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8 Claims

ABSTRACT OF THE DISCLOSURE

An antistatic textile, e.g. carpet, is disclosed which comprises a fabric layer having a surface which is susceptible to the undesired accumulation of static charge bonded to an electrically conducting static dissipating metal foil by means of a web of thermoplastic material which has been fused to the fabric layer. The web provides direct electrical contact with the surface yarns of the fabric layer.

This application is a continuation-in-part of Ser. No. 765,267, filed Oct. 4, 1968 and now abandoned.

The present invention is concerned with a novel textile product which includes means for dissipating static charges. The invention is particularly directed towards tufted or woven carpet although other types of textiles, where static charge accumulation is a problem, are also contemplated.

The accumulation of static charge on carpeting or the like is a well-recognized problem and a great amount of effort has been directed towards developing means for overcoming this problem. Numerous techniques have been proposed including the following: (1) the inclusion of metallic fiber such as stainless steel as a component of the pile yarn; (2) weaving copper, aluminum or other conducting ground wire through the fabric; (3) coating the back of the carpet with a conductive latex backing; and (4) the application of antistats to the pile surface. All of these alternatives suffer from one disadvantage or another which tend to limit the extent of their use.

It has also been proposed to use a conducting metal foil as a base layer to dissipate static charge in carpeting. However, prior efforts along these lines have not been satisfactory. Aluminum foil would be especially desirable for this purpose in view of its outstanding conductivity, but in the case of tufted fabrics, the foil tears and/or breaks on impact by tufting needles. The alternative is to adhesively bond foil to the back of a carpet fabric, tufted or woven, but conventional latex or like adhesives present other problems, the most important of which is the fact that such adhesives tend to form continuous films which function to electrically insulate the pile yarn from the aluminum foil. This precludes use of the foil for dissipating static charge since it is essential for this purpose to have intimate and direct contact between the foil and the pile yarn of the carpet where the static charge normally tends to build up. There is a further problem with latices and other liquid-based adhesives which precludes or limits their use for the purpose indicated and that is the requirement that carpet fabric treated therewith must be dried to vaporize and remove water and/or other liquid vehicle employed with the adhesive component. This is difficult to do, particularly if a metal foil which is essentially vapor-imperious is involved, since the volatilized material has to pass through the carpet body to accomplish the drying.

Despite the above difficulties, there is much to recommend the use of aluminum foil or the like for antistatic purposes and the present invention provides a way of effectively doing this based on the finding that such foil can

be usefully bonded to carpet fabric or other textile which normally tends to accumulate a static charge by using an adhesive or bonding medium containing no volatile component in open web form. Accordingly, the principal object of the present invention is the provision of an improved carpet or other textile product rendered antistatic by a foil of aluminum or other electrically conducting metal bonded thereto. Other objects will also be apparent from the following detailed description of the invention.

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 accumulation of static charges, and an electrically conducting metal foil, preferably aluminum, bonded to the bottom of the textile but 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 or functional equivalent thereof, e.g. pierced hot-meltable thermoplastic film, as described below.

An important element of the present product is the use of bonding means or medium as defined above. This medium is 100% active in the sense that no vaporizable carrier is involved and all of the solid component (i.e. the thermoplastic filament portion) functions as the adhesive on melting. Advantageously the composition of the web is selected so that it can be melted by heating only one or both of the surfaces to be adhered, rather than by heating the entire mass of the carpet in a circulating air oven as conventionally used.

A particularly important characteristic of the bonding web is that, on hot melting, it does not form a continuous insulating film or layer as imparted by emulsion or solvent adhesives after their liquid carrier is evaporated. Instead, because of its open network construction, the hot-melted filaments of the web penetrate into the yarns with which they are in contact to give an extremely strong bond between the foil and the textile but without otherwise significantly changing the interfacial relationship between these members. Stated another way, 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 carpet fabric, while at the same time, the foil and fabric are maintained in direct electrically conductive contact in those areas opposite the openings or voids in the web. These points of direct contact between the foil and carpet fabric, specifically the pile or other surface yarn which normally tends to accumulate static charge, are essential to dissipate the charge. It will be appreciated that while the foil may contact a substantial portion of the back part of the carpet fabric, at least some of such contact should be with the pile or static charge susceptible surface yarn as this yarn intermittently appears on the bottom side of the fabric.

Bonding webs of the type indicated are commercially available. One such web comprising 100% polyester and sold as "THERMOGRIP 5000" by the U.S.M. Chemical Company is described by its manufacturer as an open layer, unitary network of random, overlapping, intersecting, essentially continuous, hot-meltable, polyester filaments. As noted earlier, these webs have a number of desirable characteristics apart from giving good adhesion between the textile and the foil. In particular, the webs are 100% active in the sense that the entire web can be used for bonding and there is no carrier or solvent to be removed. Additionally, as the web is hot-melted and penetrates into the yarn bundles, it provides a good degree of suppleness and flexibility which is long lasting and

thus serves to improve the overall properties of the carpet or like product.

Polyester webs are preferred, as noted above, because of the good adhesion such webs have for aluminum or like foil and all textile fibers, natural or synthetic. However, the webs may also comprise other thermoplastic fibers or filaments, e.g. polyethylene, polypropylene, nylon, vinylidene chloride polymers, and acrylics, in addition to, or in lieu of, the thermoplastic polyester filaments.

The thickness and weight of the bonding web may be widely varied for present purposes. The "THERMOGRIP" product referred to above is available, designated as "THERMOGRIP 5050A," as a web of approximately 10 mils thickness, weighing 1 3/4 ounces per square yard and this gives outstanding results. However, it will be appreciated that other web thicknesses and weights, for example, a thickness in the range of 5 to 30 mils and a weight of from 1/2 to 5 ounces per square yard, may also be used. Usually the web is such that from 20 to 80% of its lateral surface area is open, i.e., free from filaments, although here again it will be recognized that there is considerable latitude for variation as long as the web meets the requirements indicated above.

While it is preferred for reasons of economy to use a nonwoven web of the type described, it is also possible according to the invention to use a knitted or woven web provided the relationship of voids of adhesive is maintained after hot-melting.

The characteristics of the aluminum or other metal foil are also important to the success of the invention. In particular, the foil should not only be electrically conducting but it should also be sufficiently ductile 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 ease of handling, ability to withstand flexing, and conformability to the contour of the carpet fabric and any underlay that might be used therewith.

The invention is further illustrated by the accompanying drawings wherein:

FIG. 1 is a fragmented perspective view, with parts enlarged for clarity, of a tufted carpet according to the invention;

FIG. 2 is an enlarged vertical sectional view of the carpet; and

FIG. 3 is a perspective view of the bonding web.

For convenience, a tufted carpet is shown in the drawings and described in detail below. 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.

Referring more specifically to the drawings the carpet according to the invention comprises the backing fabric 2, which is shown as woven in FIG. 2 (note the warp and filling yarns 3 and 5, respectively). Pile yarn 4 is passed back and forth through the backing fabric 2 to provide the pile surface 6 (see FIG. 1). The pile may be cut or looped as desired and it will be appreciated that the backing fabric 2 and pile yarn 4 may have any of the usual constructions. For example, backing fabric 2 may be a woven fabric, as shown, or it may be a nonwoven 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 any other fiber normally employed for this purpose.

The metal foil 8, preferably aluminum, is bonded to the backing fabric 2 by means of the web 10 which, as noted above, comprises an open, unitary network of overlapping

and/or intersecting, essentially continuous, hot-melttable thermoplastic, preferably polyester, filaments. The construction of the web is shown in FIG. 3 and comprises the continuous overlapping filaments 14 randomly disposed with respect to each other and to the openings or voids 16 so as to give the nonwoven web construction as described. It will be seen that with this web construction and the tendency of the filaments therein to penetrate the yarns adjacent thereto when hot-melted without forming a continuous film, the aluminum foil will be in direct contact with the bottom portions of the pile yarn 4 wherein the web is open as shown at 18 in FIG. 2. As noted earlier, this greatly facilitates the discharge of static electricity which might otherwise tend to accumulate on the pile surface 6. FIG. 2 also shown at 20, in exaggerated form, the manner in which the filaments 14 of the web, upon melting, penetrate into the pile yarn 4 and the yarns 3 and 5 of the backing fabric 2.

The product shown in FIGS. 1-2 may be made in several different ways. In one way, the pile surface 6 is formed on the backing fabric 2 by passing the pile yarn 4 back and forth through the backing fabric 2, after which a sandwich or laminate is formed with backing fabric 2 superposed on the aluminum foil 8 with the bonding means 10 positioned in between as shown in FIG. 1. The laminate may then be subjected to heat and pressure by means of a hot roller applied against the back of the foil 8, sufficient heat applied to melt the bonding web, after which the product is cooled to set the bond. Temperatures, pressures and times for the bonding may be varied but, as examples, there may be mentioned temperatures in the order of 300°-380° F., e.g. 360° F., pressures of about 3 to 30 p.s.i., and periods of time varying from 2 to 20 seconds. Such heat treatment is quite mild and, being localized, does not undesirably affect the overall characteristics of the pile or the backing fabric. In fact, the heating operation with consequent penetration of the adhesive web into the yarn not only serves to give the desired bond between the foil and fabric but it also serves to improve the overall suppleness and flexibility of the final product.

As shown in FIG. 2, a cellular rubber backing or other type of underlayer 22 may also be included in the product if desired. This may be added to the product after bonding the foil to the fabric or the foil may be bonded to the underlayer first and then bonded to the carpet fabric. If a rubber backing or underlayer is used, it may be desirable, although not necessary, to ground the foil to dissipate electric charge.

It will be appreciated that in addition to serving to dissipate static electricity, the aluminum or like foil used herein also functions to improve the thermal insulating value of carpeting or other fabric made according to the invention. A further advantage in using the foil is that it increases the fire resistance of carpet underlay, whether separate or attached to the carpet, because of the heat conductive and reflective properties of the foil. Carpeting made according to the invention, owing to the solvent resistance of the binder, may also be conveniently dry-cleaned in place without destroying the bond between the foil and the carpet fabric.

In the event the bond between the foil and carpet fabric should ever break, it may be easily repaired with the carpet in place by simply injecting additional melted adhesive or by using a hot iron to remelt the bonding medium.

Various modifications may be made in the invention as described above. Thus, while the invention has been illustrated in connection with a tufted carpet, other types of textile products where antistatic properties are important are also contemplated. Additionally, while the invention has been exemplified using a nonwoven web or network of hot-melttable thermoplastic fibers or filaments, it will be realized that other functional equivalents thereof may be used. For example, a woven or knitted open web or network of fibers and/or filaments may be used in lieu of the indicated nonwoven bonding means. Thus, a scrim woven

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or knit of hot-melttable fibers and/or filaments, or a scrim woven or knit of fibers and/or filaments to which a hot-melttable adhesive material has been attached before or after weaving or knitting and continuously or intermittently may be used. For example, a scrim woven of nylon yarn to which an appropriate quantity, density and size of polyethylene beads have been attached intermittently may be used. As another alternative, a hot-melttable thermoplastic film which has been pierced, perforated, or is otherwise provided with openings to give, in essence, an open unitary web or network of hot-melttable thermoplastic may be used for bonding the fabric surface to the foil. Accordingly, the scope of the invention is defined in the following claims.

What is claimed is:

1. An antistatic textile product comprising a textile fabric having two opposed surfaces, one of said surfaces being susceptible to the undesired accumulation of static charge, and an electrically conducting static dissipating metal foil bonded to said other surface of said fabric essentially by means of an open web of hot-melttable thermoplastic material which has been fused to said foil and said other surface of said fabric, said web providing direct electrically conductive contact between said fabric and said foil through the openings of said web.

2. A product as claimed in claim 1, said product being a carpet comprising a textile fabric having a surface which is susceptible to the undesired accumulation of static charge, and an electrically conducting static dissipating metal foil bonded to another surface of said fabric by means of a nonwoven open, unitary web or network of overlapping and/or intersecting hot-melttable thermoplastic fibers or filaments which have been hot-melted to said foil and said fabric; said nonwoven web providing direct

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electrically conductive contact between said fabric and said foil through the openings of the web.

3. A product according to claim 2 wherein said foil is aluminum foil of from .0002" to .002" in thickness and said textile fabric is a carpet having pile yarn which is in direct electrically conductive contact with the foil.

4. A product according to claim 3 wherein said thermoplastic fibers or filaments are polyester fibers or filaments.

5. A product as claimed in claim 1 wherein said web is a perforated thermoplastic film.

6. A product as claimed in claim 1 wherein said web is an open fabric including spaced hot-melttable thermoplastic portions.

7. A product as claimed in claim 1 wherein said surface is susceptible to the undesired accumulation of static charge is a pile surface.

8. A product as claimed in claim 7 wherein said pile surface comprises yarn which extends through to said other surface to contact said foil at said web openings.

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