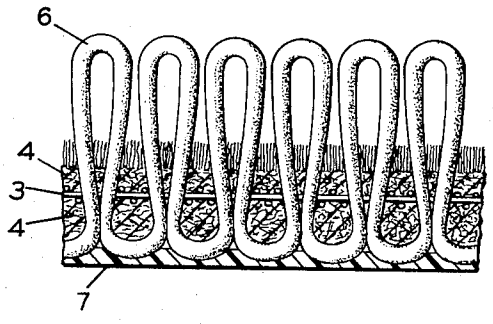
April 23, 1974 W. R. BRINKHOFF ET AL 3,806,401

ANTISTATIC CARPET CONSTRUCTION

Filed April 3, 1972

Fig. I



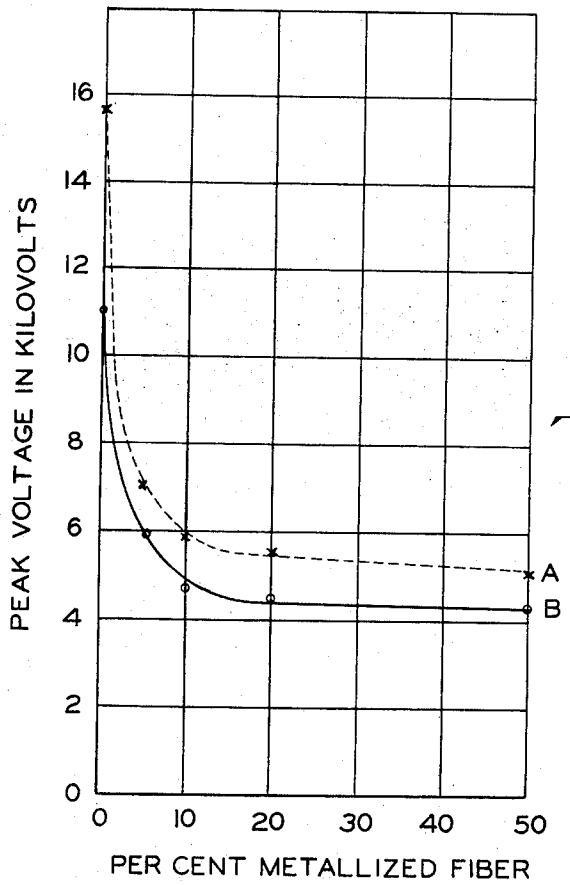


Fig. II

United States Patent Office 3,806,401
Patented Apr. 23, 1974

3,806,401

ANTISTATIC CARPET CONSTRUCTION

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Filed Apr. 3, 1972, Ser. No. 240,708
Int. Cl. D04h 11/00, 11/08
U.S. Cl. 161—67 3 Claims

ABSTRACT OF THE DISCLOSURE

A carpet is described having durable antistatic properties which are obtaind by incorporating electrically conductive fibers in a nonwoven web which goes to make up an integral part of the carpet construction. Methods of forming the carpet are described whereby the nonwoven web containing electrically conductive fiber is incorporated in the tufted carpet structure.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to a tufted carpet construction and, more particularly, to a carpet having durable antistatic properties.

Description of the prior art

Antistatic carpets are available, for example, one of which incorporates in the tufting yarn a small quantity of a continuous filament of a stainless steel fiber, and another in which the tufting yarn is made up of a combination of staple nonconducting fibers and a small portion of conductive stainless steel fibers. It is also known to use small quantities of other types of metal fibers in forming tufting yarns to achieve in the tufting yarn a conductive characteristic such that, in carpets utilizing such tufting yarn, especially under low humidity conditions, the propensity for building up a static charge is minimized by dissipating such static charges by means of the electrically conductive filaments. It is also known from U.S. Pat. No. 2,302,003 to provide a carpet having a flexible, electrically conductive material adhered to at least a portion of the underside of the carpet and a plurality of electrically conductive elements of textile material and electrically conductive rubber composition contacting said coating and extending to substantially the top of the carpet to dissipate static charges. It is also known from U.S. Pat. No. 3,582,445 to construct a carpet containing a minor percentage by weight of an electrically conductive fiber in its surface structure (i.e., tufts) in which the electrically conductive fiber may be a substrate of a conventional fiber such as nylon, polyester, acrylic, etc., having formed on the surface an electrically conductive coating from, by way of example, a polymeric binder solution or emulsion which contains dispersed therein finely divided metals such as silver gold, platinum, brass, nickel, aluminum, tungsten, etc., or other finely divided electrically conductive materials such as copper oxide or carbon black or alternatively a chemically plated conductive coating of metal such as nickel, copper, cobalt, chromium, zinc, tin or other which may be formed by means such as vacuum evaporation of the metal on the fibers.

SUMMARY OF THE INVENTION

We have now found that a tufted carpet having durable antistatic properties may be formed by forming a novel construction in which a web containing a portion of electrically conductive fibers is needle-punched to a dimensionally stable primary scrim backing after which conventional nonconductive tufting yarns are tufted through the backing and web to form a conventional carpet. The tufts are then preferably locked into the backing by means of

a conventional latex adhesive, and the tufts may be either left in their loop form or may be sheared to give a shag or cut pile configuration. Alternatively, the tufted carpet may be formed by initially tufting conventional nonconductive tufting yarns through a dimensionally stable primary scrim backing and a web containing a portion of electrically conductive fibers needle punched thereto. The needle-punched nonwoven web having the electrically conductive fibers incorporated therein serves or functions to form a layer in the interior of the carpet whereby static charges built up, for example, under low humidity conditions by traffic trically conductive fibers in the nonwoven web is such that a continuous electrically conductive circuit is not established.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing, FIG. I is a simplified diagrammatic representation of an enlarged cross section of a tufted carpet structure formed in accordance with the invention; and

FIG. II is a graph representing the static dissipating effectiveness of the carpet construction.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. I of the drawing, the antistatic carpet construction comprises a dimensionally stable scrim **3** and a layer of staple fibers **4**, a portion of which carry an electrically conductive coating on the surface thereof. The layer of staple fibers has been needled into the scrim to provide an electricaly conductive layer of fibers **4** with the nonconductive yarn **6** tufted through the scrim and the electrically conductive needled layer to provide a tufted surface supported by the scrim with the tufts being in contact with the electrically conductive needled layer **4**. In order to lock the tufts into position, a conventional latex adhesive layer **7** was applied to the backing.

The dimensionally stable scrim may be any of the conventional type such as a weave of polypropylene filaments or ribbon, jute or burlap or other woven or nonwoven scrims. In accordance with well-known procedure, a conventional lapper may be used to deposit on the surface of the scrim a uniform web or mat of garneted staple fibers. These staple fibers comprise a mixture of nonconductive fibers and electrically conductive fibers such as fibers having an electrically conductive metallic coating or fine metal fibers mixed with conventional nonconductive fibers such as nylon or acrylic fibers. The product is then passed through a conventional needle loom which acts to needle the fibers into a layer bonded to the scrim, the needles serving to compact the web and intertwine fibers therein through the scrim and bond the web thereto. After needle bonding, the product passes through a conventional tufter, which tufts yarn through the scrim and the conductive layer to develop a face comprising tufts which extend above the needled nonwoven web layer. The tufting yarn may be made up of any suitable nonconductive fiber material such as nylon and may be either a conventional continuous filament yarn or a yarn spun from staple fibers. The tufts may be of the loop type illustrated in FIG. I or they may be cut to provide a cut pile type carpet structure. After tufting, the carpet may be dyed or printed if desired, and a conventional rubber latex adhesive material is usually applied to the back of the carpet to lock the tufts in position.

Alternatively, a tufted scrim structure may have a nonwoven web applied to the back thereto and bonded to the structure by needle punching through the backing, bringing the fibers of the nonwoven web through the scrim and into the tufts to form a carpet structure similar to that described in U.S. Pat. No. 2,706,324. In any event, the layer of staple fibers, a portion of which carry an elec-

trically conductive coating or a portion of which are of electrically conductive fine metallic fibers, provide an electrically conductive layer such that charges built up in the nonconductive fibers in the tufts are readily dissipated by contact with the electrically conductive fibers in the needled layer.

The following examples will serve to more fully illustrate the invention.

Two series of antistatic carpet structures were made up as follows:

A series of 2 oz. per square yard nonwoven webs were prepared from intimate mixtures of metallized 3" 2.5 denier per filament staple acrylic fibers and 3" 15 denier per filament nylon staple fibers. For each carpet structure, a 2 oz, nonwoven web was first needle bonded to a dimensionally stable woven polypropylene primary scrim after which nylon yarn was tufted through the needle bonded web and scrim. In Series A, a needle depth of ½" with 225 penetrations per inch^2 was used to needle bond the web to the scrim, and in Series B a needle depth of ¾" with 300 penetrations per inch^2 was utilized. To finish the carpet construction and to lock in the tufts, 24 to 28 ounces of latex per square yard were applied to the back of the carpet and a 7 oz. woven burlap secondary backing adhered thereto, the carpet being passed through an oven to cure and set the latex.

In Table I which follows, the details of Series A and Series B carpet constructions are set forth:

TABLE I

Series	Yarn material and denier	Ounces per yard [2]	Stitches per inch	Gauge	Pile height	Percent by weight metal fibers in web
A	Nylon 3550	25.2	7	5/32	½"	0, 5, 10, 20, 50
B	do	23.0	9	5/32	[1] ¼"	50

[1] Sample B-1 has pile height of ½".

The carpet structures of Series A and B were subjected to static propensity tests, evaluations being made in accordance with a modified CRI (Carpet and Rug Institute) charge propensity test in which an energetic shuffle was used for charged generation. Samples were first conditioned for a minimum of three days at 20% relative humidity and at 75° F. prior to charge measurement. The maximum charge accumulated on a subject sample, wearing test shoes with leather soles and rubber heels, during a one-minute shuffle, was recorded, in terms of a voltage, as a characterization of the static charge property of the sample tested.

The construction parameters of the Series A and Series B carpet samples are as follows. In the A series of samples, a series of samples containing 0, 5, 10, 20 and 50%, respectively, of 2.5 d.p.f. metallized acrylic fibers based on the 2 oz. web were used. In Series B, the first sample was the same as the 50% level utilized in Series A, but a ¾" needle depth penetration with 300 penetrations per square inch was utilized, and a control sample containing no metallized fibers was also tested. The following results in Table II are of the measurements on carpet samples in Series A and B.

TABLE II

No.	Sample description	Peak voltage, kv.
1	Series A (20% metallized fibers by weight)	−5.6
2	Series A scoured (20% metallized fibers by weight)	−5.6
3	Series A trafficked[1] (20% metallized fibers by weight)	−3.8
4	Series B (50% metallized fibers by weight)	−5.7
5	Series B control (no metallized fibers)	−12.0
6	Series B (50% metallized fibers by weight)	−3.6

[1] Trafficked 10 days, 7,956 count.

It appears from the data gathered that the inclusion of metallized fibers in the web of tufted nylon carpet improves the static control quality of the carpet with the greatest change in generated charge level taking place from the control to a 5% of web weight metallized fiber content with improvements beyond a 10% to 20% of web weight of metallized fiber content being slight. Increases in depth of needle penetration and number of penetrations per unit area for the same pile height do not seem to produce any significant improvement in static control quality. However, decrease in pile height from ½" to ¼" while maintaining the other construction parameters constant produces an improvement in static control quality. Scouring a 20% metallized fiber content carpet sample did not appear to produce any change in generated static charge level compared to a nonscoured sample. Traffic exposure with no subsequent scouring of a 20% metallized fiber content carpet resulted in a lowering of the generated static charge level.

The graph set forth in FIG. II of the drawing shows the voltage generated on two subjects versus the percent (based on web weight) of 2.5 d.p.f. metallized acrylic fiber in A series experimental carpet structures. The voltage was generated by the shuffle with the feet being lifted from the carpet at end of each stroke utilizing leather soles and rubber heels against the carpet surface, curve A represents voltages on subject 1 and curve B represents voltages on subject 2, the percent metallized fiber in the carpet structure being plotted against the peak voltage in kilovolts.

What is claimed is:

1. An antistatic carpet construction comprising a dimensionally stable scrim, a nonwoven layer of staple fibers, of which at least about 5% by weight of the nonwoven layer is of electrically conductive fibers with the maximum percentage of said electrically conductive fibers in the nonwoven layer being insufficient to establish a continuous electrically conductive circuit, said nonwoven layer being needled into the scrim, and nonconductive yarn tufted through the scrim in contact with the electrically conductive needled layer to provide a tufted surface supported by the scrim with the tufts in contact with the electrically conductive needled layer.

2. An antistatic carpet construction in accordance with claim 1 in which the electrically conductive fibers carry a conductive coating on the surface thereof.

3. An antistatic carpet construction in accordance with claim 2 wherein at least some of the tufts are sheared to give a cut pile appearance.

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3,713,960	1/1973	Cochran	161—66

MARION E. McCAMISH, Primary Examiner

U.S. Cl. X.R.

161—62, 63, 175

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,806,401 Dated April 23, 1974

Inventor(s) William R. Brinkhoff and Edward R. Frederick

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the specification, column 1, line 56, the words "silver gold" should read --silver, gold--.

Column 2, line 11, after the word "traffic" the remainder of the paragraph should read --thereover, are dissipated and yet the percentage of electrically conductive fibers in the nonwoven web is such that a continuous electrically conductive circuit is not established.--

Column 2, line 31, "electricaly" should read --electrically--.

Signed and sealed this 5th day of November 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334