United States Patent [19]

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[11] **3,917,883**

[45] **Nov. 4, 1975**

[54] **FLOCKED PRODUCTS AND THEIR MANUFACTURE**

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[22] Filed: **Sept. 28, 1973**

[21] Appl. No.: **401,790**

[30] **Foreign Application Priority Data**

Oct. 3, 1972 United Kingdom 45588/72

[52] **U.S. Cl.** **427/198;** 118/308; 156/72; 156/435; 427/200; 427/206; 428/88; 428/90

[51] **Int. Cl.**[2] **D03D 27/00;** D04H 11/00

[58] **Field of Search** ..... 161/62–67, 161/413; 156/622, 62.4, 72, 435; 117/9, 16, 117/104 R, 93.4 R, 101, 33; 118/308; 65/8; 264/8, 143, 24, 95, 131; 26/2 R, 69 R, 27, 26/63, 66; 28/72 P

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[57] **ABSTRACT**

Novel flocked products, their preparation and apparatus for use in their preparation are described. The products comprise a substrate with a surface of flocked fibres bonded to it by a hardened binder and the fibres over part of the surface have a predominant, non-perpendicular orientation and are substantially linear and over another part of the surface have a different, predominant, non-perpendicular orientation and are substantially linear. The products enable excellent design interest and resistance to use defects e.g. bruising to be readily achieved.

9 Claims, 3 Drawing Figures

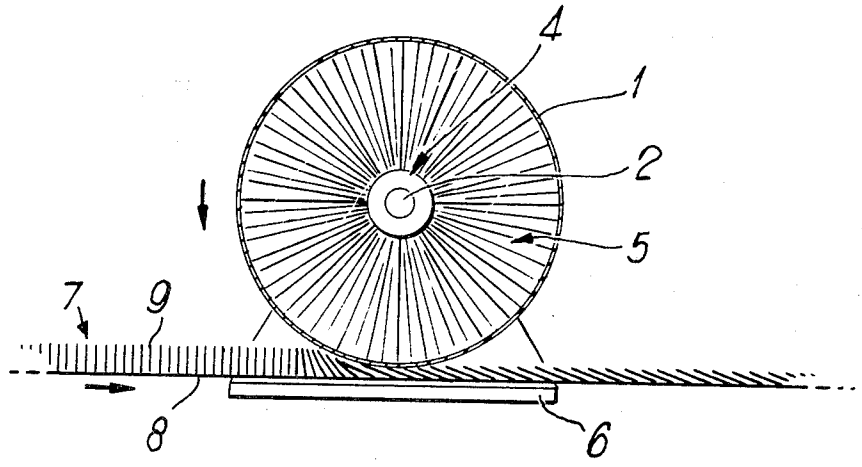


Fig. 1.

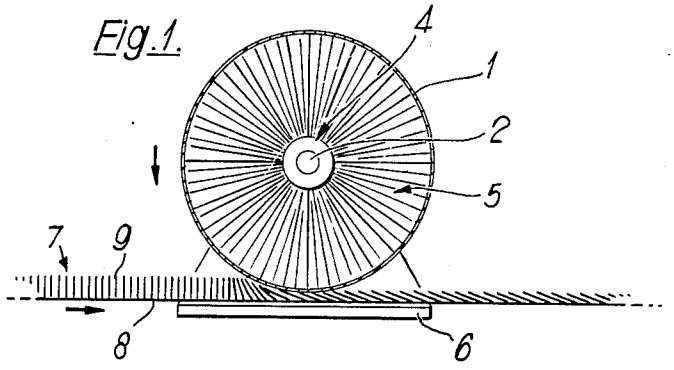


Fig. 2.

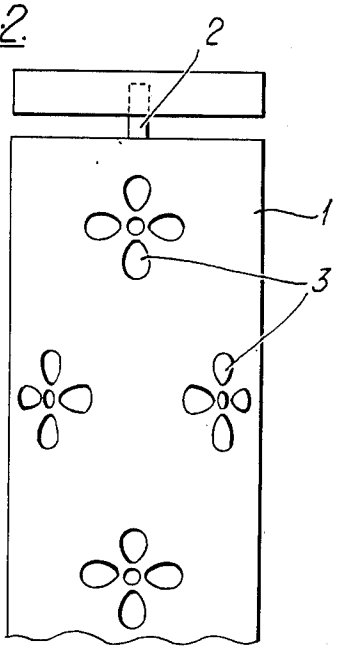
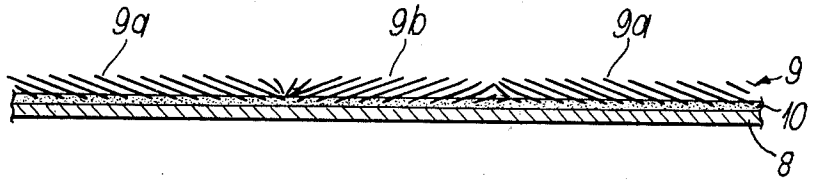


Fig. 3.



FLOCKED PRODUCTS AND THEIR MANUFACTURE

This invention relates to flocked products.

In general flocked products comprise a substrate the surface of which carries a very high density of flocked fibres that are usually both short in length and of fine denier and that are bonded to the substrate by a bonding agent applied to the substrate. Thus they are generally made by flocking fibres onto a substrate carrying an unhardened adhesive and then hardening the adhesive. They find application as, for example, upholstery materials, garment materials, shoe materials, carpets and artificial suedes.

Flocked products in general have a velvet-like or suede-like feel and appearance and in particular generally have the characteristic sheen of many suedes and velvets.

When the flocking is effected by electrostatic means the flocked fibres are oriented substantially vertically with respect to the substrate, because of the influence of the electrostatic field. Any deviations from the vertical are random; that is to say, there is no predominant orientation of the fibres other than perpendicular to the substrate. In fact, if precision cut flock is used, there is usually very little deviation from the perpendicular. When flocking is by mechanical methods, the fibres tend to have a slightly more random orientation, but again there is no predominant orientation other than vertical.

Overall flocked products are therefore usually very uniform and plain and therefore lack design interest. Since the predominant orientation of the fibres is substantially vertical, the application of pressure onto the fibres during use results in flattening. This flattening is extremely noticeable when compared to the sheen of the new product, especially since the random deflection of the fibres may cause the product to appear to be of variable colour. It is conveniently termed bruising.

Design interest has been imparted to these flocked products by softening, usually by heating, the adhesive and then embossing with an embossing roller to form a stripe or zig-zag pattern of embossed areas separated by areas in which the fibres retain their substantially perpendicular orientation. Such a method has been described in, e.g., British patent specification No. 717161. However, in the embossed areas the flattening of the fibres tended to have a significant random component, and so the appearance in the embossed areas is not entirely satisfactory. Also, the appearance is liable to be damaged by some degree of bruising during use. Also the fibres in the embossed areas are non-linear; that is to say, the individual fibres are bent with the tips being deflected considerably more than the bases of the fibres. Again this tends to detract from the appearance and to render fabric liable to acquire a bruised appearance. Furthermore, embossing techniques generally only enable surface effects of rather limited design interest to be achieved.

A flocked product according to the invention comprises a substrate and a surface of flocked fibres bonded to it by a hardened binder. The fibres over part of the surface area of the product are substantially linear and have a predominant, non-perpendicular orientation and over another part of the surface area the fibres are substantially linear and have a different, predominant, non-perpendicular orientation. The products have a velvet-like or suede-like appearance. Fibres in one or more areas will have one predominant, non-perpendicular orientation, while fibres in one or more other areas will have a different, predominant, non-perpendicular orientation. Thus products according to the invention differ from products made by embossing methods.

In the products of the invention there will often be only two different, predominant, non-perpendicular orientations and, whilst there may be only two distinct areas in which these orientations are found, usually at least one of the orientations will apply in two or more distinct areas. However, there may be three or more different, predominant, non-perpendicular orientations in a case where there are three or more distinct areas having a predominant, non-perpendicular orientation. Often the entire surface will be composed of areas having a predominant, non-perpendicular orientation but one or more areas having a predominant, perpendicular orientation and/or one or more areas having a random orientation may also be present.

The product of the invention is best made by a method in which the fibres are flocked onto a substrate carrying a fluid binder; the fibres are laid in part of the surface area with a predominant, non-perpendicular orientation and in another part with a different, predominant, non-perpendicular orientation and the binder is then hardened.

As a result, upon laying the fibres down, the fibres lay down substantially along their entire length, and are therefore substantially linear, whereas in embossing methods the deflection of the tips of the fibres is significantly greater than the deflection of the bases of the fibres. Also, as a result of the method of the invention, the fibres within each individual area have a more predominant orientation, i.e. are less randomly laid, than in embossed products. In general, the products of the invention have a much more pleasing appearance than flocked products that have been made previously and in particular have an appearance that is more resistant to bruising and other use defects.

The orientation of fibres within an area of the surface is usually such that substantially all the fibres in the area of the surface lie substantially all in one direction along the surface, for example at an angle of less than 45° and usually less than 30°, for example 10° to 20°, to the plane of the surface.

By the invention it is possible to produce a wide range of design effects in the surface, by suitable choice of orientations in flattened areas and optionally also by the inclusion of unflattened areas. The flattened areas have the particular advantage that their appearance is not harmed by wear and so it is generally preferred that the entire surface of the fabric should have its fibres laid in two or more predominant, non-perpendicular, orientations.

The individual areas of fibres having a predominent orientation may be arranged in any desired pattern which may be, for example, a regular or geometric pattern, or it may be one that gives the appearance of being an irregular pattern, for example a marble effect.

Various methods of laying the fibres of the flock can be used and include the use of bars or combs against which the flock can be made to move, for example by moving the substrate beneath the bars or combs, or air jets. However particularly satisfactory methods involve simple mechanical rolling or brushing. Conveniently the apparatus used includes means such that the de-

sired pattern of different orientations in different areas is achieved in one operation, although if desired the flocked product can of course be subjected to two or more pressing or brushing processes to achieve the desired pattern.

If fibres are to have orientations in stripes that extend along the length of the fabrics, then these orientations can adequately be accomplished by passing the flocked substrate beneath brushes, rolls or other members that, in combination with the movement of the substrate relative to the member, cause the fibres to be deflected in the desired directions. If the fibres before orientation have a very random orientation, then it may be desirable to rely upon brushing rather than simple rolling to achieve the desired predominant orientations.

For any other arrangement of areas, it is necessary to use an apparatus that is designed to provide the necessary pressing or brushing effect in the appropriate areas to give the chosen pattern.

A simple form of apparatus for producing a pattern of areas having one predominant non-perpendicular orientation and areas having a different predominant non-perpendicular orientation comprises a stencil (i.e. a perforated band or roller) and means in the stencil capable of orienting separately fibres in areas corresponding to the apertures of the stencil. There should be no relative movement at the zone of contact between the stencil and the surface so that all fibres contacted by the solid areas of the stencil are oriented in one direction while the fibres in areas corresponding to the perforations will be oriented independently, usually in a direction parallel but opposite to the direction of the other fibres. As an example, if the fibres contacted by the solid areas of the stencil are oriented such that they incline toward the north in a given rug lieing in a given position, the fibres in areas corresponding to the perforations in the stencil are oriented such that they incline toward the south. Alternatively, all the fibres in the surface may be deflected in one direction by brushing or other means, but then fibres in parts only of the surface may be reoriented by the orienting means within the stencil.

Conveniently the orienting means comprise brush bristles that may be moved relative to the stencil. For example a cylindrical brush may be mounted coaxially with the stencil for rotation independent of the stencil and may have its bristles extending almost to or into the apertures of the stencil. Normally brush bristles or other orienting means in the stencil do not extend out through the apertures, at least to any significant extent, but bring about orientation only of fibres that extend into the apertures. Suitable brush bristles are usually fairly soft, for example having characteristics similar to those of a conventional personal hairbrush.

When some or all of the laying of the fibres is brought about by means of stencils, the pressure between the stencil and the product being treated is generally very low. Thus the roller or stencil is normally positioned so as to contact only those parts of the fibres that extend above the adhesive carried on the substrate, and, for the production of products of optimum appearance, it is essential to ensure that the stencil does not squeeze the adhesive with the result that the entire length of the flocked fibres would become embedded within the adhesive and the fine pile desired on the product would be destroyed. In any method of the invention, the laying conditions should be such that the fibres do not to any substantial extent become further embedded in the adhesive.

Any suitable substrate may be used in the invention. Preferably the substrate is of fibrous material, i.e., is a textile or paper substrate, as such substrates are generally more suitable than continuous plastics films. Examples of suitable substrates are woven, knitted and non woven fabrics made from natural or synthetic fibres, and also paper.

Binders that can be used include any suitable flocking adhesives. Examples are acrylic binders, vinyl chloride homopolymer or copolymer plastisols and polyurethane binders. Generally they are binders that can be applied from solution or dispersion in very fluid form and can then be solidified by heating at moderate temperatures, for example below 180°C, the solidification either being brought about solely by evaporation of solvent or dispersant or being brought about also by cross-linking or other chemical curing or other means.

Fibres that can be flocked include cotton, rayon, nylon, acrylic and polyester fibres. They can be precision cut fibres or ground fibres or mixtures thereof. They can be applied by any suitable method of flocking, for example electrostatic flocking or by mechanical flocking. Typical fibre lengths are 0.1 to 5 mm, preferably 0.3 to 3 mm, most preferably below 1.5 mm. Typical deniers are 0.3 to 30 denier, preferably 0.5 to 20 denier. As is customary in flocked products of the general type to which the invention relates, the fibre density is usually high-e.g. 10 to 15% of the theoretical maximum for close packed cylinders.

In the accompanying drawings,

FIG. **1** illustrates in side view diagrammatically an apparatus being used for carrying out the method of the invention,

FIG. **2** is a plan view of the roller illustrated in FIG. **1**, and

FIG. **3** is a longitudinal cross section of a product according to the invention, for example obtainable by apparatus similar to that shown in FIGS. **1** and **2**.

The apparatus in FIG. **1** comprises a hollow cylinder **1** made of thin sheet material, for example metal, mounted on a central shaft **2**. The surface of the cylinder has a number of apertures **3** cut in it so that the cylinder is a stencil. Concentric with the cylinder and mounted on a sleeve **4** over the central shaft **2** is a cylindrical soft brush **5**. The bristles of this brush are of such a length that they are approximately flush with the outside surface of the cylinder and thus protrude into the apertures **3**. The apparatus also includes means for rotating the brush and the cylinder independently of one another. The cylinder **1** is mounted above a flat table **6** or any other suitable support, e.g. a roller.

Flocked material **7** (for example made by conventional electrostatic flocking) comprising a substrate **8** and fibres **9** substantially vertical to the substrate is led to between cylinder **1** and the table **6** directly from the flocking operation, while the adhesive on the substrate **8** is still wet. (The length of the fibres is greatly exaggerated in FIG. **1**). The cylinder rotates in the direction of the arrow at such a speed that its peripheral linear velocity is identical to that of the material **8** as the material passes beneath it. As a result the cylinder presses the tips of the flock lightly in such a manner that the flock in all areas except in the apertures is laid in the direction opposite to the direction of movement of the material by the surface of the cylinder.

Where there are apertures in the cylinder the flock would, in the absence of the brush, retain its vertical orientation. However, in the process illustrated the brush **5** is provided and this is rotated at a considerably higher speed that the cylinder, but in the same direction as the cylinder, and this causes the flock in the positions of the apertures to be deflected in the direction of movement of the material. As a result the fabric leaving the cylinder has the fibres over the majority of the surface deflected in one direction while the fibres in the areas corresponding to the apertures **3** are orientated in the opposite direction. On subsequent hardening of the adhesive, for example by curing in a suitable oven, the fibres are anchored in the provided orientations.

As shown in FIG. **3,** the resultant product comprises a textile base **8** carrying adhesive **10** and fibres **9***a* oriented in one direction and fibres **9***b* parallel to these but oriented in the opposite direction. A typical angle of orientation is 20° to the plane of the surface.

A further process, for producing striped effects, involves the use of a rotating brush which first lays all the flock in one direction. This is followed by a second brush operating through a fixed stencil, which rotates in the opposite direction and re-orientates alternate stripes in a direction opposite to the original lay of the flock. Alternatively, the second brush and stencil may be replaced by a suitably profiled brush. A further method of producing striped effects involves the use of complementary profiled brushes rotating in opposite directions.

The following are some examples.

EXAMPLE 1

A plain weave cotton cloth weighing about 5 ounces per square yard is spread with a thickened, cross-linking acrylic adhesive (sold under the trade name Primal HA8) at an application weight of about 10 ounces per square yard (wet weight), i.e., 4 ounces per square yard dry weight. Precision cut nylon flock, of length 1 mm and denier 3, is electrostatically deposited on the adhesive. The flocked material is then passed through the apparatus illustrated at a rate of 6 feet per minute. The cylinder has a diameter of 6 inches and rotates with a peripheral velocity the same as the rate of movement of the fabric. The brush rotates at a peripheral velocity of 24 ft/min. The fabric is then led through a curing oven for 5 minutes at 140°C. The finished product is suitable for use as an upholstering material.

EXAMPLE 2

A plain weave cotton cloth weighing about 3½ oz. per square yard is spread with a thickened cross linking acrylic adhesive (sold under the trade name Primal K87) at a wet application weight of about 10 oz./sq. yd. (4 ounces per square yard dry weight). Precision cut rayon flock of length 0.5 mm and 0.5 denier is electrostatically deposited at a weight of 2 oz. per sq. yd. onto the adhesive. The flocked material then passes under a rotating profiled brush which lays part of the flocked surface in one direction and then under a complementary profiled brush, rotating in the opposite direction to the first, which lays the remaining flock to give a striped effect. The fabric is led through a curing oven for 5 minutes at 140°C. The finished products is suitable for use as a garment material.

EXAMPLE 3

A wallpaper base of weight 2½ oz. per. sq. yd. is coated with a PVC plastisol adhesive at an application weight of approximately 3 oz. per sq. yd. Precision cut rayon flock of length 1 mm and 4½ denier is electrostatically deposited onto the adhesive at a weight of 2½ oz. per sq. yd. The flocked material is then passed through the apparatus illustrated in FIG. **1** under the conditions of Example 1. The material is then passed through a curing oven for 3 minutes at 175°C. The finished product is suitable for use as a wall covering.

By similar methods a wide variety of flocked products can be made, for example other upholstery cloths, or garment materials, carpets, shoe materials or curtain fabrics.

I claim:

1. A method of making a flocked product comprising a substrate having bonded to its surface a layer of flocked fibres which are substantially linear and which, in different parts of the surface, have different predominant non-perpendicular orientations, said method comprising the steps of:

a. applying fluid binder to the surface of the substrate;

b. flocking fibres onto the fluid binder;

c. laying the flocked fibres in a first part of the area of the surface in a predominant non-perpendicular direction while maintaining them substantially linear by rolling a stencil having perforations in the peripheral surface thereof over and in contact with the product with no relative movement at the zone of contact between the stencil and the product;

d. laying the fibres in a second part of the area of the surface in a different predominant non-perpendicular orientation while maintaining them substantially linear by movement of a separate movable orientation means contained in the stencil, the said second area being the area of the surface in contact with the perforations in the stencil; and

e. hardening the binder.

2. A method according to claim **1** in which the separately movable orienting means comprise a rotatable brush whose axis is parallel with the axis of the stencil and whose bristles extend to but not beyond the perforations where they are in contact with the product and which rotates at a speed faster than the stencil in the same direction as the stencil.

3. A method according to claim **1** in which the fibres are precision cut flock fibres.

4. A method according to claim **1** in which the fibres are less than 1.5 mm. in length.

5. A method according to claim **1** in which the fibres in the first part of the surface area and the fibres in the second part of the surface area lie substantially all at an angle of less than 45° to the plane of the surface.

6. A method of making a flocked product comprising a substrate having bonded to its surface a layer of flocked fibres which are substantially linear and which, in different parts of the surface, have different predominant non-perpendicular orientations, said method comprising the steps of:

a. applying fluid binder to the substrate;

b. electrostatically flocking precision cut flock fibres less than 1.5 mm. in length onto the fluid binder;

c. laying the fibres in a first part of the surface area in a predominantly non-perpendicular orientation which is at an angle of less than 45° to the plane of

the surface while maintaining them substantially linear by rolling a stencil over and in contact with the product with no relative movement at the zone of contact between the stencil and the product;

d. laying the fibres in a second part of the surface area of the product in a different predominant orientation which is opposite to and substantially parallel to the first orientation and which is such that the fibres are substantially all at an angle of less than 45° to the surface, while maintaining them substantially linear, by rotating in the same direction as, but faster than, the stencil a rotatable brush which is mounted in the stencil with its axis parallel with the stencil and whose bristles extend to but not substantially beyond the perforations where they are in contact with the product; and

e. hardening the binder.

7. Apparatus comprising a support for sheet material, a stencil having openings in the surface thereof rotatable in contact with sheet material carried on the support, and separately movable orienting means contained in the stencil for orienting fibres at the openings in the surface of the stencil.

8. Apparatus according to claim **7** in which the separately movable orienting means comprise a rotatable brush whose axis is parallel with the stencil, whose bristles extend to but not substantially beyond the perforations in the stencil surface where they may contact the sheet material on the support, and which is rotatable at a speed faster than the stencil in the same direction as the stencil.

9. Apparatus according to claim **7** additionally comprising means for applying a fluid binder to the sheet material, means for flocking fibres onto the fluid binder before the sheet material contacts the stencil, and means for hardening the binder after the sheet material has contacted the stencil.

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