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Dulin, Jr.

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[54] **FLOCKED FABRIC AND METHOD FOR MAKING SAME**

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[52] **U.S. Cl.** **161/64,** 117/33, 156/72, 161/67, 161/166

[51] **Int. Cl.** **D03d 27/00,** D04h 11/00

[58] **Field of Search** 161/64, 67, 166; 156/72; 117/33

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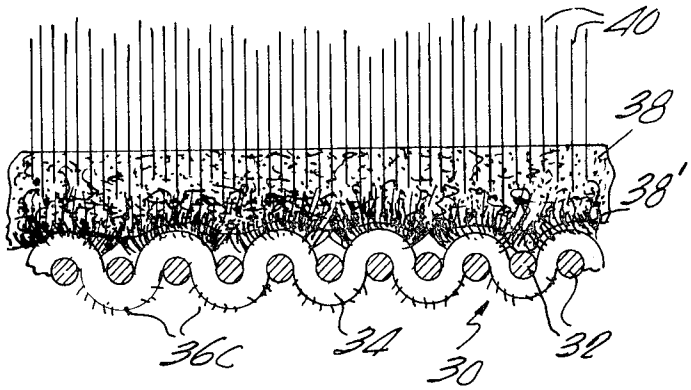
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[57] **ABSTRACT**

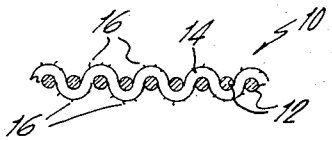
There is disclosed a flocked fabric which is both highly drapeable and strong, and a method for making it. The fabric backing is napped prior to the application of adhesive thereto. The napping, or fiber maze, which extends from the fabric backing is entrained in the adhesive layer, as are the flock fibers. The fiber maze prevents the adhesive from substantially penetrating into the fiber backing and this, in turn, enhances the drapeability of the finished fabric and increases its tear strength.

43 Claims, 11 Drawing Figures



2 Sheets-Sheet 1

FIG. 1A



PRIOR ART

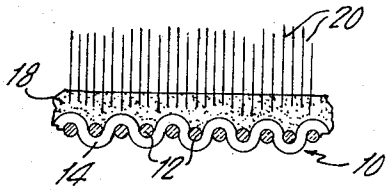


FIG. 1B

PRIOR ART

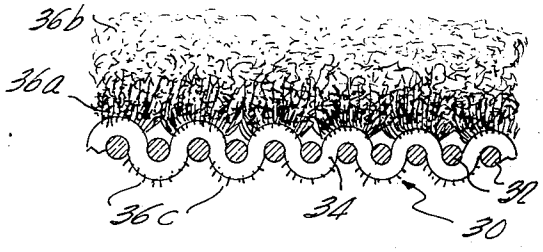


FIG. 2A

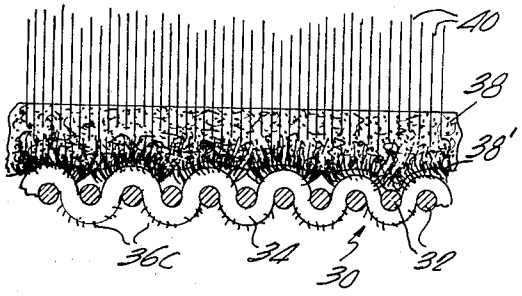


FIG. 2B

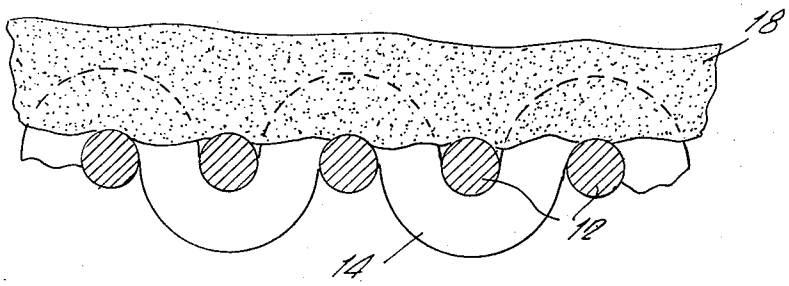


PRIOR ART

FIG. 3



FIG. 4



PRIOR ART

FIG. 5

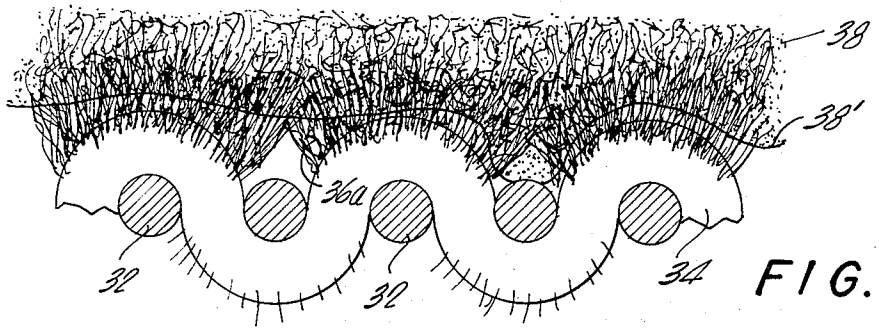


FIG. 6

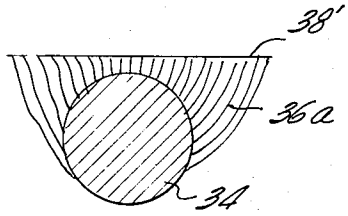


FIG. 7

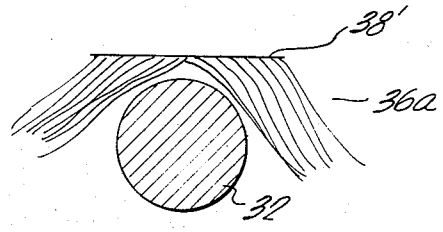


FIG. 8

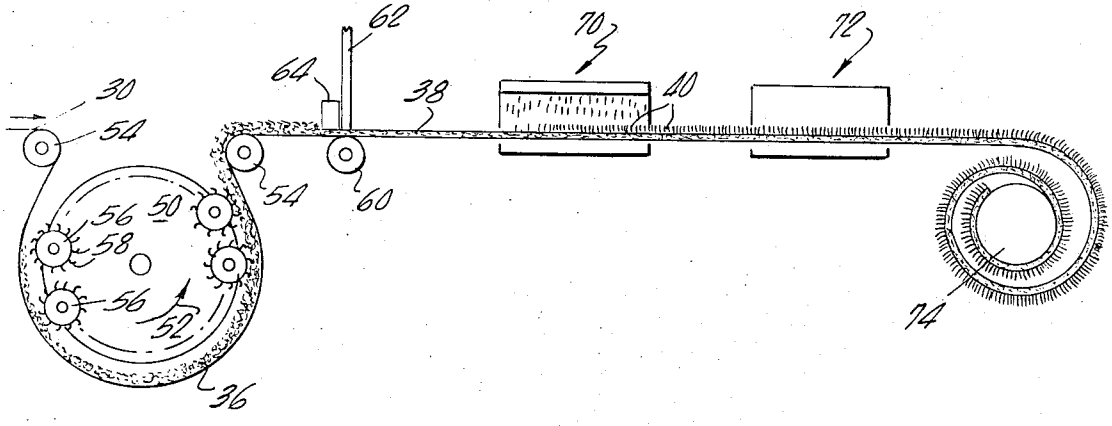


FIG. 9

FLOCKED FABRIC AND METHOD FOR MAKING SAME

This invention relates to flocked fabrics and methods for making them, and more particularly to highly drapeable and strong flocked fabrics which can be produced at little additional cost.

A conventional flocked fabric is made by coating a fabric backing with a layer of adhesive, and then embedding the ends of flock fibers in the adhesive. The latter step, which can be accomplished mechanically or electrostatically, is followed by passing the fabric through a drying and curing chamber. There are many variables which enter into the making of flocked fabrics. For example, the backing fabric or substrate can be of many different types (e.g., knitted, woven, etc.), the flock fibers can be made to simulate suede, velvet or an animal look, the finished flocked surface can be "crushed", etc. The present invention is generally applicable to all flocked fabrics and flocking processes.

It is well known that the adhesive greatly affects the physical and aesthetic characteristics of the final product. The two most important characteristics in this regard are drapeability and tear strength, and the adhesive has deleterious effects on both.

Many applications require the use of a drapeable fabric. Flocked fabrics are often unsuitable for these applications; even though the backing fabric may be sufficiently drapeable by itself, it becomes unacceptably stiff after a layer of adhesive is applied to it. For a yarn-based fabric to be drapeable, that is, for it to be sufficiently flexible to conform itself to a varying supporting shape, there must be relatively high thread mobility. A conventional woven fabric of the type as a substrate for a flocked fabric has the requisite thread mobility; the weave is often loose and the warp and filling threads can move relative to each other. But when it is coated by adhesive, the adhesive binds crossing threads to each other and there is a considerable loss in the degree of drapeability. rapeability.

The second deleterious effect of the adhesive is that the tear strength of the overall flocked fabric is usually considerably less than that of the backing alone. It might be thought that the tear strength should be increased by binding crossing backing threads to each other, but in fact the opposite is the case. The tear strength of a woven fabric, for example, depends upon the "give" or "slip" of the threads of which it is made. A high load on any individual thread causes all of the threads in the vicinity of that thread to shift slightly and to assume a portion of the load. But when the threads are fixed in position they cannot shift, and the tear strength of a fabric coated with adhesive is sometimes only slightly higher than the breaking strength of an individual thread. While the tear strength of the final flocked fabric can be improved by using fabric backings of special weaves, the addition of the adhesive generally results in a final tear strength which is no more than 60 percent of that of the uncoated fabric backing.

Since it is the adhesive which both limits the drapeability and reduces the tear strength of the flocked fabric (relative to the fabric backing alone), attempts have been made to improve the adhesives used in making flocked fabrics. One approach taken is to add plasticizers so as to improve the molecular lubricity and/or reduce the level of cross-linkage between the adhesive polymeric molecules. The resultant improved molecular mobility causes the cured adhesive to be more flexible and to some extent mitigates the deleterious effects of the adhesive. However, it is not possible to achieve in the finished flocked fabric the initial drapeability and tear strength of the backing. Furthermore, the solvent resistance of the adhesive is usually reduced and the finished flocked fabric may be damaged during dry cleaning. Also, the use of plasticizers as described usually reduces the strength of the adhesive and it takes less force to pluck the flock off the face of the finished fabric.

It is an object of my invention to provide a flocked fabric which is almost as drapeable as, and may be even stronger than, flocked fabrics made of the same materials in the prior art.

In accordance with the principles of my invention, and considering as a single example the case in which a woven fabric is used as the backing material, the face of the backing to which the adhesive is applied is napped prior to the adhesive application. Napping is a treatment whereby small steel hooks tear some of the fabrics, or the ends of the fibers, out of a yarn (warp, filling or both) so that the fabric acquires a "wholly" or "napped" surface. The napping process makes the fabric softer to the touch. It is a relatively widely used technique, and could be used (although it is generally not), for example, to make the underside (non-adhesive side) of the fabric backing softer to the touch. But there would appear to be no reason to nap the adhesive side of the backing because in the finished product it is not exposed to view, cannot be touched, and is completely covered by the adhesive. Yet I have discovered that by napping the fabric backing before the adhesive is applied to it, the finished flocked fabric can be almost as drapeable as the fabric backing alone, and the tear strength of the finished flocked fabric can be even higher than that of the fabric backing alone. In the preferred embodiments of the invention, a tear strength equal to 125 percent of that of the backing alone is attained.

When the fabric backing is napped, there results a dense fiber matrix layer directly above the structural elements of the backing, and a less dense intertangled fiber maze above it. The lower level is the more dense of the two because it contains the short as well as the long fibers which are torn or raised from the fabric yarn. The fibers are more unidirectionally oriented in the lower level because the directions in which they leave the yarn are centered around the perpendicular; in the upper level the fiber orientations are far more random. All of this is a natural consequence of the napping process, and the transition between the two levels is gradual. When the adhesive is applied to the napped backing, it penetrates the upper level maze but does not substantially penetrate the lower level matrix. Although some of the adhesive penetrates through the dense matrix to the structural yarn elements, most of the bottom surface of the adhesive does not touch the structural elements. The degree of napping and the viscosity of the adhesive should be such that only a small portion of the structural members of the backing are contacted by adhesive. After the adhesive is applied, it is flocked in the usual manner.

The fact that the adhesive does not substantially penetrate the lower level matrix can be verified as follows. In the case where only the warp yarns of the fabric backing are napped, for example, these yarns or

threads will be secured to the adhesive by way of the fibrous maze which extends from them. But if little of the adhesive has penetrated the lower level fiber matrix, then the filling members of the fabric backing should, for the most part, be unsecured to the adhesive layer. It is in fact possible to grip the end of an individual filling thread with tweezers and pull it out of the fabric backing even after the ends of the flock fibers are embedded in the adhesive and the adhesive is cured. In one flocked fabric made in accordance with the principles of the invention, it was possible to pull an eight-inch filling thread out of the fabric backing; only a few small, separated sections of the thread were noticed to have adhesive on them. In the case where the backing fabric is napped in two directions, both the warp and filling members are fixed to the adhesive by way of the fiber maze which extends from both. Although a thread is not easily pulled out of the fabric-backing, that the adhesive has not substantially penetrated the lower level fiber matrix is readily ascertainable by reason of the facts that the finished flocked fabric is almost as drapeable as the fabric backing alone, and the tear strength of the finished flocked fabric is usually greater than that of the backing alone.

The finished fabric is more drapeable because except for relatively few areas in which the adhesive has penetrated through the fiber matrix to the structural members of the backing fabric, there is a dense fiber matrix which separates the bottom surface of the adhesive and the structural fabric. The absence of direct adhesive contact allows any small area of the fabric backing to shift slightly relative to the adhesive directly above it. The effect can be understood by analogizing a small area of the structural backing and the lower surface of the adhesive directly above it to two sides of a parallelogram, with the other two sides of the parellelogram corresponding to two of the fibers in the matrix which connect the backing to the adhesive. Just as any two sides of a parallelogram can shift relative to each other (assuming that the corners are jointed) so can the adhesive and the backing. It is the potential of relative shifts on a microscopic level which makes the finished flocked fabric almost as drapeable as the backing alone.

The adhesive necessarily penetrates the fiber matrix to different extents in different regions. Ideally, in all regions the adhesive should penetrate just up to the structural backing but should not touch it. If there is insufficient penetration, the relatively long fibers which interconnect the backing to the adhesive may permit permanent macroscopic shifts, that is, relatively large non-restoring shifts of substantial areas of the adhesive and backing relative to each other. This gives rise to an "alligator" or crinkling effect which may be objectionable in some fabrics. What is desired are microscopic shifts which provide for a suitably drapeable fabric without the possibility of macroscopic shifts which can cause a fabric to lose its aesthetic appeal during use. These considerations, of course, are qualitative only; quantitative measurements are not only difficult to make, but equally difficult to define due to the random degree of penetration of the adhesive in different regions of the fiber matrix. But by varying the density of the nap or the viscosity of the adhesive (which together control the degree of adhesive penetration of the lower level fiber matrix), it is possible to vary the characteristics of a finished flocked fabric until a fabric suitable for the purpose at hand is produced.

Because little adhesive penetrates the fiber matrix all the way through to the fabric backing, the yarns in the fabric backing, for the most part, do not adhere to each other. Thus, there is little loss in the "slip" or tear strength of the backing. Furthermore, the adhesive adds to the overall tear strength. This is because, unlike the prior art, the adhesive layer is not simply a layer of pure adhesive (with the ends of the flock fibers embedded in it, which fibers have almost no effect on the tear strength of the adhesive). The adhesive layer contains an intertangled fiber maze, and this maze reinforces the adhesive. The effect is much the same as that achieved by reinforcing concrete. In one experiment, the adhesive was applied to a fiber maze which was separable from its backing. After the flocking and curing steps, the backing was removed. The final flocked fabric was thus simply a reinforced adhesive layer containing the ends of the flock fibers. Surprisingly, considerable effort was required to tear the adhesive. It is apparent that when the adhesive is applied to a backing having a fiber maze extending from it, the overall tear strength of the finished flocked fabric can be greater than that of the backing alone. The nap on the backing, at least in the upper level, should take the form of a fiber maze (as opposed to a unidirectionally oriented layer of fibers) in order to maximize the structural cross-linking and the adhesive reinforcement.

An added advantage of the flocked fabric of my invention is that it is more "breatheable" than a flocked fabric made the same way but whose backing is not provided with a fiber maze. Couch fabrics, for example, must be able to "breathe" or a cushion covered with such a fabric will "balloon" when someone sits on it; similarly, fabrics which cannot "breathe" are not suitable for wearing apparel. In the prior art, breatheability has been introduced into a flocked fabric by foaming the adhesive prior to its application to the backing. But this weakens the adhesive strength of the adhesive and may result in some of the flock fibers falling out during use. I have found that a flocked fabric made in accordance with the principles of my invention often has a satisfactory degree of breatheability even without foaming of the adhesive. When the adhesive is applied to the fabric backing, the fibers in the maze are pushed down toward the fabric backing. But because they are resilient the fibers spring back and, in so doing, they create microscopic voids in the adhesive which are then made permanent when the adhesive is cured. These voids are sufficient in many cases to provide the necessary breatheability without foaming of the adhesive. I have also found that such a fabric, when treated with a florocarbon to provide water, oil and soil repellancy, demonstrates a higher degree of "water proofness" than a fabric which includes a conventional backing and a foamed adhesive. It is believed that this is due to the fact that the pores which are created when the fibers in the maze spring back are extremely small and tubular as compared to those which result when a foamed adhesive is used and which produces globular pores.

An added advantage of using a backing having a fiber maze extending from it is that the flock fibers in the finished product are held more strongly. The result is achieved for the following reason. When a fiber is plucked from a fabric one of two things can happen. Ei-

ther the fiber is released by the adhesive, or the adhesive shears. In the latter case, the plucked end of the flock fiber exhibits a coating of adhesive around it which was sheared from the surrounding adhesive in the product. Because of the structural cross-linking characteristic of the fiber maze, the shear strength of the adhesive is greatly increased and the second type of flock removal is less likely to occur.

Yet another advantage of my invention is that the finished flocked fabric is more likely to stand up to repeated dry cleaning. When a fabric is ruined during dry cleaning, it is generally because the adhesive is attacked by the solvents used; when this happens, the top part of the adhesive layer may be stripped from the bottom part, in which case the flock facing is separated from the backing. But the structural reinforcement of the adhesive by the fiber maze makes the adhesive much more resilient to dry cleaning solvent. In this regard, it is preferable that the fiber maze extend all the way to the top of the adhesive layer. This is easily achieved by insuring that the thickness of the maze prior to the application of the adhesive is greater than the final thickness of the adhesive layer. As a napped woven fabric, for example, is moved through an adhesive applying station, the fibers in the maze are forced against the structural backing and the adhesive is applied over them. As described above, the fibers then spring back. They spring back all the way to the upper surface of the adhesive and they are held there by the surface tension of the adhesive. In fact, if the coated backing is examined prior to the flocking operation, many of the fibers in the maze are visible in the upper surface of the adhesive.

In the case of a yarn-based fabric, the adhesive should penetrate through the lower level fiber matrix to the extent that preferably less than 10 percent of the yarn cross-points in the backing become fixed, although the advantages of the invention are readily apparent if no more than 35 percent of the cross-points are affected in this way. It is important to note that while the napping of a conventional woven fabric backing is a relatively inexpensive and simple way to create the necessary fiber maze, with some types of backing it is not even necessary to provide the napping step. For example, knitted fabric backings made from extraordinarily "fuzzy" yarns may have a sufficient natural fiber maze. Similarly, non-woven fabric backings may be made in the first place to have the requisite fiber maze on one surface. In general, whatever backing material is used, it should exhibit a fiber maze, with the average length of each fiber in the maze being at least two times as great, and preferably at least five times as great, as the thickness of the adjesive layer which is applied to it. Furthermore, a flocked fabric made in accordance with the principles of my invention exhibits a tear strength which is at least 80 percent as high as the tear strength of the backing alone, although in many cases the tear strength of the finished product even exceeds that of the backing alone.

Further objects, features and advantages of the invention will become apparent upon consideration of the following detailed description in conjunction with the drawing in which:

FIG. 1A is a cross-section of a typical prior art woven fabric used as the backing for a flocked fabric;

FIG. 1B is a cross-section of a typical prior art flocked fabric made with the backing of FIG. 1A;

FIG. 2A is a cross-section of a typical napped woven fabric which may be used as the backing for a flocked fabric made in accordance with the principles of my invention;

FIG. 2B is a cross-section of a typical flocked fabric made with the backing of FIG. 2A;

FIG. 3 is a cross-section of an individual yarn in the backing fabric of FIG. 1A;

FIG. 4 is a cross-section of an individual warp yarn in the backing fabric of FIG. 2A;

FIG. 5 is an enlarged sectional view of a portion of the prior art flocked fabric of FIG. 1B;

FIG. 6 is an enlarged sectional view of a portion of the flocked fabric of FIG. 2B;

FIG. 7 is a partial sectional view taken through an individual warp yarn of the fabric of FIG. 6;

FIG. 8 is a partial sectional view taken through an individual filling yarn of the fabric of FIG. 6; and

FIG. 9 illustrates an illustrative process for making flocked fabrics in accordance with the principles of my invention.

The prior art woven fabric backing 10 of FIG. 1A consists of warp yarns 14 and filling yarns 16. Prior art woven fabrics used as backings for flocked fabrics have not been napped deliberately, nor have any of the prior art backing materials exhibited the fiber maze of my invention. Of course, any yarn-based fabric exhibits some small (inconsequential) fiber ends, shown at 16 in FIG. 1A. Similar "fuzz" may be present on fillings 12, although not shown in the drawing. FIG. 3 is a cross-sectional view taken through one of warp yarns 14. (The fiber ends 16 are not shown in FIGS. 1B and 5 because of their lack of importance and for the sake of clarity).

The flocked fabric of FIG. 1B exhibits a layer of adhesive 18 on top of the fabric backing 10. Each of flock fibers 20 has one end embedded in the adhesive layer. The drawing of FIG. 1B is not to scale (similar remarks apply to the other figures). In general, the flock fibers are much more densely packed than is shown in the various drawings. Typically, the flock fibers are precision cut so that they all have the same length. Since the various fibers extend into the adhesive to differing degrees, the upper ends of the fibers are not all at the same level. However, the percentage difference is not nearly as noticeable in an actual fabric as it is in the drawing primarily due to the fact that the adhesive layer 18 is much thinner in an actual fabric relative to the length of the flock fibers than it is as shown in the drawing.

FIG. 5 is an enlarged sectional view of a portion of the fabric of FIG. 1B. Here it is seen that the adhesive 18 contacts both the warp and filling yarns in the woven fabric backing. The yarn cross-points are in effect locked together and, as described above, it is for this reason that the finished flocked fabric is not as drapeable as the fabric backing alone, nor does its tear strength appraoch that of the latter.

When a woven fabric is used as the backing for a flocked fabric made in accordance with the principles of my invention, it exhibits the nap shown in FIG. 2A. The structural fabric consists of warp yarns 34 and filling yarns 32. In a conventional napping process, fibers are torn from either the warp or the filling, although it is possible to tear them from both. In the fabric of FIG. 2A, the nap is produced by tearing thin fibers from the warp yarn. The surface of the fabric which is napped is

that to which the adhesive is later applied. (The undersurface of the fabric backing can also be napped if it is desired for it to have a soft feel.) Directly above the structural backing there is a dense matrix 36*a* of fibers, while at the top of the nap the fibers are less dense and are in an intertangled maze 36*b*. The lower level is more dense because it includes both the short fibers as well as the longer fibers which extend up into the upper level maze. In the dense level, the fibers are relatively uni-directional in that the fibers in any small incremental area are all more or less oriented perpendicularly to the yarn surface. But in the upper level the fibers are intertangled so as to provide maximum reinforcement for the subsequently applied adhesive. The average length of each fiber is preferably five times as great as the thickness of the adhesive layer which is subsequently applied. There is also a small degree of napping, shown by the numeral 36*c*, on the undersurface of the backing. Although only the upper surface of the fabric is napped, some fibers are necessarily torn from the lower surface. The lower-surface napping is not a necessary characteristic of the fabric backing which is used in accordance with the principles of my invention. FIG. 4 depicts a cross-section through one of warp yarns 34 and illustrates the three nap regions of interest.

After adhesive 38 (FIGS. 2B and 6) is applied to the fabric backing and flock fibers 40 are embedded in it, the outward appearance of the fabric is the same as that of the fabric of FIGS. 2A and 5. However, there are two important differences. First, the bottom surface 38' of the adhesive layer makes minimal contact with the structural backing members. As the adhesive is applied to fiber maze 36*b*, it penetrates the maze and partially penetrates the fiber matrix 36*a*. However, ralatively little of the adhesive penetrates all the way through the dense matrix to the structural yarns 32 and 34. In FIG. 2B, the adhesive is shown touching only one of the fillings 32 and only one point on the warp yarn 30. On top of substantially all of the fabric backing, and separating the upper surface of the fabric backing from the under surface of the adhesive, there is a dense fiber matrix 36*a*. Preferably, less than 10 percent of the crossing yarns are adhered to each other, that is, more than 90 percent of the cross-points are "free".

As described above, the fibers in this matrix function as parallelogram linkages between incremental areas of the fabric backing and the adhesive layer. This is seen most clearly in FIG. 7 which depicts a cross-sectional view of warp yarn 34. Here it is seen that many fiber strands in matrix 36*a* extend from warp yarn 34 to the undersurface 38' of the adhesive directly above it. FIG. 8 shows a filling yarn 32 disposed underneath adhesive undersurface 38'. Since in the illustrative embodiment of the invention it is the warp yarns which are napped, there is little linkage between fillings 32 and the adhesive. In fact, in many cases it is relatively easy to pull the fillings out of the backing fabric of the finished product as described above.

The second major difference between the products of the two sets of figures is that adhesive layer 18 of the improved product of my invention contains an entrained fiber maze 36*b*. This is the fiber maze which serves to reinforce the adhesive. Preferably, for maximum solvent resistance, the fiber maze extends to the upper surface of the adhesive as shown in the drawing and every part of the adhesive encapsulates a portion of the fiber maze.

In one embodiment of the invention, the warp yarn was made of polyester 3d/f, and the filling yarn was made of polyester cotton (50–50). The size of the warp yarn was 13.4-single and the size of the filling yarn was 6.5-single. All yarns had round cross-sections; the filling yarns were semi-dull and the warp yarns were semi-dull. The backing fabric weighed 4.2 ounces per square yard, the warp had a density of 32 ends/inch and the filling had a density of 20 picks/inch. The adhesive layer was 7 mils thick and the average length of a fiber in the nap was 35 mils. The adhesive was a latex-based acrylic with a viscosity of 42,500. The flock fibers were made of type 66 nylon 6 d/f, had a bright trilobal cross-section, were 3 millimeters in length, and were deposited on the adhesive at various densities in different applications which yielded 5–15 grams of nylon per square foot of fabric.

In general, the extent to which the adhesive penetrates the lower level fiber matrix depends upon the densities of the fiber maze and the lower level matrix, and the viscosity of the adhesive; the higher the viscosity and the more dense the fibers, the less the penetration. For velvet-type fabrics the adhesive viscosity should be in the range 35,000–65,000 centipoise, as measured on a Brookfield viscometer using a No. 4 spindle rotating at 6 rpm. For suede-type fabrics, an adhesive with a viscosity in the range 60,000 – 120,000 centipoise can be used; this is due primarily to the fact that a suede fabric is provided with a very thin layer of adhesive and the flock fibers need not penetrate too far into the adhesive layer. For suede-type fabrics, the adhesive layer is preferably less than 0.6 millimeters thick, and for velvet-type fabrics the adhesive layer can have a thickness in the range 0.42 millimeters.

FIG. 9 depicts an illustrative apparatus for making flocked fabrics in accordance with the principles of my invention. A woven fabric backing 30 is passed over rollers 54 and around drum 50 which rotates in the direction of arrow 52. Around the drum there are peripheral rollers 58 (only four of which are shown). The rollers are covered with closely spaced steel hooks 58; although all of the rollers rotate in the same direction, the hooks are curved in opposite directions on alternate rollers. As the drum rotates faster than the fabric moves, fibers are torn from the fabric and the height of maze 36 progressively increases as shown. Any conventional napping apparatus can be used to create the maze (if such a maze is not already present as a result of earlier steps in the backing processing).

The fabric backing then passes over a roller 60 on top of which there is positioned an adhesive applicator 64 and a blade 62. The blade is set at a height above the upper surface of the structural backing which determines the thickness of the adhesive layer. After leaving the adhesive application stage, there is a reinforced layer of adhesive 38 on top of the fabric backing as described above.

The fabric then passes through a conventional flocking stage 70 in which the flock fibers are embedded in the adhesive. The flocked fabric then passes through a drying and curing stage 72, after which it is rolled up on a roll 74. The processing steps are basically those of the prior art; the major difference in producing the finished product is that the backing which is used contains

a fiber maze on the surface to which the adhesive is applied.

Although the invention has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the application of the principles of the invention. For example, I have found that the fibrous maze greatly reduces the percentage reduction in fabric flexibility as temperature is lowered; this allows flocked fabrics of my invention to be particularly useful as outerwear without any sacrifice in solvent resistance. Thus it is to be understood that numerous modifications may be made in the illustrative embodiments of the invention and other arrangements may be devised without departing from the spirit and scope of the invention.

What I claim is:

1. A flocked fabric comprising a fibrous textile substrate with a fibrous maze extending therefrom, a layer of adhesive encapsulating said fibrous maze with most of the undersurface of said adhesive layer being in noncontact relationship with said substrate, and flock fibers embedded in and extending out from the upper surface of said adhesive layer.

2. A flocked fabric in accordance with claim 1 wherein said substrate is a yarn-based fabric and said adhesive layer fixes less than 35 percent of the crossing yarns in said substrate to each other.

3. A flocked fabric in accordance with claim 1 wherein said substrate is a yarn-based fabric and said adhesive layer fixes less than 10 percent of the crossing yarns in said substrate to each other.

4. A flocked fabric in accordance with claim 1 wherein the average length of each fiber in said maze is at least twice as great as the thickness of said adhesive layer.

5. A flocked fabric in accordance with claim 1 wherein the average length of each fiber in said maze is at least five times as great as the thickness of said adhesive layer.

6. A flocked fabric in accordance with claim 1 wherein the tear strength of the flocked fabric is at least 80 percent of the tear strength of said fibrous textile substrate alone.

7. A flocked fabric in accordance with claim 1 wherein the tear strength of the flocked fabric is greater than the tear strength of said fibrous textile substrate alone.

8. A flocked fabric in accordance with claim 1 wherein said fibrous maze is contained within said adhesive layer from the bottom to the top surfaces thereof.

9. A flocked fabric in accordance with claim 8 wherein the fibers in said maze are progressively intertangled from the bottoms to the tops thereof.

10. A flocked fabric in accordance with claim 1 wherein the fibers in said maze are intertangled to reinforce said adhesive layer.

11. A flocked fabric comprising a substrate having a fiber maze extending therefrom, a layer of adhesive encapsulating said fiber maze, and flock fibers embedded in and extending out from the upper surface of said adhesive layer, the average length of a fiber in said maze being at least two times as great as the thickness of said adhesive layer.

12. A flocked fabric in accordance with claim 11 wherein said substrate is a yarn-based fabric and said adhesive layer fixes less than 35 percent of the crossing yarns in said substrate to each other.

13. A flocked fabric in accordance with claim 11 wherein said substrate is a yarn-based fabric and said adhesive layer fixes less than 10 percent of the crossing yarns in said substrate to each other.

14. A flocked fabric in accordance with claim 11 wherein the tear strength of the flocked fabric is at least 80 percent of the tear strength of said substrate alone.

15. A flocked fabric in accordance with claim 11 wherein the tear strength of the flocked fabric is greater than the tear strength of said substrate alone.

16. A flocked fabric in accordance with claim 11 wherein said fiber maze is contained within said adhesive layer from the bottom to the top surfaces thereof.

17. A flocked fabric in accordance with claim 11 wherein the fibers in said maze are progressively intertangled from the bottoms to the tops thereof.

18. A flocked fiber comprising a fibrous textile substrate having a fiber maze extending therefrom, an adhesive layer disposed above said substrate and encapsulating said fiber maze, and flock fibers embedded in and extending out from the upper surface of said adhesive layer, said adhesive layer making only limited contact with said fibrous textile substrate such that the tear strength of the flocked fabric is at least 80 percent of the tear strength of the fibrous textile substrate alone.

19. A flocked fabric in accordance with claim 18 wherein said adhesive layer encapulates said fiber maze such that the maze extends all the way through the adhesive layer from the bottom surface to the top surface thereof.

20. A flocked fabric in accordance with claim 18 wherein the average length of each fiber in said maze is at least twice as great as the thickness of said adhesive layer.

21. A flocked fabric in accordance with claim 18 wherein the average length of each fiber in said maze is at least five times as great as the thickness of said adhesive layer.

22. In a flocked fabric having an adhesive layer and flock fibers embedded in and extending out from the upper surface thereof, the improvement comprising a fibrous maze contained within and for reinforcing said adhesive layer.

23. A flocked fabric in accordance with claim 22 wherein the average length of each fiber in said maze is at least twice as great as the thickness of said adhesive layer.

24. A flocked fabric in accordance with claim 22 wherein the average length of each fiber in said maze is at least five times as great as the thickness of said adhesive layer.

25. A flocked fabric in accordance with claim 24 wherein said fibrous maze is contained within said adhesive layer from the bottom to the top surfaces thereof.

26. A flocked fabric in accordance with claim 22 wherein said fibrous maze is continued within said adhesive layer from the bottom to the top surfaces thereof.

27. A flocked fabric in accordance with claim 26 wherein the fibers in said maze are progressively intertangled from the bottoms to the tops thereof.

28. A method for making a flocked fabric comprising the steps of forming a backing having a fibrous maze extending therefrom, said fibrous maze having a den-

sity sufficient to prevent subsequently applied adhesive from substantially penetrating therethrough to said backing, applying an adhesive layer to the surface of said backing from which said fibrous maze extends, and embedding flock fibers in the upper surface of said adhesive layer.

29. A method for making a flocked fabric in accordance with claim 28 wherein the flock fibers embedded in said adhesive layer have a velvet appearance and the viscosity of said adhesive is in the range 35,000 – 65,000 centipoise, as measured on a Brookfield viscometer using a No. 4 spindle rotating at 6 rpm.

30. A method for making a flocked fabric in accordance with claim 28 wherein the flock fibers embedded in said adhesive layer have a suede appearance and the viscosity of said adhesive is in the range 60,000–120,000 centipoise, as measured on a Brookfield viscometer using a No. 4 spindle rotating at 6 rpm.

31. A method for making a flocked fabric in accordance with claim 28 wherein said backing is a yarn-based fabric and said fibrous maze is formed by napping a surface thereof.

32. A method for making a flocked fabric in accordance with claim 31 wherein said fibrous maze extends above said backing a distance which is greater than the thickness of the adhesive layer subsequently applied to said backing, and said fibrous maze is caused to be substantially completely encapsulated by said adhesive layer when it is applied to said backing.

33. A method for making a flocked fabric in accordance with claim 28 wherein said fibrous maze extends above said backing a distance which is greater than the thickness of the adhesive layer subsequently applied to said backing, and said fibrous maze is caused to be substantially completely encapsulated by said adhesive layer when it is applied to said backing.

34. A method for making a flocked fabric in accordance with claim 28 wherein said fibrous maze is formed such that the average length of a fiber therein is at least twice as great as the thickness of the subsequently applied adhesive layer.

35. A method for making a flocked fabric in accordance with claim 28 wherein said fibrous maze is formed such that the average length of a fiber therein is at least five times as great as the thickness of the subsequently applied adhesive layer.

36. A method for making a flocked fabric in accordance with claim 28 wherein the density of said fibrous maze is high enough and the viscosity of the applied adhesive is low enough to sufficiently prevent the applied adhesive from penetrating through said fibrous maze to said backing such that the tear strength of the flocked fabric is at least 80 percent of the tear strength of said backing alone.

37. A method for making a flocked fabric in accordance with claim 28 wherein the density of said fibrous maze is high enough and the viscosity of the applied adhesive is low enough to sufficiently prevent the applied adhesive from penetrating through said fibrous maze to said backing such that the tear strength of the flocked fabric is greater than the tear strength of said backing alone.

38. A method for making a flocked fabric in accordance with claim 28 wherein said adhesive layer is applied to said backing such that said fibrous maze extends all the way through the adhesive layer from the bottom surface to the top surface thereof.

39. In a method for making a flocked fabric in which flock fibers are embedded in and extend out from the upper surface of an adhesive layer, the improvement comprising the step of encapsulating a fibrous maze within and for reinforcing said adhesive layer.

40. A method for making a flocked fabric in accordance with claim 39 wherein the average length of each fiber in said maze is at least twice as great as the thickness of said adhesive layer.

41. A method for making a flocked fabric in accordance with claim 39 wherein the average length of each fiber in said maze is at least five times as great as the thickness of said adhesive layer.

42. A method for making a flocked fabric in accordance with claim 39 wherein said fibrous maze is made to extend from the lower surface of said adhesive layer through said adhesive layer to the upper surface thereof.

43. A method for making a flocked fabric in accordance with claim 39 wherein the fibers in said maze are controlled to be progressively intertangled from the bottoms to the tops thereof.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,772,132 Dated November 13, 1973

Inventor(s) G.N. Dulin, Jr.

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

Column 1, line 34, "used" should appear after "type".

Column 1, line 40, "rapeability." should be deleted.

Column 5, line 18, "resilient" should read "resistant".

Signed and sealed this 21st day of May 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

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