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COATED FABRIC

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This invention relates to improvements in coated fabrics and more particularly to artificial leather in which a cellulose derivative film is especially anchored to the base fabric.

Cellulose derivative coatings such as cellulose nitrate, cellulose acetate, ethyl cellulose, cellulose aceto-propionate, etc., have been used extensively as a protective coating for sheet materials such as woven fabrics, unwoven fabrics, paper, metal, etc. The flexible materials are often used as upholstery material, pocketbook material, and the like where they receive repeated flexings. The products thus far produced are not entirely satisfactory. One primary objection to the prior art material is that the bond between the cellulose derivative coating and the flexible base material is often broken during repeated flexings. This is particularly true of cellulose derivative coatings on a continuous filament fabric due to the absence of the short protruding fibers referred to as nap. In the case of a cotton fabric the nap extends up into the coating and helps bond the coating to the fabric. Also, the cellulose derivative coatings, per se, are subject on aging to brittleness, decomposition, fragility and cracking. Further, the nitrocellulose coatings when applied on a textile base, upon decomposition give off acid bodies which cause severe tendering of the textile fabric.

A primary object of this invention therefore is the provision of a cellulose derivative coated sheet having none of the disadvantages mentioned above and which is economical to produce.

A further object of this invention is the provision of essentially a cellulose derivative coated sheet material having an improved bond of the coating to the sheet material and improved resistance of the coating to cracking when subjected to repeated flexing.

A still further object is the provision of an essentially cellulose nitrate coated fabric in which the coating contacting the fabric is resistant to decomposition and does not result in the tendering of the base fabric upon aging and prolonged usage.

Other objects will appear hereinafter as the description of the invention proceeds.

These objects are accomplished by applying a substrata layer of a coating composition comprising a synthetic linear polyamide directly on a suitable base sheet material and applying directly over the said polyamide coating a cellulose derivative coating composition.

The following examples are given by way of illustration and not limitation and the invention is not to be limited except as defined in the appended claims.

In the examples the anchorage of the dried coating to the base fabric is referred to as the pounds pull required to separate the coating from a test sample. A standard test was employed for the determination of the bond between the dried coating and the base sheet material. This test is described as follows:

The anchorage of a cellulose derivative film to a base fabric is determined by measuring the force required to strip a unit width of dry film from the base fabric. A piece of cotton sheeting (running 3.60 yards per pound per 40 inch width) measuring about 10 inches x 13 inches, is given a plurality of coats of a cement comprising an unpigmented, plasticized cellulose derivative dispersion and allowed to dry after each successive coat. The cellulose derivative and plasticizer employed in the cement are usually the same as that employed in the film of the material to be tested. Before the dispersing medium is allowed to evaporate in the final coat the wet cement is firmly pressed upon the dry coating of the material to be tested and the composite assembly is thoroughly dried. The warp threads in each fabric are arranged in parallel relation. Two samples 2 inches x 8 inches which are tapered at one end are cut from the dried composite sample in such a manner that the 8 inch dimension is parallel to warp threads. The composite fabrics at the tapered end are separated and pulled apart for a distance of 2 inches, care being taken to have the coating of the original material adhere to the reinforcing fabric cemented thereto. The beginning of the separation at the tapered end is assisted by wetting the tip of the tapered portion in a suitable solvent for the cellulose derivative.

One part of the separated sample is clamped in the upper jaws of a standard Scott tensile strength tester and the other in the lower jaws. The Scott tensile strength tester is well known in the textile art and its description does not appear to be necessary. The weight is removed from the pendulum lever of the tester, which is then connected to the recorder (with chart) by means of a connecting rod. The pawl on the ratchet of the tester is disengaged during the test. The jaws which are 3 inches apart at the start of the test are separated at the rate of 12 inches per minute. As the coating is separated from the original fabric, the degree of anchorage is registered on the recorder chart in the pounds pull required to separate the film from the base fabric. It is necessary that the fabrics separate cleanly when being pulled apart. If there is a tendency for the fabric to unravel at the side of the test piece this must be corrected either by gently pulling the threads away or by cutting them, as the raveling causes an appreciable error in the final results. The average of two tests (which should not vary more than 1 pound) is reported as pounds necessary to strip the coating from a test sample 2 inches wide.

EXAMPLE I

A woven cotton textile fabric, having a sateen weave and running 1.12 yards per pound per 53 inch width, dyed a suitable color, was given one knife application of the following composition:

Anchor composition

	Per cent
Synthetic linear polyamide	33
Solvent mixture	67

The solvent mixture consisted of seven volumes of toluene and three volumes of denatured alcohol (formula 2B). The synthetic linear polyamide was derived from hexamethylene diammonium adipate (85%) and 15% of an equimolecular mixture of ethylene glycol and adipic acid. Approximately three ounces of the above composition were applied per yard per 53 inch width, which corresponds to approximately one ounce per yard per 53 inch width of the non-volatile constituent, by means of a coating apparatus disclosed in U. S. Patent 2,107,276, which issued February 8, 1938, to W. T. Anderson. The volatile solvents were dissipated by passing the coated fabric through a heated drying chamber such as disclosed in U. S. Patent 2,107,275, which issued February 8, 1938, to W. T. Anderson et al.

A plurality of coats of the following composition were applied directly over the anchor coat:

Cellulose derivative coating composition

	Per cent
Cellulose nitrate	12.3
Pigments	12.9
Blown cottonseed oil	26.4
Denatured ethyl alcohol (23A formula)	24.2
Ethyl acetate	24.2

Sufficient coats of the above composition were applied to deposit approximately 20.0 ounces per yard per 53 inch width, which corresponds to approximately 10.4 ounces per yard per 53 inch width of the non-volatile components. The above cellulose nitrate composition is applied and dried by means of the same apparatus mentioned in connection with the application of the anchor composition. At the intermediate stage of coating, that is, when approximately one-half of the total amount of coating was applied, the coated fabric was given a heat and pressure treatment by passing through conventional heated embossing rollers one of which has a shallow design referred to in the trade as Skiver grain, to compress the coating and assist in anchoring the coating to the base fabric.

For commercial production it is customary to apply a finishing composition such as an unpigmented, unplasticized cellulose nitrate dispersion to obtain a glossy finish, or a highly pigmented cellulose nitrate composition to obtain a dull finish.

The material described above was subjected to the standard anchorage test described above, which showed the anchorage of the coating to the base fabric to be 14.2 pounds.

EXAMPLE II

A control sample similar to that described in Example I was prepared in which the same materials and method were employed, except that the polyamide anchor coat was omitted, which was replaced by an equal weight of the cellulose derivative composition. The entire coating consisted of the cellulose derivative coating composition described in Example I. The material thus prepared was subjected to the standard anchorage test. The average of two test samples indicated the anchorage of the dried cellulose derivative coating to the base fabric to be 10.9 pounds.

EXAMPLE III

A coated fabric which was the same as that described in Example I was prepared by the method set forth in Example I, except that the anchor composition consisted of the following:

Anchor composition

	Per cent
Polyamide	21.0
1,12-diphenyloloctadecane	8.4
Butyl phthalyl butyl glycollate	5.6
Solvent mixture	65.0

The solvent mixture in the above composition consisted of 9 volumes of denatured ethyl alcohol (2B formula) and one volume of water. The polyamide used was derived from hexamethylene diammonium adipate, hexamethylene diammonium sebacate and caprolactam in the ratio of 40:30:30.

The coated fabric thus prepared was subjected to the standard anchorage test, which indicated the anchorage of the dried film to the base fabric to be 14.5 pounds.

EXAMPLE IV

A control sample was prepared at the same time as Example III, using the same materials and same method as described in Example III, except that the polyamide anchor coat was omitted, which was replaced by an equal weight of the cellulose derivative coating composition.

The anchorage of the dried film to the base fabric of the above coated sample as determined by the standard anchorage test was 9.2 pounds.

EXAMPLE V

A woven fabric having a sateen weave and consisting of continuous filaments of regenerated cellulose of uniform denier such as described in U. S. Patent 2,083,252, granted to Bradshaw & Hoff, was given one knife application of the following:

Anchor composition

	Per cent
Polyamide	15
Solvent mixture	85

The solvent mixture consisted of 90 volumes of ethyl alcohol (2B formula) and 10 volumes of water. The polyamide used was the same as that used in Example III. Approximately seven ounces of the above composition were applied per yard per 53 inch width, which corresponds to approximately 1.0 ounce per yard per 53 inch width of non-volatile components.

A plurality of coats of the following composition were applied directly over the anchor coat.

Cellulose derivative coating

	Per cent
Cellulose nitrate	10.82
Colored pigment	9.76
Castor oil modified glycerol sebacate	16.30
Ethyl acetate	31.56
Ethyl alcohol	31.56

Sufficient coats of the above composition were applied to deposit approximately 28 ounces per yard per 53 inch width, which corresponds to 10.4 ounces per yard per 53 inch width. Both the anchor coat and cellulose derivative coating

composition were applied and dried by the means described in Example I.

The average of two test samples prepared as described above showed an anchorage of 5 pounds as determined by the standard anchorage test.

Example VI

A control sample was prepared at the same time as Example V, using the same materials and the same method as described in Example V, except that the polyamide coat was omitted, which was replaced by an equal weight of the cellulose derivative composition.

The anchorage of the dried film to the base fabric as determined by the standard anchorage test was 3.5 pounds.

Example VII

A sateen fabric was coated as described in Example I with an anchor coat of the following composition:

	Per cent
Polyamide	22.25
N - beta - hydroxyethyl - o-methoxy-benzamide	27.75
Denatured ethyl alcohol (2B formula)	37.60
Water	12.40

The polyamide used was that derived from 60 parts of hexamethylene diammonium adipate and 40 parts of caprolactam.

Next a plurality of coats of nitrocellulose composition having the following formula:

	Per cent
Cellulose nitrate	12.3
Pigments	12.9
Blown cottonseed oil	26.4
Ethyl alcohol (23A formula)	24.2
Ethyl acetate	24.2

was applied directly over the anchor coat in the same manner and amount as described in Example I. The product gave value of 15,000 flexings before failure in the Schiltknecht test as described below.

Example VIII

A product prepared as described in Example VII but replacing the polyamide anchor coat with the following composition:

	Per cent
Cellulose nitrate	10.7
55% castor oil modified alkyd resin	24.4
Butyl acetate	15.0
Toluol	16.2
Ethyl acetate	16.8
Ethyl alcohol (23A formula)	16.9

failed in the Schiltknecht flex test at 800 flexes.

The Schiltknecht flex test is conducted on a commercial machine built for measuring the crack resistance of coatings applied on fabric bases. The machine comprises a casing to which is cast a guide for a vertically reciprocating cross-arm. The cross-arm is formed or shaped of four radiating members; at the extremities of each is attached a vertical cylinder, so positioned that separate test pieces may be clamped at either end of the cylinder. The main body of the casting is provided with eight fixed vertical cylinders (four above and four below) of the same diameter and in the same vertical axes as the cylinders described on the reciprocating cross-arm. At the time the test sample is clamped around the fixed and reciprocating cylinders the maximum clearance between the superposed cylinders is 3/4" and at full compression the minimum clearance is 3/8". One end of the test sample (3" x 1 5/8") is clamped around the fixed cylinder; the other end is clamped around the reciprocating cylinder positioned immediately below, to form a hollow tube. The reciprocation of the movable cylinder causes a 3/8" flexing in the test sample.

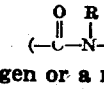
Summary of anchorage tests

	Anchorage	Increase over control
	Pounds	*Per cent*
Example I (polyamide anchor coat)	14.2	30.2
Example II (control for Example I—no polyamide anchor coat)	10.9	
Example III (polyamide anchor coat)	14.5	57.5
Example IV (control for Example III—no polyamide anchor coat)	9.2	
Example V (polyamide anchor coat)	5.0	42.8
Example VI (control for Example V—no anchor coat)	3.5	

Summary of Schiltknecht flex tests

	Flexes	Increase over control
		Per cent
Example VII (polyamide anchor coat)	15,000	1775
Example VIII (control for Example VII—no polyamide anchor coat)	800	

The synthetic linear polyamides used in this invention are of the types described in U. S. Patent 2,071,250, 2,071,253, 2,130,523, and 2,130,948. It is to be observed, with regard to the structure of these polyamides, that they contain amide groups



where R is hydrogen or a monovalent hydrocarbon radical) as an integral part of the main chain of atoms in the polymer. It also may be observed that in these polyamides the average number of carbon atoms in the segments of the chain separating the amide groups is at least two. Accordingly, in this specification and the claims appended thereto, the expression, synthetic linear polyamide, is to be understood as applying to polyamides not only belonging to types described in the aforesaid patents, but also coming within the limitations pointed out in this paragraph.

The term "polyamide" as used above is not limited to polymers derived solely from polyamide-forming reactants. It includes also polymers obtained by including with the polyamide-forming reactants from which the polymers are prepared, other polymer-forming compositions, e. g., hydroxy acids, glycol-dibasic acid mixtures, and amino alcohol-dibasic acid mixtures. The polymers obtained in this manner can still be referred to as polyamides since they contain amide groups in the main polymer chain and possess many of the desirable properties of the unmodified polyamides.

In general it is desirable to use an interpolyamide as the anchor coat rather than a simple polyamide, since the interpolyamides have better solubility characteristics and greater pliability. In addition to the interpolyamides described in the foregoing examples, the following are also very useful: the interpolyamide derived from hexamethylene diammonium adipate and deca-

methylene diammonium sebacate or heptamethylene diammonium pimelate, the interpolyamide derived from hexamethylene diammonium adipate and 6 aminocaproic acid and/or 12-amino stearic acid, the interpolyamide derived from hexamethylene diammonium adipate, hexamethylene diammonium suberate and/or azelate. However, the simple polyamides can also be used, typical examples being polyhexamethylene adipamide, polydecamethylene adipate, 6-aminocaproic acid polymer, and 9-amino nonanoic acid polymer. Mixtures of polyamides, particularly melt blends of two or more preformed polyamides, e. g., a melt blend of polyhexamethylene adipamide and polytriglycol adipamide or poly-N,N'-dimethyl-hexamethylene adipamide are also useful.

As indicated in the examples the polyamide anchor coating may contain plasticizers. Examples of additional useful plasticizers include sulfonamides, such as N-ethylamylbenzene sulfonamide; phenols such as diamyl phenol and octyl phenol; salicylamides; and other known plasticizers for the polyamides, mixed, if desired, with other materials of known softening action for the polyamides and nitrocellulose, such as castor oil or derivatives thereof, high boiling aromatic or aliphatic esters, and the like. Pigments, resins fillers and flattening agents can also be incorporated in the anchor coat although these are usually added to the cellulose derivative coat.

While the preferred embodiment of the invention as described in the examples employs a cellulose nitrate coating for the major portion of film applied on the base material, it is to be understood that other cellulose esters may be employed such as cellulose acetate, cellulose propionate and cellulose butyrate, as well as cellulose ethers such as ethyl cellulose and benzyl cellulose; also mixed esters and ether esters, such as, e. g., cellulose aceto-propionate and cellulose acetobutyrate. In the claims the term "cellulose derivative" is used to refer to the water-insoluble film-forming cellulose derivatives, such as cellulose esters, cellulose ethers, and mixed cellulose esters and not to non-film-forming cellulose derivatives such as glucose and carbon dioxide.

The base material for the system of coatings herein described is not limited to woven cotton textile fabrics, since other flexible base materials are suitable such as unwoven cotton fabrics, regenerated cellulose, paper, woven and unwoven glass fabrics and fabrics made from cellulose derivative yarns such as viscose and cellulose acetate. In the use of a cellulose derivative fabric as the base material the choice of solvents employed in the anchor composition must be such that they do not dissolve the individual threads of the base fabric. Polyamide fabrics may be employed as the base material in which case the polyamide fabric must have a solubility different from that of the polyamide employed in the anchor composition.

In Example I, 1.0 dry ounce of the polyamide anchor coat was applied to one yard of base fabric 53 inches wide. This corresponds to .7 ounce of dry coating per square yard. Any quantities of the polyamide anchor coat less than .4 ounce of dry coating per square yard are insufficient to accomplish the outstanding advantages of the invention. Quantities of the polyamide anchor coat greater than 1.5 ounces dry coating per square yard do not result in any appreciable increase in the anchorage of the composite film.

The products produced in accordance with this invention will find extended use wherever plain or embossed cellulose derivative coated products have been used and where improved anchorage of the cellulose derivative coating is desired. It is particularly useful in the manufacture of coated fabrics used for upholstery material, ladies' pocketbooks, drawsheets for rotary type printing presses, and bookbinding material.

It will be evident from the foregoing tests that an outstanding advantage of the material produced in accordance with this invention is the production of cellulose derivative coated fabrics having improved anchorage of the coating to the fabric, in which case the superior bond of the coating to the fabric is not impaired during aging and prolonged use of the material. A further advantage is the provision of an anchoring composition for cellulose derivative coated fabrics, which is not subject to decomposition upon aging and does not cause tendering of the base fabric. A still further advantage is the provision of an economical method of producing a cellulose derivative coated fabric having improved anchorage of the dried coating to the base fabric and improved resistance to repeated flexing.

It is apparent that many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, and therefore it is not intended to be limited except as indicated in the appended claims.

I claim:

1. A coated fabric comprising a base fabric having firmly anchored thereto a thin polyamide coating weighing .4 to 1.5 ounces per square yard, a continuous cellulose derivative coating weighing more than 1.5 ounces per square yard firmly anchored to said polyamide coating, and said coated fabric being characterized by the improved bond of the composite coating to said base fabric.

2. Product of claim 1 in which the polyamide is an interpolyamide.

3. Product of claim 1 in which the cellulose derivative is cellulose nitrate.

4. Process of preparing a coated fabric of improved bond of the coating to the fabric which comprises applying sufficient dispersion of a polyamide in a volatile solvent to deposit .4 to 1.5 ounces of non-volatile ingredients per square yard, removing the volatile solvents, applying to the dry coated fabric a cellulose derivative dissolved in volatile solvents, and removing the volatile solvents, thereby producing a smooth continuous cellulose derivative surface film.

5. Process of claim 4 in which the polyamide is an interpolyamide.

6. Process of clair 4 in which the cellulose derivative is cellulose nitrate.

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