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(54) FLAMEPROOFING UNWOVEN FABRICS

(71) We, ANIC S.p.A., an Italian company, of Via M. Stabile, 216, Palermo, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

5 This invention relates to a method of flame-proofing unwoven fabrics, particularly, although not exclusively, unwoven fabrics for use in interior decoration, in the interior trim of motor cars and in articles of apparel, as simulated suede leather and similar skin wares.

10 On account of the particular interest of the Applicants in a particular kind of unwoven fabrics, the present invention will be described with reference to an unwoven fabric comprising 60% polyester microfibres (polyethyleneterephthalate) bonded by polyurethane (40%), the properties and manufacturing methods of which are disclosed in Italian Patent Specifications Nos. 823 055; 839 921; 858 373; 905 222; 873 699. However, the invention may also be applied to other unwoven fabrics.

15 According to the present invention there is provided a method of flameproofing an unwoven fabric, comprising contacting a surface of the fabric with an exposed portion of a roller which has a roughened cylindrical surface and is partially immersed in a bath containing an emulsion in water of a fixable flameproofing agent thereby to transfer emulsion from the bath to the said surface of the fabric, and subsequently drying and fixing the flameproofing agent by the application of heat.

20 Preferably the roller has a circular cylindrical surface.

The emulsion is preferably applied to the bottom or reverse surface of the unwoven fabric, i.e. that surface which, in use of the fabric is not exposed to view.

25 The flame-proofing agent is preferably a brominated phosphoric ester mixed with a cross-linking or fixing agent for the ester, which agent may be a thermoplastic resin. Fabric treated by the method of the present invention may have such flame-retarding properties as to fulfil all the requirements established by United States Law for materials to be used in the interior decoration of civil dwellings and the interior upholstery of motor cars, without altering the structural features and the feel of such materials. On the contrary, when reasonable quantities of flameproofing agent are applied, the feel and the appearance of the fabric may be improved so as to make it still more similar to natural suede leather.

30 The roughened surface of the roller is important so as better to entrain the emulsion. The smoother is the roller, the less intensive the entrainment of the emulsion will be and thus the poorer will be the flameproofing efficiency.

35 The so-called "thousand-points" surface may be used which has a very large number of tiny closely spaced projections or points which entrain the emulsion and cause it to be deposited in the hollow spaces between the projections and to be transferred on to the unwoven fabric which is guided thereover.

40 The unwoven fabric can be repeatedly subjected to passages over the roller, in order that the fabric may absorb greater quantities of flameproofing agent, to achieve the desired flameproofing qualities. Every pass over the roller, all the other conditions being equal, permits the absorption of constant amounts of the flameproofing agent. The percentage by weight, relative to the weight of the untreated unwoven fabric, of the flameproofing agent which is sufficient to impart fair flame-retarding properties, is of the order of 25% - 30%. Higher amounts are preferred to obtain a self-extinguishing effect but it is not advisable to exceed amounts of 75% - 80% since the feel of the unwoven fabric may be impaired.

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The flameproofing agent is supplied in the form of a solution in an organic solvent together with a cross-linking fixing agent, and is prepared as an aqueous emulsion, prior to the treatment of the fabric, by stirring it with water.

5 The flameproofing agent is subsequently fixed on the unwoven fabric by squeezing, drying and heating up to a maximum temperature of 120°C, preferably 100°C (so as not to deform the fabric) in a conventional oven. During this stage the flameproofing agent is cross-linked and thus fixed on the unwoven fabric.

The treated unwoven fabric should not lose its flame-retarding properties by normal washing with water.

10 For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, which shows, diagrammatically, apparatus for flameproofing unwoven fabric.

In the drawings, a feeding cylinder 1 feeds unwoven fabric which has the appearance of a normal piece of hairy fabric, over a knurled or "thousand points" roller 2, which is partially immersed in an emulsion-containing bath 4. A driving roller 3 presses the unwoven fabric into contact with the spreading roller 2 and a guiding roller 5 guides the spread fabric to a drying and fixing oven (not shown) and therefrom to subsequent takeup and winding arrangements.

15 The following examples will better explain features of the invention.

Example 1

A flameproofing treatment was carried out on apparatus as described above using a thousand-point roller and a two-zone drying oven.

20 The bath was filled with an emulsion composed of 800 grams per litre of brominated phosphoric ester, 185 grams/litre of water and 15 grams/litre of a cross-linking agent.

The feeding speed of the unwoven fabric over the "thousand points", the latter being contacted by the reverse side of the fabric, was 10 metres/minute.

25 After the first pass, the unwoven fabric contained about 25.0 grams of the flameproofing agent per square metre.

30 The unwoven fabric, taken up on tensionless conveying rollers, is forwarded to the two-zone drying oven: in the first zone the fabric is dried (the temperature is between 75°C and 90°C), whereas in the second zone (the temperature lies between 90°C and 120°C), the cross-linking takes place and consequently the fixing of the flameproofing agent.

35 Samples were taken from the dried material and combustion tests effected thereon according to the specifications DIN 53906 (vertical method) and DIN 54333 (horizontal method), respectively. The material showed traces of combustion. After mechanical washing at 40°C in water no appreciable weight loss was detected, so that the result is that the washing fastness in water of the flameproofing agent can be considered satisfactory. The results are tabulated, in comparison with untreated fabric, in Tables 1 and 2.

Example 2

40 The treatment of the unwoven material was repeated as in Example 1, but the fabric was passed three times over the thousand points roller. The remainder of the procedure was identical. The treated fabric had absorbed about 68 grams per square metre of the flameproofing agent.

45 When subjected to the same tests as referred to in Example 1 above, (i.e. DIN 53906 and DIN 54333), the samples of the treated fabric proved to be self-extinguishing. The results are tabulated, in comparison with untreated fabric, in Tables 1 and 2.

Example 3

50 The treatment of Example was repeated on a material of different colour by passing the fabric twice, once on each surface, over the roller. The inflammability characteristics, according to the test specifications cited in Examples 1 and 2, were satisfactory. The results of the tests, in comparison with fabric which had not been flameproofed, are tabulated in Tables 1 and 2.

Example 4

55 The treatment of Example 1 was repeated on a material of the same colour as that used in Example 3, the material having been passed twice over the roller, both times on the same side. The inflammability characteristics were still satisfactory. The results are tabulated in Tables 1 and 2.

TEST
DETERMINATION OF THE COMBUSTION BEHAVIOUR OF
McCANTARA® BOTH UNTRITAED AND FLAMEPROOFED

(Vertical Method, DIN 53905)

SAMPLE:	No. 5 color 506 untreated	No. 1 before washing	No. 2 after 3 wash in washing machine	No. 3 before washing	No. 4 after 3 wash in washing machine	No. 5 after wash in petroleum ether
	1 pass on reverse	3 passes on reverse	NONI:	1 pass on right	1 pass each on right and reverse	2 passes on right
Flameproof- ing treat- ment	NCDFE					
Weight, grams square metre	177.5	202.4	245.8	176.8	203	225.7
Ignition time (seconds)	3	3	3	3	3	3
Combustion time (seconds)	rapid & total	75	5	15	18	30
;	;	;	;	;	;	;
Degree of destruction	total	24 30	10 12	16 14	12 18	30 60
				total	burnt area about 5 cm	burnt area about 2 cm
					self-ext- inguish- ing	self-ext- inguish- ing

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TABLE 2. DETERMINATION OF THE COMBUSTION BEHAVIOUR OF
ALCANTARA (1) BOTH UNTREATED AND AFTER FLAMEPROOFING

(Horizontal Method, DIN 54333)

SAMPLE	No. 0		No. 1		No. 2		No. 3		No. 4		No. 5	
	color	500 untreated	flame applied on reverse	light	3 passes on reverse	No. 7 color (b1) untreated	flame applied on reverse	1 pass on right	1 pass each on right & reverse	2 passes on right	No. 4 color (b1) untreated	2 passes on right
flame- proofer treatment	NONE	1 pass on reverse				NONE		1 pass on right				
weight grams	177.5	202.4				245.8	176.7	203				
square metre												
ignition time (seconds)	15	15			15		15					
Combustion time (seconds)	rapid	50/70	150			30	11	75				
Propagation speed centi- meters per minute												
NOTES:	fall of burning residues & emission of black smoke		Burnt area about 6 cm	Burnt area about 12 cm	as the flame is removed from the sample ceases to burn	fall of burning residues & emis- sion of black smoke	fall of burning residues & emis- sion of black smoke	burnt area about 10 cm without fall of burning residue	burnt area about 5 cm without fall of burning residue	burnt area about 5 cm without fall of burning residue	burnt area about 5 cm without fall of burning residue	on removal of flame sample ceases to burn

(1) ALCANTARA is the Trade Mark of the unwoven fabric as cited in the present specification.

WHAT WE CLAIM IS:-

- 5 1. A method of flameproofing an unwoven fabric, comprising contacting a surface of the fabric with an exposed portion of a roller which has a roughened cylindrical surface and is partially immersed in a bath containing an emulsion in water of a fixable flameproofing agent thereby to transfer emulsion from the bath to the said surface of the fabric, and subsequently drying and fixing the flameproofing agent by the application of heat.
- 10 2. A method as claimed in claim 1, in which the fabric is dried and the flameproofing agent is fixed by the application of heat in an oven through which the fabric is passed.
- 10 3. A method as claimed in claim 1 or claim 2, in which the surface of the roller is knurled or otherwise provided with a plurality of closely spaced projections.
- 15 4. A method as claimed in any one of the preceding claims, in which the flameproofing agent is a phosphoric brominated ester mixed with a cross-linking thermoplastic resin to fix the ester.
- 15 5. A method substantially as specifically described herein with reference to Figure 1 and to any one of Examples 1 to 4.
- 15 6. A flameproof unwoven fabric obtained using the method of any one of the preceding claims.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

