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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, 5  
 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 10  
 fabrics, the present invention will be described with reference to an unwoven fabric  
 comprising 60% polyester microfibrres (polyethyleneterephthalate) bonded by 10  
 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 15  
 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. 20  
 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 25  
 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  
 30 reasonable quantities of flameproofing agent are applied, the feel and the appearance of the 30  
 fabric may be improved so as to make it still more similar to natural suede leather.

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 35  
 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 40  
 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  
 45 exceed amounts of 75% - 80% since the feel of the unwoven fabric may be impaired. 45

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. 5

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. 10

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

20 The following examples will better explain features of the invention. 20

#### *Example 1*

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

25 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. 25

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.

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. 30

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. 35

#### *Example 2*

45 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. 55

#### *Example 4*

60 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. 60

TABLE 1 - DETERMINATION OF THE COMBUSTION BEHAVIOUR OF  
"ALCANTARA" (\*) BOTH UNTREATED AND FLAMEPROOFED

(Vertical Method, DIN 53905)

SAMPLE	No. 5 color 506 untreated	No. 1	before washing	No. 2 after 3 washing machine	No. 7 color 704 untreated	No. 3	before washing	No. 4 after 3 wash in washing machine	after wash in petroleum ether	No. 5
Flameproof- ing treat- ment	NONE	1 pass on reverse	3 passes on reverse		NONE	1 pass on right		1 pass each on right and reverse		2 passes on right
Weight, grams/square metre	177.5	202.4		245.8	176.8	203	225.7			235.1
Ignition time (seconds)	3	3	3	3	3	3	3	3	3	3
Combustion time (seconds)	rapid & total	75	5	15	18	30	immedi- ately exting- uished	15	12	18
:		24	10	16	12	30	18	16	10	12
Degree of destruction	total	burnt area about 6 cm	self-ext- inguish- ing	self-ext- inguish- ing	total	burnt area about 5 cm	9	14	burnt area about 2 cm	self-ext- inguish- ing

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

TABLE 2 - DETERMINATION OF THE COMBUSTION BEHAVIOUR OF  
ALCANTARA (J) BOTH UNTREATED AND AFTER FLAMEPROOFING

(Horizontal Method, DIN 54333)

SAMPLE	No. 6 color 506 untreated	flame applied on reverse	No. 1 right	No. 2	No. 7 color 701 untreated	No. 3 flame applied on reverse	No. 4	No. 5
flame- proofing treatment	NONE	1 pass on reverse	3 passes on reverse	NONE	1 pass on right	1 pass each on right & reverse	2 passes on right	
weight grams	177.5	202.4	245.8	176.5	203	225.7	235.1	
sq metre	15	15	15	15	15	15	15	
ignition time (seconds)	rapid	50/70	150	30	11	75	-	
Combustion time (seconds)	-	-	-	-	-	-	-	
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 the sample ceases to burn	fall of burning residues & emission of black smoke	burnt area about 10 cm without fall of burning residue	on re- moval of flame sample ceases to burn to burn	

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

## WHAT WE CLAIM IS:-

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. 5
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.
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. 10
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.
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. 15

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