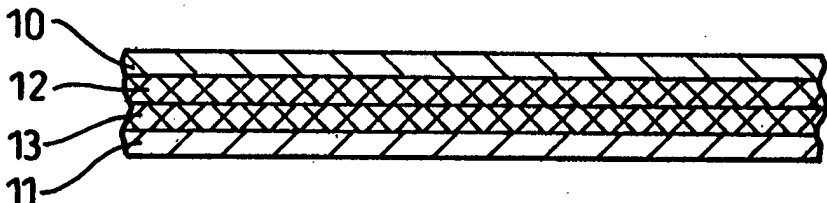




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : D04H 13/00, B32B 5/26, 27/34	A1	(11) International Publication Number: WO 98/24961 (43) International Publication Date: 11 June 1998 (11.06.98)
(21) International Application Number: PCT/GB97/03215 (22) International Filing Date: 3 December 1997 (03.12.97) (30) Priority Data: 9625151.7 4 December 1996 (04.12.96) GB (71) Applicant (for all designated States except US): TBA INDUSTRIAL PRODUCTS LIMITED [GB/GB]; 20 St. Mary's Parsonage, Manchester M3 2NL (GB). (72) Inventor; and (75) Inventor/Applicant (for US only): TOOTILL, Stephen [GB/GB]; 40 Harwood Vale, Harwood, Bolton BL2 3QU (GB). (74) Agents: CRUX, John, Anthony et al.; T & N plc, Bowdon House, Ashburton Road West, Trafford Park, Manchester M17 1RA (GB).		(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i>
(54) Title: INDUSTRIAL FABRICS (57) Abstract A cut resistant composite fabric comprises a first fabric layer (12, 13, 25) of a high tenacity fibre material and a second fabric layer (10, 11, 24) of aramid fibres, the high tenacity fibre material preferably having a tenacity of at least 1N/tex. First fabric layers in the form of woven scrim fabric are particularly preferred, as is the use of multilayer constructions in which one or more such scrim fabric layers are incorporated. 10 12 13 11 		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

Industrial Fabrics

This invention relates to textile fabrics suitable for use in clothing and upholstery applications where there is a need to confer protection against the effects of fire and/or mechanical damage. Such fabrics are commonly used in road and/or railway seating applications, especially as a cover layer for resilient foam cushioning material. Polyurethane compositions are widely used for such cushioning material and in the event of fire are likely to release toxic fumes. It is therefore highly desirable that the cushioning material shall be protected from the effects of fire for at least long enough to enable any passengers to be evacuated from the area. It is also very desirable that the cover layer for such cushioning should have good resistance to mechanical damage, since the latter would adversely affect the fire protection otherwise conferred by the cover. Vandalism is the major cause of mechanical damage to public transportation seating.

In the case of clothing for use in industrial environment, resistance to mechanical damage is often important in order to protect the wearer from injury, or at the least, from damage to normal clothing worn beneath a protective suit.

Fabrics for this type of end use are well-known. For example, GB-A-2466097 discloses a composite fabric including a layer of knitted wire mesh. This has good resistance to knife attack, but the presence of the wire component confers a harsh feel. Also, in the event of damage, projecting wire strands may present a hazard to users. This is particularly true in the case of clothing, where the incorporation of wire mesh may be wholly unacceptable.

- 2 -

It has now been discovered that it is possible to eliminate the need for the wire mesh fabric layer, whilst retaining excellent resistance to mechanical damage and in particular, resistance to cut/slash type damage.

According to the present invention, a cut-resistant composite fabric comprises a first layer of a fabric of a high tenacity fibrous material and a second layer of a non-woven fabric comprising aramid fibres. "High tenacity" in this present context means a tenacity of at least 1N/tex, more preferably in excess of 2N/tex.

Preferably the two layers are bonded by needling them together, although stitching and glueing techniques may also be used.

Particularly preferred high tenacity fibrous materials include polymeric materials such as ultra-high molecular weight polyethylene or aromatic polyesters. The first fabric layer may be a relatively open woven or knitted fabric; it could also be a non-woven fabric incorporating ultra-high molecular weight fibres in the form of laid-in yarns. Scrim fabrics are particularly preferred for present purposes.

"Ultra-high molecular weight" in this present context is a term of art; it is commonly applied to a range of materials, including for example DYNEEMA(TM) and SPECTRA(TM).

The composite fabric of the present invention is preferably used in conjunction with a third fabric layer which serves as a decorative outer layer when used to cover foam cushioning material. This third layer may be attached by use of glueing techniques, or it may be loose. Attachment is preferred, because it transfers at least in part some of the composite fabric properties to the decorative layer. The third layer could be a knitted terry fabric for example, or more usually a moquette fabric. In the case of a multilayer fabric, more than one fabric layer of high tenacity fibrous material may be used. Superposed scrim fabric layers are particularly preferred in such multilayer constructions, as will be apparent from the Examples below.

The ultra-high molecular weight fibrous material is preferably a polyethylene filamentary material wrapped with staple viscose fibres or staple aramid fibres, as for example by means of the well-known DREF-spinning process. An example of a suitable polyethylene is that sold under the registered trade mark DYNEEMA and as previously mentioned, for many

applications a relatively open scrim weave has been found to be satisfactory. Wrapping with other fibres serves primarily to stabilise the scrim fabric; it has minimal effect on cut resistance.

Example 1:

Referring first to Figure 1, a four layer product comprises facing layers 10, 11 and inner layers 12, 13. The facing layers were each made from 60/30/10 blend by weight of para-aramid fibres, pre-oxidised acrylic fibres and polyacrylate fibres, respectively. The fibre blend was processed by needling to form a felt of weight about 120 g/m².

The inner layers were each in the form of a scrim fabric woven from 44 tex DYNEEMA (TM) ultrahigh molecular weight polyethylene yarn covered with 22 tex staple viscose fibres by a DREF-spinning process. The resultant yarn was doubled to give a yarn of about 135 tex prior to weaving at a nominal 42 ends by 42 picks/dm, to yield an open scrim fabric of density about 120g/m² containing about 80 g/m² of the ultrahigh molecular weight component. The viscose was included essentially as a weaving/processing aid, but was also found useful in subsequent needling together of the four layers of Figure 1, in a free-standing needling machine. The end product exhibited excellent cut resistance.

Example 2:

Referring now to Figure 2, a six layer composite fabric was made with outer layers 14, 15 and four inner layers, 16,17,18 and 19. The outer layers 14, 15, in this case were each needlefelts of 100% para-aramid fibres and of density 240 g/m². The inner layers 16, 17, 18 and 19 were each made as per the inner layers 12, 13 of Figure 1, but staple poly-aramid fibres were substituted for viscose fibres. All six layers were united into a composite fabric by needling them together. Again, the end product exhibited excellent cut resistance.

Example 3:

Referring now to Figure 3, a four layer composite fabric was made using outer layers 20, 21 and inner layers 22, 23. The outer layers 20, 21 were of the same 100% para-aramid construction as layers 14, 15 of Figure 2. The inner layers 22, 23 were exactly as per layers 12,13 of Figure 1, using viscose covered DYNEEMA yarn. As before, the four layers were

- 4 -

united by needling to form a composite fabric and the product again exhibited excellent cut resistance.

Example 4:

Referring now to Figure 4, a two layer composite was made by needling together layers 24 and 25. Layer 24 was a needle felt of 100% para-aramid fibres, exactly as per layers 14, 15, 20 and 21 of Figures 2 and 3 respectively. Layer 25 was a commercially-available felt of density 200g/m² constituted by DYNEEMA(TM) fibres and sold under the trade mark FRAGLITE. These two layers were united into a composite, non-woven fabric by needling, as before. The product had excellent cut resistance.

In each case cut resistance was determined empirically by clamping a fabric sample to the sample of a cylindrical roller. A test blade was then applied to the curved fabric surface formed by the clamping operation. The blade was drawn across the fabric in a direction parallel to the axis of the roller, the pressure and speed of travel being controlled by air pressure. The degree of penetration of the knife blade was then assessed visually.

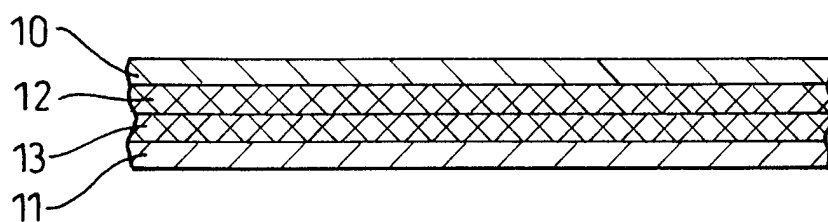
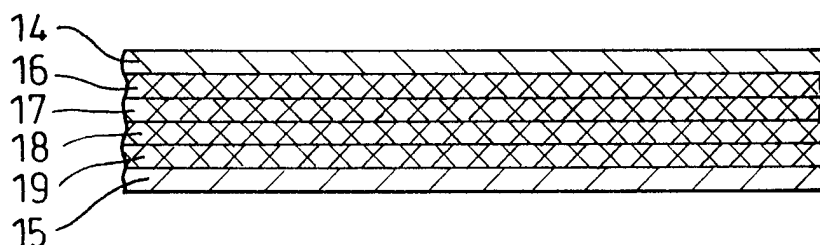
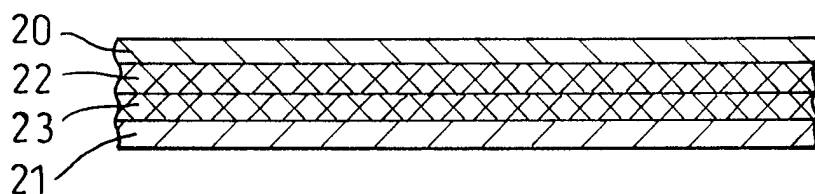
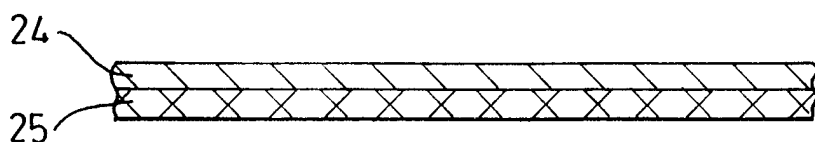
CLAIMS

1. A cut resistant composite fabric comprising a first fabric layer of a high tenacity fibre material and a second fabric layer of a non-woven fabric comprising aramid fibres.
2. A composite fabric according to claim 1 wherein the high tenacity fibre material has a tenacity of a least 1N/tex.
3. A composite fabric according to claim 1 or claim 2 wherein the high tenacity fibre material has a tenacity of at least 2N/tex.
4. A composite fabric according to any preceding claim wherein the high tenacity fibre material is polyethylene.
5. A composite fabric according to any preceding claim wherein the aramid fibre component is a para-aramid fibre.
6. A composite fabric according to any preceding claim wherein the first fabric layer is a non-woven fabric.
7. A composite fabric according to any of claims 1 to 5 wherein the first fabric layer is a relatively open woven scrim fabric.
8. A composite fabric according to any of claims 1 to 5 wherein the first fabric layer is a knitted fabric.
9. A composite fabric according to claim 7 wherein the high tenacity fibre material is a polyethylene yarn wrapped with staple viscose fibres.
10. A composite fabric according to claim 7 wherein the high tenacity fibre material is a polyethylene yarn wrapped with staple aramid fibres.
11. A composite fabric according to any of claims 1-5, or 7-10 wherein the first fabric layer is a woven scrim fabric having a density in the range 50-150 g/m².

- 6 -

12. A composite fabric according to any preceding claim wherein the second fabric layer has a density in the range 50-150 g/m².
13. A multilayer composite fabric according to any preceding claim wherein a plurality of said first fabric layers are sandwiched between two or more of said second fabric layers, the whole being united by needling.
14. A multilayer composite fabric according to claim 13 wherein said first fabric layers are constituted by superposed scrim fabric layers.
15. A cut resistant composite fabric substantially as described in relation to Examples 1-4 and as illustrated by Figures 1-4.

1/1

*Fig. 1**Fig. 2**Fig. 3**Fig. 4*

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/03215

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 D04H13/00 B32B5/26 B32B27/34

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 D04H B32B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 709 182 A (HAPPICH GMBH GEBR) 1 May 1996	1,4,6,8,12,13
Y	see column 2, line 15-30-44 - column 3, line 4-11; claims 1-3,9,11	2-4,8,9,11,12,15
A	see column 4, line 31-49 - column 5, line 17-28 see column 6, line 1-3	2,3
X	EP 0 569 849 A (AKZO NV) 18 November 1993 see column 2, line 35-40-44 - column 3, line 30-57; claims 1,3-6,8	1,8,13,15
Y	DE 44 41 842 A (AKZO NOBEL NV) 1 June 1995 see column 1, line 44-57 - column 2, line 25-59-66; claims 1,2,7,9,11-13 see column 3, line 1-22-53	1-5,9,15
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

5 March 1998

Date of mailing of the international search report

26/03/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Derz, T

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 97/03215

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 296 11 356 U (HANDSCHUHFABRIK SEIZ GMBH & CO) 5 September 1996 see page 2, paragraph 2 ---	5
A	US 5 442 815 A (CORDOVA DAVID S ET AL) 22 August 1995 see column 5, line 32-61-63 - column 6, line 21-25-34; claims 1,6,11,12,14,17,18; figure 2 ---	1-5
P,Y	US 5 598 582 A (ANDREWS WARREN L ET AL) 4 February 1997 see column 4, line 19-52-58 - column 5, line 1-5; claims 1,2,4,5,7,14-16; figure 1 ---	1,8,11,12
A	US 5 431 979 A (DELLINGER ALLAN M ET AL) 11 July 1995 see column 1, line 60 - column 2, line 10-22; claims 1,3,5; figure 2 see column 3, line 1-14 ---	1,4,5,13,15
A	EP 0 250 826 A (ALLIED CORP) 7 January 1988 see claims 1,3,4,8 -----	1-4,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 97/03215

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0709182 A	01-05-96	DE 4438013 A FI 955066 A JP 8206373 A	02-05-96 26-04-96 13-08-96
EP 0569849 A	18-11-93	DE 4215662 A DE 59304572 D ES 2096134 T	18-11-93 09-01-97 01-03-97
DE 4441842 A	01-06-95	NONE	
DE 29611356 U	05-09-96	NONE	
US 5442815 A	22-08-95	US 5568657 A CA 2071926 A DE 69103132 D DE 69103132 T EP 0510093 A JP 5503447 T WO 9110409 A	29-10-96 10-07-91 01-09-94 03-11-94 28-10-92 10-06-93 25-07-91
US 5598582 A	04-02-97	AU 5301496 A CA 2189736 A EP 0758204 A WO 9627306 A	23-09-96 12-09-96 19-02-97 12-09-96
US 5431979 A	11-07-95	NONE	
EP 0250826 A	07-01-88	CA 1284402 A JP 62299590 A US 4886691 A US 5119512 A	28-05-91 26-12-87 12-12-89 09-06-92