

(19) World Intellectual Property Organization
International Bureau



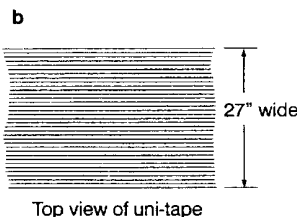
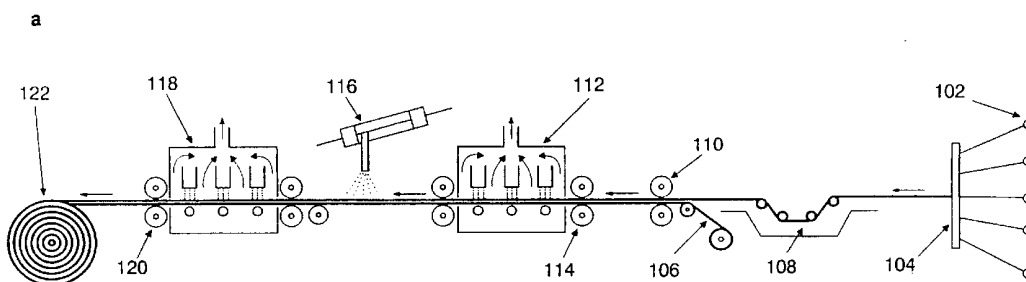
(43) International Publication Date
21 February 2002 (21.02.2002)

PCT

(10) International Publication Number
WO 02/14408 A3

- (51) International Patent Classification⁷: B32B 5/06. (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.
- (21) International Application Number: PCT/US01/25148
- (22) International Filing Date: 10 August 2001 (10.08.2001)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 09/639,903 16 August 2000 (16.08.2000) US
- (71) Applicant: HONEYWELL INTERNATIONAL INC. [US/US]; 101 Columbia Road, P.O. Box 2245, Morristown, NJ 07960 (US).
- (72) Inventors: BHATNAGAR, Ashok; 7843 Lakeforest Drive, Richmond, VA 23275 (US). ARVIDSON, Brian, Duane; 4101 Old Cheshire Drive, Chester, VA 23831 (US).
- (74) Agents: CRISS, Roger, H. et al.; Honeywell International Inc., 101 Columbia Avenue, P.O. Box 2245, Morristown, NJ 07960 (US).
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published: — with international search report
- (88) Date of publication of the international search report: 2 May 2002
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: IMPACT RESISTANT RIGID COMPOSITE AND METHOD OF MANUFACTURE



(57) Abstract: An impact resistant rigid composite has a plurality of fibrous layers, each of which comprise a network of filaments. The fibrous layers are disposed in a matrix, with elastomeric layer(s) therebetween. Prior to curing of the matrix, successive fibrous layers exhibit therebetween a peel resistance of at least about 3 g/cm. The composite has high rigidity combined with superior ballistic properties. When bonded at one or both surfaces to a hard plate selected from the group consisting of metals and ceramics, the composite affords increased protection against armor piercing projectiles.



WO 02/14408 A3

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/25148

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B32B5/06 B32B5/28 F41H5/04

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 7 B32B F41H

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 587 230 A (LIN LEROY C ET AL) 24 December 1996 (1996-12-24) cited in the application figure 1 column 1, line 58 -column 2, line 24 column 2, line 67 -column 3, line 28 column 5, line 22 -column 6, line 1 column 7, line 12 -column 9, line 45 ---	1,2,5, 7-9
X	FR 2 443 397 A (IMI KYNOCH LTD) 4 July 1980 (1980-07-04) page 1, line 1-12 page 2, line 34 -page 3, line 11 page 3, line 33 -page 5, line 10 page 6, line 6-16 page 8, line 14-21 --- -/--	1,2



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.
- *Z* document member of the same patent family

Date of the actual completion of the international search

1 February 2002

Date of mailing of the international search report

13/02/2002

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

Stabel, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 01/25148

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 738 893 A (GRILLO CHRISTIAN C G) 19 April 1988 (1988-04-19) column 1, line 1-11 column 5, line 42 -column 6, line 8 column 8, line 30-35 ---	1,2,12
A	US 5 789 327 A (ROUSSEAU WM RICHARD) 4 August 1998 (1998-08-04) figure 5 column 2, line 33-55 column 4, line 43 -column 7, line 59 ---	1,2,12
A	US 4 623 574 A (HARPELL GARY A ET AL) 18 November 1986 (1986-11-18) cited in the application column 1, line 52 -column 2, line 25 column 3, line 51-68 column 5, line 17-31 example 1 -----	1,5,8, 12,13

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/25148

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
US 5587230	A	24-12-1996	US 5552208 A EP 0658589 A1 IL 111139 A	03-09-1996 21-06-1995 30-10-1998
FR 2443397	A	04-07-1980	FR 2443397 A1	04-07-1980
US 4738893	A	19-04-1988	FR 2588073 A1 CA 1277528 A1 DE 3673758 D1 DE 221794 T1 EP 0221794 A1 ES 2001306 A6	03-04-1987 11-12-1990 04-10-1990 26-11-1987 13-05-1987 01-05-1988
US 5789327	A	04-08-1998	NONE	
US 4623574	A	18-11-1986	CA 1264411 A1 DE 3684342 D1 EP 0191306 A2 IL 77604 A JP 5058449 B JP 61209228 A US 4748064 A	16-01-1990 23-04-1992 20-08-1986 30-06-1991 26-08-1993 17-09-1986 31-05-1988