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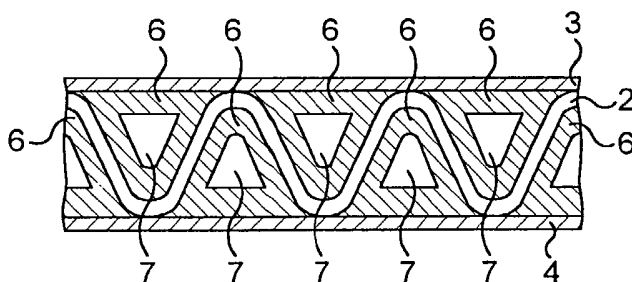
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(54) Title: FLEXIBLE ENERGY ABSORBING MATERIAL AND METHODS OF MANUFACTURE THEREOF



(57) Abstract: A flexible energy absorbing sheet material in which a dilatant material (6) is impregnated into or supported by a resilient carrier (1). The dilatant material remains soft until it is subjected to an impact when its characteristics change rendering it temporarily rigid, the material returning to its normal flexible state after the impact. The carrier can be a spacer fabric, a foam layer or modules or threads of dilatant material contained between a pair of spaced layers. Methods of manufacturing the energy absorbing sheet are also disclosed.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 02/04209

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A41D31/00

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 A41D B29C E04B C08J A61F D04H

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, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 505 730 A (SZIGETI ELEMER) 19 November 1982 (1982-11-19) page 2, line 3 - line 15 page 3, line 29 page 4, line 4 - line 5 page 4, line 13 - line 15; figures 1,3 ---	1-5, 15, 16
A	US 2 744 042 A (PACE HENRY A) 1 May 1956 (1956-05-01) column 1, line 18 column 1, line 41 - line 44 column 1, line 59 - column 2, line 6 column 2, line 20 - line 33; claim 3 --- -/--	1-4, 42-45

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

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"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

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"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

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 02/04209

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 3 649 426 A (GATES LOUIS E JR) 14 March 1972 (1972-03-14) column 1, line 12 - line 19 column 4, line 17 - line 29 column 5, line 70 - column 6, line 21 column 6, line 64 - line 66 ---	1-4,16
A	US 5 090 053 A (HAYES HARRY D) 25 February 1992 (1992-02-25) column 3, line 29 - line 46 column 4, line 8 - line 26; figures 4,5 ---	1-4,15, 16,36-39
A	US 5 599 290 A (ROBINOVITCH STEPHEN N ET AL) 4 February 1997 (1997-02-04) column 4, line 49 - line 56 column 6, line 45 - line 49 column 7, line 56 - line 58 column 8, line 3 - line 25 ---	1-4
A	WO 00 69293 A (PLANT DANIEL JAMES) 23 November 2000 (2000-11-23) page 2, line 13 - line 28 page 7, line 11 - line 25 page 10, line 24 - page 11, line 5; figures 4,5 ---	1,2,4, 39,41
A	US 3 864 181 A (WOLINSKI LEON E ET AL) 4 February 1975 (1975-02-04) column 1, line 7 - line 24; claim 1 ---	46
X	WO 00 16652 A (BROCK USA LLC) 30 March 2000 (2000-03-30) page 3, line 7 - line 10 page 3, line 26 - line 31 page 9, line 7 - line 10; claim 1 ---	20-22, 24,26
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 05, 14 September 2000 (2000-09-14) & JP 2000 045118 A (SUZUKI SOGYO CO LTD), 15 February 2000 (2000-02-15) abstract ---	20,21,23
A	US 4 905 320 A (SQUYERS JR THOMAS L) 6 March 1990 (1990-03-06) column 2, line 40 - line 50 column 3, line 54 - line 56 column 4, line 3 - line 6; figure 2 ---	20,21,26
A	DE 85 24 366 U (ANDRÄ) 6 April 1989 (1989-04-06) page 4, paragraph 6 - page 5, paragraph 1 page 5, line 12 - line 15; figures 1-3 ---	20
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 02/04209

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 941 751 A (LUJAN DARDO BONAPARTE) 15 September 1999 (1999-09-15) paragraphs '0011!', '0014!', '0015!', '0028!'; figures 1,2 -----	29
A	US 3 513 842 A (BERG DENNIS ET AL) 26 May 1970 (1970-05-26) column 2, line 61 - line 69 column 3, line 1 - line 8; figures 7,8 -----	29-31
A	US 3 676 288 A (HOYLE ALBERT G) 11 July 1972 (1972-07-11) column 3, line 10 - line 20; figure 2 -----	29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB 02/04209

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB 02 04209

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-19,36-61

A flexible energy absorbing sheet material comprising a resilient carrier with voids or cavity therein, said carrier being coated or impregnated with dilatent material.

2. Claims: 20-28

A flexible energy absorbing sheet material comprising a resilient core of discrete modules made of dilatent compound sandwiched between a pair of covering layers.

3. Claims: 29-35

An energy absorbing sheet material comprising a thread formed from a dilatent compound which is woven or knitted into a compressible layer.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 02/04209

Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
FR 2505730	A	19-11-1982	FR 2505730 A1	19-11-1982
US 2744042	A	01-05-1956	GB 718035 A FR 1056877 A	10-11-1954 03-03-1954
US 3649426	A	14-03-1972	NONE	
US 5090053	A	25-02-1992	NONE	
US 5599290	A	04-02-1997	AT 162049 T AT 197118 T AU 686065 B2 AU 1666697 A AU 679197 B2 AU 5671194 A CA 2147878 A1 DE 69316390 D1 DE 69316390 T2 DE 69329601 D1 DE 69329601 T2 DK 669811 T3 DK 797933 T3 EP 0669811 A1 EP 0797933 A2 ES 2112515 T3 ES 2152623 T3 JP 8503526 T WO 9412066 A1 US 5545128 A	15-01-1998 15-11-2000 29-01-1998 12-06-1997 26-06-1997 22-06-1994 09-06-1994 19-02-1998 10-06-1998 30-11-2000 17-05-2001 25-05-1998 27-12-2000 06-09-1995 01-10-1997 01-04-1998 01-02-2001 16-04-1996 09-06-1994 13-08-1996
WO 0069293	A	23-11-2000	AU 5082400 A CA 2373535 A1 EP 1178743 A1 WO 0069293 A1 GB 2349798 A JP 2002544405 T	05-12-2000 23-11-2000 13-02-2002 23-11-2000 15-11-2000 24-12-2002
US 3864181	A	04-02-1975	FR 2188611 A5 JP 49032966 A	18-01-1974 26-03-1974
WO 0016652	A	30-03-2000	US 5920915 A US 6032300 A US 6301722 B1 AU 6156599 A AU 6257499 A US 2002090504 A1 WO 0016651 A1 WO 0016652 A1 US 6055676 A US 6098209 A US 6357054 B1	13-07-1999 07-03-2000 16-10-2001 10-04-2000 10-04-2000 11-07-2002 30-03-2000 30-03-2000 02-05-2000 08-08-2000 19-03-2002
JP 2000045118	A	15-02-2000	NONE	
US 4905320	A	06-03-1990	NONE	
DE 8524366	U	06-04-1989	DE 8524366 U1	06-04-1989

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 02/04209

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0941751 A	15-09-1999	EP 0941751 A2	15-09-1999
US 3513842 A	26-05-1970	NONE	
US 3676288 A	11-07-1972	CA 956524 A1	22-10-1974