

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
5 February 2004 (05.02.2004)

PCT

(10) International Publication Number
WO 2004/011331 A1

(51) International Patent Classification⁷: **B64D 9/00**,
B60P 7/08

Regis, Dorset DT7 3SE (GB). **STARTUP, John, William**
[GB/GB]; 10 Sycamore Drive, Crewkerne, Somerset TA18
7BT (GB).

(21) International Application Number:
PCT/GB2003/003169

(74) Agent: **NEWSTEAD, Michael, John**; Page Hargrave,
Southgate, Whitefriars, Lewins Mead, Bristol BS1 2NT
(GB).

(22) International Filing Date: 23 July 2003 (23.07.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0217423.3 26 July 2002 (26.07.2002) GB

(81) Designated States (*national*): AE, AG, AL, AM, AT (util-
ity model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,
CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (util-
ity model), DE, DK (utility model), DK, DM, DZ, EC, EE
(utility model), EE, ES, FI (utility model), 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, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO,
RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA,
ZM, ZW.

(71) Applicant (*for all designated States except US*): **AMSAFE
BRIDPORT LIMITED** [GB/GB]; The Court, Bridport,
Dorset DT6 3QU (GB).

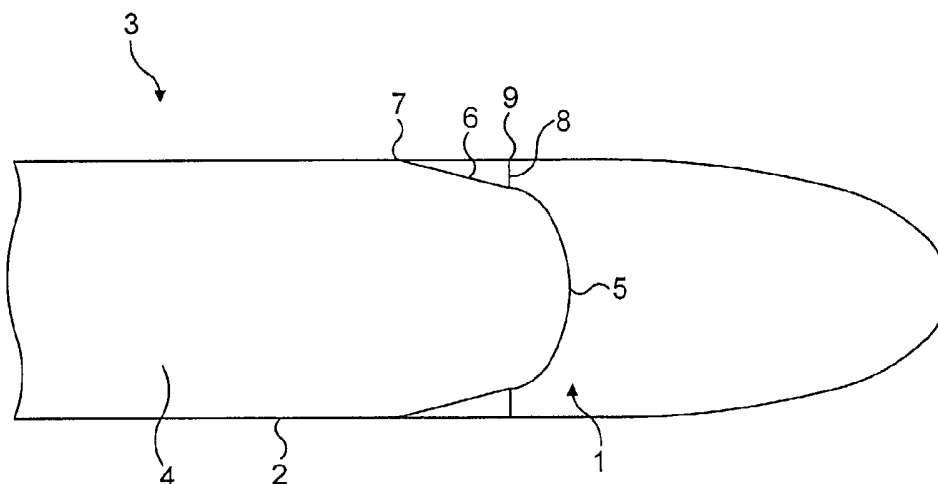
(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **ACKERMAN,
David** [GB/GB]; 8 Glebefield, Bradford Peverell, Dorch-
ester, Dorset DT2 9SS (GB). **CARDEN, Stephen, Robert**
[GB/GB]; Sispara, Greenhayes, Shipton Gorge, Bridport,
Dorset DT6 4LU (GB). **TRAFFORD, Stephen, Mark**
[GB/GB]; Quarry Pond House, Venlake, Uplyme, Lyme

(84) Designated States (*regional*): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,
ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO,
SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM,
GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: BARRIER NET



(57) Abstract: A barrier net (1) across a space defined by the fuselage (2) of an aircraft (3) and a floor (4) of the aircraft comprising a plurality of intersecting net members (5), at least some of the members (5) being: (i) attached to the fuselage (2) by attachment means (6) attached to attachment points (7) on the fuselage (2) of the aircraft (3); and (ii) held forward of the attachment points (7) so that a major portion of the net (1) is in a plane further forward than the attachment points (7).

**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, 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, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE,

DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designation US

Published:

- with international search report

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.

-1-

BARRIER NET

5 The present invention relates to a barrier net across a space defined by the fuselage of an aircraft, for example for restraining the movement of cargo in the fuselage of an aircraft.

Barrier nets formed from webbing or rope type textile elements are commonly used to act as emergency restraints for the payload on freighter aircraft in the event of an emergency landing. Typically, they have to restrain a forward loading based on the
10 payload mass multiplied by a 9g forward acting inertial factor. This generates extremely large forces within the barrier net, which, in turn, are transmitted into the aircraft structure to which the barrier net attaches.

It is in the nature of textiles, that loads can only be transmitted by way of tensile forces
15 along the elements, because these have no strength in shear or compression. In order for an element to react to a loading imposed at right angles to it, as the initial loading on a barrier net would be, it must deflect in the direction of the applied load such that, at equilibrium, the summation of the forward load components of the tension loads in the net at each attachment equals the applied load. Clearly, the more a net deflects, the
20 closer the elements at the attachments will rotate to approach the direction of the applied load and the lower the tension in those elements would have to be for a given forward load component; the tension being equivalent to the load vector tangential to the net member at the attachment. This would translate into a design philosophy to allow for as much deflection as possible in order to keep the internal tensions in the net as low as
25 possible, thus requiring lower strength elements, which would generally mean that less material need be used, leading to a lighter and cheaper product.

However, operational and space constraints on the aircraft normally dictate that barrier net deflections must be kept as small as possible, thus conflicting with the above
30 philosophy. Unfortunately, restricting the deflection of the barrier net not only implies a heavier net, or the use of more sophisticated 'low elongation' materials, but it also increases the radial components of the tension loads at the attachments, which then take on an increasing significance. In addition to restricting the allowable net deflection, the

-2-

aircraft manufacturer may also impose a radial load limit on the attachments. Often, it is extremely difficult to balance these conflicting requirements in the net design.

5 It is an object of the present invention to go at least some way towards overcoming the disadvantages of the prior art devices, or at least to provide an acceptable alternative to the prior art devices.

10 According to the present invention there is provided a barrier net across a space defined by the fuselage of an aircraft comprising a plurality of intersecting net members and capable of restraining a load up to a maximum amount, at least some of the members being:

15 (i) attached to the fuselage by attachment means attached to attachment points on the fuselage; and

(ii) held to the fuselage forward of their respective attachment points by holding means so that a major portion of the net is in a plane further forward than the attachment points, the arrangement being such that said holding means will not break away from the fuselage in the event of a load on said net up to said maximum amount.

20 This has the effect of modifying the net profile, as it allows the net members at the attachment points to lie more in line with the forward direction of the applied load and, as outlined above, have a lower tension under loading and impose a lower radial load component on the attachments.

The said maximum amount is the maximum load which the net is designed to withstand, either because of restrictions on the loading which the net members can withstand or because of restrictions on the radial load at the attachment points.

30 It is preferred that the holding means comprises further attachment means, provided for at least some of the net members, attached to further attachment points on the fuselage located forward of the first-mentioned attachment points. The further attachment points

should be sufficiently strong such that they will not break away from the fuselage in the event of a load on the net up to the maximum amount.

5 This has the effect of sharing the attachment loads between frames and, thus, keeping any potentially high radial load components to manageable levels.

When the holding means comprises the use of further attachment means it is preferred that at least some of the further attachment means comprise shackles and more preferred that at least some of the further attachment means comprise quick release fastenings.

10

In an alternative embodiment of the present invention the holding means may comprise fixed length members located on the fuselage forward of the first-mentioned attachment points and adapted to engage at least some of the net members. The further attachment points should be sufficiently strong such that they will not break away from the fuselage in the event of a load on the net up to the maximum amount.

15

The fixed length members may be either fixed length material straps or they may be fixed length rigid rod members.

20 It is preferred that the fixed length members have openings through which the net members pass. This configuration allows the further attachment point to act as a free running interface. The net profile is altered as in the first embodiment but the net member is not physically attached to the further attachment point, rather it is simply "held" in the forward plane. This enables the net member to slide freely through the further attachment points unhindered.

25

It is preferred that at least some of the first-mentioned attachment means comprise shackles and more preferred that at least some of the first mentioned attachment means comprise quick release fastenings.

30

The net members may suitably be constructed from lengths of textile webbing, rope, plastics fibre material, metallic fibre cables or a combination thereof.

-4-

For a better understanding of the present invention, reference will now be made to the accompanying drawings showing, by way of example, two examples of the present invention, in which:

5 Fig. 1 is a schematic representation of an overhead view of one embodiment of a loaded barrier net according to the present invention; and

Fig. 2 is a view of a forward attachment point of a second embodiment of a barrier net according to the present invention.

10

In the drawings like or equivalent parts are referenced with the same reference numerals.

Fig. 1 shows a schematic representation of an overhead view of one embodiment of a loaded barrier net 1 according to the present invention. This shows the profile of the barrier net 1 under the loading of a typical payload. The configuration of the barrier net 1 may be one of a number as known in the art. For example, the barrier net 1 may be in the form of a rectangular grid net, a "spider web" configuration or in the form of a "diamond grid" net as described in UK Patent Application No. 0201752.3.

20 The barrier net 1 is rigged across the space defined by the fuselage 2 of an aircraft 3 and a floor 4 of the aircraft 3. The barrier net 1 comprises a plurality of intersecting net members 5 (only one shown) having first attachment means 6 at each end attached to first attachment points 7 on the fuselage 2. The first attachment means 6 comprises a length of net material and a securing means e.g. a shackle (not shown). It is not
25 necessary for the first attachment means 6 to be made of the same material as the net member and it may conveniently be an additional length of material attached to the net member by suitable means or a rigid member attached to the net member by suitable means.

30 The net member 5 additionally comprises further attachment means 8 attached to further attachment points 9 located further forward in the fuselage 2 than the first attachment points 7. The further attachment means 8 comprises a length of net material, which may or may not be the same material as the net member 5, and a securing means e.g. a

-5-

shackle (not shown). As with the first attachment means 6, the further attachment means 8 may also be a rigid member attached to the net member 5 by suitable means. The lengths of the first attachment means 6 and the further attachment means 8 can be adjusted in order to control the forward and radial components of the load vector to ensure that they remain within certain predetermined values.

The result of the further attachment means 8 being attached to the further attachment points 9 is that the profile of the barrier net 1 is modified as compared to that of a conventional barrier net. The profile of the first attachment means 6 is modified to lie more in line with the forward direction of the applied load and the major portion of the barrier net 1 is in a plane further forward than the first attachment points 7. This results in a lower tension in the first attachment means 6 and the further attachment means 8 for a given forward load as compared with the tension experienced in a single attachment means such as is known in the art.

Fig. 2 shows an alternative embodiment of the further attachment means 8. The further attachment means 8 comprises a fixed length member 10 attached to the aircraft fuselage 2 at a point forward of the first mentioned attachment points 7 (not shown) and which supports a ring member 11 at its free end. The fixed length member 10 may be either a fixed length of material or it may be a fixed length rigid member. The fixed length member 10 is securely anchored on the fuselage 2.

The net member 5 extends across the space defined by the fuselage 2 and the floor 4 and engages with the ring member 11 of the further attachment means 8. The net member 5 passes through the ring member 11 and is attached to the first attachment point 7 (not shown) as before. This has the effect of modifying the net profile but also enables the further attachment means 8 to act as a free running interface through which the net member 5 may slide in use.

30

CLAIMS

1. A barrier net across a space defined by the fuselage of an aircraft comprising a plurality of intersecting net members and capable of restraining a load up to a maximum amount, at least some of the members being:
- 5
- (i) attached to the fuselage by attachment means attached to attachment points on the fuselage; and
- 10
- (ii) held to the fuselage forward of their respective attachment points by holding means so that a major portion of the net is in a plane further forward than the attachment points, the arrangement being such that said holding means will not break away from the fuselage in the event of a load on said net up to said maximum amount.
- 15
2. A barrier net according to claim 1, wherein the holding means comprises further attachment means, provided for at least some of the net members, attached to further attachment points located forward of the first-mentioned attachment points.
- 20
3. A barrier net according to claim 2, wherein at least some of the further attachment means comprise shackles which engage with the further attachment points.
4. A barrier net according to claim 2 or claim 3, wherein at least some of the further attachment means comprise quick release fastenings.
- 25
5. A barrier net according to any preceding claim, wherein the holding means comprises fixed length members located on the fuselage forward of the first-mentioned attachment points adapted to engage at least some of the net members.
- 30
6. A barrier net according to claim 5, wherein each of the fixed length members comprises a rigid rod.

-7-

7. A barrier net according to claim 5 or claim 6, wherein each of the fixed length members has an opening through which the net member passes.

5 8. A barrier net according to any preceding claim, wherein at least some of the first-mentioned attachment means comprise shackles which engage with first-mentioned attachment points.

9. A barrier net according to any preceding claim, wherein at least some of the first-mentioned attachment means comprise quick release fastenings.

10

10. A barrier net according to any preceding claim, wherein at least some of the plurality of net members comprise lengths of textile webbing.

11. A barrier net according to any preceding claim, wherein at least some of the plurality of net members comprise lengths of rope.

15

12. A barrier net according to any preceding claim, wherein at least some of the net members comprise lengths of plastics fibre material.

13. A barrier net according to any preceding claim, wherein at least some of the net members comprise lengths of metallic fibre cables.

20

14. A barrier net substantially as hereinbefore described with reference to the accompanying drawings.

25

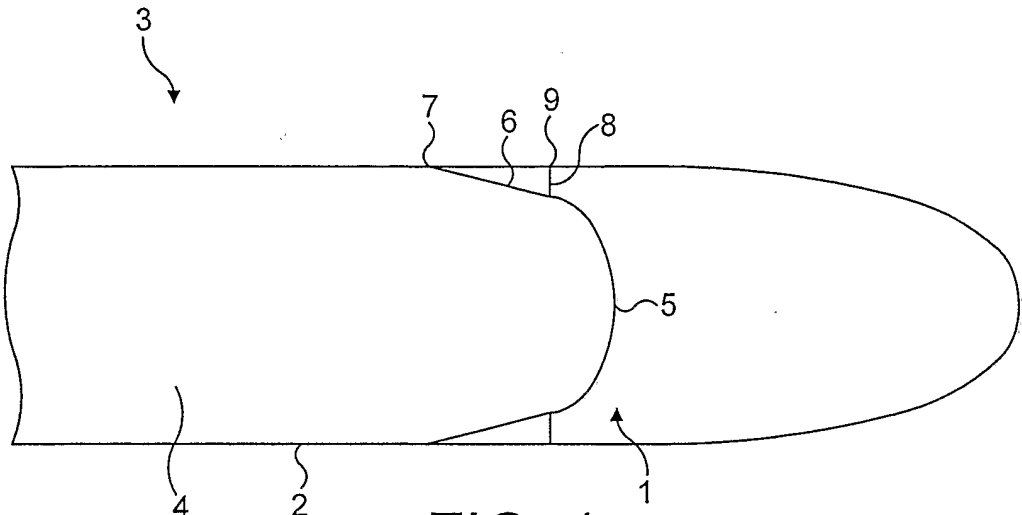


FIG. 1

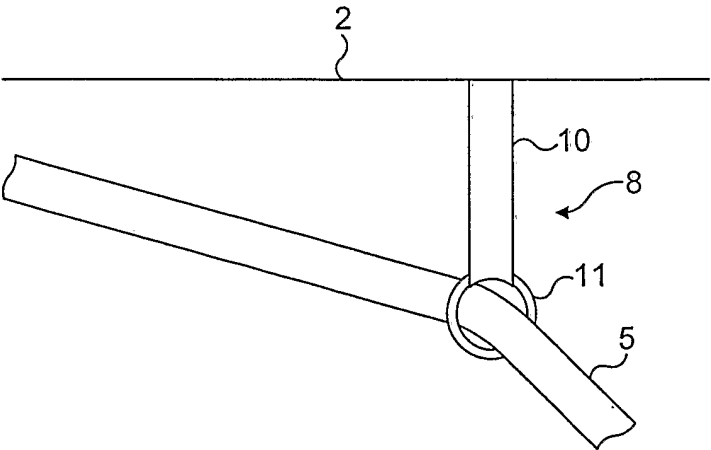


FIG. 2

INTERNATIONAL SEARCH REPORT

Application No

PCT/GB 03/03169

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 B64D9/00 B60P7/08

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 B64D B60P

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 915 652 A (CALDWELL FRANK ET AL) 29 June 1999 (1999-06-29) the whole document ---	1-13
A	US 6 244 803 B1 (PARISH JAMES M ET AL) 12 June 2001 (2001-06-12) the whole document ---	1-13
A	US 3 486 723 A (HARRISON OLLIE R) 30 December 1969 (1969-12-30) the whole document -----	1-13

☐ 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

1 October 2003

Date of mailing of the international search report

10/10/2003

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

Pedersen, K

INTERNATIONAL SEARCH REPORT

international application No.
PCT/GB 03/03169

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.: 14
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:
see FURTHER INFORMATION sheet PCT/ISA/210
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:

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 14

Dependent claim 14 consists exclusively of an unallowable (Rule 6.2(a) PCT) and vague reference to the drawings and contains no additional technical features in the sense of Rule 6.3(a) and 6.4(a) PCT. Consequently it is unclear in its entirety and not possible to search.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

Application No

PCT/GB 03/03169

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 5915652	A	29-06-1999	NONE	
US 6244803	B1	12-06-2001	NONE	
US 3486723	A	30-12-1969	NONE	