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[Continued on next page]

(54) Title: A FIRE-RESISTING PANEL

(57) Abstract: A panel [1] has a relatively thin support structure [5] with a relatively thick insulation layer [6] adhered to it. The support structure [5] has a support panel [2] which is an aluminium honeycomb core which is faced on its sides with a fibre reinforced plastic sheets [3] and [4]. A layer of metal foil is adhered to the reverse side of the support structure [5]. The insulation layer [6] is protected by a barrier [7] which has low-flame spread characteristics. Gaps between adjacent panels [1] are sealed by using cover strips [10]. Each cover strip [10] is a channel [8] which is filled with insulating material [9].

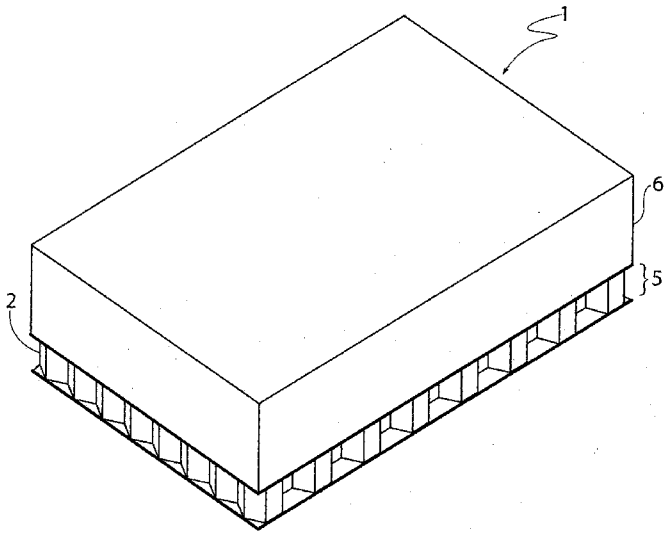

Figure 1

WO 2013/120148 A1

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

A Fire-Resisting Panel

Field of the invention

The present invention relates to fire-resisting panels. It particularly relates to panels which are suitable for lining the deckheads and bulkheads of vehicle/cargo decks, machinery spaces, aircraft hangers, accommodation spaces, equipment spaces, storage spaces and dangerous/hazardous goods spaces of aluminium, steel and composite ships.

Background of the invention

It is known to use fire-resisting composite panels which are a composite a support panel and a combustible, intumescing (expanding), and relatively thin layer of insulation to provide thermal resistance. On exposure to heat, the intumescing material expands, retarding heat transfer. The expansion of the intumescing material on adjacent panels also operates to seal gaps between those panels.

This intumescing insulation is combustible because it includes latex binder, which is essential for keeping the insulation together in its dormant state (prior to the application of heat). This insulation is not rated as "non-combustible" when tested to ISO (International Organization for Standardization) standard 1182 (*Reaction to Fire Tests for Products -- Non-Combustibility Test*). Failure to meet that non-combustibility test limits the range of sea-going vessels in which it may be used.

Summary of the invention

In contrast, in one aspect, the present invention provides a fire-resisting panel which comprises:

a relatively thin support structure; with

a relatively thick, non-intumescing, insulation layer adhered to it.

It is preferred that the support structure comprises a support panel which is faced on each side with a fibre reinforced plastic sheet.

It is preferred that the support structure comprises a honeycomb core.

It is preferred that the honeycomb core is aluminium.

It is preferred that the insulation layer comprises inorganic insulation materials with a binder. It is also preferred that the binder is organic.

It is preferred that the insulation layer is in the range of 20mm to 30mm thick. It is particularly preferred that the insulation layer is approximately 25mm thick.

It is preferred that the fire-resisting panel has been formed by a process in which the insulation layer is adhered to the support structure by applying the insulation layer to an uncured fibre reinforced plastic sheet and then curing the composite panel with heat and under pressure.

It is preferred that a layer of metal foil is adhered to the face of the support structure remote from the insulation layer.

It is preferred that the insulation layer has a low-flame spread barrier adhered to it.

In another aspect, the present invention provides fire-resisting cover strip comprising a channel containing non-intumescing insulation material.

Brief description of the drawings

For a better understanding of the invention, and to show how it may be carried into effect, embodiments of it are shown, by way of non-limiting example only, in the accompanying drawings. In the drawings:

figure 1 is an orthographic projection illustrating a portion of a panel according to a preferred embodiment of the present invention;

figure 2 is a cross-sectional view of the panel of figure 1;

figure 3 is an orthographic projection, partially cut away, illustrating aspects of the manufacture of the panel of figure 1; and

figure 4 is a cross-sectional view, illustrating aspects of the use of the panel of figure 1.

Description of preferred embodiments of the invention

As is most clearly shown in figure 3 a panel 1 according to a preferred embodiment of the invention comprises a relatively thin support structure 5 with a relatively thick insulation layer 6 adhered to it. The support structure 5 comprises a support panel 2 which is an aluminium honeycomb core which is faced on one side with a fibre reinforced plastic sheet 3 and on the other side with another fibre reinforced plastic sheet 4. The support panel 2 is approximately, but not limited to, 10mm thick. The thickness of the support panels is chosen depending on the level of stiffness/strength required.

The insulation layer 6 comprises inorganic insulation materials with an organic binder. A preferred material for the insulation layer 6 is an alkaline earth silicate paper comprising soluble fibre, perlite and organic binder and having a nominal density of about 88kg/m^3. A suitable material is the "Unifrax FyreWrap Marine Board" product of Unifrax Corporation, of Niagara Falls, NY, USA. The thickness of the insulation layer 6 is approximately, but not limited to, 25mm. The thickness of the insulation layer 6 is chosen, depending on the level of fire resistance required. The insulation layer 6 is adhered to the support structure 5 by applying the insulation panel to the uncured fibre reinforced plastic sheet 4, and then curing the composite panel 1 with heat and under pressure.

It is preferred that a layer of metal foil (which is not illustrated in the drawings) is adhered to the reverse side of the support structure 5.

The insulation layer 6 is typically protected by a barrier 7 which has low-flame spread characteristics. This barrier 7 can either be adhered by an additional layer of adhesive, applied between the insulation layer 6 and the barrier. Alternatively, the barrier 7 may have a pre-existing layer of adhesive, in which case it is directly applied to the insulation layer 6. The composite panels 1 are typically sized so that they are installed in a panel grid of 2400mm x 1200mm (8 feet x 4 feet) centres. 2400mm x 1200mm has been chosen as it is a standard commercial size for wood and metal sheet. Ships are typically constructed with 1200mm frames, so panels that are sized 2400mm x 1200mm will generally line up with these frames.

A is illustrated in figure 4, gaps between adjacent panels 1 are sealed by using cover strips 10. Each cover strip 10 comprises a longitudinally-extending channel 8 which has a broad "U-shaped" cross-section, the cross-section being filled with insulating material 9. The insulating material 9 is preferably of the same composition as is the insulation layer 6. Cover strips 10 are manufactured from metal, typically stainless steel of 0.4 to 0.55mm thickness. Strips of steel are roll formed to create a profile which stiffens the section of steel, and has a section for receipt of insulation. The cover strip 10 is typically manufactured in two different lengths, 'long' typically 2305mm end to end, and "short" typically 1110mm end to end. Insulation is installed into the cover strips, which is typically 12 to 36mm thick.

Cover strips are installed below the corresponding mounting channel 12, and cover the edge of one composite panel 1, the exposed section of channel 12, and the edge of the adjacent composite panel 1. The cover strips are fixed into place typically with machine screws 11, which are inserted through hole/s in the cover strips and screwed into the threaded insert in the channel. Each cover strip 10 is held in place by a series of bolts or other fasteners 11 which attach to mounting framework 12 and which hold the cover strip in place. The machine screws 11 operate to compress the insulation 9 against the panel 1 to create a fire seal.

While the present invention has been described with reference to a few specific embodiments, the description is illustrative of the invention and is not to be construed as limiting the invention. Various modifications may occur to those skilled in the art without departing from the true spirit and scope of the invention as defined by the appended claims.

A reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that the referenced prior art forms part of the common general knowledge, in Australia or elsewhere.

Throughout this specification, the words "comprise", "comprised", "comprising" and "comprises" are to be taken to specify the presence of stated features,

integers, steps or components but does not preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

In the claims, each dependent claim is to be read as being within the scope of its parent claim or claims, in the sense that a dependent claim is not to be interpreted as infringed unless its parent claims are also infringed.

The claims defining the invention are as follows:

1. A fire-resisting panel which comprises:

   a relatively thin support structure; with

   a relatively thick, non-intumescing, insulation layer adhered to it.

2. A fire-resisting panel as claimed in claim 1, in which the support structure comprises a support panel which is faced on each side with a fibre reinforced plastic sheet.

3. A fire-resisting panel as claimed in claim 2, in which the support structure comprises a honeycomb core.

4. A fire-resisting panel as claimed in claim 3, in which the honeycomb core is aluminium.

5. A fire-resisting panel as claimed in any one of the preceding claims, in which the insulation layer comprises inorganic insulation materials with a binder.

6. A fire-resisting panel as claimed in claim 5, in which the binder is organic.

7. A fire-resisting panel as claimed in any one of the preceding claims, in which the insulation layer is in the range of 20mm to 30mm thick.

8. A fire-resisting panel as claimed in claim 7, in which the insulation layer is approximately 25mm thick.

9. A fire-resisting panel as claimed in any one of the preceding claims, which has been formed by a process in which the insulation layer is adhered to the support structure by applying the insulation layer to an uncured fibre reinforced plastic sheet and then curing the composite panel with heat and under pressure.

10. A fire-resisting panel as claimed in any one of the preceding claims, in which a layer of metal foil is adhered to the face of the support structure remote from the insulation layer.

11. A fire-resisting panel as claimed in any one of the preceding claims, in which the insulation layer has a low-flame spread barrier adhered to it.

12. A fire-resisting cover strip comprising a channel containing non-intumescing insulation material.

13. A fire-resisting barrier comprising at least two fire-resisting panels as claimed in any one of claims 1 to 11 mounted substantially edge to edge, in which at least one gap between adjacent panels is covered by a fire-resisting cover strip as claimed in claim 12, so that the insulation layer of each adjacent panel is in contact with the insulation material of the cover strip.

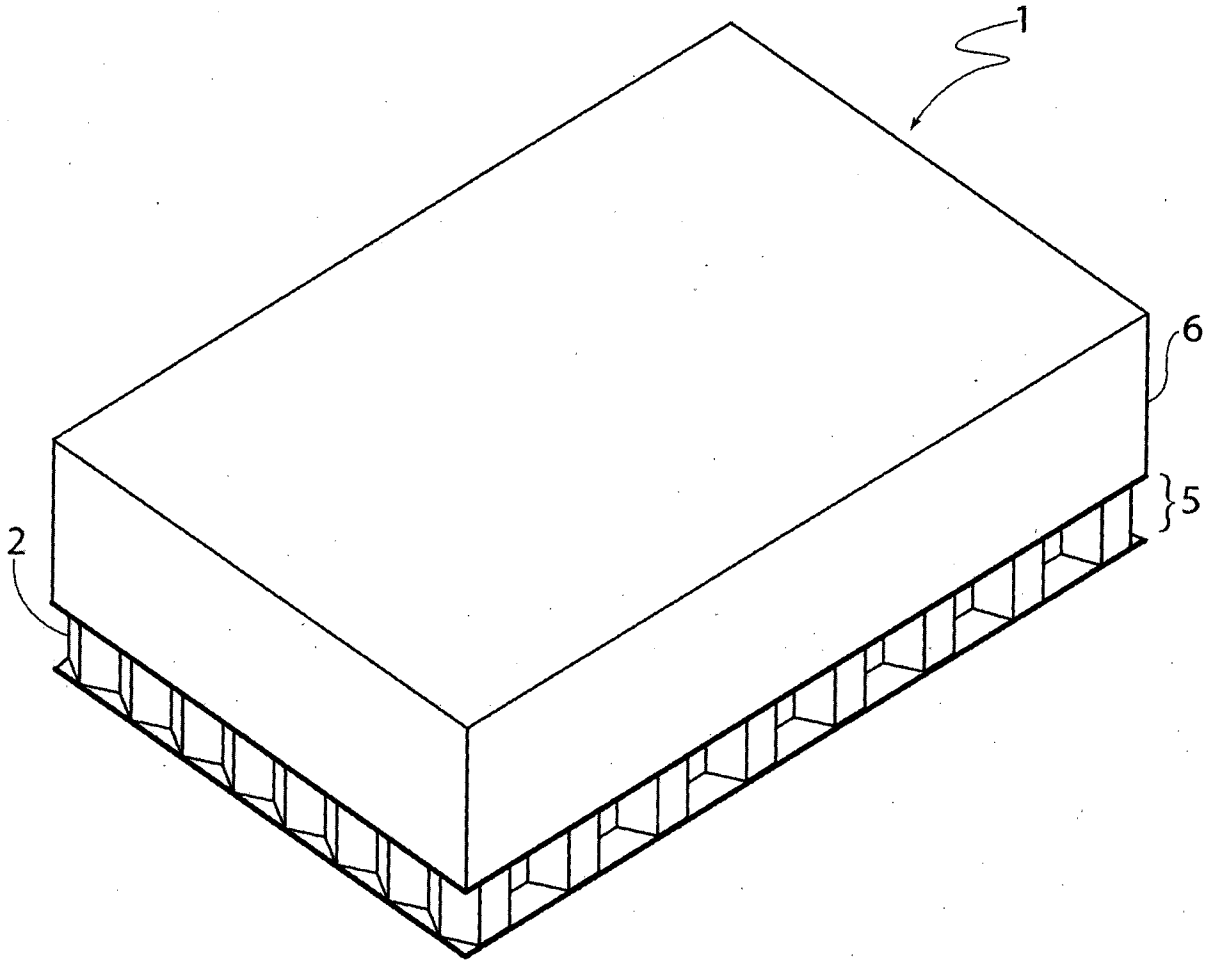

Figure 1

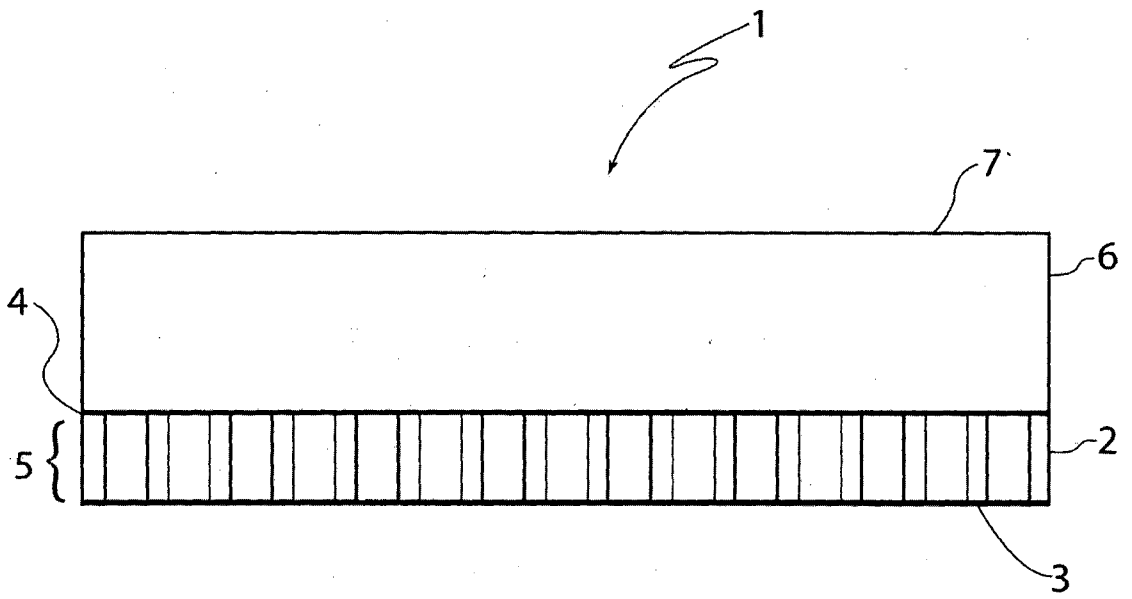

Figure 2

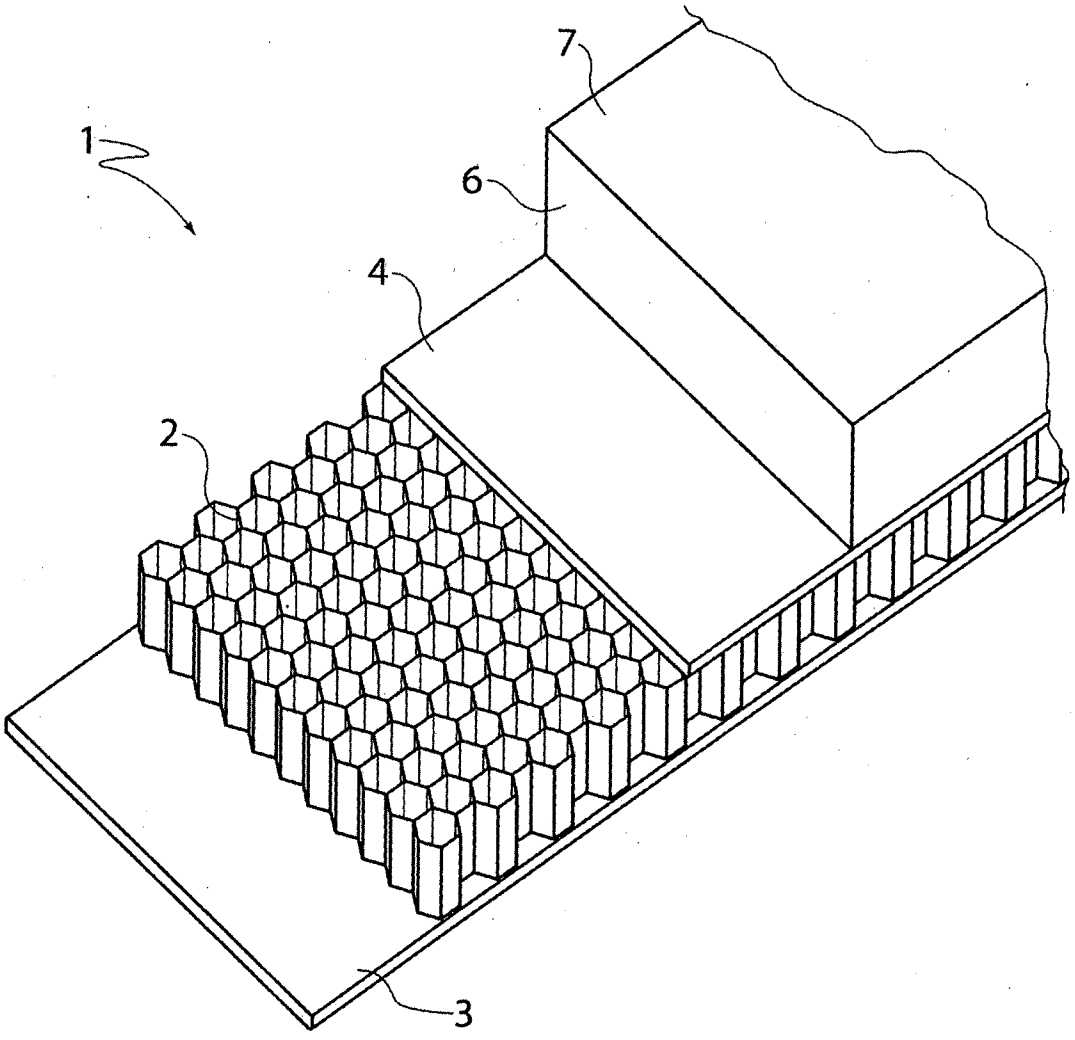

Figure 3

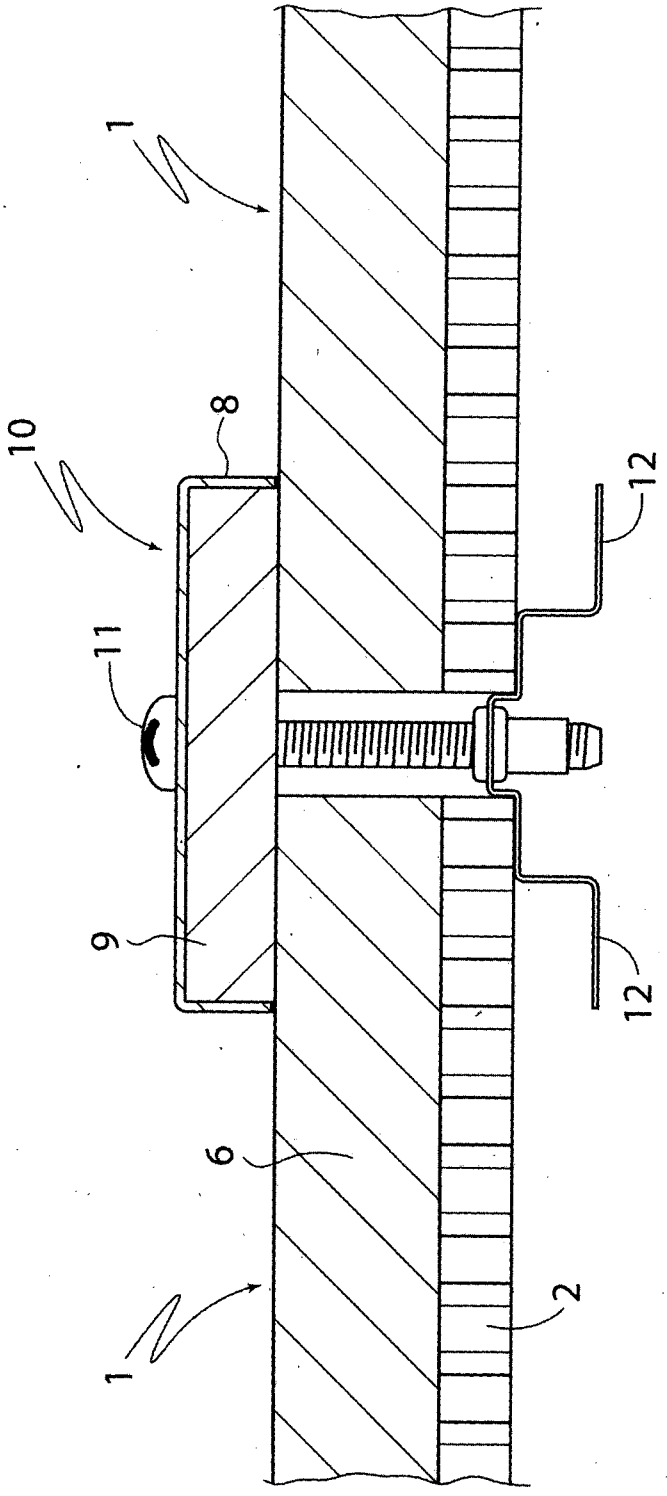

Figure 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2013/000143

A. CLASSIFICATION OF SUBJECT MATTER

E04B 1/94 (2006.01) E04B 2/74 (2006.01) E04C 2/26 (2006.01) E04B 1/80 (2006.01) E04B 1/62 (2006.01) B32B 5/18 (2006.01) B63B 3/68 (2006.01) B32B 3/12 (2006.01) B32B 19/00 (2006.01) B32B 18/00 (2006.01) A62C 3/10 (2006.01)

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)

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 practicable, search terms used)

EPODOC & WPI: IPC Marks /IC/CC E04B1/94, E04B2/74, E04C2, A62C3/10, B63B3/68, B32B3/12, B32B19, B32B1, B32B23 & Keywords: Non-intumescent, Non-combustible, Panel, Board, Sheet, Insulation, Inorganic, Flame, Fire, Resist, Proof, and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C [X] See patent family 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 application or patent 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	Date of mailing of the international search report
7 May 2013	07 May 2013

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2013/000143

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

See Supplemental Box for Details

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 additional fees, this Authority did not invite payment of additional fees.
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 and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/AU2013/000143**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 1986/06124 A1 (MORGANITE AUSTRALIA PTY. LIMITED) 23 October 1986 Abstract, Figs 1, 3 & Pages 1-5	1 & 12-13
X	US 2011/0079746 A1 (FERNANDO et al) 07 April 2011 Abstract, Fig 1 & Col 1-5	1-11
X	US 4286013 A (DAROGA et al.) 25 August 1981 Abstract, Para 1-17, 40-45, 66-67, & 86-94	1-4 & 7-11
A	US 6855393 B1 (AYRES) 15 February 2005 WHOLE DOCUMENT	

INTERNATIONAL SEARCH REPORT	International application No. PCT/AU2013/000143

Supplemental Box

Continuation of: **Box III**

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

This Authority has found that there are different inventions based on the following features that separate the claims into distinct groups:

- Claims 1-11 are directed to a fire-resisting panel . The feature of the feature of a relatively thick non-intumescing insulation layer adhered to a relatively thin support structure is specific to this group of claims.

- Claims 12 is directed to a fire resisting cover strip. The feature of the feature of a channel containing non-intumescing insulation material is specific to this group of claims.

- Claims 13 is directed to at least two fire resisting panels. The feature of the feature wherein at least one gap between two adjacent panels is covered by a fire resisting cover strip (Note that claim 13 has been considered as an independent claim solely for the purpose of clarity at it includes features of both claims 1 and 12) is specific to this group of claims.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

When there is no special technical feature common to all the claimed inventions there is no unity of invention.

In the above groups of claims, the identified features may have the potential to make a contribution over the prior art but are not common to all the claimed inventions and therefore cannot provide the required technical relationship. The only feature common to all of the claimed inventions and which provides a technical relationship among them is a non-intumescing insulation material

However it is considered that this feature is generic in this particular art. Therefore in this light this common feature cannot be a special technical feature. Hence there is no special technical feature common to all the claimed inventions and the requirements for unity of invention are consequently not satisfied *a priori* .

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/AU2013/000143**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
WO 1986/06124 A1	23 Oct 1986	AU 5692986 A	05 Nov 1986
		EP 0217875 A1	15 Apr 1987
		WO 8606124 A1	23 Oct 1986
US 2011/0079746 A1	07 Apr 2011	AU 2010301101 A1	26 Apr 2012
		CA 2775036 A1	07 Apr 2011
		CN 102985388 A	20 Mar 2013
		EP 2483485 A2	08 Aug 2012
		JP 2013509539 A	14 Mar 2013
		US 2011079746 A1	07 Apr 2011
		WO 2011040968 A2	07 Apr 2011
US 4286013 A	25 Aug 1981	US 4286013 A	25 Aug 1981
US 6855393 B1	15 Feb 2005	AU 5200200 A	09 Jan 2001
		AU 2000252002 B2	10 Jun 2004
		US 6855393 B1	15 Feb 2005
		WO 0078547 A1	28 Dec 2000

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.