(12) UK Patent Application (19) GB (11) 2 457 588 (13) A

(43) Date of A Publication 26.08.2009

(21) Application No: 0902862.2

(22) Date of Filing: 20.02.2009

(30) Priority Data:
(31) 0803349 (32) 25.02.2008 (33) GB

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(51) INT CL:
E04B 1/348 (2006.01) ***E04C 3/12*** (2006.01)
E04C 3/29 (2006.01)

(56) Documents Cited:
GB 2429217 A **GB 2418437 A**
GB 2404205 A **WO 2005/017276 A1**
US 6035594 A **US 5189860 A**
US 4677806 A

(58) Field of Search:
INT CL **B27N, E04B, E04C**
Other: **EPODOC; WPI; TXTE; TXTG; TXTF**

(54) Abstract Title: **Rib Frames**

(57) A rib frame 11 having beams 12 joined at corners 13 of the frame 11, at least one beam 12 being a composite of wood and oriented strand board (OSB) and at least one corner 13 being a composite of wood and a reinforcing material.

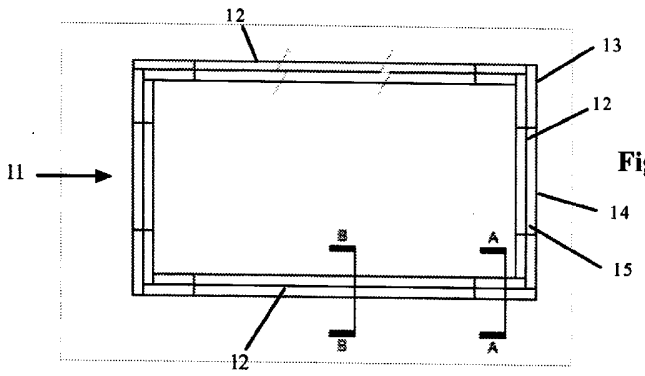

Fig 1

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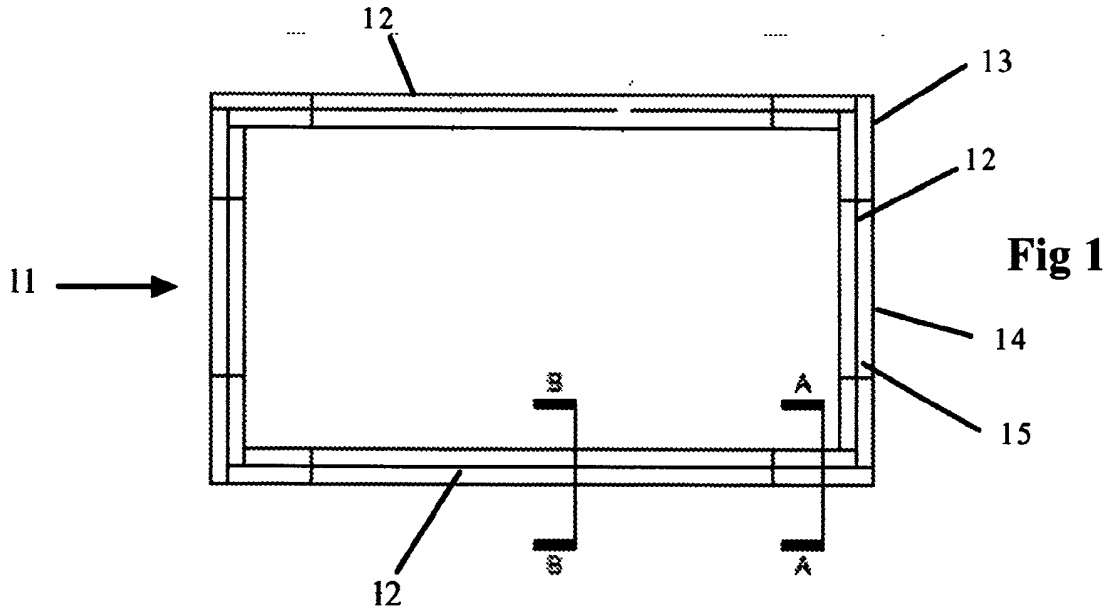

Fig 1

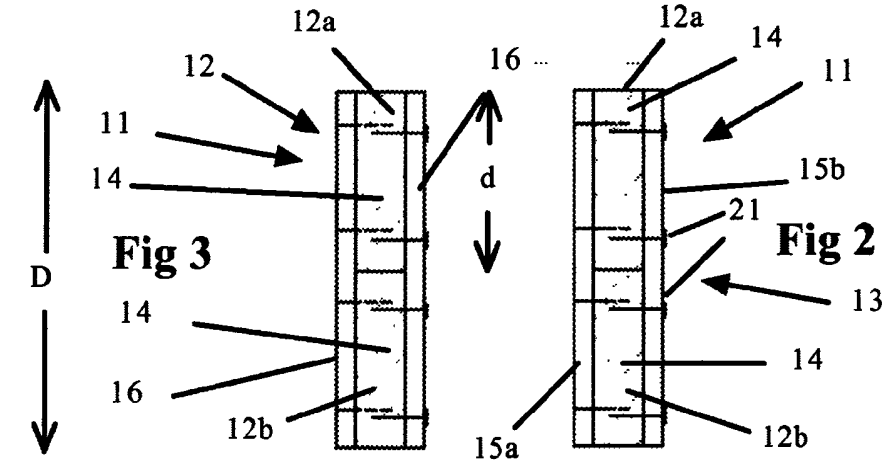

Fig 3

Fig 2

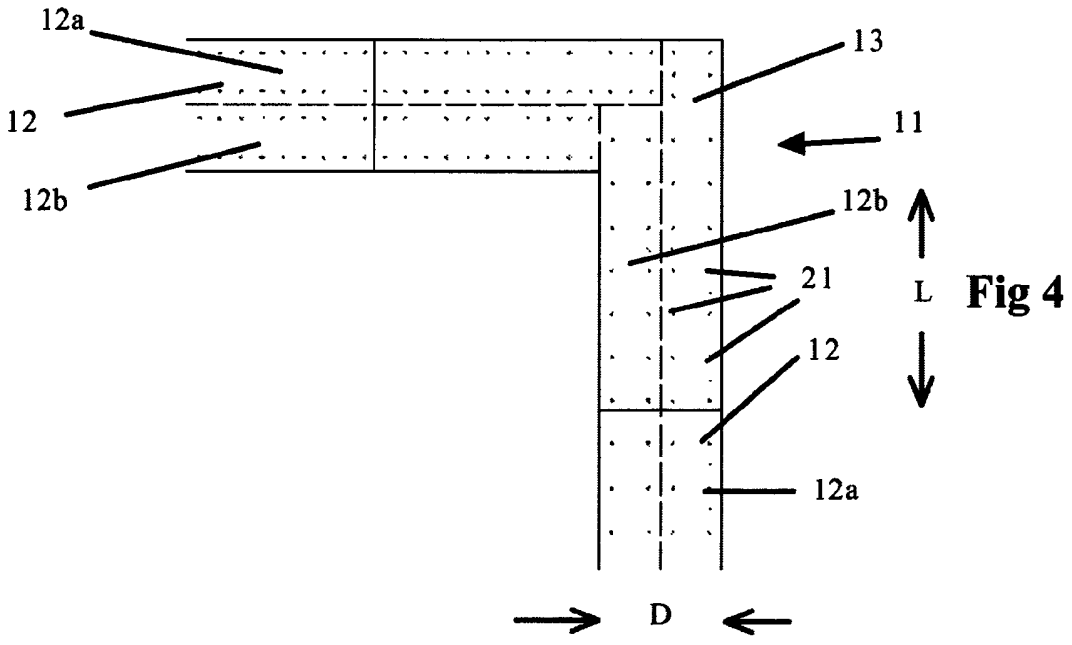

Fig 4

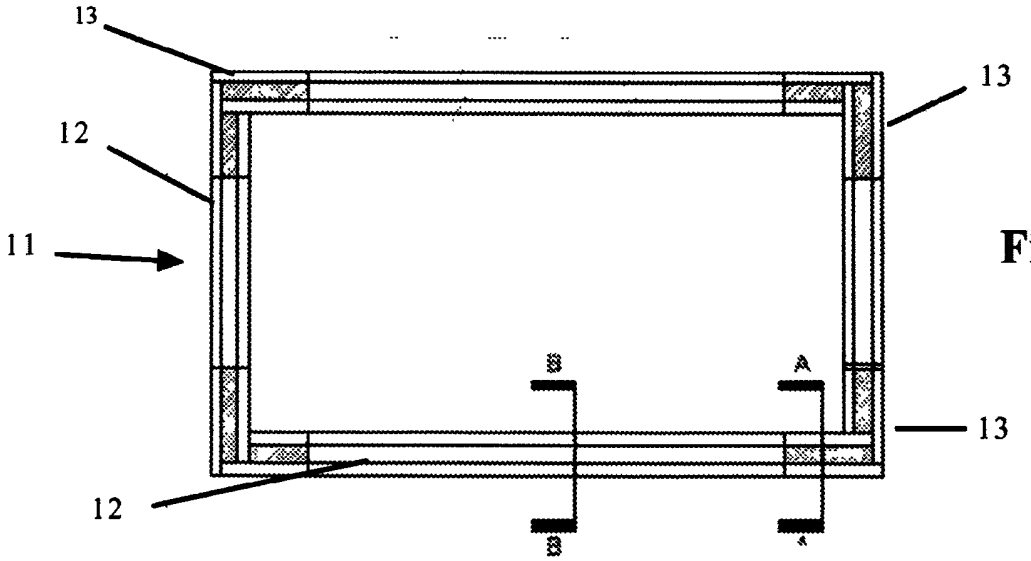

Fig 5

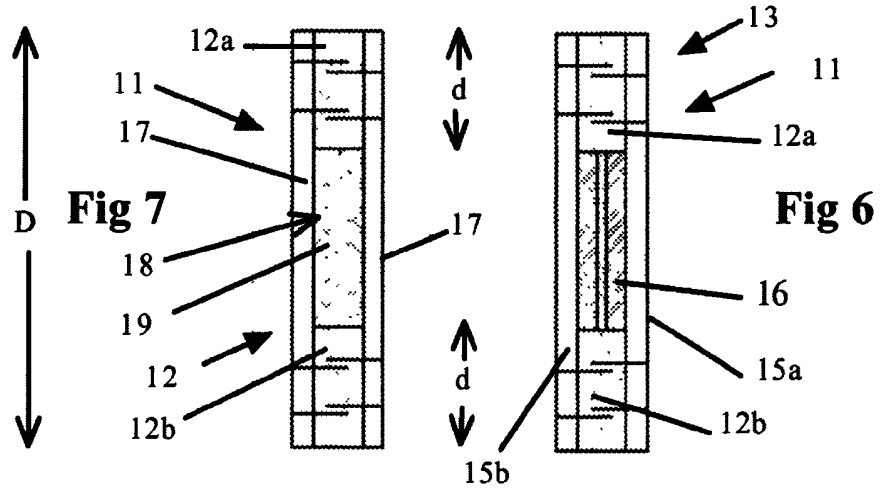

Fig 7

Fig 6

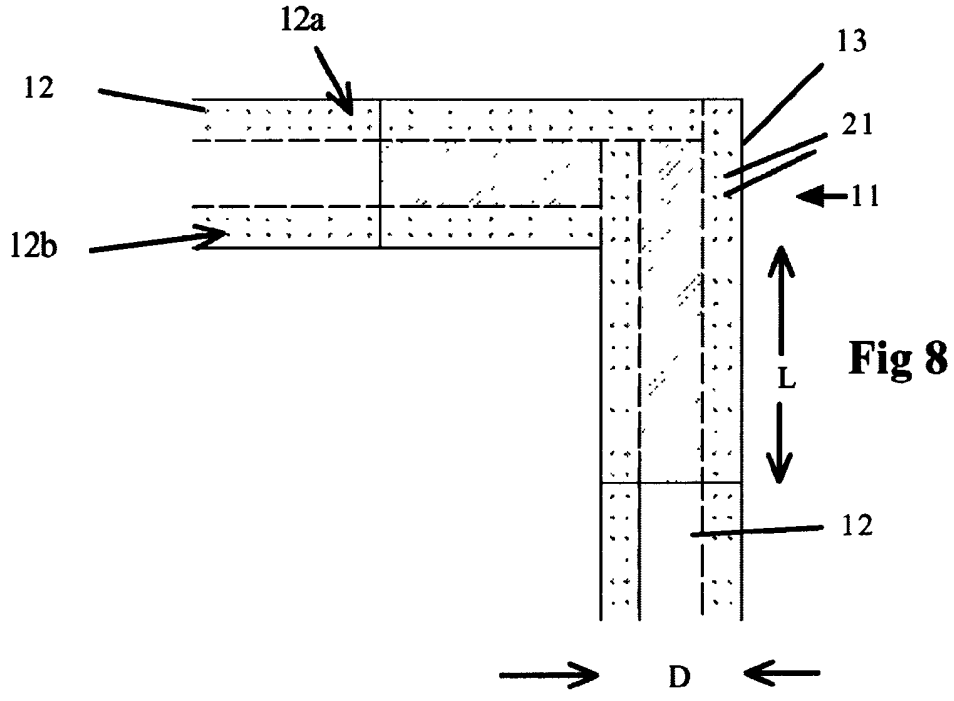

Fig 8

Rib Frames

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This invention relates to rib frames.

Rib frame construction for quickly-constructed buildings, such as residences, apartment houses, temporary housing, care homes and other single-storey or multi-storey buildings, is described in GB2404205 and GB2418437.

A rib frame structure, as therein described, comprises a plurality of rib frames, which are connected together by corner members so as to produce a tubular rib-frame structure. A plurality of such structures can be joined by coupling means at opposed corner members to form a construction.

GB2404205 and GB2418437 disclose rib frames made by fixing a pair of frame plates of substantially the same size and shape integrally across a specified spacing to allow insertion of linking plates between the frame plates. Multiple such rib frames may then be arrayed at specified spacing in a longitudinal (of the eventual structure) direction, and inner and/or outer wall boarding fixed to the inner and/or outer side of each rib frame, to form tubular rib frame structures. These structures can then be connected together in a variety of ways as described in GB2404205 and GB2418437.

Rib frame structures have numerous advantages over traditional methods of construction. The rib frames can be fabricated and inspected for quality control purposes in an indoor environment and shipped to a build site where they can be rapidly installed and incorporated into a building, so that timbers are not exposed to the elements for any length of time. Site work is substantially reduced, reducing, in turn, bad weather hold-ups and industrial accidents.

The rib frames therein disclosed have been found suitable when assembled from certain kinds of timber, such as E70 Japanese Cedar, but this is expensive, and not locally available in many regions. It is stronger than, for example, Sitka Spruce, Douglas Fir, Norway Spruce, Scots Pine, Corsica Pine and Larch, which timbers may not have adequate strength and modulus properties to meet the requirements of building codes such as Eurocode 5 (BE EN 1995-1-1:2004), particularly in regard to deflections caused by wind loads.

Such lower strength timbers, in order to be used in rib frame construction, would need to have substantially greater cross-section, which would, even if such cross-sections were commercially available, be substantially more expensive and negate much of the advantage of rib frame construction. The availability of timbers of different cross-sections is, of course, dictated by tree cross-section. This effectively rules out rib frame construction as an advantageous option for affordable wooden structures in areas where E70 Japanese cedar and like woods are not locally available.

The present invention, however, provides rib frames using such lower strength timbers in commercially available sizes that are able to meet such requirements in an economic way.

The invention comprises a rib frame having beams joined at corners of the frame, at least one beam being a composite of wood and OSB and at least one corner being a composite of the wood of the beam wood and a reinforcing material other than OSB.

Of course, all the beams and all the corners will usually be of similar construction.

OSB (oriented strand board) has been available since the 1970s, and is known principally as an inexpensive substitute for plywood, particularly in sheet form as cladding for timber frame structures. It has been proposed for structural use, particularly as web components of box beams (see particularly WO2006/17276). In order to use such beams in the construction of a building they require to be fixed to vertical support members on site and thus neither accelerate the construction process nor make it safer or more efficient. Furthermore, the junctions between the beams and the vertical support members would need to be custom designed for every situation. Corner reinforcement would extend into the space defined by resulting structure.

Directly substituting wood and OSB box beams in rib frames according to GB2404205 and GB2418437, moreover, will not meet the requirements of the relevant building codes. Using a stronger material in place of OSB, such as plywood, as a component of box beams would not yield such cost savings as would make it a commercial proposition to adopt the rib frame construction using the lower grade timbers above mentioned.

It is found, however, that by using OSB in the beams and a stronger material in the corners, rib frames using lower grade timbers can be made to conform to building codes and provide structures of adequate strength and performance.

The corner may preferably have no void space.

The reinforcing material may extend from the corner along both beams in an 'L' configuration.

The reinforcing material may comprise plywood

The reinforcing material may comprise at least two plywood components, which may be arranged with orthogonal face grain alignment. Each plywood component may have its face grain oriented substantially along one of the beams.

The reinforcing material may be in the form of facings.

The reinforcing material may comprise a metal such as steel.

The corner may contain OSB as a void infill.

The beam may comprise two depths of timber connected by OSB shear plates. The two depths of timber are contiguous or may be separated so as to form a void, which may be filled with thermal insulation.

The two depths of timber may be stepped at corners.

The corner reinforcing material may extend along the beams to twice the depth of the beams.

In one embodiment, the beam may comprise OSB sandwiched between wood facing layers. The wood may comprise a softwood, which may be a Grade C16, C18 or C24 grade timber, or it may comprise a composite or laminate, such as plywood.

A beam may comprise composite or laminate facings with an OSB filling. Where such a beam is spliced, a stronger material, such as plywood, may replace the OSB at the splice.

Frame components may be nailed together. Each nailed component may have edgewise rows of nails.

At least some components may be glued together. Glued components may be nailed together in lieu of clamping.

The invention also comprises a rib frame structure comprising rib frames according to the invention with sheathing attached. Where the rib frames comprise softwood, sheathing may be attached by driving sheathing nails into the softwood.

The invention also comprises a structure in which two rib frame structures comprising rib frames according to the invention are attached by shear connection plates which may comprise OSB, which may extend substantially the length of connected beams of rib frames.

Embodiments of rib frames according to the invention, and methods for making them, will now be described with reference to the accompanying drawings, in which:

Figure 1 is a front elevation of a first embodiment of rib frame;

Figure 2 is a section to a larger scale on the line A-A of Figure 1;

Figure 3 is a section to the same scale as Figure 2 on the line B-B of Figure 1;

Figure 4 is a view to a larger scale of part of Figure 1, showing a nailing pattern;

Figure 5 is a front elevation of a second embodiment of rib frame;

Figure 6 is a cross-section to a larger scale on the line A-A of Figure 5;

Figure 7 is a cross-section on the same scale as Figure 6 on the line B-B of Figure 5; and

Figure 8 is a view to a larger scale of part of Figure 5, showing a nailing pattern.

The drawings illustrate rib frames 11 having beams 12 joined at corners 13 of the frames 11, at least one beam 12 being a composite of wood and OSB and at least one corner 13 being a composite of wood 14 and a reinforcing material 15.

In each embodiment, the beams 12 and the corners 13 are of uniform construction.

In neither embodiment has any corner 13 a void space.

In both embodiments, the reinforcing material extends from the corners 13 along both beams 12 meeting there in an 'L' configuration. The reinforcing material 15 comprises plywood, and comprises two plywood facing layers 15a, 15b, with orthogonal face grain alignment, each plywood layer 15a, 15b having its face grain oriented substantially along one of the beams 12.

Instead of plywood, the reinforcing material could comprise a metal such as steel, but plywood will usually be found to be the most economical material having the necessary physical properties.

In the embodiment of Figures 5 to8, the corner contains OSB 16 as a void infill. The OSB 16 is in the form of a sandwich of two thick and one thin OSB plates, say two 18mm thick plates and one 9mm thick plate. This gives some limited additional corner strength

In each, the beams 12 comprise two timbers 12a, 12b connected by OSB shear plates 17. Each timber 12a, 12b has a depth d less than the depth D of the beam. In the embodiment of Figures 1 to 4, the two depths 12a, 12b of timber are contiguous, their individual depths d being one half their combined depth D, while in the embodiment of Figures 5 to 8, they are separated so as to form a void 18, which is filled with thermal insulation 19, d in this case being less than half D.

In each embodiment, the two depths 12a, 12b of timber are stepped at corners 13. In each case, the corner reinforcing material 15 extends a length L along the beams 12 equal to twice the depth D of the beams 12.

Components of the rib frames 11 are nailed together. In the nailing pattern illustrated, each nailed component has edgewise rows of nails 21. At least some components are also glued together; in particular, OSB components are both nailed and glued.

In other embodiments, not illustrated, the beam comprises OSB sandwiched between wood facing layers. The wood may comprise a softwood, which may be a Grade C16, C18 or C24 grade timber, or it may comprise a composite or laminate, such as plywood.

A beam may, on the other hand, comprise composite or laminate facings with an OSB filling. Where such a beam is spliced, a stronger material, such as plywood, may replace the OSB at the splice.

A rib frame structure as described will be sheathed. Where the rib frames comprise softwood, sheathing may be attached by driving sheathing nails into the softwood.

Where two rib frame structures comprising rib frames according to the invention are attached by shear connection plates, these may comprise OSB, which may extend substantially the length of connected beams of rib frames.

Claims:

1 A rib frame having beams joined at corners of the frame, at least one beam being a composite of wood and OSB and at least one corner being a composite of wood and a reinforcing material.

2 A rib frame according to claim 1, in which the corner has no void space.

3 A rib frame according to claim 1 or claim 2, in which the reinforcing material extends from the corner along both beams in an 'L' configuration.

4 A rib frame according to any one of claims 1 to 3, in which the reinforcing material comprises plywood

5 A rib frame according to claim 4, in which the reinforcing material comprises at least two plywood components with orthogonal face grain alignment.

6 A rib frame according to claim 5, in which each plywood layer has its face grain oriented substantially along one of the beams.

7 A rib frame according to any one of claims 1 to 6, in which the reinforcing material is in the form of facings.

8 A rib frame according to any one of claims 1 to 7, in which the reinforcing material comprises a metal such as steel.

9 A rib frame according to any one of claims 1 to 8, in which the corner contains OSB as a void infill.

10 A rib frame according to any one of claims 1 to 9, in which said beam comprises two depths of timber connected by OSB shear plates.

11 A rib frame according to claim 10, in which the two depths of timber are contiguous.

12 A rib frame according to claim 10, in which the two depths of timber are separated so as to form a void.

13 A rib frame according to claim 12, in which the void is filled with thermal insulation.

14 A rib frame according to any one of claims 10 to 13, in which the two depths of timber are stepped at corners.

15 A rib frame according to any one of claims 1 to 14, in which the corner reinforcing material extends along the beams to twice the depth of the beams.

16 A rib frame according to any one of claims 1 to 9, in which said beam comprises OSB sandwiched between wood facing layers.

17 A rib frame according to any one of claims 1 to 15, in which the wood comprises a softwood.

18 A rib frame according to claim 17, in which the softwood is a Grade C16, C18 or C24 grade timber,

19 A rib frame according to any one of claims 1 to 15, in which the wood is a composite or laminate.

20 A rib frame according to claim 19, in which the wood comprises plywood.

21 A rib frame according to any one of claims 1 to 20, in which a beam comprises composite or laminate facings with an OSB filling.

22 A rib frame according to claim 20, in which a beam is spliced, a stronger material such as plywood replacing the OSB at the splice.

23 A rib frame according to any one of claims 1 to 22, in which components are nailed together.

24 A rib frame according to claim 23, in which each nailed component has edgewise rows of nails.

25 A rib frame according to claim 23 or claim 24, in which at least some components are also glued together.

26 A rib frame according to claim 25, in which glued components are nailed together in lieu of clamping.

27 A rib frame structure comprising a rib frame according to any one of claims 1 to 26, with sheathing attached.

28 A structure according to claim 27, in which the rib frames comprise softwood, sheathing being attached by driving sheathing nails into the softwood.

29 A structure in which two rib frame structures comprising rib frames according to any one of claims 1 to 25 are attached by shear connection plates.

30 A structure according to claim 29, in which the shear plates comprise OSB.

31 A structure according to claim 30, in which OSB shear plates extend substantially the length of connected beams of rib frames.

INTELLECTUAL PROPERTY OFFICE

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Application No: GB0902862.2 **Examiner:** Jeroen Meewisse

Claims searched: 1-31 (all) **Date of search:** 20 May 2009

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-31	GB 2429217 A (GRAHAM et al.) - see claim 4; page 3, lines 15-17
Y	1-31	GB 2418437 A (BARR) - figure 3; page 6, lines 9-16; page 7, lines 7-12
Y	1-31	GB 2404205 A (BARR et al.) - see page 5, line 27- page 6, line 3; figure 3
Y	1-31	US 6035594 A (LESLIE) - column 10, lines 30-55; figures 9, 12 and 13
Y	1-31	US 5189860 A (SCOTT) - column 7, lines 13-25
Y	1-31	US 4677806 A (TUOMI) - column 5, lines 44-48
Y	1-31	WO 2005/017276 A1 (THE COURT OF NAPIER UNIVERSITY) - page 9, line 29- page 10, line 2

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X}:

Worldwide search of patent documents classified in the following areas of the IPC

B27N; E04B; E04C

The following online and other databases have been used in the preparation of this search report

EPODOC; WPI; TXTE; TXTG; TXTF

International Classification:

Subclass	Subgroup	Valid From
E04B	0001/348	01/01/2006
E04C	0003/12	01/01/2006
E04C	0003/29	01/01/2006