

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 July 2011 (28.07.2011)

PCT

(10) International Publication Number
WO 2011/089442 A1

- (51) **International Patent Classification:**
E04B 2/18 (2006.01) *E04B 2/02* (2006.01)
- (21) **International Application Number:**
PCT/GB2011/050107
- (22) **International Filing Date:**
24 January 2011 (24.01.2011)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
1001032.0 22 January 2010 (22.01.2010) GB
- (71) **Applicant (for all designated States except US):**
SPRINGAIR LIMITED [GB/GB]; Victoria House, 12
Hatherley Road, Sidcup Kent DA14 4DT (GB).
- (72) **Inventor; and**
- (75) **Inventor/Applicant (for US only):** **BLAND, Albert**
Arthur [GB/GB]; 76 High Street, Bridge, Canterbury
Kent CT4 5LA (GB).
- (74) **Agent:** **FOX-MALE, Nick**; Patent Outsourcing Limited,
1 King Street, Bakewell, Derbyshire DE45 1DZ (GB).
- (81) **Designated States (unless otherwise indicated, for every**
kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ,
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD,
SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States (unless otherwise indicated, for every**
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG,
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU,
LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,
SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
GW, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

(54) **Title:** BRICK

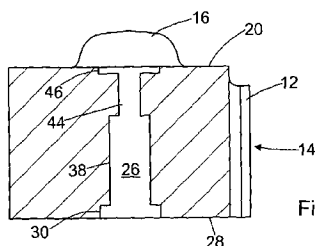


Fig. 3

(57) **Abstract:** Brick (10) has a vertical aperture (26) having: Region (30) of elliptical cross-section (32) to hold elliptical base section (34) of plug (36) fixed against axial rotation; Region (38) of circular cross-section to contain the upper, internally-threaded cylindrical sleeve (40) of plug (36), into which a rod (42) can be threadedly secured; Region (44) of circular cross-section to slidably accommodate rod (42); Region (46) of generally circular cross-section to accommodate an end portion of a wall tie (48). A number of bricks (10) are laid out lengthwise touching end-to-end, every fourth brick has a plug (36). A second course of bricks is placed over that first course in a half-bond arrangement, this being repeated for seven further courses. Rod (42) is inserted in the aligned apertures (26) and rotated until threadedly secured in plug (36).



WO 2011/089442 A1

BRICK**5 FIELD OF THE INVENTION**

The present invention relates to a brick for the assembly of a structure, to a system for the assembly of a structure, and to a method of assembling a structure.

10

BACKGROUND OF THE INVENTION

Brick-laying is a skilled profession, requiring substantial expertise which involves years
15 of training and experience.

The construction of a brick wall (whether as part of a building or merely a self-standing wall) is a slow, laborious, time-intensive and intricate operation even for a highly-experienced mastercraftsman in brick-laying, and requires many components and
20 materials, some of which (e.g mortar/cement) require mixing and then have a limited “active life” before new admixtures have to be prepared.

A brick wall is constructed from bricks held together by a cement mix applied when wet, thereafter drying to bond the bricks together. If the brick wall is later subjected to
25 an earthquake, tremor, tsunami, tornado or other major forces e.g. explosion, the mortar bonding may be substantially weakened without the wall itself collapsing. Such weakening may well not be apparent without very careful and expert examination or surveying of the structure, and yet the structure may well be very vulnerable to even a minor further force causing total collapse of the structure.

30

OBJECTIVES OF THE PRESENT INVENTION

An objective of the present invention is to provide a form of brick which allows the ready, easy and fast assembly of a structure by a person without specialist brick-laying skills.

5

Another objective of the present invention is to provide a form of brick which provides a structure which is more resistant to earthquakes, tremors, tsunamis, explosions and other major forces than conventional brick structures.

10

SUMMARY OF THE INVENTION

The present invention provides a brick for the assembly of a structure, the brick having an aperture extending between two major faces of the brick, the aperture having a plurality of regions for accommodating an elongate member to extend between a plurality of overlying bricks and for accommodating and holding an anchor for the elongate member.

15

In this way, a structure of such bricks connected by elongate members and anchors can be assembled readily, easily and quickly by unskilled labour.

20

The term "brick" is used throughout this patent specification to include bricks in all forms of building and construction, particularly but not solely house bricks, and to include building blocks of all sorts including breeze blocks and thermolite blocks.

25

Preferably, the aperture has a plurality of regions of different width, comprising a first region of a width and shape to accommodate an elongate member to extend between a plurality of courses of bricks, and comprising a second region of a width and shape to accommodate and hold an anchor for the elongate member.

30

Thus, the aperture may comprise a second region of a width and shape for accommodating and holding an anchor comprising a base plug to secure a lower section

of an elongate member, the brick having a recess shaped to prevent rotation of the base plug.

5 Additionally and/or alternatively, the aperture comprises a second region of a width and shape for accommodating and holding an anchor comprising a connecting sleeve for attachment to two elongate members.

10 In an additional form of the present invention, there is provided a brick for the assembly of a structure, the brick having an aperture extending between two major faces of the brick, the aperture for accommodating an elongate member to extend between a plurality of overlying bricks and to be secured to bricks of different courses. This form of brick has the features to accommodate an elongate member but does not incorporate the features for use with an anchor. Thus this form of brick can be used in those parts of a structure in which only an elongate member needs to be accommodated, and then the
15 version of the brick with both sets of features is used in those parts of the structure where use with an anchor is required.

A second aspect of the present invention provides a brick for the assembly of a structure, the brick having an element shaped for inter-engagement with a co-operable
20 element on another structure component, the brick having an aperture extending between the major faces of the brick for accommodating an elongate member to extend between a plurality of bricks.

In this aspect of the present invention, the brick has for example a protrusion and/or
25 recess to ensure ready and quick correct positioning on another brick for alignment of the apertures of the two bricks.

A third aspect of the present invention provides a brick for the assembly of a structure, the brick having a recess for inter-engagement with another structure component, the
30 recess being shaped to have two spaced-apart centres of symmetry.

In this aspect of the present invention, a recess is shaped to enhance and ameliorate engagement with a co-operable element on another brick, by providing a slightly enlarged recess to guide a protrusion into engagement, even when the respective elements are not particularly well aligned or have grit or detritus on their surfaces.

5 The present invention also provides a structure comprising a plurality of bricks as hereinbefore defined in the present invention.

Furthermore, the present invention also provides a system for the assembly of a structure, the system comprising at least one brick as defined hereinbefore, and further
10 comprising at least one elongate member for location in at least one said brick to extend between a plurality of overlying bricks.

Preferably, the system comprises an anchor for location in a brick to secure with an elongate member, the anchor being a base plug for location in a lower region of a brick
15 to secure an elongate member.

Additionally and/or alternatively, the anchor comprises a sleeve for connecting lengthwise two elongate members.

20 Also, the present invention provides a structure made using the system as defined hereinbefore.

The present invention also provides a method of assembling a structure, the method comprising: applying a course of bricks having at least one brick with an aperture
25 extending between two major faces of the brick, applying at least one more course of bricks on the first course, providing an elongate member extending through the apertures of bricks of different courses.

Preferably, the elongate member is inserted into apertures of the bricks after courses of
30 the bricks have been positioned, and the elongate member may then be secured to an anchor in a brick. The elongate member may be connected to an anchor for connection to another elongate member.

Also, the present invention provides a structure assembled by the method as defined hereinbefore.

5

ADVANTAGES OF THE PRESENT INVENTION

An advantage of the present invention is that it enables a structure to be built more quickly, and more easily, than a conventional structure. For example, the brick shell of a typical 3-bedroom domestic house may be constructed within 7 days, with a time saving of up to 60% as compared to the present construction techniques of the comparable part of an equivalent conventional house..

A further advantage of the present invention is that the assembly of the structure can be done by unskilled labour, thereby significantly reducing the overall cost of assembling the structure.

A further advantage of the present invention is that it does not use mortar or cement which has a number of substantial benefits, including: further cost-savings by use of fewer materials, labour time-savings by eliminating the need to mix materials (and having to switch between mixing and applying with the risk of some materials being wasted if not used in time), reducing the environmental impact by reducing use of materials and enhancing the opportunity to recycle the bricks and other components of the system (without the need of trying, usually unsuccessfully, to remove hardened mortar from conventional bricks), a cleaner work environment due to no materials-mixing, ready assembly of the structure in all weather conditions in that there is no mortar to be affected by rain, storms, frost, snow etc.

These advantages of the immediately preceding two paragraph ensure that the present invention can achieve a consequential substantial cost reduction in the assembly of a brick structure, for example in respect of the brick shell of a typical 3-bedroom

domestic house there may be a cost-saving of up to 40% as compared to the present construction techniques of the comparable part of the equivalent conventional house.

5 A further advantage of the present invention is that a brick structure made using the present invention may be substantially stronger and less vulnerable to weakening caused by earthquakes, tremors, tsunamis, tornados, explosions or other major forces as compared to conventional brick structures. Even if a brick structure of the present invention is weakened by such an event, it would remain less susceptible to spontaneous collapse or collapse by further earthquakes, tremors etc than a conventional brick
10 structure.

A further advantage of the present invention is that it may provide a structure which is capable of flexing when subjected to major forces for example resulting from earthquakes, tremors, etc.

15

APPLICATIONS OF THE PRESENT INVENTION

The present invention relates to any form of brick structure, whether a house, house
20 shell, building, stand-alone wall, support or barbecue.

The present invention is primarily directed to construction bricks, typically used for and in such brick structures, but the present invention is also applicable to building blocks generally used in construction, for example made of pre-cast cement, concrete or
25 equivalent or similar materials and constituents. Thus the term "brick" is used within this patent specification to include all appropriate suitable forms of building block including breeze blocks and thermolite blocks.

30

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may more readily understood, a description is now given, by way of example only, reference being made to various embodiments of the present invention, in which:-

- 5
FIGURE 1 is a plan view of a brick embodying the present invention;
FIGURE 2 is view from below of the brick of Figure 1;
FIGURE 3 is a section through the brick of Figure 1 along the lines B-B;
FIGURE 4 is a view of the front face of the brick of Figure 1;
10 FIGURE 5 is a section through the brick of Figure 1 along the lines A-A;
FIGURE 6 is a side view of a plug of the present invention;
FIGURE 7 is a view from ~~below~~ above of the plug of Figure 6;
FIGURE 8 is a side view of a rod of the present invention;
FIGURE 9 is a side view of a wall tie for use with a brick of the present invention;
15 FIGURE 10 is a plan view of the wall tie of Figure 9;
FIGURES 11 and 12 are views of a connecting sleeve; and
FIGURES 13 and 14 are views of the front face and a section of a building block embodying the present invention.

20

DETAILED DESCRIPTION OF THE DRAWINGS

There is illustrated in Figures 1 to 5 a brick 10 of the present invention, being of dimensions 2.4×10^{-1} metres in overall length, 7.5×10^{-2} metres in height (i.e. from
25 bottom surface to top surface), and 1.2×10^{-1} metres in total width. This brick is slightly longer than the standard conventional brick at 2.15×10^{-1} metres, due to the important consequence and benefit of the present invention that any use of mortar is obviated. Thus the length of a brick of the present invention corresponds to the combined length of a conventional brick and the appropriate amount of mortar at the
30 ends for bonding.

Typically, brick 10 is of the traditional type, manufactured by a baking process with constituents of clay, lime and cement-based mixture of aggregate and silica sand, and with appropriate standard finishing operations and techniques, but incorporating the novel and inventive features of the present invention.

5

These dimensions of the brick 10 include the finish 12 of the front face 14 which can be seen on the lower side of brick 10 as shown in Figure 1, and on the right side of brick 10 as shown in Figure 3.

10 Brick 10 of the present invention includes two domed protrusions 16, 18 of height 1.8×10^{-2} metres extending above top surface 20 of brick 10, each of the protrusions shaped to engage with one recess (if the bricks of adjacent courses are half bonded) of another brick 10' when positioned on top of brick 10.

15 Also, brick 10 has two recesses 22, 24 of depth 2×10^{-2} metres to engage with protrusions of bricks thereunder. Each recess 18, 20 is shaped such as to have two axes of symmetry which are spaced apart, in order to allow for expansion and contraction due to temperature and weather conditions and to facilitate ready and easy guiding of a
20 there is close contact and engagement of the surfaces even in the event of loose particles, grit and detritus being present.

Brick 10 has an aperture 26 extending between top surface 20 and base surface 28. This aperture 26 lies vertically in normal use orientation of brick 10 and has a number of
25 regions (as can be seen from Figure 3), being (from base surface 28 upwards in normal use orientation):-

Region 30 of elliptical cross-section 32 (see Figure 2) to hold elliptical base section 34 of plug 36 fixed against axial rotation;

Region 38 of circular cross-section to contain the upper, internally-threaded cylindrical
30 sleeve 40 of plug 36, into which a rod 42 can be threadedly secured;

Region 44 of circular cross-section to slidably accommodate rod 42;

Region 46 of generally circular cross-section to accommodate an end portion of a wall tie 48.

Bricks 10 of the present invention are used as follows to assemble a brick structure.

5

Each end face 49 of brick 10 which abuts with the equivalent face of the adjacent brick has a vertical indentation 50 of semi-circular cross-section to accommodate half of a rod 42 should it be appropriate for a rod to pass through a course of the bricks for securing to a plug 36. At the bottom of indentation 50 is an elliptical shaped recess 51 to hold
10 fixed a plug 36 if required.

Aperture 26 is suitably tapered to ensure ready, easy and fast release from the manufacturing mould process and to provide optimum support for the fitting within the brick.

15

A number of bricks 10 are laid out lengthwise touching end-to-end on top of a suitable foundation layer (with appropriate bonding as required). In every fourth brick 10, a plug 36 has been positioned in the appropriate region 30 such that the base of plug 36 is flush with base surface 38 and plug 36 is fixed against any axial rotation. Each fourth brick
20 10, in which a plug 36 has been positioned, is suitably marked.

25

A second course of bricks is placed over that first course in a half-bond arrangement and such that the respective recesses 22, 24 of a brick 10' in the second course inter-engage with one protrusion of one brick 10 on the first course and one protrusion of the adjacent brick 10 on that first course.

Once the second course has been completed, a third course is completed in like fashion, and so on until eight courses have been completed.

30

Then a rod 42 of length 6.3×10^{-1} metres is inserted down one set of aligned apertures 26 for a brick 10 previously marked as having a plug 36 in the first brick 10 until that

lower end of rod 42 contacts sleeve 40, whereupon axial rotation of rod 42 causes engagement of these two parts.

The rods 42 are inserted into the aligned apertures 26 only once the courses of bricks
5 have been assembled, otherwise there could be a risk that a person assembling the structure might be injured by rods which are sticking up to 6.3×10^{-1} metres out of the courses of bricks being assembled. Thus the present invention allows eight courses of bricks to be assembled (which can be achieved very quickly and easily because of the inter-engaging protrusions and recesses, and also with the respective apertures suitably
10 aligned), whereupon only then the rod is inserted into the aligned apertures, with no risk of the rod injuring the person because the rod does not then extend out of or beyond the top course of brick.

A hollow internally-threaded connecting sleeve 50 is attached to the upper end of rod
15 42.

This rod insertion operation is repeated for all of the bricks 10 marked as having a plug
36.

20 Then a further eight courses of bricks 10 is laid, and the rod insertion operation repeated.

This can be continued until at least a three story-high brick structure has been
25 assembled.

Once all courses of bricks required for the structure have been completed and any rods have been inserted in the aperture for each marked brick 10 as required, each rod 42 is cut to the appropriate length so that it doesn't extend unnecessarily beyond the top course of bricks, and an end cap is applied to the top of the rod to top it off.

30 Plug 36, rod 42, wall tie 42 and end cap (being a standard nut and washer, or a top-hat washer) are made from stainless steel, other steel, fiber thermoplastics resins for

example thermoplastics materials of which one is marketed with the Trademark CFT Continuous Fiber Thermoplastics with composite thermoplastic 55 volume by % glass, or any other appropriate and suitable metal or other material. One particular benefit of fiber thermoplastics materials is that, after applied forces are removed, the materials
5 return to their original form, whereas steels and other metals remain in the deformed state.s

In a variant to the screw-thread connections described hereinabove, any may be replaced by a suitable push-fit connection arrangement.

10

It is possible for the frequency of bricks 10 with plugs 36 to be varied according to particular circumstances, e.g. according to the strength requirements of the finalised brick structure and cost constraints. Thus, in a given situation it may be appropriate to
15 have a plug 36 in each aperture 26 of every brick 10, and a plug 36 between each brick 10 in the “aperture” formed by two semi-circular indentations 51 of adjacent bricks.

In variants of brick 10, the brick may be shorter, effectively with a single protrusion and recess, for example with just half apertures at ends, or it may be longer, for example
20 with three, or four, or more, pairs of protrusions and recesses, and appropriate apertures. Also, the brick may be wider, for example two rows of two pairs of protrusions/recesses, forming a “square” brick.

Figures 13 and 14 show another embodiment of the present invention wherein the brick
25 10 is replaced by a pre-cast concrete building block 60 typically made as a breeze block with concrete and clinker material or made as a building block with concrete/cement or as a thermolite aerated block, of dimensions 2.25×10^{-1} metres in height, 2.4×10^{-1} metres in length and 1.2×10^{-1} in width, and front face 62 with an aperture 64 extending between base surface 66 and top surface 68, aperture 64 having regions 70,
30 72, 74 and 76 which have equivalent functions to the respective regions 30, 38, 44 and 46 of brick 10.

Other features of building block 60 and its accessories, use and operation are identical, equivalent or similar (with appropriate modification, as required) to brick 10 and the associated system and methods as described herein.

5

10

15

20

25

30

CLAIMS

1. A brick for the assembly of a structure, the brick having an aperture extending between two major faces of the brick, the aperture having a plurality of regions for accommodating an elongate member to extend between a plurality of
5 overlying bricks and for accommodating an anchor for the elongate member.
2. A brick for the assembly of a structure, the brick having an aperture extending between two major faces of the brick, the aperture for accommodating an elongate member to extend between a plurality of overlying bricks and to be secured to bricks of different courses.
- 10 3. A brick for the assembly of a structure, the brick having an element shaped for inter-engagement with a co-operable element on another structure component, the brick having an aperture extending between the major faces of the brick for accommodating an elongate member to extend between a plurality of bricks.
4. A brick for the assembly of a structure, the brick having a recess for inter-
15 engagement with another structure component, the recess being shaped to have two spaced-apart centres of symmetry.
5. A brick according to any preceding claim comprising an aperture with a plurality of regions of different width, comprising a first region of a width and shape to accommodate and hold an elongate member to extend between a
20 plurality of courses of bricks, and comprising a second region of a width and shape to accommodate and hold an anchor for the elongate member.
6. A brick according to any preceding claim comprising an aperture with a second region of a width and shape for accommodating and holding an anchor comprising a base plug to secure a lower section of an elongate member.
- 25 7. A brick according to claim 6 wherein the brick comprises a recess shaped to prevent rotation of the base plug.
8. A brick according to any preceding claim wherein the aperture comprises a second region of a width and shape for accommodating and holding an anchor comprising a connecting sleeve for attachment to two elongate members.
- 30 9. A brick substantially as hereinbefore described with reference to, and/or as illustrated in, any one or more of the Figures of the accompanying drawings.
10. A structure comprising a plurality of bricks according to any preceding claim.

11. A structure according to claim 10 and a brick for the assembly of a structure, the brick having an aperture extending between two major faces of the brick, the aperture for accommodating an elongate member to extend between a plurality of overlying bricks and to be secured to bricks of different courses.
- 5 12. A system for the assembly of a structure, the system comprising at least one brick as claimed in any preceding claim, and further comprising at least one elongate member for location in at least one said brick to extend between a plurality of overlying bricks.
13. A system according to claim 12 comprising an anchor for location in a brick to
10 secure with an elongate member.
14. A system according to claim 13 wherein the anchor comprises a base plug for location in a lower region of a brick to secure an elongate member.
15. A system according to claim 13 wherein the anchor comprises a sleeve for connecting lengthwise two elongate members.
- 15 16. A system substantially as hereinbefore described with reference to, and/or as illustrated in, any one or more of the Figures of the accompanying drawings.
17. A structure made using the system of any of claims 12 to 16.
18. A structure according to claim 17 and a brick for the assembly of a structure, the
20 brick having an aperture extending between two major faces of the brick, the aperture for accommodating an elongate member to extend between a plurality of overlying bricks and to be secured to bricks of different courses.
19. A method of assembling a structure, the method comprising: applying a course of bricks having at least one brick with an aperture extending between two major faces of the brick, applying at least one more course of bricks on the first
25 course, providing an elongate member extending through the apertures of bricks of different courses.
20. A method according to claim 19 wherein the elongate member is inserted into apertures of the bricks after courses of the bricks have been positioned.
21. A method according to claim 20 wherein the elongate member is then secured to
30 an anchor in a brick.
22. A method according to any of claims 19 to 21 wherein the elongate member is connected to an anchor for connection to another elongate member.

23. A method substantially as hereinbefore described with reference to, and/or as illustrated in, any one or more of the Figures of the accompanying drawings.

5 24. A structure assembled by the method of any of claims 19 to 23.

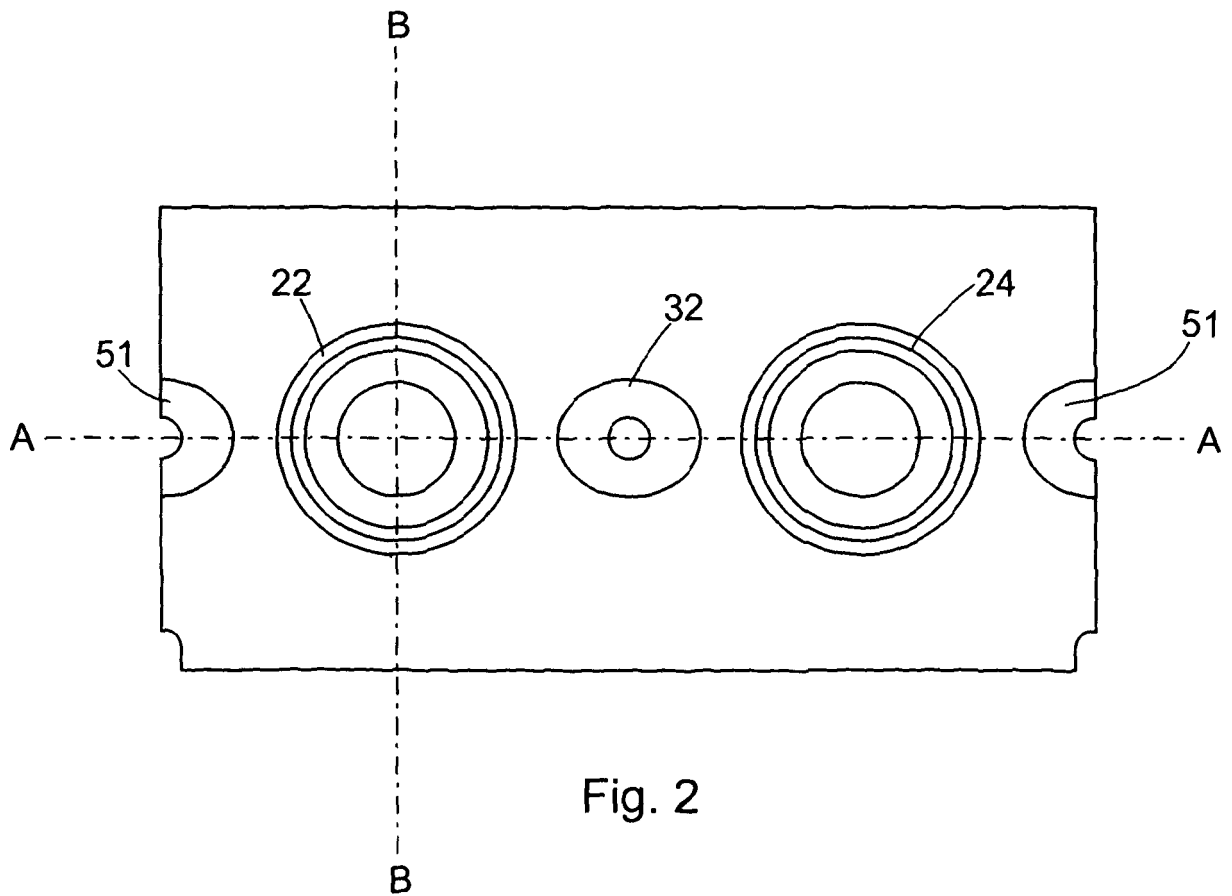
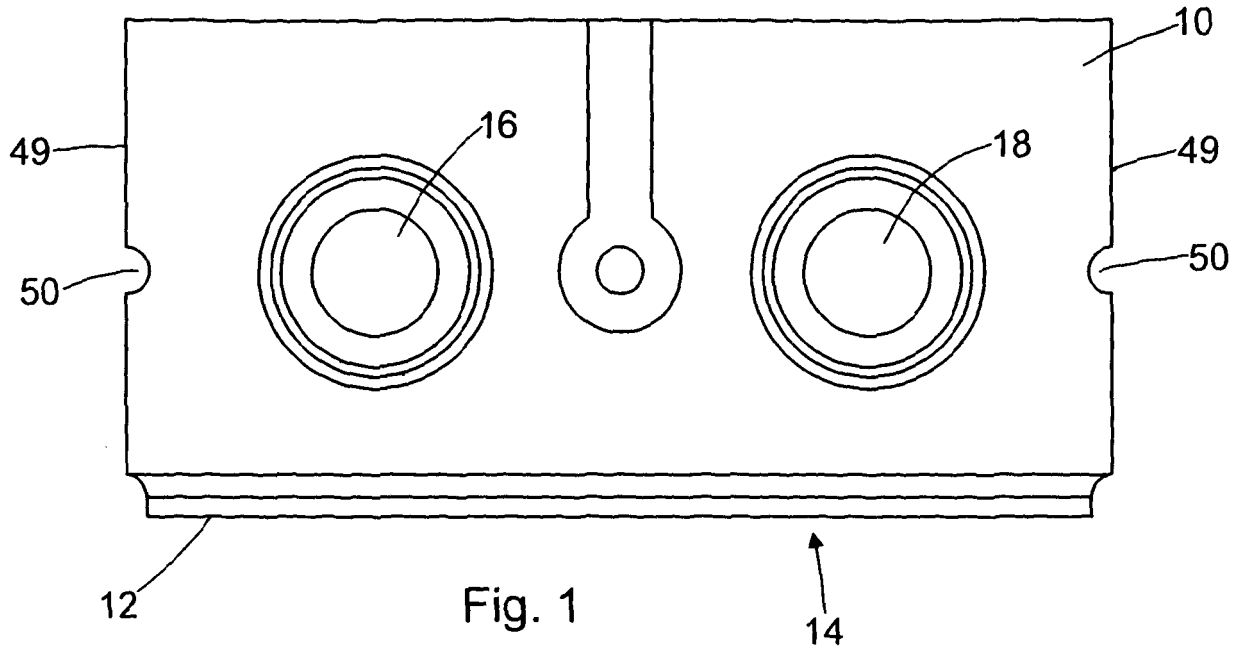
10

15

20

25

30



2/4

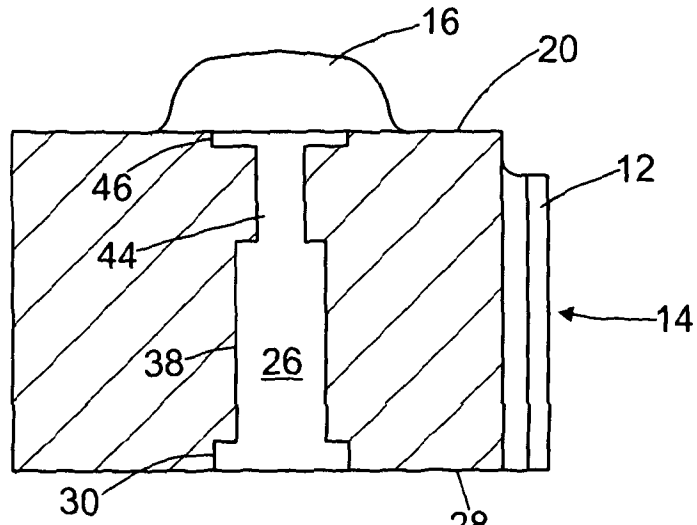


Fig. 3

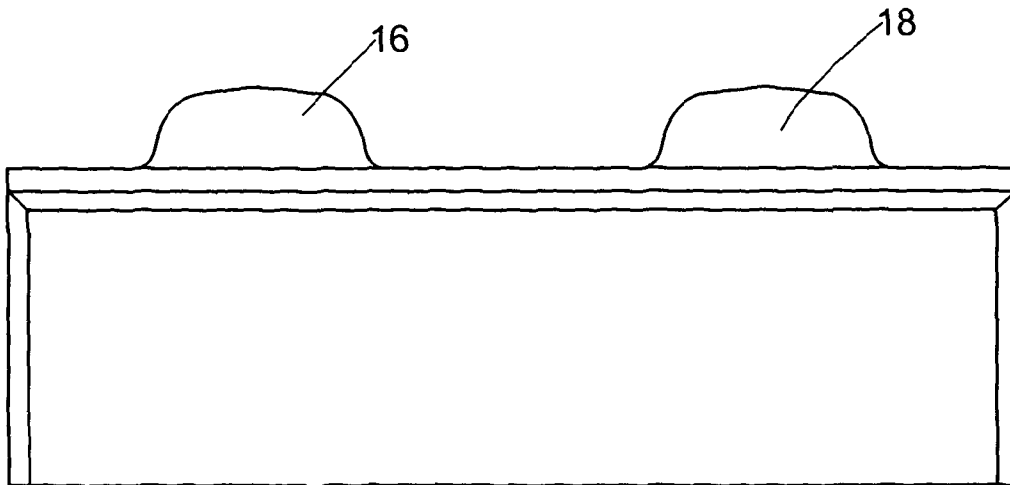


Fig. 4

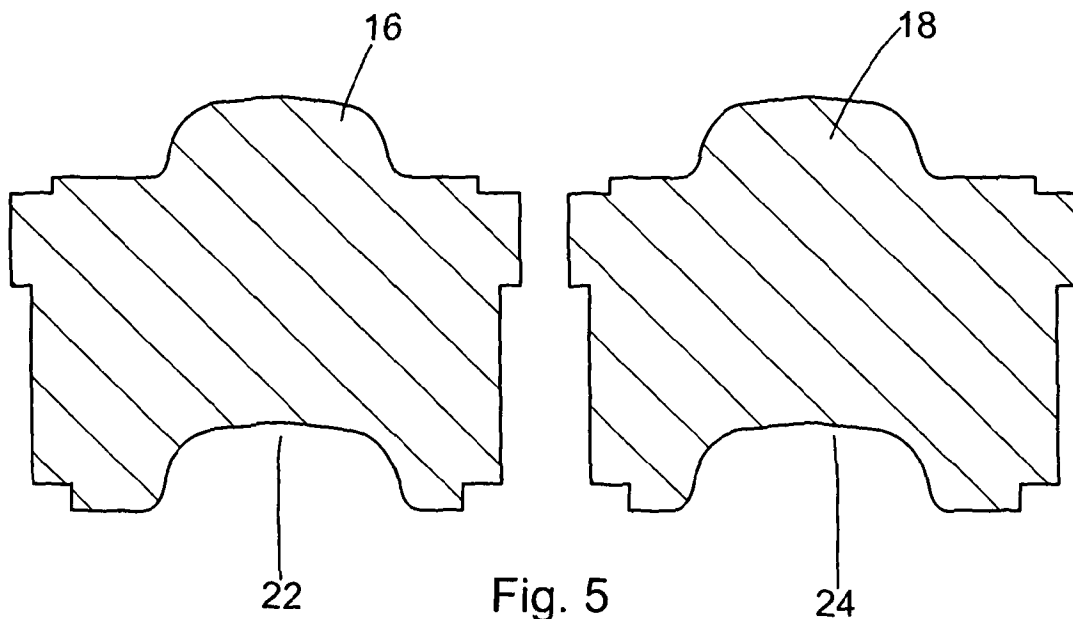


Fig. 5

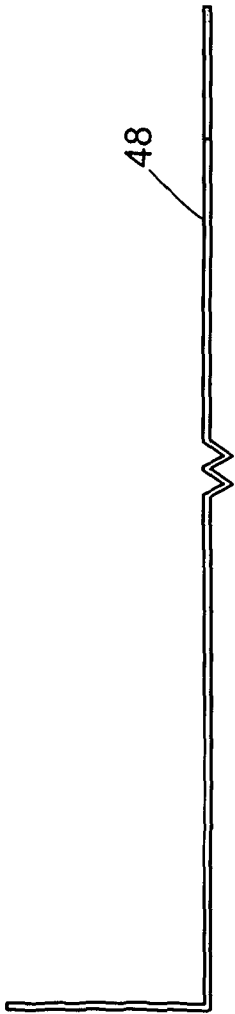


Fig. 9

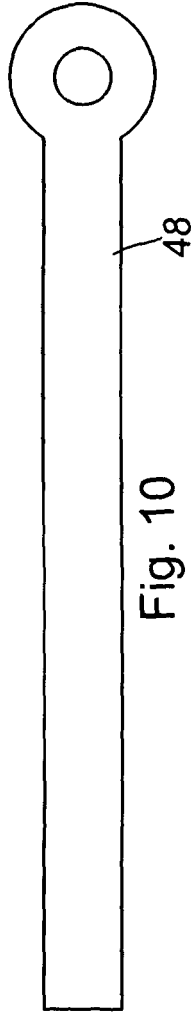


Fig. 10

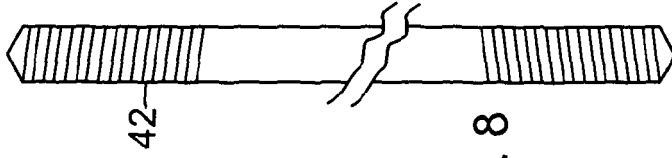


Fig. 8

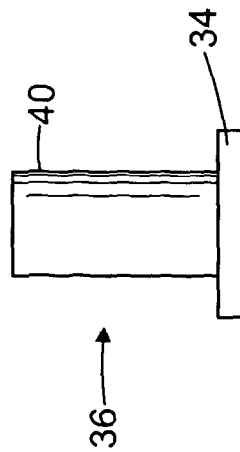


Fig. 6

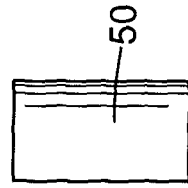


Fig. 11

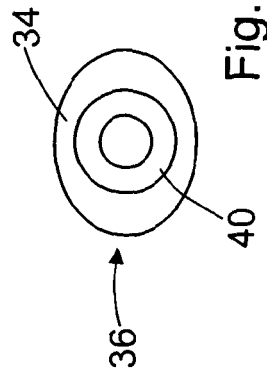


Fig. 7

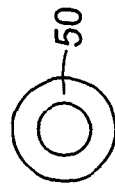


Fig. 12

4/4

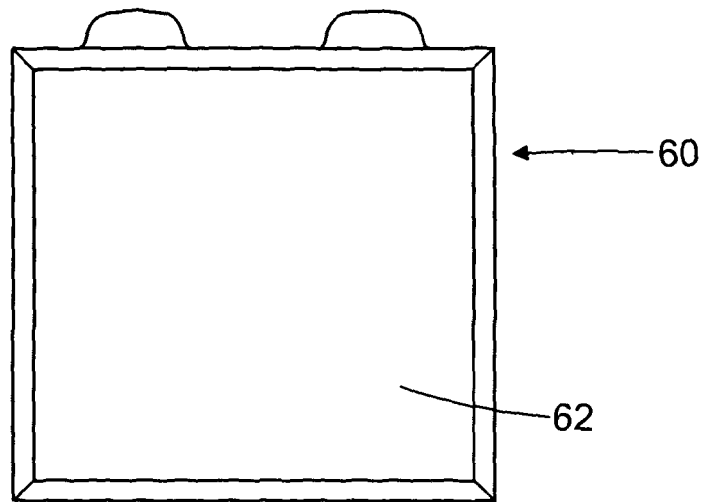


Fig. 13

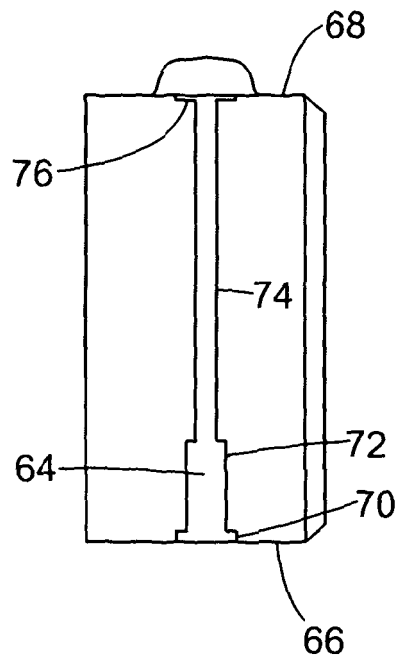


Fig. 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2011/050107

A. CLASSIFICATION OF SUBJECT MATTER INV. E04B2/18 ADD. E04B2/02		
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) E04B		
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.
X	EP 0 165 856 A1 (ALPHA COMPOSANTS [FR]; MATERIAUX MODERNES DE CONSTRUC [FR]) 27 December 1985 (1985-12-27) page 2, lines 3-8; figures 1,2,3,4,6,9 -----	1,2,4-8, 10-14, 17-22,24
X	EP 0 940 513 A2 (VOGEL WERNER [AT] VOGEL WERNER ING [AT]) 8 September 1999 (1999-09-08) figures 12-14 -----	1-4, 10-12, 17,18
X	US 4 688 362 A (PEDERSEN MORTEN C [CH] ET AL) 25 August 1987 (1987-08-25) -----	1-4, 12-15, 17,18
A	figures 1,3,5 -----	8,19,22
A	US 3 618 279 A (SEASE TRUE F) 9 November 1971 (1971-11-09) figures 9,10 -----	8
	-/--	
<input checked="" type="checkbox"/>	Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/>
	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	"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	
"E" earlier document but published on or after the international filing date	"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	
"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)	"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.	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search	Date of mailing of the international search report	
28 June 2011	05/07/2011	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Rosborough, John	

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2011/050107

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/163358 A1 (CLARKE GREGORY A [CA]) 26 August 2004 (2004-08-26) paragraphs [0132] - [0140] - paragraphs [0154] - [0161]; figures 13,15,18,19,20,21 -----	19-22

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2011/050107

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.: 4(partially)
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 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:

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 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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 4(partially)

It is unclear how a (single) recess can be shaped to have two centres of symmetry, hence the shape of the recess can not be searched. The presence of a recess for engagement with another structure component has been searched.

The applicant's attention is drawn to the fact that 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. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2011/050107

Patent document cited in search report	Publication date	Publication date	Patent family member(s)	Publication date
EP 0165856	A1	27-12-1985	FR 2565278 A1	06-12-1985
EP 0940513	A2	08-09-1999	CZ 9900775 A3	17-11-1999
			DE 59910417 D1	14-10-2004
			ES 2227914 T3	01-04-2005
			HU 9900476 A2	28-02-2001
			SK 30499 A3	14-02-2000
US 4688362	A	25-08-1987	CA 1270109 A1	12-06-1990
			CH 664786 A5	31-03-1988
			DE 3671263 D1	21-06-1990
			EP 0199978 A2	05-11-1986
US 3618279	A	09-11-1971	NONE	
US 2004163358	A1	26-08-2004	CA 2438455 A1	26-08-2004
			CA 2589425 A1	26-08-2004
			CA 2716462 A1	26-08-2004
			CA 2718037 A1	26-08-2004
			US 2007094961 A1	03-05-2007
			US 2006288654 A1	28-12-2006
			US 2006288655 A1	28-12-2006
			US 2006288656 A1	28-12-2006