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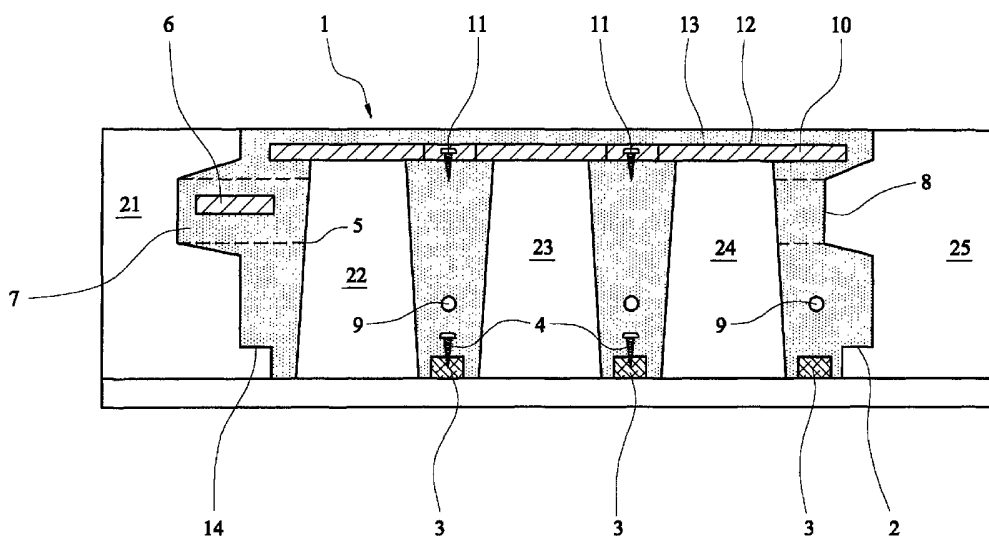
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(54) Title: METHOD OF PRODUCING A MOULDED ARTICLE



(57) Abstract: A method of producing a moulded article, which method includes charging into a mould a matrix including one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin or a dicyclopentadiene resin; and permitting the matrix to cure. The mould preferably includes a first shoulder means and a second shoulder means, each shoulder means being spaced apart by a web member. The web member including a fire retardant means extending along at least a portion of the web member between the first shoulder means and the second shoulder means.



WO 02/090090 A1

-1-

### Method of Producing a Moulded Article

The present invention is concerned with a moulded article and method of producing a moulded article. Such moulded  
5 articles are typically for use as a building component and may include insulating slabs, boards and panels, composite boards and panels, wall panels and partitions, cladding boards and panels, pipe and column claddings, doors and the like.

10

Moulded panels currently used in the building industry are particularly disadvantageous as they may not be resistant to elevated temperatures that may occur during fires. In addition, they may not have the structural stability  
15 required to be resistant to high lateral forces. Furthermore, building components currently used are undesirable as they use a considerable amount of fillers which results in the moulded article being heavy (and therefore difficult to manoeuvre without machinery) and  
20 also high in cost.

25

It is therefore an aim of the present invention to provide a moulded article which alleviates at least some of the disadvantages identified above.

30

It is a further aim of the present invention to provide a moulded article and a method of making a moulded article which has structural stability when used as a building component.

35 Therefore, according to a first aspect of the present

-2-

invention, there is provided a moulded article for use as a building component, which article includes a substantially unitary body having a first shoulder means and a second shoulder means, each shoulder means being spaced apart by a web member, the web member including a fire retardant means extending along at least a portion of the web member between the first shoulder means and the second shoulder means.

10 The moulded articles according to the present invention are particularly suitable for use as modular building components.

The first shoulder means and the second shoulder means preferably extend in the same direction away from the web member, preferably in a direction substantially perpendicular to the web member. The moulded article may therefore be arranged in a substantially C-shaped cross section.

20 According to a particularly preferred embodiment of the present invention, the moulded article includes a third shoulder means. The moulded article may also include a fourth shoulder means. The third and/or fourth shoulder means extend away from the web member in a direction substantially perpendicular to the web member.

The shoulder means typically include an interlocking connection means arranged to permit the moulded article to be connected to a separate moulded article. The separate moulded article may be a further building component according to the present invention, or a sole plate (a component fixed to the floor or foundations of a structure for the moulded article to be connected to) or a roof plate.

-3-

The interlocking means may include a male connecting means and/or a female connecting means. Therefore, it is envisaged that each shoulder means may include a male  
5 connecting means and/or a female connecting means. It is envisaged that when the interlocking means includes a male connecting means it is arranged to correspond to a female connecting means of a different moulded article or other building component (which may or may not be manufactured  
10 according to the present invention).

It is envisaged that the moulded article may include four shoulders arranged substantially about the periphery of the web member. Each shoulder including an interlocking  
15 connection means. As mentioned hereinbefore, the interlocking connection means may include male connecting means or female connecting means. Each moulded article may have a combination of 0 to 4 female connecting means and 0 to 4 male connecting means. The use of male and/or female  
20 connecting means does, of course, depend on the end use of the moulded article.

The fire retardant means preferably extends along the entire length and width of the web member of the resultant  
25 moulded article. The fire retardant means typically includes a fire retardant board, panel or the like. The fire retardant board may include a plasterboard/gypsum filler board or the like. The fire retardant board preferably has a metal coating, such as, for example  
30 aluminium backed gypsum filler board (which is preferred).

It is particularly preferred that the moulded article includes reinforcement means. The reinforcement means may be arranged substantially in the web member or any one or  
35 more of the shoulder means. The reinforcement means may

-4-

include a metal bar, rod or the like, a metal grid, mesh or the like. A steel rod is particularly preferred.

5 The reinforcement means typically extends in a direction transverse to the C-shaped cross section of the moulded article.

It is envisaged that the moulded article may further include at least one rib member. Each rib member  
10 preferably extends from the web member in substantially the same direction as the first shoulder means and the second shoulder means (which is typically perpendicular to the web member). The number of rib portions may be varied according to the end use and overall size of the moulded  
15 article. Preferably, the moulded article includes two or more ribs.

The or each rib may further include a reinforcement means substantially as described herein before. Advantageously,  
20 when the panels are in use, the ribs provide added structural stability to the wall, window or the like assembled with the moulded article according to the present invention. Furthermore, the use of ribs does not substantially increase the volume and/or weight of the  
25 moulded article.

It may be difficult for the user of the moulded article to fix other building components/ other materials such as plasterboard to the moulded article. Therefore according  
30 to a further aspect of the present invention, the moulded article further includes at least one mechanical fixing means. The mechanical fixing means are typically of a material more resilient than the remainder of the moulded article. The mechanical fixing means may include plastics  
35 or cellulose material (timber is preferred). The

-5-

mechanical fixing means is preferably arranged at an outer portion of one or more of the shoulders and/or the rib members (when present) distal to the web member. Advantageously, a chemical bond is formed between the  
5 mechanical fixing means and the cured matrix.

The mechanical fixing means may shrink under the heat of a fire therefore making the building component less stable. It is envisaged that the mechanical fixing means therefore  
10 further includes securing means arranged to secure the mechanical fixing means in the cured matrix. The securing means may include a threaded securing means (such as a screw or the like). Advantageously, securing means such as the fixing screws provide a mechanical bond between the  
15 cured matrix and the mechanical fixing means in addition to the matrix-filler piece chemical bond, thereby making the moulded article stronger.

Therefore, according to a further aspect of the present  
20 invention, there is provided a moulded article suitable for use as a building component, which includes a substantially unitary body having a first shoulder means and a second shoulder means being spaced apart by a web member, wherein the first shoulder means and/or the second shoulder means  
25 include a mechanical fixing means. Preferably, the mechanical fixing means is arranged in the first shoulder means and/or the second shoulder means substantially at a portion of the shoulder means distal the web member.

30 The mechanical fixing means is substantially as described hereinbefore. The moulded article may include three or four shoulder means. The third and/or fourth shoulder means being substantially as described hereinbefore.

35 Accordingly, the present invention therefore extends to a

-6-

method of producing a moulded article (such as a building component), which method includes:

- a) charging into a mould a matrix, the mould cavity including a first shoulder forming means and a second  
5 shoulder forming means, each shoulder forming means being spaced apart by a web forming means;
- b) positioning a fire retardant means in the matrix in the web forming means; and
- c) permitting the matrix to cure.

10

Advantageously, the fire retardant means extends along substantially the entire length of the web forming means.

The fire retardant means is substantially as described  
15 herein before.

The first shoulder forming means and/or the second shoulder forming means, preferably each include a connecting means former. The connecting means former may include a male  
20 connecting means former or a female connecting means former.

Preferably, the mould further includes a third shoulder forming means and optionally a second shoulder forming  
25 means. The resultant third and fourth shoulder forming means are substantially as described hereinbefore.

It is envisaged that the mould may further include one or more rib formers. The resultant ribs are substantially as  
30 described hereinbefore.

Therefore, according to the present invention, there is provided a method of producing a moulded article, which method includes:

- 35 (a) charging into a mould a matrix including one or more

-7-

resin selected from an orthophthalic polyester resin, an isophthalic polyester resin or a dicyclopentadiene resin.

(b) permitting the matrix to cure.

5

The mould preferably has a C-shaped cross section. However, it is envisaged that the mould may be in the form of a tray.

10 Advantageously, the resultant moulded article manufactured according to the present invention, when arranged as a load bearing wall panel positioned in a vertical plane, has a high level of fire resistance and facilitates ease of erecting.

15

The moulded article has improved structural stability over prior art panels thereby enhancing their resistance to lateral forces. As a result of the enhanced structural properties of a moulded article according to the present  
20 invention, the moulded article may be employed in a number of areas and situations, including areas of seismic activity and also areas subjected to strong wind forces in one and/or two storey buildings.

25 The matrix may be air cured and/or heat cured.

The mould typically has an internal surface, which is preferably coated with a release agent prior to step (a). The release agent may include a Paraffin based wax or a  
30 polyvinyl alcohol. Although it is envisaged that any agent which, when applied to the mould, assists in the ease of release of the resultant moulded article from the mould after step (b), may be used according to the present invention.

35



-8-

Optionally, a coating layer may be added to the mould prior to step (a) (preferably prior to application of a release agent), which may be before or after coating the mould with a release agent. The coating layer may include a gel coat  
5 (such as a polyester or acrylic preblended mould surface coat), a resin coat and/or a fibreglass laminate. According to a particularly preferred embodiment of the present invention the coating layer includes a resin laid over a waxed mould, and a layer of fibreglass mat, tissue  
10 or woven roving laid on the resin. The resin may be pre-accelerated or non-accelerated and catalysed from about 0.25% up to about 0.4% of initiator.

The term "fibreglass mat" may also be known as chopped  
15 strand mat (CSM) and may come from tissue and mat 100g and upwards. Woven roving is a fibreglass cloth.

The resin mould may be constructed or formed from wood, concrete, plaster, plastics or a metal such as aluminium.  
20 Although, any material which permits the mould to be constructed/formed in the desired shape and dimensions may be used in the present invention.

The matrix may further include a filler such as an organic  
25 or inorganic filler. Suitable fillers include silica sand, building sand, clay, concrete, stone or marble aggregate, industrial talcum powder, alumina trihydrate, calcium carbonate, vermiculite and/or perlite.

30 Preferably, the components of the matrix are mixed prior to charging into the mould.

Typically, the matrix also includes an initiator and/or a catalyst. A preferred catalyst is methyl ethyl ketone  
35 peroxide. Accelerators may include cobalt (II),

-9-

naphthenate salts of metals such as cerium, vanadium or iron; preferred accelerators include cobalt naphthenate or cobalt octoate or dimethylaniline.

- 5 The matrix may also include a fire retardant agent. The fire retardant agent may include aluminium trihydrate, aluminium hydrate or calcium carbonate. The fire retardant agent may be in powder or liquid form. Preferably, the fire retardant agent is added to the resin prior to further
- 10 components of the matrix being combined. Alternatively, reducing the amount of silica sand present in the composition would enhance the fire retardant properties of the moulded article.
- 15 It is desirable that the matrix further includes a cross-linking agent such as a monomer diluent (preferably a styrene monomer).

The matrix may further include one or more UV Stabilisers.

20

Therefore, according to particularly preferred aspect of the present invention, there is provided a method of producing a moulded article, which method includes:

- (a) charging into a mould a matrix including
- 25 i) one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin or a dicyclopentadiene resin;
- ii) a cross-linking agent;
- iii) a filler
- 30 iv) an initiator and/or a catalyst;
- v) optionally a fire retardant agent; and
- (b) permitting the matrix to cure.

A preferred matrix for use according to the present

35 invention includes:

-10-

50-150 parts by weight orthophthalic polyester resin,  
isophthalic polyester resin or a dicyclopentadiene resin;  
0-75 parts by weight cross linking agent, such as monomer  
diluent;

- 5 10-1000 parts by weight filler;  
0-750 parts by weight of fire retardant agent;  
0-5 parts by weight initiator; and  
0-10 parts by weight catalyst such as dimethylaniline.

- 10 All parts are given by weights of the matrix.

If it is desired to increase the fire retardant properties  
of the resultant moulded article, the amount of fire  
retardant agent in the composition may be increased and the  
15 amount of filler may be reduced to compensate.

A particularly preferred matrix includes:

- 75-125 parts by weight orthophthalic polyester resin,  
isophthalic polyester resin or dicyclopentadiene resin;  
20 1-65 parts by weight cross-linking agent;  
200-500 by weight parts filler;  
0-5 parts by weight catalyst;  
0.25 - 3 parts by weight initiator;  
1-700 parts by weight fire retardant agent.

25

Further preferably, the matrix includes:

- 90-110 parts by weight orthophthalic polyester resin,  
isophthalic polyester resin or dicyclopentadiene resin;  
1-10 parts monomer diluent;  
30 350-950 parts by weight filler;  
0-5 parts by weight dimethylaniline;  
1-700 parts by weight fire retardant agent.

An especially preferred matrix includes:

- 35 90-110 parts by weight orthophthalic polyester resin;

-11-

isophthalic polyester resin and/or dicyclopentadiene resin.  
1-10 parts by weight styrene monomer;  
375-425 by weight parts silica sand;  
1-50 parts by weight alumina trihydrate (ATH) or calcium  
5 carbonate;  
1-500 parts by weight vermiculite or perlite;  
2 parts by weight methyl ethyl ketone peroxide.

Therefore, according to yet a further aspect of the present  
10 invention, there is provided a matrix suitable for use in  
the production of a moulded article. The matrix is  
substantially as described hereinbefore.

According to a preferred embodiment of the present  
15 invention, a reinforcement means, such as a rod, tube, bar,  
fibreglass protrusion or the like (all of which may be  
solid or hollow) may be positioned in the mould prior to  
and/or during step (a). It is envisaged that the  
reinforcement means may be metallic, plastics, glass, or  
20 any material that does not substantially react with the  
matrix and provides additional rigidity and reinforcement  
to the resultant moulded article. The reinforcement means  
may be positioned in the mould during step (a) or after  
step (a) but prior to step (b).

25

It is envisaged that a removable body may be added to the  
mould prior to or during step (a), such that after step (b)  
the removable body may be removed thereby creating a void,  
hollow or the like in the resultant moulded article. The  
30 void, hollow or the like, may be used for cabling or the  
like. Alternatively, the mould may include conduit forming  
means whereby after the moulded article has been removed  
from the mould a conduit is formed in the article. The  
conduit may advantageously be used for cabling or the like  
35 when the moulded article is being used. Alternatively, the

-12-

conduit may be used to secure the moulded article to a further article (which may or may not be a moulded article according to the present invention).

5 It is envisaged that a mechanical fixing means, such as, for example, a building component, fixing studs and/or filler piece (which may be of cellulose based material such as wood or cardboard, plastics, metal such as steel) is added to the mould prior to step (b). Advantageously, the  
10 mechanical fixing means assists in the ease of fixing further building components, such as, for example, plasterboard or the like to the resultant moulded article when the moulded article is in its final position. The fixing stud may be a nail, screw, staple or the like.

15

The resultant moulded article may include window and/or door apertures, arch panels, sole plates or ring beams (the part of a panel which is screwed to a floor for a panel to be attached to), gable-ends, corner posts and also wall or  
20 floor panels (which may be of varying dimensions).

The mould is typically made of two or more mould halves which, when connected together, form an internal cavity.

25 The moulded article typically has a male connecting portion and a female connecting portion, the male (or female) connecting portion arranged to connect with a female (or male) connecting portion on a different moulded article (which may or may not be manufactured according to the  
30 present invention). It is also envisaged that the moulded article may include two or more male connecting portions, each arranged to connect to a female connecting portion on a different moulded article or other body.

35 The mould typically has a mould cavity which has a depth

-13-

substantially equal to the width of the resulting moulded article, and a width substantially equal to the thickness of the resultant moulded article.

5 The present invention will now be described, by way of example only, with reference to the accompanying drawings, which are given by way of example only, wherein:

Figure 1 represents a cross section of a mould for use  
10 according to the present invention along the length of the mould;

Figure 2 represents a cross section of a mould for use  
according to the present invention along the width of the  
15 mould;

Figure 3 represents a cross section of an alternative mould which may be used according to the present invention (preferably when manufacturing panels for use in two storey  
20 buildings);

Figure 4 represents a view of the mould in Figure 2 in use when manufacturing a moulded article according to the present invention;  
25

Figure 5 represents a view of the mould shown in Figure 2 in use when manufacturing a moulded article according to the present invention;

30 Figure 6 represents a panel according to the present invention in use being attached to a sole plate;

Figure 7 represents a panel according to the present invention in use being attached to a ceiling plate; and  
35

-14-

Figure 8 represents two panels according to the present invention in use.

Referring to Figures 1 to 3, where like numeral have been used to identify like parts, there is provided a mould M1 (see Figure 1), a mould M2 (see Figure 2) and a mould M3 (see Figure 3).

The Mould M3 may have the following dimensions:

10        A       20mm - 150mm  
           B&C    10mm - 75mm  
           D       2mm - 150mm  
           E       2mm - 50mm  
           F       5mm - 50mm

15

The mould M2 may have the following dimensions:

          G       20mm - 150mm  
           H&I    10mm - 75mm  
           J       50mm - 150mm

20

The moulds M1, M2 and/or M3 may vary in length from about 1m to about 10m and have a width up to about 3m.

Preferred moulded panels manufactured according to the present invention may have the dimensions shown in Table 1.

25

Height (m)	Width (m)
2.4	0.3
2.4	0.6
2.4	0.9
2.4	1.2
2.4	1.8

Table 1

35 Referring to the remaining Figures 4 to 8, where like

-15-

numerals have been used to identify like parts, there is provided a mould assembly 1 suitably of metal, such as steel. The mould assembly includes a left male connecting means former 21, three rib portion formers 22, 23 and 24,  
5 and a right female connecting means former 25.

In use, the mould has an internal mould surface 2 onto which a layer of wax is added as a release agent.

- 10 Matrix A having the following composition is premixed:  
100 parts by weight orthophthalic polyester resin  
1-10 parts by weight styrene monomer;  
400 parts by weight silica sand;  
1-50 parts by weight calcium carbonate;  
15 1-500 parts by weight vermiculite;  
2 parts by weight methyl ethyl ketone peroxide.

A layer of the matrix A is applied to the mould surface 2 over the release agent. Embedded in the uncured resin  
20 matrix A is a layer of fibreglass mat. Air bubbles that may form in the uncured resin/fibreglass mat layer are substantially removed. The resin/fibreglass mat form a fibreglass laminate layer 14.

25 Timber filler pieces 3 are inserted into the resin/fibreglass layer, prior to, during or after the resin/fibreglass layer has cured. Steel fixing screws 4 are inserted into filler pieces 3, allowing for protrusion. Advantageously, the fixing screws provide a mechanical bond  
30 for the cured resin and the filler piece. The timber filler pieces 3 may shrink under the heat of a fire therefore making the building component less stable. Advantageously, the fixing screws provide a mechanical bond between the cured resin and the timber filler piece in  
35 addition to the matrix-filler piece chemical bond, thereby



-16-

making the moulded article stronger.

A further amount of matrix A, identified above, is poured into mould 1 over filler pieces 3 and fixing screws 4 until it reaches level 5. A bridging piece of aluminium foil backed insulating board/gypsum filler board 6 is inserted into the left male connecting means former 21 of mould 1. Steel rods 9 having a substantially round cross section are inserted in mould cavities B, C and D. The steel rods advantageously provide added strength and reinforcement to the moulded article.

A fire retardant board 10 having a thickness of about 2mm to 20mm is substantially positioned on the matrix A in the mould. The matrix maybe in an uncured (which is preferred) or cured state when board 10 is positioned. Steel screws 11 are inserted through board 10 and into the uncured matrix. As discussed previously, the screws 11 provide a mechanical fixing between the cured matrix and the board 10 (in addition to the chemical bond between the board 10 and the matrix).

A further layer of matrix A is subsequently poured onto the board 10, onto which a layer of sand, fibreglass mat, tissue, woven roving and/or steel reinforcement can be added to form a layer 12 about 2mm to 25mm thick. A layer of catalysed resin and sand is preferred. A further amount of matrix A is subsequently poured into mould over layer 12 to form layer 13. Layer 13 is typically 2mm to 25mm thick. This topcoat layer 13 may then be screeded level by hand or vibration. Further reinforcement layer of, for example, steel, fibreglass or woven roving can be added to layer 13.

A layer of matting is rolled onto the uncured resin to form a level surface. On top of the level surface a layer of

-17-

sand, stone or decorative finish can be applied whilst the present composition is wet or cured. In addition, if required, additional fire retardant agents may be added to the top-level surface.

5

Referring to Figure 5, there is shown a mould including an upper female former 51 and a lower female former 52, two rib forming chambers 53 and 54 and a web forming portion 55. The panel is substantially manufactured as described with reference to Figure 4.

Referring to Figure 6, after the panel 31 has cured and released from the mould 1, it is positioned on top of a sole plate 32 which has been fixed to concrete floor 33 by recognised engineering techniques. The panel 31 is fixed to sole plate 32 by means of a bolt 34 common place in engineering techniques).

Referring to Figure 7, the wall plate 41 is secured to the top of panel 21 using a further bolt 42.

Referring to Figure 8, two moulded building panels manufactured according to the present invention are fixed together by means of a bolt or the like 42 through the female connections means in the second shoulder of panel 40a and the male connecting means in the first shoulder of panel 40b.

The cold gap (the section through the joints between the panels which has an unacceptable high "U" value) is negated by using a continuous gasket 41 typically of rubber, neoprene or other similar material.

The coffers 43 and 44 (which are the voids between the ribs and/or the male and female connecting means are typically

-18-

filled with an insulation foam 45. the density and other properties (such as fire retardance) may be varied depending on the end use and/or external weather conditions etc.

5

A sheet or panel of plasterboard 46 is attached to the wall formed by the moulded article 40a and 40b and secured in place using fixing means. The surface of the plasterboard 46 inside the final structure may then be decorated as  
10 desired. It is also envisaged that further panels, not shown, (which may be manufactured according to the present invention) are fixed substantially adjacent moulded articles 40a and 40b in a manner substantially as described above.

15

**Claims**

1. A moulded article for use as a building component,  
wherein the article includes a substantially unitary  
5 body having a first shoulder means and a second  
shoulder means, each shoulder means being spaced apart  
by a web member, the web member including a fire  
retardant means extending along at least a portion of  
the web member between the first shoulder means and  
10 the second shoulder means.
2. A moulded article according to claim 1, which includes  
a third shoulder means.
- 15 3. A moulded article according to claim 2, which includes  
a fourth shoulder means.
4. A moulded article according any preceding claim,  
wherein the shoulder means include an interlocking  
20 connection means arranged to permit the moulded  
article to be connected to a separate moulded article.
5. A moulded article according to claim 4, wherein the  
interlocking means includes a male connecting means  
25 and/or a female connecting means.
6. A moulded article according to any preceding claim,  
wherein the fire retardant means extends along  
substantially the entire length and width of the web  
30 member of the resultant moulded article.
7. A moulded article according to any preceding claim,  
wherein the fire retardant means includes a fire  
retardant board, panel or the like.

-20-

8. A moulded article according to claim 7, wherein the fire retardant board includes a plasterboard/gypsum filler board or the like.
- 5 9. A moulded article according to any preceding claim, wherein the fire retardant means has a metal coating, such as an aluminium coating.
- 10 10. A moulded article according to any preceding claim, which includes reinforcement means.
- 15 11. A moulded article according to claim 10, wherein the reinforcement means is arranged substantially in the web member, the first shoulder and/or the second shoulder.
- 20 12. A moulded article according to claim 9 or 11, wherein the reinforcement means includes a metal bar, rod or the like, a metal grid, mesh or the like.
13. A moulded article according to any preceding claim, wherein the moulded article includes at least one rib member.
- 25 14. A moulded article according to claim 13, wherein each rib member extends from the web member in substantially the same direction as the first shoulder means and the second shoulder means.
- 30 15. A moulded article according to any preceding claim, which further includes at least one mechanical fixing means.
- 35 16. A moulded article according to claim 15, wherein the mechanical fixing means are of a material more

-21-

resilient that the remainder of the moulded article.

17. A moulded article according to claim 15 or 16, wherein  
the mechanical fixing means include plastics or  
5 cellulose material (timber is preferred).
18. A moulded article according to any of claim 15 to 17,  
wherein the mechanical fixing means is arranged at an  
outer portion of the first shoulder, the second  
10 shoulder and/or the rib members (when present) distal  
to the web member.
19. A moulded article according to any of claims 15 to 18,  
wherein the mechanical fixing means includes securing  
15 means arranged to secure the mechanical fixing means  
in the cured matrix.
20. A moulded article according to claim 19, wherein the  
securing means includes a cable tie, threaded securing  
20 means (such as a screw or the like).
21. A moulded article suitable for use as a building  
component, which includes a substantially unitary body  
having a first shoulder and a second shoulder being  
25 spaced apart by a web member, wherein the first  
shoulder means and/or the second shoulder means  
include a mechanical fixing means. Preferably, the  
mechanical fixing means is arranged in the first  
shoulder means and/or the second shoulder means  
30 substantially at a portion of the shoulder means  
distal the web member.
22. A method of producing a moulded article (such as a  
building component), which method includes:  
35 a) charging into a mould a matrix, the mould cavity

-22-

including a first shoulder forming means and a second shoulder forming means, each shoulder forming means being spaced apart by a web forming means;

- 5       b)    positioning a fire retardant means in the matrix in the web forming means; and  
      c)    permitting the matrix to cure.

23.   A method according to claim 22, wherein the first shoulder forming means and/or the second shoulder forming means, include a connecting means former such as a male connecting means former or a female connecting means former.

24.   A method according to claim 22 or 23, wherein the mould cavity includes a third shoulder forming means and optionally a fourth shoulder forming means.

25.   A method according to any of claims 22 to 24, wherein the mould further includes one or more rib formers.

26.   A method of producing a moulded article, which method includes:

20       (a)   charging into a mould a matrix including one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin or a dicyclopentadiene resin.

      (b)   permitting the matrix to cure.

27.   A method according to claim 26, wherein the matrix is air cured and/or heat cured.

28.   A method according to any of claims 26 or 27, wherein the mould has an internal surface coated with a release agent prior to step (a).

35

-23-

29. A method according to claim 28, wherein the release agent is a paraffin based wax or a polyvinyl alcohol.
30. A method according to according to any of claims 26 to  
5 29, wherein coating layer is added to the mould prior to step (a).
31. A method according to according to claim 30, wherein the coating layer includes a gel coat (such as a  
10 polyester or acrylic pre-blended mould surface coat), a resin coat and/or a fibreglass laminate.
32. A method according to according to claim 31, wherein the coating layer includes a resin laid over a waxed  
15 mould having a layer of fibreglass mat, tissue or woven roving laid over the resin.
33. A method according to according to any of claims 26 to 32, wherein the mould is constructed or formed from  
20 wood, concrete, plaster, plastics or metal such as aluminium.
34. A method according to any of claims 26 to 33, wherein the matrix further includes a filler, such as an  
25 organic or inorganic filler.
35. A method according to according to claim 34, wherein the filler includes silica sand, building sand, clay, concrete, stone or marble aggregate, industrial talcum  
30 powder, alumina trihydrate, calcium carbonate, vermiculite and/or perlite.
36. A method according to any of claims 26 to 35, which further includes an initiator and/or a catalyst.



-24-

37. A method according to claim 36, wherein the catalyst is methyl ethyl ketone peroxide.
38. A method according to according to claim 36 or 37,  
5 wherein the accelerator includes cobalt (II), naphthenate salts of metals such as cerium, vanadium or iron (preferably accelerators include cobalt naphthenate or cobalt octoate or dimethylaniline).
- 10 39. A method according to any of claims 26 to 38, wherein the matrix includes a fire retardant agent, preferably in powder or liquid form.
40. A method according to according to claim 39, wherein  
15 the fire retardant agent includes aluminium trihydrate, aluminium hydrate or calcium carbonate.
41. A method according to according to claim 39 or 40,  
20 wherein the fire retardant agent is added directly to the resin.
42. A method according to any of claims 26 to 41, wherein the matrix includes a cross-linking agent.
- 25 43. A method according to claim 42, wherein the cross-linking agent is a monomer diluent (preferably a styrene monomer).
44. A method according to any of claims 26 to 43, wherein  
30 the matrix includes one or more UV stabiliser.
45. A method according to any of claims 26 to 44, wherein the matrix includes:
- 35 i) one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin

-25-

- or a dicyclopentadiene resin;
- ii) a cross-linking agent;
  - iii) a filler
  - iv) an initiator and/or a catalyst; and
  - 5 v) optionally a fire retardant agent.
46. A method according to claim 45, wherein the matrix includes:
- 10 50-150 parts by weight orthophthalic polyester resin, isophthalic polyester resin or a dicyclopentadiene resin;
  - 0-75 parts by weight cross-linking agent, such as monomer diluent;
  - 15 10-1000 parts by weight filler;
  - 0-750 parts by weight of fire retardant agent;
  - 0-5 parts by weight initiator
  - 0-10 parts by weight catalyst such as dimethylaniline.
- 20 47. A method according to claims 45 or 46, wherein preferred matrix includes:
- 90-110 parts by weight orthophthalic polyester resin; isophthalic polyester resin and/or dicyclopentadiene resin;
  - 25 1-10 parts by weight styrene monomer;
  - 375-425 by weight parts silica sand;
  - 1-50 parts by weight alumina trihydrate (ATH) or calcium carbonate;
  - 1-500 parts by weight vermiculite or perlite; and
  - 30 2 parts by weight methyl ethyl ketone peroxide.
48. A method according to any of claim 45 to 47, wherein reinforcement means is positioned in the mould (prior to, during or after step (a), but prior to step (b)).

-26-

49. A method according to according to claim 48, wherein the reinforcement means is a rod, tube, bar, fibreglass protrusion or the like (all of which may be solid or hollow).
- 5 50. A method according to according to claim 48 or 49, wherein the reinforcement means is metallic, plastics or glass.
- 10 51. A method according to any of claims 48 to 50, wherein an mechanical fixing means, such as a building component, is positioned in the mould (prior to, during or after step (a), but prior to step (b)).
- 15 52. A method according to any of claims 48 to 51, wherein the mould has a depth substantially equal to the width of the resulting moulded article, and a width substantially equal to the thickness of the resultant moulded article.
- 20 53. A matrix suitable for use in the production of a moulded article, wherein the matrix includes:
- i) one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin
  - 25 or a dicyclopentadiene resin;
  - ii) a cross-linking agent;
  - iii) a filler
  - iv) an initiator and/or a catalyst; and
  - v) optionally a fire retardant agent.
- 30 54. A matrix according to claim 53, which includes:
- 50-150 parts by weight orthophthalic polyester resin, isophthalic polyester resin or a dicyclopentadiene resin;
- 35 0-75 parts by weight cross-linking agent, such as

-27-

monomer diluent;  
10-1000 parts by weight filler;  
0-750 parts by weight of fire retardant agent;  
0-5 parts by weight initiator  
5 0-10 parts by weight catalyst such as dimethylaniline.

55. A matrix according to claim 53 or 54, which includes:  
75-125 parts by weight orthophthalic polyester resin,  
10 isophthalic polyester resin or dicyclopentadiene  
resin;  
1-65 parts by weight cross-linking agent;  
200-500 by weight parts filler;  
0-5 parts by weight catalyst;  
15 0.25 - 3 parts by weight initiator;  
1-700 parts by weight fire retardant agent.

56. A matrix according to any of claims 53 to 55 which  
includes:  
20 90-110 parts by weight orthophthalic polyester resin,  
isophthalic polyester resin or dicyclopentadiene  
resin;  
1-10 parts monomer diluent;  
350-950 parts by weight filler;  
25 0-5 parts by weight dimethylaniline; and  
1-700 parts by weight fire retardant agent.

57. A matrix according to any of claims 53 to 56, which  
includes:  
30 90-110 parts by weight orthophthalic polyester resin;  
isophthalic polyester resin and/or dicyclopentadiene  
resin;  
1-10 parts by weight styrene monomer;  
375-425 by weight parts silica sand;  
35 1-50 parts by weight alumina trihydrate (ATH) or;

-28-

1-500 parts by weight vermiculite or perlite; and  
2 parts by weight methyl ethyl ketone peroxide.

58. A matrix according to any of claims 53 to 57, which  
5 further includes UV stabilisers.

59. A moulded article manufactured from a matrix which  
includes;

- 10 i) one or more resin selected from an orthophthalic polyester resin, an isophthalic polyester resin or a dicyclopentadiene resin;
- ii) a cross-linking agent;
- iii) a filler
- iv) an initiator and/or a catalyst; and
- 15 v) optionally a fire retardant agent.

60. A moulded article according to claim 59, which  
includes a male connecting portion and a female  
connecting portion, the male (or female) connecting  
20 portion arranged to connect with a female (or male)  
connecting portion on a different moulded article.

61. A moulded article according to claim 60, which  
includes two or more male connecting portions, each  
25 arranged to connect to a female connecting portion on  
a different moulded article or other body.

62. A moulded article according to any of claims 59 to 61,  
wherein the moulded may include panels, window and/or  
30 door apertures, arch panels, sole plates or ring  
beams, gable-ends, corner posts or floor or wall  
panels (which may be of varying dimensions).

M1

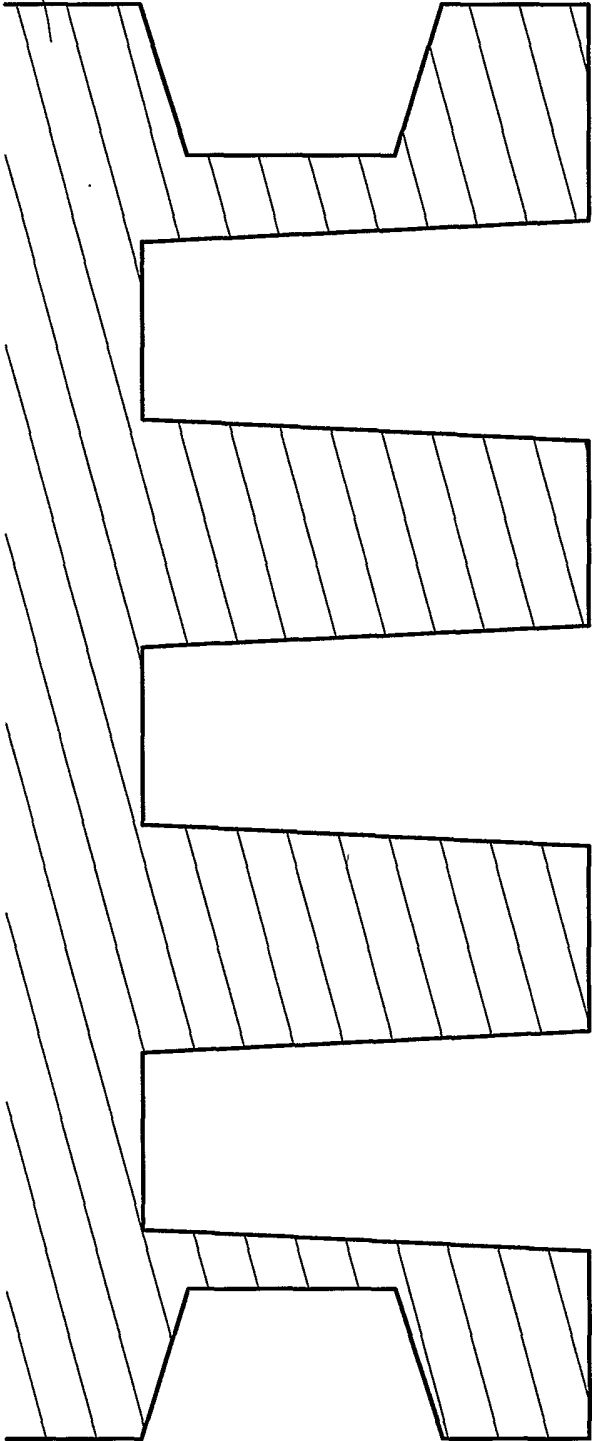


FIG. 1

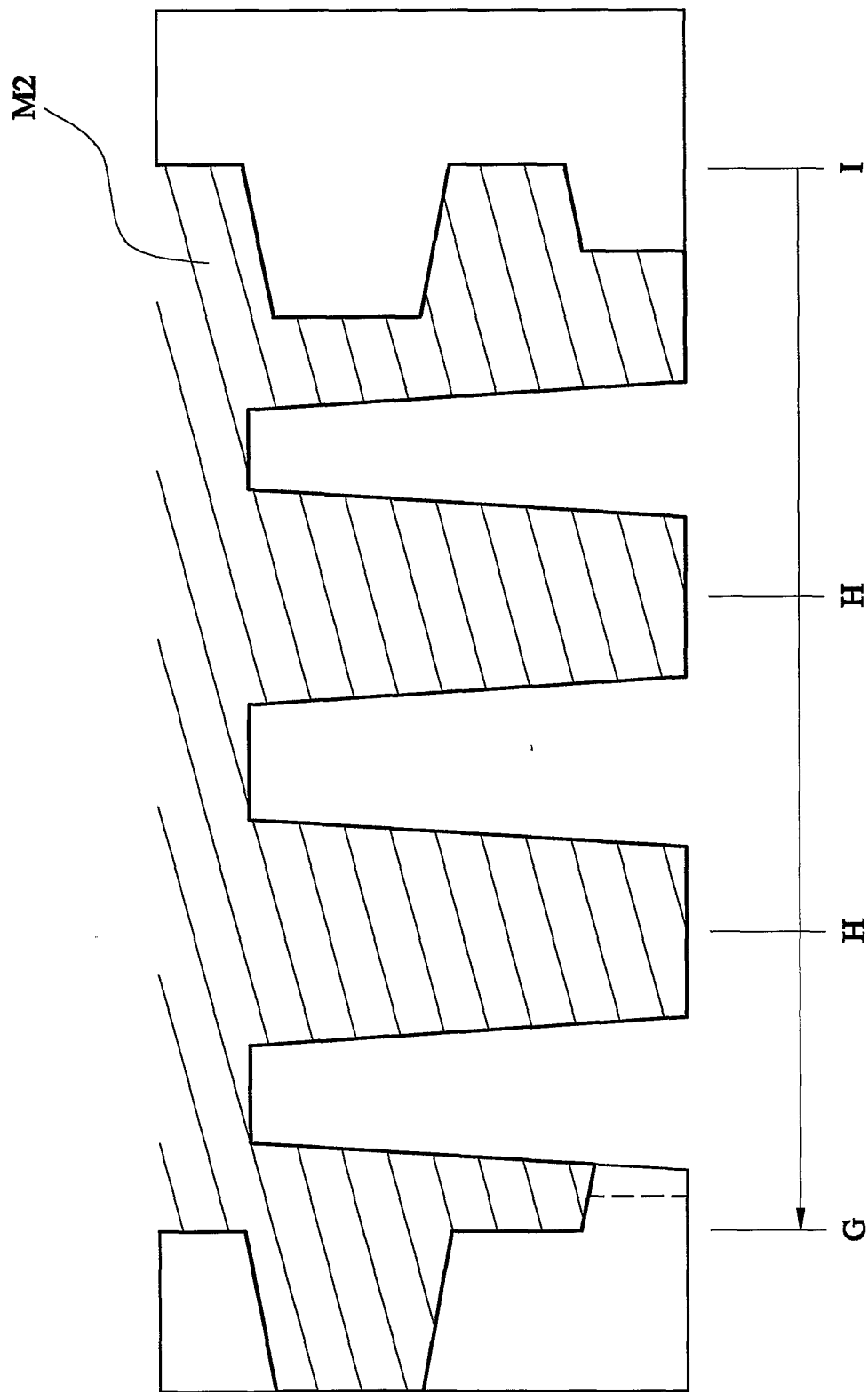


FIG. 2

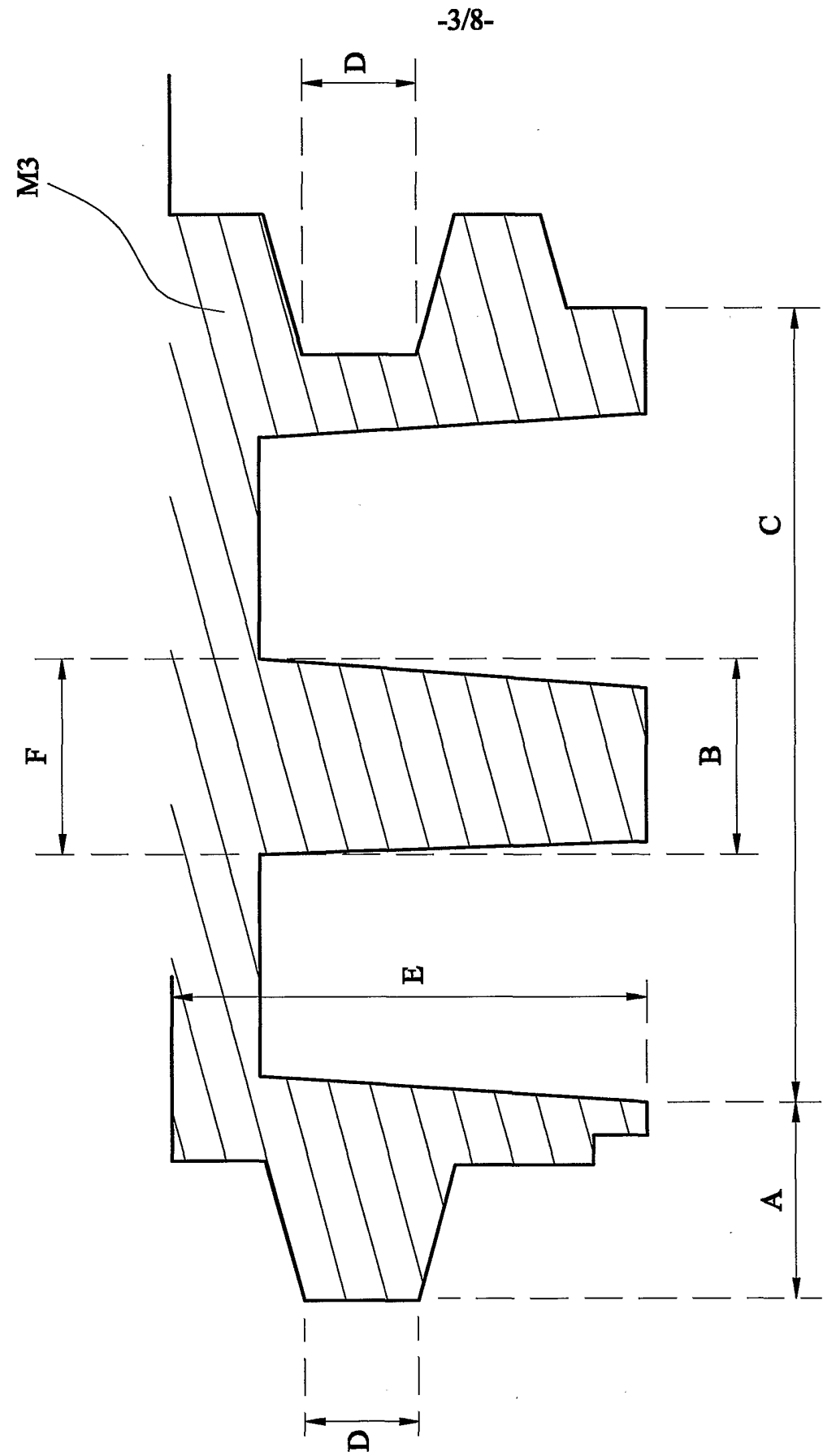
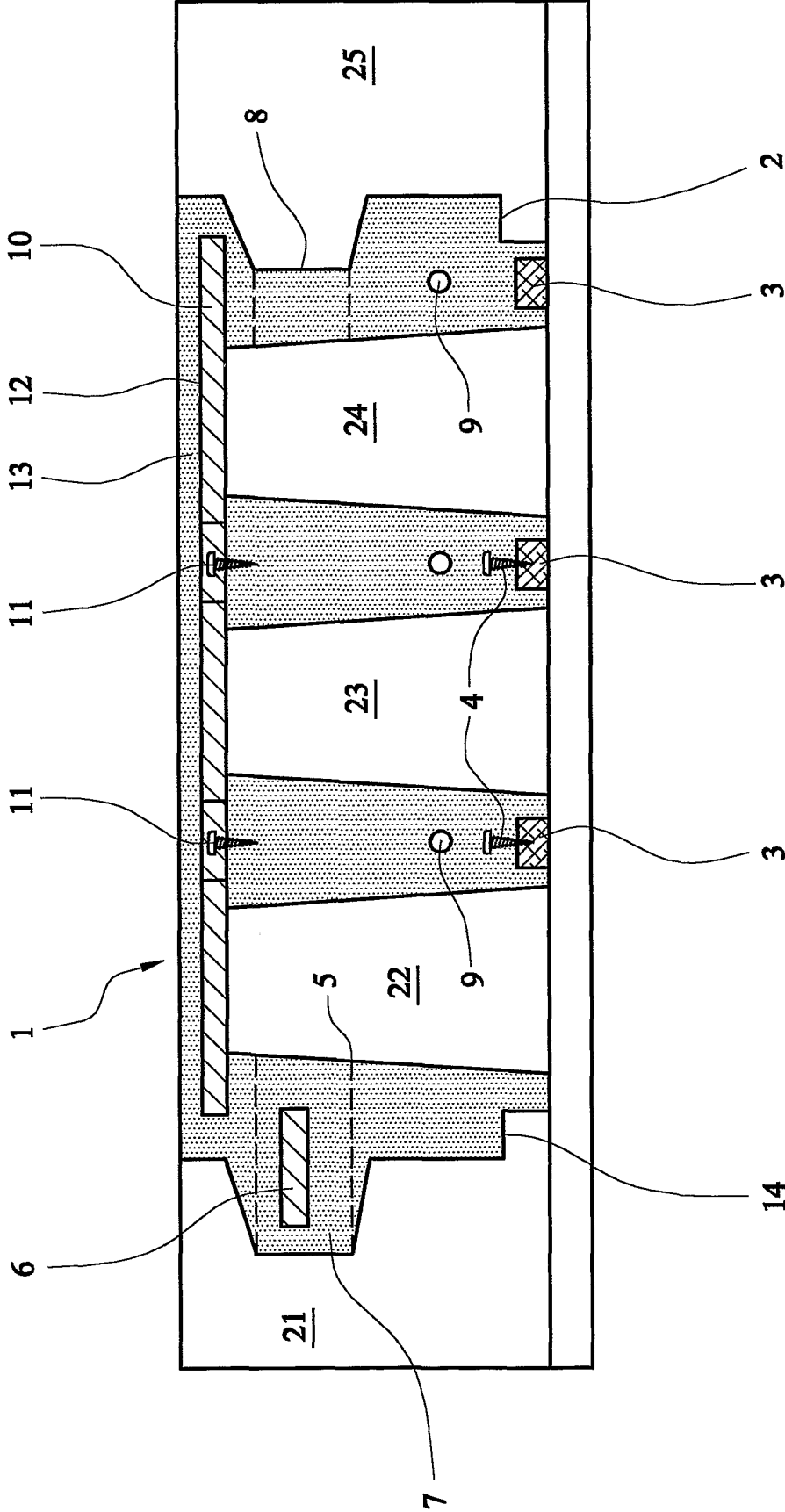


FIG. 3





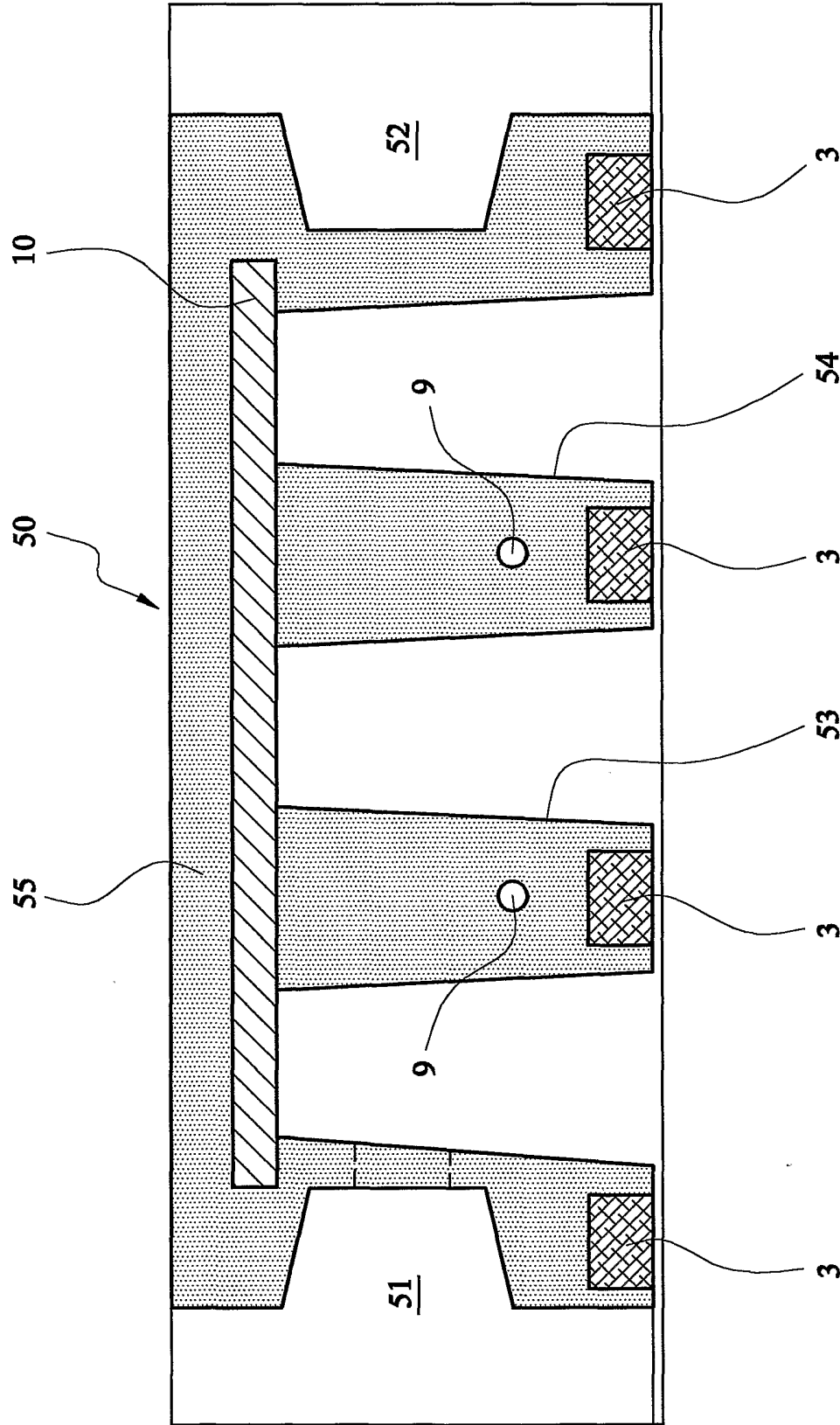


FIG. 5

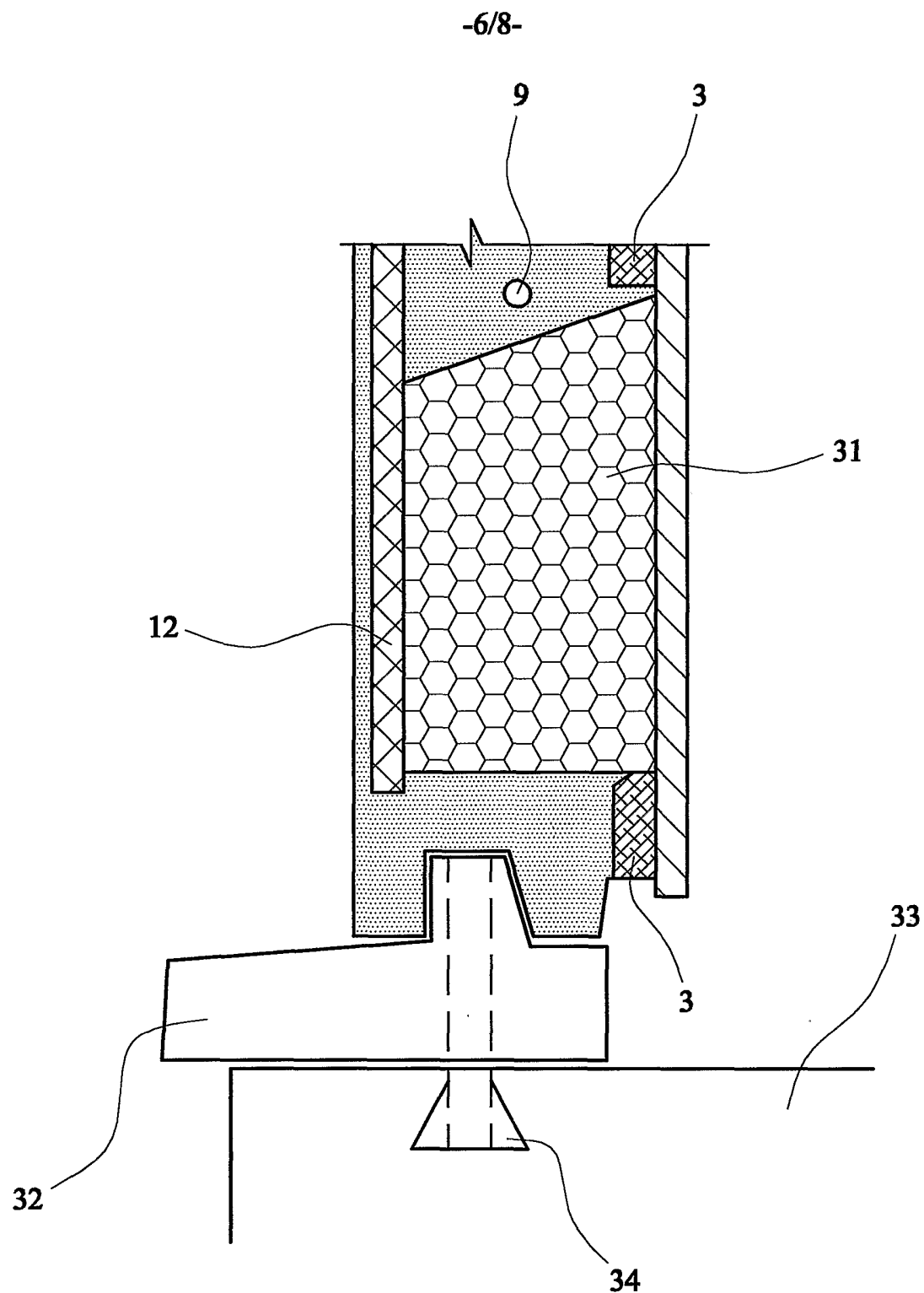
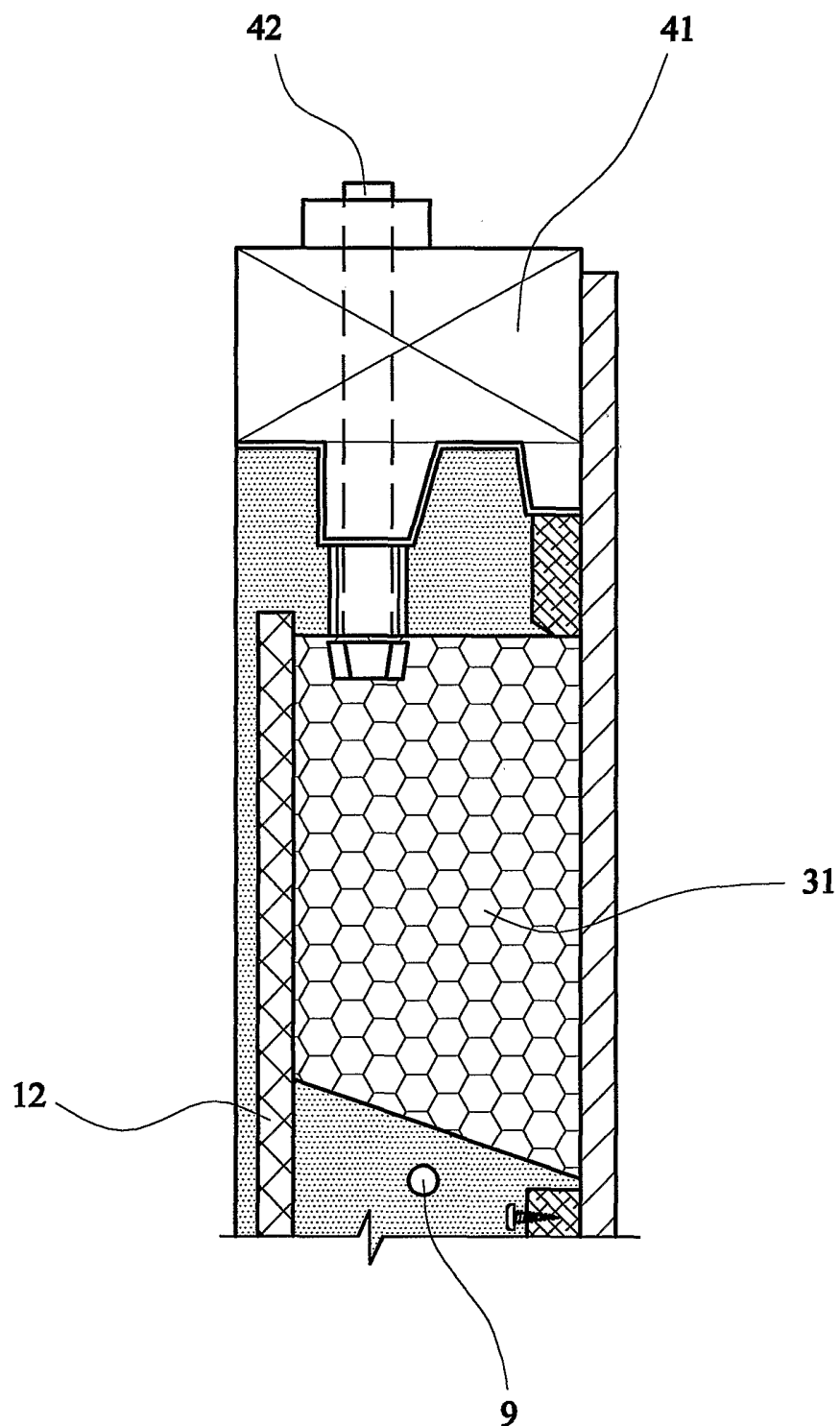


FIG. 6

-7/8-

FIG. 7

-8/8-

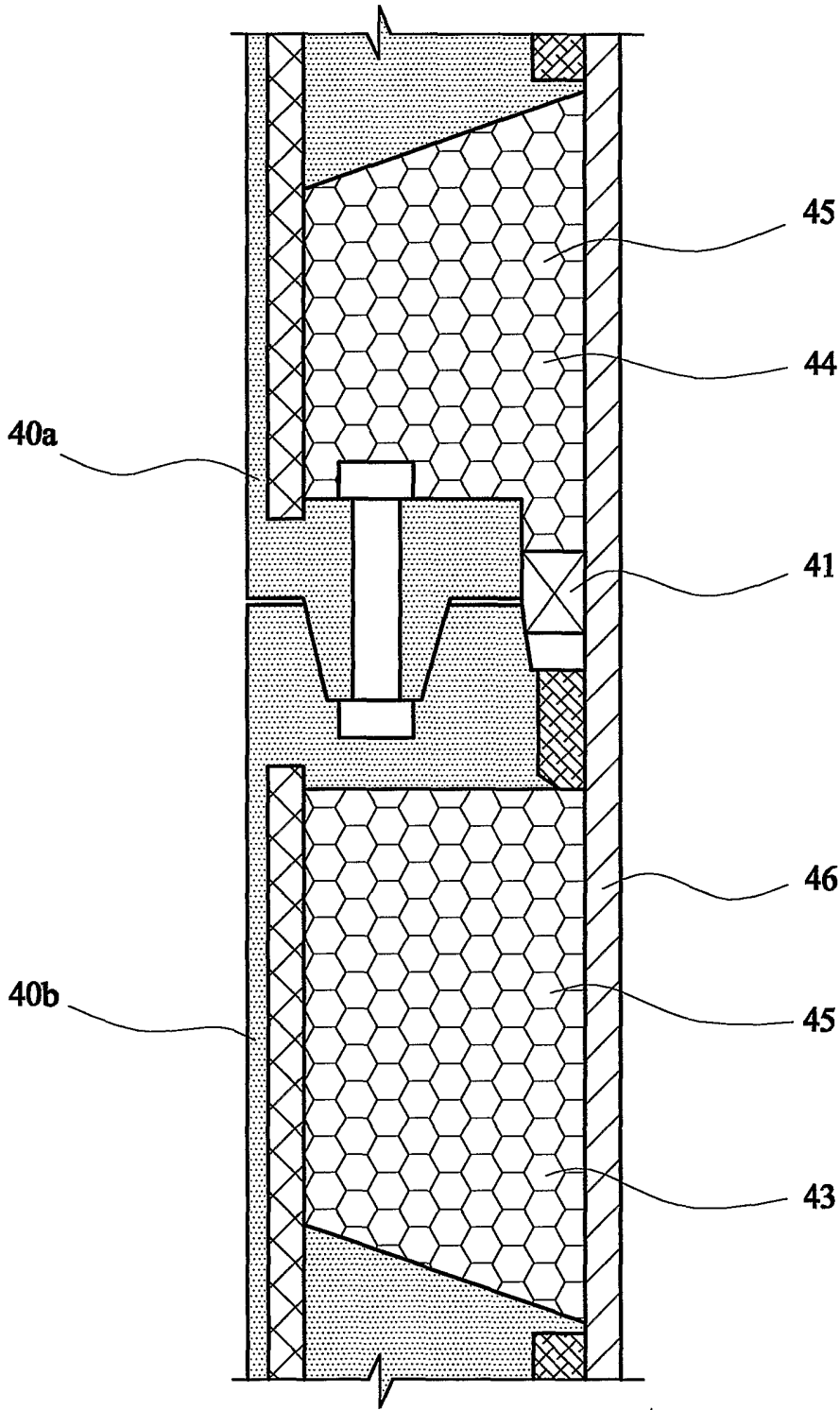


FIG. 8

## INTERNATIONAL SEARCH REPORT

ernational Application No

PCT/GB 02/02130

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B29C70/86 B29C70/68 E04C2/38 E04B1/94

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 E04C E04B B29C B29D

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)

WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 722 223 A (DAUSSAN ET COMPAGNIE) 12 January 1996 (1996-01-12)	1-3,6,7
Y	page 4, line 6 - line 35; figure 1	4,5,21
A	---	59
Y	EP 0 030 522 A (CICCOTELLI) 17 June 1981 (1981-06-17)	4,5,21
	figures 5,6	
	---	
A	FR 2 455 144 A (MAISON LPL) 21 November 1980 (1980-11-21)	13,14
	figures 1,2,7,8	
	---	
A	DE 21 34 582 A (SCHRODE) 16 March 1972 (1972-03-16)	15-18
	figure 2	
	---	
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

5 September 2002

Date of mailing of the international search report

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 787 544 A (BARNETTE) 22 January 1974 (1974-01-22) column 2, line 44 -column 3, line 41; figures 1-9	22, 26, 33
A	GB 2 306 167 A (KOBE STEEL EUROPE LIMITED) 30 April 1997 (1997-04-30) claims 1-3, 6, 8	34-36, 41, 53, 59

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 02/02130

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 2722223	A	12-01-1996	FR 2722223 A1	12-01-1996
			AU 2930295 A	25-01-1996
			EP 0717806 A1	26-06-1996
			WO 9601347 A1	18-01-1996
EP 30522	A	17-06-1981	IT 1126519 B	21-05-1986
			AU 6471980 A	11-06-1981
			BR 8007942 A	23-06-1981
			EP 0030522 A2	17-06-1981
			ES 497501 D0	16-01-1982
			ES 8202086 A1	01-04-1982
			JP 56089940 A	21-07-1981
FR 2455144	A	21-11-1980	FR 2455144 A1	21-11-1980
DE 2134582	A	16-03-1972	DE 2134582 A1	16-03-1972
US 3787544	A	22-01-1974	US 3072973 A	15-01-1963
			US 3457133 A	22-07-1969
			US 3832264 A	27-08-1974
			US 3379603 A	23-04-1968
			US 3761554 A	25-09-1973
GB 2306167	A	30-04-1997	NONE	