Title: COUPLING AN UPPER END OF A HOLLOW SECTION COLUMN TO A BUILDING UNIT SUPPORT

Abstract: A fitting for coupling an open upper end of a hollow section column to a support via which a building unit is to be supported on the column, the fitting comprising a body portion, configured to be received in the end, and rim portions which extend laterally outwardly from an upper end of the body portion so as to engage edge sections of the column at the upper end when the body portion is so received.
Coupling an upper end of a hollow section column to a building unit support

The present invention relates to construction of buildings using prefabricated building units, particularly (though not exclusively) floor panels or cassettes. More particularly, the present invention relates to coupling of an upper end of a hollow section column to a building unit.

There are a number of current trends in the building industry, including trends towards smaller lot sizes, larger houses with more open spaces and a greater focus placed on site safety, which have given rise to comparatively more large and heavy components and an increased use of cranes, scaffolding and systems to protect installers working at heights, with attendant increases in site costs. Becoming increasingly more attractive and competitive, therefore, is offsite prefabrication of components, panels and modules, including in particular floor panels or "cassettes".

Such cassettes require foundations. The traditional poured concrete slab foundation, given its inbuilt inaccuracies and susceptibility to movement under adverse conditions, as well as the level of skill required to install it satisfactorily and the relatively long time required for it to cure, is increasingly being replaced with quicker, simpler and cheaper foundations. Where the site is sloping or the floor level is to be raised above the natural ground level, there is generally a need for a post/column, which commonly comprises a square hollow steel section, and fittings at either end of it to connect it at its top end to the floor system and at its bottom end to the foundation system. It is important that these fittings be as economical, versatile and quick-to-install as possible.

According to a first aspect of the present invention, there is provided a fitting for coupling an open upper end of a hollow section column to a support via which a building unit is to be supported on the column, the fitting comprising a body portion, configured to be received in the end, and rim portions which extend laterally outwardly from an upper end of the body portion so as to engage edge sections of the column at the upper end when the body portion is so received.
The support may form a part of the building unit, e.g. it may comprise, for example, a truss of the building unit, or instead be additional to the building unit, e.g. comprise one or more bearers on which the building unit is supported.

Preferably, the building unit comprises a panel-like building unit. In a preferred embodiment of the invention, the building unit comprises a floor panel or cassette. In an alternative embodiment of the invention, the building unit may instead comprise, for example, a roof module or a wall panel.

Preferably, the body portion has a cross sectional configuration complementary to a transverse cross-sectional configuration of an interior of the column, whereby to form a substantially size-for-size fit therewith when the body portion is received in the end.

Preferably, the body portion has a cross-sectional configuration which is such that the body portion engages walls of the column to preclude rotation of the fitting about a longitudinal axis of the column when the body portion is received in the upper end.

Preferably, the cross-sectional configuration of the body portion is polygonal.

 Preferably, the cross-sectional configuration of the body is substantially rectangular. The cross-sectional configuration of the body may be substantially regular rectangular, i.e. substantially square.

Preferably, the fitting is bent from a shaped, single piece of plate.

Preferably, the fitting further comprises at least one flange portion extending from a laterally outer end of a said rim portion to be securable to the support.

Preferably, the fitting further comprises flange portions, each flange portion extending from a laterally outer end of a respective one of the rim portions to be securable to the support.

In a preferred embodiment of the invention, at least one said flange portion projects laterally outwardly.
In a preferred embodiment of the invention, at least one said flange portion projects upwardly.

Preferably, the or each flange portion is integrally formed with the rim portion from the end of which it extends.

Preferably, the or each flange portion is configured with at least one hole therethrough to receive a fastener for securing the flange portion to the support.

Preferably, the body portion is substantially hollow.

Preferably, the body portion is upwardly opening. Preferably, the body portion is configured in the form of a bowl.

Preferably, the body portion is configured with at least one hole therethrough, through which a respective tie-down rod for tying down the building unit can be received when the body portion is received in the upper end. Preferably, the or each hole through the body portion extends through a base of the body portion.

According to a second aspect of the present invention, there is provided a seat for a said fitting, the seat being receivable in the body portion such that an uppermost upwardly facing surface thereof is substantially flush with upwardly facing surfaces of the rim portions and thus engages the support so as to transfer loads therefrom to the base of the body portion.

Preferably, the seat has an exterior cross-sectional configuration complementary to an interior cross-sectional configuration of the body portion, whereby to form a substantially size-for-size fit with the body portion when received therein.
Preferably, the seat is generally hollow and has a top wall and side walls extending downwardly from the top wall so as to be downwardly opening. Preferably, each side wall is arranged to abut a respective side wall of the body portion.

5 Preferably, the insert is bent from a shaped, single piece of plate.

Preferably, the seat has a polygonal cross-sectional configuration. Preferably, the seat has a substantially rectangular cross-sectional profile. The seat may have a substantially square cross section.

10 Preferably, the seat has a top wall formed with at least one hole therethrough, through which a respective tie-down rod for tying down the building unit can be received when the body portion is received in the upper end.

15 Preferably, the seat has side walls at least one of which is configured with one or more holes therethrough, the or each hole being arranged to receive therethrough a fastener inserted through a corresponding hole in a sidewall of the fitting and/or a corresponding hole in a side wall of the column.

20 According to a third aspect of the present invention, there is provided an assembly comprising said fitting and said column, wherein said body portion is received in said upper end such that said rim portions engage said edge sections.

In a preferred embodiment of the invention, the assembly further comprises at least one tie-down rod, the or each rod passing through a said hole through the body portion. Preferably, the or each tie-down rod terminates at a level not higher than upwardly facing surfaces of the rim portions and is secured against a base of the body portion by a fastener which is threadedly engaged with the tie-down rod and likewise terminates at a level not higher than said upwardly facing surfaces.

30 Preferably, the assembly further comprises a base to which a lower end of the column is secured, the base being secured to the ground by pegs or stakes which pass therethrough and have been driven into the ground.
In the assembly according to a preferred embodiment of the invention, the or each flange is secured to the support via at least one fastener passing through a hole through the flange.

In the assembly according to a preferred embodiment of the invention, said is received in the body portion such that the uppermost upwardly facing surface thereof is substantially flush with the upwardly facing surfaces of the rim portions.

According to a fourth aspect of the present invention, there is provided a method of forming said fitting, comprising bending a blank to form the fitting. Preferably, the blank consists of a single piece of plate. Preferably, the blank comprises a central portion and tongue portions which are integral with and project laterally outwardly from the central portion, and the method includes forming bends at junctions between the tongue portion and central portion such that the tongue portions project upwardly from the central portion whereby the tongue portions define side walls of the fitting and the central portion defines a base of the fitting, the side walls and base defining said body. Preferably, the method further includes bending each tongue portion about a transverse axis so as to form a respective laterally outwardly projecting portion of the tongue which defines a respective said rim portion. At least one said flange portion may be defined by a respective said laterally outwardly projecting portion, laterally outward of the respective rim portion. At least one said flange portion may be formed by bending a respective said laterally outwardly projecting portion about a transverse axis such a distal end portion of the respective tongue portion projects upwardly.

According to a fifth aspect of the present invention, there is provided, for forming said fitting, said blank.

Preferably, the blank is configured with at least one hole arranged to receive therethrough a tie-down rod in the fitting and/or at least one hole arranged to receive a fastener to secure the fitting to the support and/or at least one hole arranged to secure the fitting to the column, the or each hole preferably being punched.

According to a sixth aspect of the present invention, there is provided a method of forming said seat, comprising bending a blank to form the seat. Preferably, the blank
for forming the seat consists of a single piece of plate. Preferably, that blank comprises a central portion and tongue portions which are integral with and project laterally outwardly from the central portion, and the method includes forming bends at junctions between the tongue portion and central portion such that the tongue portions project downwardly from the central portion to define side walls of the seat and the central portion defines a top wall of the seat.

According to a seventh aspect of the present invention, there is provided said blank for forming the seat.

Preferably, the blank for forming the seat is configured with at least one hole arranged to receive therethrough a tie-down rod in the seat and/or at least one hole arranged to receive a fastener to secure the seat to the fitting and, the or each hole preferably being punched.

The invention is described, by way of non-limiting example only, with reference to the accompanying drawings, as set out below.

Figure 1 is a perspective view of an assembly comprising a column, a bearer and a floor cassette supported by the column via the bearer, in accordance with a preferred embodiment of the present invention;

Figure 2 is a perspective view showing an arrangement via which a lower end of the column is secured to the ground;

Figure 3 is a perspective view showing details of the column, including an upper end thereof, as well as the bearer and rods which may be used to tie down the cassette/bearer;

Figure 4 is a perspective view of an end cap for coupling an upper end of the column to the bearer in accordance with a preferred embodiment of the present invention;

Figure 5 is a plan view of a blank for forming the end cap;
Figure 6 is a perspective view of the end cap fitted to the column upper end and assuming an alternative configuration;

Figure 7A is a perspective view showing the end cap fitted to the column upper end and assuming the same configuration as shown in Figure 4;

Figure 7B is a plan view showing the end cap, fitted to the column upper end, having the same basic shape as shown in Figure 7A though an exemplary alternative arrangement of holes for tie-down rods and fasteners;

Figure 8A is a perspective view showing the end cap fitted to the column upper end and assuming another alternative configuration;

Figure 8B is a perspective view showing the end cap fitted to the column upper end and assuming yet another alternative configuration;

Figure 9 is a side elevation view showing an end cap embodying the invention fitted to the column upper end and tied down by means of an internal tie-down rod and securing nut;

Figure 10 is a perspective view of a load-bearing seat, usable in combination with the end cap, in accordance with a preferred embodiment of the present invention;

Figure 11 is a perspective view showing how the seat nests within the end cap at the column upper end; and

Figure 12 is a side elevation view, corresponding to that of Figure 9, showing the seat nested within the end cap.

Referring to Figure 1, the preferred embodiments of the invention relate to coupling of the upper end of a column 50 to a support, such as a bearer 60, via which a prefabricated building unit, such as a floor cassette 100, is to be supported over the ground 70 by the column 50.
The column 50 comprises an upright length of steel square hollow section secured at a lower end thereof, via a bracket 81, to a base plate 82, the latter being secured to a flat top wall of a base support 83 via bolts 84 received through aligned slotted holes 85, 86 in the base plate 82 and top wall of the base support 83, each bolt 84 being secured by a respective nut 87. The slots 85 extend along axes which are perpendicular to those along which the slots 86 extend, permitting positional adjustment, relative to the base support 83, of the base plate 82, and thus the column 50, in a horizontal plane. Fixed to corners of the base support 83 are sleeves 88, through which stakes 89, in the form of steel tubes, are inserted and driven into the ground, the sleeves 88 being arranged at differing angles to the ground surface, whereby the base support 83, and thus the column 50, is secured firmly to the ground. The arrangement defined by the base support 83, sleeves 88 and tubes 89 is marketed in Australia under the trade mark *Surefoot*.

Shown in Figure 3 are details of an open upper end 51 of the column 50 and details of a typical configuration which the bearer 60 may assume. Tie-down rods 65 may, if appropriate, be installed to tie the bearer 60 and cassette 100 down, as will be described in further detail later.

Shown in Figure 4 is a fitting, in the form of a cap 10, for coupling the column upper end 51 to the bearer 60. The cap 10 is bent from a shaped, punched piece of metal, preferably steel, plate 1, which is shown in Figure 5 and will be described in further detail later, and has a flat square bottom wall or base 11, sidewalls 12 extending upwardly from the bottom wall 11, and rim portions 13 which extend laterally outwardly from upper ends of the sidewalls 12. The bottom wall 11 and sidewalls 12 define a hollow, upwardly opening body 14 having a substantially square cross-sectional configuration an exterior of which substantially matches the interior cross-sectional configuration of the column 50 whereby the body 14 can be downwardly inserted into the column upper end 51 to form a substantially size-for-size fit therewith, as shown in Figure 7, the rim portions 13 resting against respective edge sections 52 of the column 50 to retain the cap 10, preventing it from falling through the column 50.

The cap 10 further comprises flange portions 15 integrally formed with, and projecting from distal ends of, respective ones of the rim portions 13. The orientations of the
flange portions 15 may vary without departure from the invention. For example, each of the flange portions 15 may extend laterally outwardly, perpendicular to the sidewall 12 to which it connects, as shown in Figure 4. Alternatively, referring to Figure 6, a bend may be formed between one of the flange portions 15 and the rim portion 13 to which it connects, such that that flange portion 15 is parallel to, though laterally outwardly offset from, the side wall 12 to which it is connected via the rim portion 13. Alternatively, such a bend may be formed at each of two flange portion 15 rim portion/rim 13 junctions, whereby two of the four flange portions 15 extend upwardly instead of laterally outwardly. Those two flange portions 15 may be adjacent flange portions 15, as shown in Figure 8A, or opposite flange portions 15, as shown in Figure 8B.

At least one hole 20 is formed through the bottom wall, the or each hole being positioned to receive a respective tie-down rod 65, as will be described in further detail later. Also, each flange portion 15 is configured with one or more holes 22 through which can be inserted a fastener, typically a bolt, for securing the flange portion 15 against the bearer 60, the laterally projecting flange portions 15 being receivable against a bottom face of the bearer 60, and the upright flange portions 15 being receivable against side faces, or possibly an end face, of bearer 60.

One or more of the flange portions 15 may additionally be configured with at least one hole 24 through which, if the flange portion 15 is orientated horizontally, there may pass a respective tie-down rod (not shown), which is external to the column 50, used to provide tie-down to the bearer 60/cassette 100. Such external tie-down may be readily established once the overlying structure is in place.

The cap 10, because the body 14 thereof fits into the column upper end 51, and the rim portions 13 engage the edge sections 52 at that end, is positively located to provide both bearing and shear resistance to the bearer 60 and thus the cassette 100 supported by that bearer, even without any fixing of the cap 10 to the column 50. Referring to Figure 9, where an internal tie-down rod 65 is to be used within the column 50, the upwardly opening hollow configuration of the body 14 permits an upper end of the rod 65 and a nut 66, screwed onto that end to transfer from it tie-down load into the cap base 11, to be recessed below a plane P in which lie upwardly facing surfaces 13A of the rim portions 13, against which surfaces an
underside/bottom face of the bearer 60 is received, so that the rod end and nut 66 are
"below flush" and thus do not interfere with the engagement between the rim portions
13 (and any laterally extending flange portion(s) 15) and the bearer underside. As an
alternative or in addition to one or more tie-down rods 65/securing nuts 66, fasteners,
such as screws 40, may be received through one or more of the side walls 12 (which
may be preformed with holes (not shown), preferably punched, to receive such
fasteners) to secure the/each side wall 12 to an adjacent wall of the column 50, the
interconnections thus formed between the cap 10 and column 50 likewise being below
the plane P.

The metal plate section/blank 1 from which the cap 10 is formed, shown in Figure 5,
assumes the shape of a "+" sign, comprising a square central portion 90, defining the
base 11, and perpendicular tongue portions 92 extending from respective sides of the
central portion 90, from each of which is to be formed a respective sidewall 12, flange
portion 15 and rim portion 13 interconnecting the side wall 12 and flange portion 15.
Punched into the plate 1 are the holes 20, 22 and/or 24 as discussed above.

Each side wall portion 12 is formed by folding a respective tongue portion 92 about a
junction which it forms with the central portion 90, thereby forming a 90-degree bend
at that junction, and laterally outwardly folding a section of the tongue portion 92
about a respective transverse axis 95, thereby a forming-90 degree bend whereby an
upper end of the side wall portion 12 is defined and thus forming the rim portions 13,
as well as any flange portion(s) 15 to be orientated horizontally in the finished cap 10.
(It will be appreciated that folding about said junction can be effected either before or
after bending about the axis 95.) Finally, the/each tongue portion 92 from which
there is to be formed a flange portion 15 which projects upwardly is bent, through 90
degrees, about a transverse axis 97, whereby the/each upwardly projecting flange 15
is formed.

Advantageously, the cap 10 is formed without any need to join any one part thereof to
any other part thereof. Because the cap 10 is formed without any welding, the
corrosion resistance of the material forming the cap 10 is not impaired.

Referring to Figure 10, the cap 10 may be used in combination with a seat 30
according to a preferred embodiment of the present invention. The seat 30 is likewise
formed from a single-piece blank (not shown), comprising a square central portion, which is to form a top wall 32 of the seat 30, and perpendicular rectangular tongue portions each of which is folded downwardly about a respective axis 33 defining a junction between the tongue portion and central portion 32, such that it forms a respective one of four upright sidewalls 34 of the seat 30. At least one tie-down rod hole 20' may, if required, be punched into the central portion, so as to align with a respective hole 20 in the cap base 11. Referring to Figure 11, the seat 30 is dimensioned such that the outer faces of opposed ones of the side walls 34 have a separation approximately the same as (but slightly smaller than) a separation of inner faces of opposed ones of the cap sidewalls 12 such that the seat 30 forms a substantially size-for-size fit within the cap 10 when downwardly inserted into the body portion 14. The side walls 34, lower ends of which are received against the cap base 11, are dimensioned such that an upwardly facing exterior surface of the seat top wall 32 is substantially flush with the rim portion upper surfaces 13A, thereby lying in the plane P.

Advantageously, the seat 30, which can be used with the fitting 10 in any of the alternative configurations it may assume, thus receives thereagainst the underside of the bearer 60, providing, in addition to the rim portions 13, area which bears load from the bearer 60. Because the seat 30 is hollow and downwardly opening, it can accommodate the/each tie rod upper end/securing nut 66 therewithin.

A top washer may be interposed between a given securing nut 66 and the fitting base or seat top wall.

The column cap 10 has a number of advantages over conventional column caps. Firstly, conventional column caps are generally of a welded construction, and must thus be subjected to a corrosion protection step (typically hot-dip galvanizing), because of the displacement of any surface corrosion protection by the welding process. Consequently, there can as many as five processes (comprising cutting, punching/drilling, folding, welding and galvanizing) in their fabrication, with the final product being very specific in its application. The column cap 10 maintains the surface corrosion protection already incorporated the blank/plate 1 since there is no welding. Some conventional caps are made of relatively thick material to facilitate and hasten welding, though the additional material adds unnecessary cost and weight
in many instances. Also, the blank 1 allows for several variations in the configuration of the cap 10 required on site to allow the cap 10 to secure to different types and parts of overlying structure - e.g., at corners, along edges, at internal locations, at side, top or bottom faces, and to timber and/or steel components.

Furthermore, the cap 10 can be fixed down to the supports and up to the overlying structure in a number of ways that are appropriate to the exact load requirements from very small to very large, thus always providing a cost-effective option. Some examples are as follows:

a. It can be fixed down to the column with one or more screws from the side under small uplift loads.

b. It can be fixed down with a tie-down rod/bolt for midrange loads, with the top of the securing nut being below flush, along with the seat if employed, whereby there is no obstruction to the support of the overlying structure.

c. The inclusion of the tie-down rod holes allows, in cases of extreme uplift, one or more tie-down rods, internal and/or external to the column 50, to pass through the cap 10 directly from the foundation to the upper structure, without the configuration of the top of the cap being affected.

The ability of the cap 10 to resist a range of uplift loads has been detailed above, though, of the foundations supporting a building, a number are required to resist higher-than-usual downward loads, usually dead and live loads. It is therefore not economical to build this additional strength into all of the supports, but rather is appropriate to apply that strength only those supports that require it. Use of the seat 30 achieves the increased strength requirement only where necessary (e.g., in the case of timber bearers). The seat 30 is simply dropped into place, significantly increasing the bearing area. The top wall of the seat 30 may, of course, be configured with the same (alternative) tie-down rod hole pattern as that applied to the base of the fitting 10 shown in Figure 7B. The shape of the seat 30 is such that it does not clash with the tie-down securing nut 66 should it be fitted.

While various embodiments of the present invention have been described above, it should be understood that they have been presented by way of example only, and not by way of limitation. It will be apparent to a person skilled in the relevant art that various changes in form and detail can be made therein without departing from the
spirit and scope of the invention. Thus, the present invention should not be limited by any of the above described exemplary embodiments.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference in this specification to any prior publication (or information derived from it), or to any matter which is known, is not, and should not be taken as an acknowledgment or admission or any form of suggestion that that prior publication (or information derived from it) or known matter forms part of the common general knowledge in the field of endeavour to which this specification relates.
The claims defining the invention are as follows:

1. A fitting for coupling an open upper end of a hollow section column to a support via which a building unit is to be supported on the column, the fitting comprising a body portion, configured to be received in the end, and rim portions which extend laterally outwardly from an upper end of the body portion so as to engage edge sections of the column at the upper end when the body portion is so received.

2. A fitting according to claim 1, wherein the body portion has a cross-sectional configuration complementary to a transverse cross-sectional configuration of an interior of the column, whereby to form a substantially size-for-size fit therewith when the body portion is received in the end.

3. A fitting according to claim 1 or 2, wherein the body portion has a cross-sectional configuration which is such that the body portion engages walls of the column to preclude rotation of the fitting about a longitudinal axis of the column when the body portion is received in the upper end.

4. A fitting according to claim 2 or 3, wherein the cross-sectional configuration of the body portion is polygonal.

5. A fitting according to any one of claims 2 to 4, wherein the cross-sectional configuration of the body is substantially rectangular.

6. A fitting according to claim 6, wherein the cross-sectional configuration of the body is substantially square.

7. A fitting according to any one of the preceding claims, being bent from a shaped, single piece of plate.
8. A fitting according to any one of the preceding claims, further comprising at least one flange portion extending from a laterally outer end of a said rim portion to be securable to the support.

9. A fitting according to any one of claims 1 to 7, further comprising flange portions, each flange portion extending from a laterally outer end of a respective one of the rim portions to be securable to the support.

10. A fitting according to claim 8 or 9, wherein at least one said flange portion projects laterally outwardly.

11. A fitting according to any one of claims 8 to 10, wherein at least one said flange portion projects upwardly.

12. A fitting according to any one of claims 8 to 11, wherein the or each flange portion is integrally formed with the rim portion from the end of which it extends.

13. A fitting according to any one of claims 8 to 12, wherein the or each flange portion is configured with at least one hole therethrough to receive a fastener for securing the flange portion to the support.

14. A fitting according to any one of the preceding claims, wherein the body portion is substantially hollow.

15. A fitting according to any one of the preceding claims, wherein the body portion is upwardly opening.

16. A fitting according to claim 15 as appended to claim 14, wherein the body portion is configured in the form of a bowl.

17. A fitting according to any one of the preceding claims, wherein the body portion is configured with at least one hole therethrough, through which a respective tie-down rod for tying down the building unit can be received when the body portion is received in the upper end.
18. A fitting according to claim 17 according to any one of claims 14 to 16, wherein the or each hole through the body portion extends through a base of the body portion.

19. A fitting according to any one of the preceding claims, having side walls at least one of which is configured with one or more holes therethrough, the or each hole being arranged to receive therethrough a fastener inserted through a corresponding hole in a side wall of the column.

20. A seat for a fitting according to claim 15 as appended to claim 14, or according to claim 17 as appended to claim 16, or according to claim 18, the seat being receivable in the body portion such that an uppermost upwardly facing surface thereof is substantially flush with upwardly facing surfaces of the rim portions and thus engages the support so as to transfer loads therefrom to the base of the body portion.

21. A seat according to claim 20, having an exterior cross-sectional configuration complementary to an interior cross-sectional configuration of the body portion, whereby to form a substantially size-for-size fit with the body portion when received therein.

22. A seat according to claim 20 or 21, being generally hollow and having a top wall and side walls extending downwardly from the top wall so as to be downwardly opening.

23. A seat according to claim 22 as appended to claim 21, wherein the side walls are arranged to abut side walls of the body portion.

24. A seat according to any one of claims 20 to 23, being bent from a shaped, single piece of plate.

25. A seat according to any one of claims 20 to 24, having a polygonal cross-sectional configuration.

26. A seat according to claim 25, having a substantially rectangular cross-sectional profile.
27. A seat according to any one of claims 20 to 26, having a top wall formed with at least one hole therethrough, through which a respective tie-down rod for tying down the support can be received when the body portion is received in the upper end.

28. A seat according to any one of claims 20 to 27 having side walls at least one of which is configured with one or more holes therethrough, the or each hole being arranged to receive therethrough a fastener inserted through a corresponding hole in a sidewall of the fitting and/or a corresponding hole in a side wall of the column.

29. An assembly comprising a fitting according to any one of claims 1 to 19 and said column, wherein said body portion is received in said upper end such that said rim portions engage said edge sections.

30. An assembly according to claim 29, wherein the fitting accords with claim 17 or 18, the assembly further comprising at least one tie-down rod, the or each rod passing through a said hole through the body portion.

31. An assembly according to claim 30, wherein the or each tie-down rod terminates at a level not higher than upwardly facing surfaces of the rim portions and is secured against a base of the body portion by a fastener which is threadedly engaged with the tie-down rod and likewise terminates at a level not higher than said upwardly facing surfaces.

32. An assembly according to any one of claims 29 to 31, further comprising a base to which a lower end of the column is secured, wherein that base is secured to the ground by pegs or stakes which pass therethrough and have been driven into the ground.

33. An assembly according to any one of claims 29 to 32, wherein the fitting accords with any one of claims 9 to 13 or any one of claims 14 to 19 as dependent therefrom, and the or each flange is secured to the support via at least one fastener passing through a hole through the flange.

34. An assembly according to any one of claims 29 to 33, wherein the fitting accords with claim 15 as appended to claim 14, with claim 17 as appended to claim
16, or with claim 18, the assembly further including a seat according to any one of claims 20 to 28 received in the body portion such that the uppermost upwardly facing surface thereof is substantially flush with the upwardly facing surfaces of the rim portions.

35. A method of forming a fitting according to any one of claims 1 to 19, comprising bending a blank to form the fitting

36. A method according to claim 35, wherein the blank consists of a single piece of plate.

37. A method according to claim 35 or 36, wherein the blank comprises a central portion and tongue portions which are integral with and project laterally outwardly from the central portion, the method including forming bends at junctions between the tongue portion and central portion such that the tongue portions project upwardly from the central portion such that the tongue portions define side walls of the fitting and the central portion defines a base of the fitting, the side walls and base defining said body.

38. A method according to claim 37, further including bending each tongue portion about a transverse axis so as to form a respective laterally outwardly projecting portion of the tongue which defines a respective said rim portion.

39. A method according to claim 38, wherein the fitting accords with any one of claims 8 to 13, and wherein at least one said flange portion is defined by a respective said laterally outwardly projecting portion, laterally outward of the respective rim portion.

40. A method according to claim 38 or 39, wherein the fitting accords with any one of claims 8 to 13, and wherein at least one said flange portion is formed by bending a respective said laterally outwardly projecting portion about a transverse axis such a distal end portion of the respective tongue portion projects upwardly.

41. For a method according to any one of claims 35 to 40, said blank.
42. A blank according to claim 41, configured with at least one hole arranged to receive therethrough a tie-down rod in the fitting and/or at least one hole arranged to receive a fastener to secure the fitting to the support and/or at least one hole arranged to secure the fitting to the column, wherein the or each hole is punched.

43. A method of forming a seat according to any one of claims 20 to 28, comprising bending a blank to form the seat.

44. A method according to claim 43, wherein the blank consists of a single piece of plate.

45. A method according to claim 43 or 44, wherein the blank comprises a central portion and tongue portions which are integral with and project laterally outwardly from the central portion, the method comprising forming bends at junctions between the tongue portion and central portion such that the tongue portions project downwardly from the central portion to define side walls of the seat and the central portion defines a top wall of the seat.

46. For a method according to any one of claims 43 to 45, said blank.

47. A blank according to claim 46, configured with at least one hole arranged to receive therethrough a tie-down rod in the seat and/or at least one hole arranged to receive a fastener to secure the seat to the fitting, the or each hole being punched.
A. CLASSIFICATION OF SUBJECT MATTER
B21D 5/16 (2006.01)  B21D 11/20 (2006.01)  B21D 22/00 (2006.01)  B21D 51/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Database WPIAP, EPODOC (Cluster TXTE): IPC/CPC B21D 5/-, B21D 11/-, B21D 19/-, B21D 22/-, B21D 51/-, B21D 53/-, E04B 1/343, E04B 1/38, E04B 5/02, E04C 3/30, E04F 15/024, E04G 25/04, E02D 35/00 and Keywords: fitting, plate, post, foot, column, floor, beam, hollow, top, end, head plate, flush, rim, bent, fold, indented, recess, blank, square, tight-fit and like terms.

Google Patents & Keywords: column, pillar, structural, building, insert, fitting, end, terminal, connector, flush, recess, bent, stamped, fold and like terms.

Applicant/inventor search in Espacenet & IPAustralia internal database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>Documents are listed in the continuation of Box C</td>
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**X** Further documents are listed in the continuation of Box C  **X** See patent family annex

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<td>*</td>
<td>document defining the general state of the art which is not considered to be of particular relevance</td>
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<td>&quot;A&quot;</td>
<td>earlier application or patent but published on or after the international filing date</td>
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<td>&quot;E&quot;</td>
<td>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)</td>
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<td>&quot;O&quot;</td>
<td>document referring to an oral disclosure, use, exhibition or other means</td>
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<td>document published prior to the international filing date but later than the priority date claimed</td>
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<tr>
<td>&quot;T&quot;</td>
<td>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</td>
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<tr>
<td>&quot;X&quot;</td>
<td>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</td>
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<td>&quot;Y&quot;</td>
<td>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</td>
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<td>&quot;&amp;&quot;</td>
<td>document member of the same patent family</td>
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Date of the actual completion of the international search  17 November 2015

Date of mailing of the international search report  17 November 2015

Name and mailing address of the ISA/AU

AUSTRALIAN PATENT OFFICE
PO BOX 200, WODEN ACT 2606, AUSTRALIA
Email address: pct@ipaustralia.gov.au

Authorised officer

John Ho
AUSTRALIAN PATENT OFFICE
(ISO 9001 Quality Certified Service)
Telephone No. 0262832329
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<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<td>US 8567743 B2 (EHRHARDT et al.) 29 October 2013&lt;br&gt;See figures 9A-9C, column 3 lines 59-67, column 5 lines 38-44 and column 6 lines 1-2</td>
<td>1-6, 8-10, 12, 14-19, 29-32</td>
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<td>US 2007/01 38361 A1 (POCE) 21 June 2007&lt;br&gt;See figures 1-5F, para. 0026, 0032</td>
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<td>US 2008/0105 172 A1 (REPASKY) 08 May 2008&lt;br&gt;See figures 2-3</td>
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<td>US 6799407 B2 (SALDANA) 05 October 2004&lt;br&gt;See figures 46-47 &amp; 49-53, column 10 lines 34-42 and column 40 lines 8-16</td>
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<td>Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)</td>
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<td>This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:</td>
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<td>1.</td>
<td>Claims Nos.:</td>
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<td>because they relate to subject matter not required to be searched by this Authority, namely:</td>
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<td>the subject matter listed in Rule 39 on which, under Article 17(2)(a)(i), an international search is not required to be carried out, including</td>
<td></td>
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<td>2.</td>
<td>Claims Nos.:</td>
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<td>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:</td>
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<td>3.</td>
<td>Claims Nos:</td>
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<td>because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)</td>
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<th>Box No. III</th>
<th>Observations where unity of invention is lacking (Continuation of item 3 of first sheet)</th>
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<tr>
<td>This International Searching Authority found multiple inventions in this international application, as follows:</td>
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<td>See Supplemental Box for Details</td>
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<tr>
<td>1.</td>
<td>As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.</td>
</tr>
<tr>
<td>2.</td>
<td>As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.</td>
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<tr>
<td>3.</td>
<td>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.:</td>
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<td>4.</td>
<td>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.:</td>
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<td>1-19, 29-33, 35-42</td>
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<td>The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.</td>
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Continuation of: Box III

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

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

- Claims 1-19, 29-42 are directed to a fitting for coupling an upper end of a hollow section column to a support via which a building unit is to be supported on that column, an assembly comprising of said fitting and a column and a method of forming the fitting respectively. The feature of a fitting comprising of a body portion configured to be received in the end of the column and rim portions extending laterally outwardly from an upper end of the body portion so as to engage the edge sections of the column is specific to this group of claims.

- Claims 20-28, 43-47 are directed to a seat for a fitting of claim 15 (when appended to claim 14), claim 17 (when appended to claim 16) or claim 18. The feature of a seat being receivable in the body portion such that an uppermost upwardly facing surface thereof is substantially flush with upwardly facing surfaces of the rim portions and thus engages the support so as to transfer loads therefrom to the base of the body portion is specific to this group of claims.

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

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

Claims 20-28, 43-47 are to be construed as per se claims to a seat and a method of forming such seat respectively because the term “for” as used here merely places a limitation on what is claimed only to the extent that it must be suitable for use in the fitting of any of claims 15-18. Thus the inventions defined by the claims are only unified by their mere suitability to be located in the fitting of claims 15-18. As such the identified features of the claims are not common to all the claimed inventions and therefore cannot provide the required technical relationship. Therefore there is no special technical feature common to all the claimed inventions and the requirements of unity of invention are consequently not satisfied a priori.

In any case, the identified features common to all of the claimed inventions and which potentially provides a technical relationship among them is a fitting comprising of a body portion configured to be received in the end of a column and rim portions extending laterally outwardly from an upper end of the body portion so as to engage the edge sections of the column; the body portion being substantially hollow and is upwardly opening (claim 15 as appended to claim 14). However this feature does not make a contribution over the prior art because it is disclosed in:

Prior art documents D1, D3 and D5.

In the light of these documents there is no special technical feature common to all the claimed inventions. Therefore the requirements for unity of invention are also not satisfied a posteriori.

It is considered that search and examination for the second invention will require more than negligible additional search and examination effort over that for the first invention, and therefore an additional search fee is warranted.

Further, when the appended claims introduce features of one or more of the claimed inventions and yet are additionally appended to claims directed to any other of the claimed inventions, such claims will only be searched and reported on to the extent that additional search fees have been paid for all such claimed inventions. Claim 34 is one such claim). For this reason, claim 34 will only be considered when additional fees are paid.
This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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### US 8567743 B2
- 29 October 2013: US 2011084186 A1, 14 Apr 2011
- 29 Oct 2013: US 8567743 B2
- 31 Dec 2009: US 2009321596 A1

### US 2007/0138361 A1
- 20 Jun 2007: CA 2530902 A1, CA 2571212 A1
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- 20 Jun 2007: CA 2571219 A1
- 19 Jul 2007: US 2007166099 A1
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- 15 May 2008: CA 2682119 A1
- 03 Oct 2010: CA 2695862 A1
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- 05 Apr 2011: US 7918059 B2
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- 05 October 2004: US 2004074196 A1, 22 Apr 2004
- 10 Jun 2003: AU 2002356985 A1
- 22 May 2003: US 2003093969 A1
- 04 Apr 2006: US 702102 IB2
- 22 Apr 2004: US 2004074197 A1
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End of Annex