

DOOR FRAME ASSEMBLY AND METHOD OF INSTALLATION OF DOORS

This invention relates to door frame assemblies, and to a method of
5 installing a door.

Traditionally, when building partition walls and particularly when
installing a door in such a wall, a dry wall contractor would form an
orifice in a plasterboard partition. A timber or metal doorset comprising
10 a frame and a door would then be installed in the orifice. The dry wall
contractor would then return, install an edge trim such as a rebate trim,
around the installed frame, and would plaster the wall.

However, it is common for the orifice to be of the incorrect size, shape
15 or location, or lacking in plumbness, be it due to errors in design
information, lack of coordination between the different parties or simple
poor workmanship. Furthermore, this system requires two visits by the
dry wall contractor - one to install the partition with the orifice, and the
second to plaster the wall. This is inefficient.

20 According to a first aspect of the invention, there is provided a door
frame assembly, comprising a support frame suitable for fitment with a
door and integral support members extending away from the frame, the
support members and the door frame being arranged so that the assembly
25 can be supported by a floor and by the ends of the support members distal
from the frame, in which the support frame comprises two upright
members which define the sides of the support frame, spaced apart by a
distance determined by the width of the door to be fitted, in which each
upright member has a generally C-shaped cross section and comprises a
30 base part and a pair of opposing spaced apart side flanges that extend
away from the base part, the base of each member facing the base of the

opposing member with the side flanges of each of the members extending away from the door, and further in which the upper and lower ends of each upright member form at least a part of the support members.

- 5 By providing uprights of a support frame with a C-shape cross section provides several advantages during installation of a door and a surrounding wall. Firstly it is easy to secure the uprights to a door frame by fixing through the base into the door frame, perhaps using self tapping screws. Having an open C-shaped cross section gives clear access
- 10 compared with the use of box section members. It also means that the sides that extend away from the door are suitable for fastening panels to such as plasterboard. Thus, the frame can be erected and dry wall panelling secured to it using any standard drywall fastening technique. Because the flanges are part of the door support assembly and the panels
- 15 overlap these flanges the resulting structure can provide excellent levels of protection against fire, in some cases meeting and exceeding British Standards test such as BS5234-2 and DD-171. The open c-shape allows, for instance, an insert strip of material, perhaps panel material, to be fixed to the base of the upright between the flanges which provides
- 20 additional protection against fire at the critical joint between the panels and the door frame assembly. This also helps prevent sound passing through the completed wall as may cover the points where the fasteners penetrate the flanges.
- 25 The use of a C-section defining an open channel gives total flexibility to the contractor erecting a wall using the door frame assembly in terms of achieving desired levels of fire, acoustic, insulation and/or thermal insulation. If an upright member such as a box section was used it would need to be insulated internally to meet the same standards, which is hard
- 30 to achieve and does not offer the same level of flexibility- with the system of the invention the same door frame assembly can be incorporated into

virtually any kind of walling system to achieve a wide range of different standards. With a box section the inside of the box would need to be somehow insulated to the right level and a different box section may be needed for each installation depending on the desired properties of the
5 completed wall.

The applicant has appreciated that it is not possible to use standard dry wall component upright members, which are traditionally used to construct dry walls, as they lack the strength needed to support a door
10 before the wall is erected. These members typically are steel with a gauge of between 0.5 and 0.9mm and being of I or C section. As such they would easily deform giving a mis-shaped door opening. If a door is then fitted to the opening there may be unwanted gaps which would cause a problem in the event of a fire.

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Therefore, the upright members preferably comprise members which are sufficiently rigid to support a door and door frame prior to construction of a wall around the support frame and of thicker gauge than standard dry walling upright members. This can be achieved using a C-shaped member
20 for each upright of steel material and with side flanges having a gauge of between 1.5 and 1.7, and preferably around 1.6mm.

The gauge of the base part may be the same as that of the side flanges. It may comprise a single thickness (layer) of material, so that the upright
25 forms a simple channel. This has additional advantages for acoustic rating of any resulting wall, as well as the insulating properties of the wall because the flat base can sit flush against a door frame fitted to it without forming a void which would form a path for acoustic energy through the support frame.

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Panels can be fixed onto the flanges and also inside the flanges against the base as required. For instance, on both sides of the wall the panels may be secured on the outside of the flanges. Alternatively, on one side the panel may be secured to the outside of the flange

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A standard dry wall upright member would use a thinner gauge as it is not generally required to offer much rigidity until it is integrated the finished wall. The applicant has appreciated that the use of the proposed gauge provides the required strength whilst still being easy to penetrate with self tapping screws or nails during construction of a surrounding drywall. Depending on the application, it may mean the uprights do not need any additional reinforcement. Hence the uprights may consist solely of C-shaped members (plus any additional fasteners or fixings they may carry).

15 The ends of the support members may provide substantially the whole of a respective support member, although they may be provided with respective adjustable feet for fine tuning of their length. Generally the length of the upright members should be chosen to be substantially equal to the spacing between the floor and a ceiling track to which the support frame is fitted minus a length to accommodate and feet.

20 The base part of each upright member may have a width equal to the required spacing between the panels when the wall is constructed. The base section may have a width that is less than the thickness of a door frame which is to be installed in the opening between the upright members.

25 Each upright section may comprise a continuous pressed or folded metal component, the side flanges being set at right angles to the base part after pressing from a flat strip of material. The part may be formed by folding a flat strip in any known manner.

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If required, each upright member may comprise two or more such components connected together end on end, perhaps with some overlap. This enables the support members to be separate to the uprights, albeit
5 that they should also have generally the same c-shaped cross section.

The upright members may be connected by upper and lower horizontal cross members, which may be of the same profile as the upright members. Thus the whole support frame may be constructed from the
10 same elongate members cut or preformed at the desired lengths.

Thus, a self-supporting door frame assembly is provided, that does not require a door or a door frame to be fitted in order to be supported. The support members may be arranged so as to provide support from a ceiling
15 above the door frame assembly, so that, on installation of the door frame assembly, no supporting wall or partition may be required or indeed provided. The support frame can be of any height relative to the ceiling, as it is not required that the support frame extends to the ceiling itself.

20 The assembly may be provided with lower support members, which depend from the support frame in an opposing direction to the support members. Typically, the ends of the lower support members distal from the support frame would engage the floor. Each distal end may comprise an adjustable foot, to allow adjustment of the length of the respective
25 lower support member, typically to allow for uneven flooring and also to bias the support members against the ceiling. The use of lower support members allows the assembly to be installed with the support frame at any convenient height positioned between floor and ceiling. As mentioned these lower support members may comprise, at least in part, part of the
30 upright members.

The support members will typically be elongate members, and may be integral with the support frame, of C-shaped section.

In addition to the upright member the support frame will typically
5 comprise a plurality of further elongate members which together define an orifice for a door; the support members may comprise extensions of the elongate members of the support frame. Indeed, each support member may form a single piece with an elongate member of the support frame.

10 The assembly may be arranged such that it can be positioned in a building, before a door is attached, with a door being subsequently installed in the frame. In this position it may be sufficiently rigid as to be self supporting, albeit also that it can be affixed at the top and bottom to a ceiling or floor as required. As such, the support frame may be
15 arranged to receive a door directly. Alternatively the support frame may be arranged to support a door set comprising a door frame supporting a door, in which the support frame is arranged to support the door frame of the door set. Typically the door frame assembly would extend from floor to ceiling, with the distal ends of the support members engaging the
20 ceiling.

The frame is of a convenient size to be handled, as it is not much greater in width (width being the horizontal direction in the plane of the door orifice) than the door orifice which it forms – for example, the frame
25 assembly may be at most 5% or 10% wider than the door orifice.

The assembly may further comprise a head track, which can be fixed to a ceiling, and which the distal ends of the support members may be arranged to engage, for example by being of an appropriate size to fit
30 within the head track. Alternatively, the distal ends may be arranged to as to directly engage a portion of the ceiling, such as a concrete ceiling

soffit. The distal ends of the support members may be provided with engagement means, such as angle brackets, by means of which the distal ends engage the head track or other ceiling portion.

- 5 The assembly may further comprise a base track which may be secured to the floor.

The head track, and/or the base track may comprise tracks with a C or U shaped cross section into which the uprights, or the support members,
10 engage. These tracks may comprise part of a proprietary drywall fixing system as is known in the art, and the dimensions of the upright members may be chosen so as to be compatible with these tracks. In one arrangement the uprights may be of similar dimensions to any upright
15 members that form part of the standard system differing only in that they are of a heavier gauge to enable them to give the required rigidity.

The assembly may be provided with a safety rail, which can be removably installed in the frame in place of a door, to prevent inadvertent falls through the orifice that the door would otherwise block. Such a safety
20 rail may be positioned at approximate average waist height, to prevent human falls, or at a low height – a so-called “kicker rail” to prevent objects being inadvertently pushed through the orifice. Typically, the safety rail would be mountable horizontally in the frame.

25 Where the assembly includes a door set fixed between the uprights, the width of the base of the upright members may be less than the thickness of the door frame of the door set so that an end face of a panel subsequently fitted to a flange of the upper right member can abut against a protruding edge of the door frame. This again helps with fire safety. If
30 desired a strip of sealing material may be located in the gap between the end face of the panel and the protruding part of the door frame. An

intumescent strip could be used where a good fire rating is desired. This will then sit over the join between the C-section and the door frame, as well as sealing the end face of the wall panels. The strip is preferably resilient to accommodate any non-linearity of the door frame or panel end
5 face.

According to a second aspect of the invention, there is provided a method of installing a door, comprising fixing a door frame assembly according to the first aspect of the invention between a floor and a ceiling, and
10 installing a door in the support frame.

Typically, the step of installing the door will comprise the installation of a door set, comprising a door frame supporting the door, in the support frame. In the preferred embodiment, once the door set is installed, the
15 support frame will support the door frame, which will in turn support the door. This allows any commonly available door set to be used with the door frame assembly. The door frame of the doorset may be connected directly to the base of the c-shaped upright members.

20 The door may be installed after the assembly is fixed; this is typically the case where a timber door is used. Alternatively, the door may be installed in the door frame assembly before the assembly is fixed; this is typically the case where a metal door is used.

25 The method may comprise the step of installing a head track on the ceiling before the door frame assembly is fixed, and then, as part of the step of fixing the door frame assembly, fixing the door frame assembly to the head track. The installation of a head track is common when installing dry walls, and so this advantageously makes use of a pre-
30 existing component. Typically, the distal ends of the support members

would be engaged with the head track, possibly by use of an engagement means such as an angle bracket.

The method may comprise the step of building a wall around the door
5 frame assembly after it has been fixed. The wall may be a partition wall,
or alternatively any other type of wall, such as a glass wall, a blockwork
wall or external cladding. The step of building the wall may comprise the
steps of constructing a partition wall around the door frame assembly. In
the preferred embodiment, the method then includes plastering around the
10 wall. An edge trim, such as a rebate trim, may be installed around the
door frame assembly.

The step of building a wall may comprise abutting wall panels, such as
drylining panels, against either the outside faces of the side flanges of the
15 upright members or the inside faces (or perhaps onto both faces) and
securing the panels in place by driving (by screwing, hammering or
otherwise) fasteners partially through the drywall and the flange.

The method may further comprise adding a length of panel material or
20 some other fire resistant material or sound insulating material or
thermally insulating material up against the base of the channel between
the flanges. This material is preferably a section of the same panel
material that is secured to the flanges.

25 The fact that the wall need only be built after the door frame assembly
has been installed means the dry wall contractor can complete the wall
construction and the plastering in a single visit. Furthermore, because
the wall is built around the door frame assembly, the wall can be built
much more accurately to the correct dimensions. Because the uprights
30 provide a direct connection to the dywall panels the resulting assembly is
both strong and also can easily comply with any fire regulations that the

drywall must meet. This is especially true where the end faces of any panels used abut an edge of the doorframe that protrudes beyond the edge of the base of the upright members. There is no need to affix a separate drywall upright to the frame which can lead to an unwanted, and
5 uneven, gap between the edge of the door frame and the panels.

The door may be installed before or after the wall is built; after would be the norm for timber doors. Especially where the door is installed in the door frame assembly after the wall is built, and especially where the door
10 is to be a riser door, the method may include the step of installing a safety rail across the support frame. Typically the safety rail would be removed before the door is installed in the support frame, typically after the wall has been built. The safety rail may be positioned to stop people falling through the orifice provided by the support frame without a door,
15 or may be provided at a lower level in order to prevent objects inadvertently being pushed through the door (a so-called kicker rail).

There now follows, by way of example only, embodiments of the present invention described with reference to the accompanying drawings, in
20 which:

Figure 1 shows a perspective view of the door frame assembly of a first embodiment of the invention, with a door installed,

25 **Figure 2** shows a cross section taken horizontally through the frame of the assembly of Figure 1;

Figure 3 shows a perspective view of the engagement of the support members by the head track of the assembly of Figure 1;

Figure 4 shows a perspective view of the door frame assembly of a second embodiment of the invention, without a door installed;

Figure 5 shows the same view as Figure 4, with a door installed;

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Figure 6 shows a cross section taken horizontally through the frame of the assembly of Figure 4;

Figure 7 shows a perspective view of the adjustable feet of the door frame assembly of Figure 4; and

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Figure 8 is a cross section taken horizontally through the door frame assembly of Figure 1 when built up to form part of a drylined wall of alternative construction.

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Figures 1 to 3 show a first embodiment of the present invention, for use with metal doors. The door frame assembly comprises a support frame 1, with two elongate support members 2 extending vertically upwards from the support frame 1. Two further members (not shown) may extend downwards from the support frame. The support frame 1 comprises four members; two vertically extending upright members 3 and two horizontal members 4, 5.

20

The members 3, 4, 5 define a portal through which access can be controlled by the use of a door 6b blocking the portal. The support members 2 extend vertically as extensions of the vertical members 3- as shown they are integral to the upright members so the ends of the upright members may be considered to form part of the support members; the support members 2 and the vertical members 3 form two continuous vertical members. Adjustable feet 7 control the height of the frame above a floor.

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The support frame 1 and the support members 2 would typically be made of steel. Each upright member and support member are of C-shaped cross section along their length. The uprights are steel members, pressed or
5 folded from a flat sheet with a gauge of 1.6mm. If a lighter material such as aluminium is used a heavier gauge may be provided to give the required stiffness. This gauge gives the required strength for the frame whilst still enabling the flanges to be easily penetrated by fasteners when building the support frame into a wall.

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The functioning of this assembly is best described by considering the method by which it is installed. Firstly, a head track 8 is attached to a ceiling above where the door is to be positioned, as part of the preparation process for a partition wall being installed. The head track
15 comprises a C-shaped track which forms part of a proprietary dry wall component system. A door set 6 is installed into the support frame 1 of the door frame assembly. The door set comprises a door frame 6a and a door 6b. Any suitable door set commonly available can be used.

20 The door frame assembly, together with the door set 6 is then installed such that the ends of the upright members of the support frame 1 which define the upper support members in this embodiment (hereafter the distal ends 9) are retained in the head track 8. The width of the base part of the upright members is less than the internal width of the head track so it is
25 snugly located. The adjustable feet are adjusted such that the support frame 1 is at the correct height, and that the support members are securely retained in the head track 8 as shown in Figure 3.

In this Figure, an angle bracket 12 is secured to the support member 2 by
30 means of nut and bolt 13, and to the head track 8 by means of a screw 14. Some flexibility in the position of the angle bracket relative to the head

track 8 and the support member 2, and hence of those two members in relation to each other, is provided by the nut and bolt 13 and the screw 14 engaging the angle bracket 12 by means of slots 12a, 12b.

- 5 This work would typically be carried out by a joinery contractor or other door installer.

Accordingly, the door frame assembly is now self-supporting, due to the rigidity of the upright members, and will have been placed in the correct
10 position by the joinery contractor. By selecting the appropriate lengths of the support members 2 and the vertical members 3, it is possible to correctly position the frame merely by ensuring that the distal ends 9 are correctly retained in the head track by adjustment of the adjustable feet, assuming that the height of the ceiling is known. There is therefore less
15 possibility of measurement error.

The dry wall contractor now visits in order to install a plasterboard partition 10 or wall, as shown in Figure 2. The boards are fastened directly to the side flanges of the uprights by driving fasteners through
20 the board and flanges. This gives a neat overlapping finish, and importantly enables a high fire safety rating to be achieved. A rebate trim 11, being an example of an edge trim, is fitted, and the partition is plastered. Thus, it can be seen that the dry wall contractor can complete both the erection of the partition and the plastering in a single visit and
25 using only standard drywall construction tools and techniques. Because the wall is erected around the door, the orifice for the door in the partition wall is more likely to be in the correct place, and be of the correct size. It will also be obvious very quickly if the wall is not plumb with respect to the frame, rather than only becoming obvious after the dry
30 wall contractor has left and the joinery contractor has started installing the door.

A second embodiment of the invention, for use with timber doors, is shown in Figures 4 to 7 of the accompanying drawings. The same reference numerals have been used as in the first embodiment for
5 corresponding integers, with the reference numerals raised by 20.

Figure 7 of the accompanying drawings shown in greater detail the adjustable feet 27, which could be used with either embodiment of the invention. The feet 27 themselves comprise a threaded member 37,
10 which is supported relative to an angle bracket 36 which is itself fixed to the edge of the frame 21. A disc-shaped foot portion 39 is provided at the bottom of the threaded member 37. The threaded member 37 is held captive between two nuts 38 (only the top nut 38 being visible in Figure
7) on either side of the angle bracket 36, such that rotation of the foot 27
15 drives the foot vertically relative to the angle bracket 36 and so the frame.

Given the evident similarity between the two embodiments, it is merely necessary to describe how this embodiment functions during installation.

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Initially, as shown in Figure 5 of the drawings, the joinery contractor will install the door frame assembly between the head track 28 and the floor without a door 26 being fitted. As in the previous embodiment, the adjustable feet 27 can be used to raise the door frame assembly such that
25 the distal ends 29 of the support members 22 engage the head track 28, where they can be secured using an angle bracket as described with reference to the first embodiment.

The joinery contractor also installs a removable safety rail 35 across the
30 frame, as otherwise an open portal is provided that could be fallen through. Positioned as shown, this safety rail 35 will prevent people

falling through the open orifice; alternatively, or additionally, a kicker rail may also be provided, approximately 30 centimetres off the bottom of the support frame 1, in order to prevent objects inadvertently being pushed through the orifice.

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As previously, the door frame assembly is now self supporting. The relatively heavy gauge of the upright members, when compared with standard drywall construction components, provides the required rigidity to the door frame apparatus.

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The dry wall contractor then builds a plasterboard partition wall 30 around the frame assembly, as is shown in Figure 6 of the accompanying drawings. An edge trim, such as the rebate trim 31 shown, is installed, and the dry wall contractor plasters the wall 30. As such, both tasks can be completed in a single visit, and all of the advantages of the previous embodiment are also enjoyed.

The joinery contractor then returns, removes the safety rail 35 and installs a timber door set 26. This is secured directly to the base of the u-shaped upright members. This door set comprises a door frame 26a off which is hung a door 26b. Any commonly available suitable door set can be used. This operation leaves the door frame assembly in the state shown in Figure 5. The door has been installed accurately in the correct position, with a minimum of inconvenience to all involved.

25

A benefit of the use of the C-section upright members is that it is simple to ensure that a wall can be constructed in accordance with desired fire, acoustic and thermal requirements provided that the specification of the rest of the materials used to construct the wall are known. As shown in Figure 8 a strip of wall panel 20 may be provided which runs along the whole length of the upright and the support members and abuts the face of

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the base of the upright between the flanges. This will then lie underneath the region at which the end face of the outer wall panels abuts the protruding portion of door frame, which occurs because the door frame thickness is greater than the width of the base of the upright members.

- 5 The inner strip of material helps prevent sound leaking through the wall, and also helps fire breaking through if it is of a fire resistant material, which would be the case if the wall panels from which the material was made were fire resistant. An optional intumescent strip 21,22 may be provided between the end face of the panels and the door frame, and as
- 10 shown a double layer of panel enables a neat rebated finish to be achieved.

CLAIMS

1. A door frame assembly, comprising a support frame suitable for
5 fitment with a door and support members extending away from the frame,
the support members and the support frame being arranged so that the
assembly can be supported by a floor and by the ends of the support
members distal from the support frame, in which the support frame
comprises two upright members which define the sides of the support
10 frame, spaced apart by a distance determined by the width of the door to
be fitted, in which each upright member has a generally C-shaped cross
section and comprises a base part and a pair of opposing spaced apart side
flanges that extend away from the base part, the base of each member
facing the base of the opposing member with the side flanges of each of
15 the members extending from the base part, and further in which the upper
and lower ends of each upright member form at least a part of the support
members.
2. A door frame assembly according to claim 1 in which the upright
20 members are sufficiently rigid to support a door and door frame prior to
construction of a wall around the support frame.
3. A door frame assembly according to any preceding claim in which
the upright members are steel and with side flanges having a gauge of
25 1.2mm.
4. The door frame assembly of claim 1, 2 or 3 in which the support
members are arranged so as to provide support from a ceiling above the
support frame, so that, on installation of the door frame assembly, no
30 supporting wall or partition is required for support.

5. The door frame assembly of claim 1,2,3 or claim 4, in which the support frame is arranged to receive a door directly.
6. The door frame assembly of any one of claims 1 to 5, in which the support frame is arranged to support a door set comprising a door frame supporting a door, in which the support frame is arranged to support the door frame of the door set and in which the width of the base of the upright members is less than the thickness of the door frame of the door set so that an end face of a panel subsequently fitted to a flange of the upper right member can abut against a protruding edge of the door frame.
7. The door frame assembly of any preceding claim, provided with lower support members, which depend from the support frame in an opposing direction to the support members.
8. The door frame assembly of claim 7, in which the distal end of each lower support member comprises an adjustable foot, to allow adjustment of the length of the respective lower support member.
9. The door frame assembly of any preceding claim, further comprising a head track, which can be fixed to a ceiling, and in which the distal ends of the support members are arranged to engage the head track.
10. The door frame assembly of any preceding claim, provided with a safety rail, which can be removably installed in the support frame in place of a door.
11. A method of installing a door, comprising fixing a door frame assembly according to any preceding claim between a floor and a ceiling, and installing a door in the support frame.

12. The method of claim 11, in which the step of installing the door comprises the installation of a door set, comprising a door frame supporting the door, in the support frame, such that the support frame supports the door frame, which in turn supports the door.
- 5
13. The method of claim 11 or claim 12, in which the door is installed after the assembly is fixed.
14. The method of claim 11 or claim 12, in which the door is installed
10 in the door frame assembly before the assembly is fixed.
15. The method of any of claims 11 to 14, comprising the step of installing a head track on the ceiling before the door frame assembly is fixed, and then, as part of the step of fixing the door frame assembly,
15 fixing the door frame assembly to the head track.
16. The method of claim 15, in which the distal ends of the support members are engaged with the head track.
- 20 17. The method of any of claims 11 to 16, comprising the step of building a wall around the door frame assembly after it has been fixed by securing one or more walling panels to at least one of the flanges such that an end face of the panel abuts a protruding portion of a door frame located in the door frame assembly.
- 25
18. The method of claim 17, in which the step of building the wall comprises the steps of constructing a partition wall around the door frame assembly
- 30 19. The method of any one of claims 11 to 18 which further comprises adding a length of panel material or some other fire resistant material or

sound insulating material or thermally insulating material up against the base of the channel between the flanges.

20. The method of any of claims 11 to 19, including the step of
5 installing a safety rail across the frame and removing safety rail before the door is installed in the frame.

21. A door frame assembly substantially as described herein with
reference to and as illustrated in Figures 1 to 3 or Figures 3 to 7 of the
10 accompanying drawings.

22. A method of installing a door substantially as described herein with
reference to and as illustrated in Figures 1 to 3 or Figures 3 to 7 of the
15 accompanying drawings.

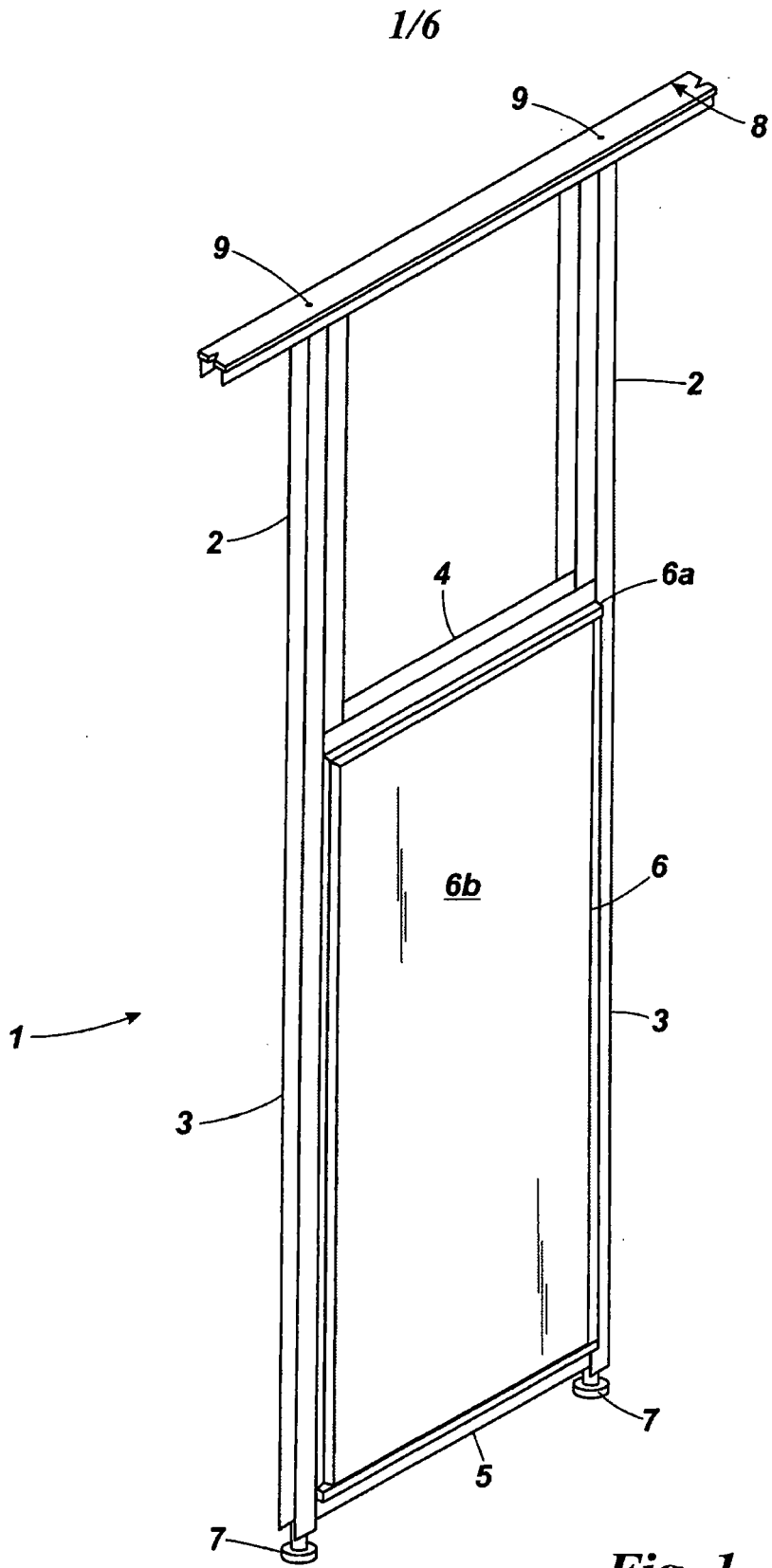


Fig. 1

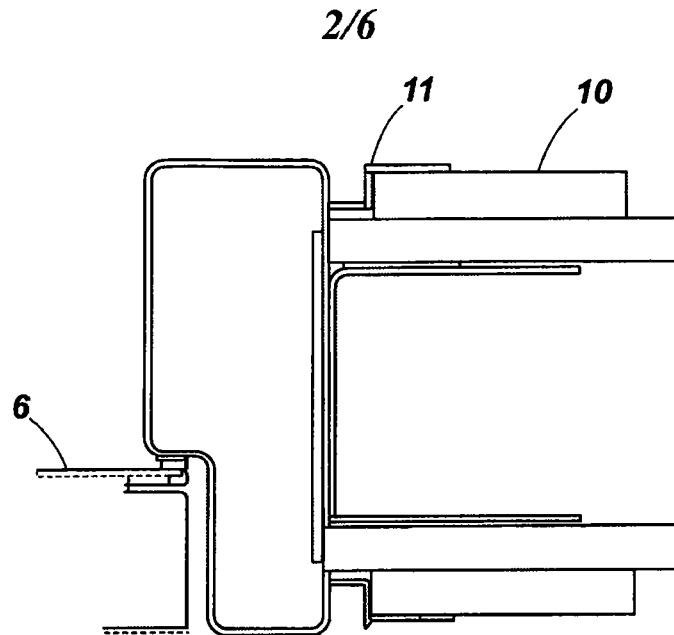


Fig. 2

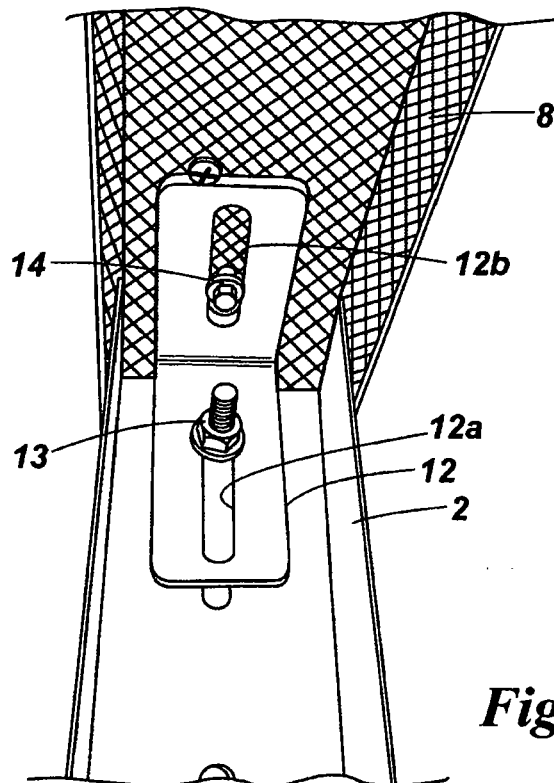
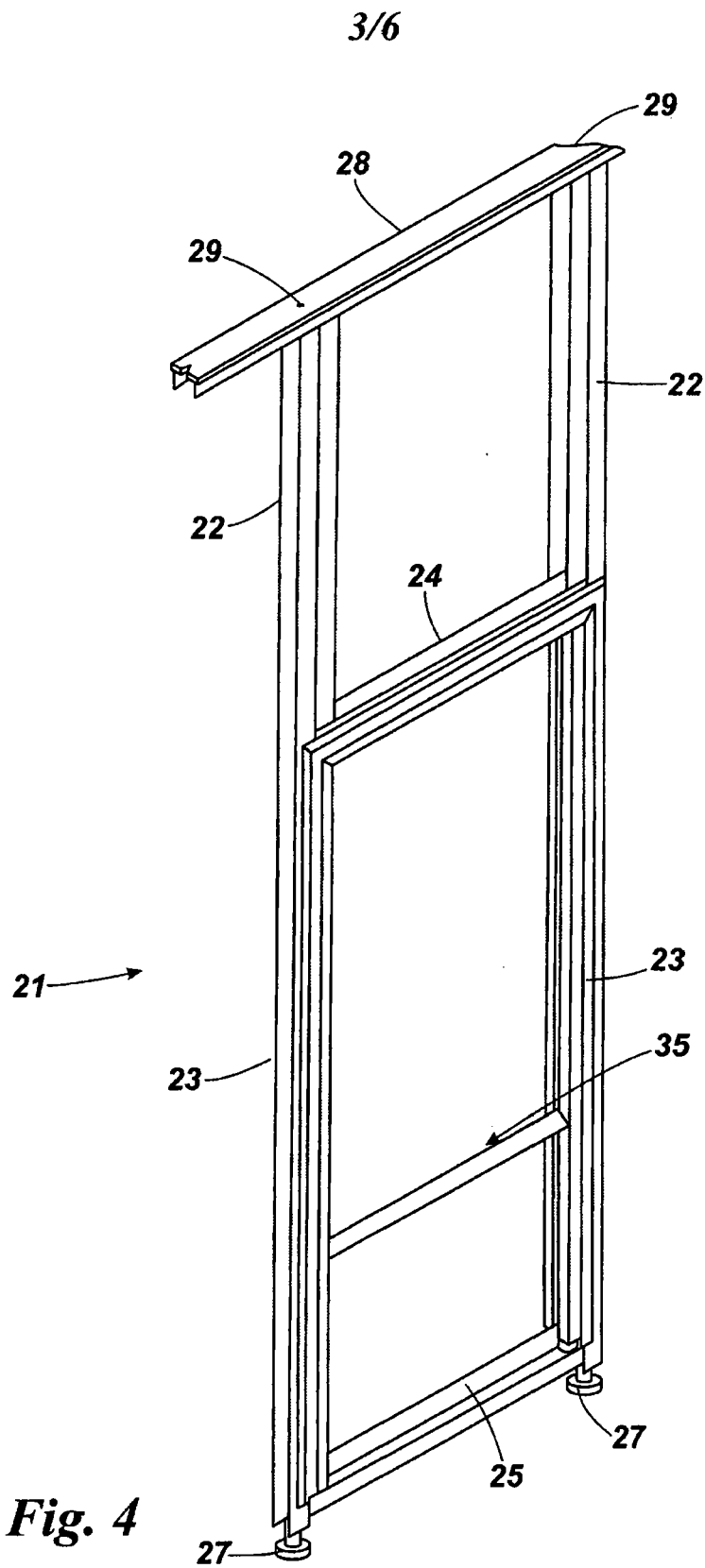


Fig. 3



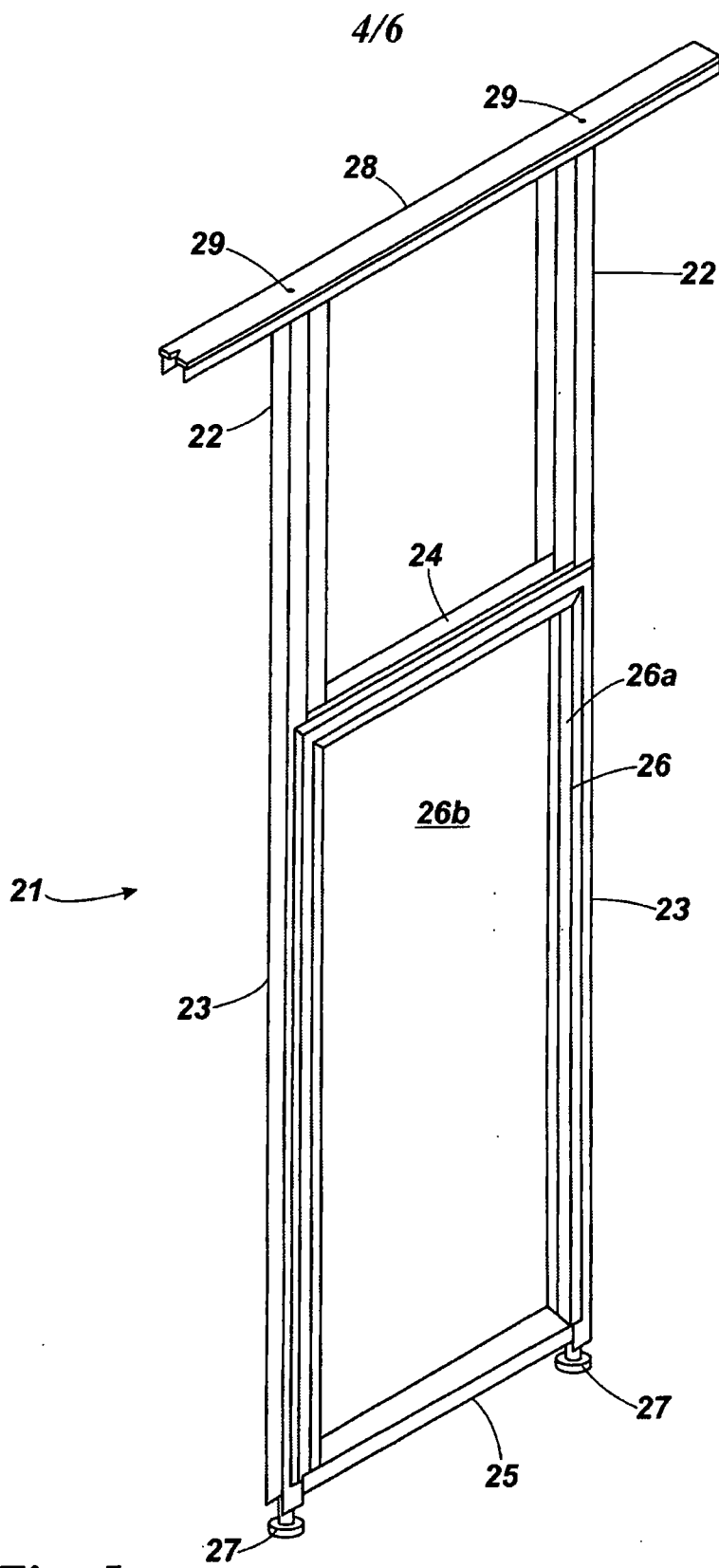


Fig. 5

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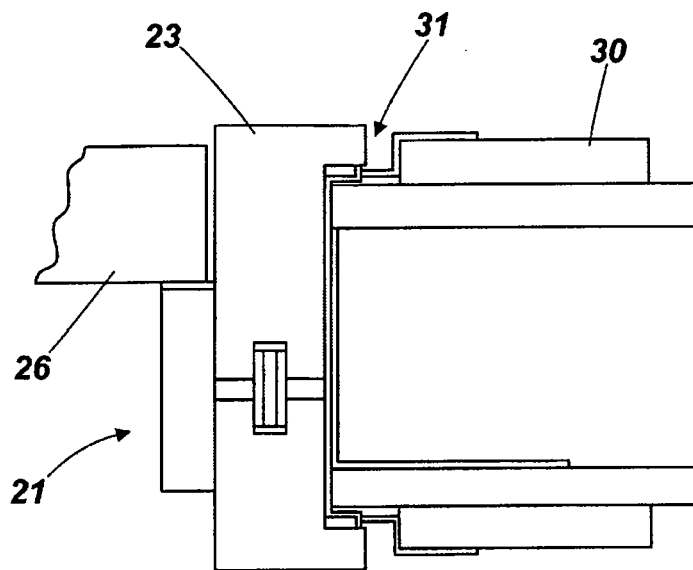


Fig. 6

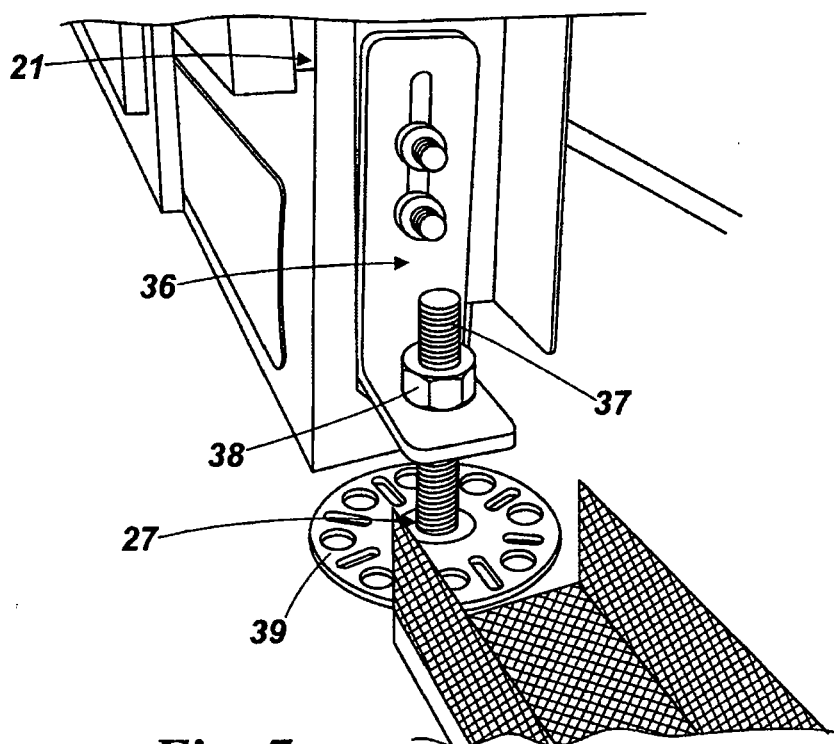


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2010/050162

A. CLASSIFICATION OF SUBJECT MATTER
INV. E06B1/02 E06B1/60 E04B2/72 E04F21/00
ADD.

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)
E06B E04B E04F

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

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

EPO-Internal, 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 Y	US 7 340 866 B1 (SMITH DONALD R [US]) 11 March 2008 (2008-03-11) the whole document	1,2,4,5, 9 3,6-8, 10-20
X	FR 2 152 530 A1 (SVEDEX NV) 27 April 1973 (1973-04-27) figures 2,4	1,2,4,6, 9
Y	US 2006/156655 A1 (RIZZOTTO JOHN L SR [US]) 20 July 2006 (2006-07-20) paragraph [0069] - paragraph [0070]; figure 3	3,7
Y	FR 2 726 027 A1 (CLIMA NEU SA [FR]) 26 April 1996 (1996-04-26) figures 2,4	6
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Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

2 June 2010

Date of mailing of the international search report

10/06/2010

Name and mailing address of the ISA/

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Authorized officer

Knerr, Gerhard

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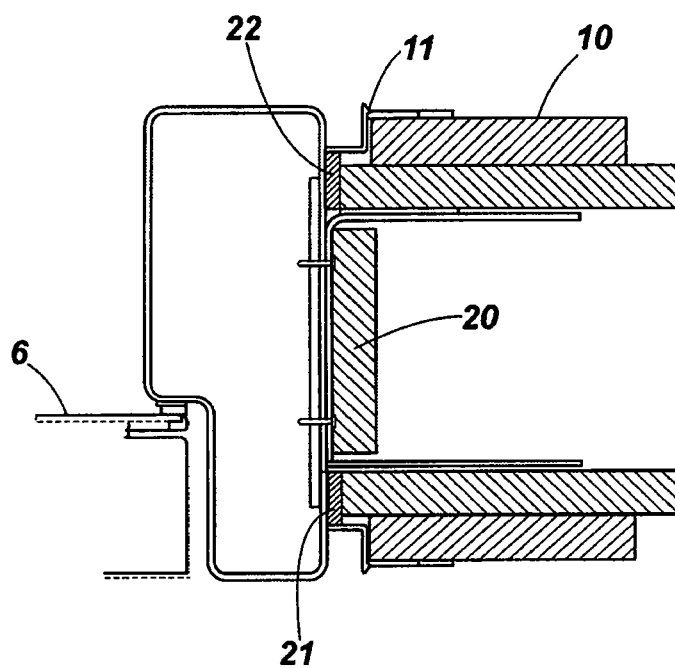


Fig. 8

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2010/050162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	DE 297 09 238 U1 (SCHERMANN HANS [DE]) 16 October 1997 (1997-10-16) the whole document	8
Y	US 2 930 480 A (BROWN JAMES L) 29 March 1960 (1960-03-29) figures 1,4	10
Y	US 1 616 426 A (ISAACSON WILLIAM O) 1 February 1927 (1927-02-01) the whole document	11-20
A	FR 2 630 145 A1 (TIASO [FR]) 20 October 1989 (1989-10-20) figure 14	1,6
A	NL 1 006 136 C1 (MACHINAAL TIMMERBEDRIJF DE WAARD B.V. TE RHOON) 1 December 1998 (1998-12-01) the whole document	1,6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2010/050162

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.: 21, 22
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

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

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International Application No. PCT/GB2010/050162

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 21, 22

Claims 21 and 22 do not contain any technical feature defining the claimed subject-matter but a mere reference to the drawings and the description

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guideline C-VI, 8.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/GB2010/050162

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7340866	B1	11-03-2008	NONE
FR 2152530	A1	27-04-1973	BE 785853 A2 03-11-1972 NL 7112470 A 13-03-1973
US 2006156655	A1	20-07-2006	US 2010083595 A1 08-04-2010
FR 2726027	A1	26-04-1996	NONE
DE 29709238	U1	16-10-1997	NONE
US 2930480	A	29-03-1960	NONE
US 1616426	A	01-02-1927	NONE
FR 2630145	A1	20-10-1989	NONE
NL 1006136	C1	01-12-1998	NONE