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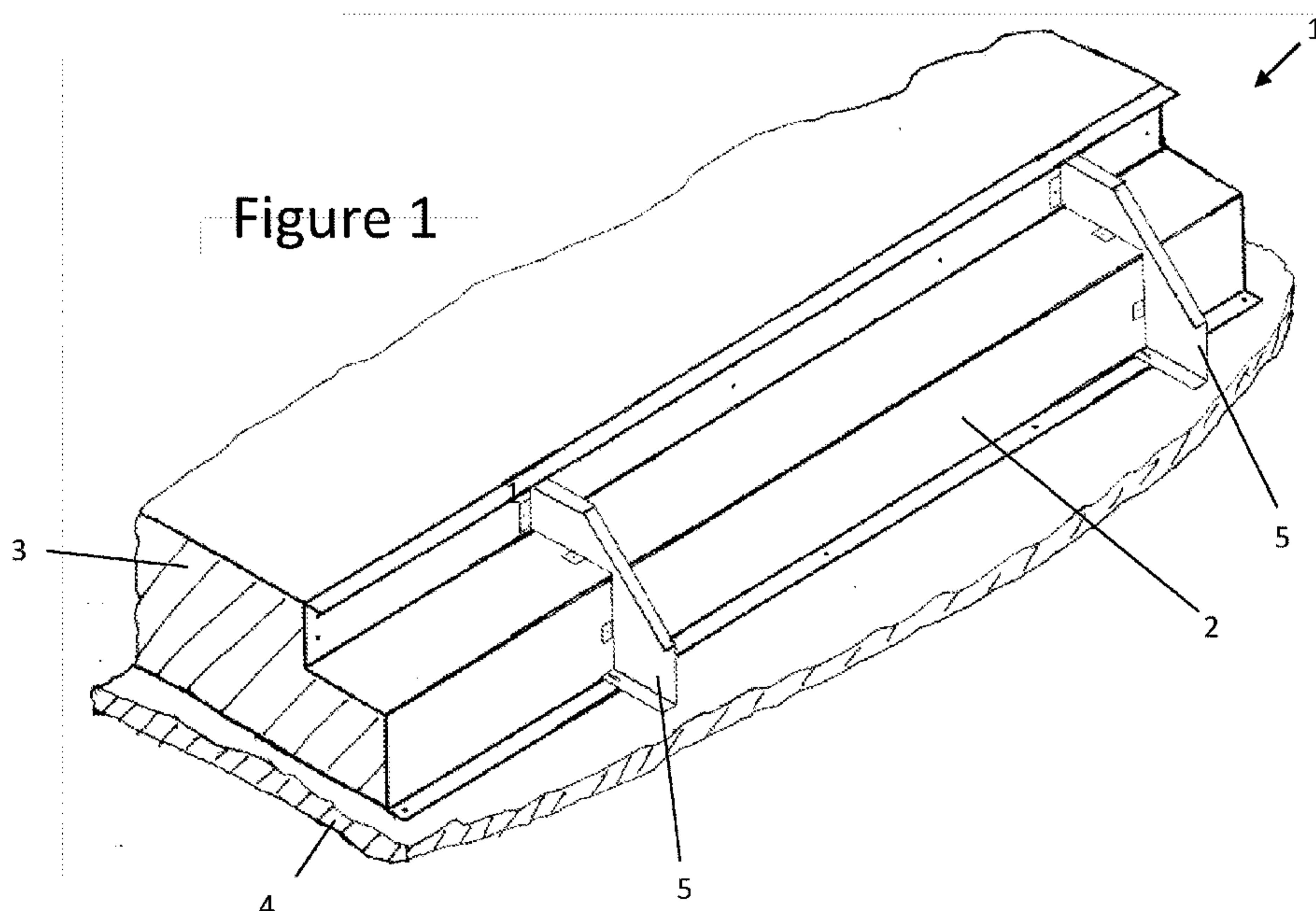
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(54) Title of the Invention: **Shuttering system**  
Abstract Title: **Shuttering System comprising a braced profile.**

(57) The shuttering system includes a preformed profile made from a sheet material. The profile includes a base 11 for locating on a surface, a wall portion and a lip 10, the base and lip extending on one side of the wall portion and settable material retained by the other side of the wall. The profile may include a number of brace members are attached with metal tabs. The profile may be stepped and include two upright 7, 9 wall sections and a horizontal joining 8 portion. The profile 31 may alternatively have a single flat wall portion extending from the base to the lip and have two upstanding wall portions 32 which are of a cuboidal form (Figure 11). The profiles may be part of a method where the profiles are peeled off.



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Figure 1

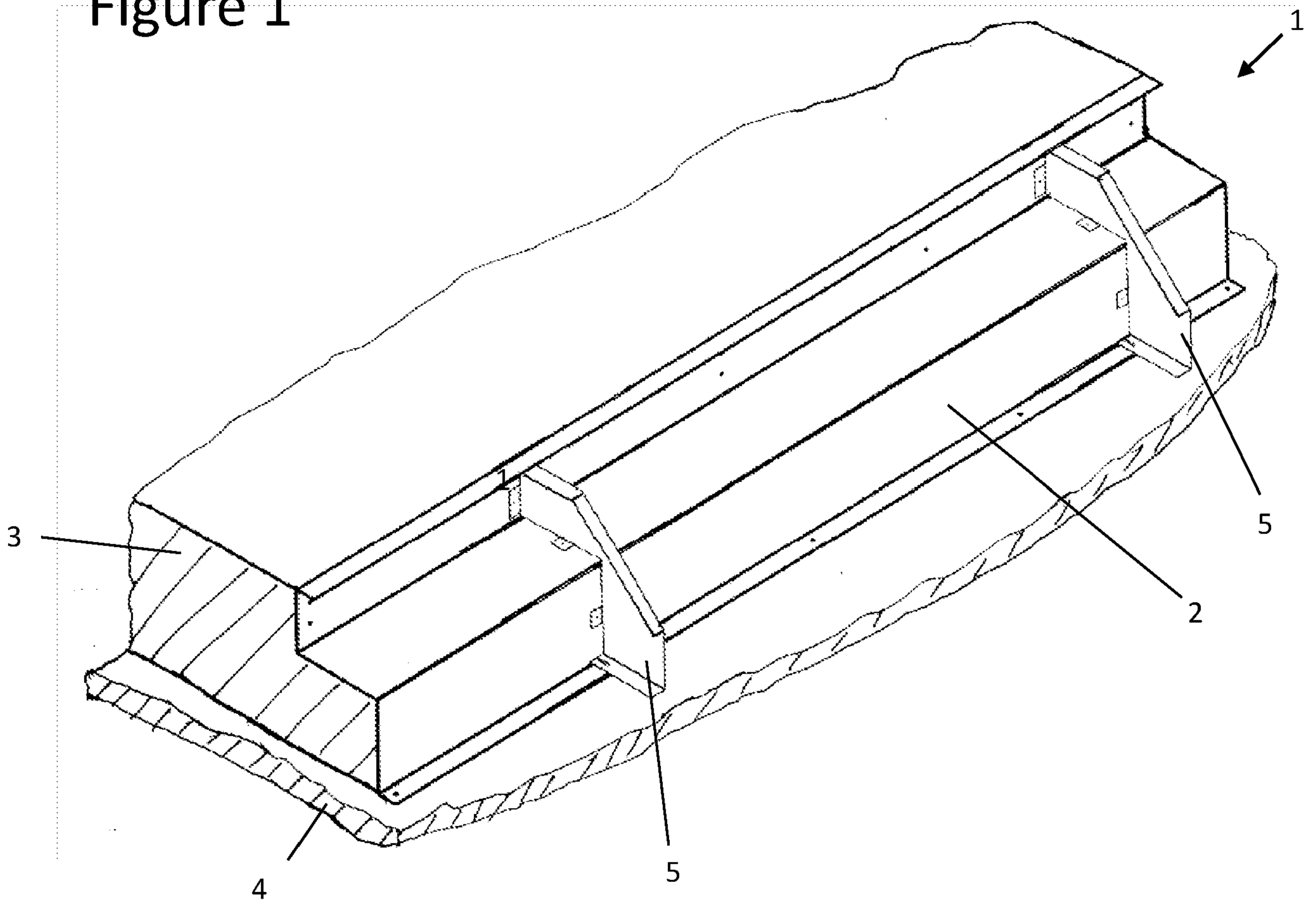


Figure 2

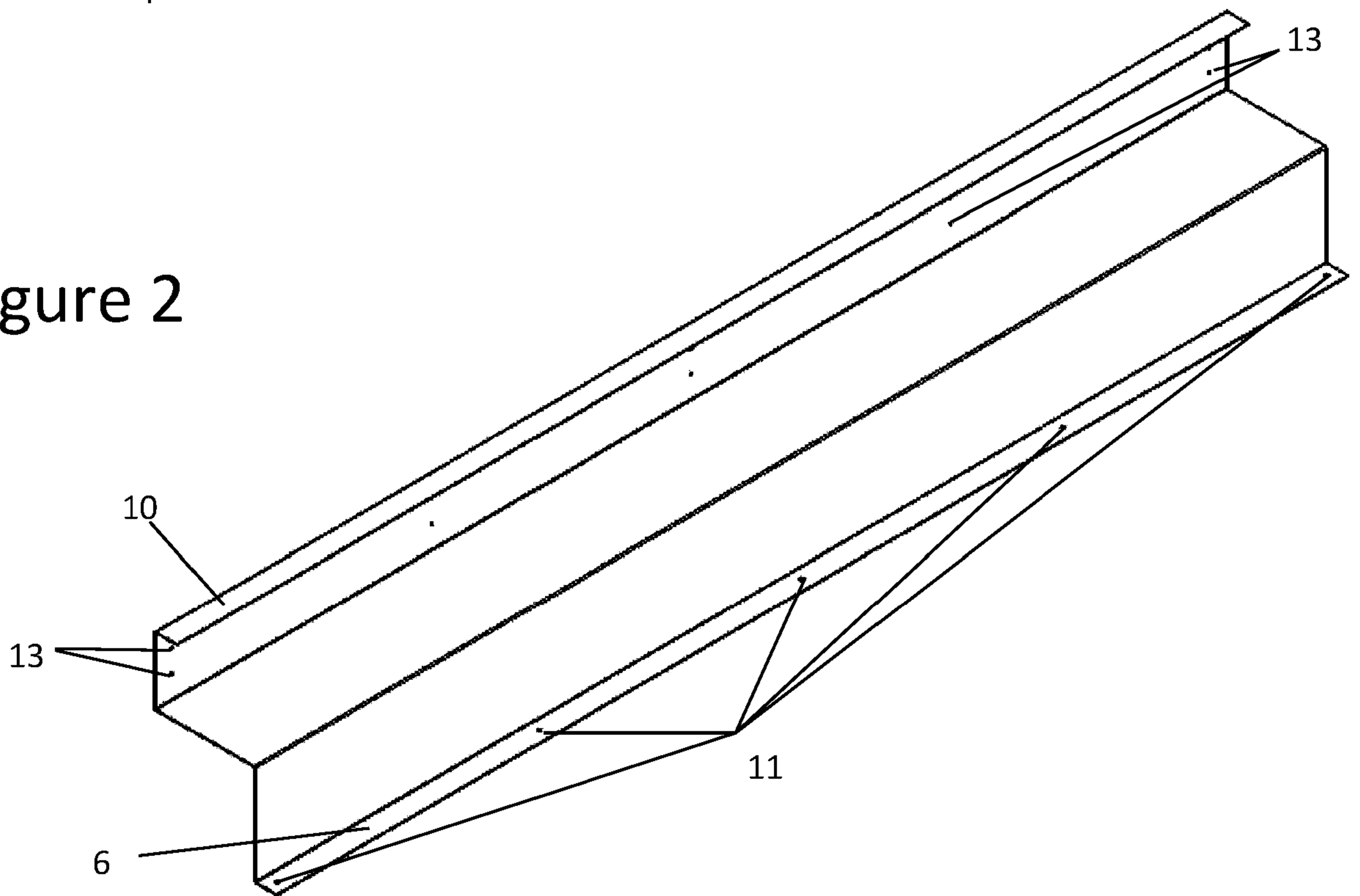


Figure 3

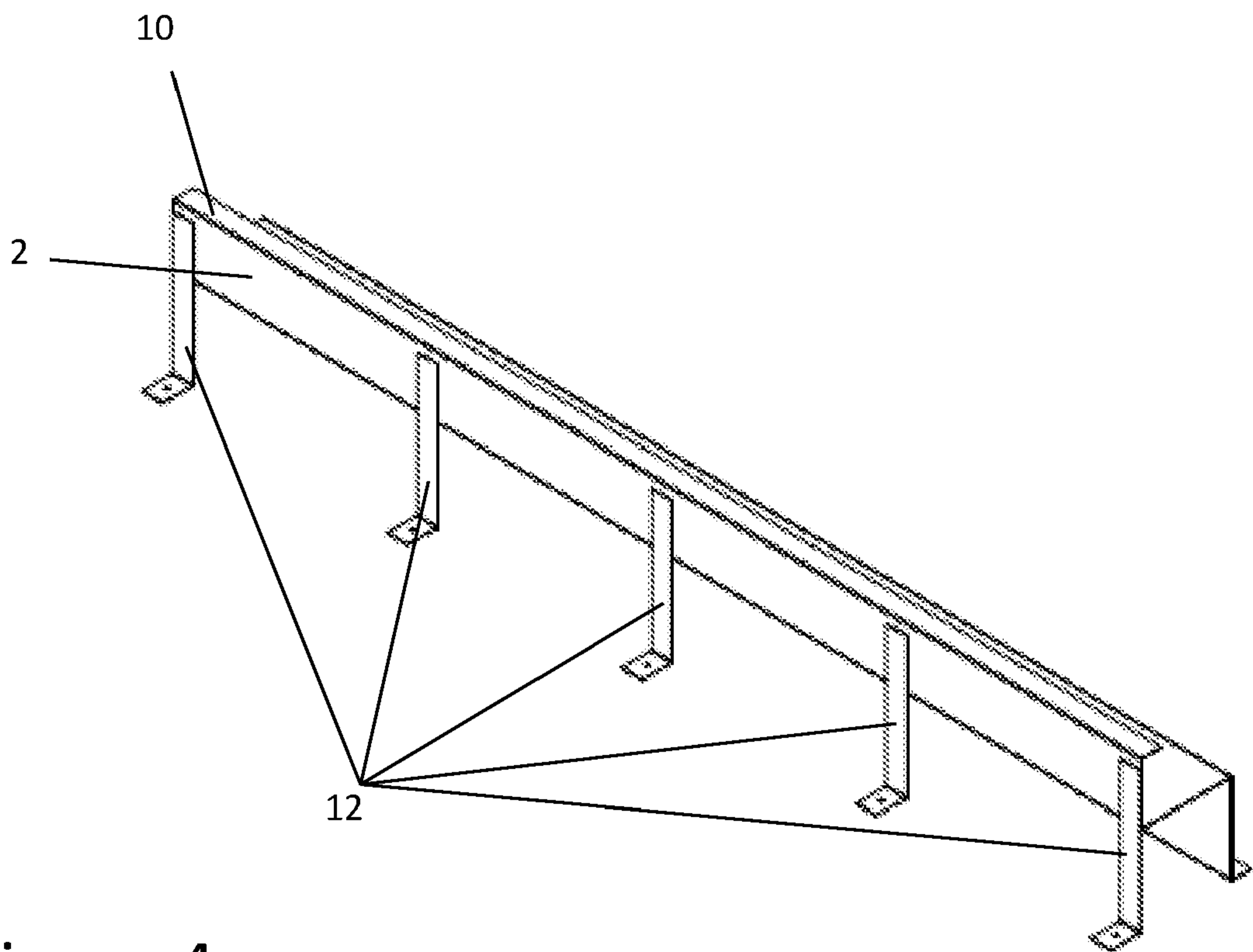
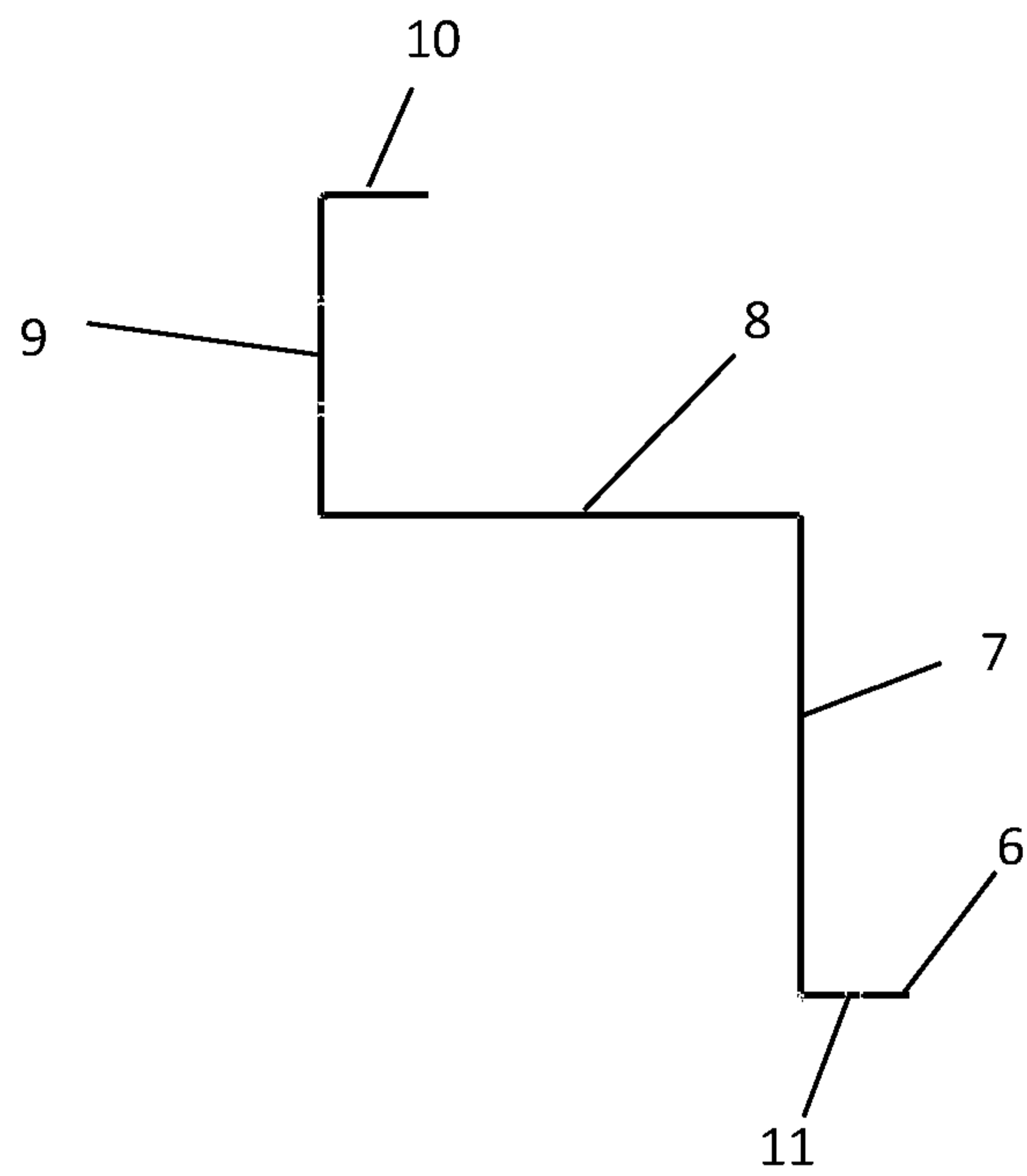


Figure 4

Figure 5

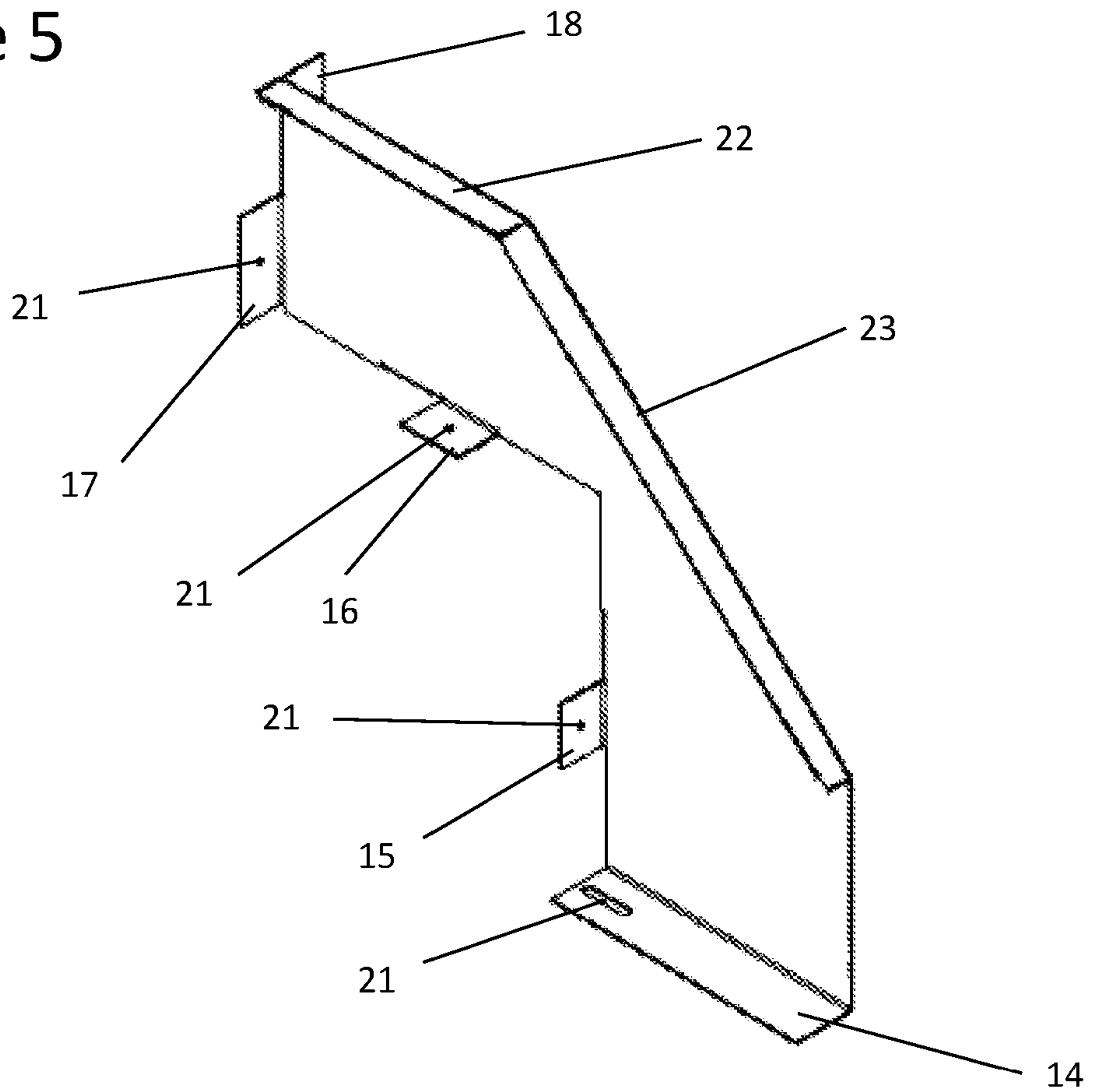


Figure 6

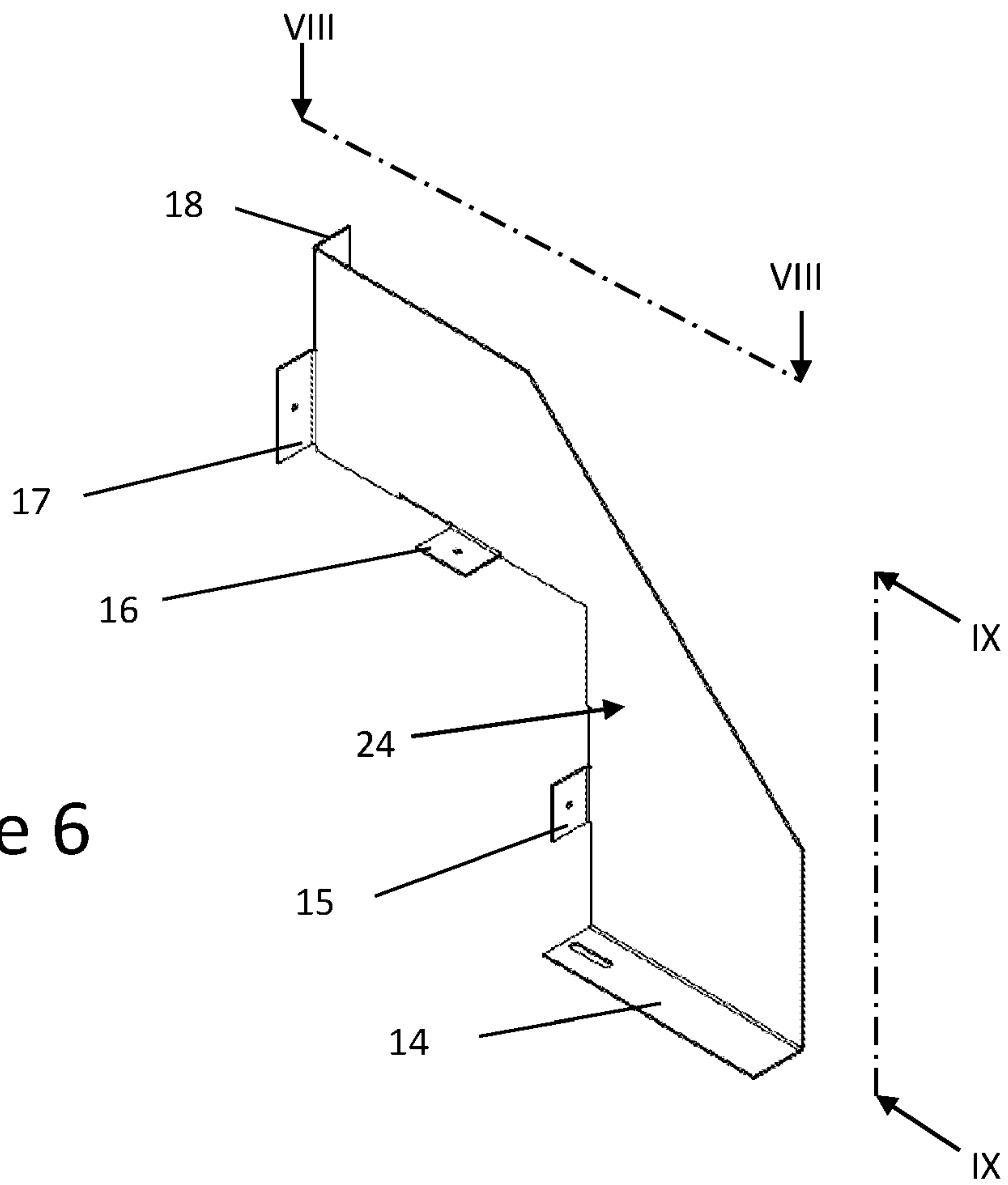


Figure 7

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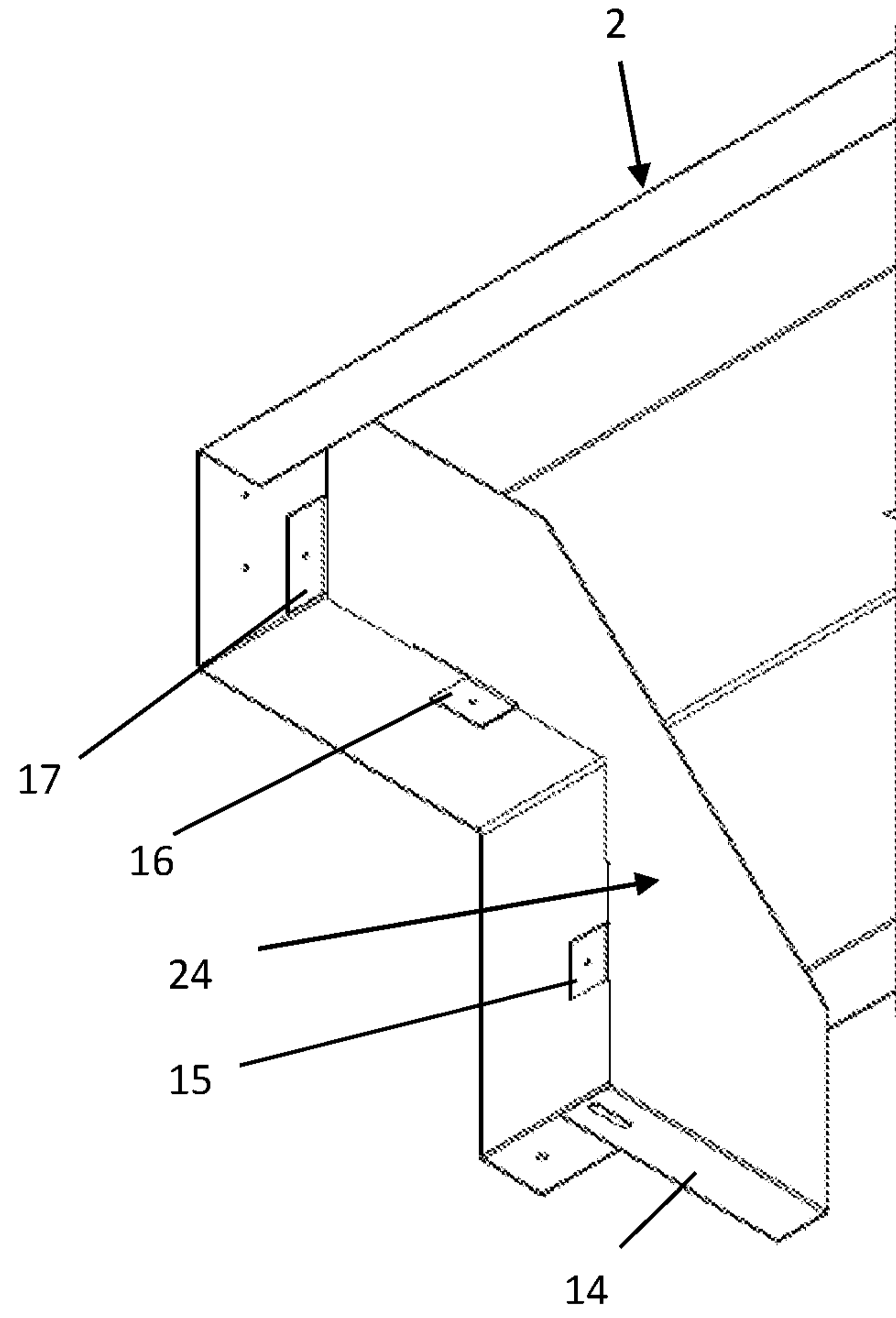


Figure 8

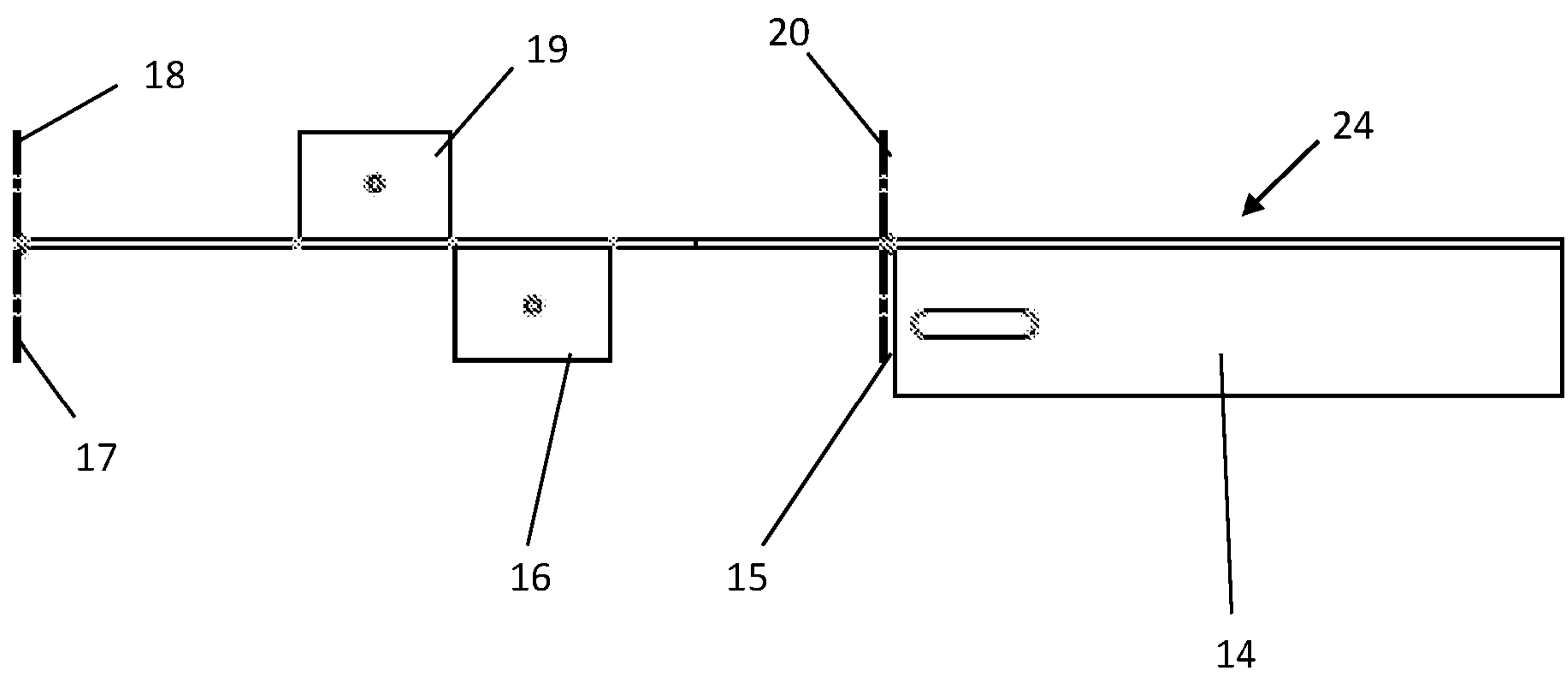


Figure 9

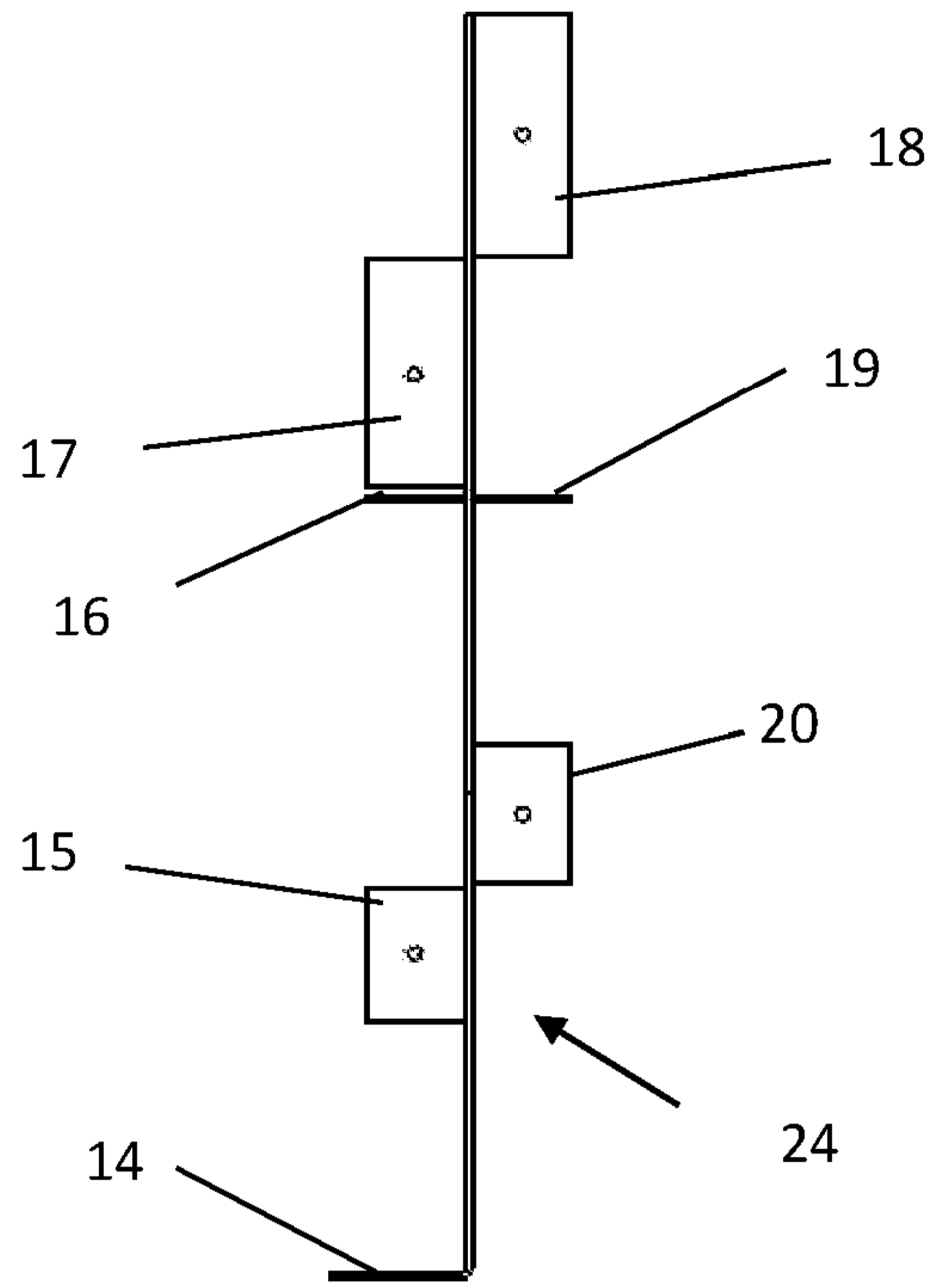


Figure 10

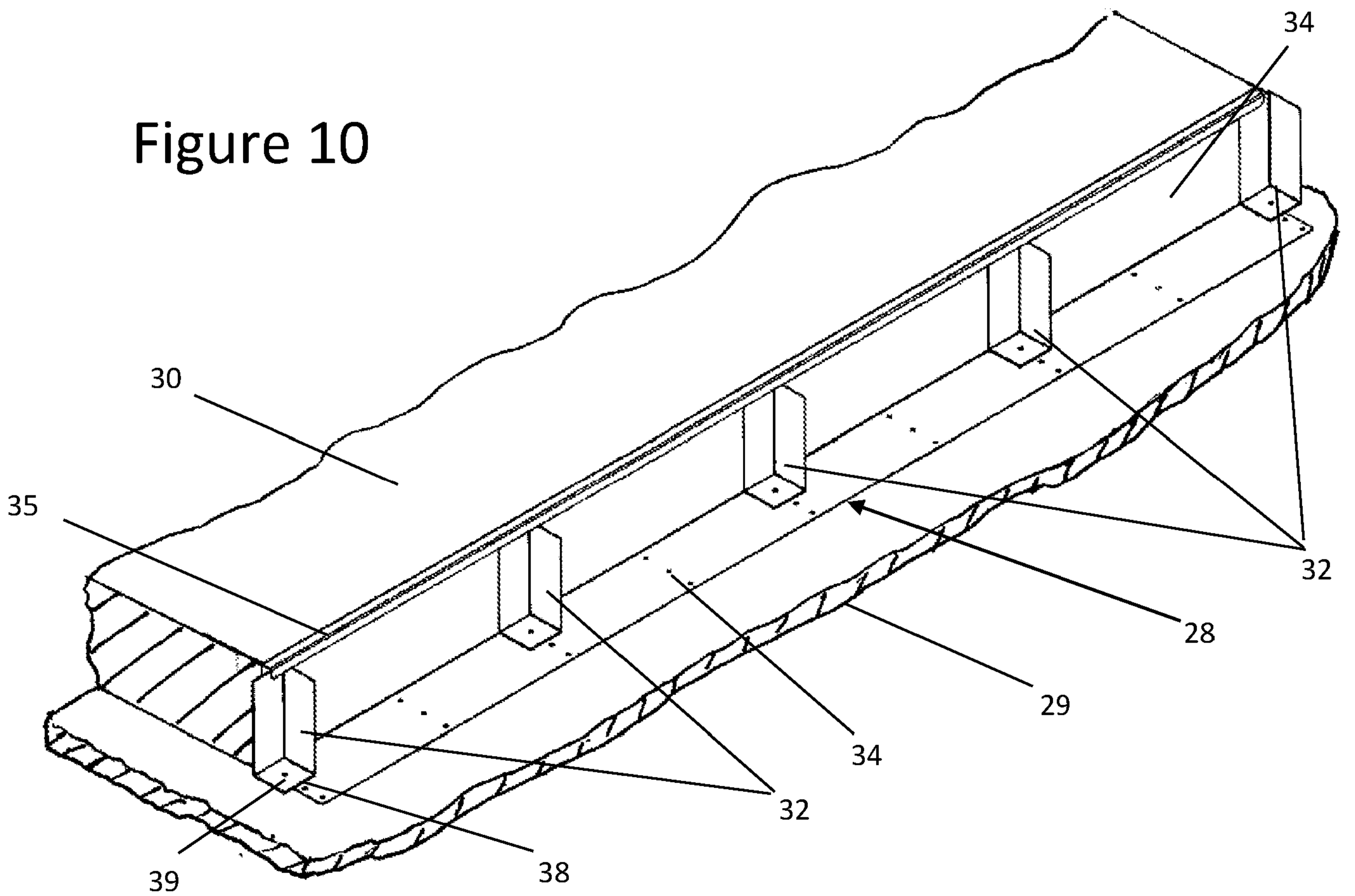


Figure 11

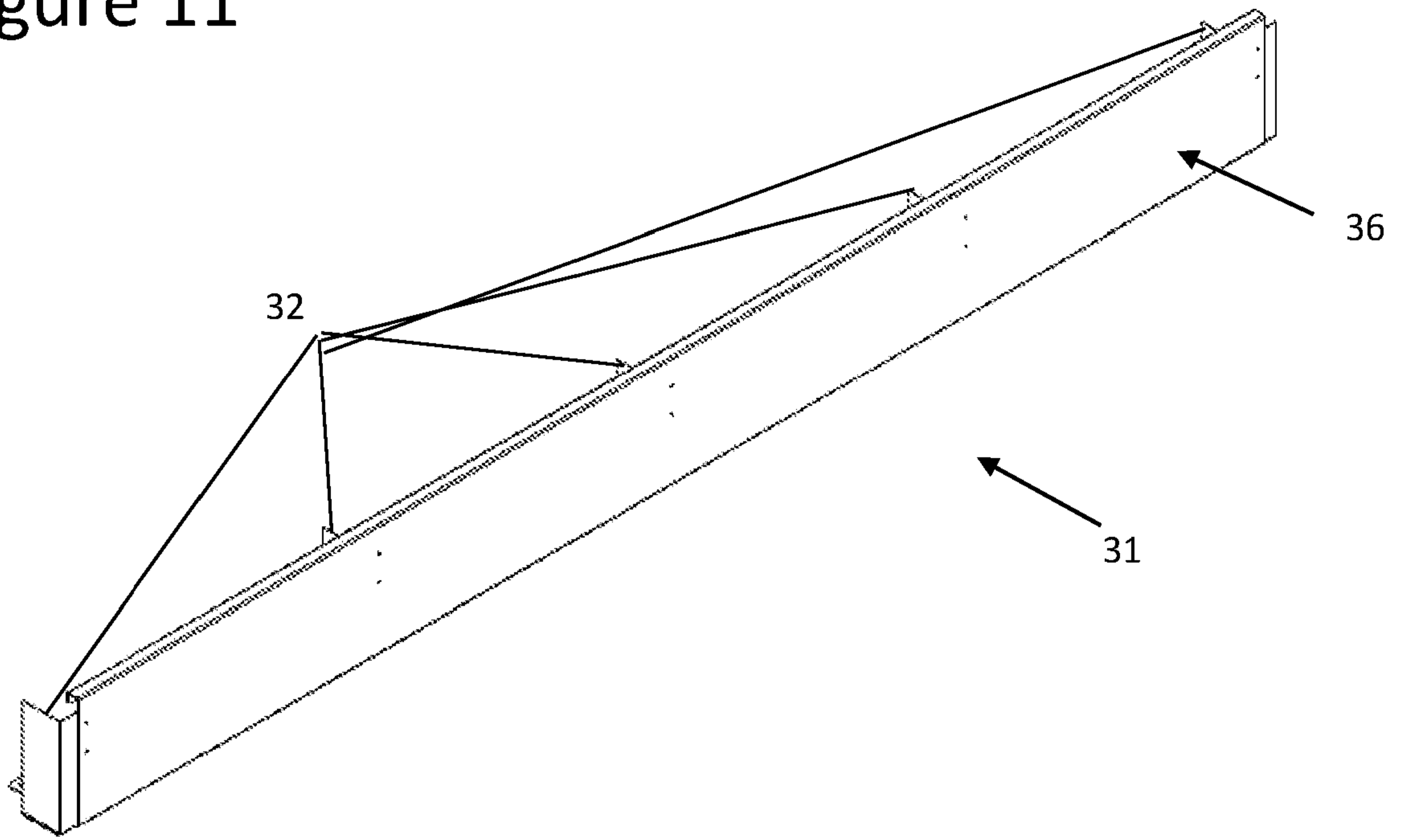


Figure 12

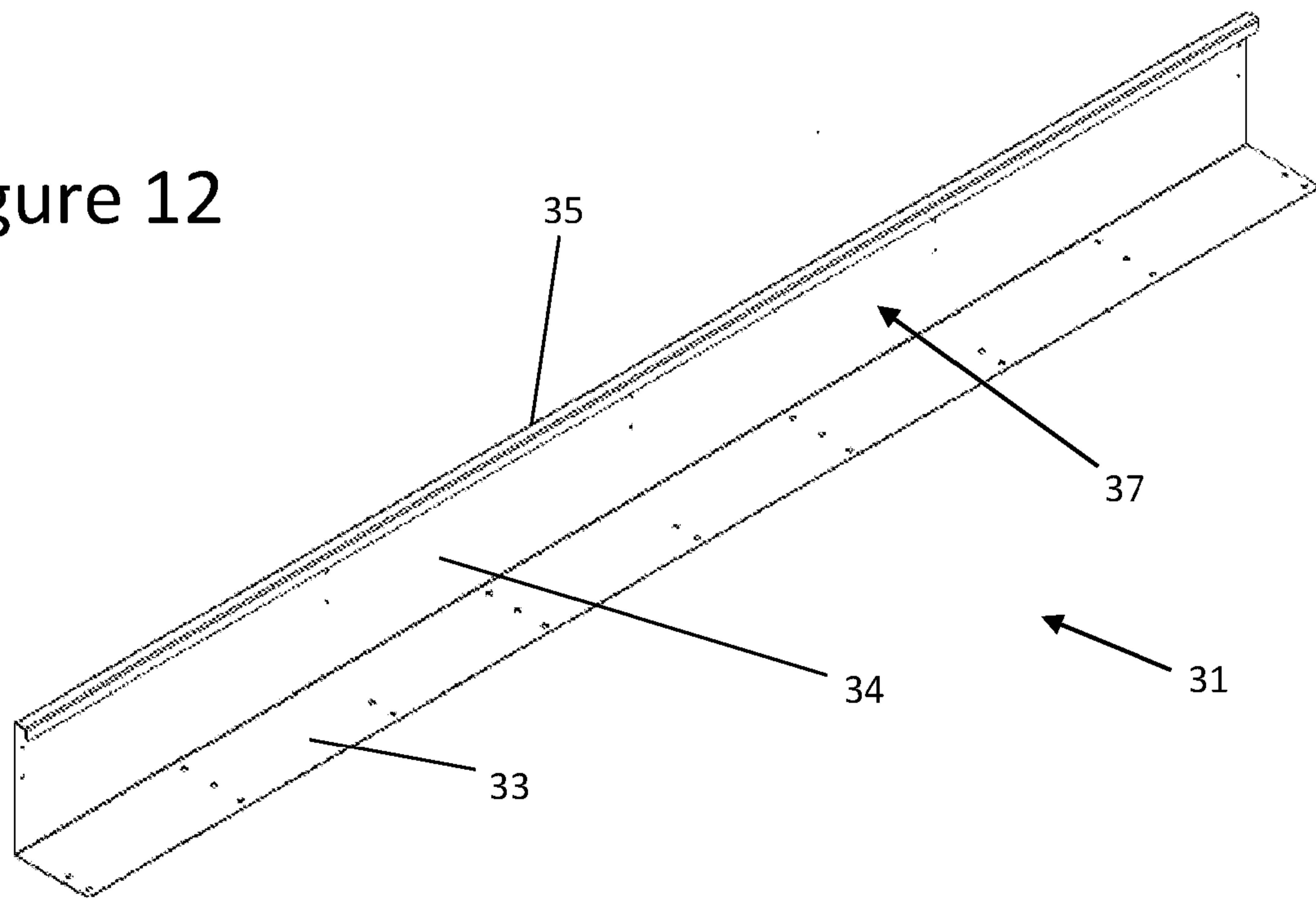


Figure 13

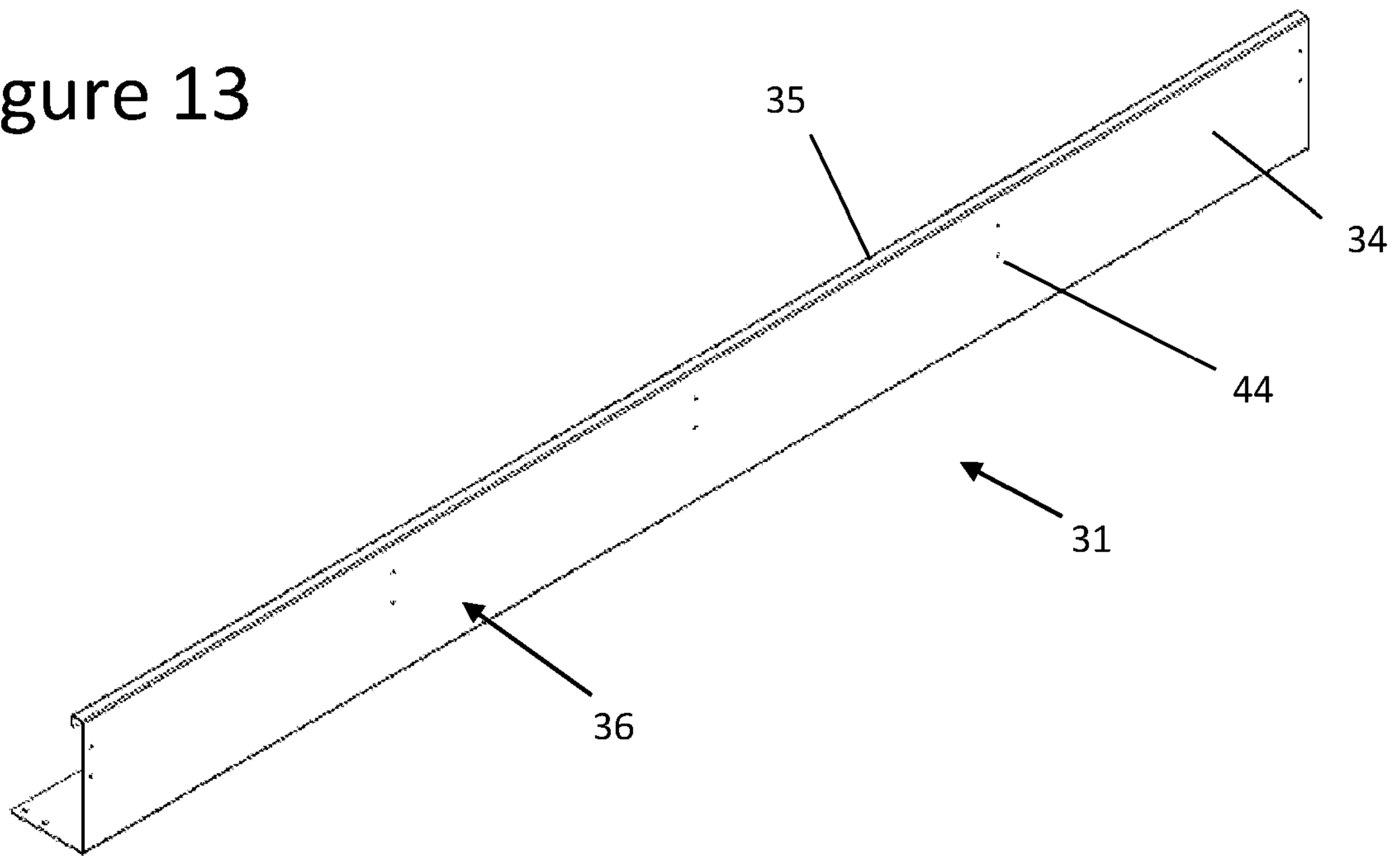
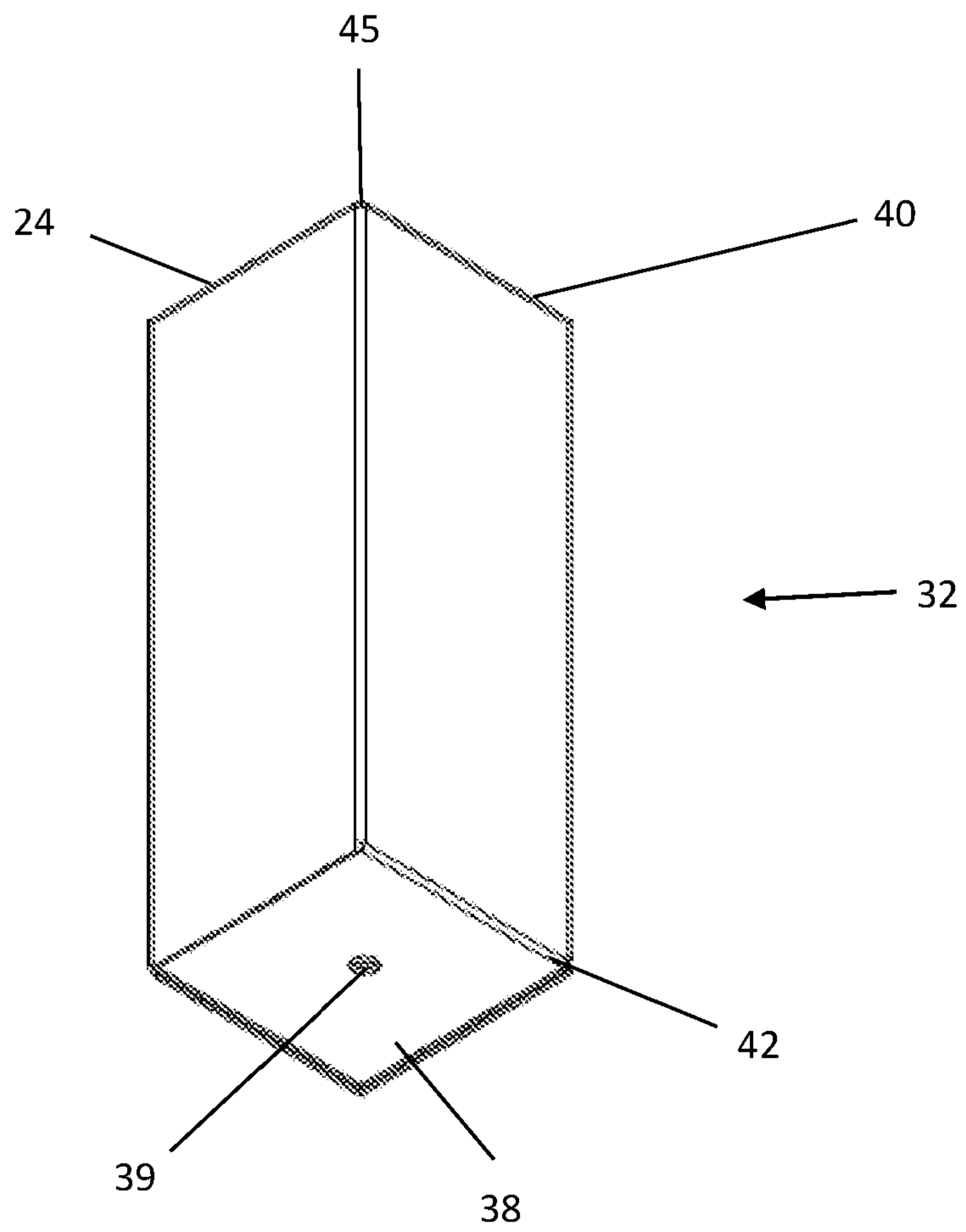


Figure 14





## **Shuttering System**

The present invention relates to a shuttering system for concrete or other settable material and particularly, but not exclusively, relates to a metal shuttering system for use in forming a concrete raft or beam of a building, or for forming features on or in a concrete raft or low level beam of a building. The invention also relates to a method of constructing a concrete structure employing such a shuttering system.

Traditionally, many domestic and commercial buildings are constructed by having substructure brick work or block work built on traditional strip concrete footings, or supported on ground beams in turn supported by piles. With such traditional structures the weight of the walls of the building is carried by the footing, or ground beams, directly below the substructure brick work or block work, with the floor of the building often being in the form of a suspended slab.

With the above construction methods, whether using traditional strip footings or piles and ground beams, significant cost will normally be incurred associated with excavation and spoil disposal. There may also be problems with ground collapse and dewatering. An alternative method of building, which avoids the needs for traditional footings, employs a concrete raft which is normally reinforced by steel bars. The concrete raft may be supported directly on appropriately treated ground (possibly by compaction where soil type permits this) or supported by piles.

Whether the concrete raft is to be supported directly by the ground or from piles, it is first necessary to provide appropriate formwork to receive the poured concrete and define the shape of the raft. The formwork will include a substrate to support the poured concrete of the raft until it has set. If the raft is to be formed on appropriately treated ground, then the substrate will often be a levelled rough concrete working surface. Alternatively, where the raft is to be supported from piles, the substrate will normally be a temporary substrate built around the piles, such as a plywood deck supported by temporary deck support units.

As mentioned above, an advantage of using a concrete raft for the base of a building is that the walls of the building may be supported by the concrete raft, avoiding the need for traditional footings and excavations. However, this in turn means there is no sub-structure brick work or block work to retain the poured concrete when the raft is being formed. Therefore, in addition to providing formwork in the form of a substrate on which to form the raft, sometimes it may also be necessary to provide formwork to shutter the concrete to define the edge of the raft.

Wooden shuttering can be used to define the edge of a raft, this normally consists of shutters of appropriately cut plywood sheets mounted on wooden frames, which are then stood in place and braced against the force of the fluid concrete raft by diagonal wooden supports. The top of the shuttering defines the level of the raft and therefore a carpenter is commonly employed to trim the shuttering to take into account undulations in the substrate. This can be relatively expensive and adds to the time required between the substrate being prepared and the concrete for the raft being poured.

Not only is traditional wooden shuttering relatively time consuming to erect, it also has to remain undisturbed until the raft has set, when it is then necessary to subsequently “strike” the shuttering to clear the shuttering from the site. In addition, it is also difficult with wooden shuttering to form features on or in the raft. For example it is sometimes desirable to provide a notch (step down) along the edge of the raft to decrease the thickness of the raft at the edges. This reduces the amount of visible concrete in the finished building or may enable the height of the concrete at the edge of the raft to be reduced to ground level. In addition, if required, brick work or block work can be built on the “step” because the thickness of the step, although less than the main body of the raft, can still be sufficient to support the walls. If wooden shuttering is used, then a floating shutter may have to be used to form this step. This can again be time consuming and will also require adjustment whilst the raft is being poured.

Metal support structures have been developed to support brick work or block work around the edge of a raft, examples of which can be found in UK Patent Applications, Publication Nos GB 2450401, GB 2450401, GB 2522886 and GB 5 2522887. These earlier applications disclose various metal shuttering systems comprising a plurality of identical shutter members which, in use, are generally arranged end to end to retain a body of settable material and form an edge to that body, often forming the edge of a raft. The shutter members of each of these shuttering systems are formed from sheet metal and thus are relatively light 10 compared to wooden structures and relatively easy to position on a substrate and fasten in place. Furthermore, the shutter members of the shuttering system disclosed in these documents are arranged to be at least partially embedded in the body of settable material. This has the advantage that the mass of settable material may act to maintain or assist in retaining wall portions of the shutter members in 15 position. A significant advantage of such shuttering systems is that they are sacrificial and retained in place by being at least partially embedded in the material once this is set, avoiding the need to strike the shuttering.

Although metal shutter members and any associated metal bracing 20 members may be more expensive per meter than traditional wooden shuttering, this is compensated for by the saving in the labour costs and the saving in time that is possible using metal shuttering systems relative to conventional wooden shuttering systems. However, the cost of such metal shuttering systems is not insignificant.

25

It is an object of the present invention to provide an improved shuttering system.

According to a first aspect of the present invention there is provided a 30 shuttering system comprising a plurality of shutter members each having a preformed profile and arranged to be aligned to form a shutter, the shutter being capable of forming an edge of a body of settable material, each shutter member

being formed from a sheet having a first side and a second side, the sheet having a substantially constant longitudinal profile along its length, the longitudinal profile defining: a base portion arranged to, in use, be positioned horizontally on a supporting substrate and anchored to that substrate; at least one wall portion, with  
5 a first side and a second side opposite the first side, the first side of the wall portion being arranged to, in use, retain the body of settable material; and a lip extending outwardly from a top edge of the wall portion, wherein: the base portion and the lip are located to the second side of the wall portion.

10 The present invention essentially retains all the benefits of the aforementioned metal shuttering systems, in that it may be more quickly and easily assembled than traditional wooden shuttering systems, with the components also being more easily stacked or nested for transportation.

15 A significant difference between the present invention and the above mentioned metal shuttering systems is that, with the present invention, the lip and base portion both extend outwardly to the second side of the wall portion opposite to the first side retaining the settable material. This can avoid the need to embed the shutter member base portion or lip in the settable material, permitting the  
20 shuttering system to be removed after the settable material has set and enabling the shuttering system to be reused.

The provision of the outwardly extending lip may be particularly advantageous, in that in addition to stiffening the wall portion, it may also provide  
25 an engagement point for a tool which can then be used to peel or break the metal shuttering away from the body of settable material, once the settable material has set, without causing excessive damage to the shutter member and thus permitting the shutter member to be reused.

30 Preferably, the shuttering system further comprises a plurality of brace members, each brace member being arranged to be positioned to abut at least

parts of both the second side of the wall portion and the base portion of the shutter member, to brace the wall portion against the base portion.

5 The brace members may brace the wall portion against the base portion and these will again be on the opposite side of the wall portion to the poured concrete, or other settable material, making it possible for the brace members to also be subsequently removed.

10 The shutter members are preferably arranged to be transported to a site stacked or nested together and the brace members are preferably arranged to be transported to a site stacked or nested together, wherein the brace members are arranged to be subsequently attached by hand at appropriate locations to the shutter members by a plurality of fastenings. More preferably the brace members and shutter members are arranged to be fastened together by at least one  
15 common fastening passing through a brace member and a base portion of a shutter member.

A significant advantage of the present invention is that it may permit the shutter members and brace members to be formed simply by stamping and folding  
20 processes only, without the need for joins or any other fastenings. Furthermore, the invention permits the shutter members and the brace members to then be stacked or nested together separately and transported to a site before then being fastened together on site. This last feature is particularly advantageous where the shutter members and brace members are to be reused, for it may enable them to  
25 be conveniently collected after use and stacked for either storage or distribution to another part of a site for reuse, or for transportation to another site or to a storage location.

30 Where the brace members and shutter members are arranged to be fastened together by at least one common fastening passing through the brace member and a base portion of a shutter member, this may then enable the process of the fixing of the shutter member to the substrate to also provide the fixing of the

brace member to the shutter member, avoiding the need to weld (in the case of metal shutter members and brace members) the two together or secure them by some other means.

5            Advantageously, the first side of the wall portion is relatively smooth with no substantial projections, wherein the shutter member has a profile arranged to permit the first side of the wall portion to be peeled off, or broken away from, the body of settable material once the body of settable material has set. This may not only assist in the removal of the shuttering member, but it may also avoid damage  
10 to the surface of the raft or other body of material formed by the shutter member, which surface may be visible in a finished structure, such as a building.

            Preferably, in one embodiment, the brace members are each arranged to be positioned substantially orthogonal to a longitudinal direction of the shutter  
15 members with each shutter member stamped and/or cut to substantially match the profiles of the shutter members. In this manner the brace members may not only provide support to points of the shutter members, in order to support the wall portions of the shutter members against the forces exerted by the settable material, but they may also act to maintain the profile of the shutter members.

20

            Advantageously, in one embodiment, each brace member has a main body comprising a flat metal sheet, and a number of integral metal tabs bent orthogonally to the main body and arranged to receive fastening to fasten the brace member to a shutter member. This arrangement provides a convenient way  
25 of fixing a brace member to a shutter member and avoids the needs for additional components, other than the fastenings themselves.

            In one embodiment each shutter member may have a step-like profile, comprising two substantially upright wall portions and a substantially horizontal  
30 portion joining a top edge of a lower wall portion to a bottom edge of an upper wall portion. A step-like profile is advantageous where the shuttering system is used to build a raft and the edge of the raft is to support brickwork, for the provision of the

step permits a course of brickwork or blockwork (which may form part of an exposed outer wall) to start partway down the raft, possibly more than half way down the raft, which may result in a more aesthetically pleasing finished structure.

5           Where the shutter members have a step-like profile, it is preferable that each brace member is cut or folded to have one end shaped to match the step-like profile of the shutter members.

10           Where a brace member is cut and/or folded to have one end shaped to match a profile of a shutter member, the brace member may then not only brace the shutter member at all points in a plane perpendicular to the shutter member (and thus act to retain the profile of the shutter member against the forces exerted by a settable material), but the shutter member may then also engage with the brace member, (particularly if fastening points are appropriately located between  
15 the shutter member and the brace member), in such a manner so as to prevent the brace member from distorting under load, enabling the brace member to be formed from a single sheet of metal, avoiding the need to add additional reinforcing components, such as spars, to the brace member.

20           Where the shutter members have a step-like profile, it is preferable that the shuttering system further comprises a plurality of brackets, each arranged to support the upper wall portion side of the shutter members. The brackets may be fixed by fastenings to the upper wall portion of the shutter member, by self-tapping fastenings for example, to support the side of the shutter member bearing the lip.  
25 The attachment of the brackets to the shutter member can thus be used not only to support the shutter member in an upright position prior to the concrete being poured, but also to determine the position of the top edge of a shutter member and thus the level of poured concrete, poured to the level of the lip.

30           In an alternative embodiment, each shutter member may have a single flat vertical wall portion extending from the base portion to the lip and wherein each brace member is folded, or formed, from a sheet to have a horizontal base portion

and two upstanding wall portions arranged in the form a base portion and two adjacent upstanding orthogonal wall portions of a cuboid. In this manner, a raft of concrete or similar may be formed with a straight vertical edge.

5 In any of the previous embodiments, each shutter member and/or brace member is preferably stamped and folded from a sheet of metal.

According to a second aspect of the present invention there is provided a method of creating a concrete raft, or other body of settable material, using a shuttering system as described above, the method comprising: transporting to a site  
10 a plurality of shutter members in a nested or stacked configuration and a plurality of brace members in a nested or stacked configuration; laying out the shutter members and bracing them with brace members by fastening both the shutter members and brace members to a substrate; pouring the concrete or other settable  
15 material against the first side of the wall portion of each shutter member; and once the settable material has set, peeling or breaking the wall portions of the shutter members away from the settable material.

The step of peeling or breaking the wall portions of the shutter members  
20 away from the settable material may comprise using tools to engage with the lip and urging the lip, and thus the first side of a wall portion of a shutter member, away from the set material.

The brace members may be removed prior to peeling or breaking the shutter  
25 members away from the set material, permitting the shutter members to be temporarily distorted or to flex to assist in their peeling or breaking away from the set material. The shutter members and brace members may thus be arranged to be used multiple times, possibly four or five, substantially improving the cost effectiveness of using metal shuttering systems, relative to the known metal  
30 shuttering systems.



Each time a metal shutter member and brace member is used it will be subject to some wear and tear or contamination by deposits of the settable material and thus the shutter members and brace members may typically have a life of between four to five cycles. Thus, the method may preferably further comprise  
5 using a number of shutter members and brace members for a final time and leaving the shutter members in position.

Where a shuttering system comprises a shutter member with a single vertical upright wall portion, it may be preferable to reverse it on the final time so  
10 that the concrete is poured against the second side of the wall portion, over any brace members and the base portion, and encapsulating the lip, so that the first side of the wall portion then forms an exposed outer surface in the finished structure.

15 Leaving the shuttering system in place after a number of cycles saves the cost of striking the shuttering on the final cycle.

Two embodiments of the present invention will now be described, by way of example only, with reference to the following drawings, of which:

20 Figure 1 is perspective view of a first embodiment of a shuttering system in accordance with the present invention, shown retaining a body of poured concrete;

Figure 2 is a perspective view of a shutter member of the shuttering system of Figure 1;

25 Figure 3 is an end view showing the cross-section profile of the shutter member of Figure 2;

Figure 4 is a rear perspective view of the shutter member of Figure 2, showing the shutter member partially supported by a plurality of brackets;

Figure 5 is a perspective view of a brace member of the shuttering system of Figure 1;

30 Figure 6 corresponds to Figure 5, but shows an alternative brace member;

Figure 7 is a perspective view of the brace member of Figure 6 shown installed on the shutter member of Figure 2;

Figure 8 is a plan view of the brace member of Figure 6, along the line VIII-VIII of Figure 6;

Figure 9 is a side elevation of the brace member of Figure 6, along the line IX-IX of Figure 6;

5 Figure 10 is a rear perspective view of a second embodiment of a shuttering system in accordance with the present invention, shown retaining a body of poured concrete;

Figure 11 is a front perspective view of the shuttering system of Figure 1;

10 Figure 12 is a rear perspective view of the shutter member of Figures 10 and 11;

Figure 13 is a front perspective view of the shutter member of Figure 12; and

Figure 14 is a rear perspective view of a brace member of the shuttering system shown in Figures 10 and 11.

15

Referring to Figure 1, a first embodiment of a shuttering system 1 in accordance with the present invention is illustrated. This comprises a plurality of identical shutter members 2 (only one of which is shown in Figure 1), arranged in a linear array to retain a body of poured concrete 3 or other settable material on a substrate 4, which substrate 4 may for example be a working surface of 2cm to 20 5cm of concrete poured over an appropriately prepared ground. Alternatively this could be an elevated substrate 4, such as a layer of plywood, which may or may not be removed after the body of poured concrete 3 has set.

25 As can be seen from Figure 1, the shutter member 2 is shown braced by two identical external brace members 5, however any appropriate number may be employed. Each brace member 5 acts to retain the shutter member 2 in place and also acts to maintain the profile of the shutter member 2, as will be described below. However, if a suitable gauge of metal is used for the shutter member then it 30 may not be necessary to employ the brace members 5.

Each shutter members 2 may be formed by being stamped and folded from a flat sheet of metal to the shape shown in Figure 2. Thus, in the manufacturing step, the shutter members 2 can be formed by an automated process, without the need for welding or any other fastenings. The shutter members 2 may then be

5 subsequently stacked in a nested configuration for ease of transport to a site where they may then be arranged end to end and either abutted or slightly overlapped to form a continuous edge for a concrete structure to be formed (or other structure made of a settable material). The size of each shutter member 2 will depend on the application for which it is to be used, but to form a concrete raft from a body of

10 poured concrete 3, as illustrated in Figure 1, having a stepped edge to subsequently form a support for a brick wall or other block type wall, the shutter members may typically be between 2.2m and 2.6m in length, and preferably 2.4m in length. The gauge of the steel may typically be between 1mm and 2mm, preferably 1.5mm, with the shutter members 2 preferably being formed from

15 galvanised steel.

Each shutter member has a profile as illustrated in Figure 3, which is essentially step-like and comprises a horizontal base portion 6, a first vertical wall portion 7, a horizontal "tread" portion 8, a second vertical wall portion 9 and an

20 outwardly protruding lip 10. The base portion 6 of the shutter member 2 has a plurality of punched holes 11 in it, each capable of receiving a fastenings in order to secure the shutter member 2 to a substrate 4, as shown in Figure 1. The horizontal base portion 6, together with the horizontal tread portion 8 and horizontal lip portion 10, act to stiffen the wall portions 7 and 9, so that they resist distortion

25 when retaining the poured concrete 3, prior to setting.

To ensure the base portion 6 of the shutter member 2 is correctly aligned and levelled on the substrate 4 (rough working surface) appropriate packing pieces, not shown, may be placed as necessary between the base portion 6 of the

30 shutter member 2 and the substrate (rough working surface) 4.

As shown in Figure 4, the rear of the shutter member 2 may be supported by a number of L-shaped brackets 12, each secured by fastenings inserted through punched holes 13, seen in Figure 2, in the shutter member 2. These fastenings may for example be small self-tapping screws which may be self-tapped at any appropriate location into the respective L-shaped brackets 12 when the outwardly protruding lip 10 of the shutter member 2 is at the desired height, the outwardly protruding lip 10 defining the top edge of the shutter member 2 and thus the upper level of the body of poured concrete 3.

Referring now to Figure 5, this shows one of the brace members 5 of Figure 1. An edge of each brace member 5 is arranged to abut all of the first vertical wall portion 7, the tread portion 8 and the second vertical wall portion 9 of the shutter member 2 and thus retain the profile of the shutter member 2.

Each brace member 5 has a base portion 14 and a plurality of tabs 15 to 20, (only tabs 15 to 18 are visible in Figure 5), which each have respective punched holes 21 for receiving fastenings. The brace member 5 also has upper lip portions 22 and 23, which both act to stiffen the brace member and also avoid any exposed upwardly protruding metal edges. Each brace member 5 is stamped from a metal sheet with the base portion 14, tabs 15 to 20 and lip portions 22 and 23 subsequently being formed by bending the stamped sheet. Thus each brace member 5 is formed purely from a stamping and folding process, without the need for any welding or other fastening steps to be employed during manufacture. Each brace member 5 may thus be relatively easily and cheaply manufactured with multiple brace members then being stacked together or placed side by side, for ease of transportation to a site and subsequent distribution and assembly with appropriate shutter members 2.

Each brace member 5 may be assembled on a shutter member 2, as shown in Figure 1, prior to the shutter member 2 being installed on the substrate 4. Alternatively the brace members 5 can be assembled on the shutter members 2 simultaneously with the shutter member being fastened to the substrate 4 and to

the L-shaped brackets 12. In this manner fastenings used to secure the shutter member 2 to the L-shaped bracket 12 may also be used to simultaneously secure the brace members 5 to the shutter members 2.

5           With reference now to Figures 6 to 9, here an alternative brace member 24 is shown. This is identical to the brace member 5 of Figure 5, except in that the lip portions 22 and 23 have been omitted in this embodiment. If it is not necessary to employ such lip portions 22 and 23 and these are omitted, as in the case of the brace member 24 shown in Figures 6 to 9, then the brace members 24 can be  
10 stacked directly one against the other, such that adding each additional brace member 24 to a stack increments the height of the stack only by the thickness of the metal sheet forming the brace member 24, thus providing a more compact stack.

15           As stated above, except for the lip portions 22 and 23, the brace member 24 of Figures 6 to 9 is identical to the brace member 5 of Figure 5, noting that Figures 8 and 9 show the tabs 19 and 20 not visible in the previous figures.

          The invention has thus far been described with reference to the shuttering  
20 systems of Figures 1 to 9, which are specifically for creating a concrete raft with a stepped edge having a profile as represented by the crossed hatch area of the body of poured concrete 3 shown in Figure 1. However, the invention may be used to form concrete rafts or other structures having different shaped edges, for example a shuttering system in accordance with the present invention may  
25 comprise shutter members 31 and brace members 32 as per those shown in Figures 10 to 14, discussed below, where they are arranged to retain a body of poured concrete (or other settable material) 30 such that the set concrete will have a vertical straight edge.

30           Regardless of the profile of the shutter members, the shutter members will each have an outwardly protruding lip 10. This not only stiffens the top edge of a vertical wall portion 9 of a shutter member, but this will also assist in the removal of

the shuttering system 1. This is possible, for the outwardly protruding lip 10 may enable a tool such as mole grips, or another type of grip or wrench, to engage with the lip 10, in order to gently prise the lip and thus the shutter member away from a front edge of a set body of poured concrete, without damaging the face of that concrete.

Depending on the size of the shuttering member, the gauge of the steel and the size and security of the fastenings used, it may be possible to use the outwardly protruding lip 10 to wrench the whole shuttering system 1 away from the set concrete. Alternatively, the brace members 5, 24 may first be removed from the shutter member 2, 25, possibly by first removing the fastenings, prior to removing the shutter member 2, 25.

The provision of the outwardly protruding lip 10 and both the base portions 6, 26 of the shutter member 2, 25 extending outwardly from the body of settable material and the brace portions 5, 24 extending outwardly from the body of settable material, makes it possible to subsequently remove the shuttering system whilst retaining the integrity of the shutter members 2, 25 and brace members 5, 24. These may thus then be subsequently reused, typically for a further four or five shuttering operations, or cycles. However, small amounts of incremental damage or distortion, incurred on each subsequent shuttering operation, in addition to residual deposits of concrete which may occur on the surfaces of the shutter members 2, 25, will typically result in a limited service life for the shutter members 2, 25 and the brace members. On a deemed final cycle, to avoid the cost of removing the shuttering system, the shuttering system 1 may be left in place, although in some applications it may be necessary to remove the brace members 5, 24.

Referring now to Figure 10, this illustrates a shuttering system, indicated generally as 28, in accordance with the second embodiment of the present invention. This is shown, in Figure 10, laid out on a substrate 29 and retaining a body of poured settable concrete 30. A front view of the shuttering system 28 of

Figure 10 is shown in Figure 11 (without the substrate 29 or poured concrete 30). The shuttering system 28 comprises a plurality of generally L-shaped shutter members 31 arranged end to end, only one of which is shown in Figure 10, and an appropriate number of brace members 32.

5

A shutter member 31 is shown separately in Figure 12. This is stamped and folded from a flat sheet of metal to have the profile shown, having a planar base portion 33, an upright wall portion 34 and an outwardly protruding lip 35. The wall portion 34 of the shutter member 31 has a first face 36 and a second face 37 with the lip 35 and base portion 33 extending outwardly from the side of the second face 37.

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Referring now to Figure 14, this shows a brace member 32, suitable for use with the shutter member 31 of Figures 12 and 13. This is stamped and folded from a sheet of steel to have the shape shown in Figure 14, effectively forming three faces of a cuboid comprising a base portion 38 with a hole 39 in it and two upstanding wall portions 40 and 41, one of which is joined at fold line 42 to the base portion 38.

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In use, as shown in Figure 10, a plurality of shutter members 31 may be carried to a site in a stacked or nested configuration and then laid out in a line on a substrate 29 to retain a body of poured concrete 30. If necessary appropriate packing members may be placed between the substrate 29 and the base portion 33 of the shutter member 31, in order to level the shutter member 31, the top edge of which will define the level of the poured concrete and thus the top level of the structure to be formed.

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A number of brace members 32 are then arranged on the shutter members (only one of which is shown in Figure 10), as shown and fastened to the shutter members by fasteners (not shown) extending through the hole 39 in the base portion 38 of each brace member 32 and extending through an appropriate hole 43 in an associated shutter member 31, to secure the shutter member 31 and brace

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member 32 to the substrate 29. Additional fasteners may also be used to secure the shutter member 31 to the substrate 29.

Further fasteners, in the form of self-tapping screws, may be then inserted  
5 through holes 44 in the wall portion 40 of the shutter member 31 (see Figure 13) to engage with a respective wall portion 41 of a respective brace member 32. In this manner, with reference to Figure 14, the wall portion 41 of the brace member 32 will be retained against the second face 37 of the wall portion 34 of the shutter member 31 and will also be retained in position by the fold line 45 anchoring it to  
10 the second wall portion 40 of the brace member 32. In turn, the second wall portion 40 will be retained in the upright position, as shown, by the fold line 42 anchoring it to the base portion 38 of the brace member 32. Thus the brace member 32 will act to retain the wall portion 34 of the shutter member 31 perpendicular to the base portion 38 and thus act to retain the wall portion 34 of the  
15 shutter member 31 in the upright configuration shown, against any forces exerted by the poured concrete 30 of Figure 10.

Once the poured concrete 30 has set, tools may then be used to engage with the lip 35 to prise the shuttering system, as a complete unit, away from the  
20 now set poured concrete 30, with the lip 35 acting to stiffen the wall portion 34 of the shutter member 31 and prevent undue distortion. In this manner, the shuttering system can be used multiple times.

After several shuttering operations the shuttering system of Figures 10 to 14  
25 will be subject to wear and tear, possibly by distortion and damage either on removal or storage, or possibly by contamination by residual quantities of concrete adhering to the first face 36. Thus, after a number of cycles, it may be determined that the next cycle will be a final cycle. On this final cycle the shuttering system may be installed in a reverse manner, whereby the second face of the shuttering  
30 system is arranged to retain the settable concrete. Concrete will then be poured over the base portion 38 of the shutter member 31 and over the brace members 32, whereby the shuttering system will then remain in place, with the first face 37



then forming an exposed edge of the raft or other structure then formed by the poured concrete 30.

5           Although two embodiments of the present invention have been described above, it should be appreciated that these have been described by way of example only and that various other modifications may be possible, which fall within the scope of the appended claims.

**Claims**

1. A shuttering system comprising a plurality of shutter members each having a preformed profile and arranged to be aligned to form a shutter, the shutter being  
5 capable of forming an edge of a body of settable material, each shutter member being formed from a sheet having a first side and a second side, the sheet having a substantially constant longitudinal profile along its length, the longitudinal profile defining:
- a base portion arranged to, in use, be positioned horizontally on a  
10 supporting substrate and anchored to that substrate;
  - at least one wall portion, with a first side and a second side opposite the first side, the first side of the wall portion being arranged to, in use, retain the body of settable material; and
  - a lip extending outwardly from a top edge of the wall portion, wherein:  
15 the base portion and the lip are located to the second side of the wall portion.
2. A shuttering system as claimed in Claim 1, further comprises a plurality of  
20 brace members, each brace member being arranged to be positioned to abut at least parts of both the second side of the wall portion and the base portion of the shutter member, to brace the wall portion against the base portion.
3. A shuttering system as claimed in Claim 1, wherein the shutter members are  
25 arranged such that they may be transported to a site stacked or nested together and the brace members are arranged such that they may be transported to a site stacked or nested together, wherein the brace members are arranged such that they may be subsequently attached at appropriate locations to the shutter members by a plurality of fastenings.
- 30 4. A shuttering system as claimed in any preceding claim, wherein the brace members and shutter members are arranged to be fastened together by at least

one common fastening passing through the brace member and a base portion of a shutter member.

5 5. A shuttering system as claimed in any preceding claim, wherein the first side  
of the wall portion is relatively smooth with no substantial projections and wherein  
the shutter member has a profile arranged to permit the first side of the wall portion  
to be peeled off, or broken away from, the body of settable material once the body  
of settable material has set.

10 6. A shuttering system as claimed in any preceding claim, wherein the brace  
members are each arranged to be positioned substantially orthogonally to a  
longitudinal direction of the shutter member and are cut and/or folded to  
substantially match the profile of the shutter members.

15 7. A shuttering system as claimed in Claim 6, wherein each brace member has  
a main body comprising a flat metal sheet and a number of integral metal tabs bent  
orthogonally to the main body and arranged to receive fastening to fasten the  
brace member to a shutter member.

20 8. A shuttering system as claimed in any preceding claim, wherein each  
shutter member has a step-like profile, comprising two substantially upright wall  
portions and a substantially horizontal portion joining a top edge of a lower wall  
portion to a bottom edge of an upper wall portion.

25 9. A shuttering system as claimed in Claim 8, further comprising a plurality of  
brace members wherein each brace member is cut or folded to have one end  
shaped to match the step-like profile of the shutter members.

30 10. A shuttering system as claimed in Claim 8 or 9, further comprising a plurality  
of brackets, each arranged to support the upper wall portion side of the shutter  
members.

11. A shuttering system as claimed in any one of Claims 1 to 5, wherein each shutter member has a single flat vertical wall portion extending from the base portion to the lip and wherein each brace member is folded or formed from a sheet to have a horizontal base portion and two upstanding wall portions arranged in the form a base portion and two adjacent upstanding orthogonal wall portions of a cuboid.

12. A shuttering system as claimed in any preceding claim, wherein each shutter member is stamped and folded from a sheet of metal.

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13. A shuttering system as claimed in any preceding claim, wherein each brace member is stamped and folded from a sheet of metal.

14. A method of creating a concrete raft, or other body of settable material, using a shuttering system as claimed in any preceding claim, the method comprising:

transporting to a site a plurality of shutter members in a nested or stacked configuration and a plurality of brace members in a nested or stacked configuration;

20 laying out the shutter members and bracing them with brace members by fastening both the shutter members and brace members to a substrate; and

pouring the concrete or other settable material against the first side of the wall portion of each shutter member; and

25 once the settable material has set, peeling or breaking the wall portions of the shutter members away from the settable material.

15. The method of Claim 14, wherein the step of peeling or breaking the wall portions of the shutter members away from the settable material comprises using tools to engage with the lip and urging the lip, and thus the first side of a wall portion of a shutter member, away from the set material.

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16. A method as claimed in Claim 14 or 15, further comprising the step of removing the brace members prior to peeling or breaking the shutter members away from the set material.

5 17. A method of forming one or more concrete rafts, or other bodies of settable material, comprising repeatedly employing the method of any one of Claims 14 to 16 and reusing the shutter members and brace members.

10 18. A method as claimed in Claim 17, comprising using a number of shutter members and brace members for a final time and leaving the shutter members in position.

Amendment to Claims have been filed as follows

**Claims**

1. A shuttering system comprising:

5 a plurality of shutter members each having a preformed, step-like profile and arranged to be aligned to form a shutter, the shutter being capable of forming an edge of a body of settable material, each shutter member being formed from a sheet having a first side and a second side, the sheet having a substantially constant longitudinal profile along its length, the longitudinal profile defining:

10 a base portion arranged to, in use, be positioned horizontally on a supporting substrate and anchored to that substrate;

15 two substantially upright wall portions and a substantially horizontal portion joining a top edge of a lower wall portion to a bottom edge of an upper wall portion, with a first side and a second side opposite the first side, the first side of the wall portions being arranged to, in use, retain the body of settable material; and

a lip extending outwardly from a top edge of the upper wall portion, wherein:

the base portion and the lip are located to the second side of the wall portions, and

20 a plurality of brace members, wherein the brace members are each arranged to be positioned substantially orthogonally to a longitudinal direction of the shutter members and are cut and/or folded to substantially match the step-like profile of the shutter members, wherein each brace member is arranged to be positioned to abut at least parts of both the second side of both the wall portions and the base portion of the shutter member, to brace the wall portions against the  
25 base portion.

2. A shuttering system as claimed in Claim 1, wherein the shutter members are arranged such that they may be transported to a site stacked or nested together  
30 and the brace members are arranged such that they may be transported to a site stacked or nested together, wherein the brace members are arranged such that

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they may be subsequently attached at appropriate locations to the shutter members by a plurality of fastenings.

3. A shuttering system as claimed in any preceding claim, wherein the brace  
5 members and shutter members are arranged to be fastened together by at least one common fastening passing through the brace member and a base portion of a shutter member.

4. A shuttering system as claimed in any preceding claim, wherein the first side  
10 of the wall portions is relatively smooth with no substantial projections and wherein the shutter member has a profile arranged to permit the first side of the wall portions to be peeled off, or broken away from, the body of settable material once the body of settable material has set.

15 5. A shuttering system as claimed in any preceding claim, wherein each brace member has a main body comprising a flat metal sheet and a number of integral metal tabs bent orthogonally to the main body and arranged to receive fastening to fasten the brace member to a shutter member.

20 6. A shuttering system as claimed in any preceding claim, wherein each brace member is cut or folded to have one end shaped to match the step-like profile of the shutter members.

7. A shuttering system as claimed in any preceding claim, further comprising a  
25 plurality of brackets, each arranged to support the upper wall portion side of the shutter members.

8. A shuttering system as claimed in any preceding claim, wherein each  
shutter member is stamped and folded from a sheet of metal.

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9. A shuttering system as claimed in any preceding claim, wherein each brace member is stamped and folded from a sheet of metal.

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10. A method of creating a concrete raft, or other body of settable material, using a shuttering system as claimed in any preceding claim, the method comprising:

5 transporting to a site a plurality of shutter members in a nested or stacked configuration and a plurality of brace members in a nested or stacked configuration;

laying out the shutter members and bracing them with brace members by fastening both the shutter members and brace members to a substrate;

10 pouring the concrete or other settable material against the first side of the wall portions of each shutter member; and

once the settable material has set, peeling or breaking the wall portions of the shutter members away from the settable material.

11. The method of Claim 10, wherein the step of peeling or breaking the wall portions of the shutter members away from the settable material comprises using tools to engage with the lip and urging the lip, and thus the first side of the wall portions of a shutter member, away from the set material.

12. A method as claimed in Claim 10 or 11, further comprising the step of removing the brace members prior to peeling or breaking the shutter members away from the set material.

13. A method of forming one or more concrete rafts, or other bodies of settable material, comprising repeatedly employing the method of any one of Claims 10 to 25 12 and reusing the shutter members and brace members.

14. A method as claimed in Claim 13, comprising using a number of shutter members and brace members for a final time and leaving the shutter members in position.





**Application No:** GB2000971.8

**Examiner:** Mr Kunal Saujani

**Claims searched:** 1-10, 12-18 (in part)

**Date of search:** 26 June 2020

**Patents Act 1977: Search Report under Section 17**

**Documents considered to be relevant:**

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-3, 5, 8, 9, 10, 12, 14-18	US6332599 B1 (SPARTZ) - See Figure 1 noting a shuttering system comprising a removable profile with a base portion 110 a wall 120-140 and a lip 15, the member including a brace 300 a bracket 600.
X	1-5, 8, 9, 12, 13,	WO2001/29343 A (TOFFOLO) - See Figures 10/11 noting formwork comprising a base 10, a brace 40, a stepped wall 30 and a lip extending on the same side as the base.
X	1, 5, 8, 12	US5882540 A (FARRINGTON) - See Figure 1 noting a removable formwork 10 comprising a base 12a, a wall 14 from which a lip 20a extends.
X	1, 3, 5, 6, 8, 9, 12, 13, 14-18	AU642121 B (BEBEK) - See Figure 8 noting a a reusable formwork with a base 29, a wall 22-24 and an inner lip at the top of 22.
A	-	CH682685 U (MANFRED) - See Figures 1 and 2 noting a shuttering with a base 6, wall 16 and lip 5.
A	-	GB2395221 A (BARCONS) - See Figure 2 noting a reusable form with a lip 6, base and a brace 7 extending between an inner wall of the form.
A	-	GB 2522887 A (ABBEY PYNFORD) - See Figure 1.

**Categories:**

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

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

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



E04G

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

WPI, EPODOC

**International Classification:**

<b>Subclass</b>	<b>Subgroup</b>	<b>Valid From</b>
E04B	0005/32	01/01/2006
E04G	0009/06	01/01/2006
E04G	0011/36	01/01/2006



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**Claims searched:** 11-18 (originally filed)

**Date of search:** 21 January 2021

**Patents Act 1977**

**Further Search Report under Section 17**

**Documents considered to be relevant:**

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
Y	11-18	US 1512165 A (VERNON et al.) - See Figures 1 and 2 noting a formwork with wall 1 with a lip 2 and a base 4 extending on the same side of the wall and can receive a box shaped brace
Y	11-18	US1909458 A (DIECKMANN) - See Figure 2 noting a shuttering 10 with a lip 37 and a base 36 which is capable of receiving a box shaped brace.
Y	11-18	EP 0649951 A1 (PERI) -See Figure 1 noting a brace for shuttering comprising a flat base 14 which extends underneath a pair of folded vertical walls to form a small cuboidal section.
Y	11-18	FR2327376 A1 (CAME DI ANACLETO) - See Figure 3 noting a brace for a shuttering comprising a base 18 underneath a folded sheet 1 forming a cuboidal structure.

**Categories:**

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

**Field of Search:**

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC<sup>X</sup> :

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

E04G
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The following online and other databases have been used in the preparation of this search report

WPI, EPODOC, Patent Fulltext
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**International Classification:**

Subclass	Subgroup	Valid From
E04B	0005/32	01/01/2006



Intellectual  
Property  
Office

<b>Subclass</b>	<b>Subgroup</b>	<b>Valid From</b>
E04G	0009/06	01/01/2006
E04G	0011/36	01/01/2006