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(54) **PREFABRICATED WALL ASSEMBLY AND METHOD THEREFOR**

VORGEFERTIGTE WANDANORDNUNG UND VERFAHREN DAFÜR

ENSEMBLE PAROI PRÉFABRIQUÉ ET PROCÉDÉ ASSOCIÉ

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Description

Field of the Invention

[0001] The present invention relates to a prefabricated wall assembly, a building structure and a method for manufacturing thereof as defined in the claims. The invention in particular relates to a prefabricated wall assembly which can be pre-assembled and installed to form an external wall of a multi-level building.

[0002] The invention has been developed primarily for use in/with single or multilevel building structure and will be described hereinafter with reference to this application. However, it will be appreciated that the invention is not limited to this particular field of use.

Background of the Invention

[0003] Conventional methods of constructing cavity walls of a single storey or multi-level building are often time-consuming and labour intensive. Typically, to construct a wall conventionally using masonry units such as bricks or concrete blocks requires much on-site labour and ordering of bulk raw materials on site. These raw materials must be stored on site until they are used up during the building process. In addition, a substantial amount of time and resources are typically required for vertical lifting and loading of materials when constructing high rise buildings. In addition, a substantial amount of effort and labour is required for installing scaffolding for safe access to these cavity walls on multiple story constructions.

[0004] Prefabricated walls offer the convenience of pre-fabricating wall panels in a factory controlled environment and then transporting these panels to the site, lifting them up to the desired level and securing them to the side of the building. They also do not require large amount of raw materials to be present and handled by workers on site which reduces occupational health and safety risk to the workers on-site. Less workers are also required to transport and install prefabricated walls. Thus, construction using prefabricated walls is more time efficient over conventional construction processes. This in turn increases the chances of the project being completed in time.

[0005] However, one of the inherent challenges in using pre-fabricating walls are that wall panels must be sufficiently secured and robust during transport, lifting and installation, especially for higher levels of high-rise buildings. There is also the risk that the wall panels will break during transportation. During transportation, handling and installation, panels may be subject to bending forces, which creates tension stresses in the panel. Panels are typically designed for handling compressive stressors and not tension stresses, and this can result in the panels becoming easily damaged or broken.

[0006] A brick wall panel is typically desired over concrete outer walls for aesthetic purposes. However, typi-

cally brick walls are ill-equipped to withstand loading that the walls may experience during transport such as tensile and bending loads.

[0007] Also, as prefabricated walls are constructed as a whole in a factory controlled environment, for example using traditional brick and mortar and/or concrete, they must be completed before transportation. Hence, after the walls have been constructed, there is less opportunity to modify the prefabricated wall to accommodate, for example, reinforcement members or in-wall and through-wall elements.

[0008] Other challenges include being able to easily configure walls for different purposes such as different loading conditions for example, at different levels of a building. Also, if pre fabricated walls have a complicated bespoke design, then lifting and transporting the particular panel must be configured to suit the physical and mechanical characteristics of the particular design. This can be an expensive process, especially if skilled labour is used to construct these walls.

[0009] In the specification, any reference to the term "masonry" shall be deemed to include clay, stone such as mobile, granite, travertine, and limestone; or concrete, , including without limitation, conventional concrete masonry units such as hollow stretcher blocks, autoclaved aerated concrete blocks, bricks, or any other mineral, rock or similar material that may be used for cladding on a building structure.

[0010] The present invention seeks to provide a prefabricated wall and a method of manufacturing a prefabricated wall, which will overcome or substantially ameliorate at least some of the deficiencies of the prior art, or to at least provide an alternative.

[0011] It is to be understood that, if any prior art information is referred to herein, such reference does not constitute an admission that the information forms part of the common general knowledge in the art, in Australia or any other country.

[0012] US 5,644,891 A1 details an invention focused on improving the manufacture of brick wall panels through a novel vibrating mortar plow. This plow has parallel fins designed to fit into mortar spaces between bricks, ensuring even mortar distribution and preventing air pockets. The brick wall panels feature cantilevering connectors, allowing them to be directly attached to a building structure or connected to a backing layer to form composite panels. This innovation enhances the quality and efficiency of brick wall panel production and provides flexible mounting options, resulting in more robust constructions and faster installation.

Summary of the Invention

[0013] According to a first aspect of the present invention, there is provided a prefabricated wall assembly as defined in claim 1 for constructing a wall of a building. According to a further aspect of the invention; there is provided a method of manufacturing a prefabricated wall

assembly as defined in claim 15.

[0014] In the first aspect, the invention may be said to consist in a prefabricated wall assembly including:

- a. an outer frame assembly connected to a masonry panel assembly, the masonry panel assembly comprising a plurality of masonry units compressed into at least one masonry panel;
- b. an inner frame assembly attached to an insulation panel;
- c. the masonry panel and the insulation panel being spaced at a distance from each other by an air gap;
- d. the inner frame assembly and the outer frame assembly being securely connected to each other at one or more connecting assemblies;
- e. the prefabricated wall assembly being configured for being connected to the outside of a building structure as cladding.

[0015] In one embodiment, the prefabricated wall assembly further includes at least one or more support brackets on which the prefabricated wall assembly may be supported by a building structure.

[0016] In one embodiment, the prefabricated wall assembly further includes a wall connector arrangement configured for securely engaging a prefabricated wall assembly with an adjacent similar prefabricated wall assembly.

[0017] In one embodiment, the prefabricated wall assembly further includes slinging formations associated with one or both selected from the outer frame assembly and the inner frame assembly, the slinging formations being configured for slinging of the prefabricated wall assembly during installation of the prefabricated wall assembly on a building structure.

[0018] In one embodiment, the slinging formations are configured for being received into complementary recesses in an adjacent similar prefabricated wall assembly as the wall connector arrangement.

[0019] In one embodiment, the connecting assemblies include a thermal barrier layer.

[0020] In the further aspect, the invention may be said to consist in a method of manufacturing a prefabricated wall assembly, the method comprising the steps of:

- a. manufacturing a prefabricated wall assembly as described;
- b. transporting the prefabricated wall assembly to an installation site; and
- c. securing the prefabricated wall assembly to a building structure.

[0021] The step of manufacturing the prefabricated wall assembly may include the step of:

- i. providing an inner frame assembly;

[0022] In one embodiment, the rigid vertical members are rigid side members.

- i. connecting a lower support to the inner frame assembly;

[0023] In one embodiment, the rigid vertical members are rigid side members.

- i. building layers of masonry units on the lower support with settable material;

[0024] In one embodiment, the rigid vertical members are rigid side members.

- i. building at least one or more support clips into at least one or more layers of masonry units;

[0025] In one embodiment, the rigid vertical members are rigid side members.

- i. attaching at least one or more rigid vertical members to the lower support;

[0026] In one embodiment, the rigid vertical members are rigid side members.

- i. attaching the rigid side member to the at least one or more support clips.

[0027] In one embodiment, the rigid vertical members are rigid side members.

- i. allowing the settable material to cure.

[0028] In one embodiment, the rigid vertical members are rigid side members.

- i. providing an upper support along an upper edge of the masonry units.

[0029] In one embodiment, the rigid vertical members are rigid side members.

- i. inserting tensioning members between the lower support and the upper support.

[0030] In one embodiment, the rigid vertical members are rigid side members.

- i. tensioning the tensioning members to compress the masonry units between the upper support and lower support.

[0031] In one embodiment, the rigid vertical members are rigid side members.

- i. adjusting the adjustment mechanism to connect the rigid side members between the upper support and the lower support.

Brief Description of the Drawings

[0032] The invention will now be described, by way of example only, with reference to the accompanying drawings. Here figures 1-6 concern an aspect not according to the invention but which is useful for understanding the invention. In the drawings:

Figure 1 is a perspective view of a prefabricated masonry wall installed between a first and a second building structure; and

Figure 2 is a side view of part of the installed prefabricated wall assembly of Fig 1 ;

Figure 3 is a section view of a side view of the installed prefabricated wall assembly in accordance with the embodiment shown in Fig 1 ;

Figure 4 is a top view of the installed prefabricated wall assembly in accordance with the embodiment shown in Fig 1;

Figure 5 is a bottom view of the installed prefabricated wall assembly in accordance with the embodiment shown in Fig 1;

Figure 6 is a rear view of the installed prefabricated wall assembly in accordance with the embodiment shown in Fig 1;

Figure 7 shows a perspective view of a building structure cladded with prefabricated wall assemblies according to the present invention;

Figure 8 shows a top perspective view of a building structure cladded with the prefabricated wall assemblies according to the present invention;

Figure 9 shows a cutaway cross-section side elevation view of section A-A of figure 8, showing two prefabricated wall assemblies mounted above each other;

Figure 10 shows a cutaway cross-section side view of section B-B of figure 8;

Figure 11 shows a cutaway cross-section side view of section C - C of figure 7;

Figure 12 shows detail view of circle A of figure 9, showing two prefabricated wall assemblies mounted above each other;

Figure 13 shows detail view of circle B of figure 10 and figure 11 ;

Figure 14 shows a horizontal section view of a pair of prefabricated wall assemblies mounted next to each other on a building structure by dead and wind load brackets to either side of a column;

Figure 15 shows a horizontal section view of a pair of prefabricated wall assemblies mounted next to each other on a building structure by a wind loading bracket;

Figure 16 shows a top right perspective view of the top right portion of a second embodiment of prefabricated wall assembly; and

Figure 17 shows detail view of circle A of figure 9, showing two prefabricated wall assemblies mounted above each other;

Figure 18 shows detail view of circle B of figure 10 and figure 11 ;

Description of Embodiments

[0033] It should be noted in the following description that like or the same reference numerals in different embodiments denote the same or similar features.

First embodiment (not according to the invention)

[0034] A first embodiment of a prefabricated masonry panel assembly 1000 not according to the invention is depicted with reference to figures Figure 1 - 6. A prefabricated wall panel assembly 1000 in accordance with one embodiment of the present disclosure is positioned and installed between an upper building structure 1 and a lower building structure 2 which together define a level of a building.

[0035] The prefabricated masonry panel assembly 1000 can be used to construct the outer walls of a single level building or a multi-level building.

[0036] The prefabricated masonry panel assembly 1000 includes a panel 100 formed from masonry units (such as a type of brick) laid using mortar. In this embodiment, a standard clay brick comprising three "cores" or holes which extend through the entire the thickness of each brick, are used (not shown). Each core is substantially cylindrical. In this embodiment, each core has a diameter of 50 mm. It is envisaged that in other embodiments, other types of masonry units can be used. However, an advantage of this prefabricated masonry panel assembly is that conventional bricks which are readily available, can be used.

[0037] The brick panel 100 can be formed by laying individual blocks of bricks which can be stacked to form a brick panel. Each panel 100 includes several horizontal

layers or courses of laid brick. As shown in figure 1 and figure 6, for example, each course is horizontally offset relative to a vertically adjacent course.

[0038] The bricks in each course are positioned relative to bricks of a vertically adjacent course such that cores of vertically adjacent bricks are aligned to provide at least one continuous longitudinally extending aperture extending from the top surface to the bottom surface of each block. Thus, each block can have a plurality of continuous apertures along the breadth of the block, each aperture extending from a top surface of the block to the bottom surface of the block. In the illustrated embodiment, each block has five continuous apertures. When the blocks are stacked vertically, each continuous aperture in each block is contiguous with a corresponding continuous aperture in a vertically adjacent block. This results in apertures extending continuously through each panel from the top surface 101 of each brick panel 100 to the bottom surface 102 of each brick panel 100 for housing a rod (not shown).

[0039] In other embodiments, the brick panel can also have a thickness (T) of more than one brick.

[0040] In the illustrated embodiment, each block has a width or breadth that is equal to the width or breadth of the panel.

[0041] Typically, each brick has at least one hole extending through the brick. In the present embodiment, it is not necessary for each laid brick to be filled with settable material such as concrete as it is laid. Typically, each hole is filled to stiffen each brick and in turn, to stiffen a wall formed of the laid bricks, for example. In the present system, each brick does not have to be filled with concrete or mortar. An advantage of this is that a robot such as the SAM construction robot can quickly and efficiently lay the bricks in each block, especially in an off site environment. This reduces the need for costly human labour and is more efficient. Using a robot can also reduce workplace health and safety risk associated with employing human construction workers to lay bricks. An advantage of using blocks of bricks is that an entire panel of bricks does not need to be constructed at once. Another advantage of this is that reinforcement members can be horizontally positioned between blocks of bricks that have been laid by the robot, for example.

[0042] Alternatively, when bricks are laid manually, the brick laying process is made more efficient and less variable (i.e. the blocks will have more uniform stress distribution across each block under loading) if the holes in each brick do not need to be filled. Less mortar is also required to assemble each block of laid bricks.

[0043] Figure 2 illustrates a side view of a portion of the brick panel 100 of the present embodiment. In this embodiment, each block 110 includes 5 courses or rows of bricks. The laid brick panel 100 can be reinforced using reinforcing members (not shown) at bed joints 120 to stiffen and strengthen the brick panel. Reinforcing members at bed joints may be in the form of wire tracks that run in parallel between each row or course of bricks, or any

other suitable form of reinforcement. Also, other reinforcing members can be used to connect adjacent blocks and to reinforce joints between adjacent blocks of bricks. For example, an elongate rod such as a helix bar can be used to join adjacent blocks of bricks within the panel. It is envisaged that other types of reinforcement members can be used to reinforce and connect adjacent blocks such as re-bars.

[0044] A bed joint 120 is preferably positioned between adjacent blocks 110 (i.e. after every five rows) to connect and simultaneously reinforce adjacent blocks 110. The panel 100 shown in figure 2 has a thickness or width of one brick. It is envisaged that in other embodiments, the thickness or width of the panel can be the thickness of more than one laid brick to achieve a desired strength or other parameter.

[0045] The type, number and spacing of reinforcement members each brick panel 100 can be varied.

[0046] Figure 3 shows a side view of the prefabricated wall assembly 1000 installed between an upper building structure 1 and a lower building structure 2 of a level of a multi-level building.

[0047] The assembly 1000 also includes a first support 210 attached to a top end of the brick panel 100, as shown in figures 3 and 4.

[0048] The first support is shown as a first angle bracket 210 defines an internal angle that is positioned and installed to abut over an inner edge of a top of the brick panel 100. The first angle bracket 210 has a first flange 211 and a second flange 212 perpendicular to the first flange 211. The first flange 211 is flush with the top surface of the brick panel 101. The first angle bracket 210 is installed such that the second flange 212 depends or extends downwardly from the top surface of the brick panel 101. The first angle bracket 210 extends along substantially the entire top surface of the brick panel 101. The blocks 110 of the upper course of the brick panel include an extended portion 112 for hiding the first support for better aesthetics from outside of the brick panel 100, so that an oversize gap is not shown between adjacent installed masonry panels.

[0049] The assembly 1000 also includes a second support 220 attached to and configured to support the bottom end of the brick panel 100. As shown in figure 5, the second support 220 is a strip of metal 222. The second support 220 preferably extends along the entire width of the brick panel.

[0050] The assembly 1000 further includes at least one tensioning and/or torquing fastener 300 configured to fasten the first support 210 and the second support 220 to the brick panel 100 and to apply a clamping force to compress the brick panel 100 between the first support 210 and the second support 220. In the embodiment illustrated in figure 3, the torquing fastener 300 comprises a threaded rod 310 and at least one torquing member 320 coupled to the threaded rod 310 at one or both ends of the rod 310. In an alternative embodiment (not shown), it is envisaged that the rod 310 may be

permanently secured one of the support members at one end, for example by welding, and threaded at an opposed end.

[0051] As mentioned previously, the brick panel 100 has 5 continuous apertures extending through an entire height of the brick panel 100. Each of the first and second support members (210, 220) also have at least one aperture or hole extending through each of the first flange 211 of the first support, and the second support 220. Each of the holes in each of the first 211 and second support 220 members is aligned or concentric with each of the longitudinally extending continuous apertures in the brick panel 100 such that each threaded rod 310 can simultaneously extend through the respective holes in each of the supports and also, through the entire height of the brick panel 100.

[0052] In the embodiment illustrated in figure 3, the torqueing member 320 are provided as torqueing nuts 322 or a threaded nut including an internal thread complementing the thread of the rod. There is a first torqueing nut 320 coupled to a first end of the rod when the rod is inserted within the brick panel 100. The first torqueing nut 322, in use, is also located above the first flange 211. There is a second torqueing nut 322 coupled to the second end of the rod 310. The prefabricated wall assembly of claim 1, wherein the torqueing member is a threaded nut.

[0053] In this embodiment, the prefabricated wall panel assembly 1000 also includes a second angle bracket 230 configured to connect the brick panel 100 to the lower structure 2 of the building. Figure 3 shows that the second angle bracket 230 is located three courses or rows of masonry units above the bottom of the brick panel 100 and is attached to the top of the lower building structure. This is so that the outer side of the floor of the level is concealed and/or covered by the brick wall 100. The height of the structure 2 in the current embodiment corresponds to three blocks.

[0054] As shown in figure 3, a first flange 231 of the second angle bracket 230 is located between and attached to adjacent vertical blocks of the brick panel 100. A second flange 232 of the second angle bracket 230 is located adjacent the lower structure 2 of the building. In this case, the structure 2 of the building includes a concrete slab to which the prefabricated brick panel assembly is attached.

[0055] The second angle bracket 230 is installed such that the second flange 232 of the second angle bracket 230 preferably extends upwardly. However, in alternative embodiments, it is envisaged that the second flange 232 could extend downwardly. The second flange 232 of the second angle bracket 230 extends parallel to an inner side of the brick panel (i.e. a side of the brick panel that will be located internal to the building after the prefabricated brick panel assembly is installed).

[0056] After a threaded rod 310 is inserted into each of the continuously extending apertures (not shown), one or both of the torqueing nuts 320 can be rotatably coupled to

each end of the rod. Further rotating of applying torque to one or both of the torqueing nuts 320 creates tension within each of the threaded rods which, in turn applies a clamping force to the first and second support (210, 220) and the brick panel 100. Each of the first support and the second support (210, 220) restrain the brick panel 100 and reinforce the ends of the brick panel 100 to prevent crumbling of bricks located at either end of each brick panel 100.

[0057] Having rods 310 within the brick panel 100 is advantageous as when the clamping force is applied, the brick panel 100 will not tend to buckle under any bending force as it is restrained by each of the rods. As each of the rods extend through the entire height of the panel 100, the clamping force or preload is relatively evenly distributed along the entire height of the panel. In this way, a clamping arrangement and/or tensioning arrangement is provided by the torqueing nuts, first and second supports and threaded rod acting in concert to compress the brick panel.

[0058] Advantageously, after the panel 100 has been sufficiently compressed to achieve the desired stiffness across the entire panel, the rods 310 being located inside the brick panel 100 also act as reinforcing members to internally reinforce the brick panel. The stiffened and strengthened brick panel 100 can be transported using suitable machinery to the installation site.

[0059] Stiffening the panel reduces the likelihood that the brick panel will warp and be damaged in use. Bricks are porous and typically, have a low tensile strength. Bricks have a relatively high compressive strength and so, are able to be compressed to a significant extent without breaking. The torqueing fastener and/or clamping arrangement holds the entire brick panel including all reinforcing members together during transport. Pre-compressing the brick panel 100 therefore requires the pre-compression to be overcome before the bricks and/or mortar move into a state of tension, thereby helping to prevent the bricks being damaged or the panel 100 coming apart.

[0060] Other types of masonry units made of clay or concrete or other similar materials have similar characteristics. By reinforcing and compressing the brick panel 100, the brick panel 100 is able to better withstand tensile, compressive, bending, torqueing and shear loading during transport.

[0061] Figure 4 depicts a top view of the prefabricated masonry panel assembly 1000 after it has been installed.

[0062] Figure 5 depicts a bottom view of the prefabricated masonry panel assembly 1000 after it has been installed.

[0063] Both figures illustrate that five torqueing fasteners 300 were used to compress the brick panel 100 in this embodiment. It is envisaged that in other embodiments, the prefabricated wall assembly 1000 can include more or less than five torqueing fasteners.

[0064] The diameter, gauge of thread of each rod, number of fasteners, and spacing of fasteners can be

varied to achieve the desired mechanical characteristics of the wall.

[0065] As shown in each of figures 3 and 6, the assembly also includes a restraining arrangement 400 to restrain the walls against lateral loads caused by wind at higher levels of the building, and assist with slab deflections. The restraining arrangement 400 includes a first part 410 including a first protrusion or plate 412 configured to be connected to an underside of the upper structure 1 of the building to extend substantially vertically.

[0066] The restraint or restraining arrangement 400 also includes a second part 420 including two protrusions in the form of plates 422 projecting perpendicularly to and inwardly (towards the inside of the building) from preferably the second flange 212 of the first angle bracket. Each projecting plate 422 includes a slot (not shown) that is sized to receive the first plate 412 of the first part 410 within the slots of the plates 422. Figure 3 shows the first plate 412 received within and through the slots.

[0067] The vertically oriented first plate 412 of the first part 410 is preferably substantially rectangular and has a length, a width and a thickness. When attached to the building structure, the first plate 412 extends vertically downwards through the slots provided in each of the two projecting plates 422. The first plate 412 of the first part 410 extends perpendicularly downwards relative to the two projecting plates 420 and through the slots of each of the two projecting plates 422. The first plate 412 also extends in a direction parallel to the brick wall panel 100.

[0068] Each slot (not shown) in plates 422 has a length that is slightly greater than the width of the first plate 412 and a width that is slightly greater than the thickness of the first plate 412 so that the first plate can pass through the slots. The two plates 422 act to contain the first plate 412 within the slots, while allowing relative vertical movement of the first plate 412.

[0069] Therefore, when the wall is laterally loaded for example, by wind, the first plate 410 restrains the wall 100 and prevents the wall 100 from moving laterally.

[0070] This prevents at least the top of the wall from being pulled off the side of the building by wind, while allowing for movement between the building structure and the panel assembly 1000, due to, for example thermal stresses or the like.

[0071] As can be seen in Figure 3, each of the slots is oriented such that each slot extends longitudinally along the length of each plate 422. The first plate 412 is oriented such that it is parallel to the brick panel 100. This means that the entire width of the first plate 412 extends along the panel to strengthen the panel in the direction in which the wind will act to suck the panel off the building. Hence, in this orientation of the first plate 412 there is a greater amount of material to counteract the forces of the wind on the installed wall in use.

[0072] The dimensions, type of material and mechanical properties of the plates can be varied depending on the magnitude of the forces the wall will be subjected to at least level of the building, for example. In other embodi-

ments, the number of restraints along each wall can be selected to sufficiently counteract the magnitude of the external forces, in use.

[0073] In the embodiment illustrated in figures 1 - 6, there are two restraints or restraining arrangement 400 against lateral loading that are spaced from each other along the top of the wall.

[0074] In other embodiments, there may be more than two restraints 400 spaced from each other along the top of the wall.

[0075] As mentioned above, the first plate 412 is vertically moveable within the slots. Building structures typically include materials that contract or expand (both vertically and laterally) as a result of a change in temperature. Hence, the brick wall assembly 1000 must be configured to adjust to accommodate for these vertical changes to prevent the brick wall and/or structure being mechanically stressed by these vertical changes. Repeated stressing can cause the wall and/or building structure to be damaged.

[0076] The dimensions and relative positions of each of the first vertically extending plate 412 and two laterally extending plates 422 can be selected to accommodate for predicted vertical movement of the wall relative to the structure during the life of the building.

[0077] Conventionally, wall ties are used to tether an outer wall to an inner wall along the height of the wall to restrain the wall against lateral wind loading. This requires wall ties to be inserted during construction of the wall. Advantageously, the present prefabricated wall assembly 1000 does not require there to be an internal wall and the top restraint and bottom restraint are both preferably configured to be sufficiently strong to withstand any external and internal forces on the wall that may act to detach the wall from the building.

[0078] As mentioned above, the second angle bracket 230 is installed such that the second flange 232 of the second angle bracket 232 extends upwardly and parallel to an inner surface of the wall panel 100. The second flange 232 provides a structure for attachment of one or more brackets 200 through which the brick panel assembly 100 can be attached to the lower building structure 2 to create a wall or cladding of the building. In the illustrated embodiment shown in figures 1 - 6, there are two brackets spaced from each other, each connecting the brick panel assembly 100 to the building structure.

[0079] To assemble the illustrated prefabricated brick panel 1000, blocks 110 of laid bricks are created. Threaded holes can be drilled through each block 110 for insertion of reinforcement. Each block 110 spans substantially the entire width of the wall. Each block 110 is connected to another block 110 at a bed joint 120 via a suitable joining material. Bed joints 120 are installed every five courses or rows between adjacent blocks throughout the entire height of the brick wall, while ensuring that the holes for each fastener are not covered. While the blocks are being assembled, the second angle bracket 230 is secured to the brick panel 100.

[0080] Holes corresponding to the position in which threaded rods are to be inserted are then made in the first flange 211 of the first support member 210 i.e. first angle bracket including the two projecting plates 422 as part of the restraining arrangement 400. The holes may be threaded. The first angle bracket 210 including two projecting plates 422 can be of unitary construction, or can be assembled and connected, for example by welding. Holes corresponding to the position in which threaded rods are to be inserted are then made in the second support member 220 which is an elongated plate. The holes may be threaded.

[0081] Each rod 310 is then inserted into and through the brick panel 100 and the second support member 220 in the correct place. A torqueing nut 322 is fastened onto the bottom of the rod 310 by screwing the nut 322 on to the threaded ends of the rod 310. It is envisaged that the torqueing nut 322 will initially be tightened by hand.

[0082] The first support member 210 is installed over the top of the rod in the correct place, and then another torqueing nut 322 is secured onto the top of the rod 310. It is envisaged that the torqueing nut 322 will initially be tightened by hand.

[0083] The torqueing nuts 322 at the bottom face of the panel 100 are then clamped to haul them still, while the torqueing nuts 322 at the top of the brick panel are then tightened to evenly compress the brick panel 100 to achieve a desired stiffness for safe transport of the wall.

[0084] Installation of the prefabricated wall assembly 1000 between an upper building structure 1 and a lower building structure 2 is now described. A plurality of brackets 500 are fixedly attached to the second flange 232 of the second angle bracket 230 at selected points along the second angle bracket 230. Alternatively, the brackets 500 can be attached to the second flange 232 before the assembly 1000 is transported.

[0085] The prefabricated wall assembly 1000 can be strapped or otherwise secured and transported to the installation site to be installed on a building structure of a building that is being constructed.

[0086] On-site, while the prefabricated wall assembly 1000 is held in place, each of the brackets 500 attached to the second angle bracket 232 are connected to the lower building structure 2 by fastening each bracket 500 to the lower building structures using at least one suitable bolt 510. As can be seen from figure 3, each bolt 510 is inserted deep into the concrete of the building structure. The bracket can then be grouted underneath and an adjustment screw 520 positioned horizontally along the bracket 500 between the bolt 510 and the second angle bracket 230 to adjust for tolerances and to ensure that the wall is at the right level.

[0087] The first part 410 of the restraining arrangement 400 is then provided. As shown in Figure 3 this includes a flat base 415 and the plate 410 of the first part, extending from the flat base 415. The bottom of the plate 410 is aligned with the slots of the plates 422 of the second part 420 and the plate 410 is inserted into the slots.

[0088] The base 415 is then bolted to an underside of the upper building structure 1 using a suitably sized connector in the form of an anchor bolt 417 as shown in figure 3.

[0089] As mentioned previously, the prefabricated masonry panel 1000 is also suitable for domestic buildings as an external masonry wall. For a domestic building, each prefabricated masonry panel is positioned as an external wall adjacent and parallel to and connected to an inner wall. The inner wall is spaced from the external wall by a desired distance to allow for airflow. In a preferred embodiment (not shown), this distance is 50 mm. In other embodiments, the distance may be greater than 50 mm or less than 50 mm.

[0090] In an embodiment suitable for domestic buildings (not shown), the prefabricated masonry panel assembly includes wall ties such as helical rods, extending perpendicularly to an inner surface of the wall. A first end of each wall tie is secured within the brick panel while the second end is fixed to an internal wall. Multiple wall ties can be arranged at intervals along a height and a width of the wall to secure the outer wall to the inner wall.

[0091] In such an embodiment, the prefabricated masonry panel assembly may not include brackets to fix the bottom of the wall to a lower building structure. However, any of the first support 210, second support 220, bracket 500, and restraining arrangement 400 could also be used for a residential construction.

[0092] For domestic buildings, the internal wall can be constructed in a factory controlled environment or otherwise off-site, and then attached to the prefabricated masonry panel assembly. The internal wall and the connected prefabricated masonry panel assembly can be transported together to the installation site and installed.

[0093] An advantage of the prefabricated masonry panel described above, is that many parts are not required to assemble the prefabricated wall assembly 1000. Hence, it is relatively easy to assemble and therefore, there is less opportunity for human error during assembly.

[0094] Another advantage is that less raw material is required on site, less labour is required to construct buildings. There is less chance of a prefabricated wall breaking during transport, lifting and installation and so there is less chance of there being wastage of materials especially, an entire prefabricated wall. The overall cost of construction can also be reduced as less labourers are required on-site, less OHS risk is posed to the labourers on-site and if robots are used to construct blocks, less labourers are required to construct each prefabricated wall. Furthermore, as walls do not have to be constructed on-site, less on-site time is required to construct a building and long delays due to bad weather can be avoided.

[0095] The embodiments described above also provide a modular system whereby, blocks and reinforcement and other elements such as number of fasteners or brackets etc. can be selected to design a panel having desired mechanical characteristics. As prefabricated

walls do not have to be designed from scratch and a large number of different types of materials are not required, each prefabricated wall can be made less expensive than a bespoke designed prefabricated wall.

[0096] The number of options for types of reinforcement and dimensions of blocks and types of masonry units, for example, can be provided to a user to pre-select to quickly and cost-effectively design a wall with well-known or highly predictable mechanical characteristics. In this way, the design process can be streamlined and greater quality control over prefabricated walls can be provided.

Second embodiment

[0097] A second embodiment, according to the invention, of a prefabricated wall assembly 2000, and a building structure 4000 constructed using the prefabricated wall assembly 2000, is shown in figures 7 - 16. The building structure 4000 shown include columns 3 and floor slabs 4. The prefabricated wall assembly 2000 includes an outer panel assembly 2050 and an inner panel assembly 2060. The outer panel assembly 2050 and inner panel assembly 2060 are rigidly connected to each other by connectors or panel connecting arrangement 2950.

[0098] The outer panel assembly 2050 in this embodiment is shown in the form of masonry panel 2100 (shown schematically with hatching) comprising a plurality of masonry units or bricks 2112 arranged in a wall formation, and a securing arrangement 2200 configured for pre compressed the masonry units to haul them together. The securing arrangement 2200 includes a tensioning mechanism 2300.

[0099] The inner panel assembly 2060 includes an inner insulation panel 2700 composed of an insulation layer 2710 that is framed by a frame 2730.

[0100] It is envisaged that the prefabricated wall assembly could be provided in a variety of different forms. For example, as shown in figures 7-16, the prefabricated wall assembly includes an inner panel assembly 2060.

[0101] The masonry panel 2100 is planar in configuration and defines a pair of rectangular opposed major faces 2103, with minor faces 2104 extending between the major faces. The minor faces 2104 define a top surface 2101 and a bottom surface 2102. In the embodiment shown, the masonry panel is made up of a plurality of masonry units 2112 such as bricks, or another other suitable unit. It will be appreciated by person skilled in the art that a wide variety of masonry type units and materials could be used. The masonry units 2112 can be arranged into blocks 2110 that may be made up of one or more rows or courses of masonry units 2112. Blocks 2110 of masonry units 2112 can be connected to adjacent similar blocks at bed joints (not shown).

[0102] As shown in detail in figures 12 and 13, and in more detail in figures 18 and 19, the securing arrangement 2200 includes a first compression or support mem-

ber 2210 in the form of first angle bracket 2213. First angle bracket 2213 includes first flange 2211 that is intended to extend vertically in operation when the prefabricated wall assembly 2000 is attached to a building structure, and second flange 2212 that is intended to extend horizontally in operation. Second flange 2212 includes a plurality of apertures 2214 extending along its length. The securing arrangement 2200 further includes a second compression or support member 2220 in the form of second angle bracket 2221. Second angle bracket 2221 mirrors first angle bracket 2213 in that it includes a first flange 2223 and second flange 2225, with second flange 2225 including a plurality of apertures (not shown) along its length. Both of the first compression member 2210 and second compression member 2220 are configured for compressing opposed sides of the masonry panel 2100.

[0103] The tensioning mechanism 2300 is configured for pulling the first compression member 2210 and second compression member 2220 towards each other to thereby pre-compress the masonry panel 2100. The tensioning mechanism 2300 includes a tensioning elongate member 2310 in the form of a preferably galvanised rigid rod 2312. The rigid rod 2312 includes threaded end at each end. The rigid rod 2312 is configured to extend through the masonry panel 2100 via apertures in the masonry units 2112, and be tensioned by fasteners, in the form of screws 2320, extending through apertures 2214 in the first compression member 2210 and similar apertures (not shown) in the second compression member 2220. The screws 2320 are threaded with a complementary internal thread which fits over the threaded rods 2312. As screws 2320 are tightened, this tensions the rigid rod 2312 to pull the first compression member 2210 and the second compression member towards each other to compress the masonry panel 2100 between them.

[0104] As shown in figures 10, 11 and 13 include glass panes 2850 supported by window frames 2860 may be seated on the prefabricated panel assemblies. It is envisaged that a sealing sheet or flashing will extend underneath the windowpane outwardly over the outer edge of the masonry panel 2100. It is envisaged that a differently sized prefabricated wall assemblies 2000 will be provided, depending on whether windows are required or not. For example, the prefabricated wall assembly 2000a on the left-hand side shown in figure 7, 8 and 9 will extend from one floor to the same relative level on the next floor. The smaller masonry panels 2100b shown in figures 7, 8 and 11 will be used to extend from the top of the window pane on one level to the bottom of the window pane on a vertically adjacent level. Another smaller prefabricated wall assembly 2000c is shown in figure 10, and is used for making up the difference in height between the top of a prefabricated wall assembly 2000b and the bottom of a windowpane. The smaller prefabricated wall assembly 2000c is mounted on top of the larger prefabricated wall assembly 2000b, with the

[0105] In an alternative embodiment (not shown) is envisaged that the prefabricated panel assemblies may include built-in window frames with or without glass panes. However, this would require the window frames to be compressed together with the masonry units, and is not preferred.

[0106] By providing an outer panel assembly 2050 connected to an inner panel assembly 2060 that are rigidly connected to each other and supportable by a wide variety of brackets as will be discussed below, it is possible to reduce the stresses on windows and window frames.

[0107] It will be appreciated by persons skilled in the art that a wide variety of alternative securing arrangements and tensioning mechanisms could be used.

[0108] In an alternative embodiment (not shown), it is envisaged that the tensioning member need not be rigid and could be a flexible member such as a steel cable.

[0109] As mentioned previously, the prefabricated wall assembly includes an inner panel 2700. The inner panel 2700 is substantially rectangular in shape, and includes a rectangular planar insulation layer 2710 and a waterproof vapour layer 2720.

[0110] The planar insulation layer 2710 defines a pair of major faces 2702 and four minor faces 2706 connecting the major faces at edges 2704. The planar insulation layer 2710 is surrounded by a frame 2730 that preferably encloses the edges 2704 and minor faces 2706 of the insulation layer 2710. In figure 12 a vertically aligned plate 2735 is welded to an inwardly facing surface of the uppermost edge member 2740 of frame 2730, the vertically aligned plate 2735 extending above the edge member 2730. In figure 17, the channel shaped edge members 2740 are disposed in opposite orientation to the edge members 2740 in figure 12. In figure 17, a preferably steel sealing plate 2736 is provided that extends between the two panels from in front of the first angle bracket 2213 to behind the inner insulation panel 2700, where it extends vertically in a similar fashion to the vertically aligned plate 2735 of figure 12.

[0111] The frame 2730 is composed of four parallel flange channel (PFC) edge members 2740 that are preferably U-shaped in cross-section, and are either welded or bolted together

at their ends to form a rectangular shape corresponding to the insulation layer 2710. In this way, the general shape of the inner panel 2700 is also rectangular, and substantially coincides with the shape and dimensions of the masonry panel 2100. The waterproof vapour layer 2720 is shown in figures 12 and 13 as being inside the insulation layer 2710, however in alternative embodiments, it is envisaged that the waterproof vapour layer could be disposed outside of the insulation layer, or both inside and outside.

[0112] Figure 18 shows a similar view to figure 13, but with a slightly different sealing arrangement, in that sealing plate 2738 is provided as flashing for sealing the windowsill. In the embodiment shown in figure 18, the

window frame can be seen to be bolted or otherwise anchored into rigid edge member 2740.

[0113] The inner panel 2700 can also include a layer of plasterboard lining 2760 connected to the insulation layer 2710 by top hat members 2750, although it is preferable that this is installed on site due to the frangible nature of the plasterboard lining. When installing the plasterboard lining on site, the screw lengths for securing the plasterboard to the top hat members 2750 will have a suitable end so that they do not pierce the vapour barrier. It is envisaged that, due to the fragility of the plasterboard lining, the plasterboard lining layer 2760 would typically be installed once the prefabricated wall assembly 2000 has been attached to the building structure on site, and would not be installed site for transport to the construction site.

[0114] The inner panel 2700 is spaced from the masonry panel 2100 to allow for airflow and equal pressurisation between the masonry panel 2100 and inner panel 2700, thereby allowing for any water, such as from rain, that has ingress inside of the masonry panel 2100 to dry.

[0115] The inner panel 2700 and masonry panel 2100 are disposed with their major faces in alignment with each other, and are connected to each other along their top edges, and preferably along the bottom edges as well, by a panel connecting arrangement 2950. The panel connecting arrangement 2950 includes a securing arrangement 2960 in the form of a screw and nut assembly, and a thermal barrier 2964. The thermal barrier 2964 is preferably in the shape of an elongate rectangular planar strip, and is composed of a material that is heat resistant, such as cementitious material; a fireproof plastic; carbon fibre, basalt fiber; or any other suitable material. The thermal barrier 2964 functions to reduce thermal bridging between the outer panel assembly and the inner panel assembly, for example in the event of a fire or the like.

[0116] As shown in figures 12 and 13, the first vertical flange 2211 of the first compression member 2210 includes an aperture (not shown) for receiving the screw 2963 from a screw and nut assembly 2962. In an alternative embodiment, a bolt and nut assembly could be used.

[0117] The thermal barrier also includes spaced apertures along its length that coincide with the size and spacing of apertures along the length of the first vertical flange 2211. Similarly, the outer wall of the U-shaped edge members 2740 along an upper edge and lower edge of the frame 2730 also includes spaced apertures along its length for receiving screws 2963. Along an upper edge of the masonry panel 2100 and frame 2730, screws 2963 extend through corresponding spaced apertures in first vertical flange 2211, thermal barrier 2964 and the upper edge member 2740, and are fastened by complementary nuts 2961.

[0118] Similarly, along a lower edge of the masonry panel 2100 and frame 2730, screws 2963 extend through corresponding spaced apertures in the first flange 2223,

thermal barrier 2964 and lower edge member 2740 to be secured with complementary nuts 2961. In this way, the masonry panel 2100 and the inner panel 2700 are held in parallel alignment with each other, and spaced from each other.

[0119] As shown in figure 15, it is further envisaged that side angle brackets 2230 can be provided for supporting the sides of the masonry panel 2100. The side angle brackets 2230 are preferably not connected to the first compression member 2210 and/or second compression member 2220 as this would interfere with the compressive loading by the tensioning mechanism 2300. Instead, the side angle brackets 2230 are preferably bolted to the frame 2730, preferably with a thermal barrier 2964 extending between the side angle brackets 2230 and the frame 2730 in the same way as described above.

[0120] As shown in figure 11, the prefabricated wall assembly can further include a pivot arm 2800 located to each side of the frame 2730. The pivot arm 2800 includes an arm member 2810 that is pivotably connected to a fastening bracket 2830 that is adapted to be secured to building structures 1, 2. The arm member 2810 and fastening bracket 2830 are connected at hinge 2820. Similarly, another fastening bracket 2830 is secured to frame 2730 and connected to an opposed end of arm member 2810 at hinge 2820. The pivot arm 2800 secures the prefabricated wall assembly 2000 to the building structure while still allowing for movement of the prefabricated wall assembly 2000 due to thermal stresses and/or strains.

[0121] The prefabricated wall assembly can also include a structural support bracket 2900 (shown in figures 10, 11 and 15) that is configured for attachment to the structure of a building. The wind loading bracket 2900 includes a pair of plates 2910, 2920 extending at 90° to each other. One of the plates 2910 includes a pair of apertures 2912 for securely mounting the bracket 2900 to a building structure by anchor bolts 2913, preferably in a horizontal alignment. The other plate 2920 extends vertically and parallel with the inner panel. The vertically extending plate 2920 includes a slot (not shown) that extends vertically in operation.

[0122] Wind loading bracket 2900 is adapted for supporting the prefabricated wall assembly against wind loading forces generated by wind loading.

[0123] The wind loading bracket 2900 is secured to the frame 2730 by a nut and bolt arrangement 2922 (shown in figure 15). The bolt is movable within the vertical slot in the vertical plates 2920, to allow for relative movement between the frame 2730, and the building structure on which the wind loading bracket 2900 is securely mounted. In alternative embodiments it could be secured by other means such as by using fasteners such as screws, bolts or rivets, or by any other suitable means. The wind loading bracket 2900 is configured for being secured to a building structure such as a concrete slab 4 or column 3 preferably by an anchor bolt or similar arrangement that can be sunk into, for example a con-

crete floor slab.

[0124] The fabric prefabricated wall assembly 2000 can also include a dead and wind loading bracket 2920 (as shown in figures 10, 11 and 14) that is designed for supporting the dead weight of the prefabricated wall assembly 2000, as well as against wind loading forces. The dead and wind loading bracket 2930 is in the form of a flat plate 2931 with a pair of mounting apertures 2932 for securely mounting the plates to a horizontal building structure surface such as a floor slab, preferably using anchor bolts 2934 or the like. The dead and wind loading bracket 2930 does not allow for any vertical play between the building structure and the prefabricated wall assembly 2000 likely wind loading bracket 2900. The dead and wind loading bracket 2920 is securely mounted to the frame 2730, preferably by welding, however alternative securing arrangement such as using fasteners such as screws, bolts or rivets are envisaged.

[0125] Further, the prefabricated wall assembly 2000 is configured for attachment to adjacent similar prefabricated wall assemblies 2000 by means of a wall connector arrangement 2980. The wall connector arrangement 2980 includes a rectangular protrusion 2982 (shown in figures 16 and 12) that extends outwardly, and preferably upwardly, from an upper edge member 2740 of frame 2730. The rectangular protrusion 2982 is securely connected to the frame 2730 and preferably includes an aperture 2984 to act as slinging formations by which the prefabricated wall assembly 2000 can be rigged for transport to and from the construction site, as well as by which the prefabricated wall assembly 2000 can be lifted or slung into place on site.

[0126] The rectangular protrusion 2982 is receivable into a slot (not shown) in the lower edge member 2740 of frame 2730 in a sliding fashion. It is envisaged that, on site, a prefabricated wall assembly 2000 will be slung into position above a pre-installed similar prefabricated wall assembly, and lowered until the rectangular protrusion of the lower prefabricated wall assembly 2000 is received into the slot, as a spigot and socket assembly 2986 (shown in figure 10). The rectangular protrusion may be welded onto the frame 2730 of the adjacent prefabricated wall assembly 2000 in order to be secured in place.

[0127] The prefabricated wall assembly 2000 further includes sealing formations, preferably in the form of gaskets 2974 for sealing around an outer periphery of the frame 2730. One upper gasket 2975, preferably in the form of rubber, silicon or plastic liners mounted to aluminium carriers or tracks, is provided disposed along the length of an outer surface of the vertically aligned plate 2735, for abutment with an inner edge of the lowest edge member 2740 of a similar prefabricated panel assembly 2000 located above. This prevents water from flowing in from outside between horizontal gaps between the adjacent prefabricated panel assemblies 2000. Further, side gaskets 2977 are provided (shown in figure 16) for sealing the vertical gap between adjacent similar

prefabricated panel assemblies 2000 laid side to side. It is further envisaged that a waterproof sealing sheet 2976, preferably composed of tough waterproof material such as silicone, and preferably embedded in sealant, may be provided to seal the top of the prefabricated panel assembly 2000 where it abuts with a similar prefabricated panel assembly 2000 lying next to it. Such a waterproof sealing sheet 2976 is shown in broken lines in figure 16.

[0128] In this way, a prefabricated panel assembly 2000 may be provided that can be mostly assembled off-site and slung into position on the frame of a building structure, and which allows for movement due to thermal stresses, water ingress and air movement, while also providing for the required levels of water tightness.

Manufacture

[0129] During manufacture, it is envisaged that, in order to manufacture the prefabricated wall assembly, initially an inner frame assembly similar to those described above will be constructed. The lower support/compression member will then be connected to the inner frame assembly, preferably by a panel connecting arrangement as described above. Tensioning members are then inserted into the lower support/compression member. Side support members will be securely connected to the lower support with fasteners.

[0130] Layers of masonry units will then be constructed onto the lower support/compression member, building onto the tensioning members, preferably using settable material such as mortar between the masonry units. Connector clips will be built in between the layers of masonry units at bed joints towards the side edges of the masonry panel, and preferably extend towards the inner frame assembly from the masonry panel.

[0131] Side support members will be engaged with the connector clips as they are built into the masonry panel. Upper support/compression member will then be laid on top of the masonry panel, and loosely connected to the side support members to hold the panel in alignment. Fasteners will be loosely attached to the top of the tensioning members to hold the upper support and lower support together. The settable material will then be allowed to cure, completing the masonry panel.

[0132] The tensioning members are then tensioned to compress the masonry units between the upper support and the lower support.

[0133] At this stage, the fasteners of the adjustment mechanism will be tightened to create a rigid outer panel frame. The upper support will then be securely connected to the inner frame assembly.

Interpretation

Embodiments:

[0134] Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular

feature, structure or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment, but may do so.

[0135] Similarly it should be appreciated that in the above description of example embodiments of the invention, various features of the invention are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of one or more of the various inventive aspects. This method of disclosure, however, is not to be interpreted as reflecting an intention that the claimed invention requires more features than are expressly recited in each claim. Rather, as the following claims reflect, inventive aspects lie in less than all features of a single foregoing disclosed embodiment. Thus, the claims following the Detailed Description are hereby expressly incorporated into this Detailed Description, with each claim standing on its own as a separate embodiment of this invention.

Comprising and Including

[0136] In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprise" or variations such as "comprises" or "comprising" are used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

[0137] Any one of the terms: including or which includes or that includes as used herein is also an open term that also means including at least the elements/features that follow the term, but not excluding others. Thus, including is synonymous with and means comprising.

Industrial Applicability

[0138] It is apparent from the above, that the arrangements described are applicable to the construction industries.

Claims

1. A prefabricated wall assembly (1000, 2000) comprising:

a. an outer frame assembly connected to a masonry panel assembly, the masonry panel assembly comprising a plurality of masonry units (2112) compressed into at least one masonry panel;

- b. an inner frame assembly attached to an insulation panel (2700);
 c. the masonry panel and the insulation panel (2700) being spaced at a distance from each other by an air gap;
 d. the inner frame assembly and the outer frame assembly being securely connected to each other at one or more connecting assemblies;
 e. the prefabricated wall assembly being configured for being connected to the outside of a building structure as cladding.
2. The prefabricated wall assembly (1000) as claimed in claim 1, further including at least one or more support brackets (200) on which the prefabricated wall assembly (1000) may be supported by a building structure.
3. The prefabricated wall assembly (1000) as claimed in either of claims 1 or 2, further including a wall connector arrangement (2980) configured for securely engaging a prefabricated wall assembly (1000) with an adjacent similar prefabricated wall assembly (1000).
4. The prefabricated wall assembly (1000) as claimed in any of claims 1 to 3, further including slinging formations associated with one or both selected from the outer frame assembly and the inner frame assembly, the slinging formations being configured for slinging of the prefabricated wall assembly (1000) during installation of the prefabricated wall assembly (1000) on a building structure.
5. The prefabricated wall assembly (1000) as claimed in claim 4, wherein the slinging formations are configured for being received into complementary recesses in an adjacent similar prefabricated wall assembly (1000) as the wall connector arrangement (2980).
6. The prefabricated wall assembly (1000) as claimed in any of claims 1 to 5, wherein the masonry panel assembly comprises:
- a. a first compression member (2210) adapted for compressing at least one side of the masonry panel;
 - b. a second compression member (2220) adapted for compressing at least on opposed side of the masonry panel; and
 - c. a tensioning arrangement configured for pulling the first compression member (2210) and second compression member (2220) towards each other to thereby compress the masonry panel,
- preferably the tensioning arrangement includes:
- d. at least one or more tensioning elongate members; and
 - e. fasteners for fastening the tensioning elongate member between the first compression member (2210) and second compression member (2220) under tension.
7. The prefabricated wall assembly (1000) as claimed in any of claims 1 to 6, wherein the outer frame assembly and the inner frame assembly are connected to each other around the periphery of the masonry panel and the insulation panel (2700).
8. The prefabricated wall assembly (1000) as claimed in any of claims 1 to 7, wherein the insulation panel (2700) defines a pair of major faces spaced apart from at least one or more minor faces (2706), and the inner frame assembly includes rigid edge members that enclose the at least one or more minor faces (2706) of the insulation panel (2700).
9. The prefabricated wall assembly (1000) of any of claims 1 to 8, wherein the prefabricated panel assembly includes sealing formations for sealing around an outer periphery of the frame.
10. The prefabricated wall assembly (1000) as claimed in claim 9, wherein the sealing formation includes gaskets (3974) extending vertically along an outer minor face of the inner frame.
11. The prefabricated wall assembly (1000) as claimed in any of claims 7 to 10, wherein the outer frame assembly includes rigid side support members (4082) securely attachable between the first compression member (2210) and the second compression member (2220), the rigid side support members (4082) being adjustable in length.
12. The prefabricated wall assembly (1000) as claimed in claim 11, wherein the rigid side support members (4082) include an adjustment mechanism allowing for adjustable connection of the rigid side member to one or more selected from the first compression member (2210) and the second compression member (2220).
13. The prefabricated wall assembly (1000) as claimed in either of claims 11 to 12, wherein the prefabricated wall assembly (1000) includes at least one or more clip members extending from between the masonry units (2112) to the rigid side members.
14. A building structure (4000) including a prefabricated wall assembly (1000, 2000) as claimed in any one of claims 1 to 13.
15. A method of manufacturing a prefabricated wall as-

sembly (1000, 2000), the method comprising the steps of:

- a. manufacturing a prefabricated wall assembly (1000) as claimed in any of claims 1 to 13;
- b. transporting the prefabricated wall assembly (1000) to an installation site; and
- c. securing the prefabricated wall assembly (1000) to a building structure.

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5. Die vorgefertigte Wandbaugruppe (1000) nach Anspruch 4, wobei die Anschlagmittel so konfiguriert sind, dass sie in komplementäre Aussparungen in einer benachbarten ähnlichen vorgefertigten Wandbaugruppe (1000) wie die Wandverbinderanordnung (2980) aufgenommen werden.

6. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 5, wobei die Mauerwerksplatten-Baugruppe umfasst:

- a. ein erstes Druckelement (2210), das zum Zusammendrücken mindestens einer Seite der Mauerplatte geeignet ist;
- b. ein zweites Kompressionselement (2220), das zum Komprimieren zumindest einer gegenüberliegenden Seite der Mauerplatte geeignet ist; und
- c. eine Spannanordnung, die so konfiguriert ist, dass sie das erste Kompressionselement (2210) und das zweite Kompressionselement (2220) zusammenzieht, um dadurch die Mauerwerksplatte zusammenzudrücken,

vorzugsweise umfasst die Spannvorrichtung:

- d. mindestens ein oder mehrere längliche Spannelemente; und
- e. Befestigungselemente zur Befestigung des länglichen Spannelementes zwischen dem ersten Druckelement (2210) und dem zweiten Druckelement (2220) unter Spannung.

7. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 6, wobei die äußere Rahmenbaugruppe und die innere Rahmenbaugruppe um den Umfang der Mauerwerksplatte und der Dämmplatte (2700) herum miteinander verbunden sind.

8. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 7, wobei die Dämmplatte (2700) ein Paar von Hauptflächen definiert, die von mindestens einer oder mehreren Nebenflächen (2706) beabstandet sind, und die innere Rahmenkonstruktion starre Randelemente enthält, die die mindestens eine oder mehreren Nebenflächen (2706) der Dämmplatte (2700) umschließen.

9. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 8, wobei die vorgefertigte Plattenkonstruktion Dichtungsformen zum Abdichten um einen Außenumfang des Rahmens herum aufweist.

10. Die vorgefertigte Wandbaugruppe (1000) nach Anspruch 9, wobei die Dichtungsanordnung Dichtungen (3974) umfasst, die sich vertikal entlang einer

Patentansprüche

1. Eine vorgefertigte Wandbaugruppe (1000, 2000), enthaltend:

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- a. eine äußere Rahmenbaugruppe, die mit einer Mauerwerksplattenbaugruppe verbunden ist, wobei die Mauerwerksplattenbaugruppe eine Vielzahl von Mauerwerkseinheiten (2112) umfasst, die zu mindestens einer Mauerwerksplatte zusammengepresst sind;
- b. eine innere Rahmenanordnung, die an einer Dämmplatte (2700) befestigt ist;
- c. wobei die Mauerwerksplatte und die Dämmplatte (2700) durch einen Luftspalt voneinander beabstandet sind;
- d. wobei die innere Rahmenbaugruppe und die äußere Rahmenbaugruppe an einem oder mehreren Verbindungselementen sicher miteinander verbunden sind;
- e. die vorgefertigte Wandbaugruppe ist so gestaltet, dass sie an der Außenseite einer Gebäudestruktur als Verkleidung angebracht werden kann.

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2. Die vorgefertigte Wandbaugruppe (1000) nach Anspruch 1, die ferner mindestens eine oder mehrere Stützkonsole (200) umfasst, auf denen die vorgefertigte Wandbaugruppe (1000) von einer Gebäudestruktur getragen werden kann.

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3. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 oder 2, ferner mit einer Wandverbindungskonstruktion (2980), die so konfiguriert ist, dass sie eine vorgefertigte Wandbaugruppe (1000) sicher mit einer benachbarten ähnlichen vorgefertigten Wandbaugruppe (1000) in Eingriff bringt.

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4. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 3, die ferner Anschlagmittel enthält, die mit einem oder beiden aus der äußeren Rahmenkonstruktion und der inneren Rahmenkonstruktion ausgewählten Elementen verbunden sind, wobei die Anschlagmittel zum Anschlagen der vorgefertigten Wandbaugruppe (1000) während der Installation der vorgefertigten Wandbaugruppe (1000) an einer Gebäudestruktur konfiguriert sind.

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äußeren Nebenfläche des Innenrahmens erstrecken.

11. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 7 bis 10, wobei die äußere Rahmenkonstruktion starre seitliche Stützelemente (4082) enthält, die sicher zwischen dem ersten Druckelement (2210) und dem zweiten Druckelement (2220) befestigt werden können, wobei die starren seitlichen Stützelemente (4082) in der Länge verstellbar sind. 5
12. Die vorgefertigte Wandbaugruppe (1000) nach Anspruch 11, wobei die starren Seitenstützelemente (4082) einen Einstellmechanismus umfassen, der eine einstellbare Verbindung des starren Seitenelements mit einem oder mehreren aus dem ersten Druckelement (2210) und dem zweiten Druckelement (2220) ausgewählten Elementen ermöglicht. 10
13. Die vorgefertigte Wandbaugruppe (1000) nach einem der Ansprüche 11 bis 12, wobei die vorgefertigte Wandbaugruppe (1000) mindestens ein oder mehrere Klammerelemente enthält, die sich zwischen den Mauerwerkselementen (2112) zu den starren Seitenelementen erstrecken. 15
14. Eine Gebäudestruktur mit einer vorgefertigten Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 13. 20
15. Verfahren zur Herstellung einer vorgefertigten Wandbaugruppe (1000), wobei das Verfahren die folgenden Schritte umfasst: 25
 - a. Herstellung einer vorgefertigten Wandbaugruppe (1000) nach einem der Ansprüche 1 bis 13; 30
 - b. Transport der vorgefertigten Wandbaugruppe (1000) zu einem Installationsort; und 35
 - c. die Befestigung der vorgefertigten Wand (1000) an einer Gebäudestruktur. 40

Revendications 45

1. Ensemble mural préfabriqué (1000, 2000) comprenant : 45
 - a. un ensemble cadre externe raccordé à un ensemble panneau de maçonnerie, l'ensemble panneau de maçonnerie comprenant une pluralité d'unités de maçonnerie (2112) comprimées en au moins un panneau de maçonnerie ; 50
 - b. un ensemble cadre interne fixé à un panneau isolant (2700) ; 55
 - c. le panneau de maçonnerie et le panneau isolant (2700) étant espacés l'un de l'autre par

un écart d'air ;

d. l'ensemble cadre interne et l'ensemble cadre externe étant solidement raccordés l'un à l'autre par un ou plusieurs ensembles de raccord ;

e. l'ensemble mural préfabriqué étant conçu pour être raccordé à l'extérieur d'une structure de bâtiment comme bardage.

2. Ensemble mural préfabriqué (1000) selon la revendication 1, comportant en outre au moins une ou plusieurs consoles (200) sur lesquelles l'ensemble mural préfabriqué (1000) peut être supporté par une structure de bâtiment.
 3. Ensemble mural préfabriqué (1000) selon l'une des revendications 1 ou 2, comportant en outre un agencement de raccord mural (2980) conçu pour mettre solidement en prise un ensemble mural préfabriqué (1000) à un ensemble mural préfabriqué (1000) adjacent similaire.
 4. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 1 à 3, comportant en outre des formations d'élingage associées à l'un ou aux deux ensembles choisis parmi l'ensemble cadre externe et l'ensemble cadre interne, les formations d'élingage étant conçues pour l'élingage de l'ensemble mural préfabriqué (1000) lors de l'installation de l'ensemble mural préfabriqué (1000) sur une structure de bâtiment.
 5. Ensemble mural préfabriqué (1000) selon la revendication 4, dans lequel les formations d'élingage sont conçues pour être reçues dans des évidements complémentaires dans un ensemble mural préfabriqué (1000) adjacent similaire à l'agencement de raccord mural (2980).
 6. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 1 à 5, dans lequel l'ensemble panneau de maçonnerie comprend :
 - a. un premier élément de compression (2210) conçu pour comprimer au moins un côté du panneau de maçonnerie ;
 - b. un second élément de compression (2220) conçu pour comprimer au moins un côté opposé du panneau de maçonnerie ; et
 - c. un agencement de tension conçu pour tirer le premier élément de compression (2210) et le second élément de compression (2220) l'un vers l'autre afin de comprimer le panneau de maçonnerie,
- de préférence, l'agencement de tension comporte :
- d. au moins un ou plusieurs éléments allongés de tension ; et

- e. des éléments de fixation pour fixer l'élément allongé de tension entre le premier élément de compression (2210) et le second élément de compression (2220) sous tension.
7. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 1 à 6, dans lequel l'ensemble cadre externe et l'ensemble cadre interne sont raccordés l'un à l'autre autour de la périphérie du panneau de maçonnerie et du panneau isolant (2700). 10
8. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 1 à 7, dans lequel le panneau isolant (2700) définit une paire de faces principales espacées d'au moins une ou plusieurs faces mineures (2706), et l'ensemble cadre interne comporte des éléments de chant rigides qui entourent au moins une ou plusieurs faces mineures (2706) du panneau isolant (2700). 20
9. Ensemble mural préfabriqué (1000) de l'une quelconque des revendications 1 à 8, dans lequel l'ensemble panneau préfabriqué comporte des formations d'étanchéité pour l'étanchéité autour d'une périphérie externe du cadre. 25
10. Ensemble mural préfabriqué (1000) selon la revendication 9, dans lequel la formation d'étanchéité comporte des joints d'étanchéité (3974) s'étendant verticalement le long d'une face mineure externe du cadre interne. 30
11. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 7 à 10, dans lequel l'ensemble cadre externe comporte des éléments de support latéraux rigides (4082) solidement fixés entre le premier élément de compression (2210) et le second élément de compression (2220), les éléments de support latéraux rigides (4082) étant réglables en longueur. 40
12. Ensemble mural préfabriqué (1000) selon la revendication 11, dans lequel les éléments de support latéraux rigides (4082) comportent un mécanisme de réglage permettant de régler le raccord de l'élément latéral rigide à un ou plusieurs éléments choisis parmi le premier élément de compression (2210) et le second élément de compression (2220). 45
13. Ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 11 à 12, dans lequel l'ensemble mural préfabriqué (1000) comporte au moins un ou plusieurs éléments d'agrafe s'étendant entre les unités de maçonnerie (2112) et les éléments latéraux rigides. 55
14. Structure de bâtiment (4000) comportant un en-

semble mural préfabriqué (1000, 2000) selon l'une quelconque des revendications 1 à 13.

15. Procédé de fabrication d'un ensemble mural préfabriqué (1000, 2000), le procédé comprenant les étapes consistant à :

- a. fabriquer un ensemble mural préfabriqué (1000) selon l'une quelconque des revendications 1 à 13 ;
 b. transporter l'ensemble mural préfabriqué (1000) vers un site d'installation ; et
 c. fixer solidement l'ensemble mural préfabriqué (1000) à une structure de bâtiment.

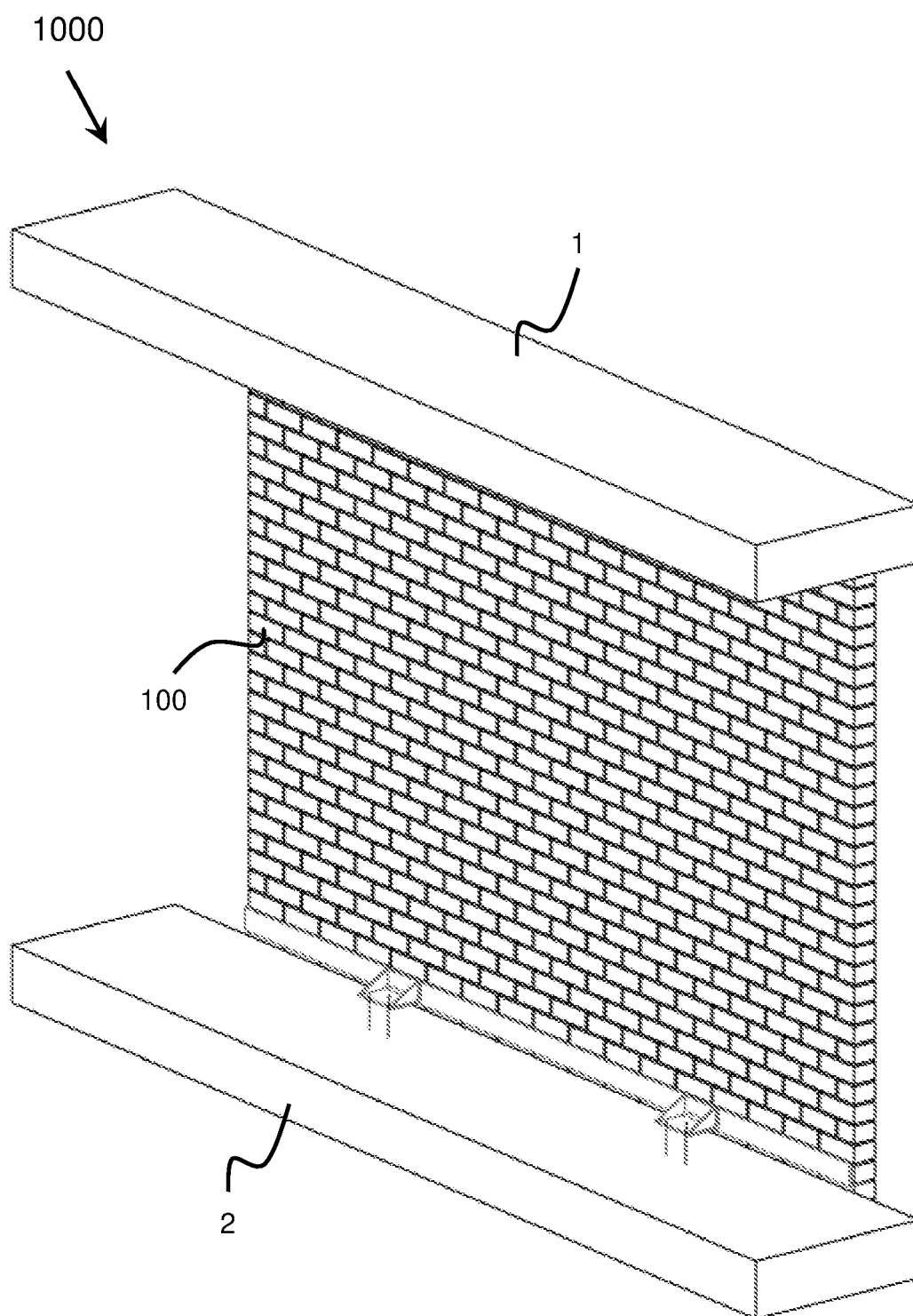


Figure 1

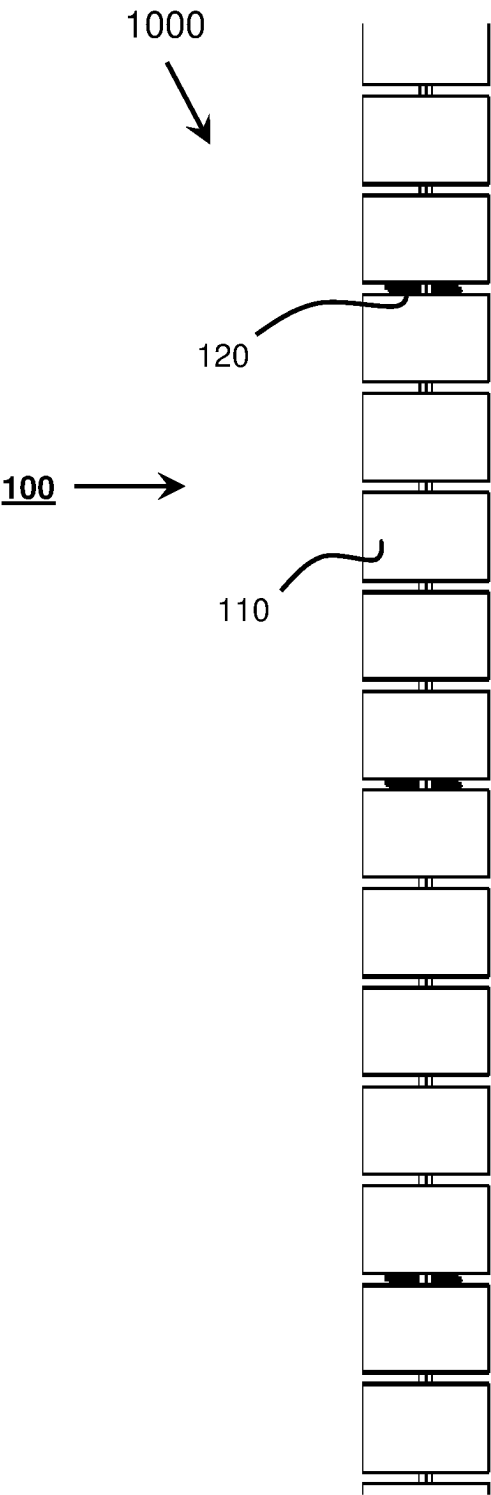


Figure 2

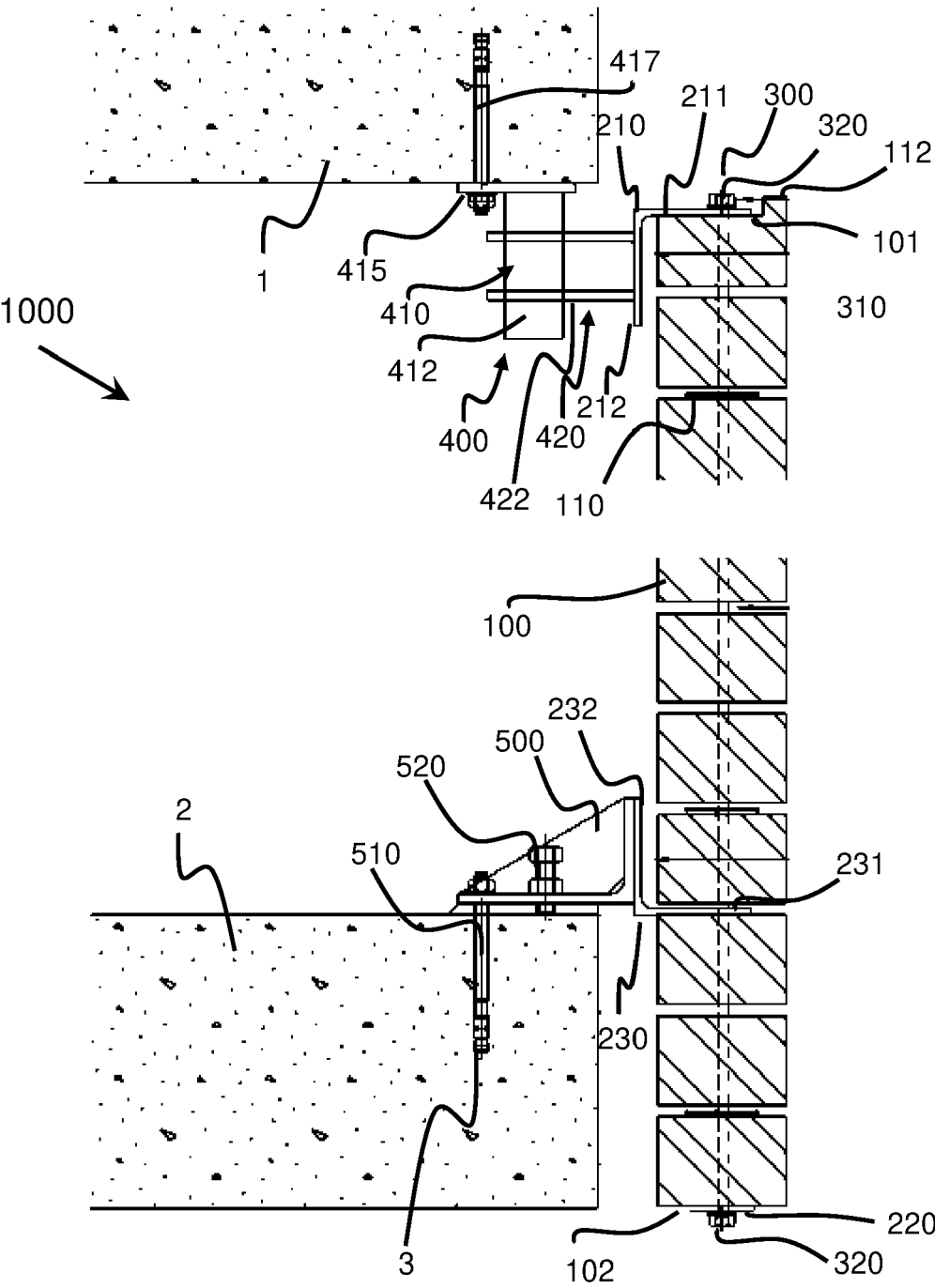


Figure 3

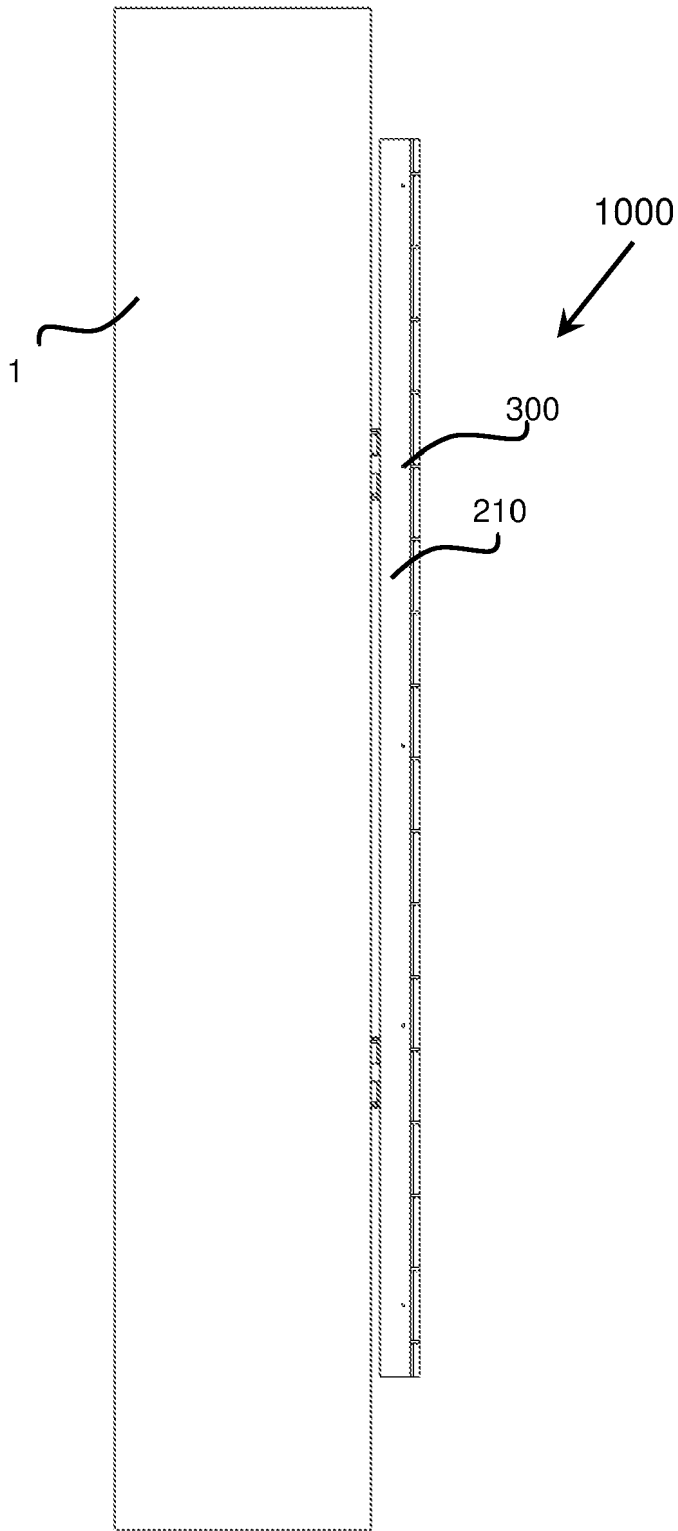


Figure 4

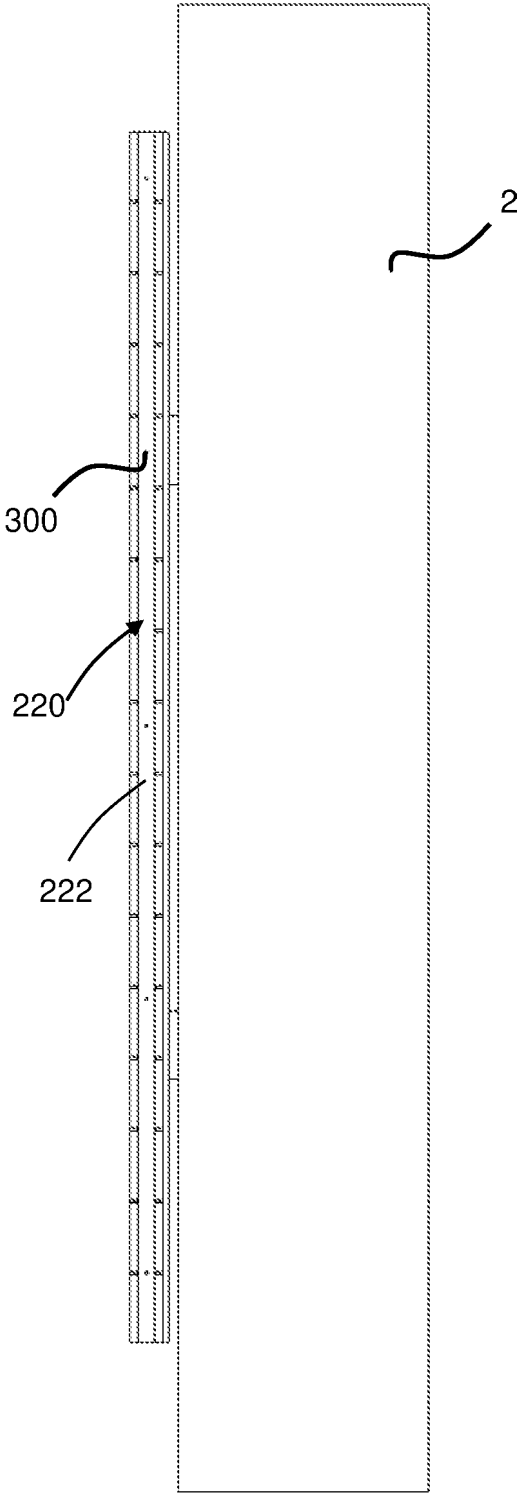
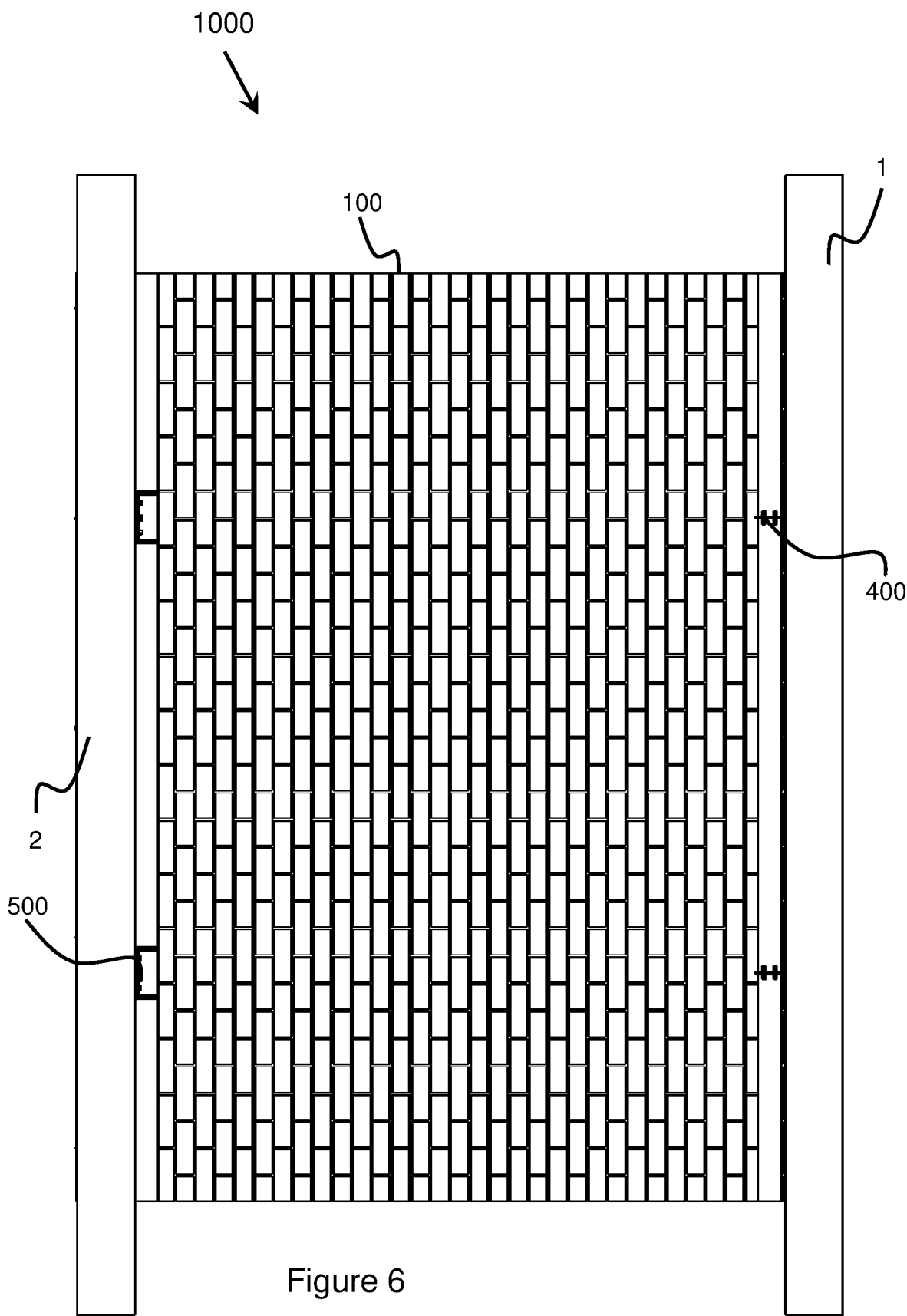


Figure 5



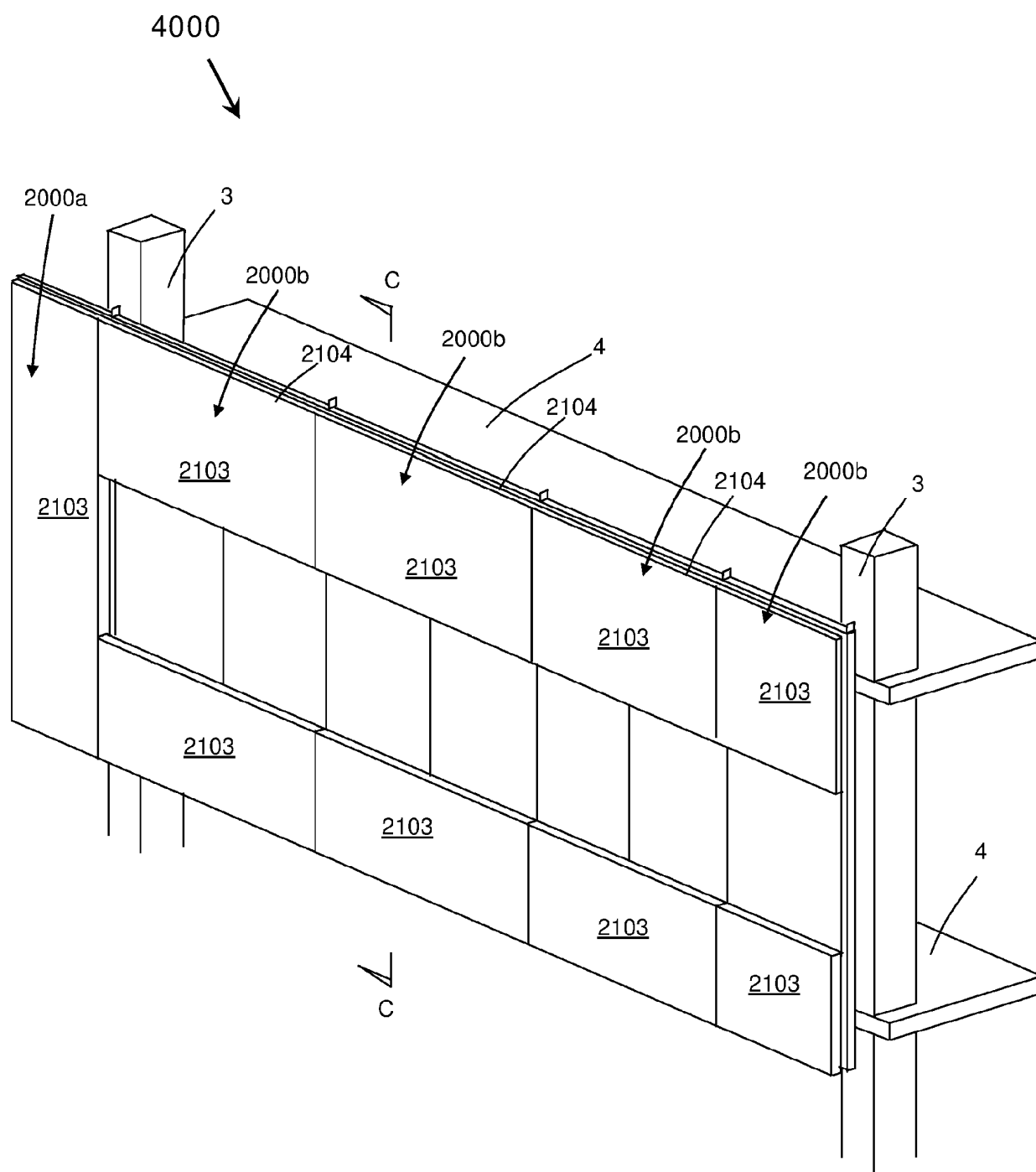


Figure 7

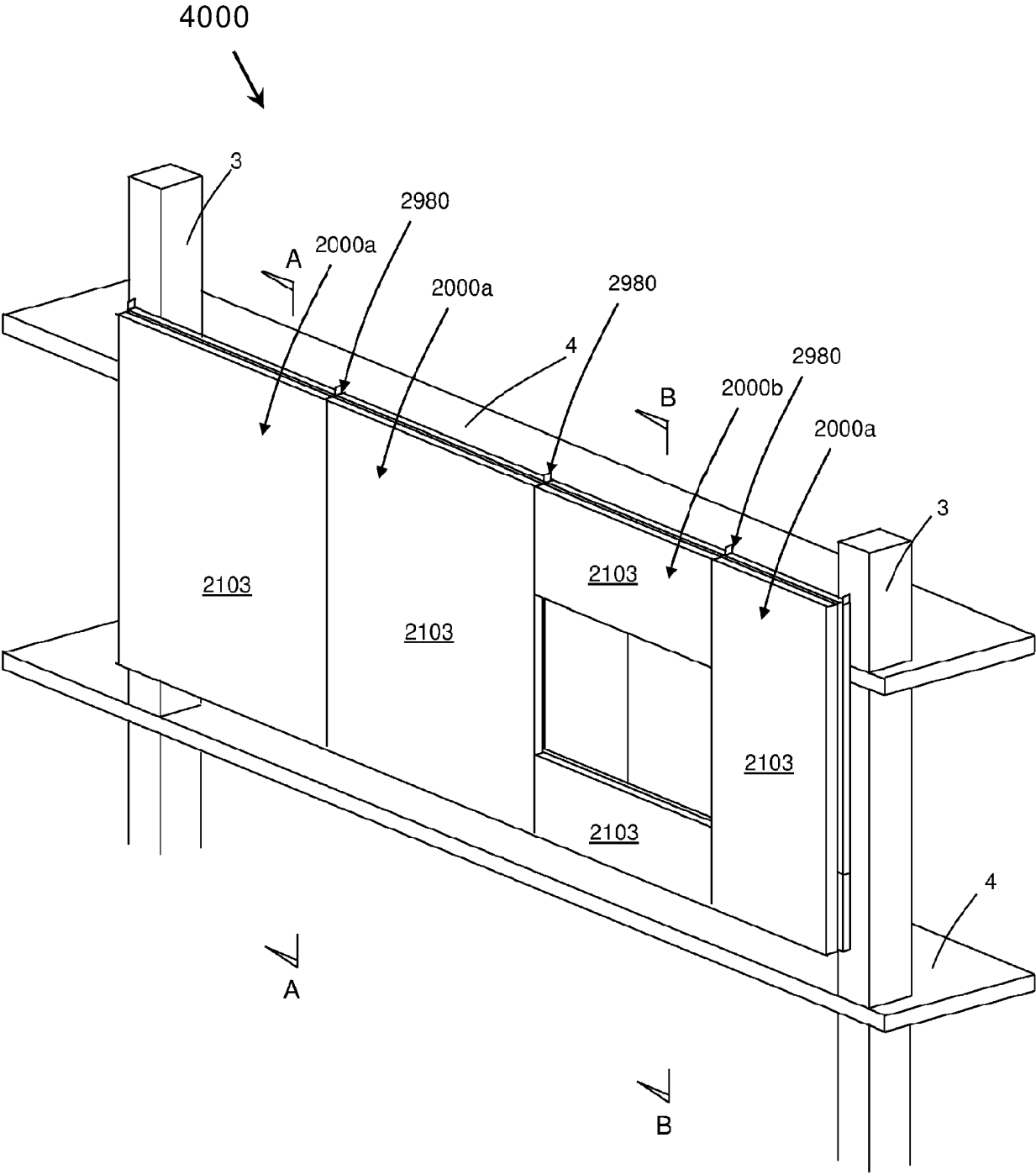


Figure 8

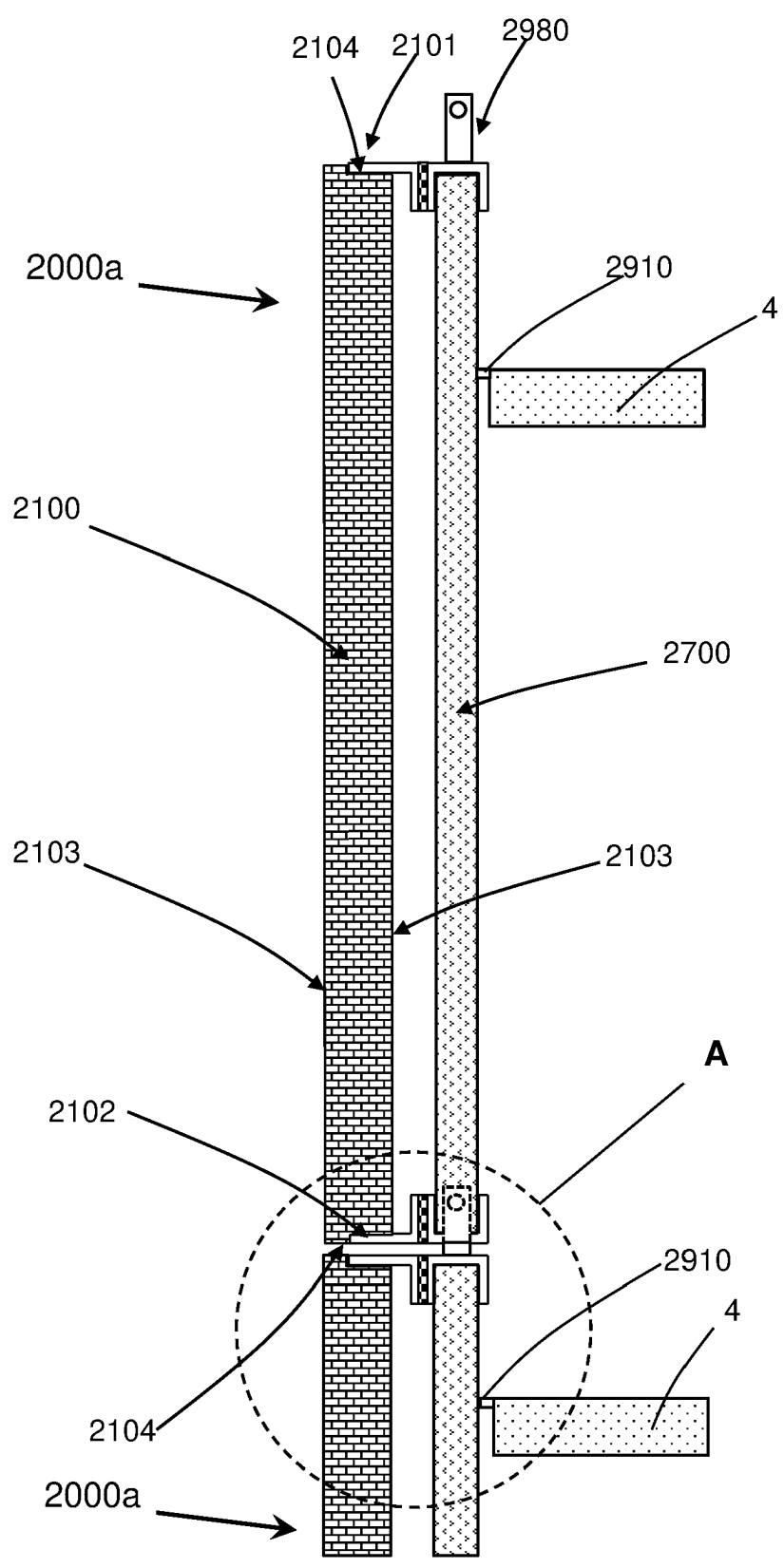


Figure 9

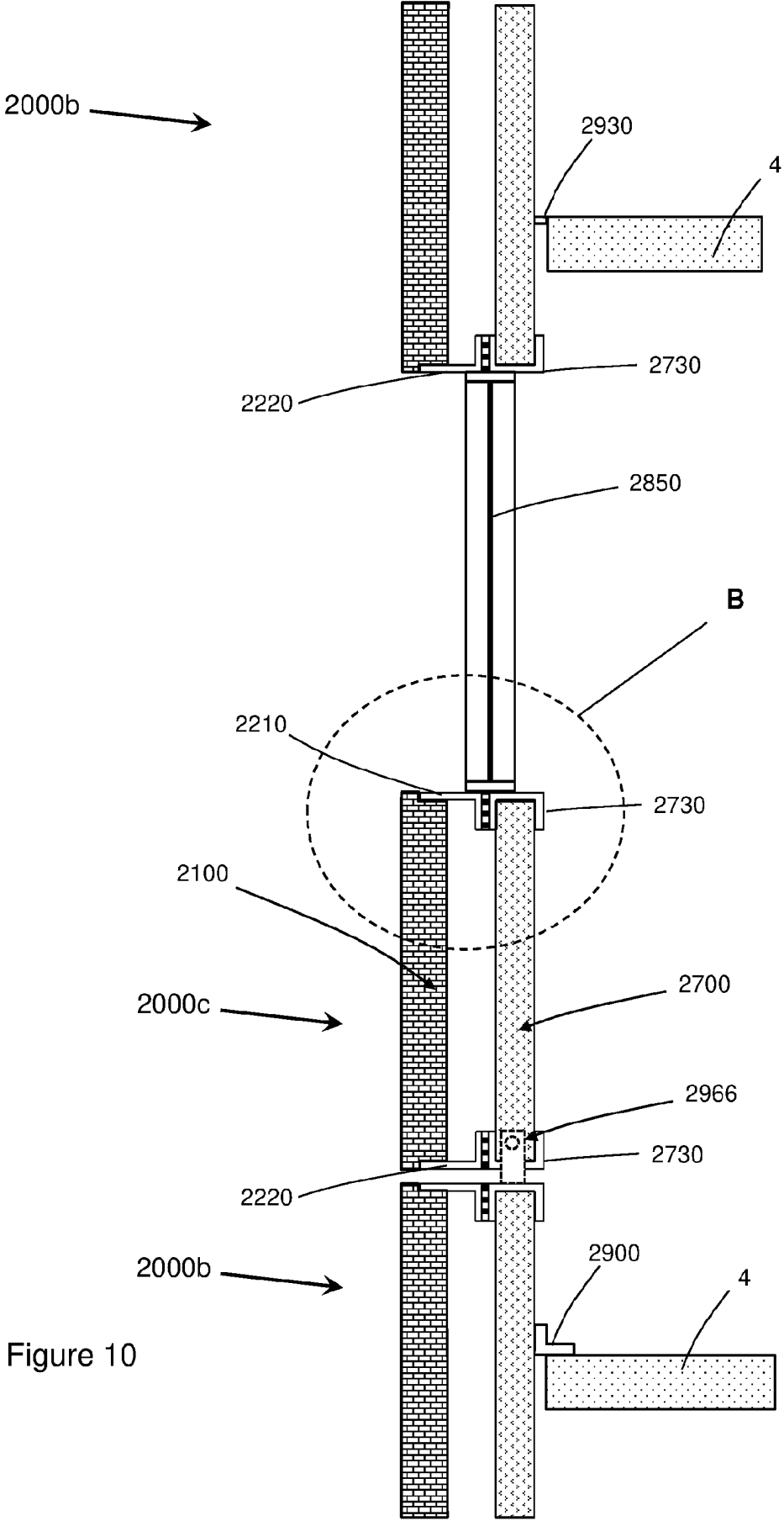


Figure 10

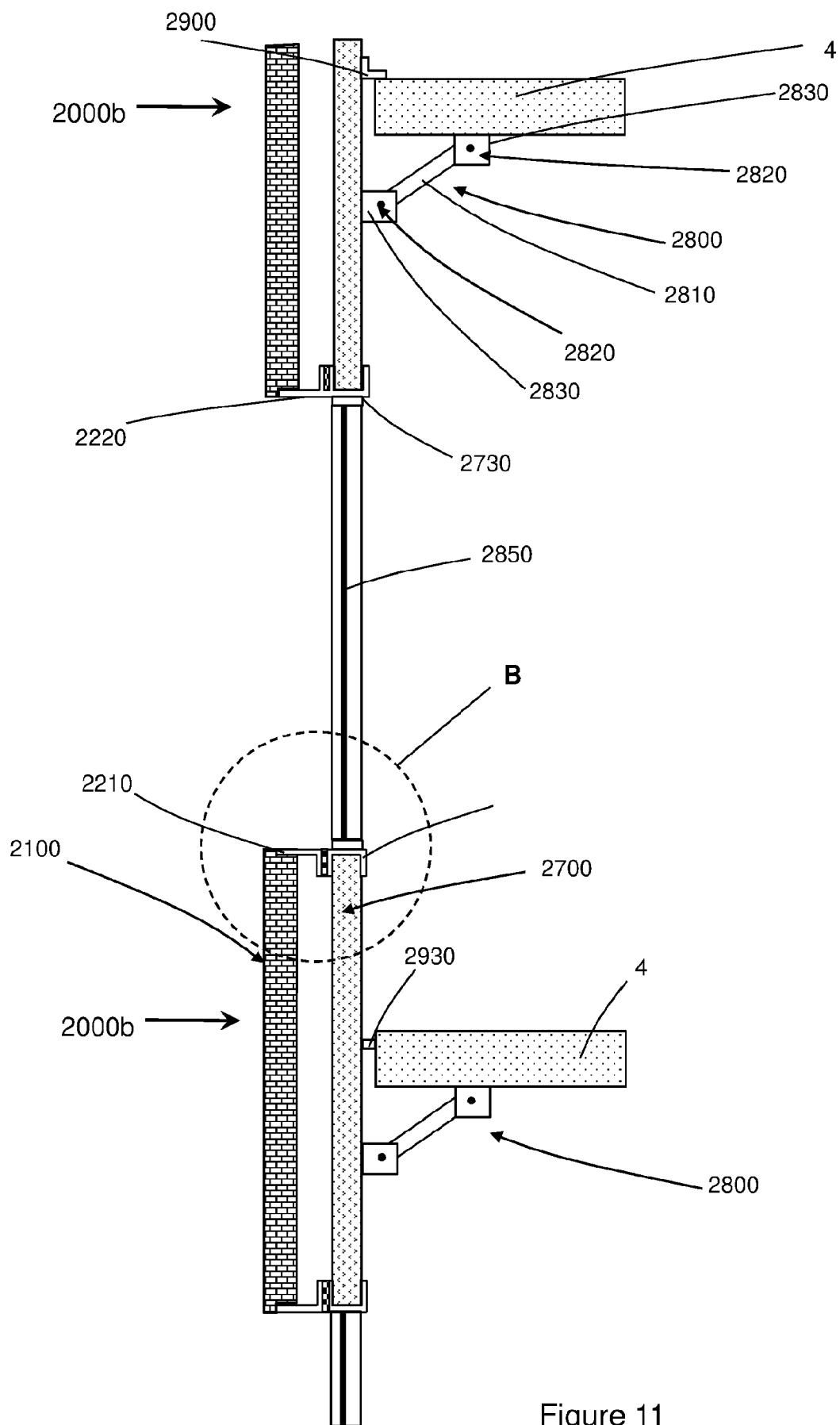


Figure 11

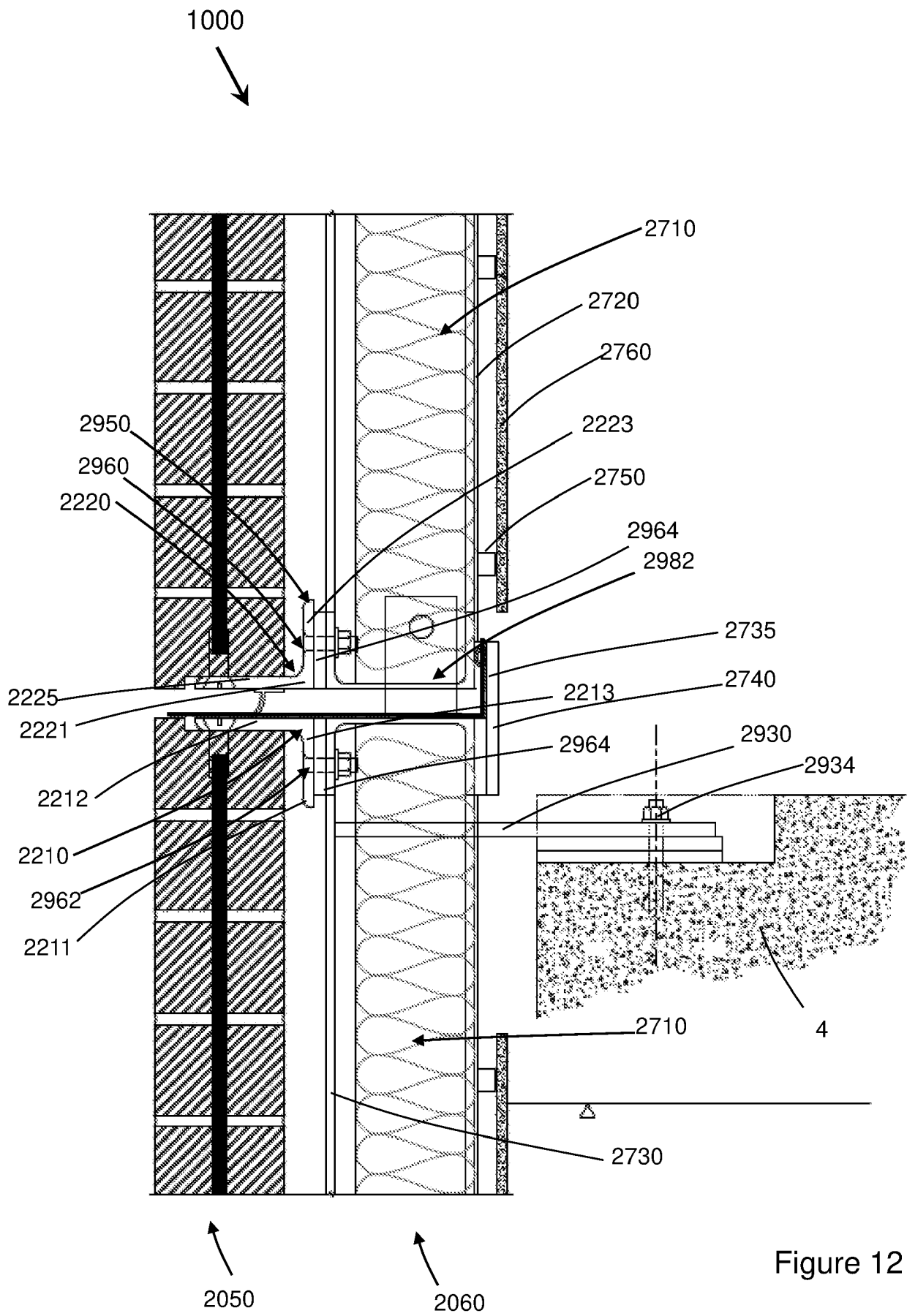


Figure 12

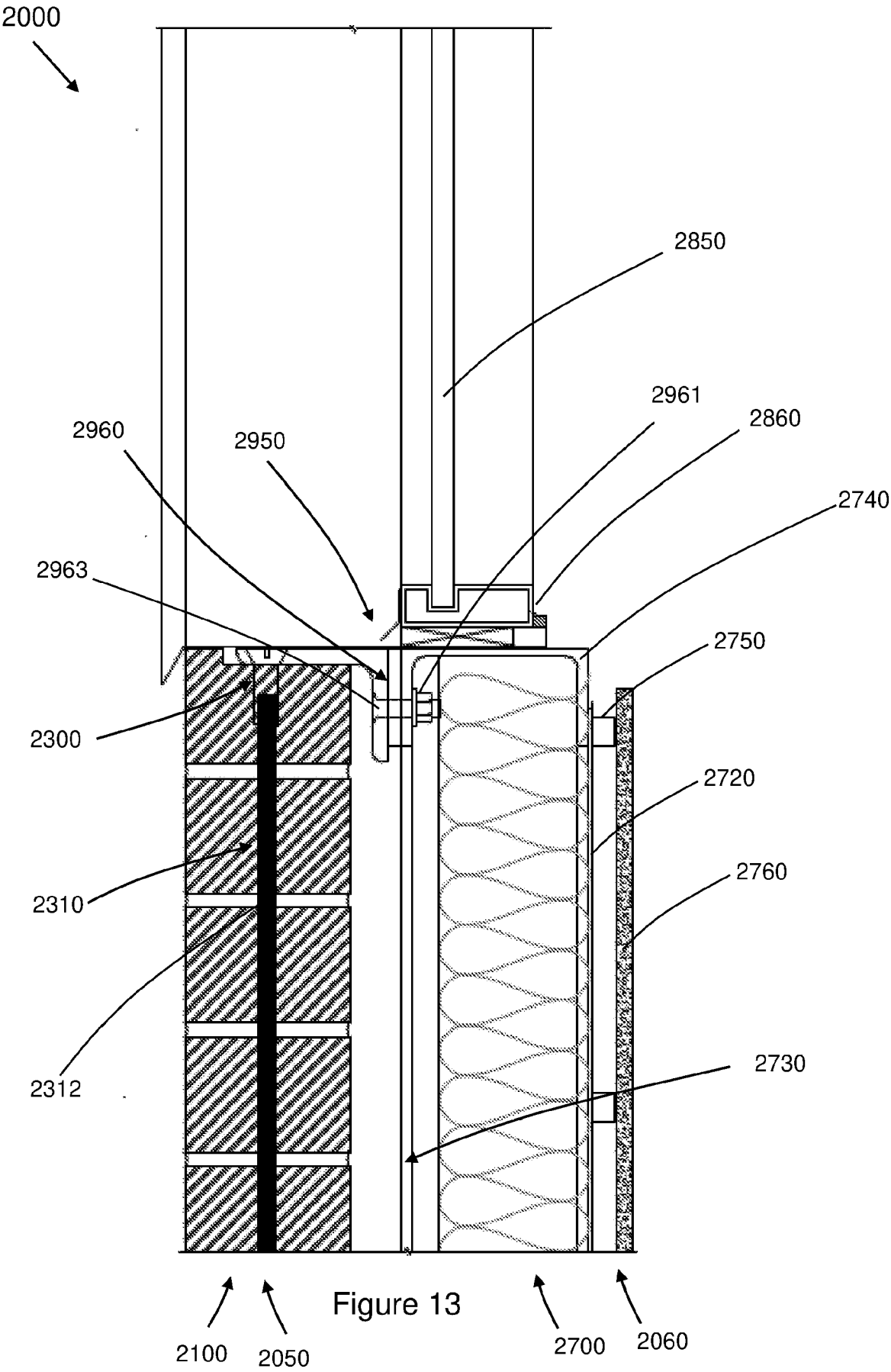


Figure 13

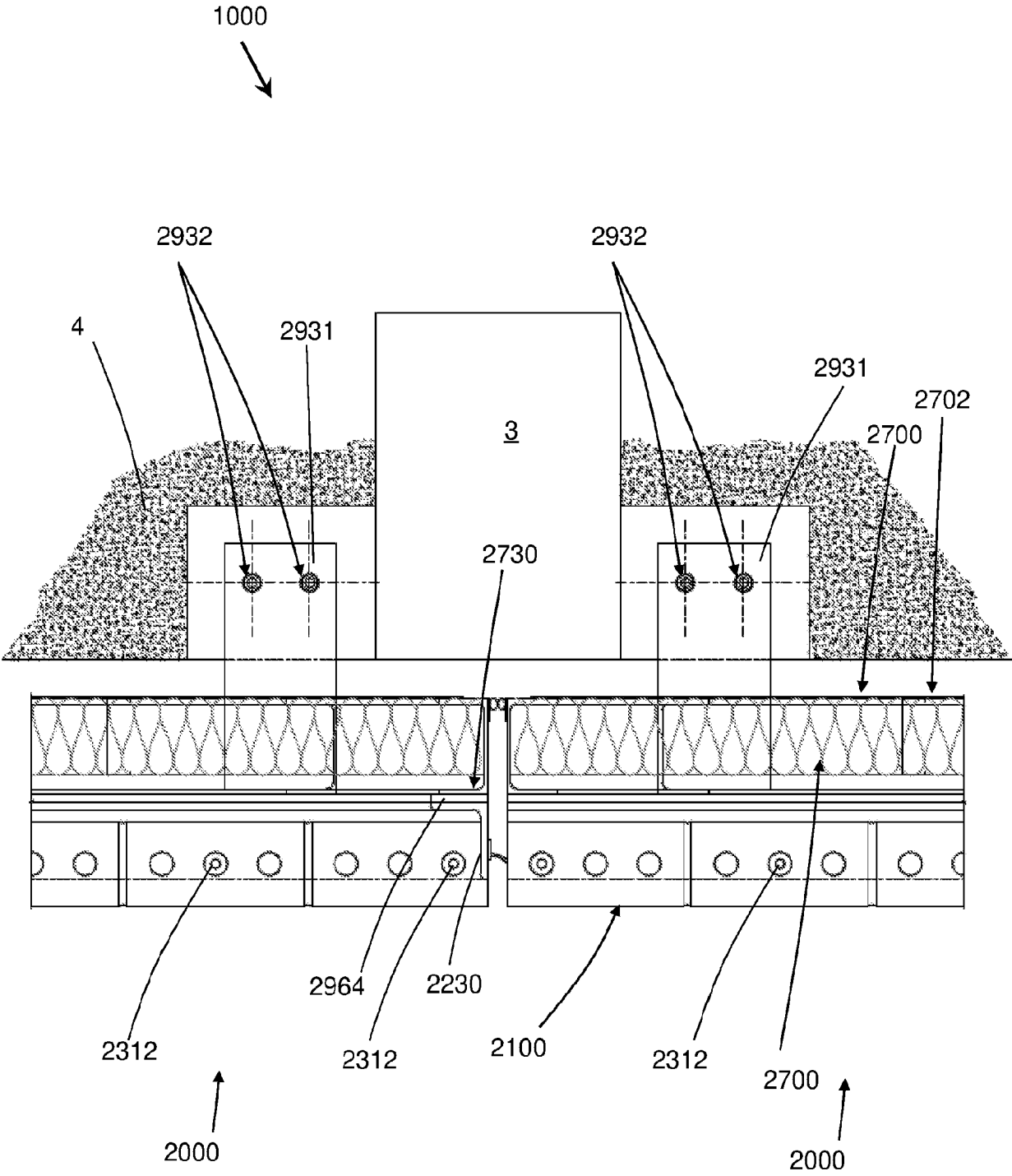


Figure 14

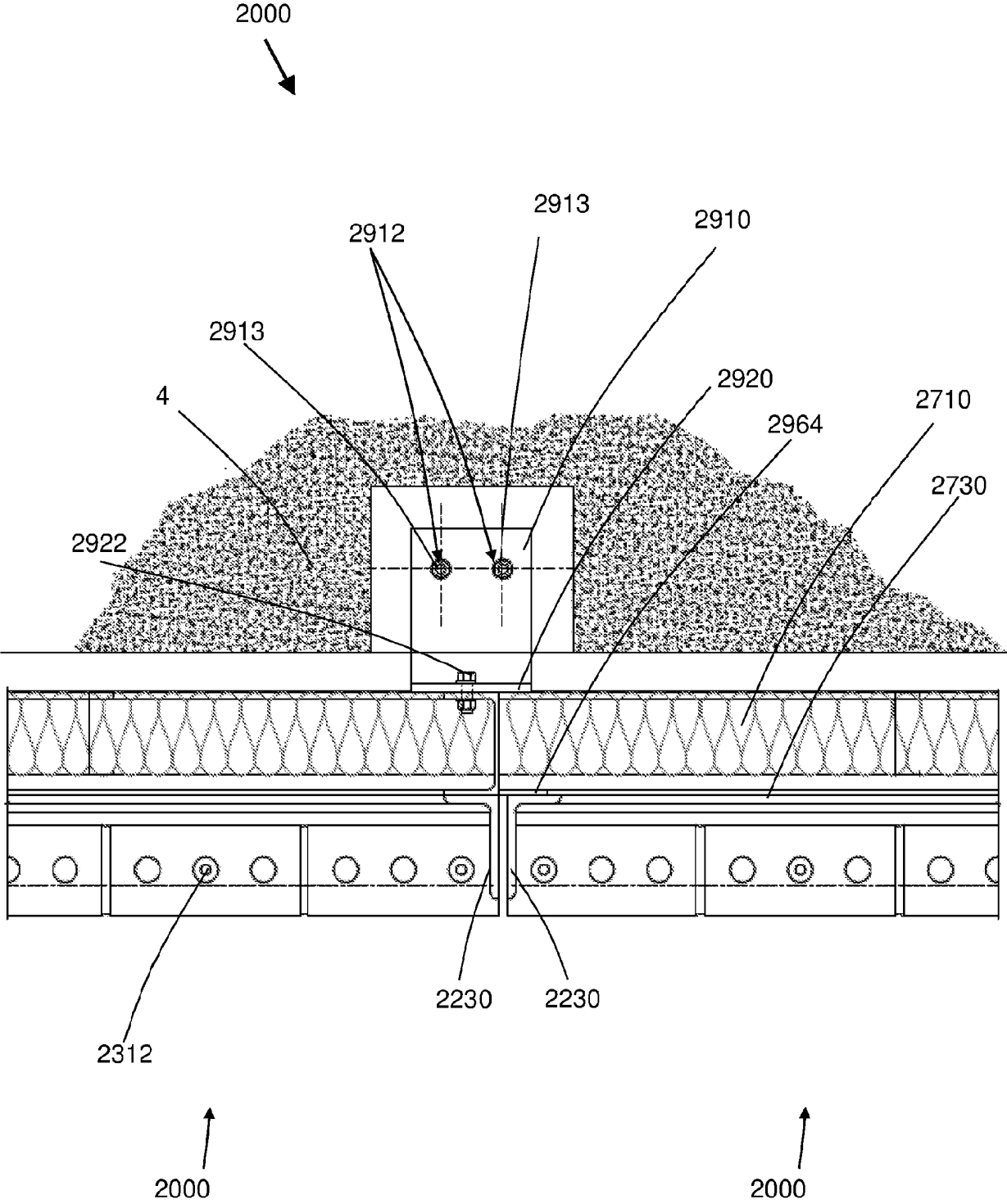


Figure 15

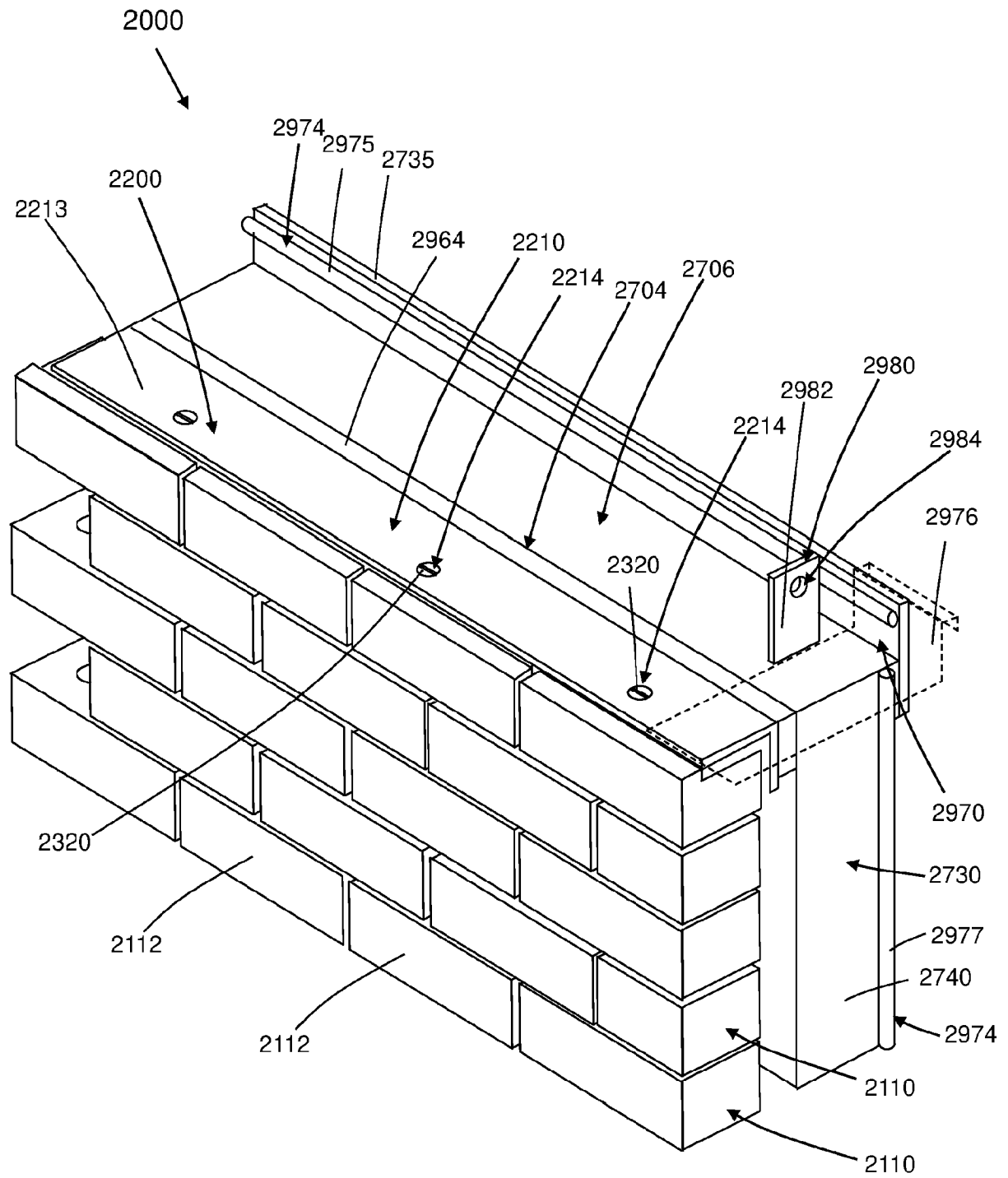


Figure 16

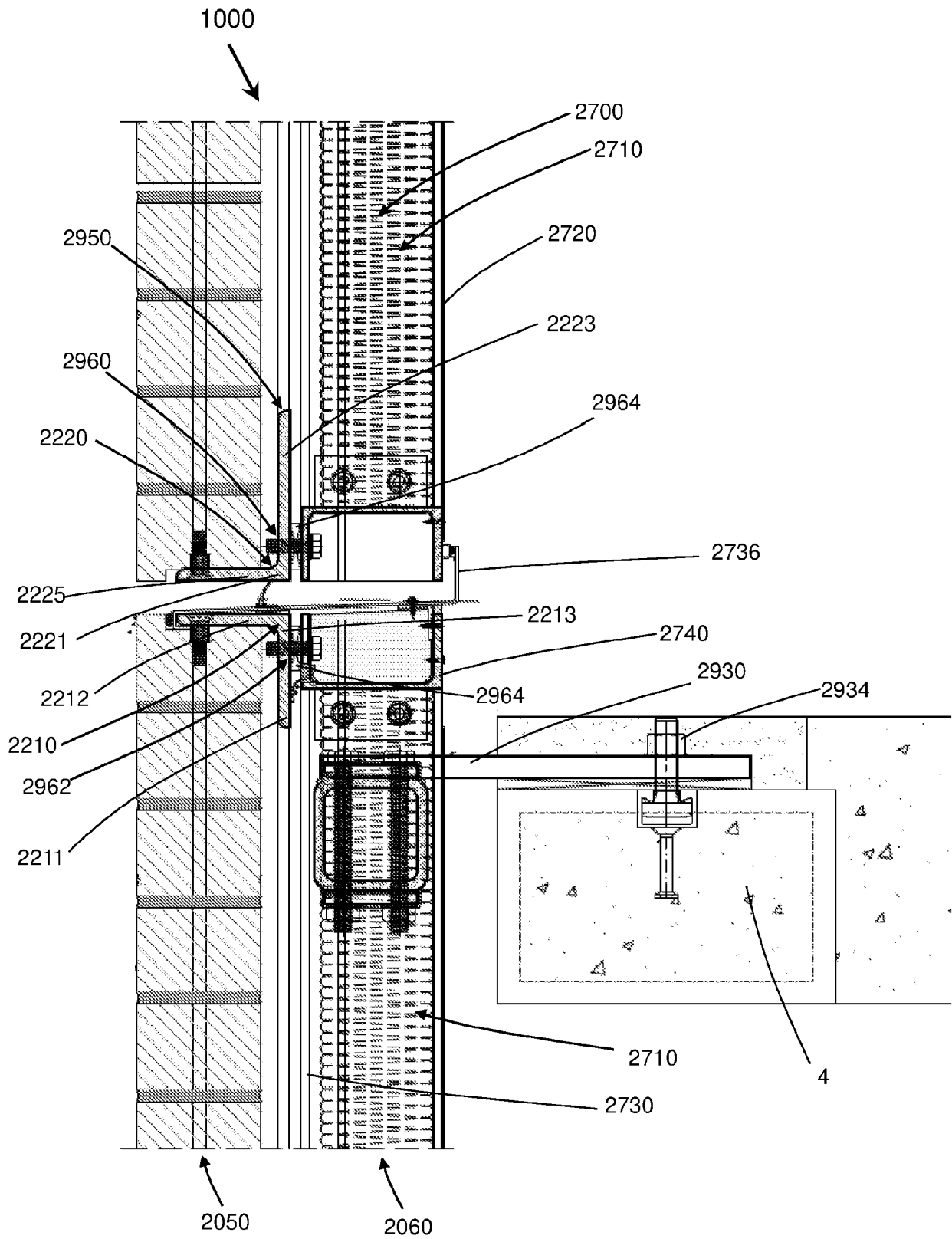


Figure 17

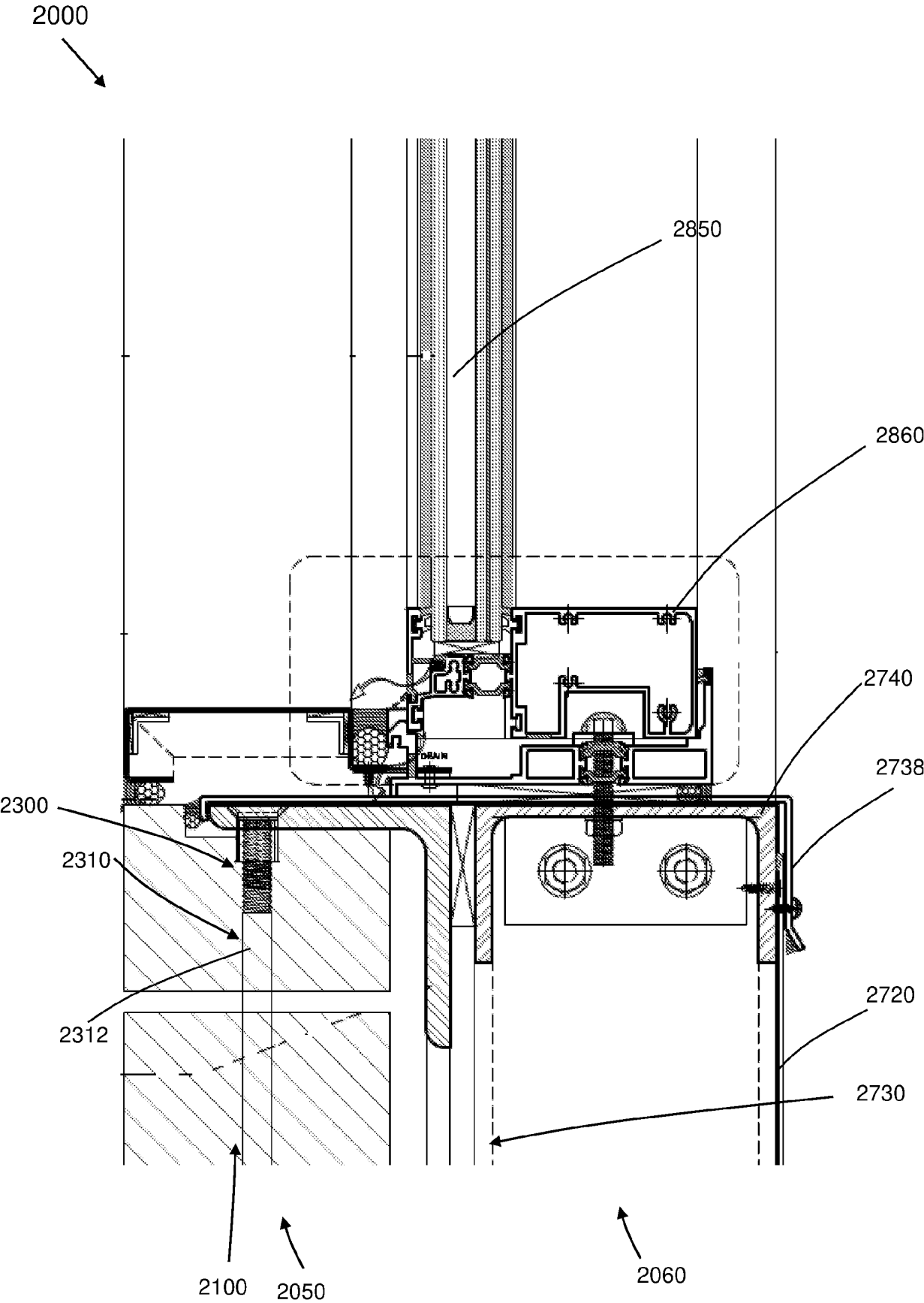


Figure 18

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5644891 A1 [0012]