

(19)



(11)

EP 2 586 935 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
18.03.2015 Bulletin 2015/12

(51) Int Cl.:
E04G 23/02 (2006.01)

(21) Application number: **12190463.5**

(22) Date of filing: **29.10.2012**

(54) **Method for reinforcing a wall structure and corresponding reinforcement system**

Verfahren zur Verstärkung einer Wandstruktur, und entsprechendes Verstärkungssystem

Procédé de renforcement d'une structure de paroi et système de renforcement correspondant

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

(30) Priority: **28.10.2011 IT BO20110611**

(43) Date of publication of application:
01.05.2013 Bulletin 2013/18

(73) Proprietor: **UAB "Leonardo, Gef Baltic, Gef"**
03213 Vilnius (LT)

(72) Inventor: **Forcucci, Gianfranco**
03213 Vilnius
Aguonu G. 5-8 (LT)

(74) Representative: **Bergadano, Mirko et al**
Studio Torta S.p.A.
Via Viotti, 9
10121 Torino (IT)

(56) References cited:
EP-A1- 1 170 440 EP-A1- 1 607 547
JP-A- 2001 090 255 JP-A- 2006 225 878

EP 2 586 935 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a method for reinforcing a wall structure and to a corresponding reinforcement system for a wall structure.

[0002] In particular, the present invention is advantageously, but not exclusively, applied in the reinforcement of wall structures of existing buildings with the purpose of meeting the requirements of recent seismic legislation, in particular Circular no. 617 of 2009 issued by the Supreme Council for Public Works ("Consiglio Superiore Lavori Pubblici") of the Italian Republic, to which the following description will explicitly refer without however losing in generality.

[0003] A masonry building must be conceived and built as a three-dimensional assembly of walls and floors so as to define the so-called "box effect or behaviour of the whole" which should ensure the stability, ductility and robustness of the building.

[0004] The masonry constructions in Italy's current building patrimony are generally characterized by wall structures with poor features, both in terms of conformation and of the quality of the bindings used. The wall structures in very old buildings often have a double facing. Indeed, most masonry constructions have poor, or do not even have, transverse connections, so-called "perpenders", in the load bearing walls, have a poor or ineffective scarf between stones or the individual brick elements forming the walls, have poor connections between the orthogonal walls and in the corner joints and have an inadequate connection of the floors to the walls. Furthermore, the poor quality of the binding material (mortars) used to bind the stone or brick elements in the construction of stone or combined masonries does not ensure enduring wall monolithicity over time and leads to an inexorable disaggregation of the wall texture. Finally, the wall structure of existing masonry constructions is often characterized by low resistance to both horizontal and vertical seismic actions.

[0005] Therefore, in interventions to reinforce the wall structure of buildings, which have the goal of improving the box behaviour of the whole, the main problems to be resolved are: the lack of connections between orthogonal walls in the so-called angled walls or in the so-called intersection walls; the lack or inadequacy of perpenders in load bearing walls and, therefore, the poor stability for loads; the lack or inadequacy of the scarfs between load bearing walls and floors; the poor resistance to the actions which promote out-of-plane toppling of the wall panels; the poor resistance to the actions parallel to the plane of the wall; and the inadequate distribution of the horizontal and containment forces of the walls by the floors.

[0006] It is known to make artificial perpenders by following techniques which firstly provide creating one or more transversal openings in the masonry walls to be reinforced and then closing the openings by placing a mix of reinforced concrete. If the reinforcement to be made requires a significantly large artificial perpenders,

the creation of the openings could be extremely invasive, with the risk that making the artificial perpenders could cause more harm than good.

[0007] It is also known to make dovetail reinforcement connections between at least one vertical wall and a related floor. However, making dovetail connections between walls and floors requires significant demolition work of the masonry at the floors.

[0008] Italian patent application RM99A000736 describes a reinforcement system particularly suitable for reinforcing walls of masonry constructions, the system comprising closed bindings which pass through transverse holes drilled into the walls to be reinforced and drawn holed plates, each of which is arranged at a respective transverse hole for the passage of the closed seams and is adapted to divide the load of the seams over the entire lead-in of the respective transverse hole. Such a system is theoretically capable of applying a diffused status of compression over the entire wall, in the horizontal, vertical directions and transversal to the wall, which allows the resistance to the horizontal and vertical seismic actions to be increased.

[0009] However, in practice, such a system has revealed to be particularly complicated, and therefore costly, to implement, in the adjacent masonries in two contiguous buildings because it does not consider the different tension required in the three orthogonal directions, and in the case of rubble masonries, because it is not very effective, and may even be harmful, due to the impossibility to control the transversal tension. Moreover, such a system does not consider the requirements imposed by Circular no. 617 of 2009, which absolutely advises against generalized, diffused tensioning in the vertical direction. EP 1170 440 discloses a method for reinforcing a wall structure, comprising drilling transverse holes into the wall structure and applying a plurality of plates with a cylindrical bar into each hole.

[0010] The object of the present invention is to provide a method for reinforcing an existing wall structure, which is free from the above-described drawbacks and at the same time is easy and affordable to embody and perfectly meets recent seismic legislation.

[0011] In accordance with the present invention, a method for reinforcing a wall structure and a reinforcement system for a wall structure are provided according to what is defined by the appended claims.

[0012] To better comprehend the present invention, a preferred embodiment thereof is now described, by way of a mere non-limiting example and with reference to the accompanying drawings, in which:

- figures 1 and 2 depict, according to two prospective views from two opposite directions, a portion of wall structure to which the reinforcement system is applied, which is made according to the dictates of the present invention;
- figures 3 to 7 depict certain elements of the reinforcement system in figures 1 and 2;

- figure 8 depicts, in greater detail, a part of the reinforcement system depicted in figures 1 and 2, removing the rest of the reinforcement system for clarity of illustration; and
- figure 9 depicts, according to a prospective view, the portion of wall structure in figure 1 to which the reinforcement system is applied, which is made according to a further embodiment of the present invention.

[0013] Numeral 1 in figures 1 and 2 generically indicates a portion of wall structure as a whole, which comprises two walls 2 and 3 which are connected to each other so as to form an internal corner 4 (figure 1) and a corresponding external corner 5 (figure 2) and comprises two respective beams 6 and 7 arranged on the walls 2 and 3. The portion of wall structure 1 shown represents a so-called "angled wall". The elements forming the wall structure 1 are brick blocks, or stones, or a combination of stones and brick blocks. An "internal corner" is intended as a corner defined by an angle less than 180° and an "external corner" is intended as a corner defined by an angle greater than 180°. By convention, it is hereinafter considered that the side of the wall structure 1 which comprises the internal corner 4 is the internal side 4a and the side opposite to the wall structure 1, that is the one which comprises the external corner 5, is the external side 5a of the wall structure 1. The wall structure 1 shown is reinforced by means of the reinforcement system made according to the invention, the system not being anything more than the implementation of the reinforcement method provided with the present invention.

[0014] With reference to figures 1 and 2, the reinforcement system comprises a plurality of plates 8, 9, 10, 11 which are applied onto both sides 4a, 5a of the wall structure 1 at the transverse holes (not shown in figures 1 and 2) drilled into the wall structure 1 according to a predetermined arrangement, so that each plate 8-11 on one side of the wall structure 1 is associated, at least at one of the transverse holes, with at least another plate 8-11 on the other side of the wall structure 1. The reinforcement system comprises a plurality of threaded cylindrical bars (not shown in figures 1 and 2), each of which is inserted into a respective transverse hole to connect each plate 8-11 on one side of the wall structure 1 with the corresponding plate 8-11 on the other side of the wall structure. Each plate 8-11 has a plurality of eyelets obtained along an external portion of the same plate (figures 3 to 6). Each plate 8-11, on each side of the wall structure 1, is connected with the ones adjacent thereto, that is the closest surrounding ones, by means of respective closed loop bindings 12, each of which passes through an eyelet of such a plate and an eyelet of the related adjacent plate.

[0015] The plates indicated with numeral 8 are standard plates, which are applied onto the surfaces of the walls 2 and 3. The plates indicated with numeral 9 are angular plates, which are applied along the corners 4 and 5. The plates indicated with numeral 10 are terminal plates, which are applied onto the beams 6 and 7. The

plates indicated with numeral 11 are connecting plates, which are applied onto the walls 2 and 3 close to the beams 6 and 7 to be bound, each, to at least one adjacent terminal plate 10, to at least one adjacent standard plate 8, to at least one adjacent connecting plate 11 and, if nearby, to one angular plate 9.

[0016] Advantageously, the plates 8-11 are made of stainless or galvanized steel and have a thickness selected from a range between 3 and 5 mm and a larger side between 15 and 25 cm long. The bindings 12 consist of closed loop stainless or galvanized steel bands and are preferably less than 1 mm thick.

[0017] Figures 3 to 6 show the plates in greater detail. Figure 3 shows a standard plate 8, which is rectangular and has, in middle position, a through hole 13 and, along an external portion, four curved eyelets 14 which are symmetrical with respect to two axes 15a and 15b which are orthogonal to each other at hole 13. The standard plate 8 is provided with four U-shaped saddles 16, each of which is inserted into a respective eyelet 14 with the concave side 16a of saddle 16 facing perimeter 17 of plate 8 to be, in use, wound by a related binding 12.

[0018] Figure 7 shows, from the side, a saddle 16 thread into an eyelet 14 with the concave side 16a facing perimeter 17 of plate 8 and the convex side 16b wound by a section of a binding 12. The saddles 16 serve for protecting the bindings 12, that is they have the purpose of preventing the bindings 12 from being sheared by the edges 18 of the eyelets 14 when the bindings 12 are placed under tension, and of promoting the sliding of the bindings 12 through the eyelets 14 during the adjustment of the tension of the bindings 12.

[0019] Figure 4 shows an angular plate 9, which is L shaped and comprises two flat portions 19 and 20 which extend, in transversal directions to each other, from one rounded corner 27 of the same angular plate 9 and which have respective through holes 21 and 22 having respective axes substantially transversal to each other. The reciprocal orientation between the axes of the holes 19 and 20 depends on the angle of the corners 4 and 5 of the wall structure 1. For example, if the walls 2 and 3 are orthogonal to each other, then the axes of the holes 19 and 20 are orthogonal to each other. Each portion 19, 20 has, along an external portion thereof, three curved eyelets 23, 24, two of which are symmetrical with respect to an axis 25a, 26a which is substantially parallel to corner 27, and the third of which is symmetrical with respect to an axis 25b, 26b which is substantially perpendicular to axis 25a, 26a.

[0020] Figure 5 shows a terminal plate 10, which is rectangular and has a through hole 28 and two curved eyelets 29 which are symmetrical with respect to respective axes 30a, 30b thus forming, with a side of the terminal plate 10, respective angles of about 45°, and therefore form a right angle with each other.

[0021] Figure 6 shows a connecting plate 11, which consists of a rectangular portion 31 and of a semicircular portion 32 connected to portion 31 and has, in middle

position, a through hole 33. The rectangular portion 31 has, along an external portion thereof, three curved eyelets 34, two of which are symmetrical with respect to an axis 35a which is parallel to a side 36 of portion 31 not connected to portion 32, and the third of which is symmetrical with respect to an axis 35b which is perpendicular to side 36. Semicircular portion 32 has, along an external portion thereof, two curved eyelets 37 which are symmetrical with respect to respective axes 38a and 38b thus forming, with side 36, respective angles of about 45°, and therefore form a right angle with each other. Each of the side eyelets 34, that is the symmetrical ones with respect to the axes 35 which are parallel to side 36, is adapted to be passed through by a respective binding 12 which is closed through a side eyelet 34 of another adjacent connecting plate 11 or an eyelet 23, 24 of an adjacent angular plate 9 (figure 1). The lower eyelet 34, that is the symmetrical one with respect to axis 35 which is perpendicular to side 36, is adapted to be passed through by a respective binding 12 which is closed through an eyelet 14 of an adjacent standard plate 8 (figure 1). At least one of the eyelets 37 is adapted to be passed through by a respective binding 12 which is closed through an eyelet 29 of a terminal plate 10 (figures 1 and 2).

[0022] With reference to figures 4 to 6, each of the plates 9, 10 and 11 is provided with a plurality of saddles 16, each of which is identical to the ones shown in figures 3 and 7, and is inserted into a respective eyelet 23, 24, 29, 34, 37 in the same way as indicated in figures 3 and 4 and for the same purpose as mentioned for plate 8.

[0023] The reinforcement method of the present invention is hereinafter described in detail, while making particular reference to figure 8, which only illustrates a part of the reinforcement system in figures 1 and 3, that is two rows of plates 8 and 9 applied onto the two sides 4a and 5a of the two walls 2 and 3, respectively, while the rest of the reinforcement system has been removed for clarity of illustration.

[0024] The reinforcement method provides drilling transverse holes into the wall structure 1, on opposite sides of the internal corner 4 (or of the external corner 5), that is divided among the ones indicated with numeral 39, which are drilled into wall 2, and the ones indicated with numeral 40, which are drilled into wall 3. The transverse holes 39 and 40 are through holes, that is they pass through the walls 2 and 3 from one side 4a to the other side 5a of the wall structure 1. The transverse holes 39 and 40 have, for example, a diameter selected from a range between 20 and 30 mm and are made by drilling according to a predetermined arrangement which adapts to the particular type of wall structure and to any openings or obstacles in the wall structure 1. In the example in figures 1 and 2, the transverse holes 39 and 40 in the walls 2 and 3 are made in the knots of a grid with rectangular meshes. According to another embodiment not shown, the transverse holes 39 and 40 are arranged staggered.

[0025] After having drilled the transverse holes 39 and 40, the plates 8 and 9 are applied onto the wall structure 1 at the transverse holes 39 and 40 by using, for example, controlled-shrinkage thixotropic mortar with synthetic fibres, of the type known under the trade name "Excocem FP".

[0026] The standard plates 8 are applied onto the two sides 4a and 5a of the wall structure 1 so that each standard plate 8 on the internal side 4a is associated, at a respective transverse hole 39, 40, with a respective standard plate 8 on the external side 5a and so that hole 13 of each standard plate 8 is substantially coaxial to the related transverse hole 39, 40. The angular plates 9 are applied along the internal corner 4, and therefore on the internal side 4a, so that the two holes 19 and 20 of each angular plate 9 are substantially coaxial, the first, to a given transverse hole 39 and, the other one, to a given transverse hole 40, and so that the angular plate 9 is associated, at such a given transverse hole 39 and at such a given transverse hole 40, with two standard plates 8 applied on opposite sides of the external corner 5.

[0027] Other angular plates 9 are applied along the external corner 5 without positioning them at any transverse hole 39, 40. These angular plates 9 are only bound to adjacent plates, as better explained below. For apparent reasons of production scale, the same type of angular plates 9 are used for the internal corner 4 as for the external corner 5. In theory, angular plates without the holes 21 and 22 could be used for the external corner 5.

[0028] At this point, a respective threaded cylindrical bar 41 is inserted into each transverse hole 39, 40, so that its two free ends project from the holes 13, 21, 22 of the two plates 8, 9 applied at such a transverse hole 39, 40 on both sides 4a, 5a of the wall structure 1. The bars 41 are made of steel and have a diameter, for example, selected from a range between 6 and 12 mm. Each plate 8, 9 is blocked at the free end of the related bar 41 by means of a respective threaded flanged nut 42, so that plate 8, 9 presses against the wall structure 1. Thereby, each standard plate 8 is rigidly connected on the internal side 4a to the respective standard plate 8 on the external side 5a, and each angular plate on the internal side 4a to the two corresponding standard plates 8 on the external side 5a. The tension of the nuts 42 is suitably adjusted by means of a tension regulator, for example by means of a manual dynamometric spanner. Thereby, a true scarf is obtained between the two walls 2 and 3.

[0029] After having blocked the various plates 8 and 9, controlled-shrinkage fluid mortar is injected into the transverse holes 39 and 40, for example, of the type known under the trade name "Excocem 22", by using a known machine for injecting mortar. Advantageously, the bars 41 are threaded for the entire length thereof. Thereby, there is a double advantage: there is no need to manufacture custom bars 41 for the particular wall structure 1, because it is sufficient to manufacture sufficiently long bars 41 and to custom cut them during installation; furthermore, the threading improves the adherence of the

bars 41 to the mortar and once the latter has matured, thus increases the seal against the axial extraction of the bars 41.

[0030] Once the mortar is injected into the transverse holes 39 and 40, each of the plates 8 and 9 is bound with the adjacent plates 8 and 9 by means of respective bindings 12. Figure 8 only shows the horizontal bindings 12 between standard plates 8 and angular plates 9. In particular, each binding 12 between two adjacent standard plates 8 passes through a single eyelet 14 of each of the two standard plates 14, and each binding 12 between a standard plate 8 and an adjacent angular plate 9 passes through a single eyelet 14 of the standard plate 8 and a single eyelet 23, 24 of the angular plate 9. Each binding 12 is made by passing the related steel band through two eyelets of two adjacent plates, and by closing the loop band by means of a respective seal (not shown) of known type, for example a so-called overlap seal, or a so-called monolithic mould seal, both made of stainless or galvanized steel. The overlap seal is much more affordable than the monolithic mould seal, but provides less tear resistance. Indeed, the resistance of the overlap seal is about 75% of the resistance of the band, while the resistance of the monolithic mould seal is substantially equal to the one of the band.

[0031] During the closing with the seal, the tension of each binding 12 is preferably, but not necessarily, adjusted, by means of a suitably calibrated dynamometric device, according to whether binding 12 is substantially horizontal or vertical. For example, the tension of the horizontal bindings 12 is greater than the one of the vertical bindings 12. The tension of the bindings 12 is adjusted, in the case of overlaps seals, by means of a commercial strap stretcher or, in the case of monolithic mould seals, by a tensioning tool which is suitable for the purpose. The operations described above with reference to the standard plates 8 and to the angular plates 9 are performed similarly for the terminal plates 10, and therefore the transverse holes 39 and 40 are made in the beams 6 and 7, and for the connecting plates 11 so as to obtain a mesh of bindings 12 like the one shown in figures 1 and 2. The reinforcement system thus made allows the wall structure 1 to be reinforced in a way that is not highly invasive, is effective in the three directions of space, due to the presence of the bars 41, which being fixed to the wall structure 1 by means of mortar and respective pairs of plates, act as artificial perpenders, and due to the presence of the mesh of bindings 12 which are coplanar to the surfaces of the walls 2 and 3 and which act as small horizontal and vertical tie rods capable, due to their flexibility, of overcoming any small obstacles along the surface of the walls 2 and 3 or of following a curved path of such a surface.

[0032] According to a further embodiment of the present invention shown in figure 9, in which the corresponding elements are indicated with the same numbers and letters as in figure 1, the reinforcement system comprises at least two nets 43 (only one is shown in figure

9) made of thermoplastic material, each of which is applied onto a respective side 4a, 5a of the wall structure 1 underneath the plates 8-11. In particular, in accordance with the reinforcement method of the present invention, each net 43 is applied onto the respective side 4a, 5a immediately after having drilled the transverse holes 39 and 40, and therefore before applying the plates 8-11. Once applied with the compensated shrinking mortar, the plates 8-11 also serve for fixing net 43 to the wall structure 1 like a kind of seam. Advantageously, net 43 is an extruded net, and in particular it is an extruded net made of alkaline resistant polypropylene. Net 43 also has rectangular meshes whose ratio between large side and small side is selected between a range of 1.4 and 1.8. Preferably, the larger side of net 43 is selected between a range of 6 and 8 cm long.

[0033] The application of net 43 accentuates the reinforcing effect in the three orthogonal directions of space, thus in fact increasing the overall bordering and therefore the ductility of the reinforced wall structure 1, and adds an anti-expulsion effect of the elements forming the wall structure 1. Furthermore, net 43 ensures improved adhesion of the finish plaster and decreases the risk of cracks forming in the plaster over time.

[0034] According to a further embodiment of the present invention not shown, which is applied, for example, to a wall structure 1 not accessible on one side, the reinforcement method differs from that described above in that the transverse holes, made by only drilling into the wall structure 1 on the accessible side, are not through holes, and therefore the bars 41 inserted into the respective transverse holes only project with a free end thereof from the respective transverse hole and the plates are only applied onto the accessible side of the wall structure 1.

[0035] According to a further embodiment of the present invention not shown, which is applied to a wall structure 1 consisting of a so-called "wall intersection", that is of the type comprising a front wall joined to a transversal wall so as to form a T and therefore, to define two internal corners on the two internal sides opposite to the wall intersection, the reinforcement method differs from what is described above in that the holes 39 are made in the transversal wall and the holes 40 are made in the front wall, the angular plates 9 are applied along the two internal corners so that each angular plate 9 on an internal corner is associated, at one hole 39, with an angular plate 9 applied onto the other internal corner and, at one hole 40, with a standard plate 8 applied onto the external side of the front wall. Thereby, a true scarf is obtained between the front wall and the transversal wall of the wall intersection.

[0036] Although the above-described invention makes particular reference to a precise embodiment, it is not limited to such an embodiment, as all those variants, modifications or simplifications fall within the scope thereof which are apparent to the expert field technician, such as for example:

- the plates 8-11 have a different shape than the one described above, for example the standard plates 8 are circular in shape;
- the bindings 12 consist of bands made of highly resistant plastic material of the type of the ones normally used for packaging ferrous material, and are loop closed by means of high-temperature gluing; or
- the plates 8-11 do not have saddles 16 and the related eyelets have at least one section of rounded edge to promote the sliding of the bindings 12 and prevent the shearing thereof.

[0037] The main advantages of the above-described reinforcement method and of the corresponding reinforcement system are to ensure an effective triaxial reinforcement of the wall structure 1, that is a reinforcement which acts in the three directions of space capable of increasing the resistance to the bending and cutting of the walls 2 and 3, the overall ductility of the wall structure 1, and to ensure not being highly invasive on the wall structure 1, because essentially through holes 39 and 40 are to be drilled which all things considered, are reduced in diameter and the positioning of the plates 8-11 and of the bindings 12 falls under the normal thickness of the plaster. The embodiment which provides the application of net 43 improves the triaxial reinforcement effect, adds an anti-expulsion effect of the elements forming the wall structure 1, which is very important in case the wall structure 1 breaks during an earthquake, and improves the cracking resistance of the plaster, which normally is increased in thickness in old wall structures 1. In other words, net 43 determines, together with the plates 8-11 combined in pairs by means of the bars 41 and adjacent ones bound together by means of bindings 12, an important cage effect which improves the overall ductility of the wall structure 1 and the box effect as a whole, thus incrementing the resistance of the wall structure 1 to all types of horizontal and vertical seismic actions.

[0038] Furthermore, the reinforcement system is completely reversible and certifiable. Indeed, the bands of the bindings 12, the seals which close the bindings and the overall seal of the bindings 12 are certifiable, the tension of the bindings 12 can be differentiated according to needs, the plates 8-11 and the saddles 16 are certifiable, the bars 41 are certifiable, and the extruded net 43 made of polypropylene is certifiable. This is an extremely important aspect because the reinforcement system must necessarily comply with seismic legislation and the legislation concerning the use of steel in constructions.

[0039] Finally, it is worth underlining that the reinforcement method and the corresponding reinforcement system of the present invention may not only be advantageously used for old brick and/or stone buildings, but also to increase the performance characteristics of the structures of the newly built brick buildings and to reinforce buildings made with concrete, wood or metal structures.

Claims

1. A method for reinforcing a wall structure, said method comprises:

- drilling a plurality of transverse holes (39, 40) into the wall structure (1) according to a predetermined arrangement;
- applying, onto at least one side (4a, 5a) of the wall structure (1), a plurality of plates (8-11), each of which presents at least one respective through hole (13, 21, 22, 28, 33) and a respective plurality of eyelets (14, 23, 24, 29, 34, 37), so that the hole (13, 21, 22, 28, 33) of each plate (8-11) is substantially coaxial to a respective hole of said transverse holes (39, 40);
- inserting, into each transverse hole (39, 40), a respective threaded cylindrical bar (41), so that at least one free end of the latter projects from the hole (13, 21, 22, 28, 33) of the plate (8-11) coaxial to the transverse hole (39, 40);
- blocking each plate (8-11) at the end of the relative bar (41) by means of a threaded nut (42), so that the plate (8-11) presses against the wall structure (1);
- injecting mortar into said transverse holes (39, 40);
- binding each plate (8-11) to at least part of the adjacent plates (8-11) by means of respective closed loop bindings (12), each of which passes through one of the eyelets (14, 23, 24, 29, 34, 37) of said plate (8-11) and one of the eyelets (14, 23, 24, 29, 34, 37) of the relative adjacent plate (8-11).

2. A method according to claim 1, and comprising:

- laying a net (43) of thermoplastic material onto said at least one side (4a, 5a) of the wall structure (1);
- said plates (8-11) being applied onto said net (43).

3. A method according to claim 1, wherein said transverse holes (39, 40) are through holes between two opposite sides (4a, 5a) of the wall structure (1); said plates (8-11) being applied onto both sides of the wall structure (1), so that each plate (8-11) on one side (4a) of the wall structure (1) is associated, in correspondence to at least one of said transverse holes (39, 40), to at least another plate (8-11) on the other side of the wall structure (1); each bar (41) being inserted into the respective transverse hole (39, 40), so that its two free ends project from the holes (13, 21, 22, 28, 33) of the plates (8-11) applied in correspondence to said transverse hole (39, 40) on both sides (4a, 5a) of the wall structure (1); each binding (12) binding plates (8-11) on the same side

(4a, 5a) of the wall structure (1).

4. A method according to claim 3, and comprising:

- laying, onto each one of said two sides (4a, 5a) of the wall structure (1), a respective net (43) of plastic material;
said plates (8-11) being applied onto the nets (43) of both sides (4a, 5a) of the wall structure (1).

5. A method according to any of the claims from 1 to 4, wherein said wall structure (1) comprises two walls (2, 3), which are connected to each other so as to form at least an internal corner (4); said transverse holes (39, 40) comprising first (39) and second (40) transverse holes made on opposite sides of the internal corner (4); said plates (8-11) comprising first angular plates (9), each of which presents two through holes (21, 22) having axes that are transverse to each other; the first angular plates (9) being applied along said internal corner (4), so that the two holes (21, 22) of each first angular plate (9) are substantially coaxial, the first one (21), to a given hole of said first transverse holes (39) and, the other one (22), to a given hole of said second transverse holes (40).

6. A method according to claim 3 and 5, wherein said wall structure (1) comprises an external corner (5) corresponding to said internal corner (4), the two corners (4, 5) being defined on the two opposite sides (4a, 5a) of the wall structure (1); said plates (8-11) comprising flat plates (8), which are applied onto the side (5a) on which the external corner (5) is defined; each one of said first angular plates (8) being associated, in correspondence to said given first transverse hole (39) and to said given second transverse hole (40), to two respective flat plates (8), which are applied on opposite sides of the external corner (5).

7. A method according to any of the claims from 1 to 6, wherein said wall structure (1) comprises two walls (2, 3), which are connected to each other so as to form an external corner (5); said plates (8-11) comprising flat plates (8), which are applied on opposite sides of said external corner (5); the method comprising:

- applying, along said external corner (5), a plurality of second angular plates (9), each of which presents a respective plurality of eyelets (23, 24);
- binding each second angular plate (23, 24) to at least part of the adjacent flat plates (8) and/or of the adjacent second angular plates (9) by means of respective closed loop bindings (12), each of which passes through one of the eyelets

(23, 24) of said second angular plate (9) and one of the eyelets (14, 23, 24) of the relative adjacent plate (8, 9).

8. A method according to any of the claims from 1 to 7 and comprising:

- adjusting the tension of each one of said bindings (12) as a function of their inclination with respect to the ground.

9. A method according to any of the claims from 1 to 8, wherein said bindings (12) are made of respective steel bands.

10. A reinforcement system for a wall structure (1), said system comprising: a plurality of plates (8-11), each of which comprises at least one respective through hole (13, 21, 22, 28, 33) and a respective plurality of eyelets (14, 23, 24, 29, 34, 37), said plates (8-11) being suited to be applied onto at least one side (4a, 5a) of the wall structure (1), so that the hole (13, 21, 22, 28, 33) of each plate (8-11) is substantially coaxial to a respective transverse hole (39, 40) drilled into the wall structure (1); a plurality of threaded cylindrical bars (41), each of which is suited to be inserted into a respective transverse hole (39, 40) of the wall structure (1), so that at least one free end of the bar (41) projects from the hole (13, 21, 22, 28, 33) of the plate (8-11) coaxial to the transverse hole (39, 40); threaded nuts (42) for blocking the plates (8-11) at the free ends of the relative bars (41), so that the plates (8-11) press against the wall structure (1); and a plurality of closed loop bindings (12) for binding each plate (8-11) to the adjacent plates (8-11), so that each binding (12) passes through one of the eyelets (14, 23, 24, 29, 34, 37) of said plate (8-11) and one of the eyelets (14, 23, 24, 29, 34, 37) of the relative adjacent plate (8-11).

11. A system according to claim 10, and comprising at least one net (43) of thermoplastic material, which is suited to be applied onto said side (4a, 5a) of the wall structure (1) under said plates (8-11).

12. A system according to claim 10 or 11, wherein said transverse holes (39, 40) are through holes between two opposite sides (4a, 5a) of the wall structure (1); said plates (8-11) being suited to be applied onto both sides (4a, 5a) of the wall structure (1), so that each plate (8-11) on one side (4a) of the wall structure (1) is associated, in correspondence to at least one of said transverse holes (39, 40), to at least another plate (8-11) on the other side (5a) of the wall structure (1); each bar (41) being suited to be inserted into the respective transverse hole (39, 40), so that its free ends project from the holes (13, 21, 22, 28, 33) of the plates (8-11) applied in correspond-

ence to said transverse hole (39, 40) on both sides (4a, 5a) of the wall structure (1); each binding (12) being suited to bind plates (8-11) on the same side (4a, 5a) of the wall structure (1).

13. A system according to any of the claims from 10 to 12, wherein the eyelets (14, 23, 24, 29, 34, 37) of each plate (8-11) are arranged along an perimetric portion of the plate (8-11) and each plate (8-11) is provided with a plurality of U-shaped saddles (16), each of which is inserted into a respective eyelets (14, 23, 24, 29, 34, 37) with the concave side (16a) of the saddle (16) facing the perimeter (17) of the plate (8-11) in such a way that the convex side (16b) of the saddle (16) is wound, in use, by a section of a relative binding of said bindings (12).

Patentansprüche

1. Verfahren zum Verstärken einer Wandstruktur, wobei das Verfahren umfasst:

- Bohren von mehreren Querbohrungen (39, 40) in die Wandstruktur (1) gemäß einer vorgegebenen Anordnung;

- Anbringen an wenigstens einer Seite (4a, 5a) der Wandstruktur (1) mehrere Platten (8 bis 11), von denen jede wenigstens eine jeweilige Durchgangsbohrung (13, 21, 22, 28, 33) aufweist und eine jeweilige Mehrzahl von Ösen (14, 23, 24, 29, 34, 37) aufweist, so dass die Bohrung (13, 21, 22, 28, 33) jeder Platte (8 bis 11) im Wesentlichen koaxial zu einer jeweiligen Ausnehmung der Querbohrungen (39, 40) vorgesehen ist;

- Einführen einer jeweiligen ein Gewinde aufweisenden zylindrischen Stange (41) in jede Querbohrung (39, 40), so dass wenigstens ein freies Ende der letzteren von der Bohrung (13, 21, 22, 28, 33) der Platte (8 bis 11) koaxial zu der Querbohrung (39, 40) hervorsteht;

- Blockieren jeder Platte (8 bis 11) an dem Ende des relativen Riegels (41) mittels einer Gewindemutter (42), so dass die Platte (8 bis 11) die Wandstruktur (1) beaufschlagt;

- Einspritzen von Mörtel in die Querbohrungen (39, 40);

- Verbinden jeder Platte (8 bis 11) mit wenigstens einem Teil der angrenzenden Platten (8 bis 11) mittels eines jeweiligen geschlossenen Schlaufengebindes (12), von denen jedes durch eine der Ösen (14, 23, 24, 29, 34, 37) der Platte (8 bis 11) passiert und durch eine der Ösen (14, 23, 24, 29, 34, 37) der jeweiligen angrenzenden Platte (8 bis 11) passiert.

2. Verfahren gemäß Anspruch 1 weiter umfassend:

- Legen eines Netzes (43) aus thermoplastischem Material auf die wenigstens eine Seite (4a, 5a) der Wandstruktur (1); wobei die Platten (8 bis 11) auf dem Netz (43) angebracht werden.

3. Verfahren gemäß Anspruch 1, bei dem die Querbohrungen (39, 40) als Durchgangsbohrungen zwischen zwei gegenüberliegenden Seiten (4a, 5a) der Wandstruktur (1) ausgebildet sind; wobei die Platten (8 bis 11) auf beiden Seiten der Wandstruktur (1) angebracht werden, so dass jede Platte (8 bis 11) an einer Seite (4a) der Wandstruktur (1) korrespondierend mit wenigstens einer der Querbohrungen (39, 40), mit wenigstens einer anderen Platte (8 bis 11) auf der anderen Seite der Wandstruktur (1) verbunden ist; wobei jede Stange (41) in die jeweilige Querbohrung (39, 40) eingeführt ist, so dass seine zwei freien Enden aus den Ausnehmungen (13, 21, 22, 28, 33) der Platten (8 bis 11) hervorsteht, die korrespondierend zu den Querbohrungen (39, 40) an beiden Seiten (4a, 5a) der Wandstruktur (1) angebracht werden; wobei jedes Gebinde (12) Platten (8 bis 11) auf derselben Seite (4a, 5a) der Wandstruktur (1) verbindet.

4. Verfahren gemäß Anspruch 3 und weiter umfassend:

- Legen auf jede der zwei Seiten (4a, 5a) der Wandstruktur (1) ein jeweiliges Netz (43) aus Plastikmaterial; wobei die Platten (8 bis 11) auf die Netze (43) von beiden Seiten (4a, 5a) der Wandstruktur (1) angebracht werden.

5. Verfahren gemäß einem der Ansprüche 1 bis 4, bei dem die Wandstruktur (1) zwei Wände (2, 3) umfasst, die miteinander verbunden sind, um so wenigstens eine innere Ecke (4) zu bilden; wobei die Querbohrungen (39, 40) erste (39) und zweite (40) Querbohrungen umfassen, die an gegenüberliegenden Seiten der inneren Ecken (4) hergestellt sind; wobei die Platten (8 bis 11) erste winkelförmige Platten (9) umfassen, von denen jede zwei Durchgangsbohrungen (21, 22) aufweist, mit Achsen, die transversal zueinander ausgerichtet sind; wobei die erste winkelförmige Platten (9) entlang der inneren Ecke (4) angebracht werden, so dass die zwei Bohrungen (21, 22) von jeder jeweils ersten winkelförmigen Platte (9) im Wesentlichen koaxial zueinander ausgerichtet sind, die erste (21) zu einer vorgegebenen Ausnehmung der ersten Querbohrung (39) und die andere (22) zu einer vorgegebenen Ausnehmung der zweiten Querbohrungen (40).

6. Verfahren gemäß Anspruch 3 und 5, bei dem die Wandstruktur (1) eine äußere Ecke (5) umfasst, die

zu der inneren Ecke (4) korrespondiert, wobei die zwei Ecken (4, 5) an den zwei gegenüberliegenden Seiten (4a, 5a) der Wandstruktur (1) definiert werden; wobei die Platten (8 bis 11) flache Platten (8) umfassen, die auf die Seite (5a), an der die äußere Ecke (5) definiert ist, angebracht werden; wobei jede der ersten winkelförmigen Platten (8) korrespondierend zu der gegebenen ersten Querbohrung (39) und zu der gegebenen zweiten Querbohrung (40) zu den zwei jeweiligen flachen Platten (8), die an gegenüberliegenden Seiten der äußeren Ecke (4) angebracht sind miteinander verbunden sind.

7. Verfahren gemäß einem der Ansprüche 1 bis 6, bei dem die Wandstruktur (1) zwei Wände (2, 3) umfasst, die miteinander verbunden sind, um so eine äußere Ecke (5) zu bilden; wobei die Platten (8 bis 11) flache Platten (8) umfassen, die an gegenüberliegenden Seiten der äußeren Ecke (5) angebracht werden; wobei das Verfahren umfasst:

- Anbringen von mehreren zweiten winkelförmigen Platten (9), von denen jede eine jeweilige Mehrzahl von Ösen (23, 24) entlang der äußeren Ecke (5) aufweist;
- Verbinden von jeder zweiten winkelförmigen Platte (23, 24) mit wenigstens einem Teil der angrenzenden flachen Platten (8) und/oder der angrenzenden zweiten winkelförmigen Platten (9) mittels jeweiliger geschlossenen Schleifengebinde (12), von denen jedes durch eine der Ösen (23, 24) der zweiten winkelförmigen Platte (9) und durch eine der Ösen (14, 23, 24) der jeweiligen angrenzenden Platte (8, 9) passiert.

8. Verfahren gemäß einem der Ansprüche 1 bis 7, weiter umfassend:

- Anpassen der Spannung von jedem der Gebinde (12) als eine Funktion von deren Neigung bezüglich des Bodens.

9. Verfahren gemäß einem der Ansprüche 1 bis 8, bei dem die Stangen (12) aus jeweiligen Stahlbändern hergestellt sind.

10. Ein Verstärkungssystem für eine Wandstruktur (1), wobei das System umfasst:

mehrere Platten (8 bis 11), von denen jede wenigstens eine jeweilige Durchgangsbohrung (13, 21, 22, 28, 33) umfasst und eine jeweilige Mehrzahl von Ösen (14, 23, 24, 29, 34, 37) umfasst, wobei die Platten (8 bis 11) ausgelegt sind, um auf wenigstens eine Seite (4a, 5a) der Wandstruktur (1) angebracht zu werden, so dass die Bohrung (13, 21, 22, 28, 33) jeder Platte (8 bis 11) im Wesentlichen koaxial zu der jeweiligen

Querbohrung (39, 40) ausgerichtet ist, die in die Wandstruktur (1) gebohrt ist; mehrere ein Gewinde aufweisende zylindrische Stangen (41), von denen jede ausgelegt ist, um in eine jeweilige Querbohrung (39, 40) der Wandstruktur (1) eingeführt zu werden, so dass wenigstens ein freies Ende der Stange (41) von der Bohrung (13, 21, 22, 28, 33) der Platte (8 bis 11) koaxial zu der Querbohrung (39, 40) hervorsteht; Gewindemütter (42) zum Blockieren der Platten (8 bis 11) an den freien Enden der jeweiligen Stangen (41), so dass die Platten (8 bis 11) die Wandstruktur beaufschlagen;

und mehrere geschlossene Schlaufengebinde (12) zum Verbinden jeder Platte (8 bis 11) mit der angrenzenden Platten (8 bis 11), so dass jedes Gebinde (12) durch eine der Ösen (14, 23, 24, 29, 34, 37) der Platten (8 bis 11) und durch eine der Ösen (14, 23, 24, 29, 34, 37) der jeweiligen angrenzenden Platte (8 bis 11) passiert.

11. System nach Anspruch 10, weiter umfassend wenigstens ein Netz (43) aus einem thermoplastischen Material, das ausgelegt ist, um auf die Seite (4a, 5a) der Wandstruktur (1) unter den Platten (8 bis 11) angebracht zu werden.

12. System gemäß Anspruch 10 oder 11, bei dem die Querbohrungen (39, 40) als Durchgangsbohrungen zwischen zwei gegenüberliegenden Seiten (4a, 5a) der Wandstruktur (1) ausgebildet sind; wobei die Platten (8 bis 11) ausgelegt sind, um auf beiden Seiten (4a, 5a) der Wandstruktur (1) angebracht zu werden, so dass jede Platte (8 bis 11) an einer Seite (4a) der Wandstruktur (1) korrespondierend mit wenigstens einer der Querbohrungen (39, 40) zu wenigstens einer anderen Platte (8 bis 11) an der anderen Seite (5a) der Wandstruktur (1) verbunden ist; wobei jede Stange (41) ausgelegt ist, um in die jeweiligen Querbohrungen (39, 40) eingeführt zu werden, so dass ihre freien Enden von den Bohrungen (13, 21, 22, 28, 33) der Platten (8 bis 11) hervorstehen, die korrespondierend zu den Querbohrungen (39, 40) auf beiden Seiten (4a, 5a) der Wandstruktur (1) angebracht sind; wobei jedes Gebinde (12) ausgelegt ist, um Platten (8 bis 11) an derselben Seite (4a, 5a) der Wandstruktur (1) zu verbinden.

13. System gemäß einem der Ansprüche 10 bis 12, bei dem die Ösen (14, 23, 24, 29, 34, 37) jeder Platte (8 bis 11) entlang eines perimetrischen Bereichs der Platte (8 bis 11) angeordnet sind und jede Platte (8 bis 11) mit mehreren U-förmigen Satteln (16) versehen ist, von denen jeder in eine jeweilige Öse (14, 23, 24, 29, 34, 37) eingeführt ist, wobei die konkave Seite (16a) des Sattels (16) dem Umfang (17) der Platte (8 bis 11) in einer derartigen Art und Weise

gegenüberliegt, dass die konvexe Seite (16b) des Sattels (16) über einen Abschnitt eines relativen Gebindes der Gebinde (12) in Gebrauch gewunden wird.

Revendications

1. Procédé de renforcement d'une structure de paroi, ledit procédé comprenant :

- le perçage d'une pluralité de trous transversaux (39, 40) dans la structure de paroi (1) selon une disposition prédéterminée ;
- l'application, sur au moins un côté (4a, 5a) de la structure de paroi (1), d'une pluralité de plaques (8 à 11) qui possèdent chacune au moins un trou traversant respectif (13, 21, 22, 28, 33) et une pluralité d'oeillets respectifs (14, 23, 24, 29, 34, 37) de sorte que le trou (13, 21, 22, 28, 33) de chaque plaque (8 à 11) est sensiblement coaxial à un trou respectif desdits trous transversaux (39, 40) ;
- l'insertion, dans chaque trou transversal (39, 40), d'une barre cylindrique filetée respective (41) de sorte qu'au moins une extrémité libre de celle-ci fait saillie du trou (13, 21, 22, 28, 33) de la plaque (8 à 11) coaxialement au trou transversal (39, 40) ;
- le blocage de chaque plaque (8 à 11) à l'extrémité de la barre associée (41) au moyen d'un écrou fileté (42) de sorte que la plaque (8 à 11) presse contre la structure de paroi (L) ;
- l'injection de mortier dans lesdits trous transversaux (39, 40) ;
- la liaison de chaque plaque (8 à 11) à au moins une partie des plaques adjacentes (8 à 11) au moyen d'éléments de liaison à boucle fermée respectifs (12), qui passent chacun à travers l'un des oeillets (14, 23, 24, 29, 34, 37) de ladite plaque (8 à 11) et l'un des oeillets (14, 23, 24, 29, 34, 37) de la plaque adjacente associée (8 à 11).

2. Procédé selon la revendication 1, ledit procédé comprenant :

- la pose d'un filet (43) de matière thermoplastique sur ledit au moins un côté (4a, 5a) de la structure de paroi (1) ;
- lesdites plaques (8 à 11) étant appliquées sur ledit filet (43).

3. Procédé selon la revendication 1, dans lequel lesdits trous transversaux (39, 40) sont des trous traversants ménagés entre les deux côtés opposés (4a, 5a) de la structure de paroi (1) ; lesdites plaques (8 à 11) étant appliquées des deux côtés de la structure

de paroi (1) de sorte que chaque plaque (8 à 11) située d'un côté (4a) de la structure de paroi (1) est associée, en correspondance avec au moins l'un desdits trous transversaux (39, 40), à au moins une autre plaque (8 à 11) de l'autre côté de la structure de paroi (1) ; chaque barre (41) étant insérée dans le trou transversal respectif (39, 40) de sorte que ses deux extrémités libres font saillie des trous (13, 21, 22, 28, 33) des plaques (8 à 11) appliquées en correspondance dudit trou transversal (39, 40) des deux côtés (4a, 5a) de la structure de paroi (1) ; chaque élément de liaison (12) reliant des plaques (8 à 11) du même côté (4a, 5a) de la structure de paroi (1).

5

10

15

20

25

30

35

40

45

50

55

4. Procédé selon la revendication 3, ledit procédé comprenant :

- la pose, sur chacun desdits deux côtés (4a, 5a) de la structure de paroi (1), d'un filet respectif (43) en matière plastique ;
- lesdites plaques (8 à 11) étant appliquées sur les filets (43) des deux côtés (4a, 5a) de la structure de paroi (1).

5. Procédé selon l'une quelconque des revendications 1 à 4, dans lequel ladite structure de paroi (1) comprend deux parois (2, 3) qui sont reliées l'une à l'autre de manière à former au moins un coin intérieur (4) ; lesdits trous transversaux (39, 40) comprenant des premiers (39) et des seconds (40) trous transversaux ménagés sur des côtés opposés du coin intérieur (4) ; lesdites plaques (8 à 11) comprenant des premières plaques angulaires (9) qui possèdent chacune deux trous traversants (21, 22) ayant des axes qui sont transversaux l'un par rapport à l'autre ; les premières plaques angulaires (9) étant appliquées le long dudit coin intérieur (4) de sorte que les deux trous (21, 22) de chaque première plaque angulaire (9) sont sensiblement coaxiaux, le premier (21), à un trou donné desdits premiers trous transversaux (39) et, l'autre (22), à un trou donné desdits seconds trous transversaux (40).

6. Procédé selon la revendication 3 et 5, dans lequel ladite structure de paroi (1) comporte un coin extérieur (5) correspondant audit coin intérieur (4), les deux coins (4, 5) étant définis sur les deux côtés opposés (4a, 5a) de la structure de paroi (1) ; lesdites plaques (8 à 11) comprenant des plaques plates (8) qui sont appliquées sur le côté (5a) où le coin extérieur (5) est défini ; chacune desdites premières plaques angulaires (8) étant associée, en correspondance avec ledit premier trou transversal (39) donné et ledit second trou transversal (40) donné, à deux plaques plates respectives (8) qui sont appliquées sur des côtés opposés du coin extérieur (5).

7. Procédé selon l'une quelconque des revendications

1 à 6, dans lequel ladite structure de paroi (1) comprend deux parois (2, 3) qui sont reliées entre elles de manière à former un coin extérieur (5) ; lesdites plaques (8-11) comprenant des plaques plates (8) qui sont appliquées sur des côtés opposés dudit coin extérieur (5) ; le procédé comprenant :

- l'application, le long dudit coin extérieur (5), d'une pluralité de secondes plaques angulaires (9) qui possèdent chacune une pluralité respective d'oeillets (23, 24) ;
- la liaison de chaque seconde plaque angulaire (23, 24) à au moins une partie des plaques planes adjacentes (8) et/ou des secondes plaques angulaires adjacentes (9) au moyen d'éléments de liaison à boucle fermée respectifs (12) qui passent chacun à travers l'un des oeillets (14, 23, 24) de ladite seconde plaque angulaire (9) et l'un des oeillets (14, 23, 24) de la plaque adjacente associée (8, 9).

8. Procédé selon l'une quelconque des revendications 1 à 7, ledit procédé comprenant :

- le réglage de la tension de chacun desdits éléments de liaison (12) en fonction de son inclinaison par rapport au sol.

9. Procédé selon l'une quelconque des revendications 1 à 8, dans lequel lesdits éléments de liaison (12) sont faits de bandes d'acier respectives.

10. Système de renforcement d'une structure de paroi (1), ledit système comprenant : une pluralité de plaques (8 à 11), qui comprennent chacune au moins un trou traversant respectif (13, 21, 22, 28, 33) et une pluralité respective d'oeillets (14, 23, 24, 29, 34, 37), lesdites plaques (8 à 11) étant adaptées pour être appliquées sur au moins un côté (4a, 5a) de la structure de paroi (1) de sorte que le trou (13, 21, 22, 28, 33) de chaque plaque (8 à 11) est sensiblement coaxial à un trou transversal respectif (39, 40) percé dans la structure de paroi (1) ; une pluralité de barres cylindriques filetées (41) qui sont chacune adaptées pour être insérées dans un trou transversal respectif (39, 40) de la structure de paroi (1) de sorte qu'au moins une extrémité libre de la barre (41) fait saillie du trou (13, 21, 22, 26, 33) de la plaque (8 à 11) coaxialement au trou transversal (39, 40) ; des écrous filetés (42) servant à bloquer les plaques (8 à 11) au niveau des extrémités libres des barres associées (41) de sorte que les plaques (8 à 11) pressent contre la structure de paroi (1) ; et une pluralité d'éléments de liaison à boucle fermée (12) servant à relier chaque plaque (8 à 11) aux plaques adjacentes (8 à 11) de sorte que chaque élément de liaison (12) passe à travers l'un des oeillets (14, 23, 24, 29, 34, 37) de ladite plaque (8 à 11) et l'un des

oeillets (14, 23, 24, 29, 34, 37) de la plaque adjacente associée (8 à 11).

11. Système selon la revendication 10, ledit système comprenant au moins un filet (43) en matière thermoplastique qui est adapté pour être appliqué sur ledit côté (4a, 5a) de la structure de paroi (1) sous lesdites plaques (8 à 11).

12. Système selon la revendication 10 ou 11, dans lequel lesdits trous transversaux (39, 40) sont des trous traversants ménagés entre deux côtés opposés (4a, 5a) de la structure de paroi (1) ; lesdites plaques (8 à 11) étant adaptées pour être appliquées sur les deux côtés (4a, 5a) de la structure de paroi (1) de sorte que chaque plaque (8 à 11) d'un côté (4a) de la structure de paroi (1) est associée, en correspondance avec au moins un desdits trous transversaux (39, 40), à au moins une autre plaque (8 à 11) sur l'autre côté (5a) de la structure de paroi (1) ; chaque barre (41) étant adaptée pour être insérée dans le trou transversal respectif (39, 40) de sorte que ses extrémités libres font saillies des trous (13, 21, 22, 28, 33) des plaques (8 à 11) appliquées en correspondance avec ledit trou transversal (39, 40) des deux côtés (4a, 5a) de la structure de paroi (1) ; chaque élément de liaison (12) étant adapté pour relier des plaques (8 à 11) du même côté (4a, 5a) de la structure de paroi (1).

13. Système selon l'une quelconque des revendications 10 à 12, dans lequel les oeillets (14, 23, 24, 29, 34, 37) de chaque plaque (8 à 11) sont disposés le long d'une partie périphérique de la plaque (8 à 11) et chaque plaque (8 à 11) est pourvue d'une pluralité d'étriers (16) en forme de U qui sont chacun insérés dans l'un des oeillets respectifs (14, 23, 24, 29, 34, 37), le côté concave (16a) de l'étrier (16) étant tourné vers le périmètre (17) de la plaque (8 à 11) de telle sorte que le côté convexe (16b) de l'étrier (16) est enroulé, en utilisation, par une section d'un élément de liaison associé desdits éléments de liaison (12).

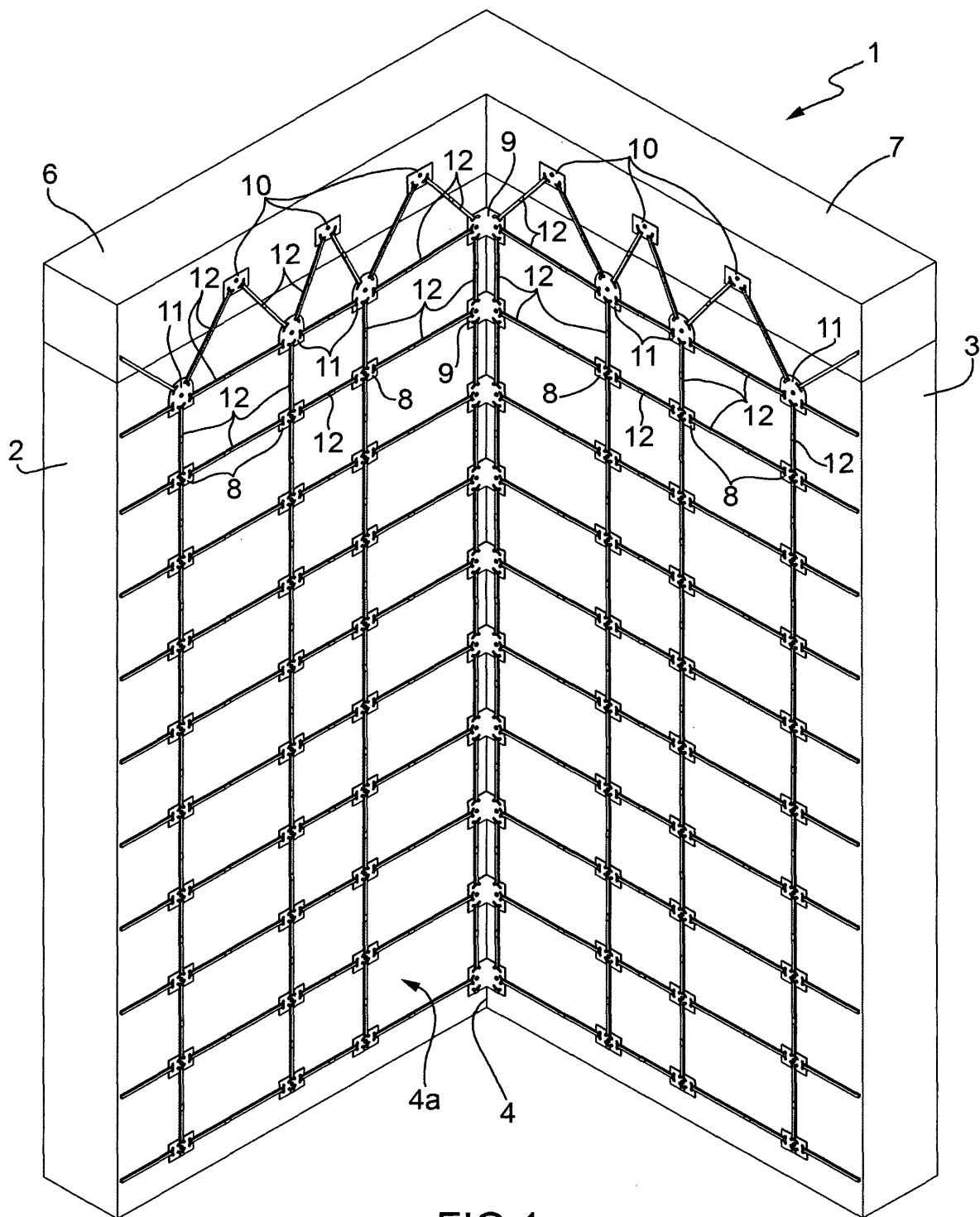


FIG.1

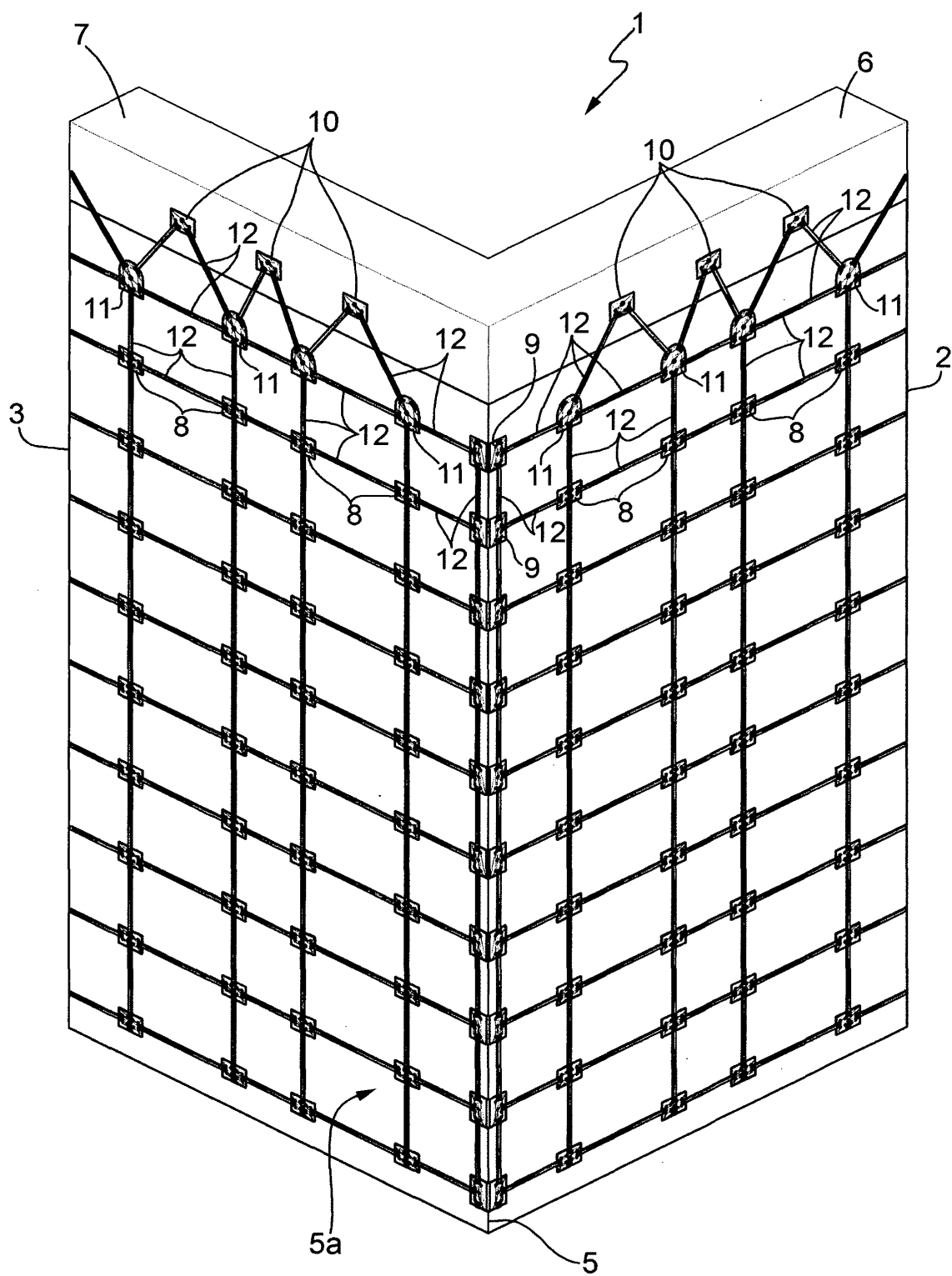


FIG.2

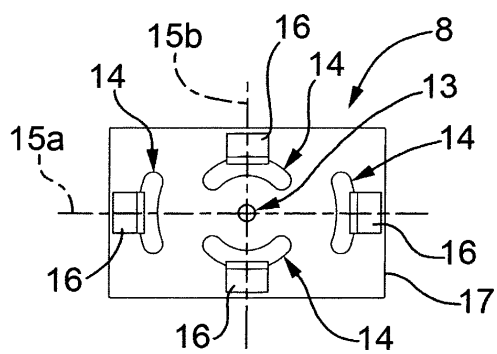


FIG. 3

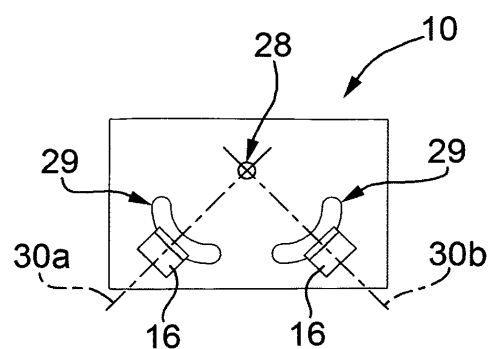


FIG. 5

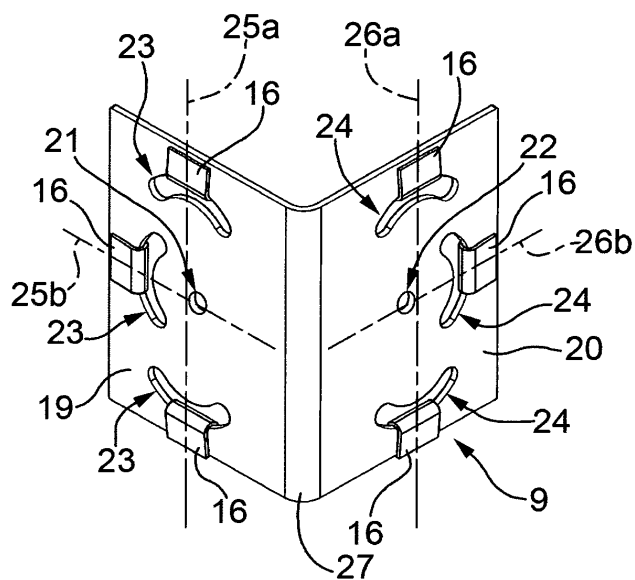


FIG. 4

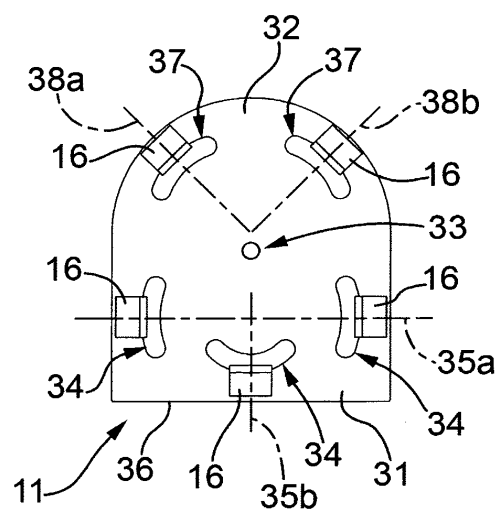


FIG. 6

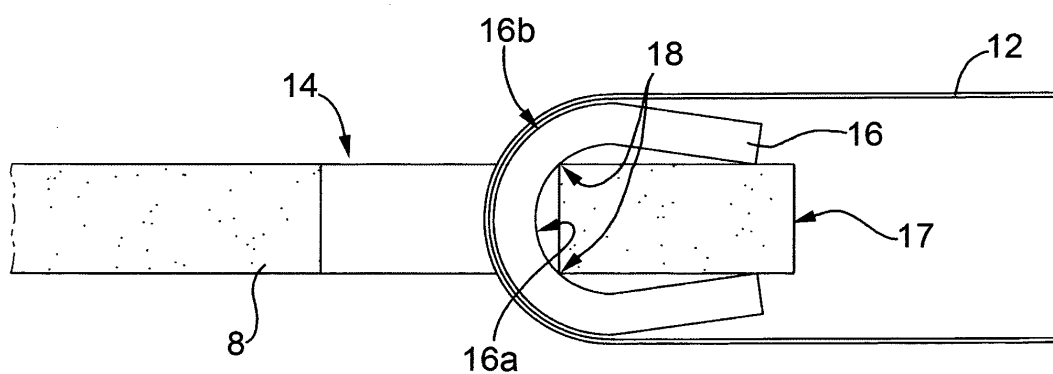


FIG. 7

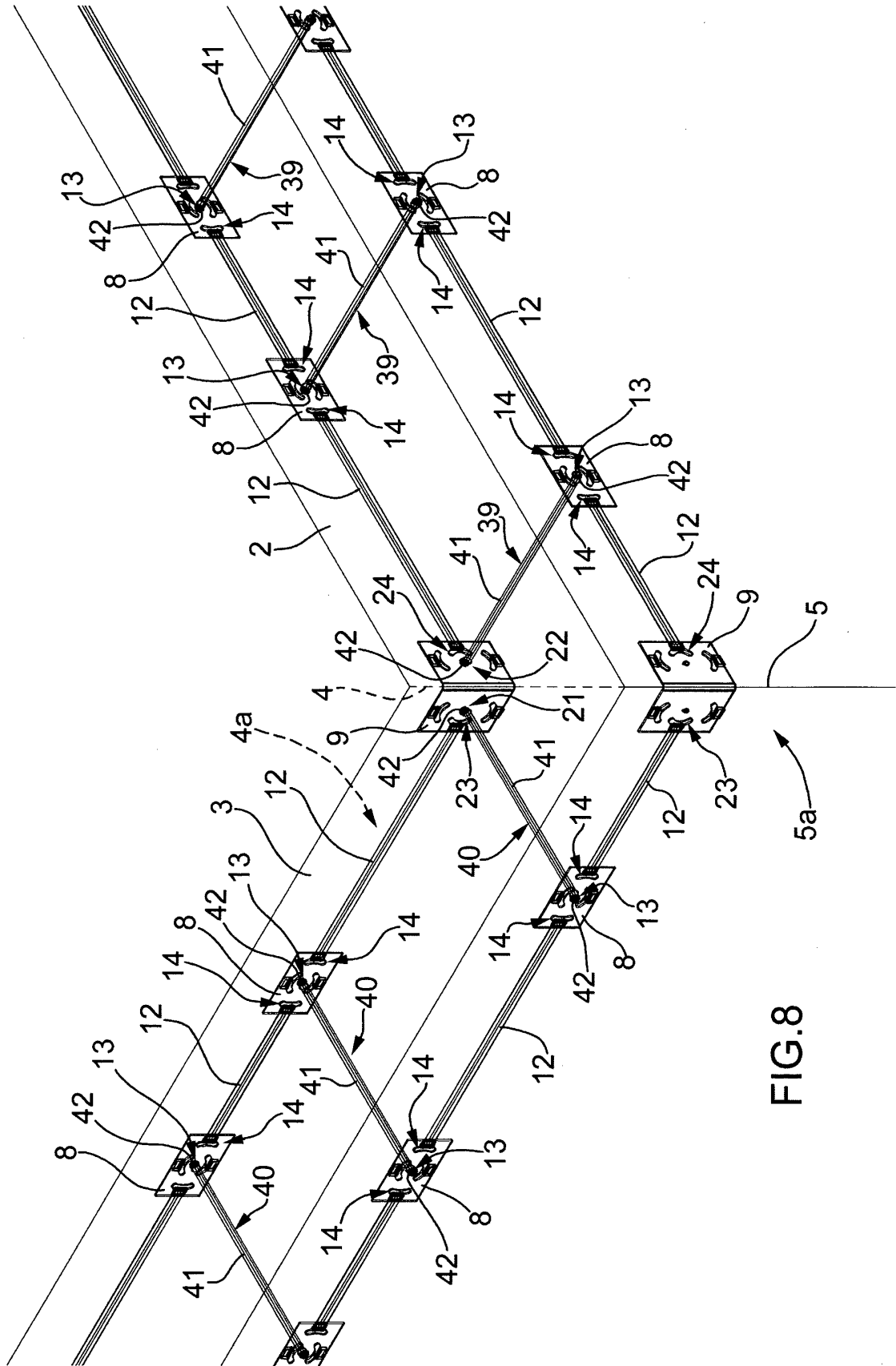


FIG. 8

30/10/2014

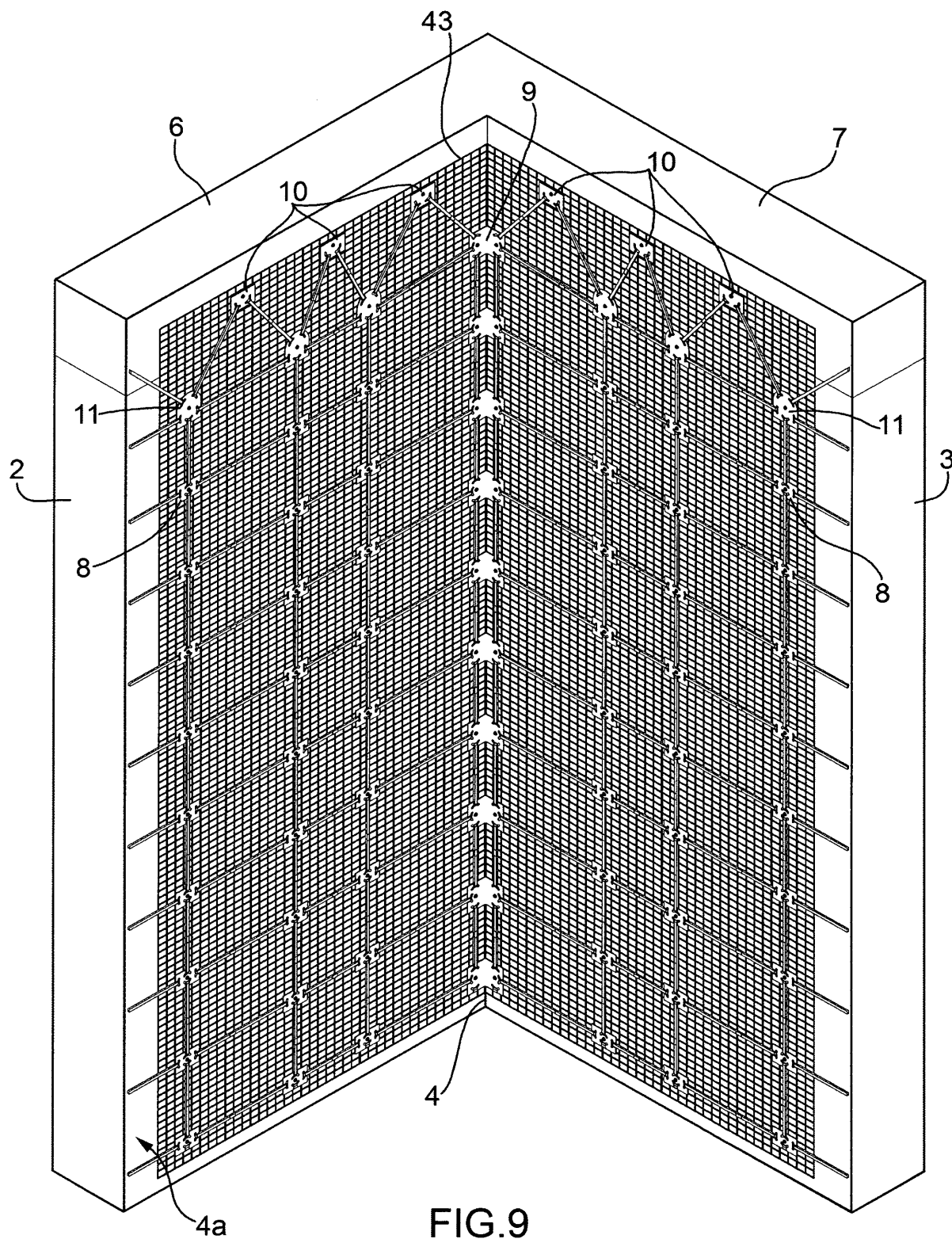


FIG.9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT RM990736 A [0008]
- EP 1170440 A [0009]