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(54) **Mechanically stabilized composite made earthwall**

Mechanisch stabilisierter Erdwall aus Verbundmaterial

Paroi de fondation en composite mécaniquement stabilisé

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Description

Object of the Invention

[0001] The present invention refers to the constituent elements of a mechanically stabilized wall, being such elements made of composite materials. The invention is applicable to the field of civil engineering, both in public works and in housing.

Technical Problem to Be Solved and Background of the Invention

[0002] The construction of mechanically stabilized earth walls is widely known in the state of the art of the technical field, and its development has been remarkable over the last decades.

[0003] These walls are comprised of three elements: flat pieces -i.e. panels- that make up the covering element of the contained earth mass, strips that remain embedded into the embankment, and an element that secures the connection of the strips to the panels.

[0004] The elements traditionally used in the construction of mechanically stabilized walls are made up of concrete and metal materials. Concrete is used in the construction of panels, and the strips are made of metal.

[0005] The use of metal in the manufacturing of strips poses a major problem, since such strips, once inserted in the embankment, are subject to significant corrosion processes, especially if exposed to chemically aggressive environments. This fact requires a fundamental re-orientation of the specific design of the strips; it means moving radically away from the thickness required by the usual calculations, and manufacturing those strips considerably thicker, so as to prevent the loss of section due to local corrosion; thus, considering the significant loss of section suffered by steel during the lifetime of the structure, by manufacturing them thicker the resistant section of the aforementioned strips endures the lifetime of the structure; -the amount of steel that can be lost by the section due to corrosion, while still maintaining a safe structure at the end of the design life, is referred to as 'sacrificial thickness'-.

[0006] The use of concrete panels poses the problem of the increase in weight: lifting this heavy weight requires the use of specific machinery, capable of moving heavy weights, since the panels must be moved in order to be able to place them in their final position inside the mechanically stabilized wall, these movements cannot be performed without the use of such machinery.

[0007] For the construction of mechanically stabilized walls it is necessary to use the aforementioned specific machinery, e.g. a truck crane, in order to place the panels in their final location, as well as the work force of three operators, who should bring extensive experience in the implementation of this type of walls. In this way we can achieve a high level of execution and the proper technical performance of all related procedures, which make the

option of building this type of wall far more advantageous than the construction of other types of walls.

[0008] A good contribution to the state of the art in this field is document ES 1048529 U, which suggests an earth retaining wall consisting of a stackable element provided with a connecting pin, i.e. a metallic tube connecting all the stackable elements, introduced by the same stackable elements and with the connecting pin being in turn fastened to various anchoring wires in order to hold the wall to the earth it retains. Another technical contribution to the state of the art in this technical field is document JP 2008050876 A, which proposes a piece of concrete with anchoring elements to the earth it retains, being these attached to each piece of concrete, whose anchoring wires are made of synthetic resin fiber. Further, WO 99/20846 discloses a wall according to the preamble of claim 1.

[0009] The object of the invention proposes the implementation of all the elements that together make up a mechanically stabilized wall, made of composite materials, offering characteristics of mechanical stability and a greater resistance against corrosion than those found in the current state of the art of the technique. Furthermore, these features reduce the weight of the said elements, thus facilitating their proper placement in the building site.

Description of the Invention

[0010] The present invention refers to the elements that conform a mechanically stabilized wall.

[0011] The wall object of the invention is of a mechanically stabilized type, comprising such wall at least two face panels for an earth mass to be contained, at least one strip embedded into the earth mass to be contained, at least one connector that allows for the longitudinal joint between panels, and at least one connecting profile, allowing fastening the strip to the panel. The wall is **characterized in that** all its elements -panel, strip, connector and connecting profile- are made of composite materials consisting of a matrix to be chosen from a thermostable or thermoplastic resin and a reinforcing agent in the form of yarns and fabrics of a material to be chosen from fiberglass, carbon, basalt or polyparaphenylene terephthalamide.

[0012] In said wall, the panels have a flat shape, with at least one through hole on the inside, with vertical sides that form the visible area of the wall and certain internal ribs that connect the opposite sides of the panel.

[0013] There are two specific embodiments, a first one, in which the through hole in the panels is vertically oriented, and a second one in which the through hole in the panels is horizontally oriented.

[0014] On the wall object of the invention the strips have a flat geometry, in which two dimensions are predominant over a third one. A cut that allows the connection to a connecting profile is included at one end of the strip.

[0015] The connecting profiles attaching the wall to the

strips have "T"-shaped profiles, with the wing of the "T"-shaped profile being thicker in the central area than at the ends.

[0016] In the first embodiment of the wall, the one in which the through hole is vertically oriented, the panels that make up the wall include connecting profiles in their configuration, with each panel and connecting profile forming a single piece.

[0017] In the first embodiment, the panel includes the connectors in a horizontal tongue and groove system, with a male part and a female part of the connector co-forming the panel, thus forming both parts a single piece.

[0018] The horizontal tongue and groove joint of the panels may have different shapes, in one of them the male part is circular and the female part is shaped as a hook, in another one the male part is "T"-shaped whereas the female is square.

[0019] In the second embodiment of the wall, one in which the through hole is horizontally laid, the panels have a vertically tongue and groove system, consisting of a flange and a recess.

[0020] In this second embodiment, the connectors are stand-alone pieces, independent from the panels; thus, the connection between the strips and the panels is made by means of such connectors, and the strips are fastened to the connectors by means of the connecting profiles.

[0021] There is a shape of connectors and connecting profiles in which both are a single piece including an "H"-shaped profile that is the connector and a "T"-shaped profile, which is the connecting profile, wherein the core of the "T"-shaped profile is set next to the core (i.e. as a continuation of) the "H"-shaped profile.

[0022] A different embodiment of this embodiment of profiles and connectors is --done- by forming an integral single piece in which the connecting profiles are independent elements attached to the connector by means of an adhesive, in order to form the aforementioned integral single piece.

[0023] The construction procedure of the wall defined above consists of the following steps:

- preparing the surface where the wall is going to be installed, by doing some digging and leveling the area where the wall will be restated,
- assembling a first row of panels on the leveling area,
- extending and compacting a first layer of a filling material in the backfill of the wall,
- after having compacted the first layer of filling material, a first row of strips is laid,
- continue extending and compacting layers, raising the height of the filling and, at the same time as the level of the filling increases, thus forming an embankment, the panels are laid, forming the wall, and the strips are laid beginning straight-wise and nailing them onto the "tongue" at a set distance from each other in a vertical direction.

Description of Related Figures

[0024] To complete the description and in order to help better understand the features of the invention, there is attached to this specification, as an integral part thereof, a set of drawings wherein by way of illustration and not limitation, the following is represented:

Figure 1 shows a plan view of the panel selected from the wall according to a first embodiment, in which the connecting profiles are embedded into the panels. This figure includes three details: detail 1 of the system for mounting the strips, and details 2 and 3 of the longitudinal tongue and groove pieces according to a first embodiment of that tongue and groove.

Figure 2 shows a perspective view of the wall in Figure 1 (according to the first embodiment).

Figure 3 shows a flat view of one embodiment of the wall wherein the connecting profiles are embedded into the panels. It shows also a tongue and groove system different from Figure 1.

Figure 4 shows a perspective view of two consecutive panels of a wall according to a second embodiment, which includes the connecting profiles along with the connectors that make up an integral single piece separated from the panels. The strips connected to the connecting profiles are reflected in the figure.

Figure 5 shows a perspective view of an integral piece that includes the connector and the connecting profile, such as that of Figure 4.

Figure 6 is a cross-sectional view illustrating an integral piece that includes the connector and the connecting profile, as the second embodiment.

Figure 7 shows a flat view of a connection between the integral piece of the second embodiment in Figures 4 and 5, and a strip.

Figure 8 is a cross-sectional view of a panel according to the second embodiment.

Figure 9 is a perspective view of the embodiment of a curved wall made with straight profiles, with elements arranged according to the second embodiment (connectors and connecting profiles forming a single piece).

Figure 10 is a plan view showing a detail of the joining area between the connectors and the panels when constructing a wall according to Figure 8.

Figures 11 and 12 are plan views showing two variants of the horizontal tongue and groove system that can be included in the panel according to the embodiment in which the connecting profiles are embedded into the panel.

Figure 13 shows a plan view of another variant of the horizontal tongue and groove system for the panels, in the embodiment according to which the wall panels include the connecting profiles, showing two details of such embodiment.

Figure 14 shows a perspective view of the construction of a wall with the panels of Figure 13.

Figure 15 shows a perspective view of the connector and the connecting profile in the embodiment in which the connecting profile is fastened to the connector by means of an adhesive.

Figure 16 shows a cross-sectional view of a wall of a mechanically stabilized type.

[0025] A list of all numerical references used in the Figures herein is shown below:

- 1.- wall,
- 2.- panel,
- 3.- connector,
- 4.- male part,
- 5.- female part,
- 6.- strip,
- 7.-ribs,
- 9.- embankment,
- 10.- cut,
- 11.- side,
- 12.- through hole,
- 13.-T wing,
- 131.- T wing tips
- 132.- T wing central area,
- 14.- T core,
- 15.- H wing,
- 151.- H wing tips,
- 152.- H wing central area,
- 16.- H core,
- 16.- H core central area,
- 17.- flange,
- 18.- recess,
- 19.- leveling screed,
- 20.- landfill
- 21.- adhesive
- 22.- foundation floor,
- 25.- circular appendix
- 26.- channeling
- 27.- connecting profile.

Description of an embodiment of the invention

[0026] A description of an embodiment of the invention follows, with reference to all indications in the Figures.

[0027] Mechanically stabilized walls are made up of four main elements: a panel (2), a connector (3), a connecting profile (27) and a strip (6).

[0028] The panels (2) serve no major structural function, but they ensure local stability of the wall (1) area, they prevent the loss of loose soil from the embankment (9) behind the face of the wall (1), and improve the aesthetic value of the earth wall execution (1). The function performed by the panels (2) is the absorption of the landfill (20) thrusts, by transmitting these thrusts to the strips (6). For a successful and smooth transmission of thrusts, we need to structurally check the panels (2), thus ensur-

ing the integrity of the panels (2) and the local stability of the wall (1).

[0029] The connectors (3) are elements that join panels (2) together in the longitudinal direction of the wall (1). In one embodiment of the panels (2), the connectors (3) are replaced by a horizontal tongue and groove system having a great variety of shapes. The connectors (3) include the connecting profiles (27), which are used to connect a connector (3) to a strip (6). The contour of the connectors (3) and the connecting profiles (27) has two possible shapes: in a first one the connector (3) and the connecting profile (27) is the same piece, thus engaging the strip (6) in the connecting profile, (27) and, in a second one, the connecting profile (27) is a separate piece from the connector (3), which is fastened to the said connector (3) by means of an adhesive (21).

[0030] The strips (6) are elements used for reinforcement (1) and through the friction generated between them and the soil mass, by means of some surface corrugations included in the strips (6), they increase the stability of the wall (1). The resulting effect is analogous to that of increasing soil cohesion: the thrust exerted by the earth mass is counterbalanced by the frictional forces over the surface of the strip (6).

[0031] The constituent elements of this invention, i.e. the panels (2), connectors (3), connecting profile (27) and strips (6), are made of composite materials made from thermoplastic or thermostable polymers, reinforced with fibers, in the form of yarns and fabrics made of materials such as: glass, carbon, polyparaphenylene terephthalamide, basalt, or others with similar characteristics.

[0032] In one embodiment of the invention, the strips (6) have dimensions of 10 cm in width, a thickness of 5.5 mm and variable length. In order to improve adhesion of the strip (6) to the ground, the surface of the strip (6) is pre-treated with either a "peel-ply" surface treatment -i.e. an adhesive, tightly-woven fabric that is laid-up on the outermost surfaces of the composite material in order to increase its roughness- or, with the application of some presses in the last stage of the manufacturing process of the strips (6), so that the strips (6) have certain corrugations of several millimeters in thick on their surface.

[0033] Figure 1 shows the plan view of a first embodiment of a mechanically stabilized wall (1), with a configuration such that the panel (2) incorporates a horizontal, tongue and groove system. In this figure we can see 3 configuration details for this embodiment of the wall (1). This figure shows the shape and dimensions of the panels (2) according to an embodiment; there are some rectangular panels (2) of 1200 mm in height, 900 mm in width, and 80 mm in thickness. The interior of the panel (2) is hollow (12), leaving a laminate thickness in the side (11) of the panel (2) of 4 mm. In addition, there are a number of ribs (7) -also of 4 mm in thickness-, connecting the sides (11) of the panel (2) and increasing the rigidity of said panels (2). The through holes (12), according to this first embodiment, are vertically laid according to the

mounting direction of the panel (2).

[0034] According to the embodiment depicted in Figure 1, we can see the connecting profiles (27) incorporated into the panel (2) through the inner part of the wall (1), and laid perpendicularly to the panel (2), as some continuous profiles extended along the full height of the panel (2). So that when the wall (1) is completed, the connecting profiles (27) become embedded within the embankment (9) supported by the wall (1). At different heights of the connecting profile (27), the strips are mounted (6); these strips are embedded in the embankment (9), when the wall (1) reaches its final height. There are several possibilities to organize the panels (2) in this way, since they incorporate a greater or lesser number of connecting profiles (27), arranged along the full length of the panel (2).

[0035] The shape of the connecting profiles (27) in this embodiment, whose section is shown in detail 1 of Figure 1, is a "T"-shape. In that section, the T wing (13) is the area of the connecting profile (27) that connects to the strip (6), thus being the core of the connectors (3) perpendicular to the panel (2). According to one embodiment, the dimensions of the aforementioned connecting profiles (27) are the ones detailed here: the thickness of the T wing (13) varies from 7 mm in the T wing tip (131) up to 16 mm in the central area of the T wing (132); the said T wing (13) is symmetrical and has a total length of 50 mm (with two symmetrical parts of 25 mm), the T core (14) has a thickness of 8 mm and a length of 28 mm.

[0036] Details 2 and 3 of Figure 1 show the horizontal tongue and groove system that serves to connect panels (2) to each other, according to this embodiment of the invention. The system comprises, at one end of the panel (2), a male connector (4) of circular type -which, according to this embodiment, has a maximum radius of 28 mm- and, at the opposite end, a female connector (5) in the form of a clamp or hook, as appropriate -which, according to the same embodiment, has a radius of 29 mm-.

[0037] There are other multiple embodiments of the horizontal tongue and groove system for joining the panels (2) to each other. In one of them, the male part (4) is "T" shaped and the female part (5) is a square clamp that embraces the "T"-shaped male part (4). This variation of horizontal tongue and groove is reflected in Figure 3.

[0038] Figures 11, 12 and 13 show other embodiments of the horizontal tongue and groove system. In these three embodiments, the male part (4) is circular in shape but different to each other in the size of the circular piece and in the shape of the panel (2) in areas close to the male (4) and female (5) parts. In the embodiment of Figures 11 and 13, the panel (2), in those areas where the horizontal tongue and groove elements are located, is triangular in shape, according to a plan view, with the tongue and groove elements at a vertex of the triangle. In the embodiment depicted by Figure 12, the panel (2) is square, ending in the circular element that makes up the male part (4). In all three cases, the tongue and groove elements are outwardly oriented, in the case of the male part (4), and incorporated into the inner part of

the panel (2) in the case of the female part (5).

[0039] In the embodiment of Figure 13, the female part (5) consists of a single circular appendage (25), which allows for the placing of panels (2) at 90° between them.

The apex of the panel (2) on which the male part (4) is placed has a channeling (26) wherein the end area of the circular appendix (25) of the female part (5) is inserted, when the panels (2) are mounted perfectly aligned.

[0040] Figure 2 shows a perspective view of a panel (2) according to the embodiment of Figure 1 of the wall (1), with a sectioned panel (2), a connecting profile (27) included in the panel (2) and a sectioned strip (6), already placed in the connecting profile (27).

[0041] Figure 4 shows a different embodiment of the wall (1), in which the connectors (3) are independent pieces with a double function. In this embodiment, Figure 4 shows the connectors (3) including the connecting profiles (27) in the same piece, thus serving to both connect the panels (2) to each other and connect the strips (6) to the panels (2). Connectors (3) are manufactured by means of a pultrusion process. In this embodiment, the strips (6) do not vary with respect to the other embodiment.

[0042] Figure 5 shows a perspective view of a connector (3) with the connecting profile (27) included, one of those used in the execution of the wall (1) according to the embodiment seen in Figure 4. The section of the connector (3) (shown in Figure 6) has an "H"-shaped profile and the section of the connecting profile (27) has a "T"-shaped profile. The shape of the integral piece formed by both profiles is defined as being the core of the "T"-shaped profile (14) a continuation of the core of the "H"-shaped profile (16).

[0043] The joining of the strips (6) to the wall (1) is done by means of the connecting profile (27).

[0044] The dimensions of the profile resulting from the joining of the connector (3) and the connecting profile (27) of Figure 6, in one embodiment, are as follows: in the "H"-shaped profile, the core (16) has a section of 6 mm in thickness in the central area (161), which increases up to 10 mm in the 8 mm closest to the wings (15) of the "H"-shaped profile, being the total length of the core (16) 80mm. The wings (15) of the "H"-shaped profile are symmetrical with regard to the center of the core (16), showing a thickness of 6 mm at the 12 mm outermost tips (151) of the wing (15), increasing such thickness up to 8 mm in its central area (152), towards the axis of symmetry of such wing (15), the total length of the wing (15) is 50 mm (two symmetrical parts of 25 mm each). The "T"-shaped profile, is positioned so that the core (14) of the "T"-shaped profile is a continuation of the core (16) of the "H"-shaped profile. The "T"-shaped profile has a core (14) of 8 mm thick and 28 mm length, and a wing (13), symmetric about the core (14), whose thickness ranges from 6 mm at the tip (131) to 16 mm in the central area (132), having a central area (132) of 8 mm, i.e. 4 mm on each side of an axis of symmetry originated at the center of the core (14) of the "T"-shaped profile, with

a constant thickness of 16 mm. The 10 mm in thickness that the wing (13) in the T increases, are increased in 21 mm along the path in the aforementioned T wing (13). The total length of the wing (13) of the "T"-shaped profile is 50 mm (25 mm on each side of said axis of symmetry).

[0045] Figure 7 shows a plan view at the connection between a connecting profile (27) and a strip (6). The strip (6) shows a T-shaped cut (10) at the end of the strip (6) that facilitates the connection between the strip (6) and the connecting profile (27) formed by a "T" shaped profile. The geometry of the strip (6) is a flat geometry, such that two of its dimensions are predominant over the third dimension.

[0046] Figure 14 shows a Wall constructed with panels (2) according to the second embodiment, in particular with the panels (2) that appear in Figure 13, however that embodiment is valid for walls built with any panel (2) having embedded connecting profiles (27), with different embodiments of the horizontal tongue and groove that are reflected in Figures 11 and 12.

[0047] Figure 15 shows a different configuration of the assembly piece made up of by a connector (3) and a connecting profile (27), in which the connecting profile (27) is a not a "T"-shaped profile continuous throughout the length of the connector (3), but a "G"- or "C"-shaped profile that is fixed by an adhesive (21) in the position wherein a strip (6) is going to be placed on the outside area of one of the wings (15) of the "H"-shaped profile making up the connectors (3). This embodiment is limited to loading conditions supported by the adhesive (21) used to fix the connecting profiles (27) to the connector (3).

[0048] The characteristics of the adhesive (21) used for fixing the connecting profiles (27) to the connector (3) are: a minimum tensile strength of 70 MPa and a minimum shear strength of 10 MPa.

[0049] In the embodiment according to which the panels (2) require independent connectors (3) for their longitudinal joint, the panels (2) have a vertical tongue and groove system to vertically connect the various panels (2), consisting of the existence of a flange (17) and a recess (18) at both the top and the bottom of the panel (2), respectively. A sectional view of the panel (2) of this embodiment is reflected in Figure 8.

[0050] The fact that the panels (2) have at least one through hole (12) therein, contributes to them being so lightweight, and allows for the manual placement of the panels (2) that make up the wall (1) during the construction of the wall (1), thus being it indispensable the participation of workers capable of handling the panels (2), and not requiring the use of machinery for the placement of said panels (2).

[0051] The construction of the wall (1), in any of the embodiments set forth above, follows the following steps:

A) Firstly, it is necessary to prepare the ground wherein the wall (1) is going to be built. This will require performing the necessary excavations. Addi-

tionally, the necessary area to fit the leveling screed (19) must be prepared.

The leveling screed (19), where the wall (1) is placed, serves as a supporting substrate and fixing surface for the installation of the first row of panels (2), its smooth and leveled surface serves to ensure that the panels (2) of the wall (1) are perfectly aligned and horizontal.

B) Once the leveling screed (19) is finished, and the layout of the wall (1) has been marked, it is made the assembly of the first row of panels (2). The assembly of the first row of panels (2) is done by placing panels (2) of two different heights, one after the other (of 120 cm and 60 cm).

Once the entire first row is finished, the vertical and horizontal levels of the panels (2) are checked, leaving an inclination inward of 1 cm at the panels (2) of 120 cm, and 0.5 cm in the panels (2) of 60 cm, and then the whole row is underpinning. Similarly is done with the connectors (3), if the wall (1) is executed according to this embodiment.

In the event that the level of the panels (2) and/or connectors (3) is not the correct one, the following corrective measures may be taken:

- Horizontality corrections to the panels (2) are made through the use of wooden wedges.
- Additionally, a few rounds (i.e. steel bars of small diameter) can be installed, which allow to ensure that the panels (2) and connectors (3) remain in place;
- Small displacements have to be provided to the panels (2) once positioned on the leveling screed (19) or over another panels (2); this is performed without damaging the panels (2) themselves.

C) Once the first row of panels (2) for the wall (1) has been completely installed, the next step in the construction of the wall is spread and compact the filling (20) in layers of 30 cm thickness each.

Once the layers have been extended, the compaction of these layers is the next step, following the existing construction procedures. The finishing of each layer is the correct one when the strips (6), if any, are leaning properly and fully over the filling (20). In the areas closest to the face of the wall (1) it is necessary to use smaller compaction rollers than in the compaction of the remainder of the embankment (9) and in the 50 cm closest to the face of the wall (1) it is necessary to use vibrating trays. This is done in order to avoid any possible damages in the face of the

wall (1) due to the effect of vibration. The strips (6) are placed perpendicular to the face of the wall (1) in the connectors (3).

D) After the first layer of filling (20) material has been compacted, the first row of strips (6) is laid. As the

height of the embankment increases further (9), the panels (2) are laid in order to construct and support the wall (1); at the same time, in the extrados, we continue spreading and compacting soil and placing the strips (6) every 60 cm in a vertical direction. The procedure is continued until the wall (1) is finished. In the building of the wall (1) the panels (2) are assembled on each other. Panels (2) of 120 cm are mounted on top of each other, which allows to raise the wall (1) without the need for a particular device, since the geometrical configuration of the panels (2) allows for the compact stacking thereof. The last row of panels (2) installed -the top of the embankment (9)- shall consist of panels (2) of 2 different heights so that at the top of the wall (1) a uniform horizontal alignment (2) is obtained.

[0052] The present invention should not be limited to the embodiment described herein. Other shapes can be made by those skilled in the art in view of the present description. Accordingly, the scope of the invention is defined by the following claims.

Claims

1. A mechanically stabilized Wall (1) comprising:

- at least two facing panels (2) of an earth mass to be contained,
- at least one strip (6) embedded into the earth mass to be contained,
- at least one connector (3) that allows for the longitudinal joining amongst the panels (2), and
- at least one connecting profile (27), which allows for the connection between the strip (6) and the panel (2),

characterized in that.

- the panels (2), the strip (6), the connector (3) and the connecting profile (27) are made of composite materials consisting of a matrix to be chosen from either thermostable or thermoplastic resins, plus a reinforcing agent in the form of yarns or fabrics made of a material to be chosen from fiberglass, carbon, basalt or polyparaphenylene terephthalamide,
- the panels (2) have a flat configuration, and they include (2) at least one through hole (12) therein, vertical sides (11) making up the visible area of the wall (1), and internal ribs (7) joining the opposite sides (11) of the panel (2).

2. A Wall (1) according to claim 1, **characterized in that** the strips (6) have a flat geometry, in which two dimensions are predominant over the third one, including a cut (10) at one end of the strip (6) that

allows the connection to a connecting profile (27).

3. A Wall (1) according to any of the preceding claims, **characterized in that** the through hole (12) in the panels (2) is vertically oriented.

4. A Wall (1) according to claims 1 to 3, **characterized in that** the connecting profiles (27) comprise a "T" shape, with the T wing (13) thicker in the central area (132) than at the tips (131).

5. A Wall (1) according to any of the preceding claims, **characterized in that** the panel (2) includes the connecting profiles (27) in its configuration, the panel (2) and the connecting profiles (27) forming a single piece.

6. A Wall (1) according to any of the preceding claims, **characterized in that** the panel (2) includes the connectors (3) in its configuration, as a horizontal tongue and groove system, with the panel (2) and the connectors (27) forming a single piece.

7. A Wall (1) according to claim 6, **characterized in that** the horizontal tongue and groove system comprises a male part (4) of circular shape and a female part (5) shaped as a hook.

8. A Wall (1) according to claim 6, **characterized in that** the horizontal tongue and groove system comprises a male part (4) shaped as a "T" and a female part (5) with a square shape.

9. A Wall (1) according to claims 1 to 2, **characterized in that** the through hole (12) within the panels (2) is horizontally oriented.

10. A Wall (1) according to claim 9, **characterized in that** the panels (2) comprise a vertical tongue and groove system.

11. A Wall (1) according to claims 9 and 10, **characterized in that** the vertical tongue and groove system of the panels (2) comprises a flange (17) and a recess (18).

12. A Wall (1) according to any of claims 9 to 11 **characterized in that** the connectors (3) are independent pieces from the panels (2); being such connectors (3) the joining pieces between the various panels (2) and fastening the strips (6) to the aforementioned connectors (3) by means of the connecting profiles (27).

13. A Wall (1) according to any of claims 9 to 12, **characterized in that** the connectors (3) and the connecting profiles (27) are a single piece comprising a configuration of an "H"-shaped profile which is the

connector (3) and a "T"-shaped profile, which is the connecting profile (27), wherein the core (14) of the "T"-shaped profile is set immediately next to the core (16) of the "H"-shaped profile.

14. A Wall (1) according to any of claims 9 to 13, **characterized in that** the connecting profiles (27) are independent elements that are attached to the connector (3) by an adhesive (21), in order to form an integral single piece.

15. A Procedure for constructing a mechanically stabilized wall (1) according to any of the preceding claims, **characterized in that** it comprises the following steps:

A. preparing the ground wherein the wall (1) is going to be built, doing some digging and preparing an area for a leveling screed (19), wherein the wall (1) is placed,
B. assembling a first row of panels (2) on the leveling screed (19),
C. spreading and compacting a first layer of a filling (20) material in the backfill of the wall (1),
D. after compacting the first layer of the filling (20) a first row of strips (6) is placed,
E. continuing spreading and compacting the layers, thus raising the height of the filling (20) and, in turn, as the height of the filling (20) increases further, an embankment (9) is formed where the panels (2) are laid, thus forming the wall (1) and the strips (6) are laid at a set distance from each other in a vertical direction.

Patentansprüche

1. Mechanisch stabilisierte Wand (1) mit:

- mindestens zwei sich gegenüberliegenden Füllwänden (2) für eine aufzunehmende Erdmasse,
- mindestens einer Leiste (6), die in die aufzunehmenden Erdmasse eingebettet ist,
- mindestens einem Verbinder (3), der das Verbinden der Füllwände (2) in Längsrichtung ermöglicht, und
- mindestens einem Verbindungsprofil (27), welches die Verbindung zwischen der Leiste (6) und der Füllwand (2) ermöglicht,

dadurch gekennzeichnet, dass

- die Füllwände (2), die Leiste (6), der Verbinder (3) und das Verbindungsprofil (27) aus Verbundwerkstoffen hergestellt sind bestehend aus einer Grundsubstanz ausgewählt aus entweder wärmebeständigen oder thermoplastischen

Harzen und einem Verstärkungsmittel in Form von Garnen oder Geweben aus einem Material gewählt aus Fiberglas, Karbon, Basalt oder Polyparaphenylenterephthalamid,

- die Füllwände (2) flach sind und mindestens ein Durchgangsloch (12) aufweisen, wobei senkrechte Seiten (11) den sichtbaren Bereich der Wand (1) darstellen, und innere Rippen (7) die gegenüberliegenden Seiten (11) der Füllwand (2) miteinander verbinden.

2. Wand (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Leisten (6) eine flache Gestalt aufweisen, wobei zwei Dimensionen gegenüber der dritten prädominant sind, wobei die Leisten (6) an einem Ende einen Schnitt (10) aufweisen, der die Verbindung mit einem Verbindungsprofil (27) ermöglicht.

3. Wand (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** das Durchgangsloch (12) in den Füllwänden (2) vertikal orientiert ist.

4. Wand (1) nach den Ansprüchen 1 bis 3, **dadurch gekennzeichnet, dass** die Verbindungsprofile (27) "T"-förmig sind, wobei der T-Flügel (13) im mittleren Bereich (132) dicker ist als an den Spitzen (131).

5. Wand (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Füllwand (2) die Verbindungsprofile (27) in ihrem Aufbau umfasst, wobei die Füllwand (2) und die Verbindungsprofile (27) einstückig ausgeformt sind.

6. Wand (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Füllwand (2) die Verbinder (3) in ihrem Aufbau umfasst, als ein horizontales Nut-und-Feder-System, wobei die Füllwand (2) und die Verbinder (27) einstückig ausgeformt sind.

7. Wand (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** das horizontale Nut-und-Feder-System einen männlichen Teil (4) mit kreisrunder Form und einen weiblichen Teil (5) in Form eines Hakens aufweist.

8. Wand (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** das horizontale Nut-und-Feder-System einen männlichen Teil (4) in Form eines T's und einen weiblichen Teil (5) mit quadratischer Form aufweist.

9. Wand (1) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** das Durchgangsloch (12) in den Füllwänden (2) horizontal orientiert ist.

10. Wand (1) nach Anspruch 9, **dadurch gekennzeichnet, dass** die Füllwände (2) ein vertikales Nut-und-Feder-System aufweisen.

11. Wand (1) nach den Ansprüchen 9 und 10, **dadurch gekennzeichnet, dass** das vertikale Nut-und-Feder-System der Füllwände (2) einen Flansch (17) und einen Rücksprung (18) aufweist.
12. Wand (1) nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** die Verbinder (3) von den Füllwänden (2) unabhängige Teile sind, wobei die Verbindungsteile zwischen den verschiedenen Füllwänden (2) angeordnet sind und die Leisten (6) mit den vorgenannten Verbindern (3) durch die Verbindungsprofile (27) verbunden sind.
13. Wand (1) nach einem der Ansprüche 9 bis 12, **dadurch gekennzeichnet, dass** die Verbinder (3) und die Verbindungsprofile (27) ein einziges Teil bilden, das ein "H"-förmiges Profil bildet, welches der Verbinder (3) ist, und ein "T"-förmiges Profil, welches das Verbindungsprofil (27) darstellt, wobei der Kern (14) des "T"-förmigen Profils in unmittelbarer Nähe des Kerns (16) des "H"-förmigen Profils positioniert ist.
14. Wand (1) nach einem der Ansprüche 9 bis 13, **dadurch gekennzeichnet, dass** die Verbindungsprofile (27) unabhängige Elemente sind, die an dem Verbinder (3) mit einem Kleber (21) befestigt sind, um ein einziges Stück zu bilden.
15. Verfahren zum Bilden einer mechanisch stabilisierten Wand (1) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** es folgende Schritte aufweist:
- A. Vorbereiten des Bodens, auf dem die Wand (1) errichtet wird, Graben und Vorbereiten eines Bereichs für einen Ausgleichsestrich (19), auf dem die Wand (1) angeordnet wird,
- B. Zusammensetzen einer ersten Reihe von Füllwänden (2) auf dem Ausgleichsestrich (19),
- C. Ausbreiten und Verdichten einer ersten Schicht eines Füllmaterials (20) in der Auffüllung der Wand (1),
- D. Plazieren einer ersten Reihe von Leisten (6) nach dem Verfestigen der ersten Schicht Füllmaterial (20),
- E. Fortsetzen des Ausbreitens und Verdichtens der Schichten, wodurch die Höhe der Füllung (20) erhöht wird, und wodurch somit, wenn die Höhe der Füllung (20) weiter steigt, ein Damm (9) gebildet wird, wo die Füllwände (2) angeordnet sind, wodurch die Wand (1) gebildet wird, und die Leisten (6) in Vertikalrichtung in einem vorgegebenen Abstand voneinander angeordnet sind.

Revendications

1. Mur mécaniquement stabilisé (1) comportant :

- au moins deux panneaux de parement (2) d'une masse de terre devant être contenue,
- au moins une bande (6) incluse dans la masse de terre devant être contenue,
- au moins un connecteur (3) qui permet la jonction longitudinale des panneaux (2), et
- au moins un profilé de raccordement (27), qui permet le raccordement entre la bande (6) et le panneau (2),

caractérisé en ce que

- les panneaux (2), la bande (6), le connecteur (3) et le profilé de raccordement (27) sont fabriqués dans des matériaux composites se composant d'une matrice devant être choisie parmi des résines thermostables ou thermoplastiques, plus un agent de renfort sous forme de fils ou de tissus composés d'une matière devant être choisie parmi la fibre de verre, le carbone, le basalte ou le téréphthalamide de polypara-phénylène,
- les panneaux (2) ont une configuration plate, et ils comprennent (2) au moins un trou débouchant (12), des côtés verticaux (11) constituant la zone visible du mur (1), et des nervures internes (7) reliant les côtés opposés (11) du panneau (2).

2. Mur (1) selon la revendication 1, **caractérisé en ce que** les bandes (6) ont une géométrie plate, dans laquelle deux dimensions sont prédominantes par rapport à la troisième, comprenant une découpe (10) à une extrémité de la bande (6) qui permet le raccordement à un profilé de raccordement (27).
3. Mur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le trou débouchant (12) dans les panneaux (2) est verticalement orienté.
4. Mur (1) selon les revendications 1 à 3, **caractérisé en ce que** les profilés de raccordement (27) comportent une forme en « T », avec l'aile du T (13) plus épaisse dans la zone centrale (132) qu'aux extrémités (131) .
5. Mur (1) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le panneau (2) comprend les profilés de raccordement (27) dans sa configuration, le panneau (2) et les profilés de raccordement (27) formant une unique pièce.
6. Mur (1) selon l'une quelconque des revendications

- précédentes, **caractérisé en ce que** le panneau (2) comprend les connecteurs (3) dans sa configuration, sous la forme d'un système à rainure et languette horizontal, avec le panneau (2) et les connecteurs (27) formant une unique pièce. 5
7. Mur (1) selon la revendication 6, **caractérisé en ce que** le système à rainure et languette horizontal comporte une partie mâle (4) de forme circulaire et une partie femelle (5) sous la forme d'un crochet. 10
8. Mur (1) selon la revendication 6, **caractérisé en ce que** le système à rainure et languette horizontal comporte une partie mâle (4) sous la forme d'un « T » et une partie femelle (5) avec une forme carrée. 15
9. Mur (1) selon les revendications 1 à 2, **caractérisé en ce que** le trou débouchant (12) dans les panneaux (2) est orienté horizontalement. 20
10. Mur (1) selon la revendication 9, **caractérisé en ce que** les panneaux (2) comportent un système à rainure et languette vertical. 25
11. Mur (1) selon les revendications 9 et 10, **caractérisé en ce que** le système à rainure et languette vertical des panneaux (2) comporte une bride (17) et un renforcement (18). 30
12. Mur (1) selon l'une quelconque des revendications 9 à 11, **caractérisé en ce que** les connecteurs (3) sont des pièces indépendantes des panneaux (2) ; les pièces de jonction étant ces connecteurs (3) entre les différents panneaux (2) et fixant les bandes (6) aux connecteurs mentionnés ci-dessus (3) au moyen des profilés de raccordement (27). 35
13. Mur (1) selon l'une quelconque des revendications 9 à 12, **caractérisé en ce que** les connecteurs (3) et les profilés de raccordement (27) sont une unique pièce comportant une configuration d'un profil en forme de « H » qui est le connecteur (3) et d'un profil en forme de « T », qui est le profilé de raccordement (27), dans lequel l'âme (14) du profil en forme de « T » est placé immédiatement à la suite de l'âme (16) du profil en forme de « H ». 40 45
14. Mur (1) selon l'une quelconque des revendications 9 à 13, **caractérisé en ce que** les profilés de raccordement (27) sont des éléments indépendants qui sont fixés sur le connecteur (3) par un adhésif (21), afin de former une unique pièce intégrale. 50
15. Procédure de construction d'un mur mécaniquement stabilisé (1) selon l'une quelconque des revendications précédentes, **caractérisée en ce qu'elle** comporte les étapes suivantes : 55

- A. préparation du sol où le mur (1) va être construit, en creusant légèrement et en préparant une zone pour une couche de mise à niveau (19), où le mur (1) est placé,
- B. assemblage d'une première rangée de panneaux (2) sur la couche de mise à niveau (19),
- C. étalement et compactage d'une première couche de matière de remplissage (20) dans l'épaisseur du mur (1),
- D. après le compactage de la première couche du remplissage (20), une première rangée de bandes (6) est placée,
- E. poursuite de l'étalement et du compactage des couches, en élevant ainsi la hauteur du remplissage (20) et, à son tour, lorsque la hauteur du remplissage (20) augmente encore, un remblai (9) est formé où les panneaux (2) sont posés, en formant ainsi le mur (1) et les bandes (6) sont posés à une distance déterminée l'un par rapport à l'autre dans une direction verticale.

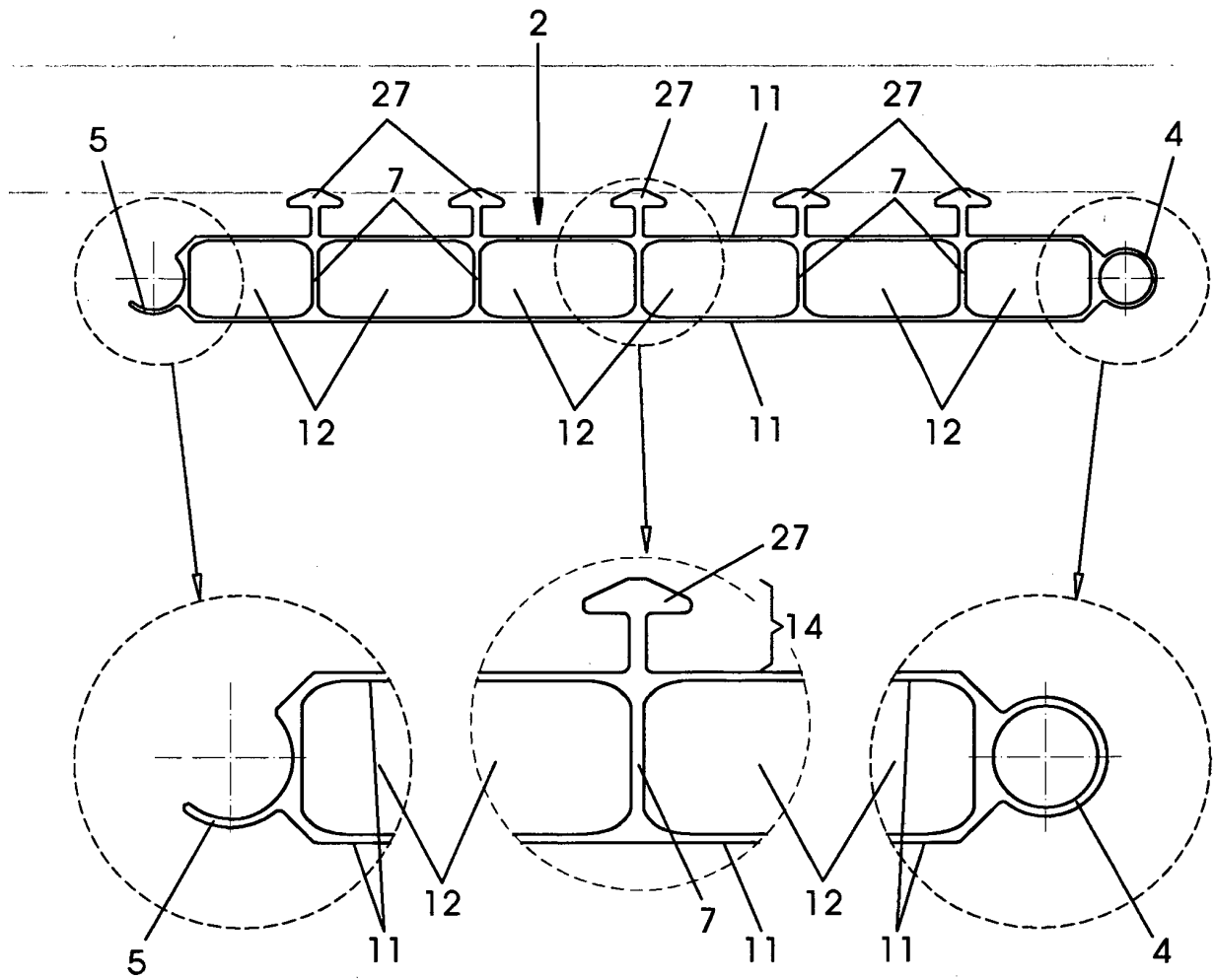


FIG. 1

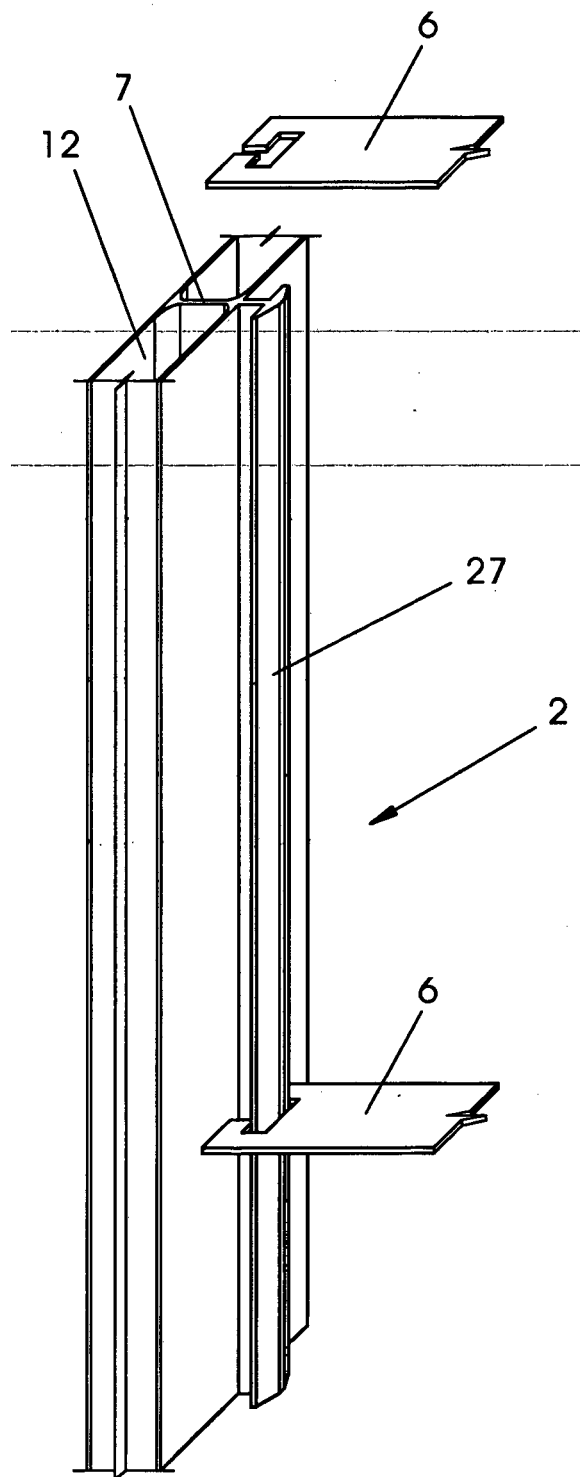


FIG. 2

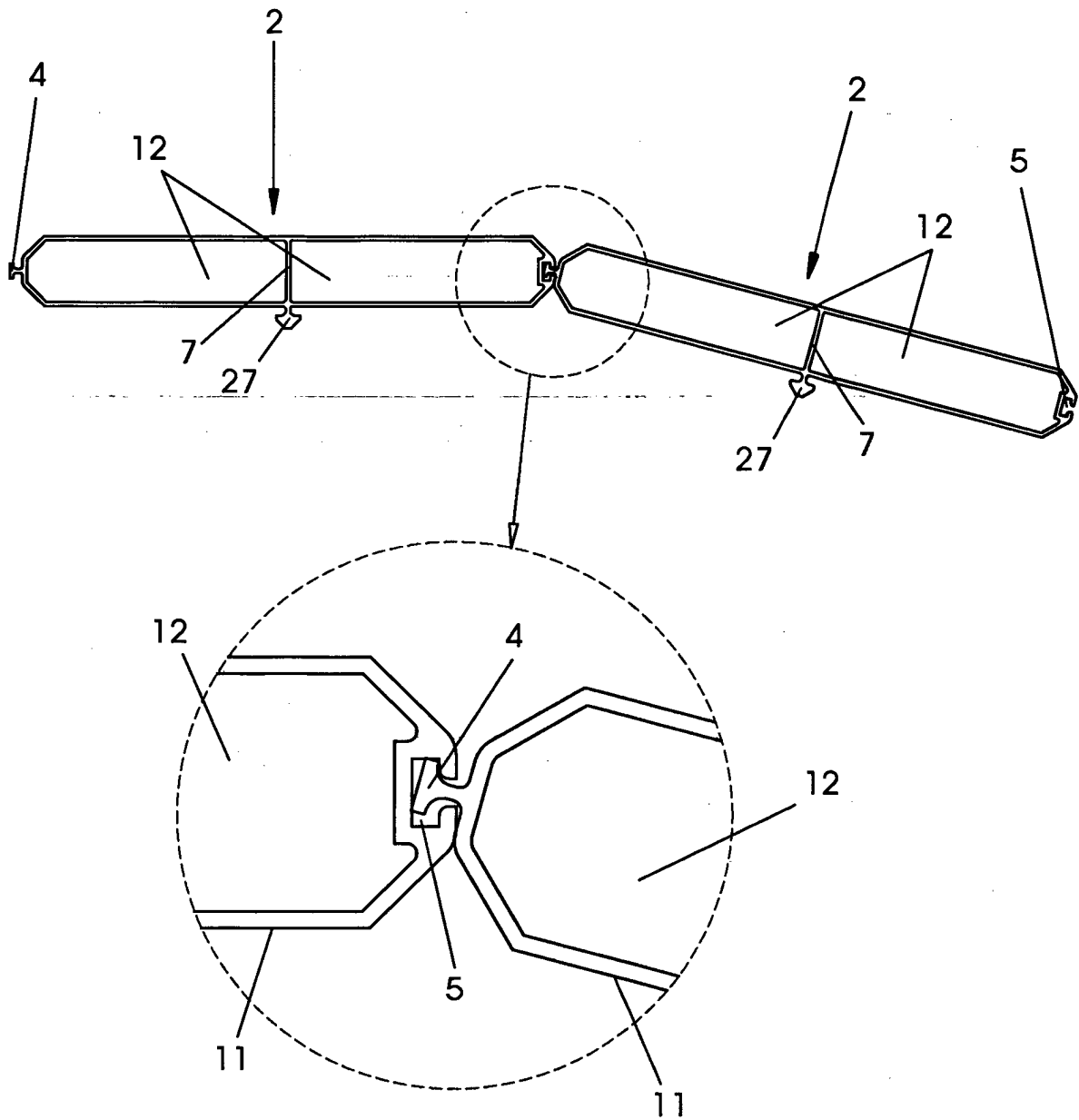


FIG. 3

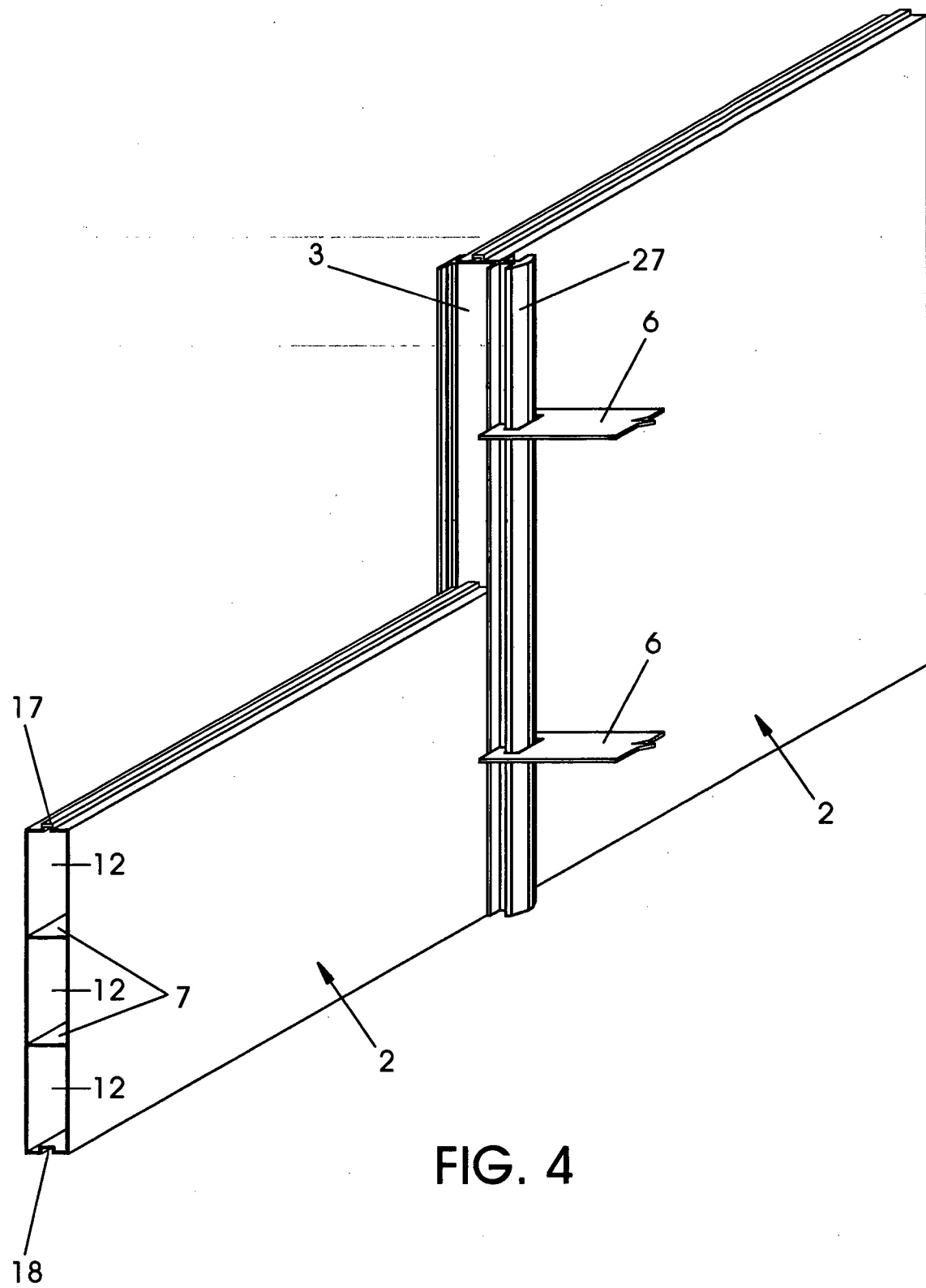


FIG. 4

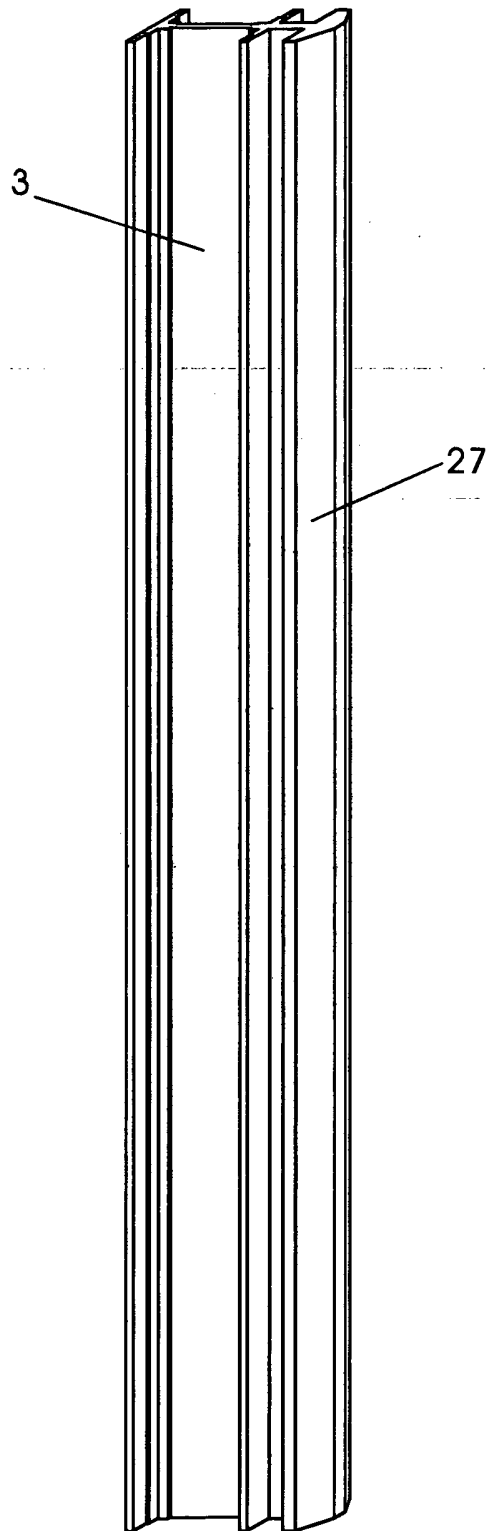


FIG. 5

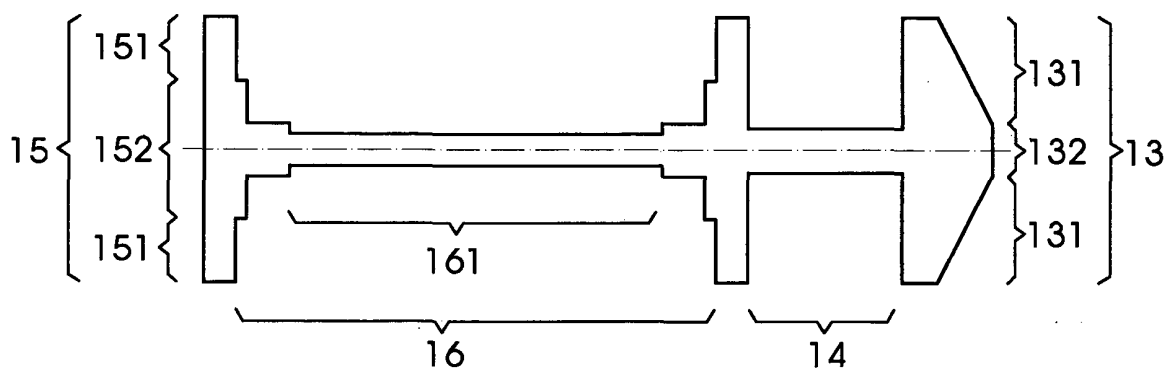


FIG. 6

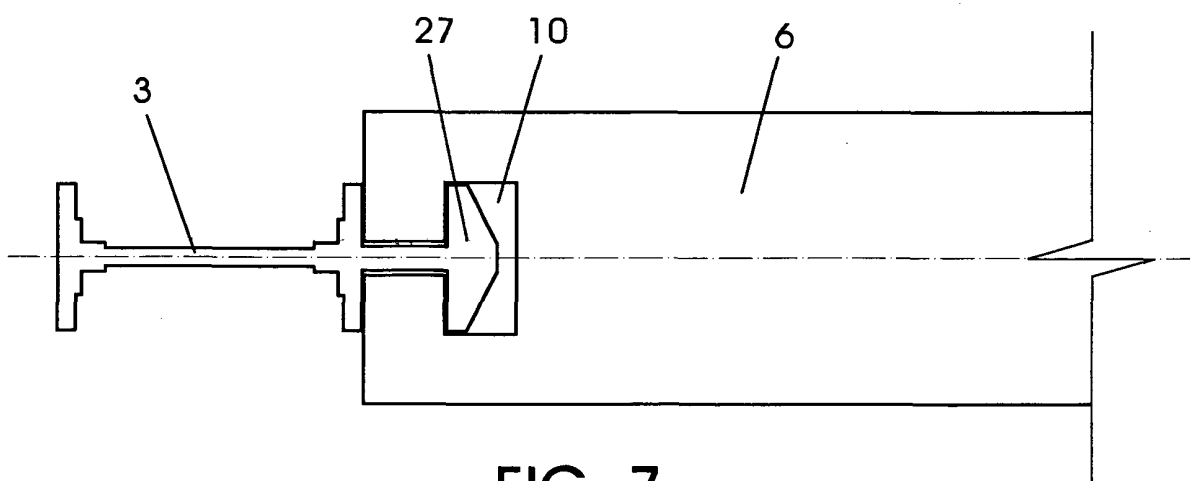


FIG. 7

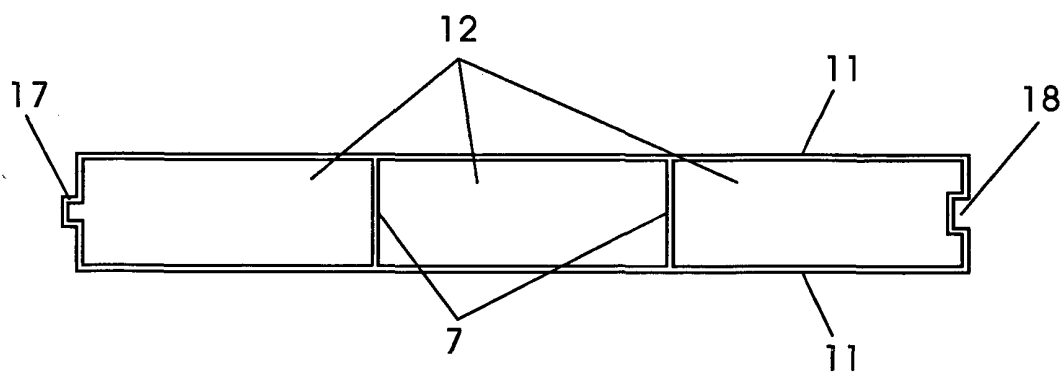


FIG. 8

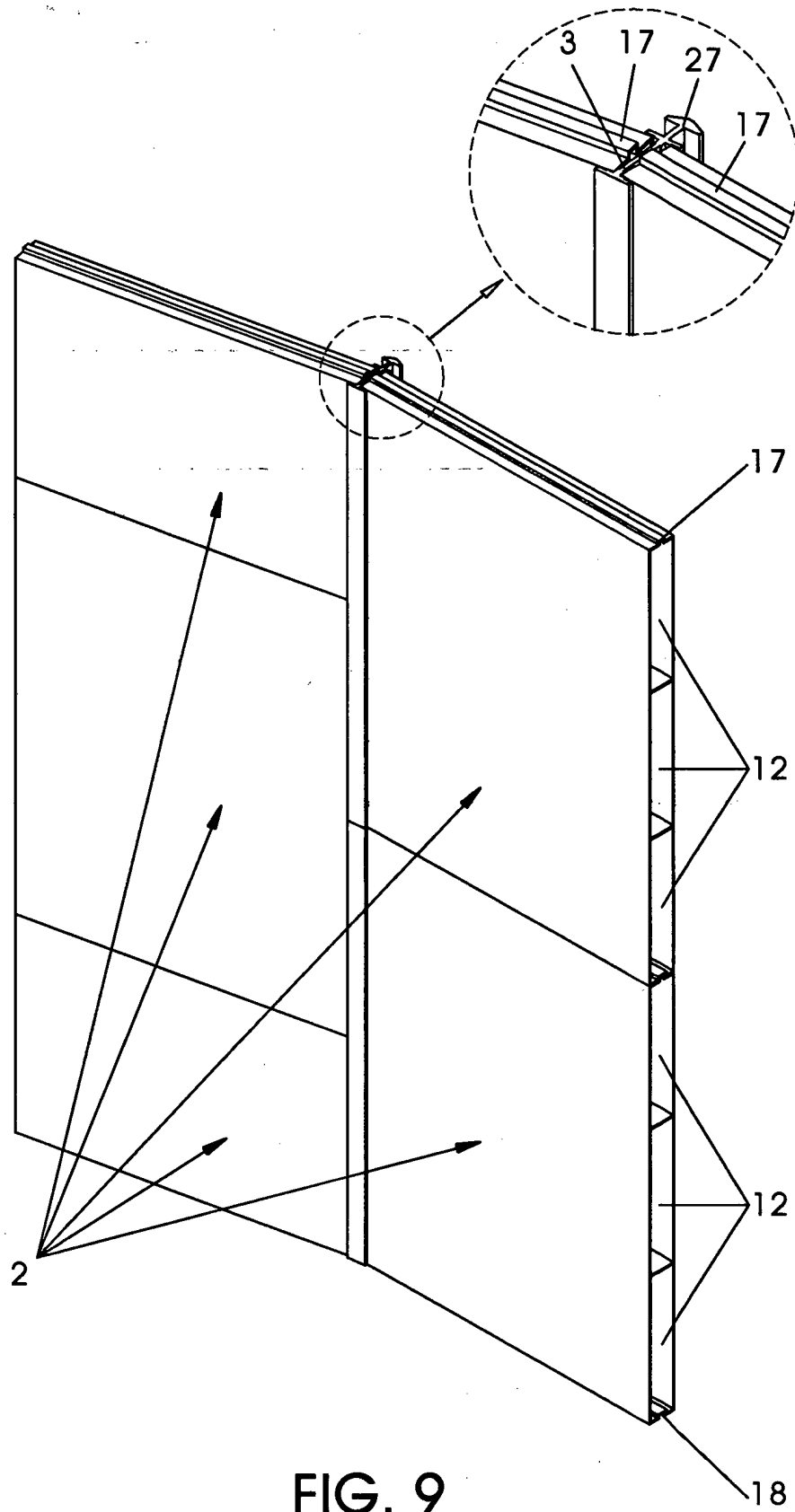


FIG. 9

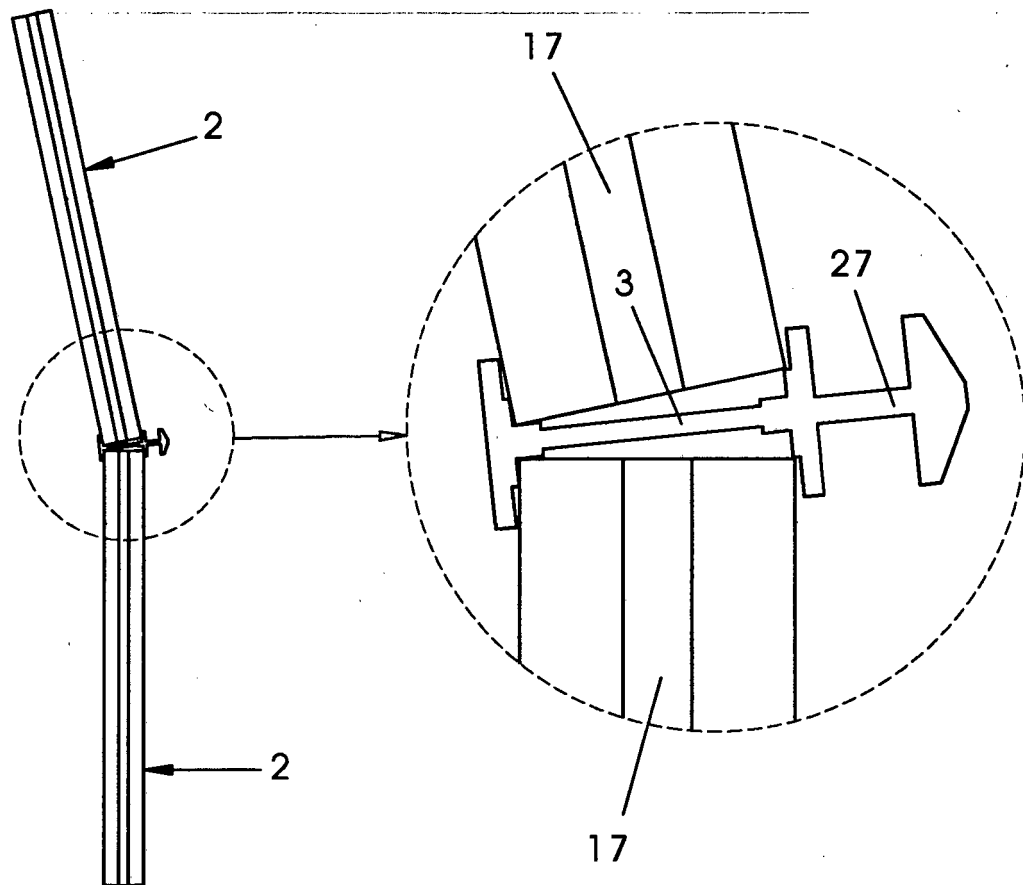


FIG. 10

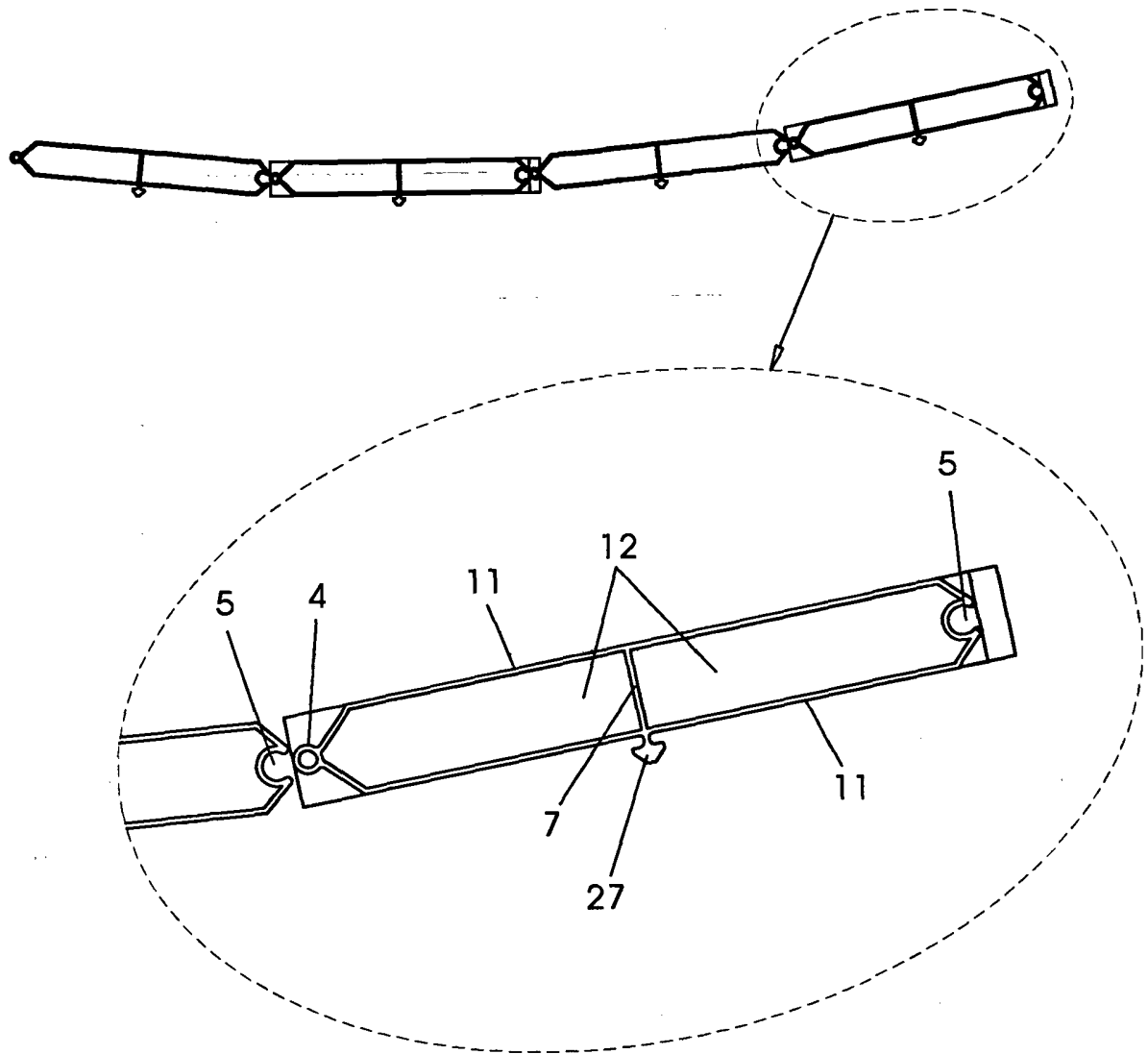


FIG. 11

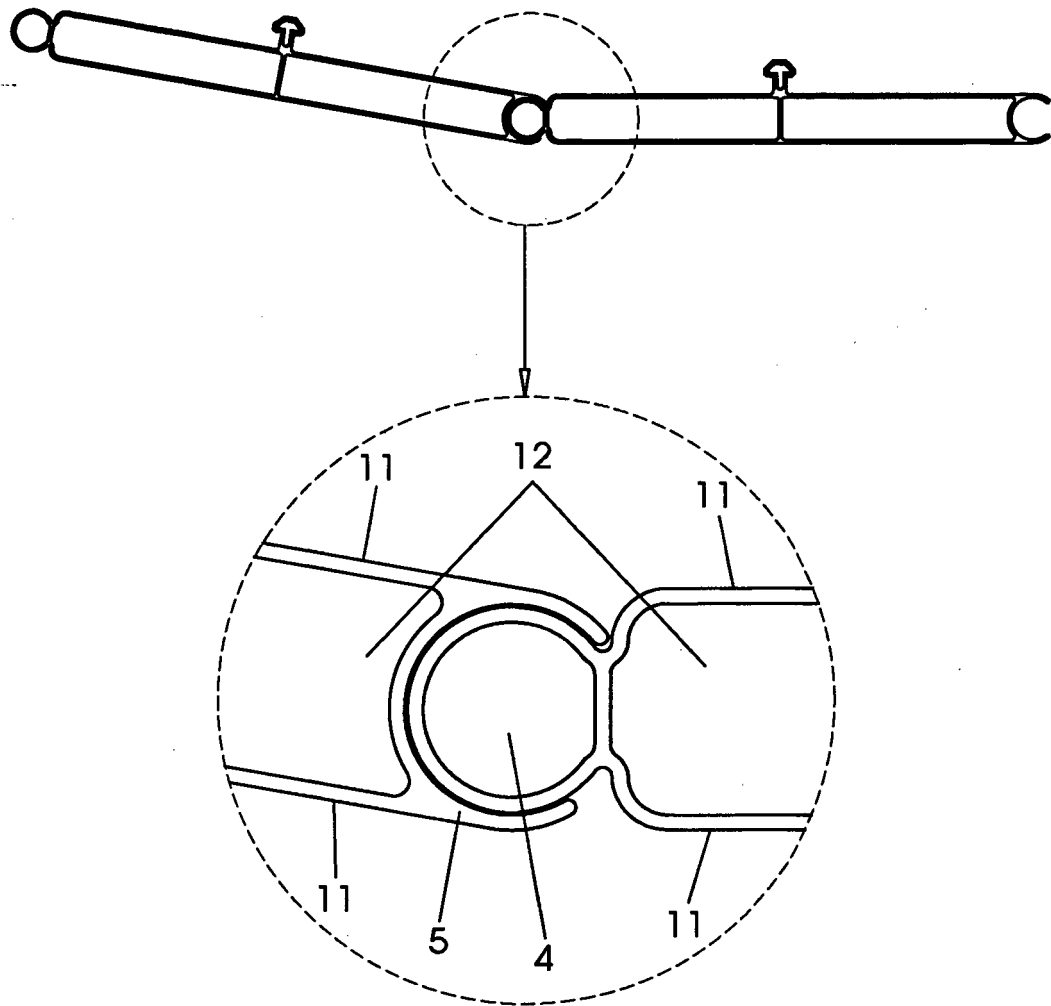


FIG. 12

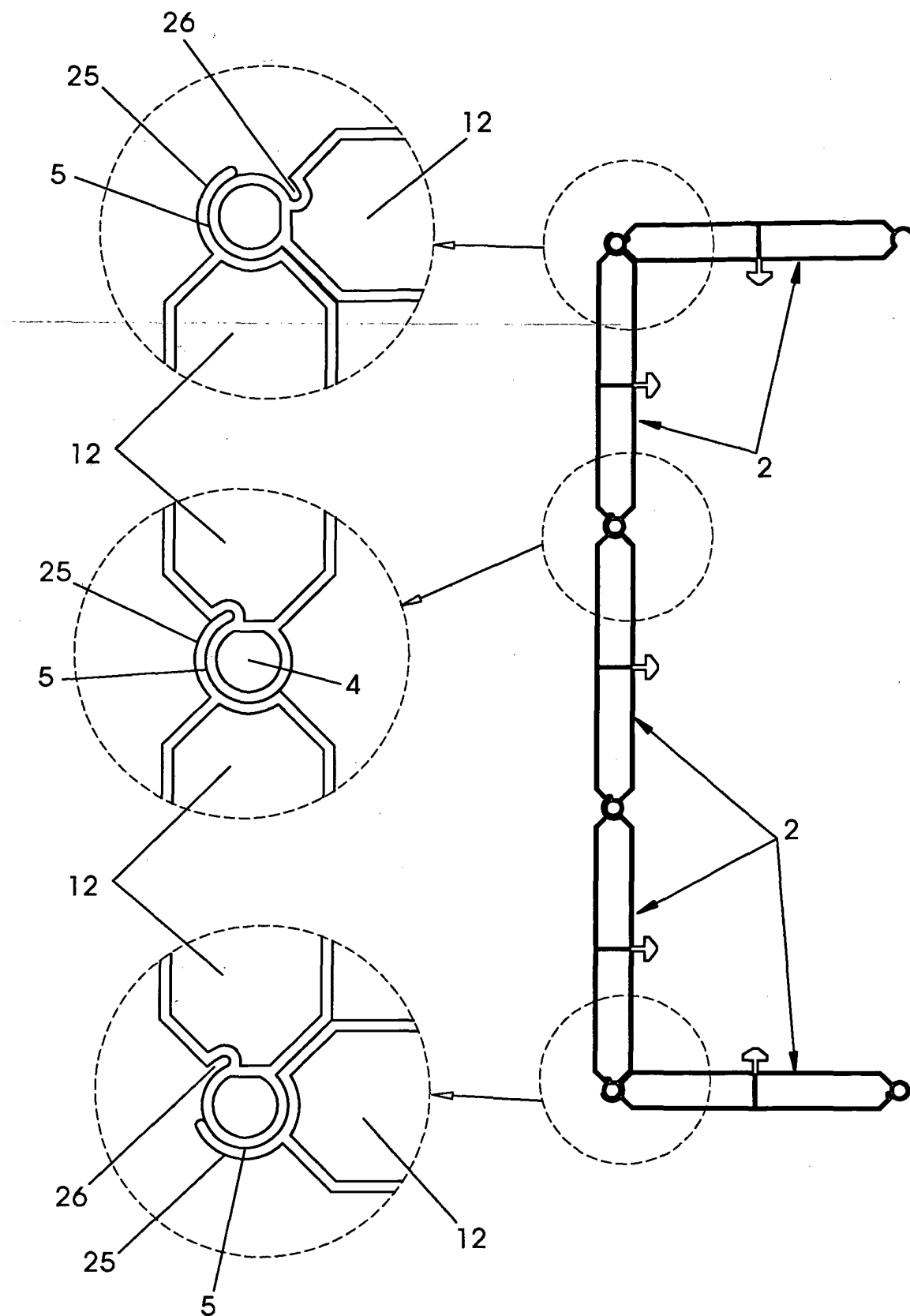


FIG. 13

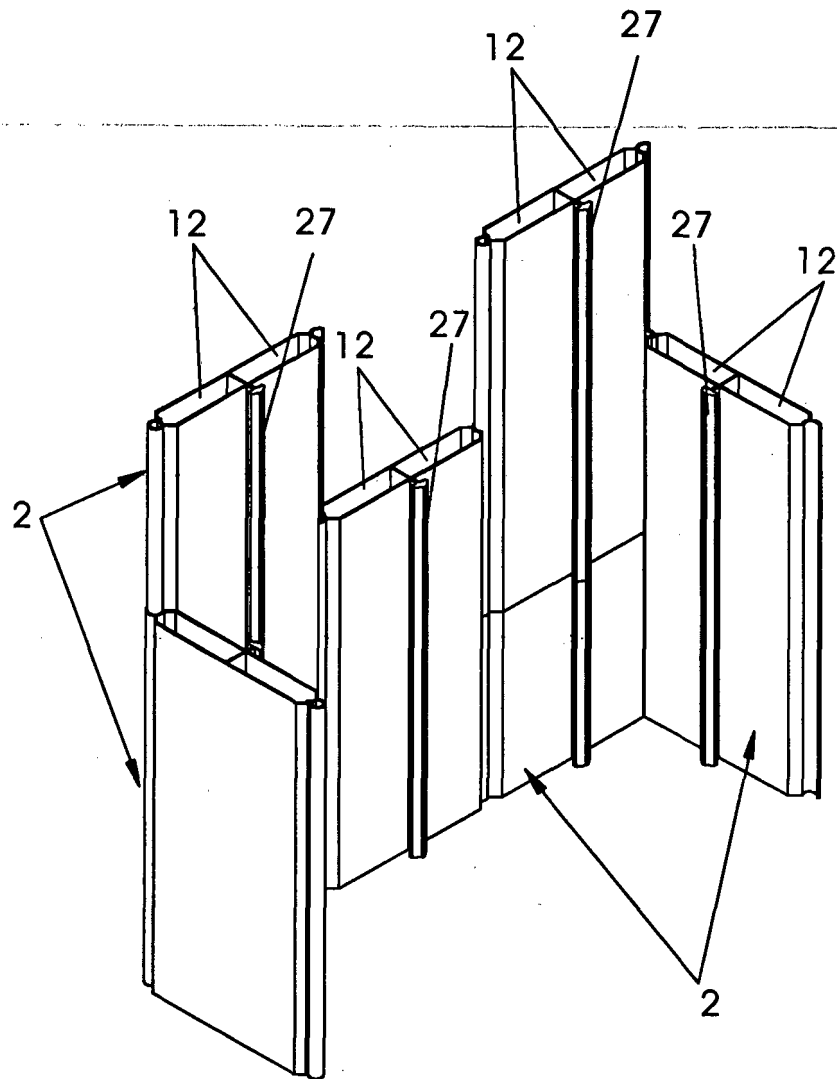


FIG. 14

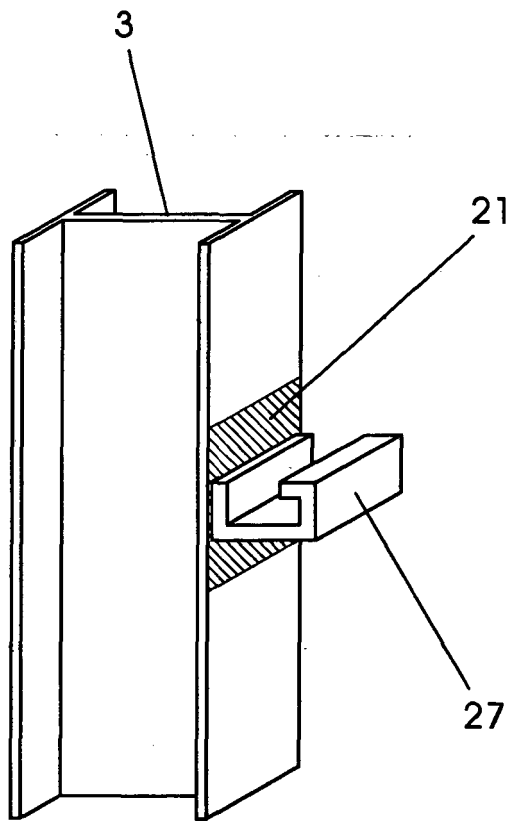


FIG. 15

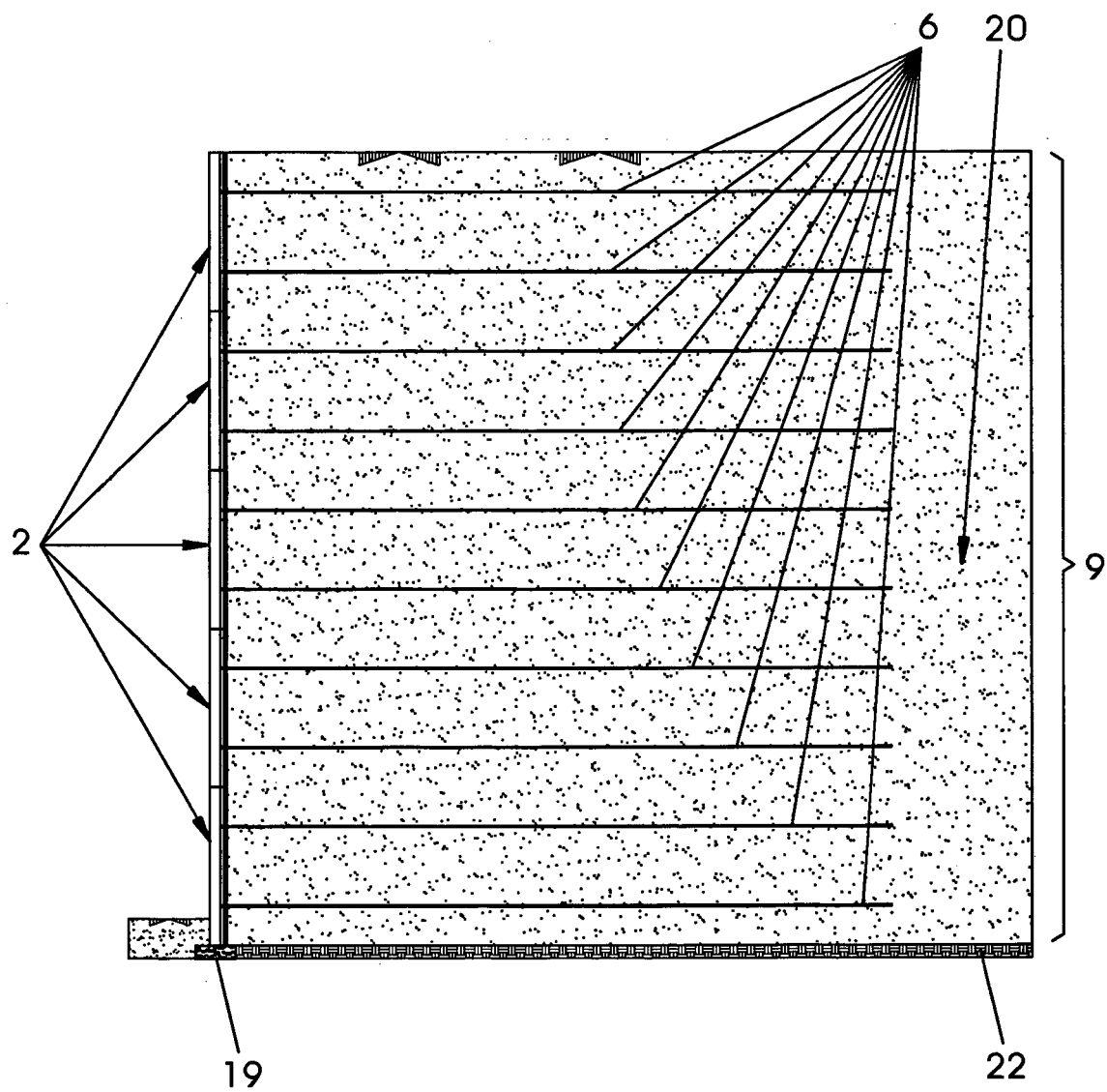


FIG. 16

REFERENCES CITED IN THE DESCRIPTION

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