



(12) PATENT ABRIDGMENT (11) Document No. AU-B-79001/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 682407

- (54) Title
CELLULAR STRUCTURES FOR SUSTAINING WALLS
- International Patent Classification(s)
(51)⁵ **E02D 029/02**
- (21) Application No. : **79001/94** (22) Application Date : **23.11.94**
- (30) Priority Data
- (31) Number (32) Date (33) Country
608914 21.08.89 CA CANADA
- (43) Publication Date : **02.02.95**
- (44) Publication Date of Accepted Application : **02.10.97**
- (62) Related to Division(s) : **61667/90**
- (71) Applicant(s)
VALERIAN CURT
- (72) Inventor(s)
VALERIAN CURT
- (74) Attorney or Agent
GRIFFITH HACK , GPO Box 1285K, MELBOURNE VIC 3001
- (56) Prior Art Documents
US 4341491
DE 3121681
FR 2233857
- (57) Claim

1. A cellular structure for sustaining an embankment comprising a facing element adapted to extend at an angle with respect to a horizontal plane, an embedding element formed of at least one anchorage, opposite extremities of each anchorage member being adapted for connecting to respective lateral opposite side edges of said facing element, said anchorage member having substantially a U shape adapted to extend from said facing element in the embankment so as to be anchored away from said facing element only by the embankment itself, said facing element defining a facade of said cellular structure.

8. A sustaining wall comprising many similar cellular structures each including a facing element extending at an angle with respect to the horizontal and an embedding element formed at least of one anchorage member, opposite extremities of each anchorage member joined to respective lateral opposite side edges of said facing element, each anchorage member having the shape of a U extending from said facing element in an embankment

(11) AU-B-79001/94
(10) 682407

-2-

contained in a respective cellular structure so as to be anchored away from said facing element only by the embankment itself.

AUSTRALIA

PATENTS ACT 1990

COMPLETE SPECIFICATION FOR A

STANDARD PATENT

Name of Applicant: VALERIAN CURT

Address of Applicant: 45, Avenue De Bercy
Candiac
Quebec J5R 4B8
CANADA

Actual Inventor: VALERIAN CURT

Address for Service: Griffith Hack & Co., 509 St. Kilda Road,
Melbourne, Victoria 3004, AUSTRALIA

Standard Complete Specification for the invention entitled:

CELLULAR STRUCTURES FOR SUSTAINING WALLS

Details of Parent Application for Divisional Applications:

Australian Patent Application No. 61667/90 filed 17 August 1990

The following is a full description of this invention, including the best method of performing it known to me:-

CELLULAR STRUCTURES FOR SUSTAINING WALLS

TECHNICAL FIELD

The present invention relates to new cellular structures for producing sustaining walls.

5 BACKGROUND ART

Throughout this specification, including the claims: the term "sustaining walls" is intended to have the same meaning as the term "retaining walls" and/or "supporting walls"; and the term "stirrup" is used interchangeably with and has the same meaning as "anchorage member".

10 In my Canadian Patent 1,186,516, I disclose a cellular structure which comprises two straight embedding walls joined by a curved wall which forms the front of the cellular structure. In this type of module, the lateral pressure of the mass retained between the walls of the cellular structure maintains these walls stationary. Indeed, the lateral pressure exerted by the retained mass anchors the walls which retain this mass.

15 DISCLOSURE OF THE INVENTION

It is an aim of the present invention to provide new cellular structures for sustaining walls which use materials available on the market.

20 According to one aspect of the present invention there is provided a cellular structure for sustaining an embankment comprising a facing element adapted to extend at an angle with respect to a horizontal plane, an embedding element formed of at least one anchorage, opposite extremities of each anchorage member being adapted for connecting to respective lateral opposite side edges of said facing element, said anchorage member having substantially a U shape adapted to extend from said facing element in the embankment so as to be anchored away from said facing element only by the embankment itself, said



facing element defining a facade of said cellular structure.

5 According to another aspect of the present invention there is provided a sustaining wall comprising many similar cellular structures each including a facing element extending at an angle with respect to the horizontal and an embedding element formed at least of one anchorage member, opposite extremities of each anchorage member joined to respective lateral opposite side edges of
10 said facing element, each anchorage member having the shape of a U extending from said facing element in an embankment contained in a respective cellular structure so as to be anchored away from said facing element only by the embankment itself.

15 According to another aspect of the present invention there is provided a cellular structure for sustaining an embankment comprising a facing element adapted to extend at an angle with respect to a horizontal plane, an embedding element formed of at least one anchorage member, said facing element comprising many
20 elongated elements made of prefabricated concrete adapted to be horizontally mounted in an openwork way on a non-horizontal plane, said elongated elements being adapted to overlap at the extremities thereof with similar elongated elements of adjacent cellular structures, opposite
25 extremities of each anchorage member being adapted for connecting to respective opposite side extremities of the facing element, said facing element being adapted to define a facade of said cellular structure, and each anchorage member having the shape of a U adapted to extend from said
30 facing element in the embankment from the extremities of the facing element so as to be anchored away from said facing element only by the embankment itself.

35 According to another aspect of the present invention there is provided a sustaining wall comprising a plurality of cellular structures each including a facing element which extends at an angle with respect to a



horizontal plane and which is connected to an embedding
element formed of at least one anchorage member, said
facing elements each being formed of many elongated
elements made of prefabricated concrete horizontally
5 mounted in an openwork way on a non-horizontal plane, said
elongated elements overlapping at their extremities with
similar elongated elements of adjacent facing elements,
each anchorage member having the shape of a U and being
connected at opposite extremities thereof to respective
10 opposite side extremities of a respective facing element,
each cellular structure containing an embankment, and each
embedding element extending from a respective facing
element in the embankment of a respective cellular
structure so as to be anchored away from said facing
15 element only by the embankment itself.

According to another aspect of the present
invention there is provided a method for erecting a
sustaining wall comprising the following steps:

20 a) aligning a plurality of cellular structures
each including a facing element extending at an angle with
respect to the horizontal and an embedding element formed
at least of one anchorage member connected at opposite
extremities thereof to respective lateral opposite side
edges of said facing element in order to form a U extending
25 opposite said facing element; and

b) filling up of each of said cellular
structures, said embedding elements being anchored by the
embankment. _____



BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view illustrating a series of cellular structures in accordance with the present invention of copending application no. 61667/90, wherein the facing and embedding structures are made of lattices;

Figure 2 is a perspective view illustrating a series of cellular structures in accordance with a first embodiment of the present invention, wherein the facing structures are lattices and the embedding structures are stirrups;

Figure 3 is a top plan view illustrating the filling of the cellular structures of Figures 1 and 2 by way of a sunk framework, and also illustrating a facade of cast concrete;

Figure 4 is a top plan view similar to Figure 3, but wherein the facade is a masonry made of concrete blocks;

Figure 5 is a perspective view similar to Figure 1, but wherein the facing structure is constituted of independent bars;

Figure 6 is a perspective view similar to Figure 2, but wherein the facing structure is constituted of independent bars for receiving architectural concrete blocks;

Figure 7 is a horizontal cross-section illustrating the structures described in Figures 5 and 6 and adapted with a facade made of concrete blocks;

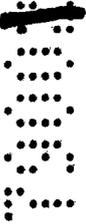


Figure 7a is a cross-section taken along lines 7a-7a of Figure 7 and illustrating an assembly of the concrete blocks to the facing structure;

Figure 8 is a perspective view similar to Figure 1, but wherein the facing structure is conceived to receive panels made of prefabricated concrete;

Figure 9 is a perspective view similar to Figure 2, but wherein the facing structure is conceived for receiving panels made of prefabricated concrete;

Figure 10 is a perspective view illustrating a façade made of concrete panels and adapted to the cellular structure of Figure 8;

Figure 11 is a perspective view illustrating a façade made of concrete panels and adapted to the cellular structure of Figure 9;

Figure 12 is a horizontal cross-section of the structures described in Figures 10 and 11;

Figure 12a is a cross-section taken along lines 12a-12a of Figure 12;

Figure 13 is a perspective view similar to Figure 1, but wherein the facing structure comprises elements made of prefabricated concrete which define an openwork structure;

Figure 14 is a perspective view similar to Figure 2, but wherein the facing structure comprises elements made of prefabricated concrete which define an openwork structure;

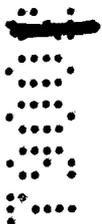


Figure 15 is a perspective view similar to Figure 2, but wherein the facing structure comprises blocks made of architectural concrete;

Figure 16 is a top plan view of the structure of Figure 15;

Figure 17 is a horizontal cross-section illustrating a variant of the structure shown in Figures 15 and 16;

Figure 18 is a top plan view illustrating the mud trench used to set a rigid cellular structure;

Figure 19 is a top plan view illustrating the foundation elements of the rigid cellular structure;

Figure 20 is a top plan view illustrating a rigid cellular structure adapted to the foundation elements of Figure 19;

Figure 21 is an elevation view based on Figure 20;

Figure 22 is a top plan view of a mud trench adapted for a rigid cellular structure for basements of buildings;

Figure 23 is a top plan view illustrating the foundation elements of the rigid cellular structure;

Figure 24 is a top plan view of the rigid cellular structure adapted to the foundation elements of Figure 23;

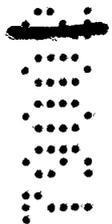


Figure 25 is an elevation view of the embedding elements of the rigid cellular structure of Figure 24 along the height of one storey;

Figure 26 is a partly fragmented top plan view illustrating the application of rigid cellular structures for a deep water pier;

Figures 27a and 27b are views illustrating the application of rigid cellular structures for the sub-structure of a building;

Figure 28 is a top plan view and Figure 28a is a vertical cross-section taken along lines 28a-28a of Figure 28 illustrating the sub-structure of a large building located on a shore;

Figure 29 is a perspective view of a sustaining wall using the openwork cellular structures of Figures 13 or 14; and

Figure 30 is a perspective view of a sustaining and elevation wall using the openwork cellular structures of Figures 13 and 14.

20 MODES FOR CARRYING OUT THE INVENTION

According to one aspect of the present invention, cellular structures for sustaining walls comprise base structural elements which are made of metallic or synthetic lattices. The lattice can be combined with elements made of metal sheet, with cables or with prefabricated concrete. The juxtaposition and the filling of these cellular structures form sustaining walls.

The two basic elements of a cellular structure are the facing elements and the embedding elements. With reference more particularly to

Figures 1 and 2, the cells in the form of a U are open towards the massif with facing elements 1 and embedding elements 2 being both made of lattices. We can also realize cells which are fictitiously closed, being constituted of facing elements 1 made of lattices and embedding elements 3 made of stirrups (Figure 2).

As it will be described in detail hereinbelow, the facing elements can be constituted of independent metallic bars or flat bars or even of cables. All of these facing elements can be combined with elements made of prefabricated concrete. Also, cells with facing elements made of blocks of architectural concrete of small or large dimensions can be produced.

In the actual state of knowledge, these types of constructions can be defined as composite and monolithic massifs which are produced by the interdependence between a soil massif and a structure.

All of the metallic elements forming the cellular structure are protected adequately against corrosion. The assembly of the facing elements 1 to the embedding elements 2 or 3 is done by way of rods, circular bars or pipes 4.

The structure illustrated in Figure 1 is executed by the continuous juxtaposition of cells made of lattice panels or of independent facing and embedding lattice elements 1 or 2. In the latter case, the independent elements are assembled with the rods 4.

The structure of Figure 2 which comprises facing elements formed of lattices and embedding

elements formed of stirrups is assembled with the rods 4.

The structures described hereinabove can be filled with a stone packing. In the case of unavailability of the stone packing, the use of soil is possible with the interposition of a membrane between the embankment and the lattice facing element 1. As illustrated in Figure 3, this membrane which is like a sunk framework 5 can be made from sheet metal, of plastic or of asbestos-cement. A thick geotextile can also be used.

When the composite work is erected, the second phase consists of completing the work aesthetic-wise. With reference to Figure 3, this façade revetment is represented by the application of cast concrete 6. This revetment can have aesthetic or resistance purposes.

In Figure 4, the façade revetment is constituted by a masonry made of architectural concrete blocks or of cut stone 7. These concrete blocks can be those used for building façades or they can be adapted specially for sustaining walls. The masonry is fortified with metal rods and tied to the facing structure 1. As an option, the space between the façade masonry 7 and the cellular structure can be filled with concrete 8.

It is also possible to integrate the revetment elements to the facing elements 1. The cellular structures so used are similar to those described hereinabove and are represented generally in Figures 1 and 2. However, the structure will be realized with a facing structure constituted of independent horizontal and vertical bars or flat bars 9 and 10, as illustrated in Figures 5 and 6.



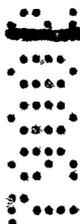
The positioning of these independent bars or flat bars 9 and 10 is carried out at the same time as the positioning of the concrete blocks and of the advance of the embankment. The vertical bars 10 are added during execution in the form of joggles.

During the execution of the work, this type of structure allows for the insertion in the facing structure of small elements made of prefabricated concrete. The concrete blocks for the facing structure are designed for these means and the erection of the facing elements is carried out according to the principles of dry masonry (Figure 7).

The horizontal facing armature 9 can be realized with metallic circular bars or flat bars. Figure 7 and 7a illustrate the use of metallic flat bars. The vertical armature 10 can be realized with circular bars or with pipes. The prefabricated concrete blocks 11 are adapted for these means. The facing structures produced can thus have the desired aesthetic.

As an option, Neoprene type joints 12 can be used when the cellular structure is subject to important stresses.

Figures 8 and 9 illustrate cellular structures of the same type as those described respectively in Figures 1 and 2 but wherein the facing structure is designed for receiving plane panels of large dimensions. The horizontal bars of the facing structure 13 define a broken geometry which is developed from one assembly rod 4 to the other. The changes in the direction of the horizontal bars 13 is done at the level of the



vertical bars 14. Cables can replace the horizontal bars 13.

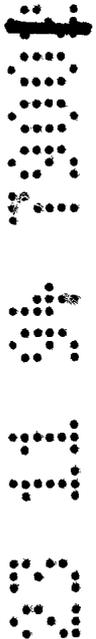
Figures 10 and 11 illustrate the cellular structures described in Figs. 8 and 9 which comprise in addition large dimension prefabricated concrete panels 15 which have been inserted in the façade. The prefabricated concrete panels 15 are characterized by the fact that two of their dimensions (width and height) are large with respect to the third dimension (depth). These panels 15 are adapted for resisting to the thrust of the ground. The panels 15 are also designed in order that they can be assembled with the lattice or stirrup embedding structures 2 or 3.

The characteristic of this type of composite structure lies in the fact that a plane facing structure is obtained while preserving the principle of cells which are open or fictitiously closed towards the massif to sustain.

Figure 12 illustrates the details of the structures described in Figures 8 to 11. The horizontal armatures of the facing structure are cylindrical bars or cables 13. The vertical bars 14 are pipes which are perforated or not. Neoprene type strips 16 are intended for the horizontal joints (Figure 12a).

This type of structure is thus carried out dry with Neoprene joints and as assembly joggles, pipes which are perforated or not are used.

The use of joggles-pipes allows for the retransmission of the stresses of the cables to the joggles and from the joggles to the concrete on surfaces which are larger.



The perforated joggles-pipes allow, after the work has been carried out, for injections to be made with a view of realizing the monolithism of the facing structure.

5 The joggles-pipes allow also for the realization of the post-tension of the façade if desired. Also, cables positioned in the pipes can extend to the foundation in order to be thereafter post-tensioned.

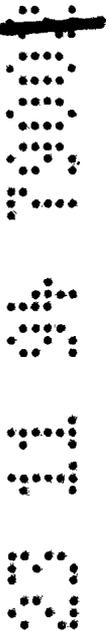
10 In this way, very large resistance sustaining walls can be realized, especially at the level of the dynamic stresses.

Figures 13 and 14 illustrate cellular structures with embedding elements made of lattices 2 or stirrups 3 and which are characterized by prefabricated concrete facing elements 17 mounted as an openwork. The facing element can also be formed of wood beams.

The assembly elements are bars or pipes 20 18. Post-tensioned or not, these elements 18 allow also for the positioning of post-tension cables and also for the realization of injections. In the overlapping zone of the prefabricated concrete elements 17, that is at their extremities, one or 25 more assembly elements 18 can be provided.

This type of cellular structure can be filled with stone of appropriate size or with soil. In the latter case, the openings in the façade are blocked off by metal sheet, asbestos-cement, 30 geotextile, etc.

One of the particularities of this structure lies in the fact that it allows for



vegetation to grow through the façade while retaining a large stability.

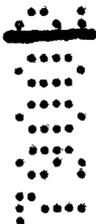
However, the spaces between the prefabricated elements 17, on the side of the soil, can be partially or totally blocked in order to allow or not the growth of the vegetation. This obturation is generally accomplished with blocks made of architectural concrete.

The parallelepiped-shaped prefabricated concrete element 17 is characterized in that its dimensions in its transversal cross-section are small with respect to its length. The opposite faces can be parallel or not. These elements are designed in order to absorb the thrust of the ground, to be assembled to the lattice or stirrup embedding elements 2 or 3 and to produce columns along their overlapping zone.

It is noted that as a result of the columns, this type of facing structure can be executed on limited heights with no embedding structures. In the overlapping zone, many elements or assembly bars 18, post-stressed or not, can then be used.

Figure 29 illustrates the use of cellular structures having openwork facing elements as described hereinabove for the production of sustaining walls 43. In this case, the openworks have not been blocked in order to allow for vegetation to grow through the façade of the sustaining walls 43.

Figure 30 illustrates a wall 44 which is a sustaining wall in its lower section and an elevation wall in its upper section on both sides.



The elevation wall is used principally as a soundproof wall; that is why all of its openworks have been obturated.

With openwork cellular structures, we can
 5 realize sustaining walls of all types, with or without vegetation, abutment-peers for bridges, walls for the head of culverts and even culverts, elevation walls, soundproof walls, etc.

Figures 15 to 17 illustrate cellular
 10 structures with facing elements made of small or medium size concrete panels. The same principles of cellular structures described hereinabove are complied with. Figure 15 illustrates a cellular structure with an embedding structure made of
 15 stirrups 3, even though lattice embedding structures can also be used, and small or medium size architectural concrete blocks 20. The architectural concrete blocks 20 or the blocks made of cut stone are masoned using vertical rods or joggles 19.
 20 These rods 19 provide on one hand resistance and on the other hand a connection between the facing element and the embedding elements.

The stirrup embedding elements 3 are
 positioned in the vertical joints (Figure 16) or in
 25 the horizontal joints (Figure 17).

The stirrup embedding elements are built
 with metallic or synthetic flat bars (Figure 16) or with round or square bars (Figure 17). In the case
 of Figure 17, wherein the embedding elements 3 are
 30 positioned in the horizontal joints, Neoprene type joints 12, similar to those of the integrated revetment cellular structures (Figure 7) are anticipated.

The structures described hereinafter are sustaining walls made of large size prefabricated reinforced concrete elements assembled by post-tension in a mud trench or in water, in order to
 5 construct a rigid cellular structure having the shape of a U (Figures 18 to 25) which uses the same theoretical principles as those of the structures described hereinabove.

The prefabricated elements are heavy
 10 elements which are plant-manufactured and then carried and positioned in the liquid medium by way of appropriate machines.

The assembly elements, represented generally by pipes which are perforated or not, are
 15 used as guides for the installation and finally can be tensioned directly or by way of ties anchored in the foundation. These same pipes can be used for the injection of mortar.

Once the prefabricated elements have been
 20 assembled by post-tension, the structure will be completed with concrete poured on site.

The rigid cellular structures are constituted of facing structures which recover the stresses due to the thrust of the ground and of the
 25 water. The embedding structures are elements which recover the stresses of the facing structures and of other structures for transmitting them to the foundation. The assemblies are appropriately dimensioned pipes which are perforated or not and
 30 which have the multiple functions described hereinbelow. The concrete poured on site serves on one hand as the foundation and on the other hand it completes the structure.

These structures can be designed to be, or not, in close interdependence with the soil mass to support. In order to mount these rigid cellular structures, a trench of bentonite mud (Figure 18) is previously built with guide low walls 22, in accordance with known and proven methods.

The foundation elements 23 which are then set (Figure 19) comprise holes 24 provided for pouring the concrete under the foundation elements 23. The foundation elements 23 constitute an integral part of the embedding structures and are positioned at appropriate depth on a layer of concrete.

The pouring of the foundation concrete can precede the positioning of the prefabricated elements wherein the concrete can be poured through the holes 24 intended for this operation.

Pipes 25 fixed to the foundation elements 23 are used for guiding the prefabricated elements and then the pipes are used for the post-tension and for the injection.

The first embedding elements 26 are lowered along guiding elements 24 until their final position. Then, follows the positioning of the facing elements 27 (Figure 20). The concrete 28 is then poured on site.

The operation of alternately mounting the embedding elements and the facing elements is continued until the final shore.

Once the prefabricated elements have been set, the operations of post-tensioning and the filling of the pipes with mortar are carried out.



Neoprene strips can be provided to improve the sealing of the structure and also to ensure a better contact between the horizontal joints.

As a last phase, the fresh concrete will
5 be poured between the prefabricated elements and the soil, thereby completing the structure.

Figures 18 to 21 illustrate an underframe of a pier. It consists of rigid cellular structures containing soil. The interdependence between the
10 structure and the ground is clearly revealed. This type of structure can be used for piers of all types, be they constructed by way of a mud trench (Figure 18), or directly in water.

The facing elements are continuous in the
15 vertical direction whereas the embedding elements can be hollowed out in order to lighten the prefabricated elements and in order to obtain a better monolithism with the concrete poured on site or with the embankment (Figure 21). The embedding
20 elements can be constructed with ironwork elements or with concrete elements poured on site.

Figures 22 to 25 illustrate an underframe of a building. The erection steps are similar to those found in Figures 18 to 21. In this case, it
25 consists of rigid cellular structures with cleared away embedding elements. This structure will be used mainly for the construction of buildings having multiple basements.

The construction is identical to the
30 preceding case, but the structural behavior is different. There is no interaction between the ground and the structure since the embedding elements will remain free inside the building which

is an integral part of its structure. In this case, the embedding elements become buttresses (Figure 24).

The prefabricated facing and buttress elements can have a height equal to the distance between the floors (Figures 25).

Once the sustaining structure has been assembled and the concrete poured on place has sufficiently hardened, the excavation works can begin. The perpendicular underpinning on the buttresses can be felt in the case of large depths.

The extremities of the buttresses can be seatings for the columns of the building's superstructure. The buttress elements can be more or less hollowed out, according to their degree of stress (Figure 25).

The floors which are built represent a good horizontal wind-brace, which results in an increase in the stability.

If necessary for the overall stability, anchoring ties are installed inside the assembly pipes (Figure 25).

More particularly, Figure 22 illustrates a mud trench 29 having guide low walls 30 which are designed for positioning the rigid cellular structure intended for the basements of the buildings.

Figure 23 illustrates the setting of foundation elements 31 which comprise holes 34 with a view of pouring concrete under the foundations. Guide pipes 35 are fixed on the foundation elements 31.

In Figure 24, the cleared away rigid veil structure is illustrated with its embedding elements 32 and its facing elements 33. Between the structure and the soil, there is the filling concrete 36.

Figure 25 is an elevation view of the embedding elements 32 along the height of one storey. There is found the floor bed 38 and the structure 39 of one storey. As an option, post-tension ties 37 are disposed inside the guiding pipes 35.

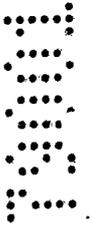
The rigid cellular structures can be constructed perfectly tight. One very important advantage for the use of this type of structure lies in the total absence of anchoring ties outside of the periphery of the construction, which is what is found in conventional walls built in a mud trench.

A few practical examples of rigid veil cellular structures are illustrated in Figures 26 to 28. Figure 26 illustrates a deep water pier 40 which uses a plurality of rigid cellular structures as described in Figures 18 to 21. Figures 27a and 27b illustrate a building infrastructure 41 which uses the cellular structures of Figures 22 to 25. Figures 28 and 28a illustrate the infrastructure of a large size building 42 (the basements) located on the shore. In this case, the rigid cellular structure is stressed by the soil or by the water.

One of the main advantages of the use of cellular structures having lattice facing elements and lattice or stirrup embedding elements and also of the other cellular structures described hereinabove lies in the fact that the materials

necessary for their erection are available on the market.

These structures are very simple on one hand by the manufacture of the structural elements and on another hand by their implementation. They can accommodate many types of façades, whereby the desired aesthetic can be given to the sustaining wall so erected. Under their different forms, these cellular structures have various applications.



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. A cellular structure for sustaining an embankment comprising a facing element adapted to extend at an angle with respect to a horizontal plane, an embedding element
5 formed of at least one anchorage, opposite extremities of each anchorage member being adapted for connecting to respective lateral opposite side edges of said facing element, said anchorage member having substantially a U shape adapted to extend from said facing element in the
10 embankment so as to be anchored away from said facing element only by the embankment itself, said facing element defining a façade of said cellular structure.

2. A cellular structure according to claim 1 wherein said embedding element is constituted of at least two anchorage members depending on the height of the cellular structure, said facing element comprising a substantially vertical lattice, said anchorage members being connected to said facing element in a spaced apart way along a vertical plane an extending in the embankment in a substantially
15 horizontal and parallel way.
20

3. A cellular structure according to claim 1 or 2 wherein said facing element is constituted of a metallic or synthetic lattice, and wherein said embedding element is constituted of metallic or synthetic anchorage members.

4. A cellular structure according to any one of claims 1 to 3 wherein said anchorage members are flat strips or round or square bars.
25

5. A cellular structure according to any one of claims 1 to 4 wherein a sunk framework and a facade of cast concrete are installed respectively behind and in front of
30 said facing element.



6. A cellular structure according to any one of claims 1 to 4 wherein a sunk framework and a masonry of concrete blocks or cut stone are installed respectively behind and in front of said facing element, said masonry facade being reinforced and joined to said facing element, the space between the facing element and the masonry being adapted for being filled with concrete.

7. A cellular structure according to any one of claims 1 to 6 wherein vertical rods are used for connecting the embedding elements to the vertical edges of the facing elements.

8. A sustaining wall comprising many similar cellular structures each including a facing element extending at an angle with respect to the horizontal and an embedding element formed at least of one anchorage member, opposite extremities of each anchorage member joined to respective lateral opposite side edges of said facing element, each anchorage member having the shape of a U extending from said facing element in an embankment contained in a respective cellular structure so as to be anchored away from said facing element only by the embankment itself.

9. A method for erecting a sustaining wall comprising the following steps:

a) aligning a plurality of cellular structures each including a facing element extending at an angle with respect to the horizontal and an embedding element formed at least of one anchorage member connected at opposite extremities thereof to respective lateral opposite side edges of said facing element in order to form a U extending opposite said facing element; and

b) filling up of each of said cellular structures, said embedding elements being anchored by the embankment.



10. A cellular structure for sustaining an embankment comprising a facing element adapted to extend at an angle with respect to a horizontal plane, an embedding element formed of at least one anchorage member, said facing
5 element comprising many elongated elements made of prefabricated concrete adapted to be horizontally mounted in an openwork way on a non-horizontal plane, said elongated elements being adapted to overlap at the extremities thereof with similar elongated elements of
10 adjacent cellular structures, opposite extremities of each anchorage member being adapted for connecting to respective opposite side extremities of the facing element, said facing element being adapted to define a facade of said cellular structure, and each anchorage member having the
15 shape of a U adapted to extend from said facing element in the embankment from the extremities of the facing element so as to be anchored away from said facing element only by the embankment itself.

11. A cellular structure according to claim 10
20 wherein the facing element comprises vertical rods for securing together the overlapping elongated elements of two adjacent cellular structures, the extremities of said elongated elements adapted to allow the vertical rods to extend therethrough.

12. A cellular structure according to claim 10 or 11
25 wherein a geotextile is adapted to be positioned in a substantially vertical way between the facing element and the embankment in order to allow a soil embankment and to allow vegetation to extend through said facing element at
30 the openings defined between said prefabricated concrete elements.

13. A cellular structure according to claim 10 or 11 wherein architectural concrete elements are adapted to be positioned in openings defined between said prefabricated



concrete elements.

14. A sustaining wall comprising a plurality of cellular structures each including a facing element which extends at an angle with respect to a horizontal plane and which is connected to an embedding element formed of at least one anchorage member, said facing elements each being formed of many elongated elements made of prefabricated concrete horizontally mounted in an openwork way on a non-horizontal plane, said elongated elements overlapping at their extremities with similar elongated elements of adjacent facing elements, each anchorage member having the shape of a U and being connected at opposite extremities thereof to respective opposite side extremities of a respective facing element, each cellular structure containing an embankment, and each embedding element extending from a respective facing element in the embankment of a respective cellular structure so as to be anchored away from said facing element only by the embankment itself.

15. A sustaining wall according to claim 14 wherein each facing element comprises vertical rods which extend through the extremities of overlapping elongated elements of two adjacent cellular structures to secure them together.

16. A sustaining wall according to claim 14 wherein said facing elements extend vertically above said embedding elements in order to form an elevation wall, the openings defined between the prefabricated concrete elements of said elevation wall being closed by elements made of architectural concrete, said elevation wall being used as a soundproof wall.

17. A cellular structure according to claim 1 or 10 substantially as herein described with reference to and as



illustrated in any one or more of the accompanying drawings.

18. A sustaining wall according to claim 8 or 14 substantially as herein described with reference to and as
5 illustrated in any one or more of the accompanying drawings.

19. A method for erecting a sustaining wall according to claim 9, said method substantially as herein described with reference to and as illustrated in any one or more of
10 the accompanying drawings.

Dated this 4th day of July, 1997.

VALERIAN CURT

By its Patent Attorneys:

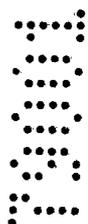
GRIFFITH HACK

15 Fellows Institute of Patent Attorneys of Australia.



ABSTRACT

A cellular structure for sustaining an embankment is comprised of a vertical facing structure including generally a lattice (1) connected to an embedding structure (2, 3). The embedding structure (2, 3) is extended from the facing structure (1) into the embankment. The embedding structure is comprised of at least one U-shaped stirrup (3) connected at each of its free ends to a respective vertical edge of the facing structure (1). The stirrup (3) is generally extended horizontally in the embankment. The masonry of the facing structure (1) may be carried out in different ways in order to achieve various finishings. The cellular structure may also include a sunk framework (5) between the embankment and the facing structure (1). The cellular structure may thus be filled with stones of smaller or larger dimensions as well as with earth. The use of a geotextile allows the vegetation to grow through the facing structure (1).



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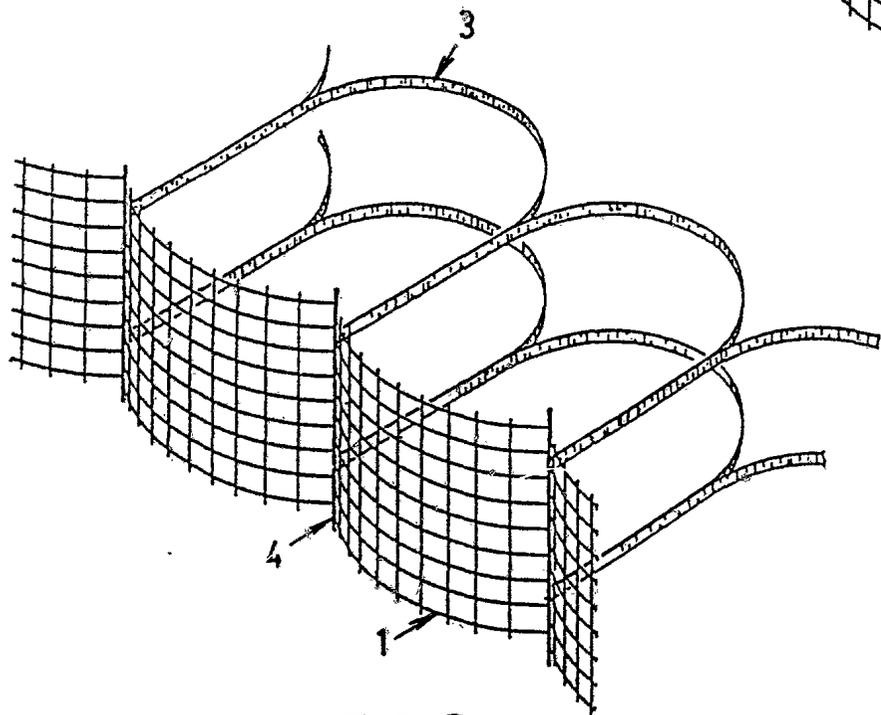


FIG. 2

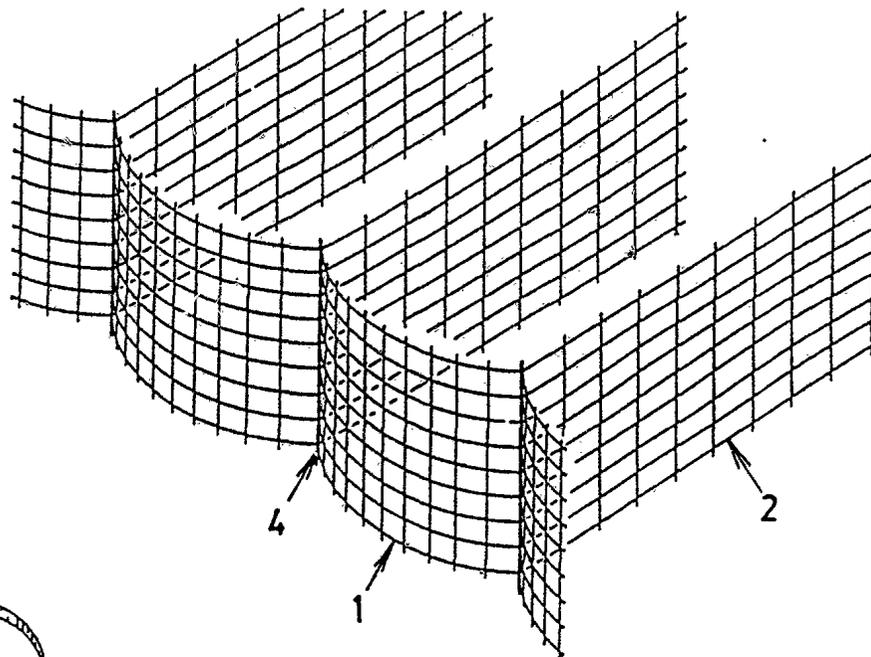


FIG. 1

1/15

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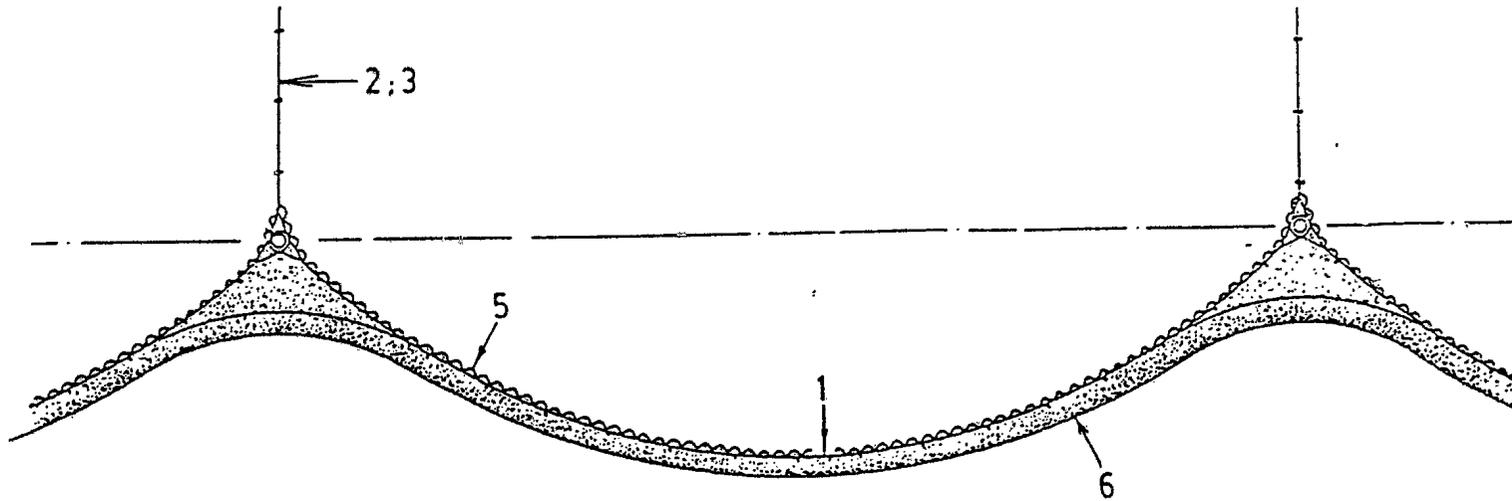


FIG. 3

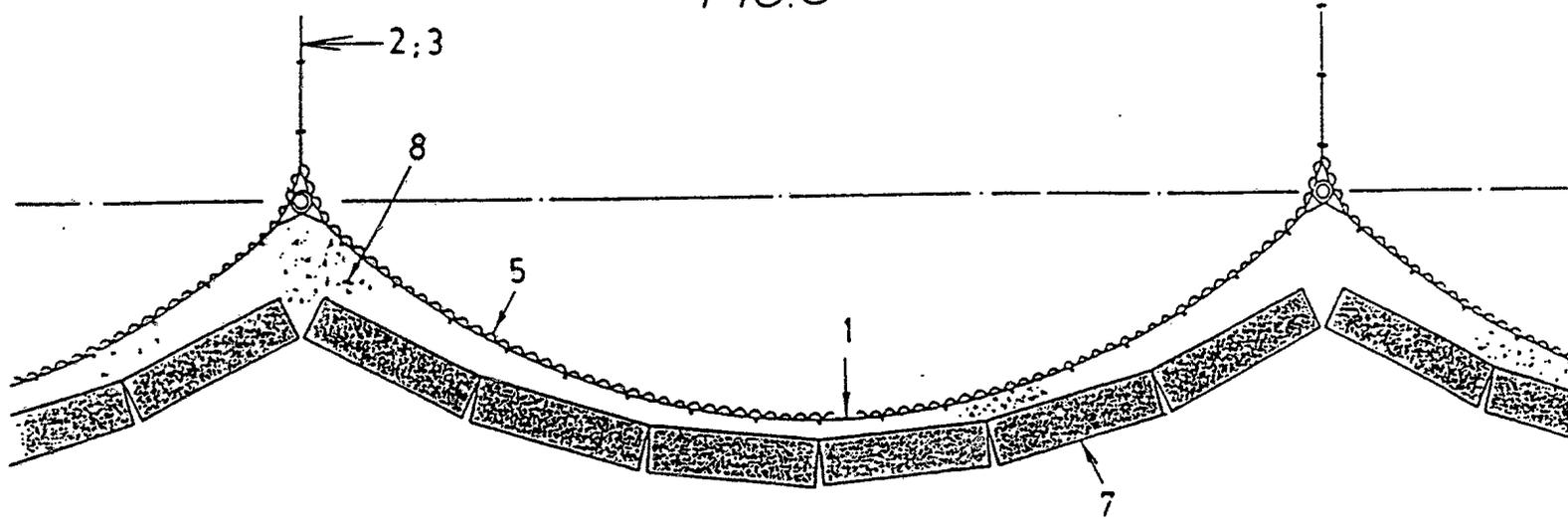


FIG. 4

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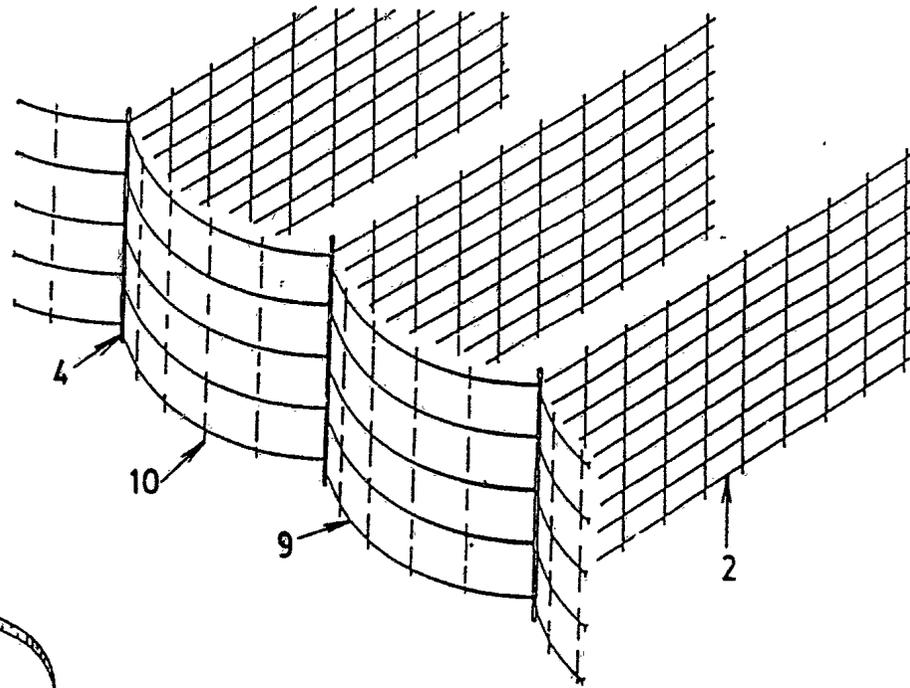


FIG. 5

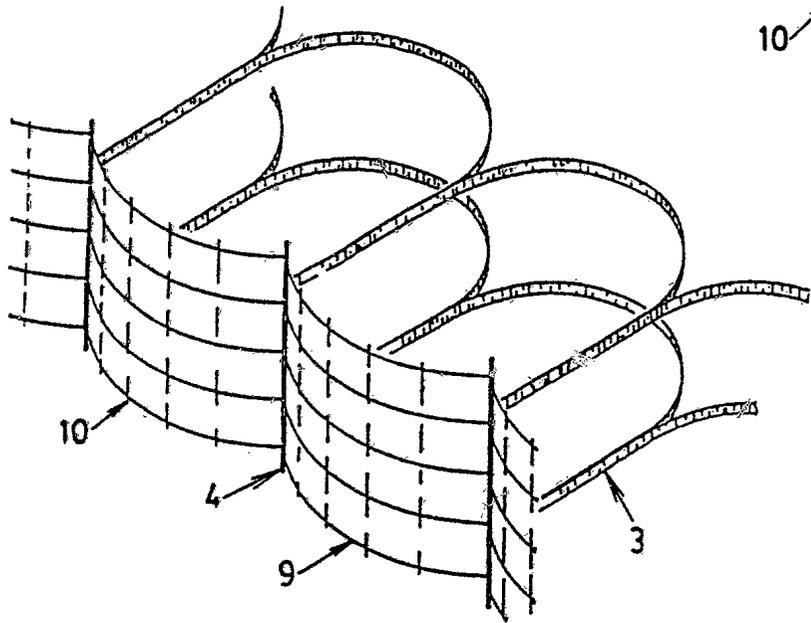


FIG. 6

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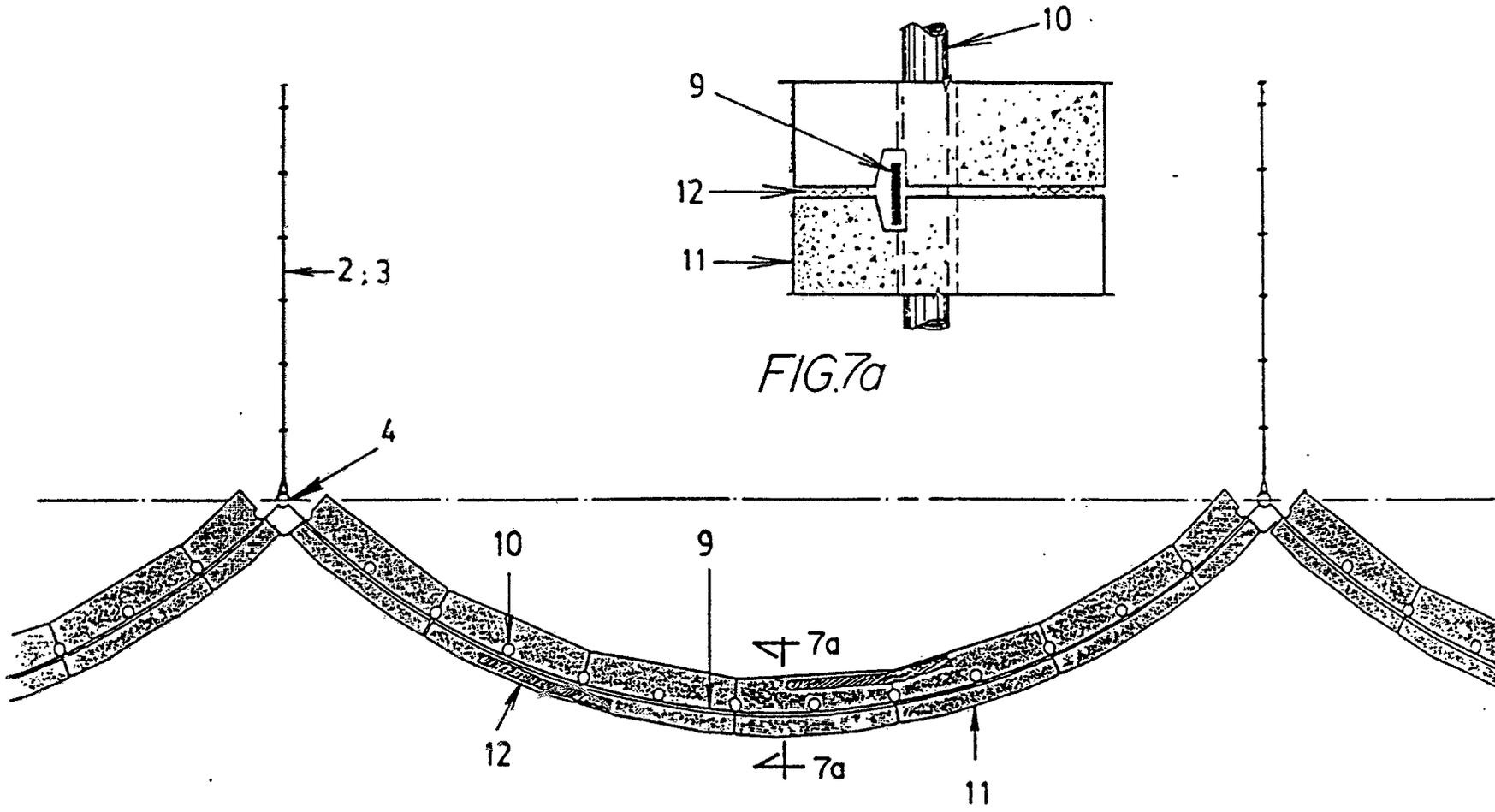


FIG. 7

4/15

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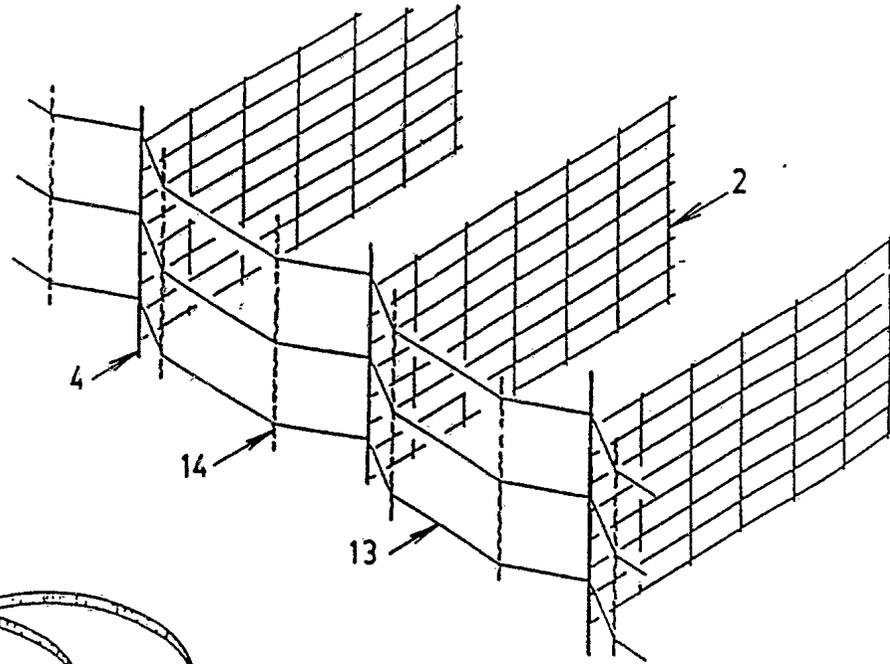


FIG. 8

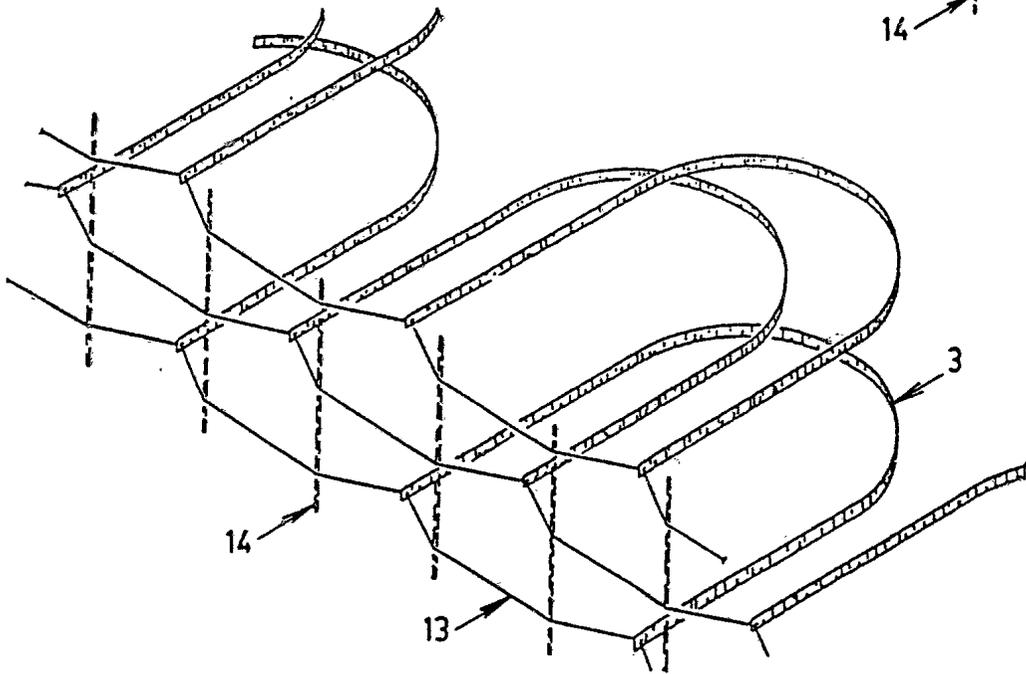


FIG. 9

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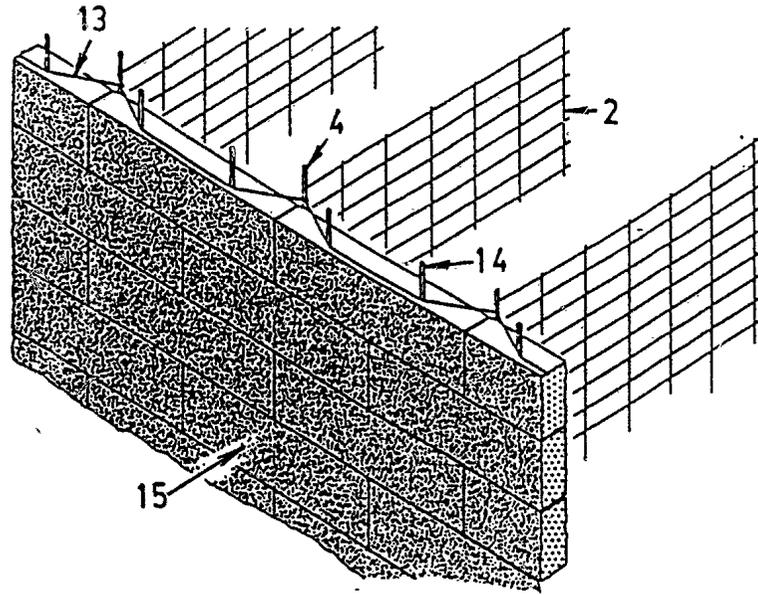


FIG. 10

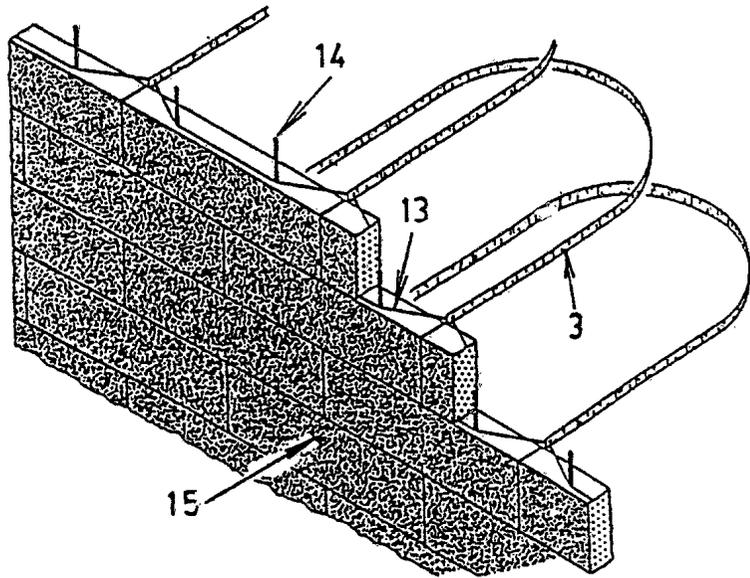


FIG. 11

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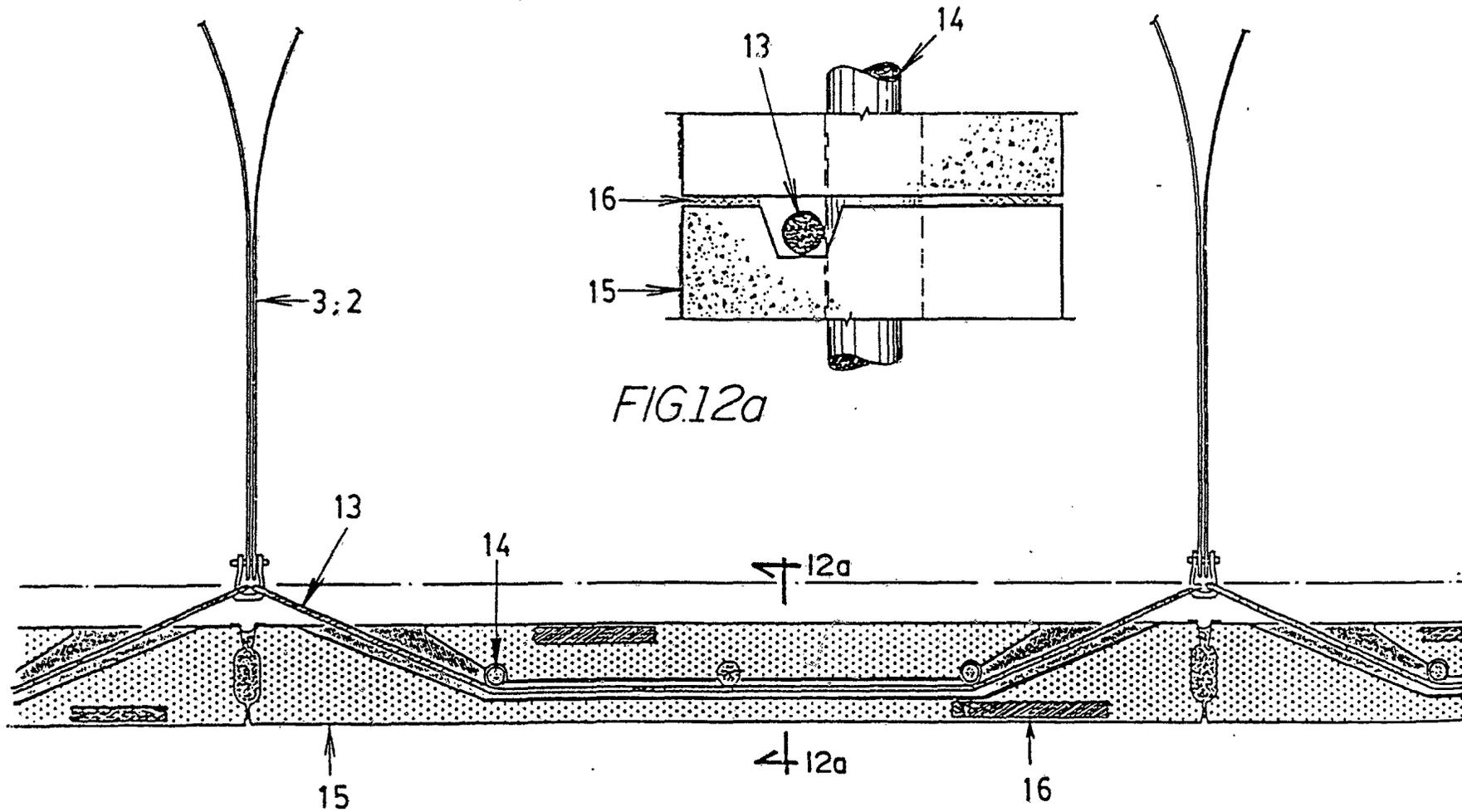
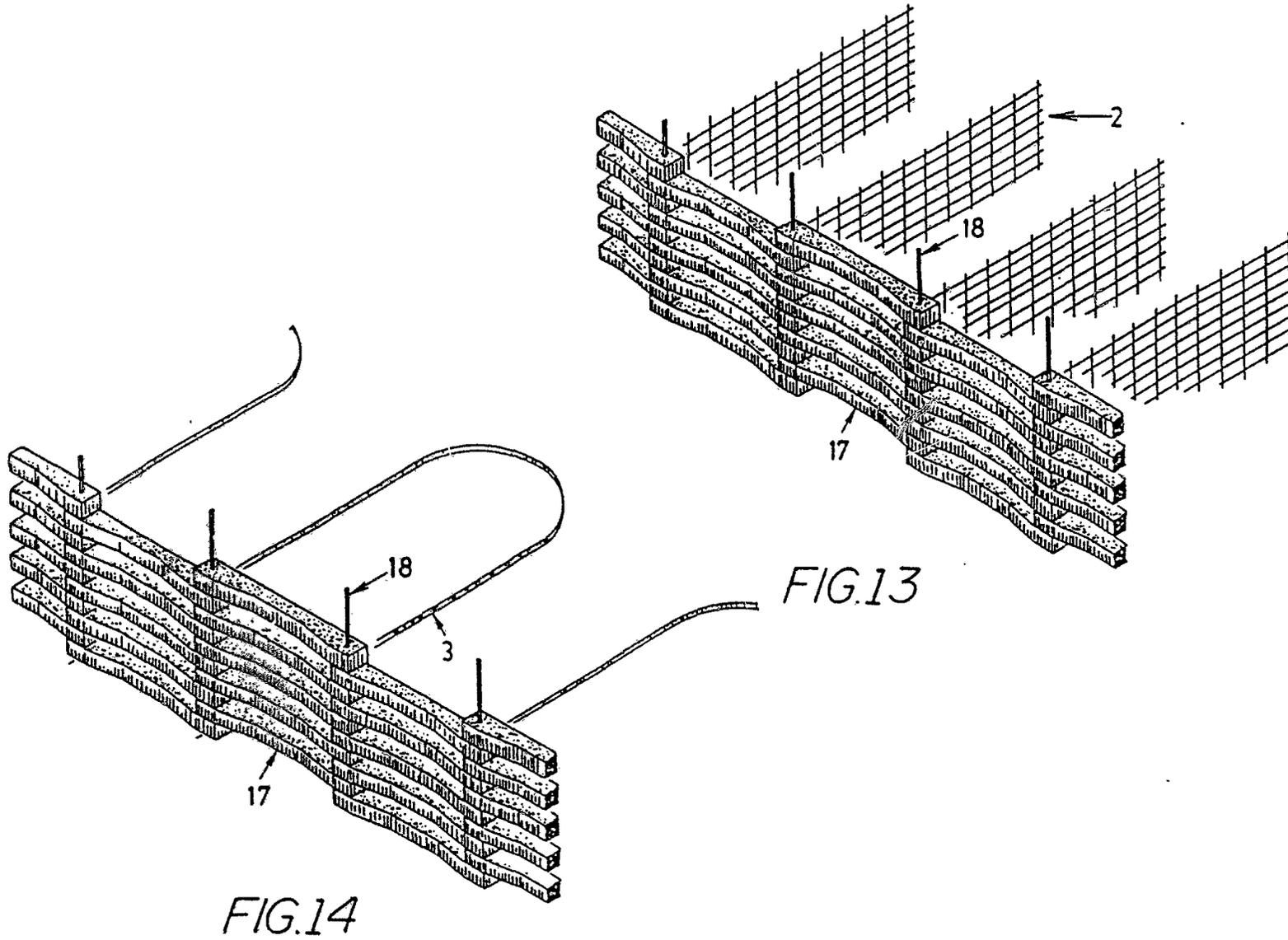


FIG.12a

FIG.12

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8/15

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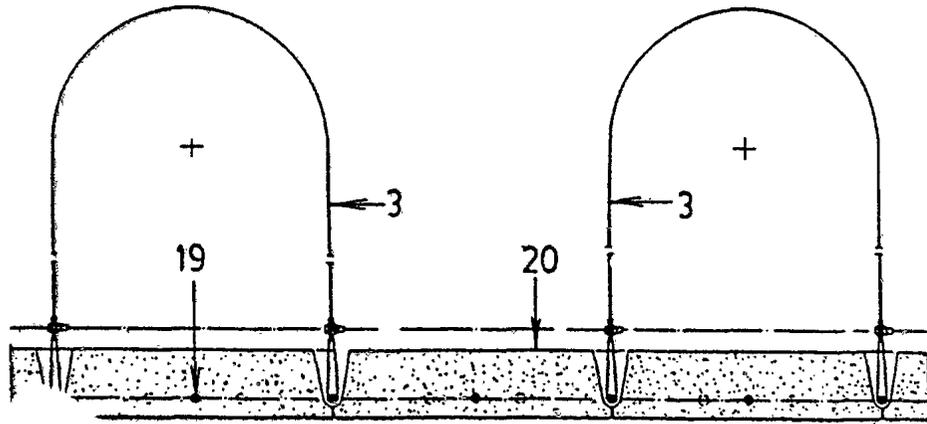


FIG. 16

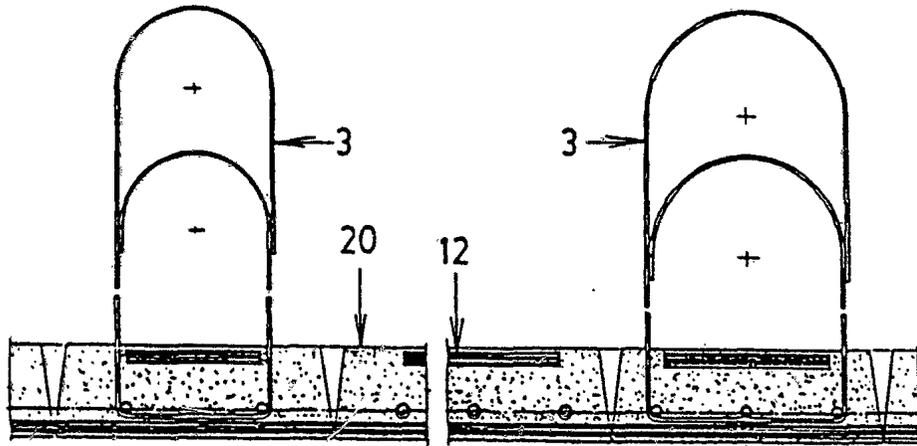


FIG. 17

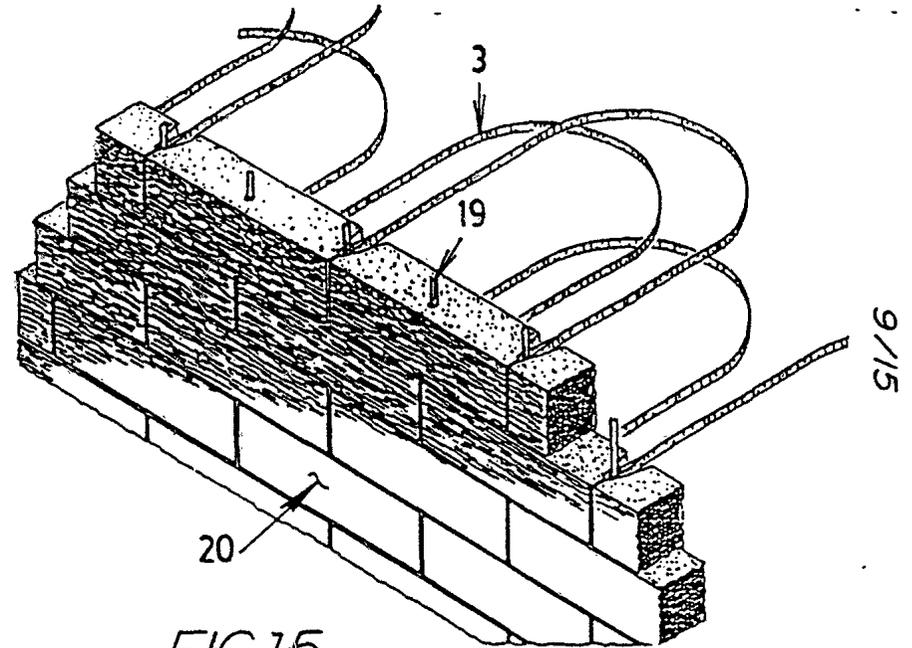


FIG. 15

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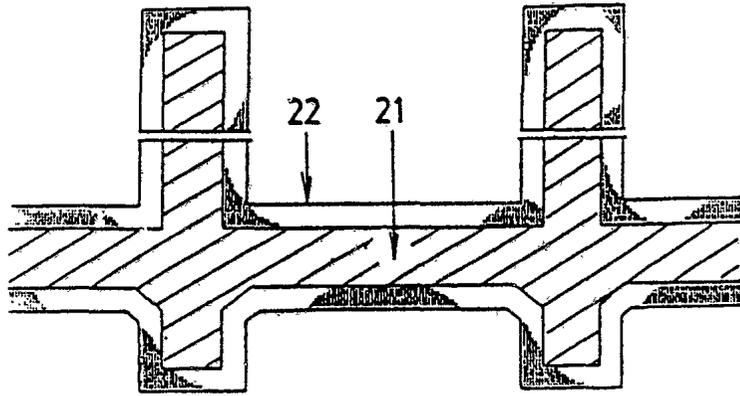


FIG. 18

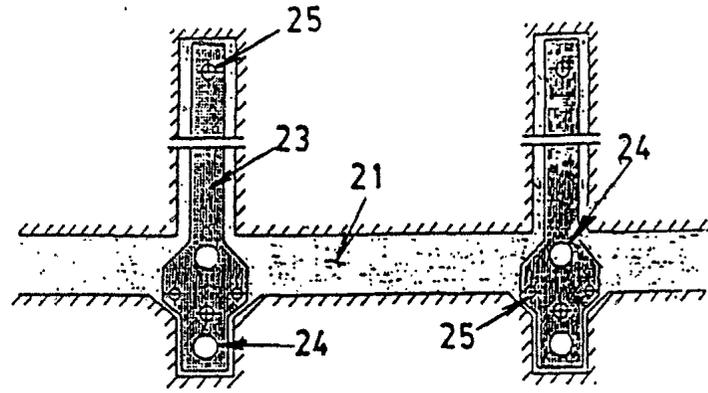


FIG. 19

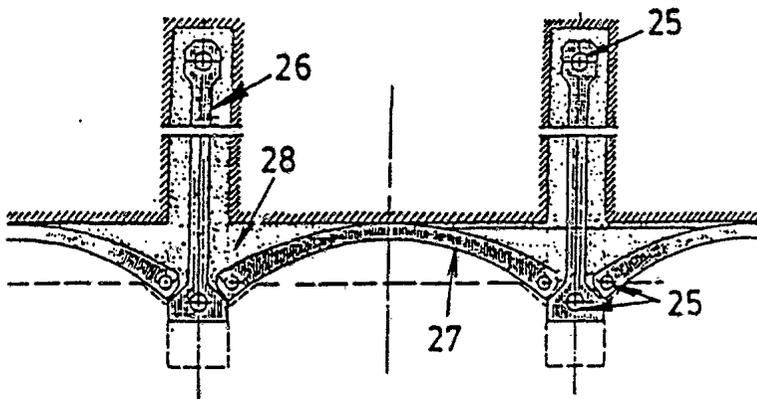


FIG. 20

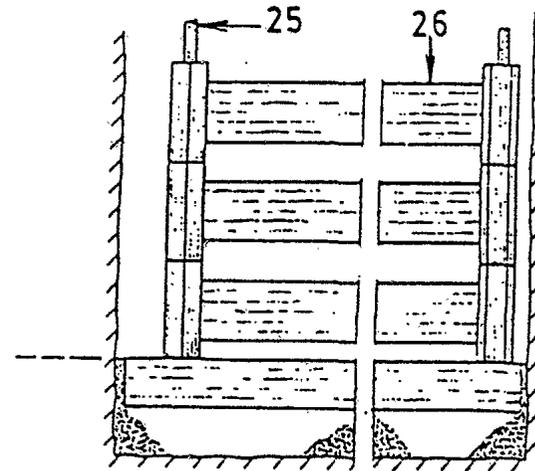


FIG. 21

10/15

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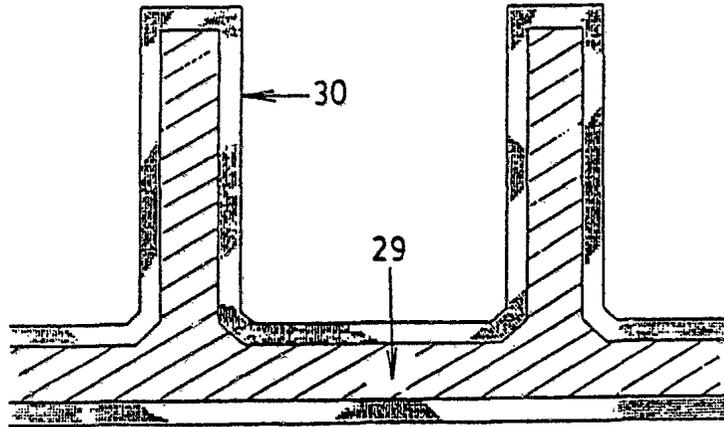


FIG. 22

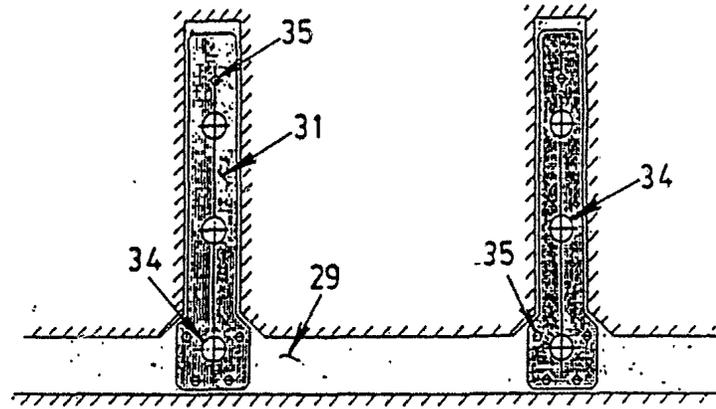


FIG. 23

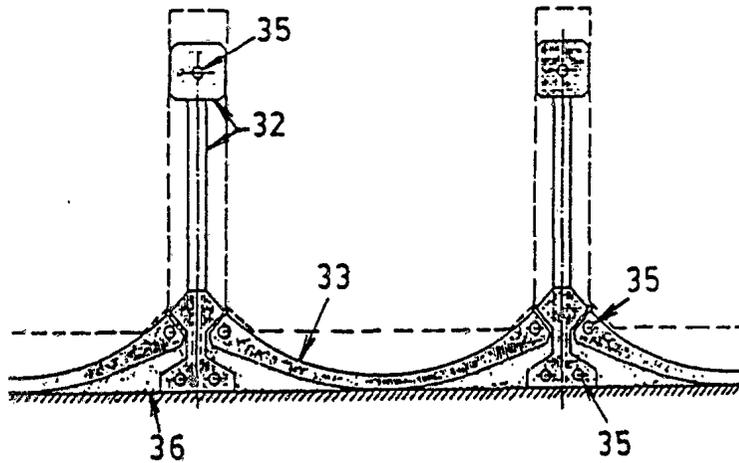


FIG. 24

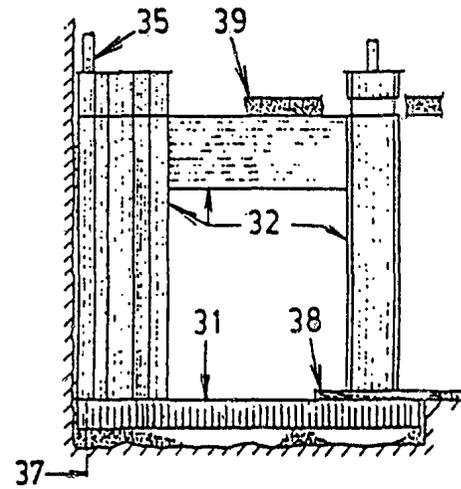


FIG. 25

11/15

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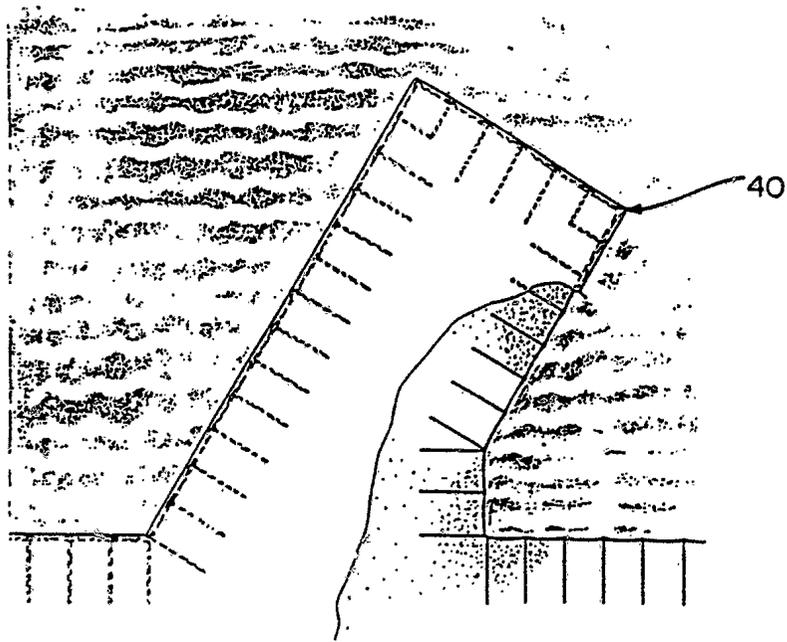


FIG. 26

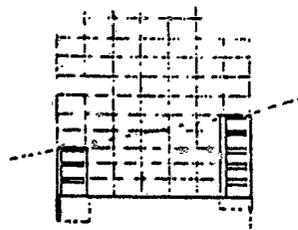


FIG. 27a

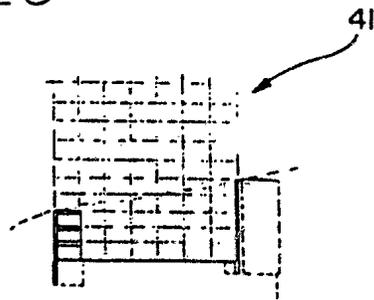
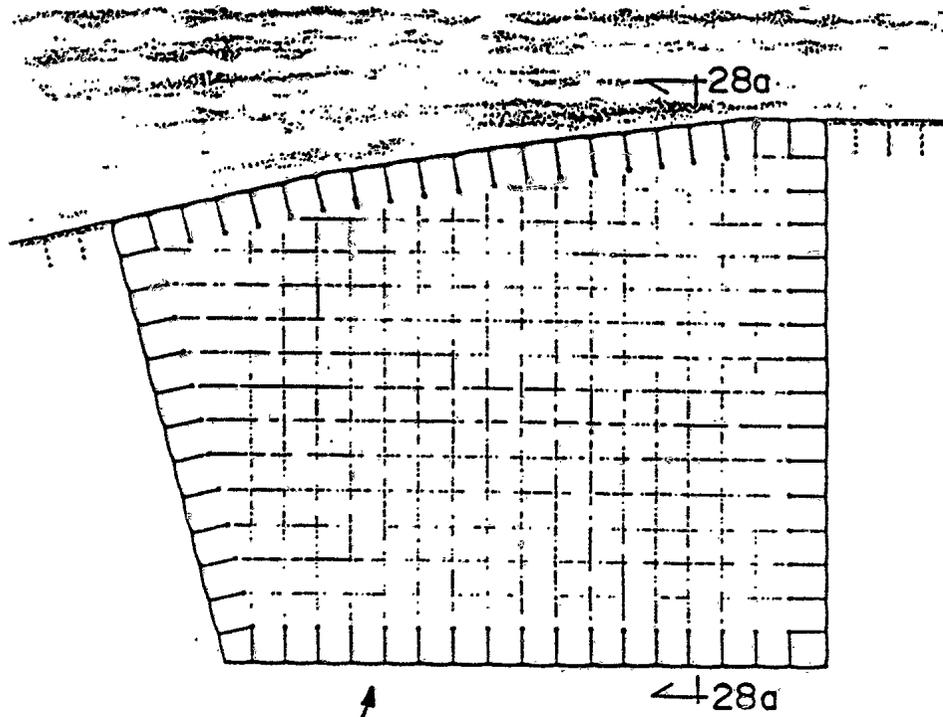


FIG. 27

12/15

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FIG. 28

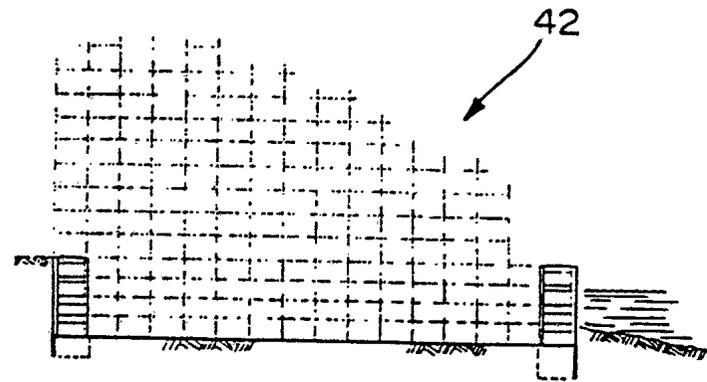


FIG. 28a

13/15

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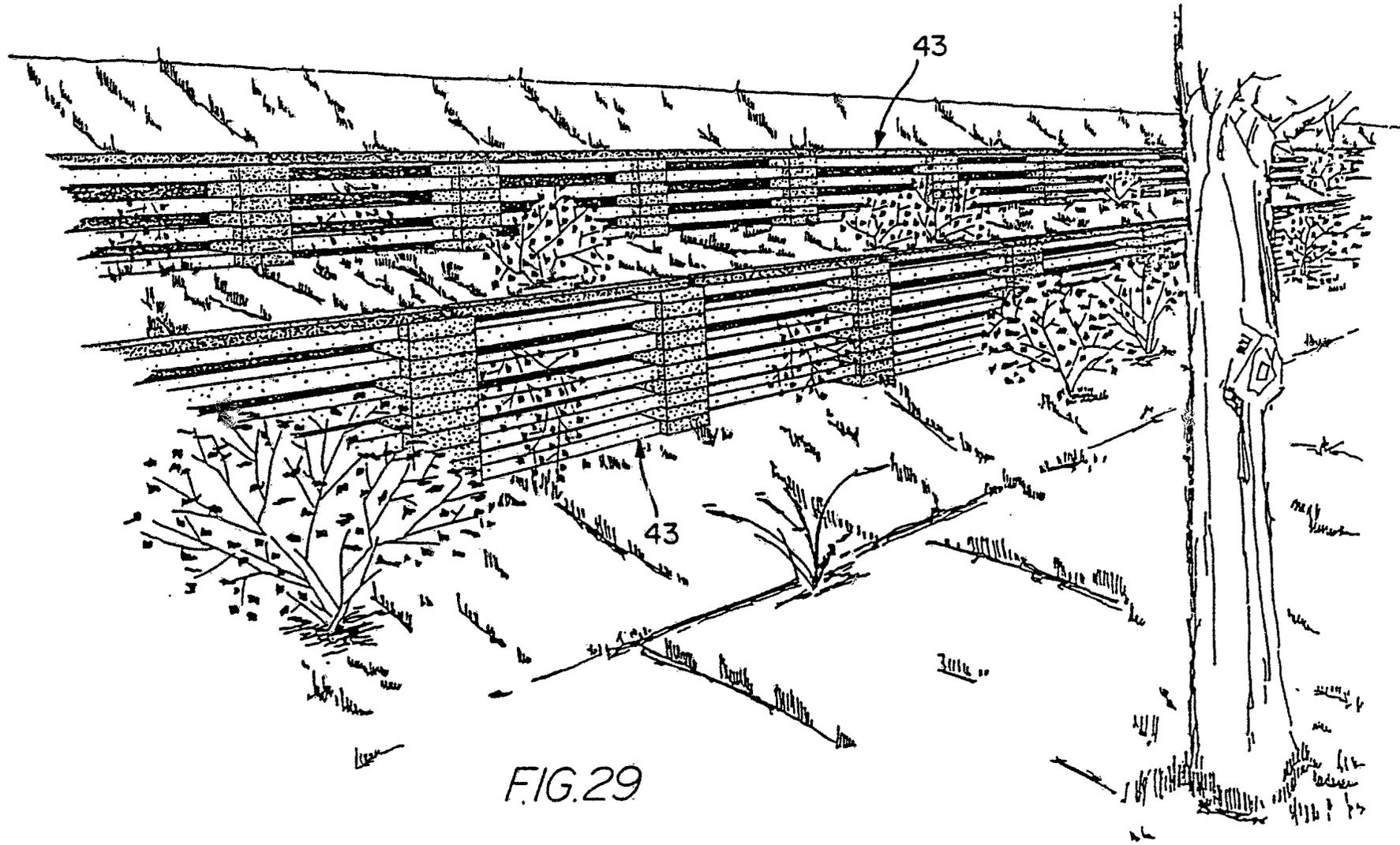


FIG. 29

14/15

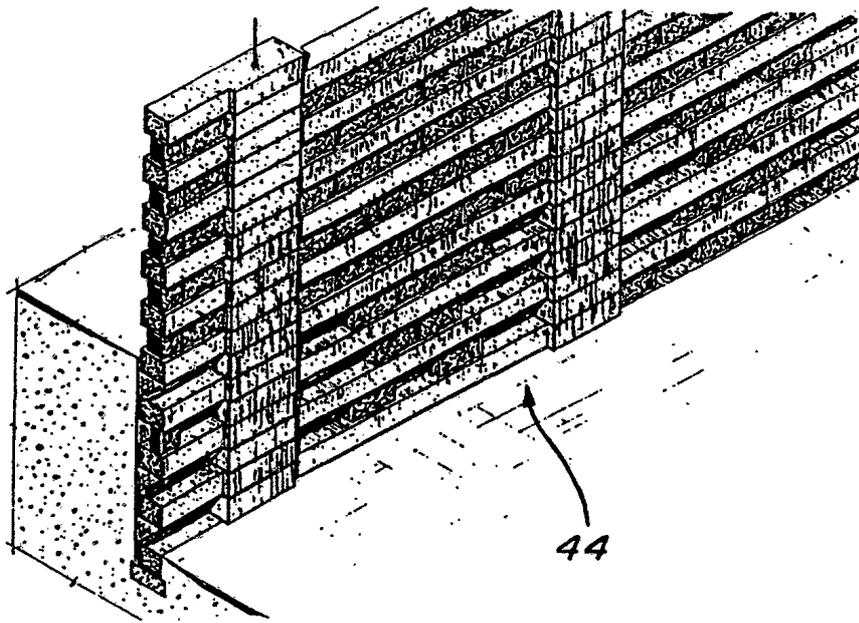


FIG. 30