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(54) A system for anchoring a wall structure of concrete blocks

(57) The present invention relates to a system for anchoring a wall structure of concrete blocks with an upper surface defining a canal, comprising a grid or mesh suitable for being positioned and put in traction in the ground behind the wall structure, a bar suitable for restraining a portion of said grid inside said canal and a plurality of clips that can be inserted into said canal to lock said bar into position inside the canal.

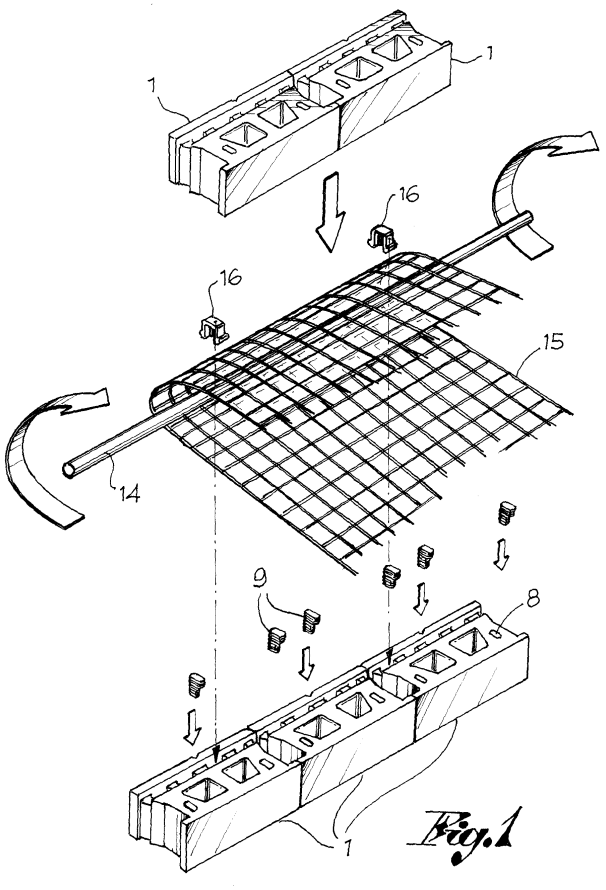

Fig.1

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Description

[0001] The present invention relates to blocks, for example vibrated and compressed concrete blocks, suitable for being overlapped in rows or layers for the construction of supporting wall structures, such as for example face walls, toe walls, ornamental walls, anti-erosive facings for slopes, sound proofing barriers, barriers and partitions between gardens, facings for canals, protective facings for river banks and the like. In particular, the present invention relates to a system for anchoring a wall structure to the ground behind. The invention also relates to a pin for constraining two overlapping rows of blocks, and a block for receiving said pin.

[0002] Supporting walls composed of a plurality of blocks arranged in overlapping rows and blocked by pins are already known, for example from the patents US 4 914 876, US 5 865 006 and US 5 913 790.

[0003] It is also known to provide for a system for anchoring a wall structure to the ground behind comprising a grid or mesh, which extends backwards in said ground behind the wall, whose connection to the wall can be guaranteed by means of friction, in other words simply by interposing the grid between block and block, or by means of mechanical connectors of various types and forms, which guarantee a suitable connection, whilst reducing the thicknesses of the blocks set on the facing.

[0004] There are continuous bars between these mechanical connectors, which also act as load distributors and which can be connected to the grid in various ways.

[0005] The anchoring system proposed here provides a simple winding of the grid around a bar set in a continuous canal made in each row of blocks, with the return of a front portion of the grid in the ground, so that, after the traction exerted by the grid, the bar goes to rest against a shoulder of the canal and distributes the load along the whole extension of the grid.

[0006] However, during the phase of laying the blocks, when the grid is laid and turned around the bar, and a row of blocks has not yet been placed on top, the bar tends to be undermined by the canal in which it is set, so it is necessary to hold it in position manually. The unwanted movements of the bar are accentuated by the fact that the bar is very light compared to the grid and it is positioned with a clearance in the canal.

[0007] An anchoring system is described in the document WO 03/006748, wherein the bar is hooked by pressure to a respective connector set in the canal and this extends for at least the whole length of this. However, this system requires the section of the canal to be increased also to accommodate the connector for the bar, with the disadvantage that the concrete block is weakened.

[0008] The clamp type coupling between the bar and connector means a lack of clearance between the two elements, and the consequent impossibility of using the same bar and connector with grids of a different thickness.

[0009] Moreover, the presence of a connector, which extends for the whole of the length of the bar and which has a certain rigidity needed to restrain the bar also under elevated loads, hampers the realization of wall structures running in a curvilinear direction.

[0010] Finally, the envisaging of a complementarily shaped connector and bar makes the structure of the wall structure more complex and costly to realise.

[0011] It will be noted that the structure with concrete blocks must also be feasible in the sector of D-I-Y and therefore it must be as simple and cheap as possible, and equally reliable.

[0012] Therefore, it is an object of the present invention to propose a system for anchoring a wall structure to the ground behind that allows the above stated disadvantages to be remedied.

[0013] Said object is achieved, according to the invention, with an anchoring system according to claim 1.

[0014] The features and advantages of the anchoring system according to the present invention will nonetheless be appreciated more clearly from the description reported below of a preferred embodiment, which is given by way of example and not limiting, with reference to the accompanying drawings, wherein:

[0015] - figure 1 shows an exploded, perspective view of the anchoring system according to the present invention;

[0016] - figures 2 and 2a show a perspective, top view of a concrete block;

[0017] - figures 3 and 3a represent a perspective and front view of one of the elements for locking the anchoring bar to the concrete blocks;

[0018] - figures 4 and 4a show a perspective and top view of an interconnecting pin between blocks;

[0019] - figure 5 shows a top view of an anchoring grid laid over a concrete block and constrained by means of a bar;

[0020] - figure 6 represents a detail of the block in the previous figure at the height of a clip for blocking the bar, in section according to the line A-A in figure 5;

[0021] - figure 7 represents a detail of the block in figure 6 at the height of the anchoring bar, in section according to the line B-B in figure 5;

[0022] - figure 8 shows two overlapping blocks in section in a first configuration of use;

[0023] - figure 9 shows two overlapping blocks in section in a second configuration of use;

[0024] - figure 10 represents a perspective view of the clip for blocking the bar, in a different embodiment; and

[0025] - figure 11 represents a top view of a row of blocks for constructing a wall running in a curved direction.

[0026] In said drawings, concrete blocks are indicated with reference numeral 1 to be used to form wall structures by arranging them in overlapping rows. When building a wall, after laying a first row of blocks next to each other, below, a second row of blocks is laid on top of the first row, above, so that the two rows are vertically

dephased, in other words so that each block of the row above rests on two adjacent halves of two blocks of the row below. According to one embodiment, the blocks exhibit a plane of vertical symmetry.

[0027] The block 1 exhibits a substantially rectangular form or size and comprises upper 2 and lower 3 parallel surfaces, a front face 4, a rear face 5 and two opposite side walls 6. The front face 4, represented here substantially level, can be variously shaped; the rear face 5 is substantially parallel to the front one 4.

[0028] The side walls 6 are indented and converge towards the rear face 5 so that both the latter and the front face 4 exhibit protruding lateral ends 4', 5' useful for defining an external rectangular size, which facilitates operations of packaging the blocks. The rear lateral ends 5' are also configured for easy removal in the event of using the blocks to realise convex walls, in other words that curve inward.

[0029] Holes 8 are made in the rear part of the block 1, near the corners between the rear face 5 and the side walls 6 for receiving and blocking corresponding interconnecting pins 9 between overlapping adjacent blocks. These holes 8 preferably have an orthogonal axis in relation to the bearing areas 2 and 3 of the block and they cross the latter for the whole of its height.

[0030] In a central position in relation to the side walls 6 and slightly back towards the rear face 5, the block 1 exhibits an opening 10, possibly divided into two parts by a central separator 10', in which the pins 9 of the blocks of a row underneath on which it rests engage. This opening 10, which is also preferably orthogonal to the bearing areas 2 and 3 of the block, extending for the whole of its height, exhibits an extended form parallel to the front and rear faces 4 and 5 to be able to receive the pins 9 of two blocks below. The opening 10 is measured to maximize the resistance of the block and, at the same time, minimize the weight.

[0031] According to a preferred embodiment of the invention, the central opening 10 exhibits a trapezoidal form with rounded corners, bases parallel to the front and rear facades and the smaller base facing the rear façade 5.

[0032] Thus configured, the central opening 10 acts as a running rail to be able to arrange the blocks 1 along rectilinear rows, along rows curved inward and along rows curved outward, the distance between the pins 9 engaging in a central opening 10 being able to vary freely according to the required bend radius.

[0033] As it will be better explained later on, the holes 8 for receiving the interconnecting pins 9 are preferably aligned with the rear wall that defines the opening 10. In other words, the straight line passing by the rear wall is tangent to the holes 8, as it can be appreciate particularly in figure 2a.

[0034] At least one front chamber 12 is also made in the block 1 between the central opening 10 and the front face 4, which extends for the whole height of the block, from the upper surface 2 to the lower one 3. As represented in the figures, the block 1 preferably exhibits four front chambers 12 at the side, each with an extended form parallel to the front face 4 and the rear face 5. These chambers allow ventilation of the front of the wall structure, avoiding the formation of humidity and consequent stains on the front face 4 of the blocks, consequently preserving the aesthetic appearance of the facade. Moreover, the front chambers 12 also serve for thermal isolation to protect the interior part of the wall, and in particular the anchoring grids or meshes, from excessive increases in temperature caused by the face of the wall being exposed to the sun. Again advantageously, the front chambers 12 make it possible to protect the wall face in the event of damage, without compromising the structural characteristics of the wall itself.

[0035] Thanks to the provision of two series of chambers, at least one at the front 12 and at least one in the centre 10, the first suitable for thermally isolating and the second suitable for consolidating and guiding the block onto the portions of pin protruding from the adjoining blocks, it is possible to prevent the pins 9 from moving and consequently the block/pin coupling during use. Moreover, the coupling is also guaranteed in the event of partial damage to the front part of the block.

[0036] A canal 13 is made in the upper surface 2 of the block 1, which extends transversally from one side wall 6 to the other, parallel to the front 4 and rear 5 faces. As one can clearly see, particularly in figure 1, once a row of blocks 1 has been laid, the canal 13 of each block is aligned with the canals of the adjacent blocks forming one continuous canal.

[0037] Said continuous canal resulting from the alignment of the canals 13 of adjacent blocks is suitable for holding an anchoring bar 14 wrapped around which there is the end of a mesh or grid 15 set between overlapping rows of blocks for anchoring them to the ground behind. The general method of installing and working an anchoring mesh or grid is described for example by the patent US 6,338,597, in particular from column 4, line 52, to column 5, line 19, which is reported here for reference.

[0038] Note that the bar 14 allows the load to be distributed uniformly along the whole width of the mesh or grid 15.

[0039] Advantageously, the bar is realised in plastic material, preferably polyethylene.

[0040] Advantageously, the bar 14 has a circular section.

[0041] The canal 13 preferably intersects the front chambers 12, in other words it is made in the walls that define said chambers. In conjunction with the front chambers 12, the canal 13 then defines a grid of passages behind the face of the wall, which allows electric cables, for example to be housed for lighting systems, irrigation pipes or other devices, besides acting as a drainage system for the face itself.

[0042] According to the invention, the anchoring bar is held in position inside the canal 13 by a plurality of clips 16 that can be inserted by force into the canal itself. Each

clip has (figures 3, 3a and 10) an upside down U-shape, in other words it comprises a pair of substantially parallel elastic arms 17 suitable for coming together to insert the clip by force and lock it into position between the walls of the canal. The two arms are connected by an upper horizontal side 18, internally with a concave form, where the anchoring bar 14 is to engage. Each arm 17 terminates at the bottom with an inclined plane 19 facing inward so as to act as an invitation to insert the clip 16 into the canal 13.

[0043] According to a particularly advantageous embodiment, the clips are inserted level with the front chambers 12 of the blocks intersected by the canal 13. In this way, the bar 14 rests on the bottom of the canal, whilst the arms of the clips extend inside said chambers, at a lower level in relation to that of the bottom of the canal.

[0044] On the one hand this allows the depth of the canal to be kept reduced to a minimum, which is essential for housing the bar and not weakening the structure of the block and, on the other hand, it allows the mechanical seal of the bar to be increased. In fact, the elastic arms of the clips extend deep into the block, exploiting the front chambers 12 and anchoring the clips firmly to the block, also for elevated loads exerted by the grid. Moreover, the upside down U configuration of the clips, therefore the presence of a closed upper side, prevents the bar from coming unthreaded from the same clips.

[0045] Laboratory tests have proven, also when the traction exerted by the grid is sufficient to cause an angular displacement of the upper blocks, in other words their partial lifting in relation to the lower blocks, that the presence of locking clips inserted deep into the front chambers stops the bar from lifting up and wedging between the two rows of overlapping blocks. Therefore the correct re-positioning of the blocks is guaranteed when the abnormal occurrence ceases, such as a seismic event or the presence of a big trailer lorry on the ground behind the wall, which has caused the blocks resting on the grid to lift up.

[0046] The clips constitute a system for locking the bar in position that is "discontinuous", in other words it is realised locally or precisely by arranging the clips at a certain distance from each other. This system allows the portion of bar included between two clips to bend as much as is allowed by the material with which it is realised and by its section. The fact that the bar is able to bend is particularly advantageous mainly for two reasons. Firstly, it is possible to realise wall structures that run in a curvilinear direction, as shown in figure 11, where it is possible to appreciate that the presence of the suitably distributed clips does not affect the possibility of the bar to bend in order to follow the curve of the wall.

[0047] Secondly, as one can see from figure 5, the bar in traction can bend until it rests on the rear wall, which defines the canal 13. Therefore, the resistance to the traction is not only supported by the locking clips, but it is also distributed on this wall of the concrete block.

[0048] The clips locking system also enables thin, light, circular section anchoring bars to be used. Since no particular geometric coupling is required between the clips and the bar, grids of different thicknesses can also be used. The distance between the clips can be chosen, for example, on the basis of the grid used. For example up to four clips per block can be applied by a clip for each block, in other words one in each front chamber 12.

[0049] Now back to the connection between overlapping blocks, the pins 9 must be firmly blocked in the respective holes 8 to oppose the greatest resistance possible to a translation of the blocks on each other as a result of the thrust of the ground behind.

[0050] This locking is realised by force coupling, in other words by geometrically measuring and configuring the hole and pin so their coupling occurs with suitable interference. In other words, the external size of the pin 9 is greater than the diameter of the hole 8.

[0051] According to a preferred embodiment of the invention, this force coupling is not given by the whole external surface of the pins, but only by more protruding parts of it. This is obtained by making the external surface of the pin corrugated, for example bearing radial protuberances.

[0052] The presence of said radial protuberances or protrusions also allows any dimensional distortions or differences of the section of the holes 8 to be compensated 8 for.

[0053] According to one embodiment, said radial protuberances comprise a plurality of annular projections 11, which extend from the body 11' of the pin, at least for an axial portion lower 20 than this. Said projections preferably exhibit a conical section facing the direction of insertion into the hole 8.

[0054] Advantageously, the body 11' of the pin exhibits a cross structure in transversal section, the projections 11 being configured as a plurality of overlapping discs crossed axially by said cross body.

[0055] According to a preferred embodiment, at a determined height, the pin exhibits an undercut 21 suitable for defining a lower axial portion 20 of insertion into the corresponding hole in the block and an abutment for the pin on the upper surface 2 of the concrete block 1. In this way, the operation of inserting the pin into the blocks is easier, since the pin will penetrate the respective hole to the height defined by the abutment, and the layer will no longer have to worry about gauging the pressure to be applied to the pin to insert it into the hole at the most suitable height.

[0056] Advantageously, the undercut 21 defines an upper axial portion 22 intended to protrude from the hole 8, with a greater transversal size in relation to the lower portion and therefore in relation to the section of the hole. Consequently, the side for inserting the pin into the hole is clearly identified.

[0057] The undercut 21 is substantially provided at the mid-height of the pin, so that the two axial portions 20, 22 substantially exhibit the same extension.

[0058] Advantageously, the pin 9 exhibits an upside

down L shape, in other words an upper axial portion with an axis that is parallel, but not coinciding with the axis of the lower portion. This form allows overlapping blocks to be arranged in vertical alignment (figure 8) and backward (figure 9). In the first case, the pin 9 is inserted into the respective hole 8 with the upper portion 22 facing ahead, in other words towards the face 4 of the block. In fact, in this way an upper block can be overlapped in perfect vertical alignment with a lower block keeping the upper portion 22 of the pin 9 in contact with the rear wall defining the opening 10 in the upper block (figure 8), thus avoiding any forward translation of the upper block in relation to the lower one.

[0059] In the second case, the pin 9 is inserted into the respective hole 8 with the upper portion 22 facing backwards, in other words towards the rear wall 5 of the block, and therefore rotated by 180° in relation to the previous situation. In fact, in this way, the upper block can be placed over the lower one only by moving it back in relation to it (figure 9). This moving backward will at least be equal to the protrusion of the upper portion 22 of the pin in relation to the lower portion 20.

[0060] Advantageously, the two assembly positions of the pin, rotated by 180° in relation to each other, are identified by the structure of the pin itself and the relative hole. For example, the discs 11, which define the transversal size of the pin and the transversal section of the hole 8 exhibit an extended or flattened form in a transversal direction, for example an elliptical form.

[0061] The pin 9 can be realised in plastic material, preferably polyethylene, which exhibits a good result with low working temperatures too.

[0062] Laying the wall structure foresees laying a first row of blocks, for example in a suitable trench that has been previously dug out, placing the grid over the row of blocks, providing a return of the necessary length and inserting the interconnecting pins into the relative holes, depending on the required direction. At this point the bar is positioned in the canal and locked into position with the clips. Now the grid can be fixed to the ground behind, for example using pegs. The presence of the blocking pins makes operations related to positioning and returning the grid around the bar extremely quick and easy. At least one second row of blocks can be placed over the first, resting on the grid. Note that it is not necessary to position the anchoring grid after laying each row of blocks, but it may be sufficient to position it, for example, every three or four rows of blocks.

[0063] With the described anchoring system it is possible to realise wall structures of various heights. In fact, the firm hooking between the blocks and the grids creates a synergic effect that allows the mass of ground to be made stable at the back of the face.

[0064] Naturally, in order to satisfy specific and contingent needs, the skilled person can make further modifications and variations to the anchoring system according to the present invention and resulting wall structure, all of which are included within the scope of protection of the invention, as defined by the following claims.

Claims

1. System for anchoring a wall structure of concrete blocks with an upper surface defining a canal, comprising a grid or mesh suitable for being positioned and put in traction in the ground behind the wall structure, a bar suitable for restraining a portion of said grid inside said canal, **characterised in that** it also comprises a plurality of clips suitable for being inserted into said canal at a distance from each other to lock said bar into position inside the canal.

2. Anchoring system according to claim 1, wherein the anchoring bar is realised in material suitable for bending or deforming plastically or elastically, and wherein the clips can be positioned in the canal at a distance from each other to allow said deformation or bending of the bar to follow the course of the wall structure.

3. Anchoring system according to claim 1 or 2, wherein each of said clips can be inserted by force into the canal.

4. Anchoring system according to claim 3, wherein each clip has an upside down U shape.

5. Anchoring system according to claim 4, wherein each clip comprises a pair of substantially parallel elastic arms, suitable for coming together to insert the clip by force and lock it into position between the walls of the canal.

6. Anchoring system according to claim 5, wherein said arms are connected by an upper horizontal side where the anchoring bar is to engage.

7. Anchoring system according to claim 6, wherein the bar has a circular section, and wherein said upper horizontal side is internally concave.

8. Anchoring system according to claim 7, wherein each arm ends at the bottom with an inclined plane facing inward acting as an invitation to insert the clip into the canal.

9. Block, for example, of concrete, comprising an upper face defining a canal suitable for receiving an anchoring bar for an anchoring system according to any one of the previous claims, wherein at least one front chamber leads into said canal, which extends transversally to it, suitable for receiving the elastic arms of a locking clip.

10. Block according to claim 9, wherein said front cham-

ber extends orthogonally to the upper face.

11. Block according to claim 9 or 10, comprising a front face, a rear face substantially parallel to the front face, two side walls and at least one hole suitable for receiving an interconnecting pin suitable for constraining a first row of blocks, below, and a second row of blocks, above, resting on the first row.

12. Block according to claim 11, wherein said hole exhibits dimensions so as to guarantee an insertion of said pin with interference.

13. Block according to claim 12, comprising at least one central opening suitable for receiving the free end of at least one pin coming out of an adjoining block.

14. Block according to claim 11, 12 or 13, comprising two holes for receiving and blocking respective pins, said holes being made near the corners formed by the side walls with the rear face.

15. Block according to claim 13 or 14, wherein said central opening has an extended form parallel to the front and rear faces.

16. Block according to any one of the claims from 13 to 15, wherein said central opening is trapezium shaped, with the smaller base turned towards the rear face.

17. Block according to any one of the claims from 11 to 16, wherein the at least one hole for receiving and blocking a corresponding pin extends for the whole height of the block.

18. Block according to any one of the claims from 13 to 16, wherein said at least one hole for receiving an interconnecting pin is aligned with the rear wall that defines said central opening.

19. Block according to any one of the claims from 11 to 18, wherein said hole exhibits an extended section in a transversal direction so as to realise a geometric coupling with a respective pin.

20. Interconnecting pin for blocks according to any one of the previous claims, with an external surface bearing a plurality of radial protuberances to realise a coupling with interference with the hole of the block in which it is to be inserted.

21. Pin according to claim 20, wherein said radial protuberances comprise a plurality of annular protrusions, which extend from the body of the pin, at least for an axial portion lower than this.

22. Pin according to claim 21, wherein said protrusions exhibit a conical section facing the direction of insertion into the hole.

23. Pin according to claim 22, wherein the body of the pin exhibits a cross structure in transversal section.

24. Pin according to any one of the claims from 20 to 23, wherein an undercut is made at a determined height suitable for defining a lower axial portion for insertion into the corresponding hole in the block and an abutment for the pin on the upper surface of said block.

25. Pin according to claim 24, wherein said undercut defines an upper axial portion designed to protrude from the hole in the block, which has a greater transversal size in relation to the lower portion and consequently in relation to the section of the hole.

26. Pin according to claim 25, exhibiting an upside down L shape, in other words an upper axial portion with an axis that is parallel but not coinciding with the axis of the lower portion.

27. Pin according to claim 26, suitable for coupling geometrically to the relative hole in the block so as to define at least two positions for insertion into said hole, which are angularly dephased from one another by 180°.

28. Pin according to claim 27, with a flattened or extended transversal section in one direction, for example elliptical.

29. Pin according to any one of the previous claims, realised in plastic material.

30. Pin according to claim 29, realised in Polyethylene.

31. Wall structure comprising a plurality of blocks according to any one of the claims from 9 to 19 arranged in overlapping rows, wherein a system is provided for anchoring to the ground behind between at least two adjacent rows of blocks according to any one of the claims from 1 to 8.

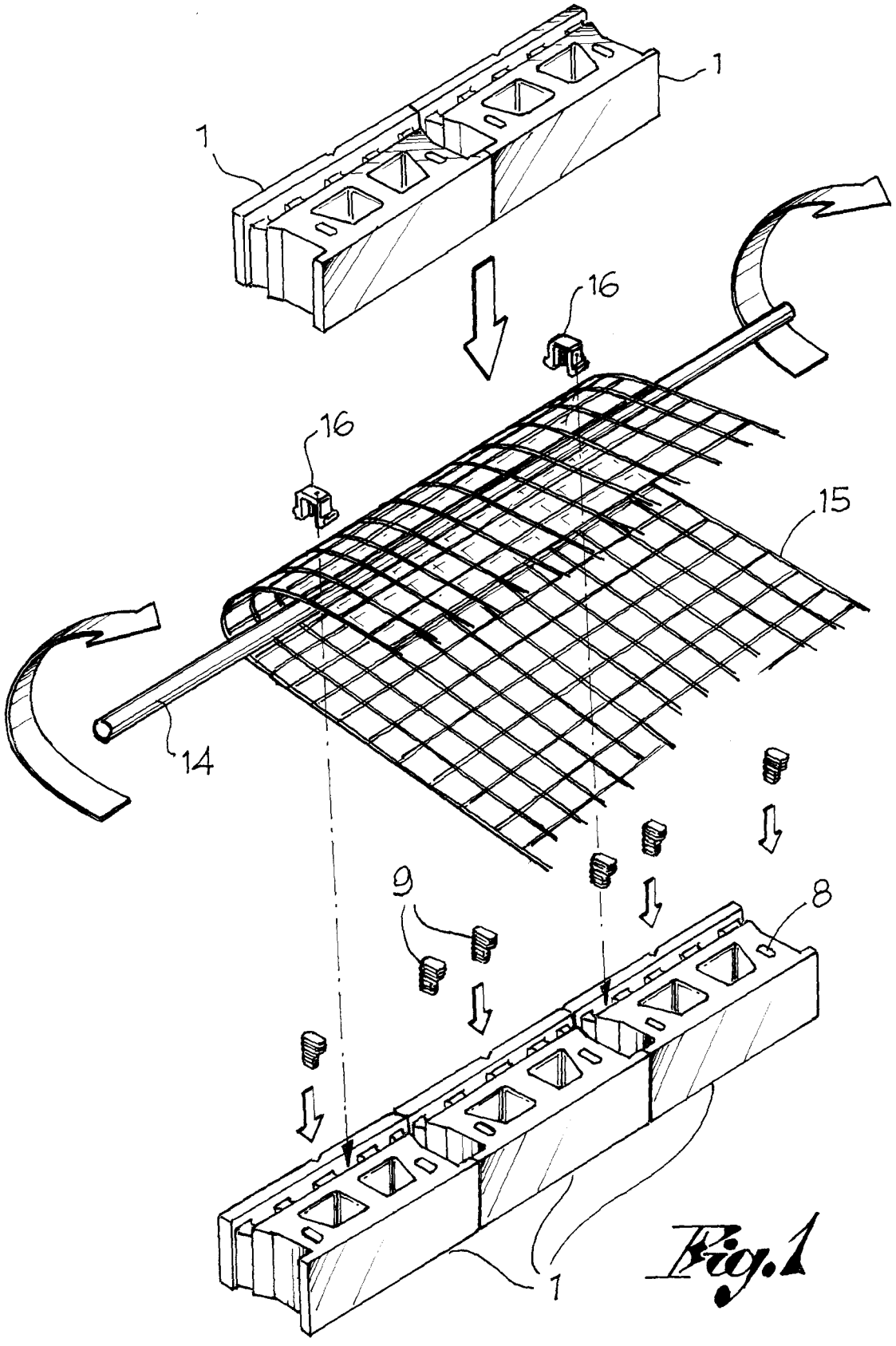


Fig.1

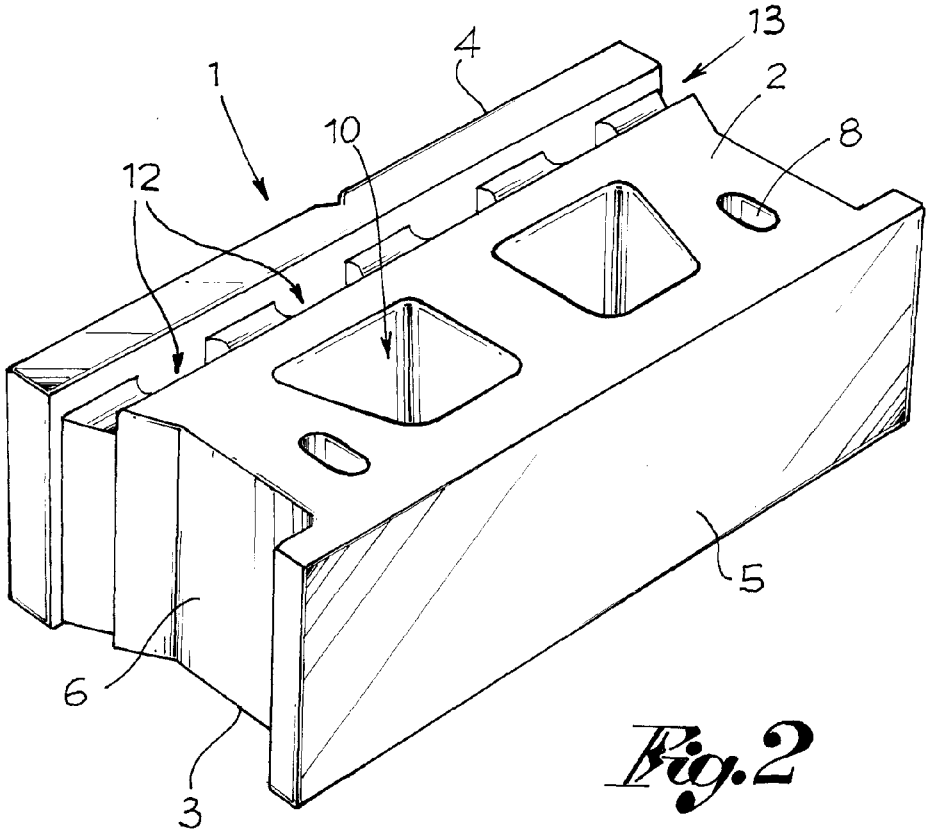


Fig.2

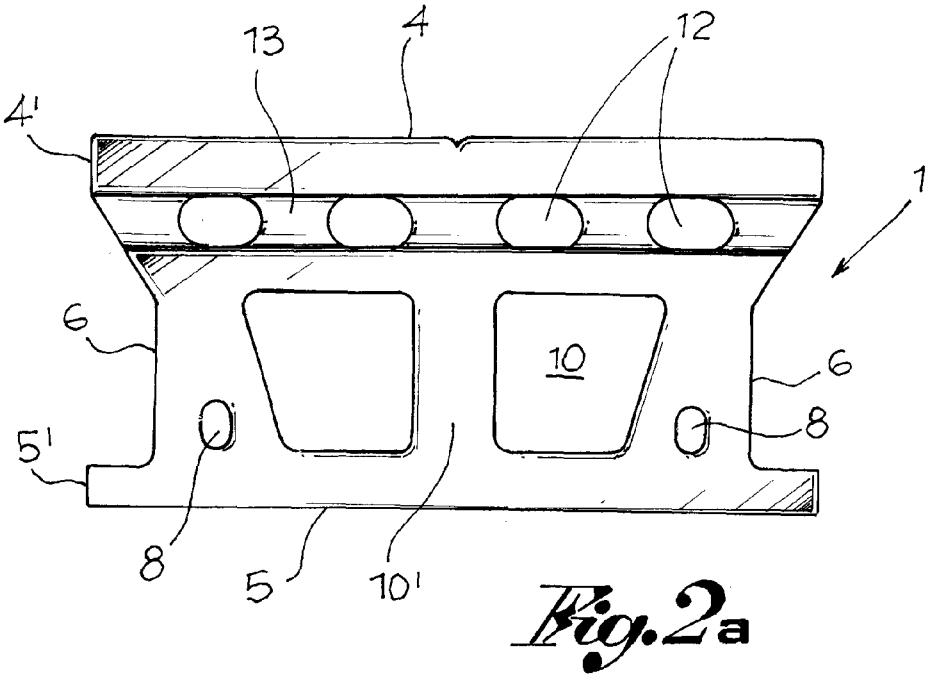


Fig.2a

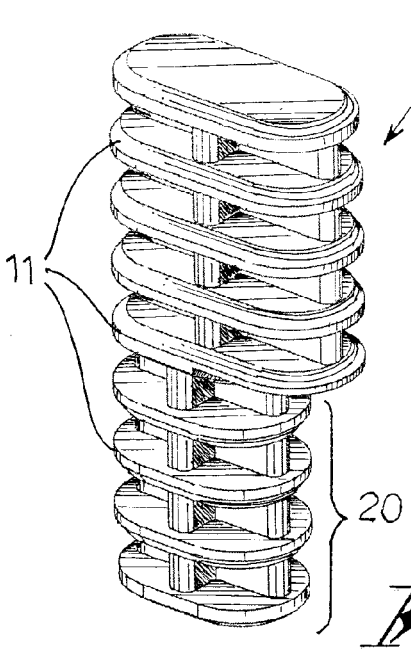


Fig. 4

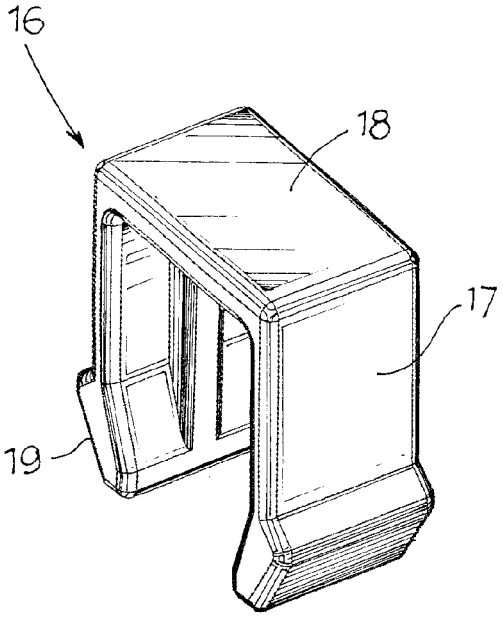


Fig. 3

Fig. 4a

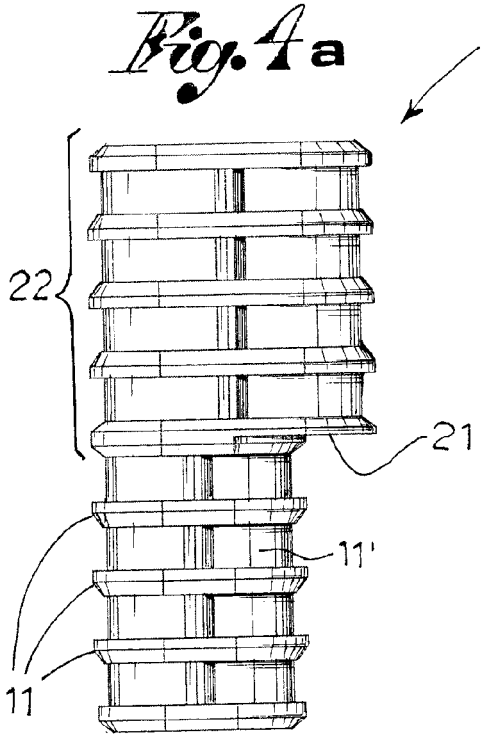


Fig. 3a

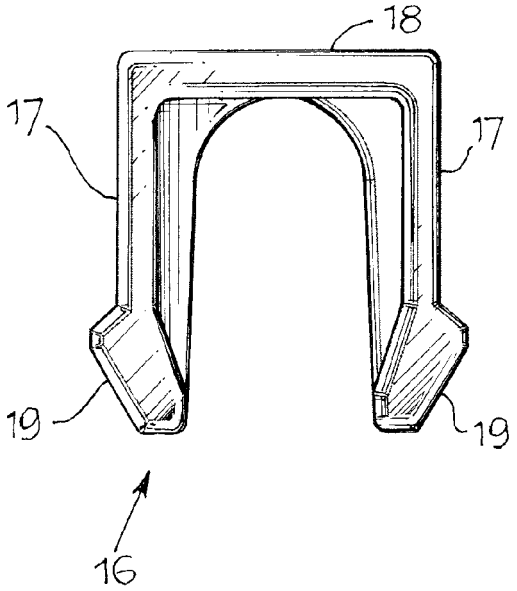
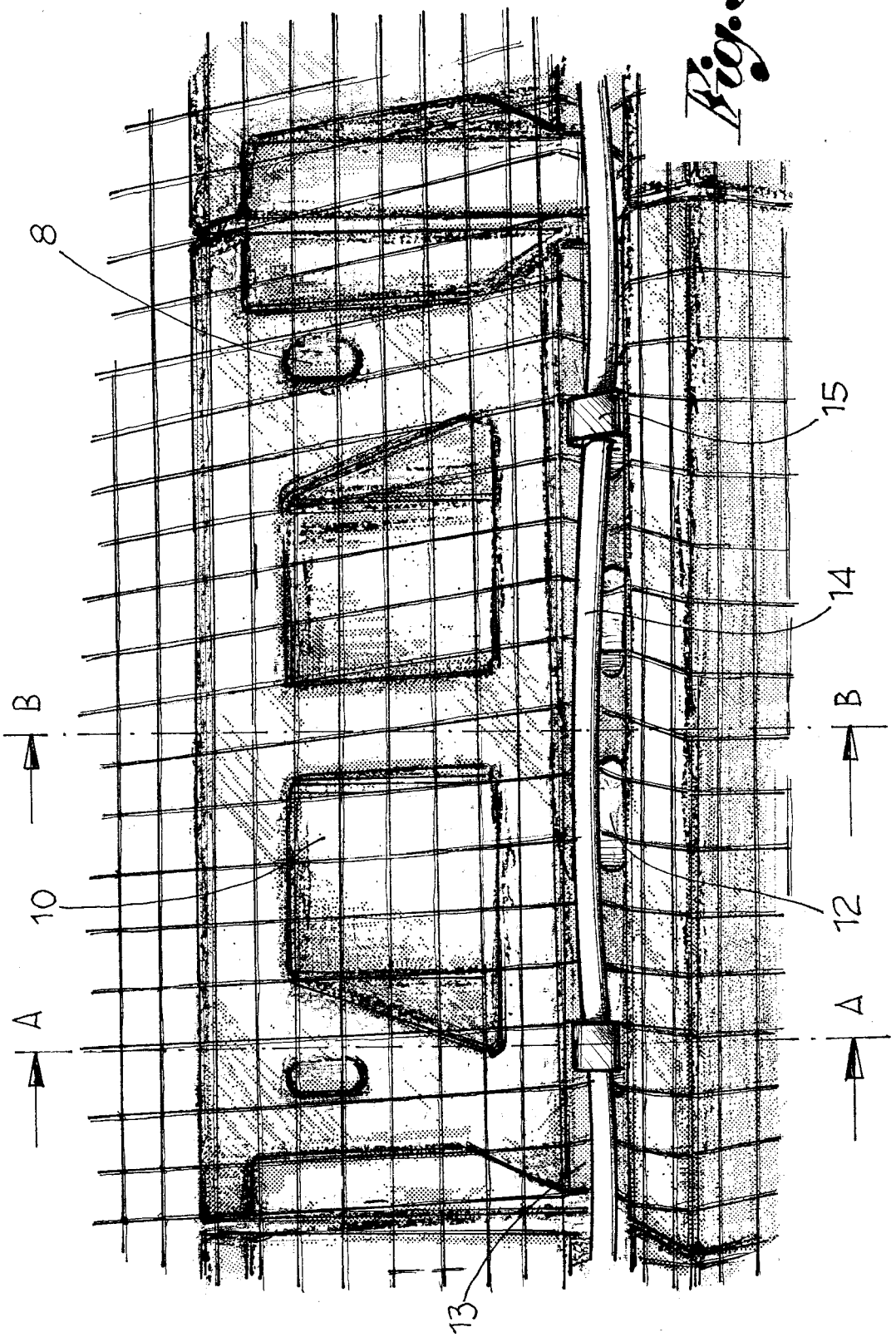


Fig.5



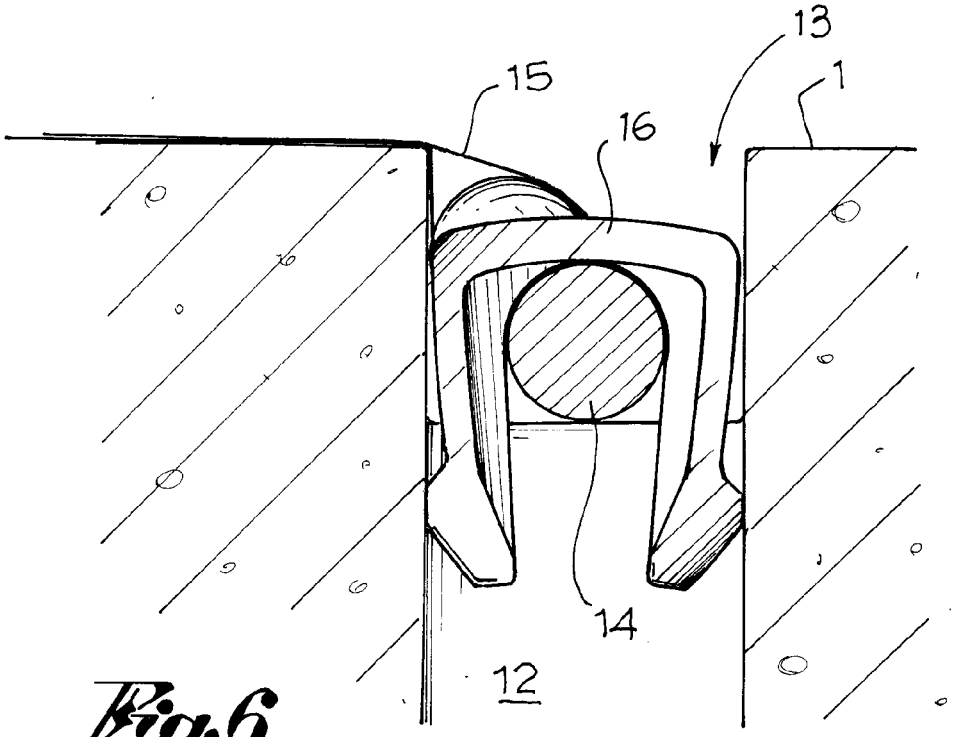


Fig.6

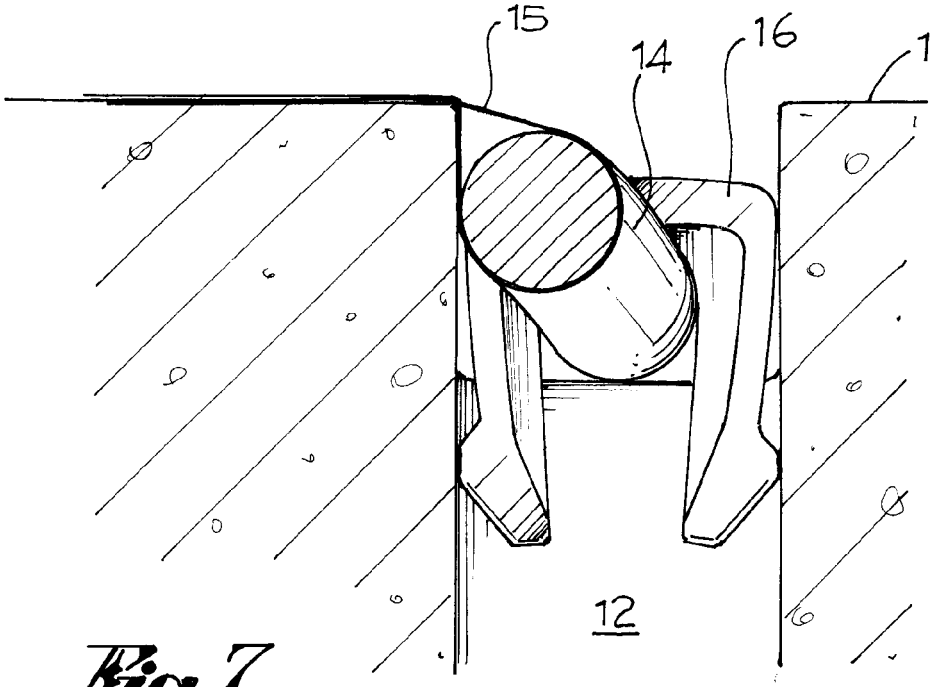


Fig.7

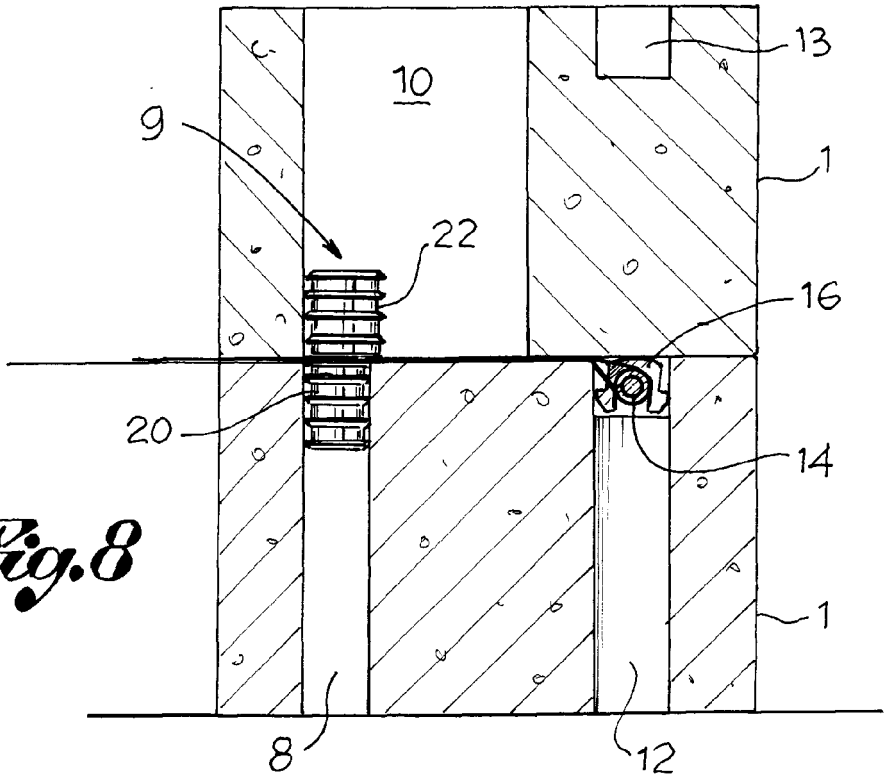


Fig.8

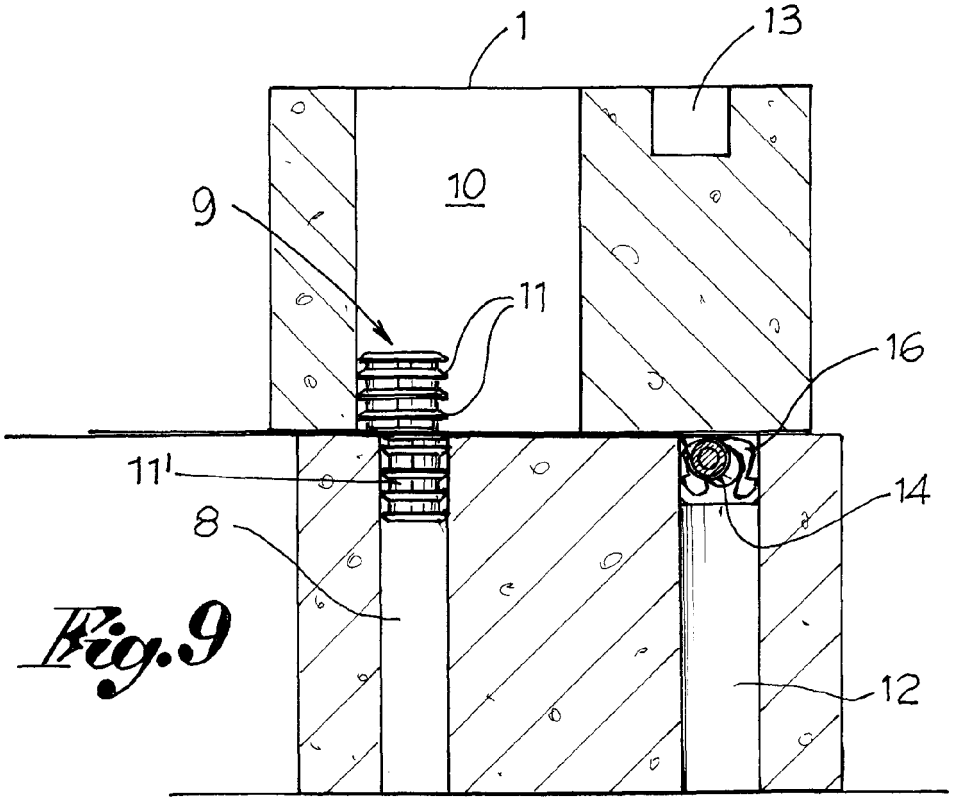


Fig.9

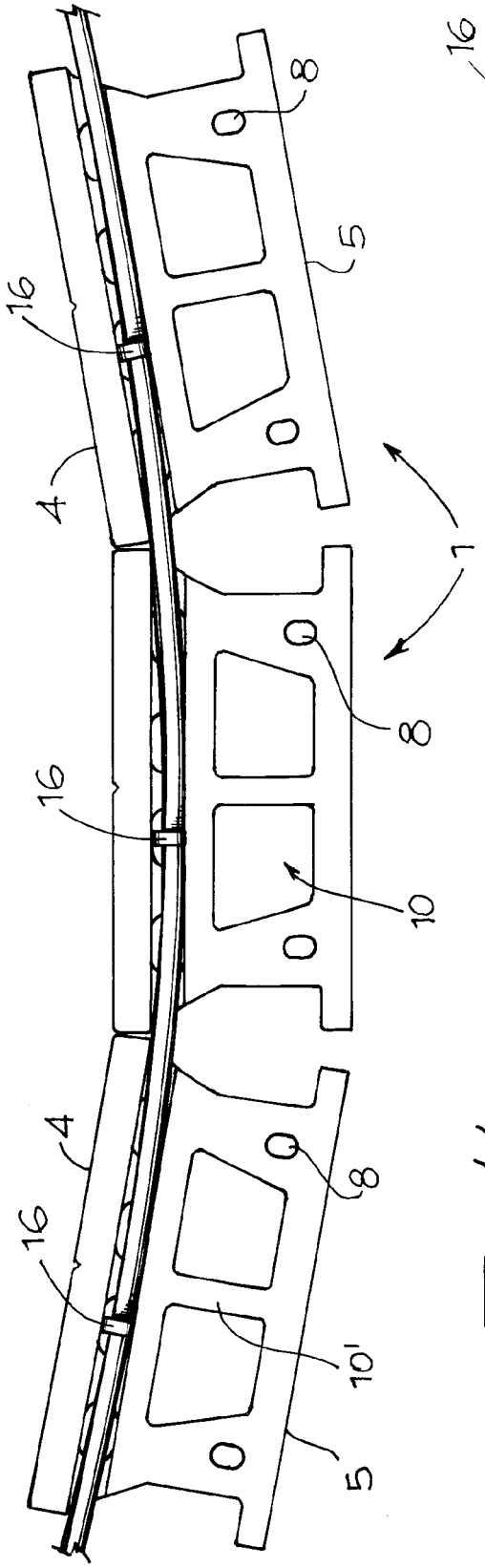


Fig.11

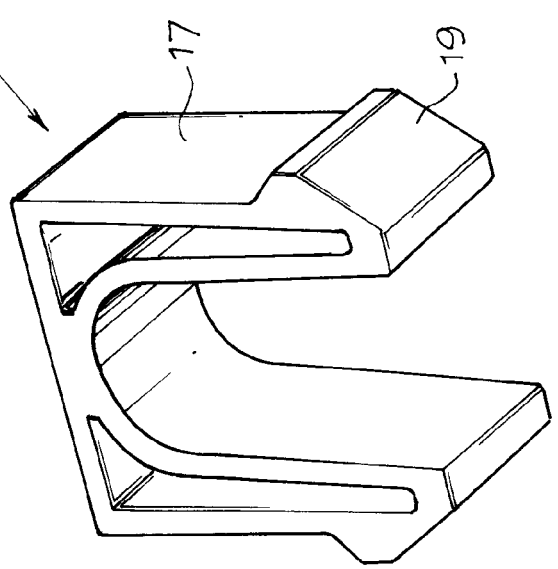


Fig.10

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EUROPEAN SEARCH REPORT

Application Number
EP 05 10 6159

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 October 2006	Nilsson, Lars

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