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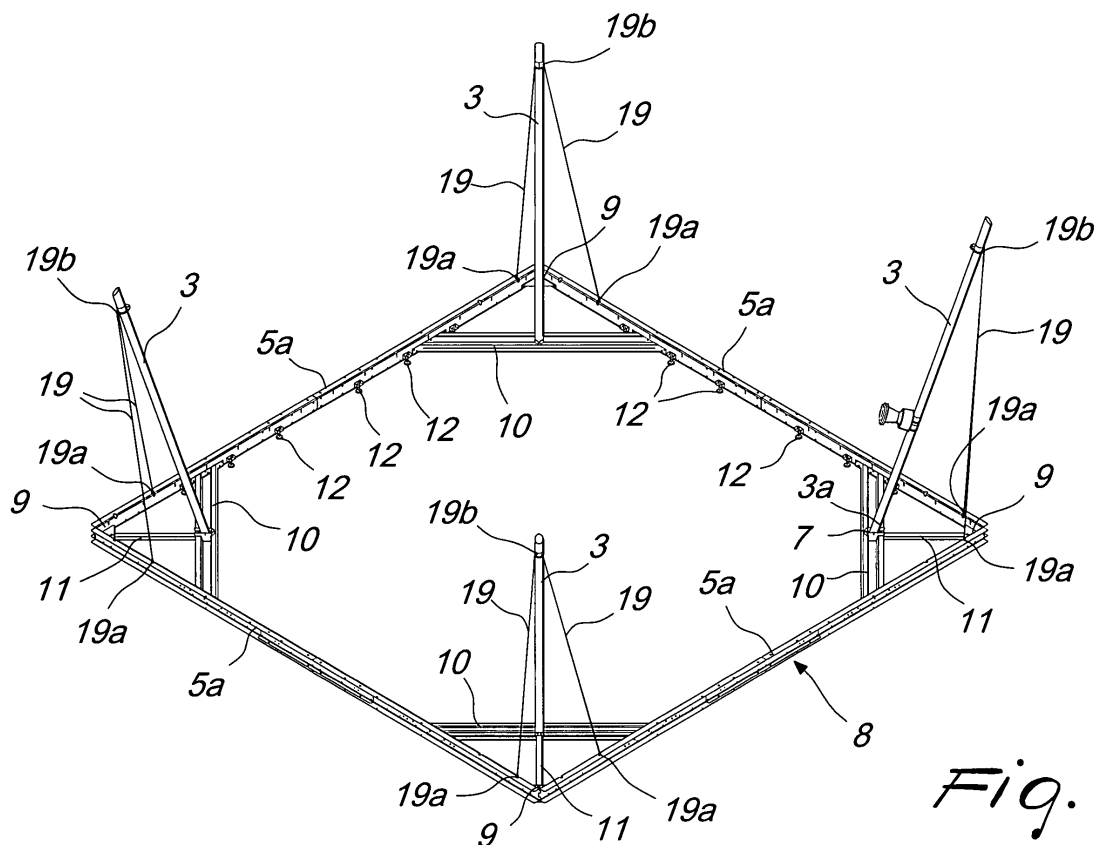
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(54) **High-rigidity modular footing for structure having an at least partially vertical extension**

(57) A high-rigidity modular footing (1) for structures having an at least partially vertical extension, the structures (2) comprising at least one column (3) designed to support at least one element (4) that lies substantially transversely to the column (3). The modular footing (1) comprises a plurality of beams (5), which are mutually coupled so as to constitute at least one supporting grid

(6), which is provided with at least one locking node (7) for the lower end (3a) of the at least one column (3) and has such dimensions as to balance, with suitable constraining reactions, the forces and moments applied by the column (3) to the locking node (7), ensuring the balance and stability of the column (3) and of the at least one respective substantially transverse element (4).



Description

[0001] The present invention relates to a high-rigidity modular footing for structures having an at least partially vertical extension.

[0002] Many types of awning and other covering elements, particularly for outdoor use (for example gardens and other open-air spaces), are currently commercially widespread.

[0003] Among these, solutions are known which use one or more awnings that can slide from a fully extended configuration, in which they allow to protect the underlying area against the sun or other atmospheric elements, to a configuration that is completely wrapped around a transverse element, such as a shaft.

[0004] The transverse element is supported by one or more substantially vertical columns and the extended configuration of the awning is ensured by one or more tension members, which act on the opposite side with respect to the shaft and in turn are supported by additional columns.

[0005] However, this solution is not free from drawbacks.

[0006] The forces and moments that the tension members and the shafts discharge onto the columns, at the extended configuration, and in particular in the presence of external stresses such as strong winds, are particularly critical for the columns and for the supporting structure in general.

[0007] It is therefore necessary to provide appropriate counterweights (which are bulky and particularly heavy) to be fixed to the footing of the structure in order to ensure its stability.

[0008] This solution is obviously absolutely unwelcome from an aesthetic viewpoint, in addition to causing considerable inconvenience during installation (due to the need to move such heavy counterweights).

[0009] These drawbacks are partially remedied by constructive solutions that bury the lower portion of the columns, thus utilizing the ground to give the desired stability to the structure.

[0010] However, even these solutions require heavy installation interventions, and, as is evident, the provision of excavations, which moreover are not always easy and welcome in the presence of previous paving.

[0011] The aim of the present invention is to solve the above-mentioned drawbacks, by providing a modular footing that is capable of ensuring high rigidity and stability to the structure to be supported, at the same time maintaining ease and low cost of installation.

[0012] Within this aim, an object of the invention is to provide a footing that ensures the desired stability, at the same time ensuring a pleasant appearance.

[0013] Another object of the invention is to provide a footing that ensures high reliability in operation.

[0014] Another object of the invention is to provide a footing that can be obtained easily starting from commonly commercially available elements and materials.

[0015] Another object of the invention is to provide a footing that has low costs and is safe in application.

[0016] This aim and these and other objects, that will become better apparent hereinafter, are achieved by a high-rigidity modular footing for structures having an at least partially vertical extension, said structures comprising at least one column designed to support at least one element that lies substantially transversely to said column, **characterized in that** it comprises a plurality of beams, which are mutually coupled so as to constitute at least one supporting grid, said grid being provided with at least one locking node for the lower end of the at least one column, said grid having such dimensions as to balance, with constraining reactions, the forces and moments applied by the column to the locking node, ensuring the balance and stability of the column and of the at least one respective substantially transverse element.

[0017] Further characteristics and advantages of the invention will become better apparent from the following detailed description of two preferred but not exclusive embodiments of the footing according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is an exploded top perspective view of an awning provided with a footing according to the invention;

Figure 2 is an exploded bottom perspective view of an awning provided with the footing according to the invention;

Figure 3 is a perspective view of the perimetric frame and of the columns connected thereto of the footing according to the invention;

Figure 4 is a plan view of the footing according to the invention;

Figure 5 is a side view of the footing according to the invention;

Figure 6 is a sectional side view of the footing, taken along the line VI-VI of Figure 5;

Figure 7 is a sectional side view of the footing, taken along the line VII-VII of Figure 5.

[0018] With reference to the figures, a high-rigidity modular footing, generally designated by the reference numeral 1, is particularly suitable for supporting structures 2 that have an at least partially vertical extension. The structures 2 comprise at least one column 3 that is designed to support at least one element 4 that is substantially transverse with respect to the column 3.

[0019] The footing 1 comprises a plurality of beams 5, which are mutually coupled so as to constitute at least one supporting grid 6.

[0020] The grid 6 is conveniently provided with at least one locking node 7 for the lower end 3a of the at least one column 3. The grid 6 further necessarily has such dimensions as to balance, with suitable constraining reactions, the forces and moments applied by the column 3 (and/or by the columns 3) to the (respective) locking

node 7, ensuring the balance and stability of the column 3 and of the at least one respective substantially transverse element 4. The structure that constitutes the grid 6 is therefore subjected to mechanical stresses that increase in intensity as the tension of the columns 3 by the respective transverse element 4 increases: these stresses necessarily lead to corresponding deformations of the grid 6, which by way of the correct sizing of the components of the grid 6 all occur within the elastic range.

[0021] With reference to the embodiments shown in the accompanying figures, but without any limitation to this particular application, the grid 6 can comprise a substantially perimetric frame 8, which is constituted by mutually coupled beams 5a. At each corner 9 of the frame 8 there is a cross-member 10, which is interconnected to the two beams 5a that are incident to the corner 9: the cross-member 10 is provided with the locking node 7 for the lower end 3a of the corresponding column 3.

[0022] According to the particular embodiment shown in the accompanying figures, the cross-member 10 is also associated with a band 11 arranged substantially along the direction of the bisecting line of the corner 9: the set of the two incident beams 5a, the cross-member 10 and the band 11 constitutes a high-rigidity frame that is adapted to withstand easily the mechanical load transmitted by the column 3.

[0023] In order to ensure sufficient mechanical strength of the frame 8 and of the components associated therewith, the beams 5a that constitute the frame 8 are of the reinforced type, with greater mechanical strength and rigidity, and rest on a plurality of distributed supports 12. The supports 12 are constituted by small pillars having a variable length (which are adjustable according to the installation requirements) and are provided with a disk-like base that is designed to distribute on a large surface the mechanical load (weight) to which they are subjected. A large number of supports 12 ensures optimum load distribution: depending on the type of structure that will surmount the footing 1 and depending on the environmental conditions of the installation site (wind, snow load, et cetera), it may be appropriate to vary the number of supports 12 in order to optimize load distribution.

[0024] The expression "beams 5a of the reinforced type" is to be understood as an accurate mechanical dimensional selection, by way of which the deformations of the beams 5a when loaded are minimized without compromising their weight and dimensions (characteristics which would compromise the ease of assembly of the footing 1).

[0025] Guides 14 are coupled to the beams 5a of the frame 8 and can perform a translational motion along a direction that is substantially transverse with respect to the longitudinal direction of the respective beam 5a: in particular, the guides 14 can perform a vertical translational motion.

[0026] The guides 14 are adapted to support internal beams 5a of the grid 6 and, even indirectly, to support a

plurality of covering panels 15 that are designed to constitute the walkable upper surface of the footing 1.

[0027] The guides 14 can be locked with respect to the respective beam 5a in different positions: when the transverse element 4 is arranged in the active configuration (and therefore is suitably tensioned and stressed) and the corresponding columns 3 are subjected to mechanical tension, the frame 8, which is also stressed, undergoes an elastic deformation. In Figure 5, which shows a side view of the footing 1 in the active configuration with the corresponding mechanical stresses applied, it is possible to see that the visible side of the frame 8 is substantially curved: the beams 5a that constitute it are in fact at the maximum distance from the ground at the corners 9 and at the minimum distance from the ground at its centerline.

[0028] The locking of the guides 14 with respect to the respective deformed beams 5a occurs at different levels for each beam section 5a in order to keep all the guides 14 on a same preferably horizontal plane. The expressed concept is exemplified in Figures 6 and 7. Figure 6 is a sectional view, taken along the line VI-VI shown in Figure 5: in this position, a distance A of the beam 5a from the ground is maximum, in the deformed configuration, and therefore the guide 14 is fixed downward with respect to the top of the beam 5a. Figure 7 is a sectional view, taken along the line VII-VII shown in Figure 5: in this position, a distance B of the beam 5a from the ground is minimal, in the deformed configuration, and therefore the guide 14 is fixed upward with respect to the top of the beam 5a.

[0029] For the sake of simplicity, it can be supposed that each beam 5a comprises substantially vertical slots onto which the corresponding guides 14 are fixed: the height variations of the axis of the beams 5a with respect to the ground, caused by the elastic deformation of such beams when subjected to a load, are compensated by fixing the guides 14 at different heights along the corresponding vertical slots in order to define, with the guides 14, a substantially horizontal plane.

[0030] Internal beams 5b are provided with adjustable feet 16 for resting on the ground; the variation of the height of each foot 16 ensures the flatness and substantial horizontality of the surface identified by the upper face 17 of the internal beams 5b and by a sheet-like resting portion 18 of the guides 14.

[0031] The covering panels 15 suitable to constitute the upper walkable surface of the footing 1 are arranged so as to rest on the upper face 17 of the internal beams 5b and on the sheet-like resting portion 18 of the guides 14.

[0032] The nodes 7, in the embodiments of greatest practical interest, are at least two, for respective columns 3 that are arranged along the frame 8 and are associated with respective substantially transverse elements 4.

[0033] The footing 1 can comprise a plurality of grids 6, which are constituted by the beams 5 (in particular 5a and 5b), the grids 6 being mutually side by side according to appropriate arrangements and having plan shapes

with various configurations.

[0034] Each one of the grids 6 is provided with at least one locking node 7 for the lower end 3a of at least one respective column 3 of the supporting structure 2.

[0035] Each column 3 comprises respective tension members 19, which are coupled, by means of a first end 19a, to the frame 8 and, by means of a second end 19b, to the column 3 on the face that lies substantially opposite the fixing face of the substantially transverse element 4.

[0036] The provision of footings 1 having irregular, polygonal or circular or elliptical shapes is not excluded: the choice of the shape will be dictated solely by the installation requirements, since the set of beams 5 (5a and 5b) is particularly versatile.

[0037] In the case of curved configurations, the corner 9 is no longer such but appears as an arc of a curve, the band 11 is arranged along a substantially radial direction, and the cross-member 10 is arranged like a chord of such arc. In any case, the components and their functions shall be the same, thus falling within the scope of the protection of the appended claims.

[0038] The covering panels 15 are made of wood or other materials, for the at least partial covering of the grid 6. The use of the panels 15 thus allows to hide from sight the grid 6, ensuring a better aesthetic result of the footing 1 according to the invention, and to make the latter easier to walk on. Below the panels 15, proximate to the grid 6, it is possible to accommodate systems (electrical cables, air and water conveyance ducts) of any services that are intended to be associated with the footing 1 according to the invention.

[0039] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0040] In the exemplary embodiments shown, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other exemplary embodiments.

[0041] Moreover, it is noted that anything found to be already known during the patenting process is understood not to be claimed and to be the subject of a disclaimer.

[0042] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0043] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

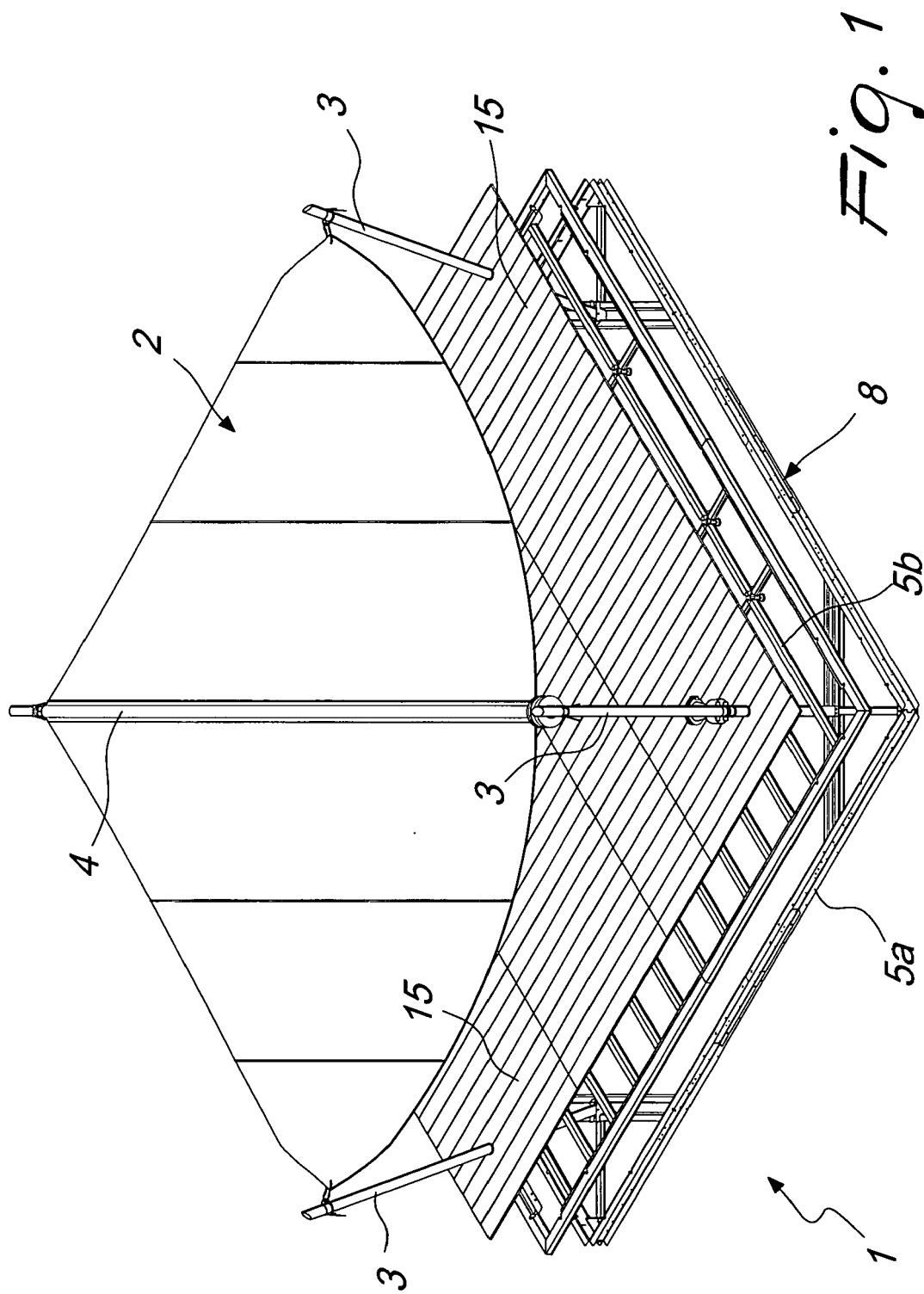
1. A high-rigidity modular footing (1) for structures having an at least partially vertical extension, said structures (2) comprising at least one column (3) designed to support at least one element (4) that lies substantially transversely to said column (3), **characterized in that** it comprises a plurality of beams (5), which are mutually coupled so as to constitute at least one supporting grid (6), said grid (6) being provided with at least one locking node (7) for the lower end (3a) of the at least one column (3), said grid (6) having such dimensions as to balance, with constraining reactions, the forces and moments applied by the column (3) to the locking node (7), ensuring the balance and stability of the column (3) and of the at least one respective substantially transverse element (4).
2. The footing according to claim 1, **characterized in that** said grid (6) comprises a substantially perimetric frame (8), which is constituted by mutually coupled beams (5a), at each corner (9) of said frame (8) there being a cross-member (10), which is interconnected with the two beams (5a) that are incident in said corner (9) and is provided with said locking node (7) for the lower end (3a) of said column (3).
3. The footing according to claim 2, **characterized in that** the beams (5a) of said frame (8) are of the reinforced type, with greater mechanical strength and rigidity, and rest on a plurality of distributed supports (12).
4. The footing according to claim 2, **characterized in that** guides (14) are coupled on the beams (5a) of said frame (8) and can perform a translational motion along a direction that is substantially transverse with respect to the longitudinal extension of the respective beam (5a), said guides (14) being adapted to support internal beams (5b) of said grid (6) and, even indirectly, a plurality of covering panels (15) designed to constitute the walkable upper surface of said footing (1).
5. The footing according to one or more of the preceding claims, **characterized in that** said guides (14) can be locked with respect to the respective beam (5a) in different positions, when said transverse element (4) is arranged in the configuration for use and the corresponding columns (3) are subjected to mechanical tension, said frame (8), also subjected to stresses, is deformed elastically, the locking of the guides (14) with respect to the respective deformed beams (5a) occurring at different levels and heights for each beam section (5a) in order to keep all of said guides (14) on a same preferably horizontal plane.

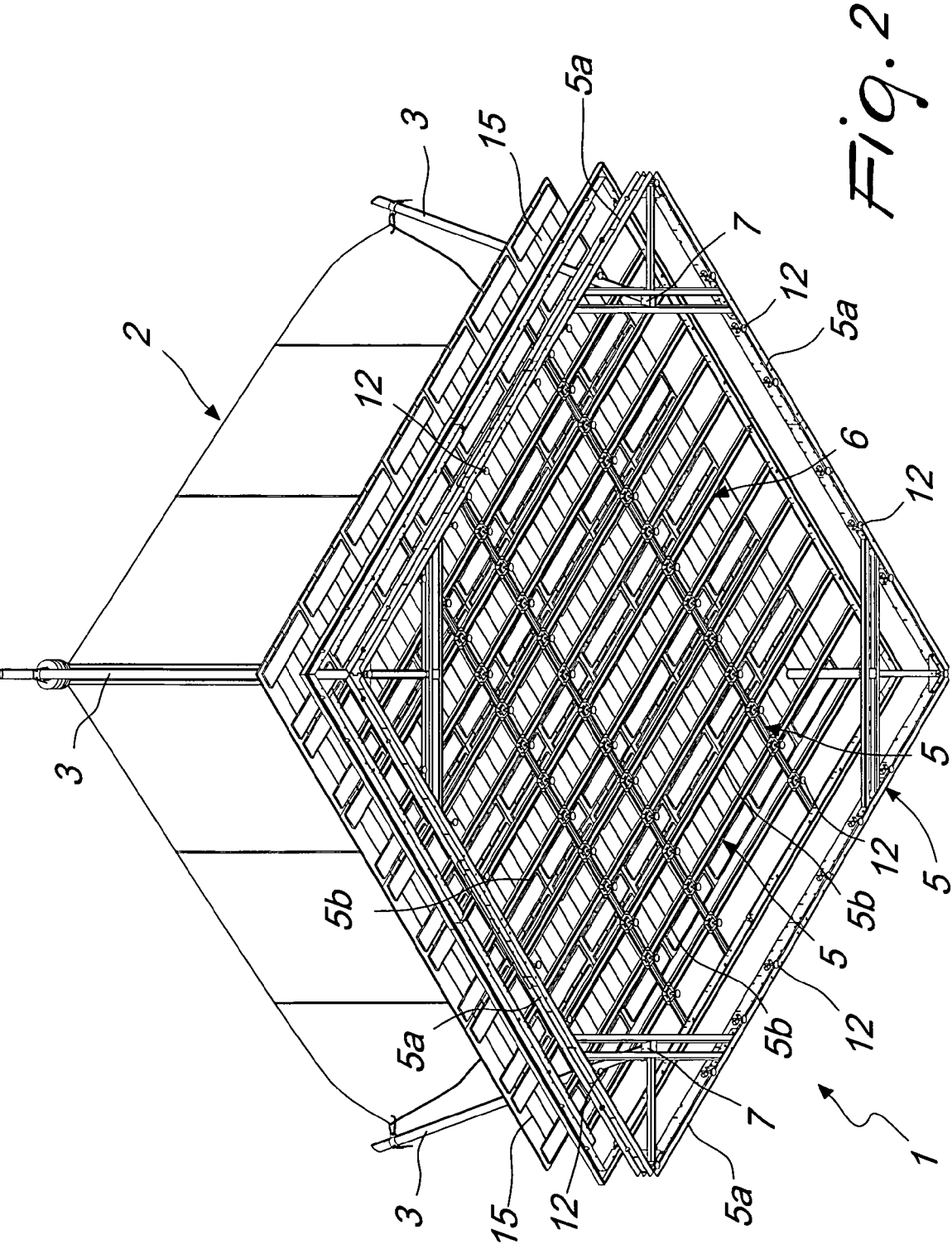
6. The footing according to one or more of the preceding claims, **characterized in that** said internal beams (5b) are provided with adjustable feet (16) for resting on the ground, the height variation of each one of said feet (16) ensuring the planarity and substantial horizontality of the surface identified by the upper face (17) of said internal beams (5b) and by a sheet-like resting portion (18) of said guides (14). 5
7. The footing according to one or more of the preceding claims, **characterized in that** said covering panels (15) suitable to constitute the walkable upper surface of said footing (1) are arranged so as to rest on the upper face (17) of said internal beams (5b) and on the sheet-like resting portion (18) of said guides (14). 10 15
8. The footing according to one or more of the preceding claims, **characterized in that** said nodes (7) are at least two, for respective columns (3) arranged along said frame (8) and associated with respective substantially transverse elements (4). 20
9. The footing according to one or more of the preceding claims, **characterized in that** it comprises a plurality of said grids (6), constituted by said beams (5, 5a, 5b), said grids (6) being arranged mutually side by side according to appropriate arrangements and having plan shapes with various configurations, each one of said grids (6) being provided with at least one of said locking nodes (7) for the lower end (3a) of at least one respective column (3) of said supporting structure (2). 25 30
10. The footing according to one or more of the preceding claims, **characterized in that** each column (3) comprises respective tension members (19) that are coupled, by means of a first end (19a), to said frame (8) and, by means of a second end (19b), to said column (3) on the face that lies substantially opposite the face for fixing said substantially transverse element (4). 35 40

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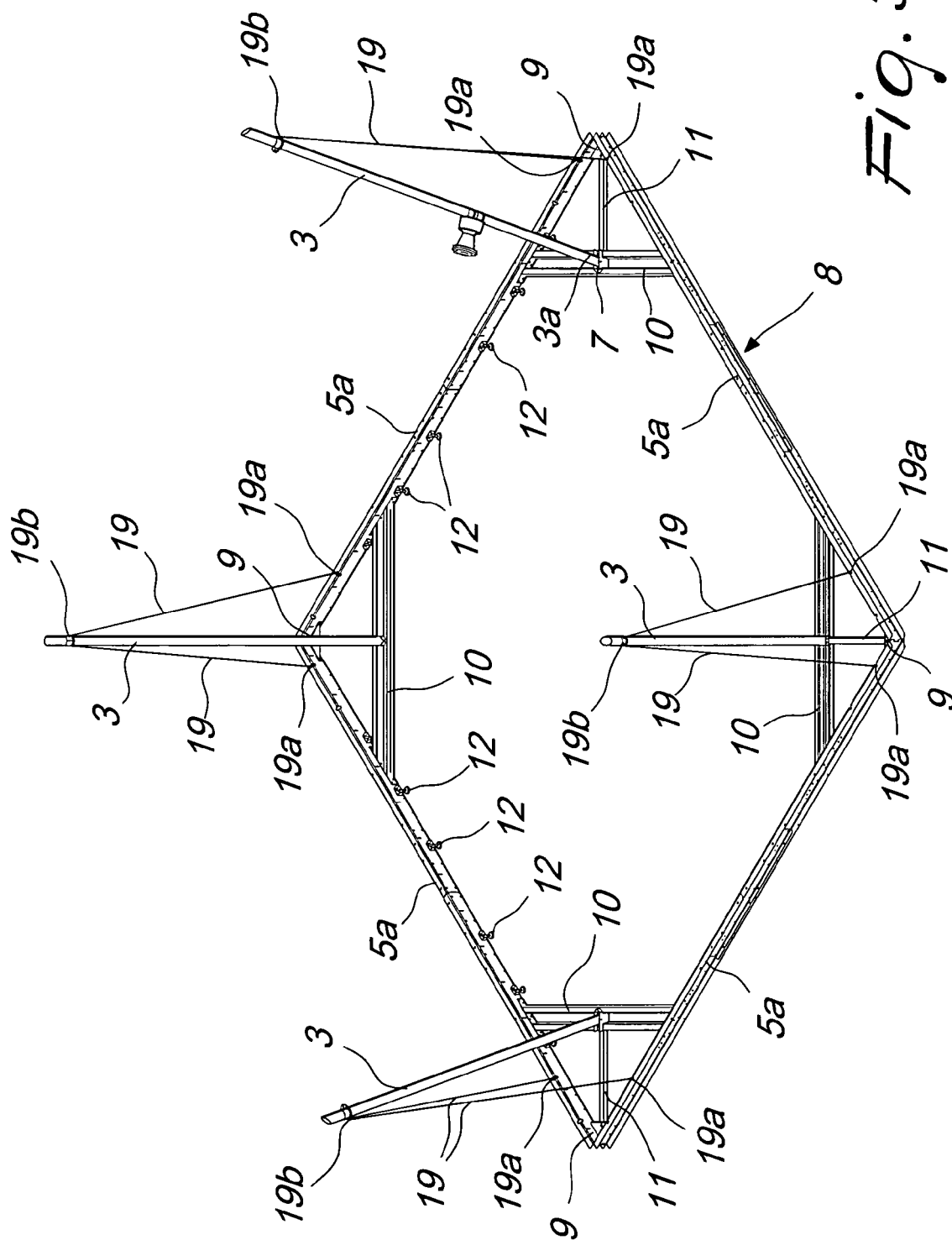


Fig. 3

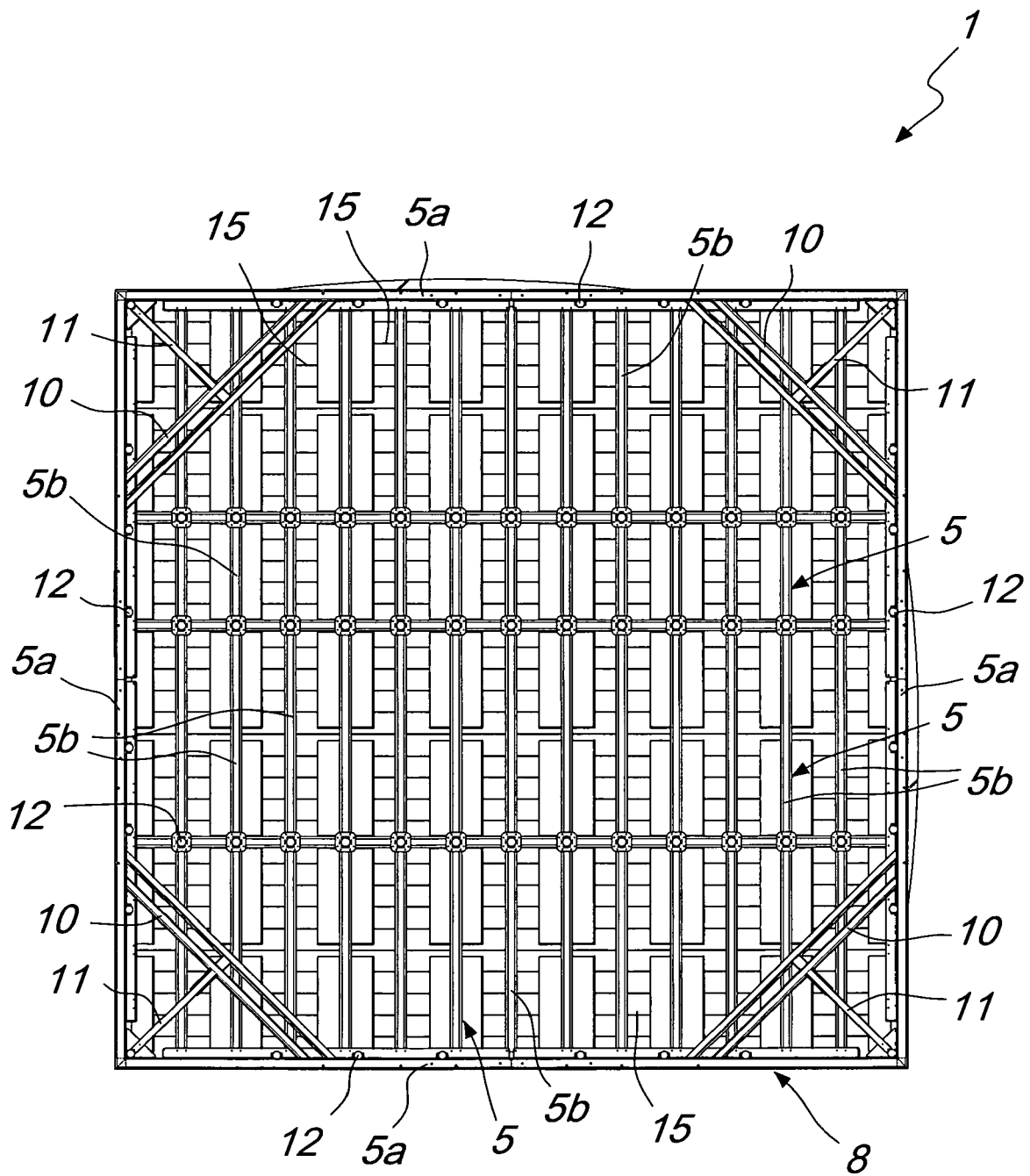


Fig. 4

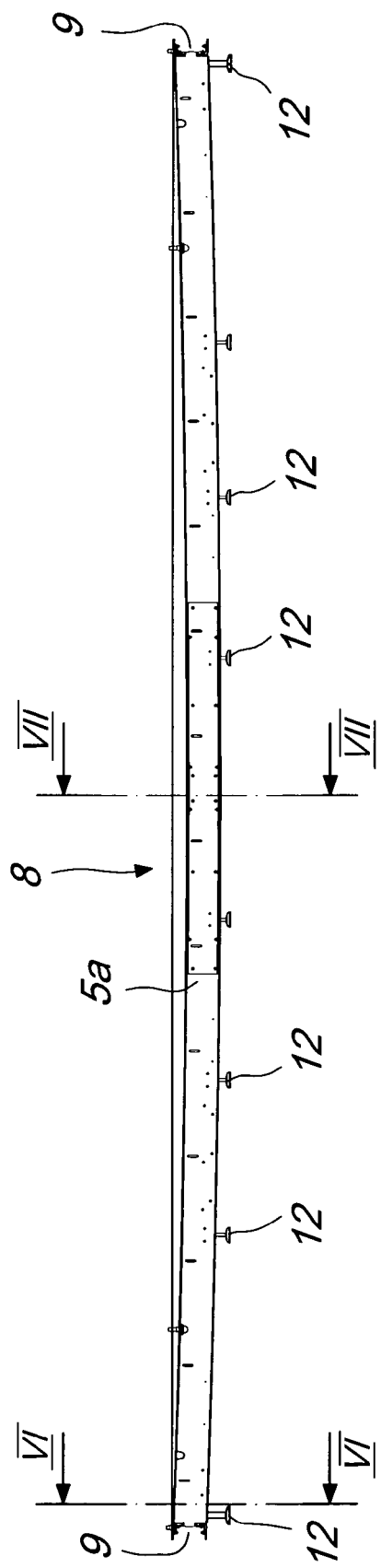


Fig. 5

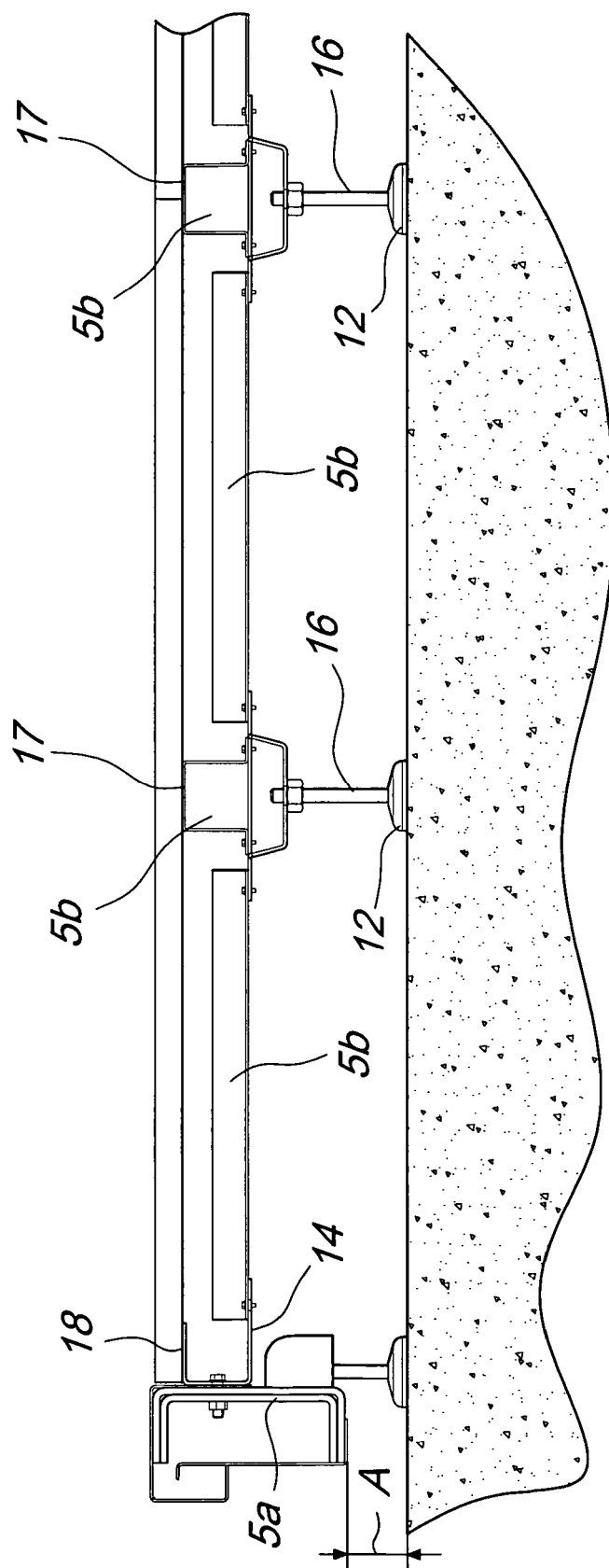


Fig. 6

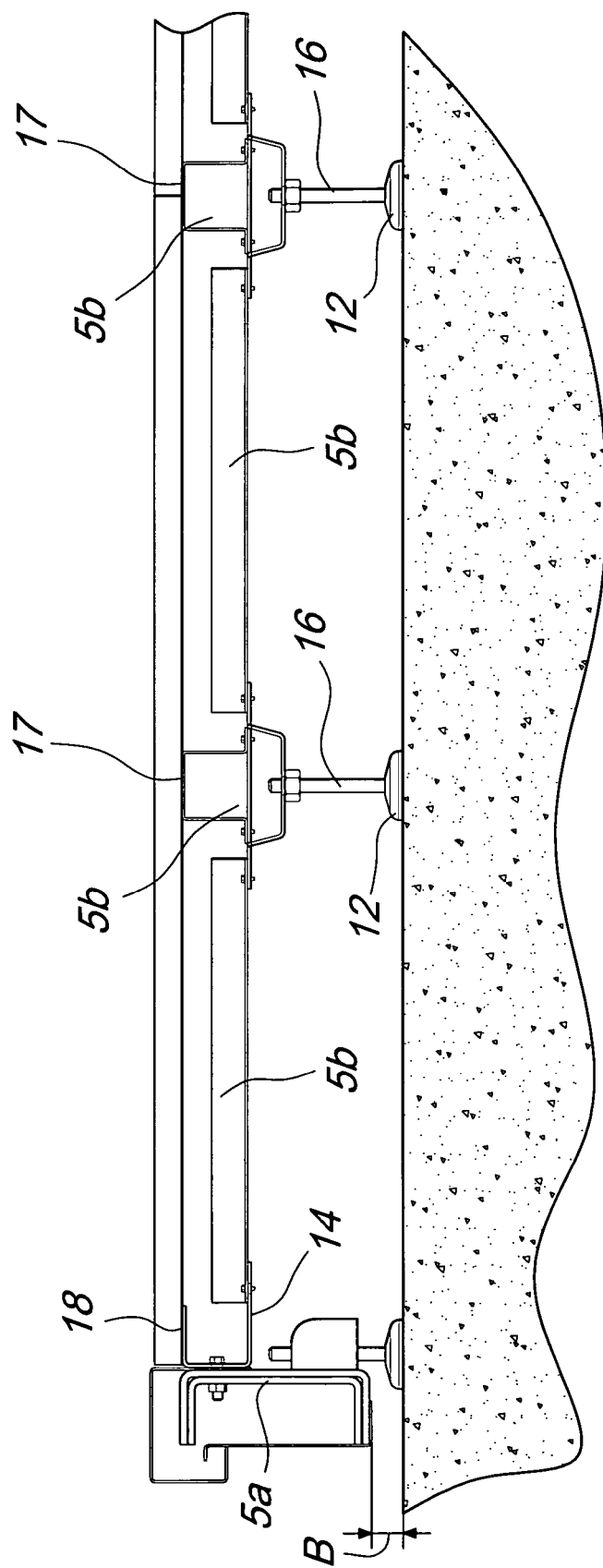


Fig. 7



EUROPEAN SEARCH REPORT

Application Number
EP 09 42 5148

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Place of search The Hague		Date of completion of the search 16 September 2009	Examiner Hellberg, Jan
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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