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(54) Self-supported modular vehicle parking structure

(57) The parking system consists of prefabricated parts (self-supported platform elements, columns, railings, sunroof, ramp, and escalated ladder), which are assembled easily and in short time on site.

The basic element of the parking system is the self-supported, prefabricated platform element, supported by columns which are based on the ground by base plates and by the use of special anchors without any requirement for foundation construction.

It is important to notice that at areas with low seismic activity these special anchors are not necessary. The easy transportation and assemblage of the parts of the system is a basic advantage. There is the ability of changing the layout quickly and easily in a way that no part is lost or thrown away.

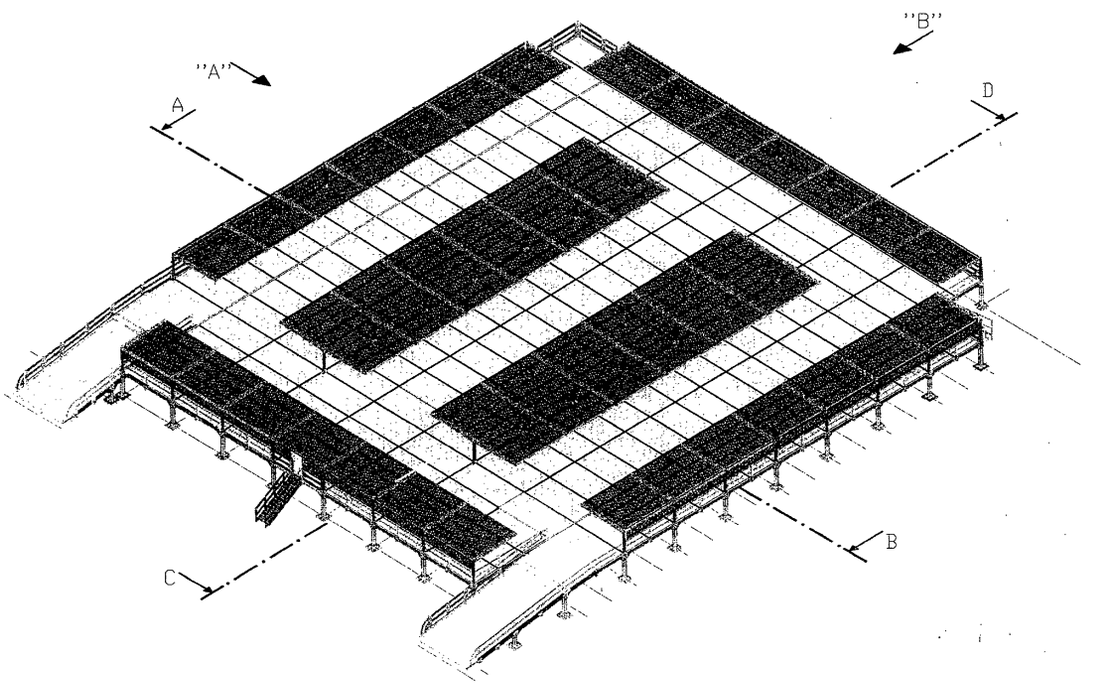

Fig. 1a

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Description

[0001] The present invention relates to prefabricated preassembled sections, which are erected in the work site and are secure with screws and nuts through the specially located holes on the platform element and top plates of the supported columns. The prefabricated preassembled sections have excellent constructibility, high earthquake resistance, a wide ground and first floor space due to the unique location of support columns spaced 5500mm apart. More importantly, the present invention does not require any foundation as well as horizontal and vertical beams between the support columns.

[0002] An other aspect of this invention there is provided a method of erecting the modular structure from a plurality of prefabricated units of modular construction.

[0003] Portable parking structures have been already provided in the prior art. Generally, there is great demand of parking space due to the increasing number of cars in urban areas.

[0004] The prefabricated sections are easily erected and dismantled.

[0005] The prefabricated parking system gives the possibility of easily extending or reducing the number of cars to be parked.

[0006] The present invention due to the unique designed of the three different types of support columns and platform elements has its objective to provide a multi-storey building which can be quickly and easily erected from the prefabricated components which are suitable for providing temporary multi-level car parking or a temporary building such as temporary ware house.

[0007] Due to the modular system and no need of foundation the structure can be assembled, dismantled or rearranged very easily and in a very short time without loosing or destroying parts. That means that there is the possibility to rent the system and not being obliged to buy it.

[0008] The construction is based on the latest European technical standards, so there is no problem to get a licence for using the system in the EC-countries or countries outside the EC, who accept the European technical standards.

[0009] The system has, compared to the patents US 5826381, WO 9945220 and US 4800694, the following differences and advantages:

[0010] Easy assemblage and dismantling of the prefabricated parts because of their standardized dimensions and shape. The easy assemblage of the self-supported prefabricated platforms gives the ability to expand the existing parking places and also to change the arrangement (layout) of the parking places.

[0011] Due to the unique design of the columns (2), (3) and (4) and platform elements (1) the self-supported prefabricated platform do not require any support or framework.

[0012] The lack of horizontal and vertical beams (bracings) between the columns allows easy circulation of the vehicles on the ground floor.

[0013] For the support of the columns to the ground there is no foundation construction needed. In places with high seismic activity special anchors are provided to secure the structure to the ground.

[0014] The columns give the ability to adjust their height ±150mm, for the platform to be flat. This means that even on not complete flat or uneven ground a smooth and plane parking platform is possible.

[0015] The construction materials can be standardized steel profiles, shaped iron plates or non-steel materials.

[0016] The ascent and descent ramps for the upper parking surface have an incline slope of 20% which is gradually reduced to 0%, with a preferable slope of 14% reduced to 7% reduced to 0%. Protection bars on both sides are provided.

[0017] On the top floor there are special sunroofs.

[0018] There is also the ability to increase the height of the construction to be more than one floor. In case of two floors or more, there is certainly the need to have foundations below the columns.

[0019] Perimetric protection bars on the top floor are provided.

[0020] There is no need to use the land permanently as parking area, because this construction consists of prefabricated modules and can be placed in another area, if this is required.

[0021] The structure, as designed, can withstand loads from snow, ice, earthquake or crowded humans as well as the parked cars. This design meets and exceeds the European technical standards.

[0022] For the structure to be more economical (less weight) and still withstanding all the loads as described above, it can be assembled as shown in Figure 5, so that the internal forces are distributed more evenly to each member (rearranging the prefabricated modules).

[0023] According to this invention the self-supported prefabricated parking structure comprises:

a) three types of support columns with adjustable height,

b) self-supported prefabricated platform element with reinforced steel plates with furrows on top to support the weight and eliminate slippage of the vehicles parked and humans on top of the platform. Each platform elements has a maximum of 40 holes specially located at the corners and center of the steel frame,

c) a ramp for driving up and down, with an incline slope of 20% reduced to 0%,

d) a step like staircase,

e) side and top covers (sunroofs),

f) metal rails around the perimeter of the parking structure on the first floor for protecting vehicles and humans, and for parametrically reinforcing the parking structure.

[0024] This invention, will be now described by way of example and with reference to the accompanying drawing in which:

Figure 1 and Figure 1a show a perspective view of a self-supported modular vehicle parking structure according to the present invention.
Figure 2 shows views A and B of Figure 1a.
Figure 3 shows sections A-B and C-D of Figure 1.
Figure 4 shows a plan view on platform level with classic arrangement of platform elements.
Figure 5 shows a plan view on platform level with rearranged platform elements.
Figure 6 shows a perspective view of the central column.
Figure 7 shows a perspective view of the edge column.
Figure 8 shows a perspective view of the corner column.
Figure 9 shows a detail view of special anchors with the column base plate.
Figure 10 shows a detail view of the platform element.
Figure 11 shows a connection detail of platform with column.
Figure 12 shows a connection detail of platform with intermediate joint.
Figure 13 shows a perspective view of ramp.
Figure 14 shows a section of the edge sunroof.
Figure 15 shows a section of the central sunroof.
Figure 16 shows a section of the parametric protection rail.
Figure 17 shows a typical minimal assemblage of elements.

[0025] Figures 1 and 1a illustrate a perspective view of a self-supported modular vehicle parking structure according to the present invention. Figures 2 and 3 illustrate a cross sectional view A and B, and C and D of Figure 1a which is utilized as a parking station.

[0026] The first basic elements of the self-supported prefabricated parking structure of Figures 1 and 1a are the three types of specially designed columns (2), (3) and (4) for central, edge and corner locations. Columns (2), (3) and (4) are shown in Figures 6, 7 and 8. Each column consists of two square hollow steel parts. Column (2) consists of parts (12) and (13), column (3) consists of parts (12) and (14) and (4) consists of parts (12) and (15). Parts (12) and (13), (12) and (14), and (12) and (15) have an easily adjustable height (telescope) up to ±150mm.

[0027] The support columns (2), (3) and (4) attain flatness to the platform element (1) for uneven grounds through specially located holes 10mm apart, and jointed with pins (25) in the support column (2), (3) and (4).

[0028] With references to Figures 4 and 5 also, the illustrated self-supported vehicle parking structure as shown in Figure 1 is assembled in the form shown in Figures 1 to 5 by assembling several kinds of assembly elements but it is basically comprises of six types of assembly elements shown in Figures 6, 7, 8, 10, 13, 14, 15 and 16.

[0029] As will be seen from Figures 6 to 8 the square hollow steel part (12) is welded to the base plate (26).

[0030] Further more in cases where there is high seismic activity, base plate (26) of columns (2), (3) and (4) can be bolted to the ground with high strength steel anchors (16) shown in Figure 9 through the eight wholes, which are provided.

[0031] On the vertical square hollow steel part (13) there is a welded top plate (21) supported with stiffeners (22) and (23). These stiffeners (22), (23) and the plate (21) yield the bending moment resistant connection between the columns (2) and the platform element (1). Further, plate (21) of column (2) has a maximum of thirty-two holes used to be bolted to the platform element (1).

[0032] The construction of columns (3) and (4) is based on the same idea and function with the central column (2). The main differences being, that the top plate (24) of column (3) and top plate (24a) of column (4) is designed differently, depending on the system location of the column (3) and (4).

[0033] Further more, top plate (24) of column (3) has a maximum of twenty-six holes used to be bolted to the platform element (1). Top plate (24a) of column (4) has a maximum of twenty holes used to be bolted to the platform element (1).

[0034] Columns (2), (3) and (4) are specially designed so, that they can withstand all the loads from the parked vehicles and people with out requiring additional foundation on the ground.

[0035] Column (2), (3) and (4) are placed 5500mm apart and are used to hold the weight of the structure as illustrated in Figure 1. Columns (2), (3) and (4) are stabilized to the ground by special anchors (16), as shown in Figure 9, to withstand horizontal forces. Depending on the system layout and the earthquake area, where the system is erected, the number of these anchors (16) varies from eight down to zero. However, for places with low seismic activity anchors (16) are not needed. Instead a sheet of rubber or plastic or other friction increasing material is provided on the bottom surface of the support columns (2), (3) and (4) which makes contact to the ground.

[0036] The second preferred feature of the self-supported prefabricated parking structure according to this invention is the design of a plurality of platform elements (1). The dimensions of platform elements (1) as illustrated in Figure 10 are 2750mm×5500mm. Platform element (1) is made from UPN profile (or bended steel plate) (17), which creates an "integrated frame".

[0037] Along the length of the platform element (1) supporting beams (18) from L-profile or bended steel plate are welded to the platform element (1). The top of the platform element (1) is made from steel plate (19) with furrows in order to eliminated slippage of vehicles

and people. Platform element (1) is designed symmetrically so that it can be placed at all points of the parking structure and in different directions. Each platform element (1) has a maximum of 40 holes specially located at the corners and center of the steel plate (19).

[0038] Figures 4 and 5 illustrate the different arrangements of platform elements (1). Due to the possibility of different arrangement of platform element (1) it is possible to use profiles of smaller crossections. Thus, a lighter construction is achieved and therefore lower cost.

[0039] Figures 11 and 12 illustrate a connection detail of platform element (1) of the second embodiment shown in Figures 1 and 10 with columns (2) and or (3) and or (4) with intermediate joint (5). The connection is made by aligning the holes (already provided) of the platform element (1) with those of the top plates (21), (24) and (24a) of support columns (2), (3) and (4).

[0040] The third main part of the self-supported prefabricated parking structure is the ramp for driving up and down as illustrated in Figure 13. The width of the ramp is 2500mm to 5500mm (or more), to allow double-lane traffic of cars. The ramp comprises prefabricated columns (2), (3) and (4), platform elements (1), ramp parts (6) and (7), and railings (9).

[0041] The ramp is designed with an inclination slope of 20% gradually reduced to 0%, with a preferable slope of 14% reduced to 7% to 0%.

[0042] Figures 14 and 15 illustrates the central sunroof (10) and edge sunroof (11).

The edge sunroof (11) shown in Figures 1 and 14 comprises of roof columns (30), horizontal beams (29), plurality of purlings (27), which are supported to the horizontal beams (29) with U-bolts (28), and a sun proof lightweight net (20).

The central sunroof (10) shown in Figures 1 and 15 comprises of two horizontal beams (29) on each column (30), plurality of purlings (27) supported by the horizontal beams (29) with U-bolts (28), a sun proof lightweight net (20) and plurality of columns (30).

The main difference between the edge sunroof (11) and the central sunroof (10) is that the central sunroof (10) has two horizontal beams (29) on each column (30).

[0043] Figures 1 and 16 illustrates the perimetric protection railing (9). The railing (9) is designed to protect cars and people from falling down from the parking platform. Railing (9) is also a static main part of the system. The U-beam (31) shapes together with the platform elements beam (17) a double U-beam (I-beam) to withstand the horizontal perimetrical forces resulting from earthquake, wind loads, etc.

[0044] The system is easy to assemble with just two sizes of hexagonal bolts at all the connections; so only two tools are needed to assemble the entire parking system.

Claims

1. A self supported prefabricated modular vehicle parking structure for erection over a parking location, said structure including the following: plurality of three types of support columns, central edge and corner support columns , said columns consist of two square hollow steel sections adjustable for height, said support columns attain flatness of the platform element for uneven grounds (not flat) through specially located holes and joint with pins, said support columns do not required any foundation plurality of self supported prefabricated platform elements designed symmetrically, said platform element can be placed at all points of the parking structure and in different directions said platform element together with the support columns providing a combined moment resistance which is at least sufficient to support the weight of vehicles parked on top of the platform element, plurality of metal rails for reinforcing perimetrically the vehicle Parking structure.

2. Prefabricated structure of claim 1 wherein there is no need for horizontal and vertical beams between the central, edge, and corner support columns allowing easy movement of the parked vehicles on the ground floor.

3. Prefabricated structure of claim 1 and 2 wherein the support columns are placed 5500mm apart, said support columns height is adjustable up to ±150mm, said support columns attain flatness of the platform for uneven grounds through specially located holes 10mm apart and joined with pins in the support columns, said support columns having welded plates supported with stiffeners, said welded plates yield the bending moment resistance connections between the support columns and platform element said support columns having welded based plate with a maximum of 8 holes for making contact to the ground, further for areas of high seismic activity columns base plates are bolted to the ground with specially designed high strength steel anchors.

4. Prefabricated structure of claims 1 to 3 wherein one or more reinforcing plates welded along the upper end of the support columns having a minimum of 20 holes and a maximum of 32 holes, said holes exactly matching with holes at the corner and center of platform elements.

5. Prefabricated structure of claims 1 to 4 wherein said platform elements are bolted to said columns.

6. Prefabricated structure of claims 5 wherein platform element comprises of a steel plate forming the upper surface of the floor section and welded support

beams on the underside of said steel plate.

7. Prefabricated structure of claim 1 wherein a sheet of rubber or plastic or other friction increasing material is provided on the bottom surface of the support column which make contact with the ground.

8. Prefabricated structure of claim 1 wherein one or more ramps for going up and or down are provided, said ramp is designed to create a substantially incline slope of 20% gradually reduced to 0%.

9. Prefabricated structure of claim 1 wherein a reinforcing plastic mesh covering material used for covering the park vehicles.

10. Prefabricated structure of any one of the preceding claims wherein metal rails all around the perimeter of the parking structure are provided for the first floor, said rails in addition to protecting the park vehicles, reinforce parametrically the parking structure.

11. Prefabricated structure of claim 1 wherein a prefabricated staircase extending between first floor and ground.

12. Prefabricated Structure of claim 1, wherein the height of the construction can be increased to more than one floor, said construction of two floors or more, requires foundations below the columns.

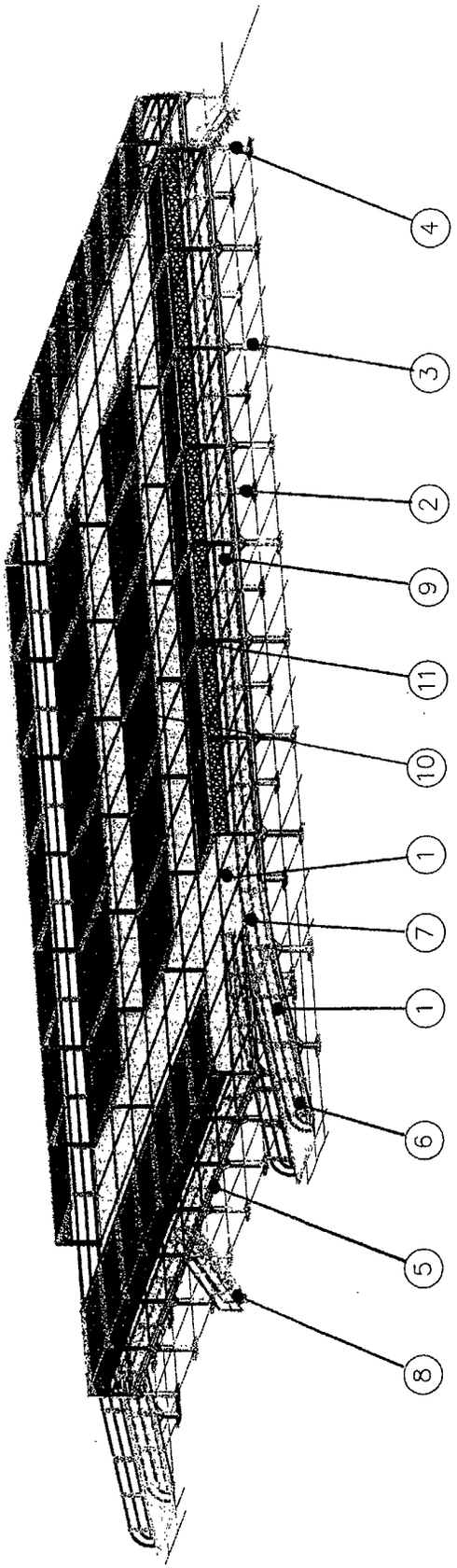

Fig. 1

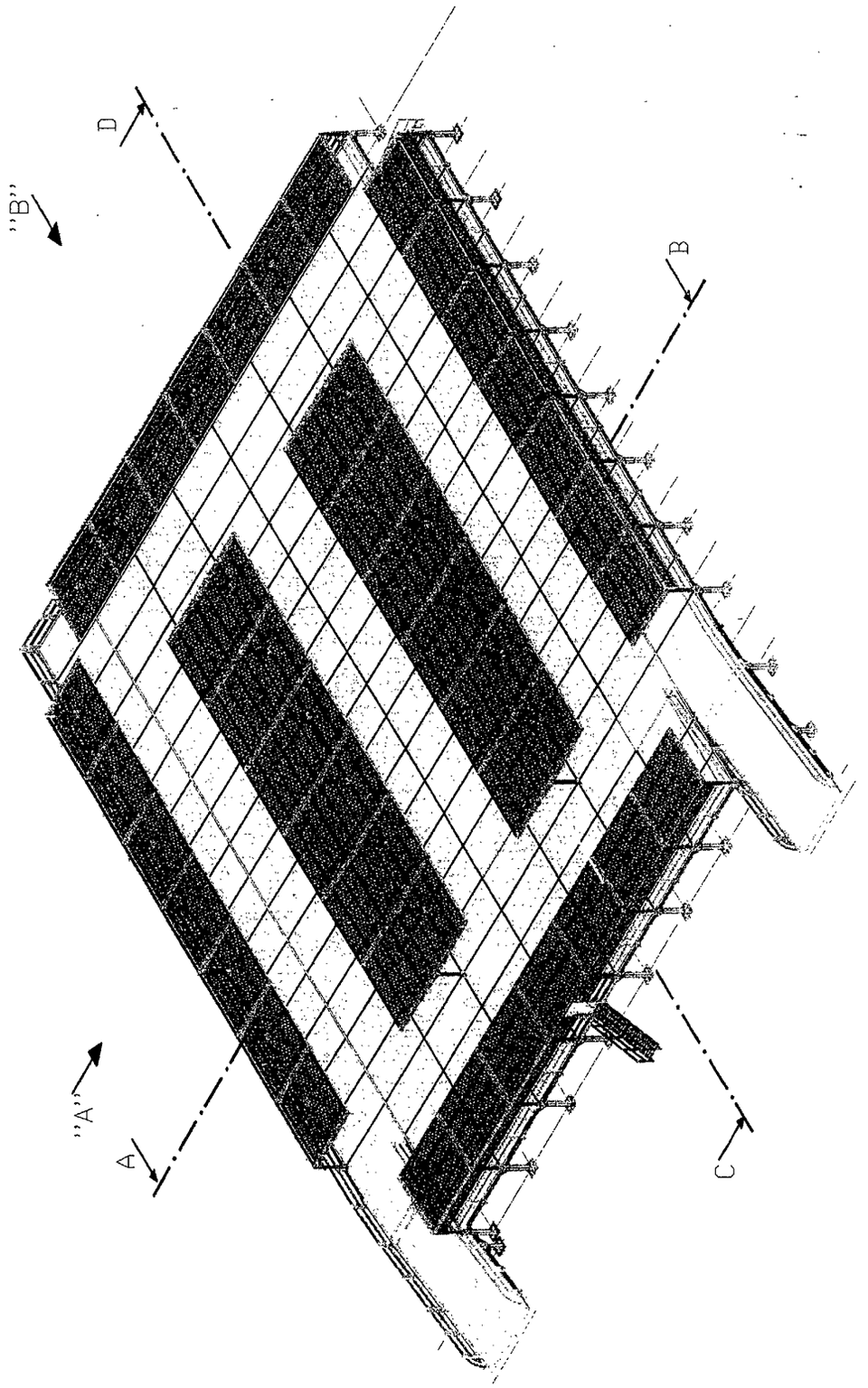

Fig. 1a

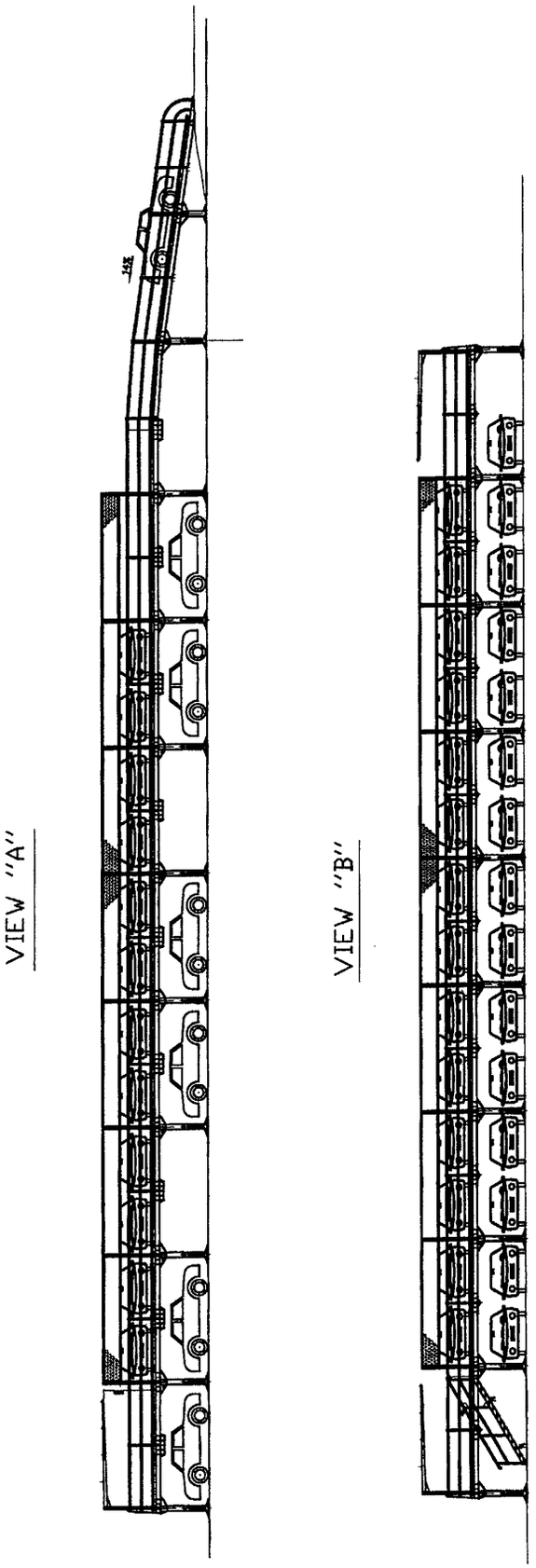

Fig. 2

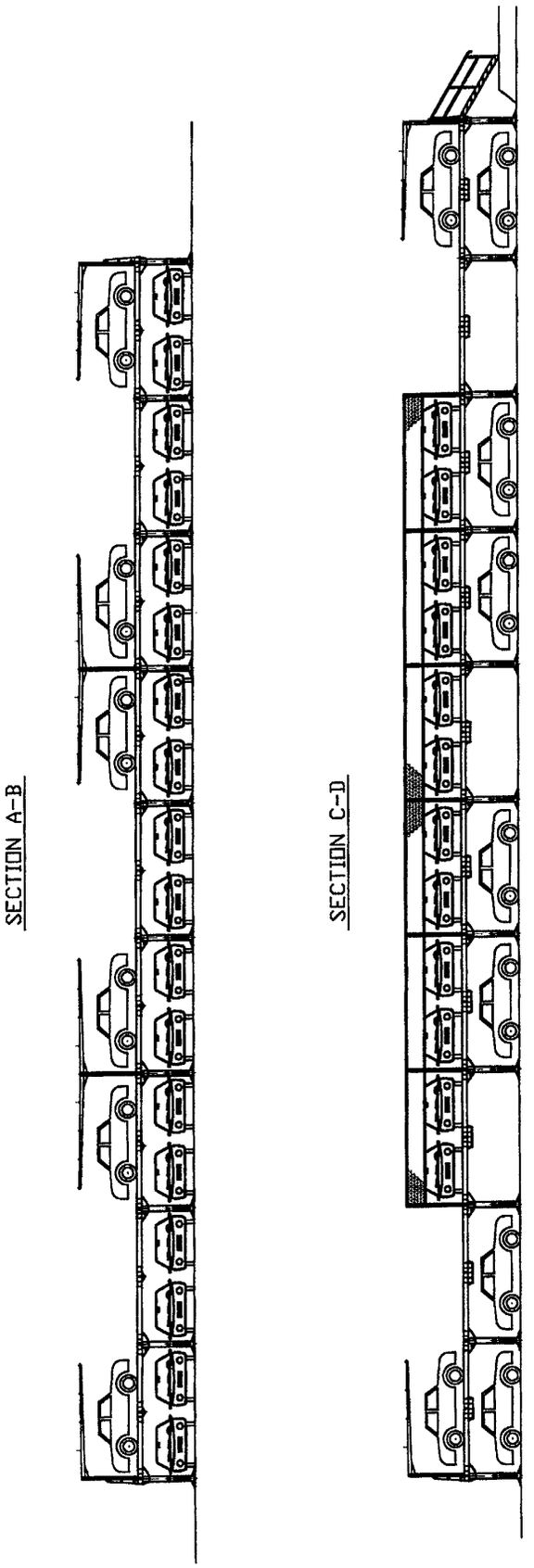

Fig. 3

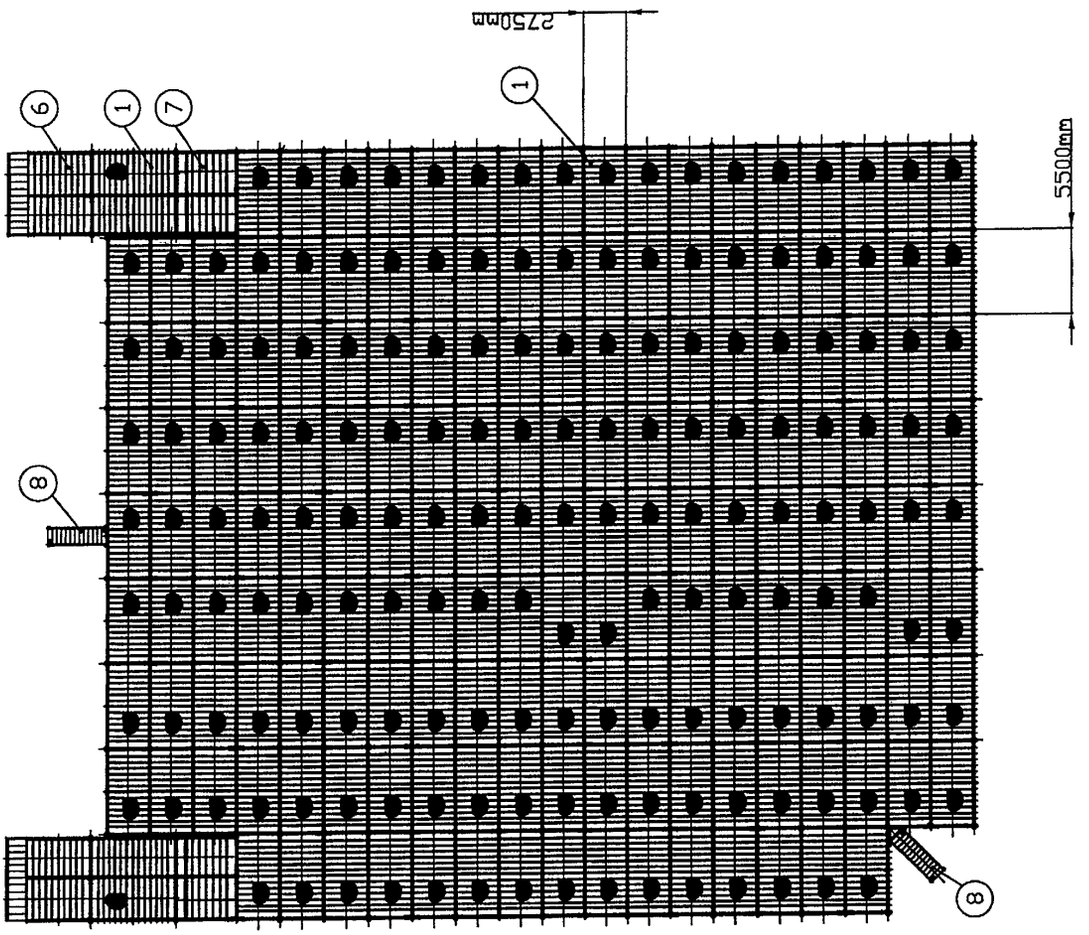

Fig. 4

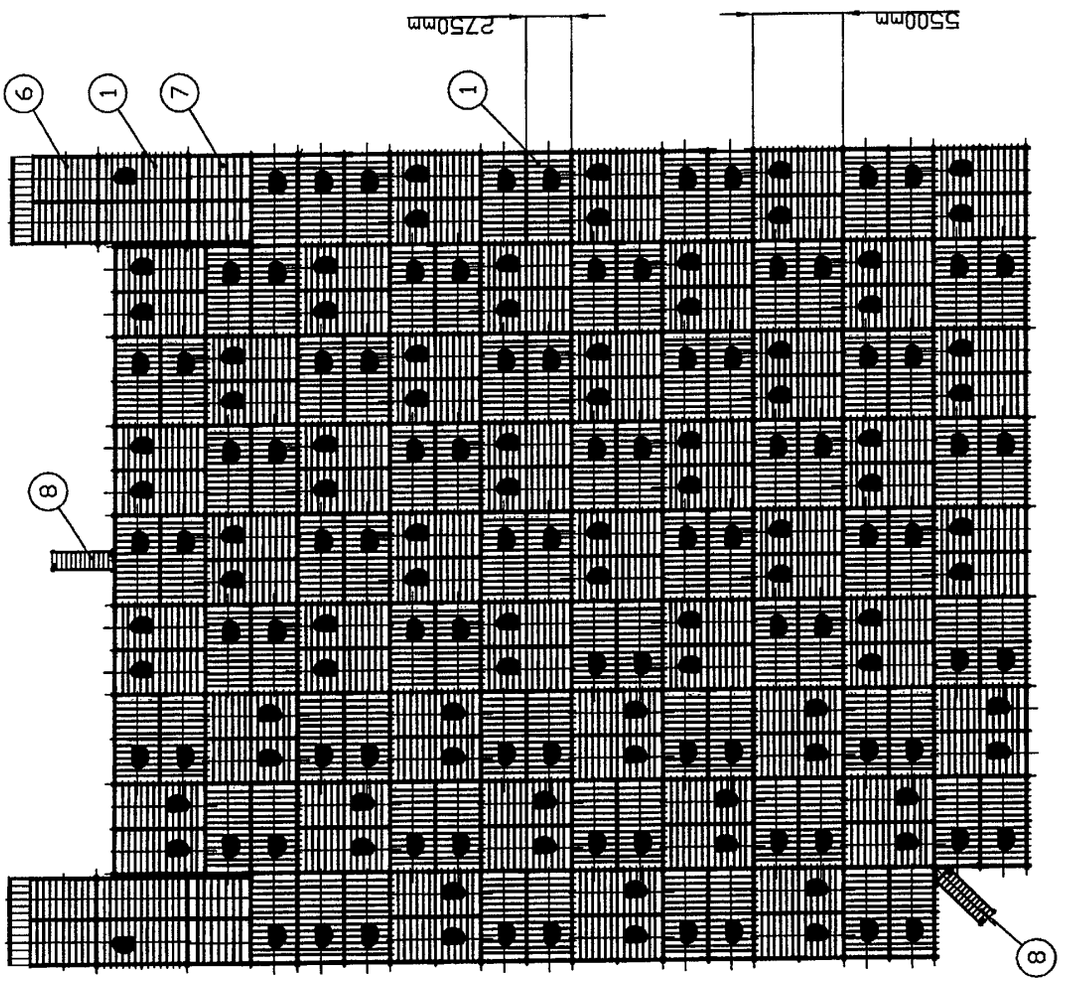

Fig. 5

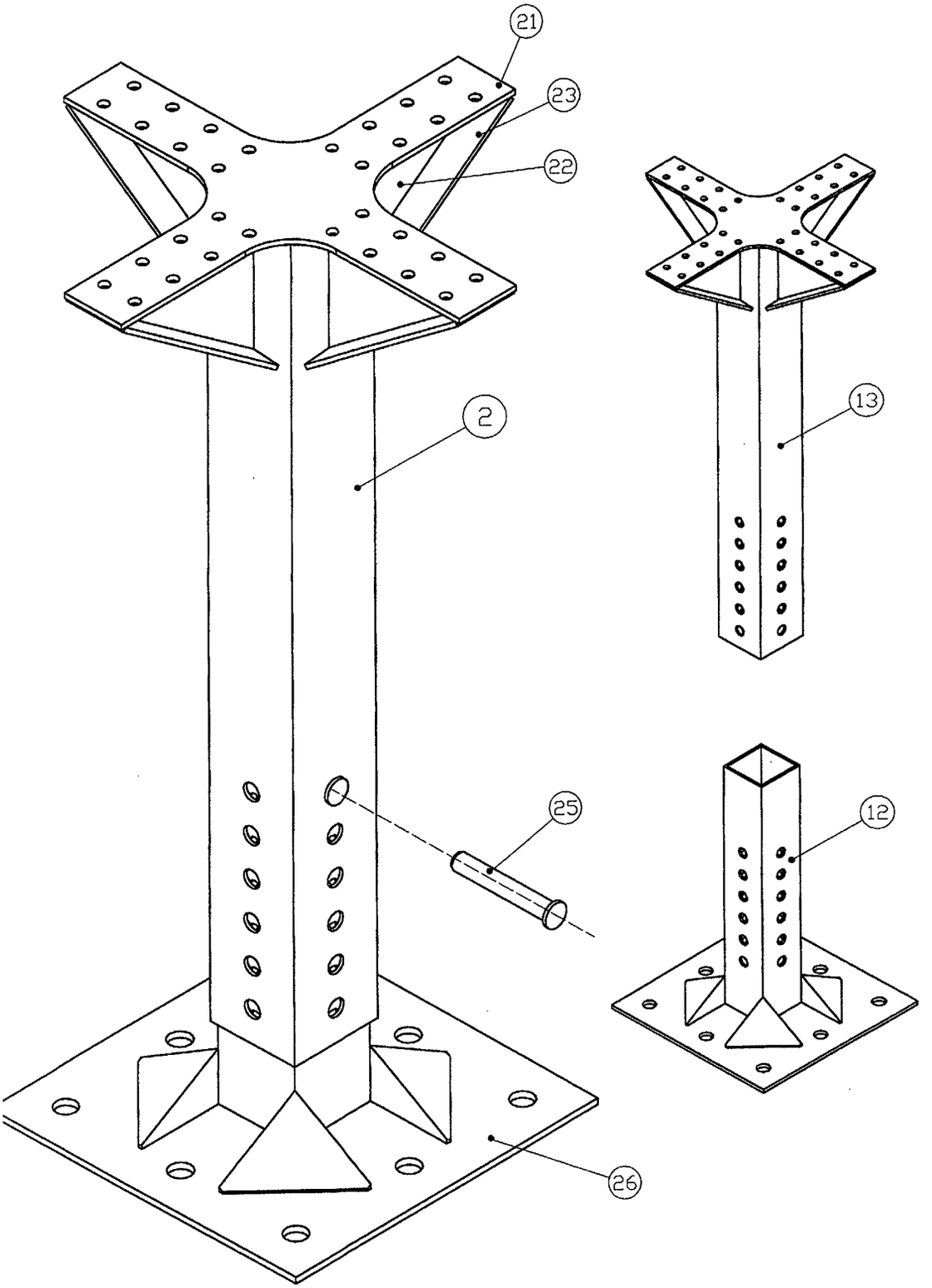

Fig. 6

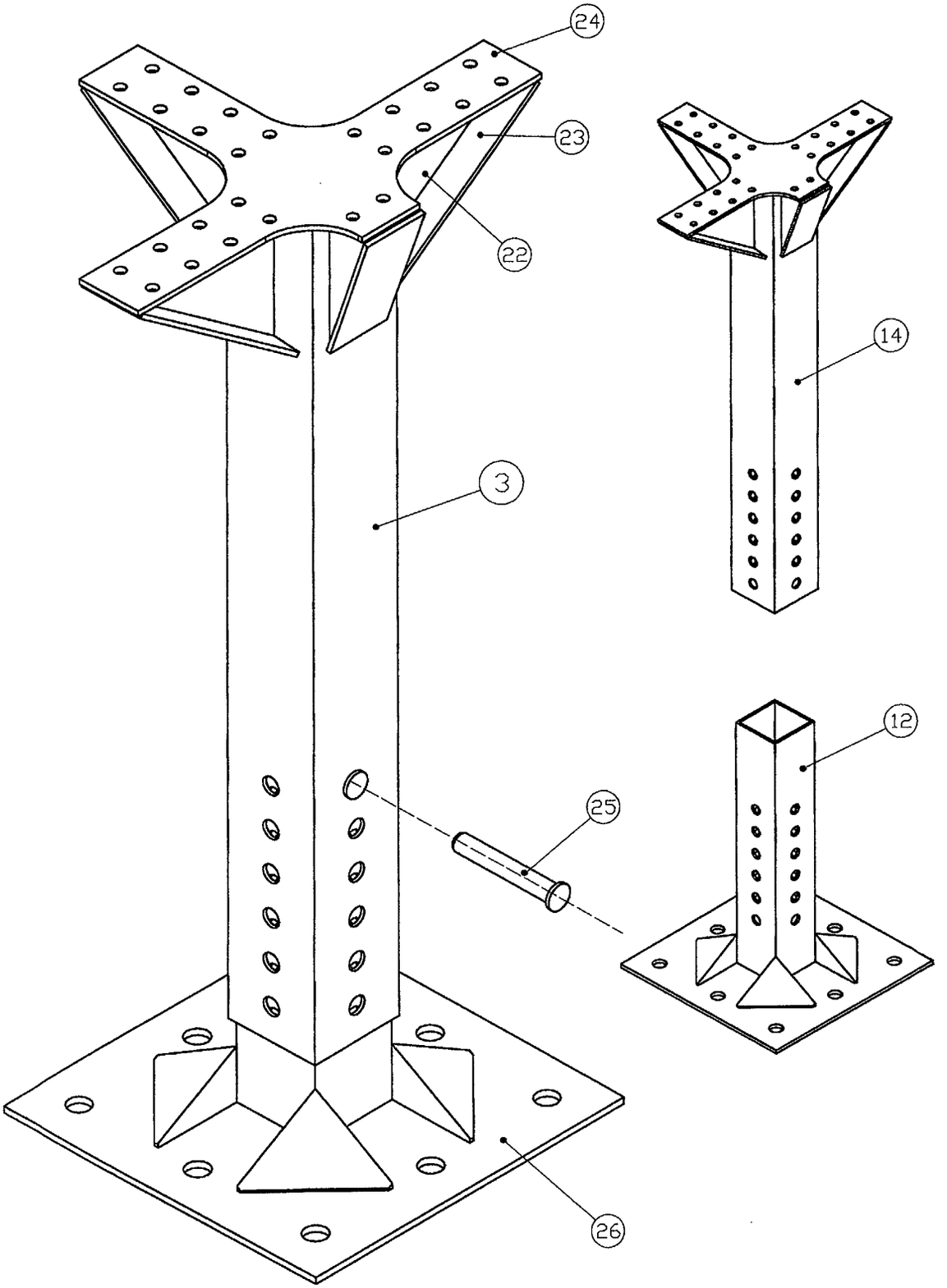

Fig. 7

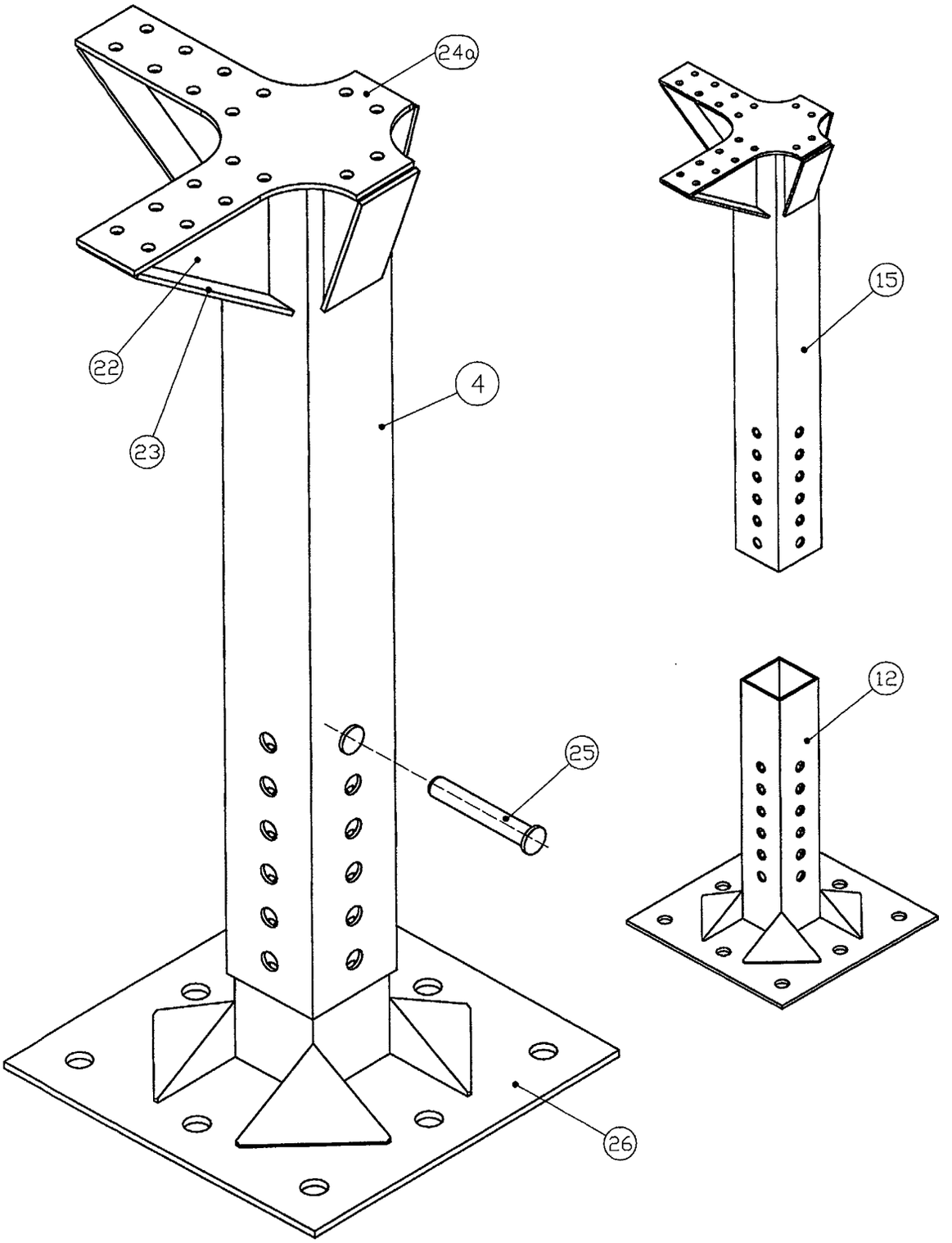

Fig. 8

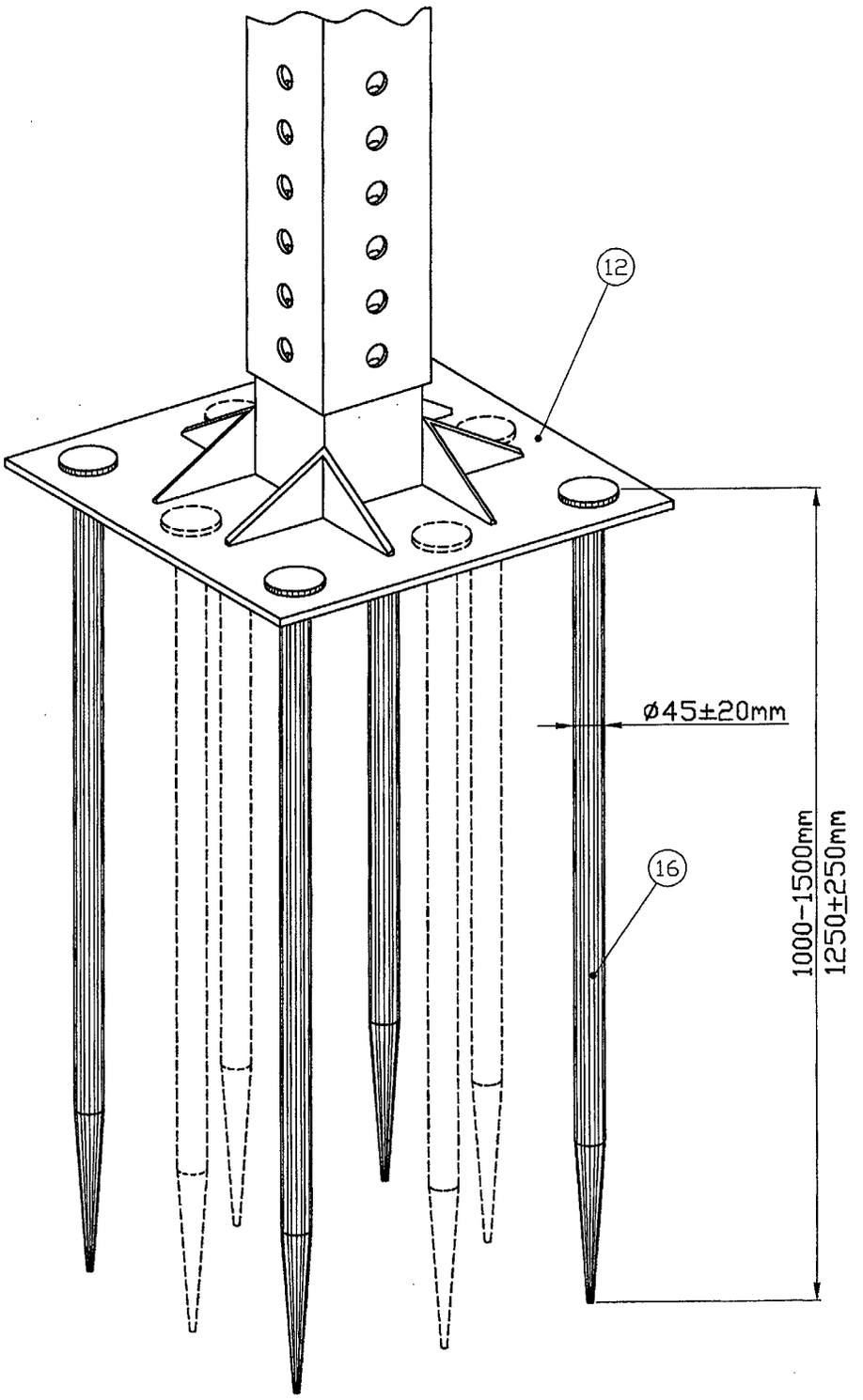

Fig. 9

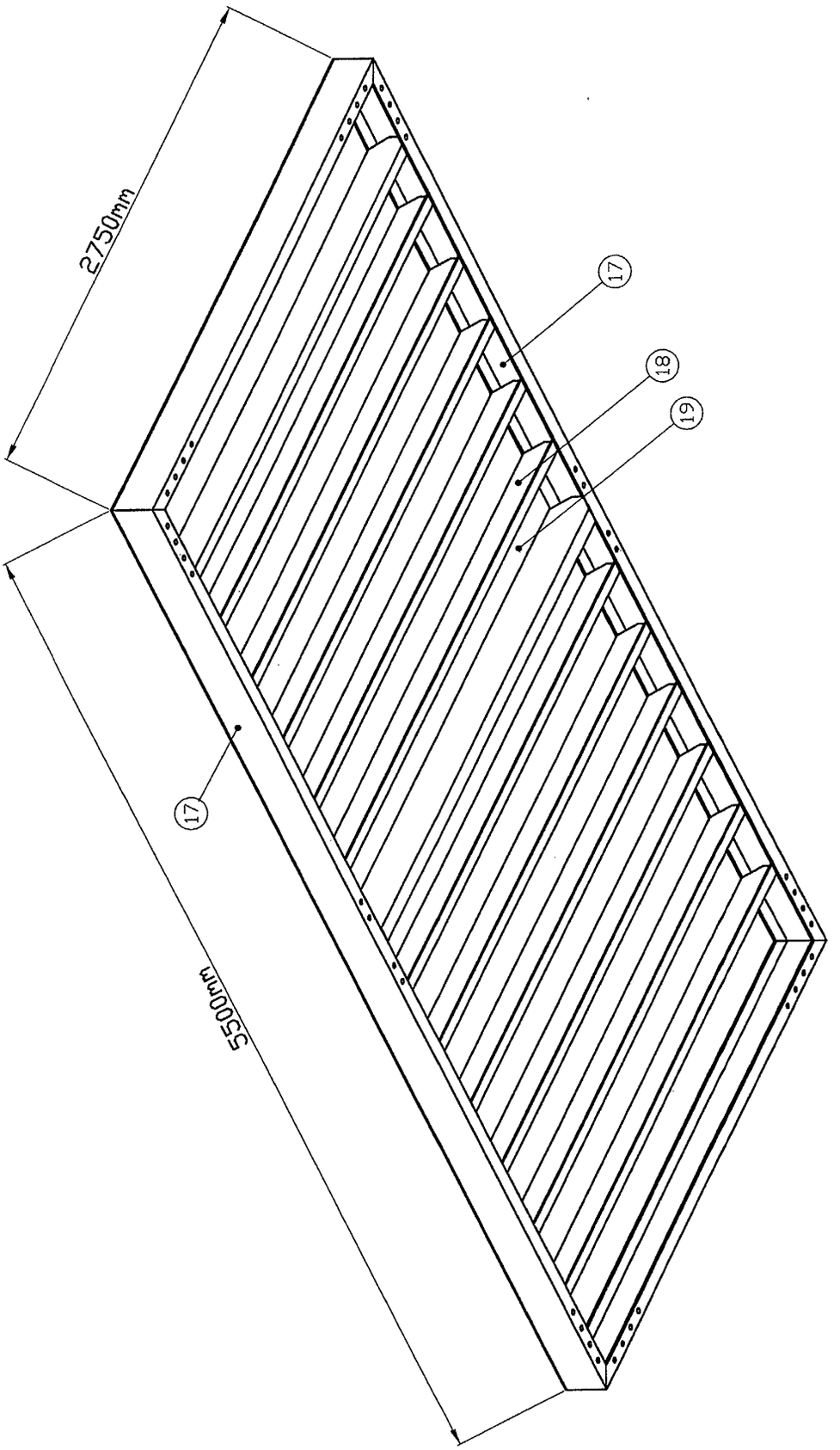

Fig. 10

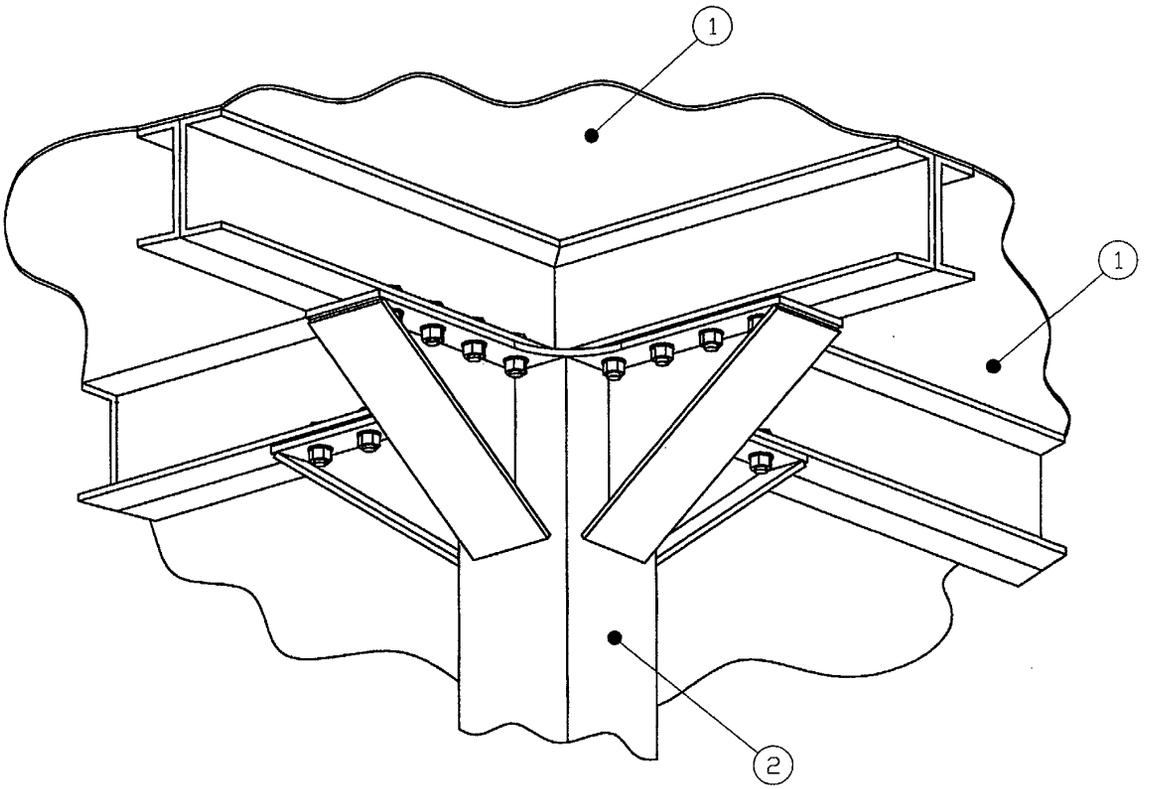

Fig. 11

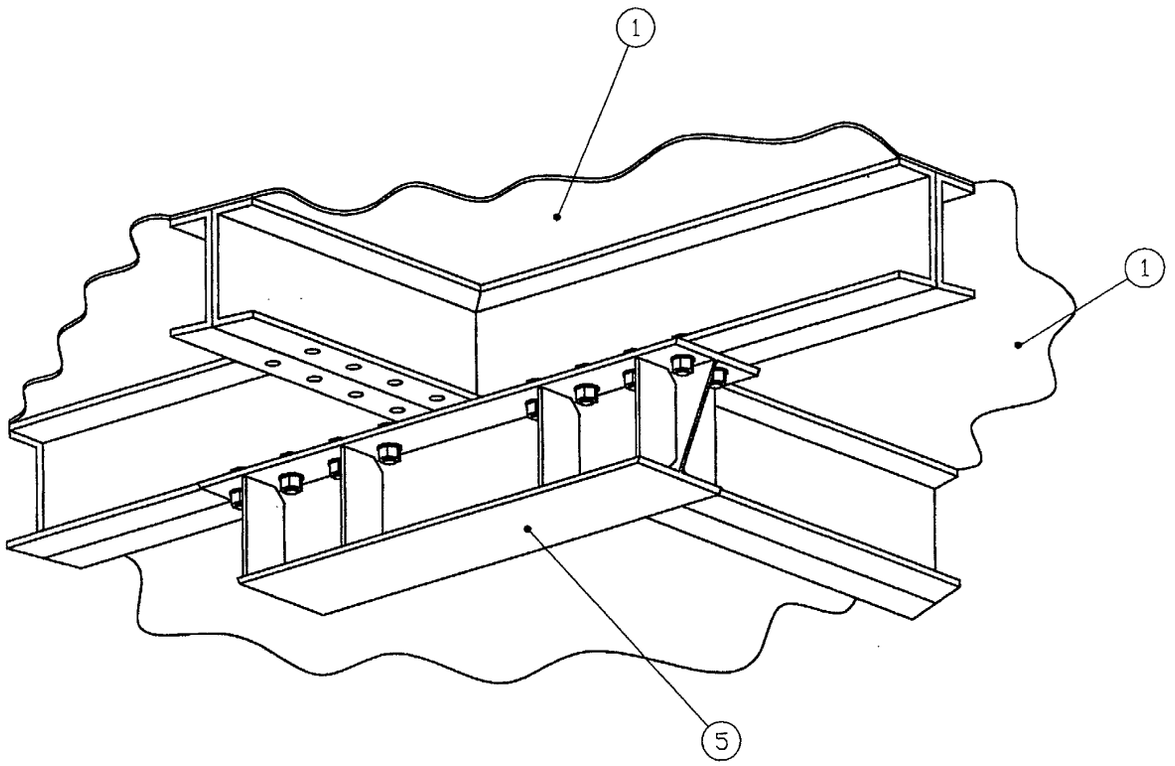

Fig. 12

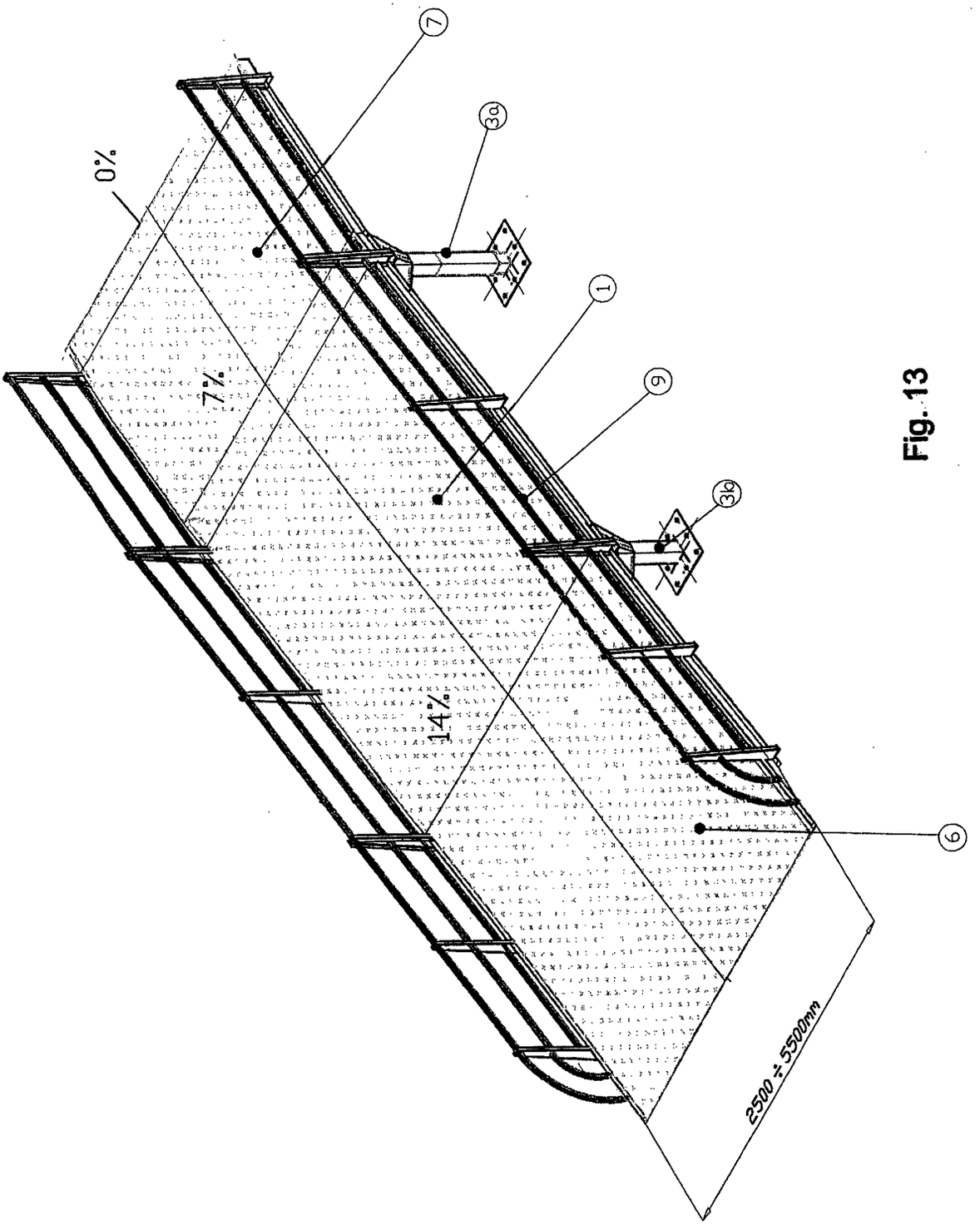

Fig. 13

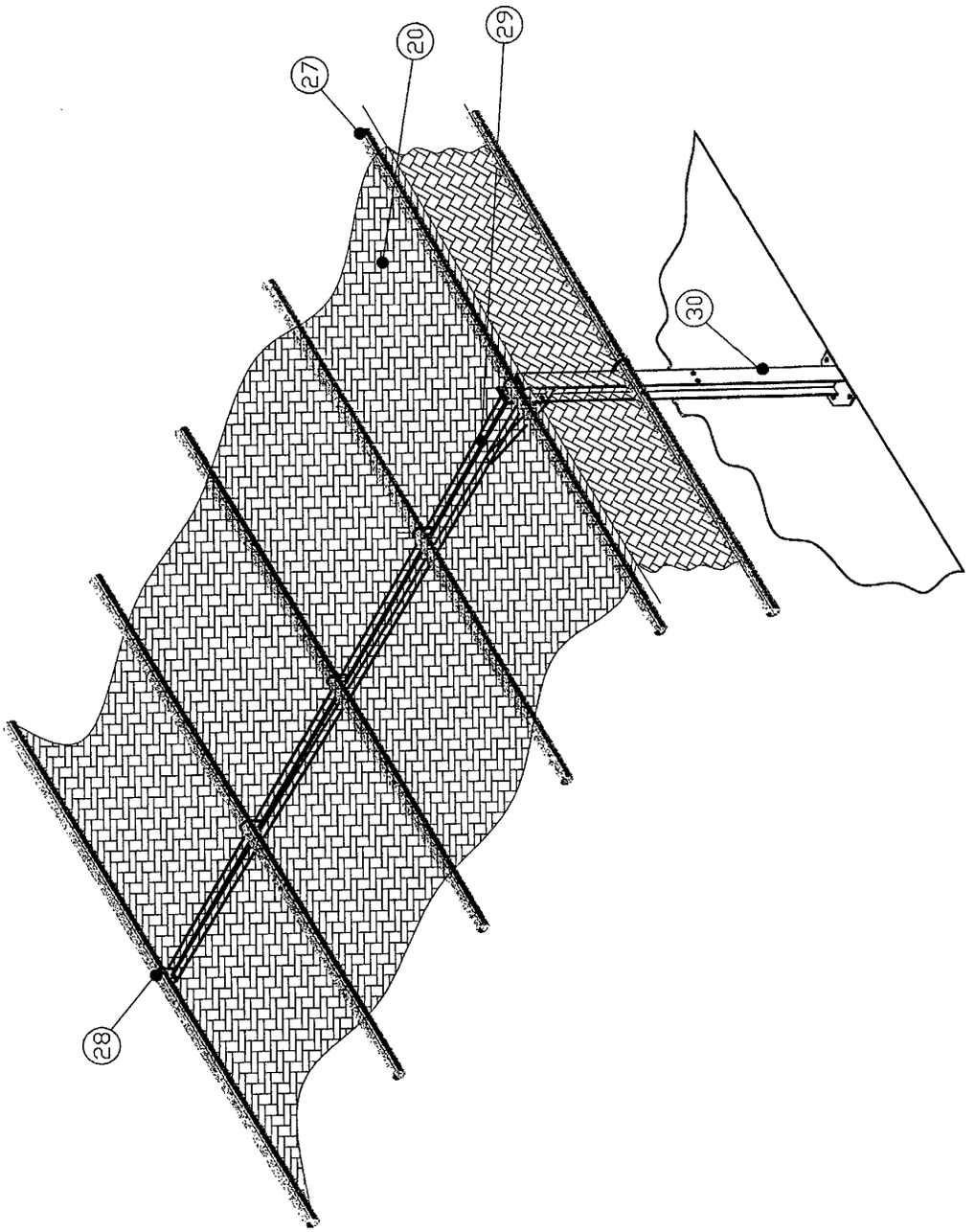

Fig. 14

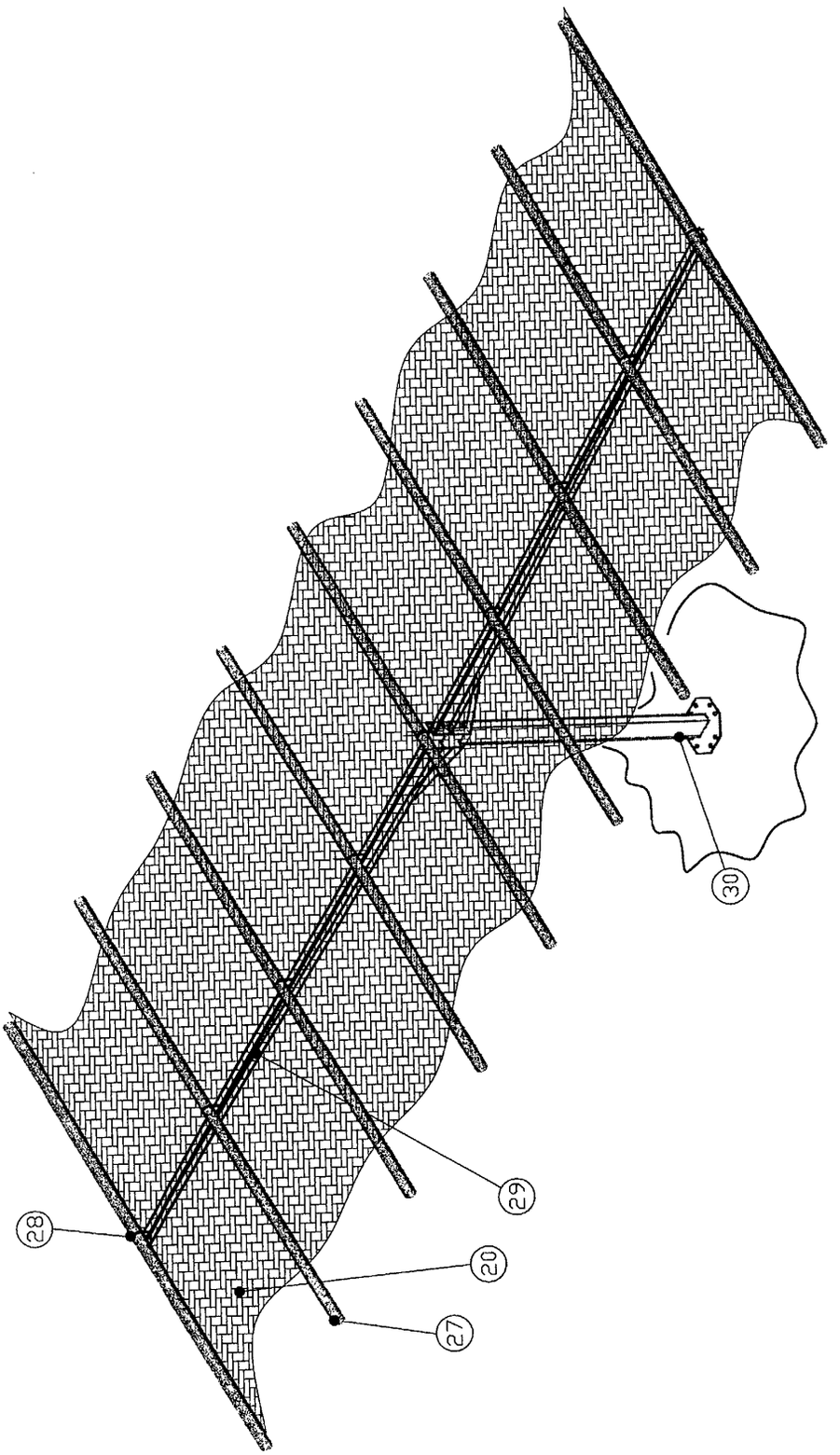

Fig. 15

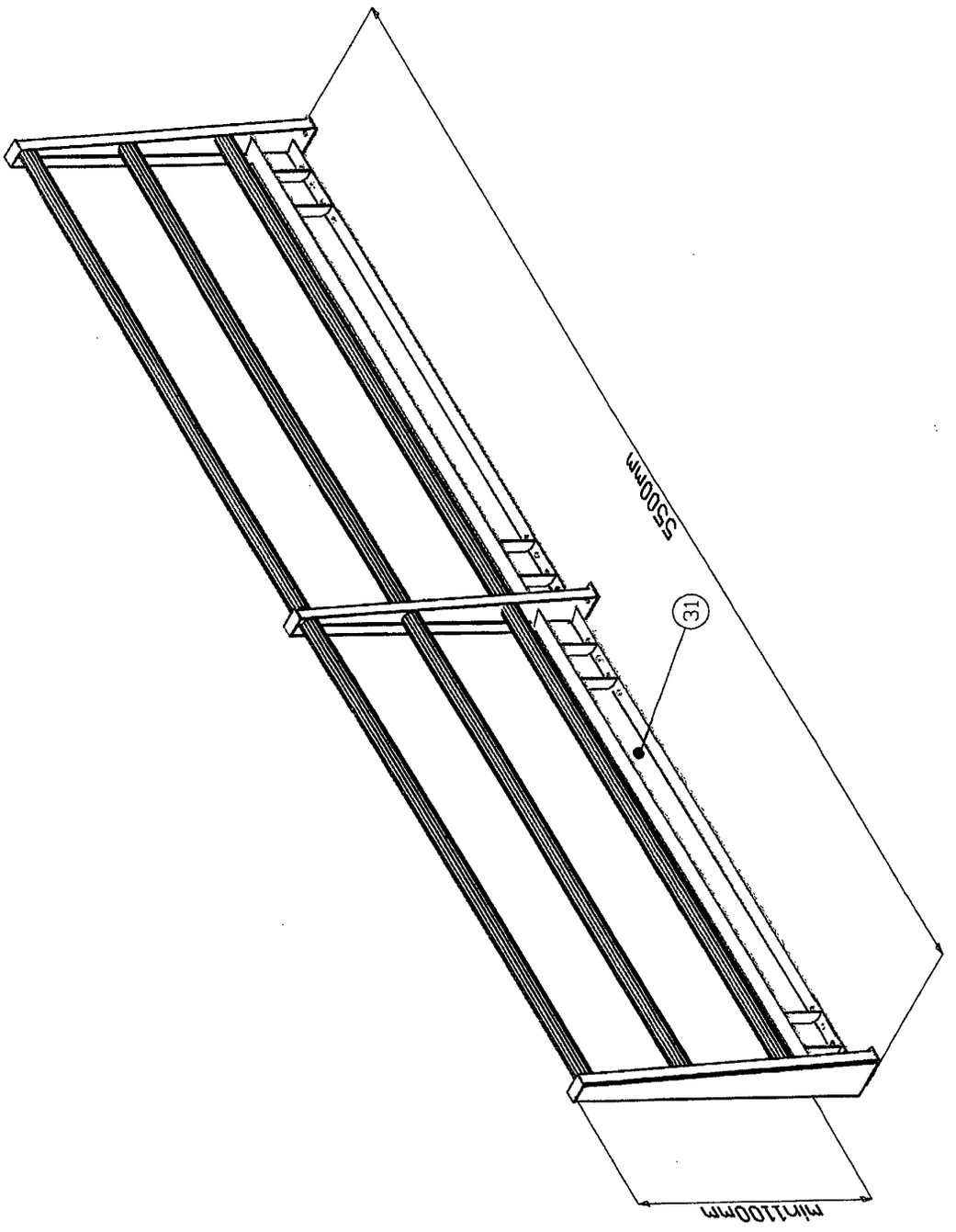

Fig. 16

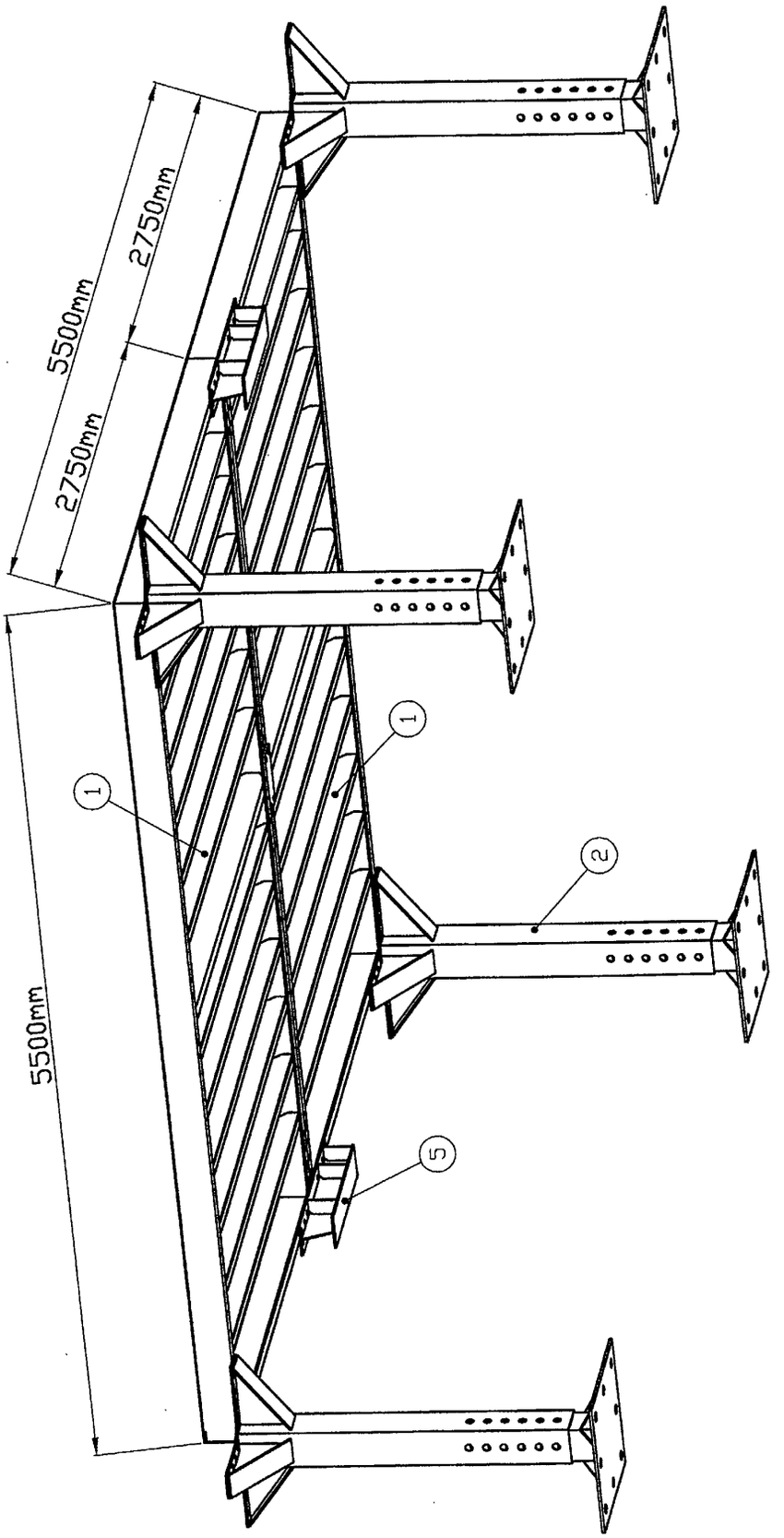

Fig. 17