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(54) **FOUNDATION PLINTH AND FOUNDATION SYSTEM COMPRISING SAID PLINTH**

(57) A plinth and a foundation system comprising said plinth are concerned. More specifically, such plinth and foundation system comprising said plinth have characteristics that improve its construction, transport and assembly compared to plinths of a known type.

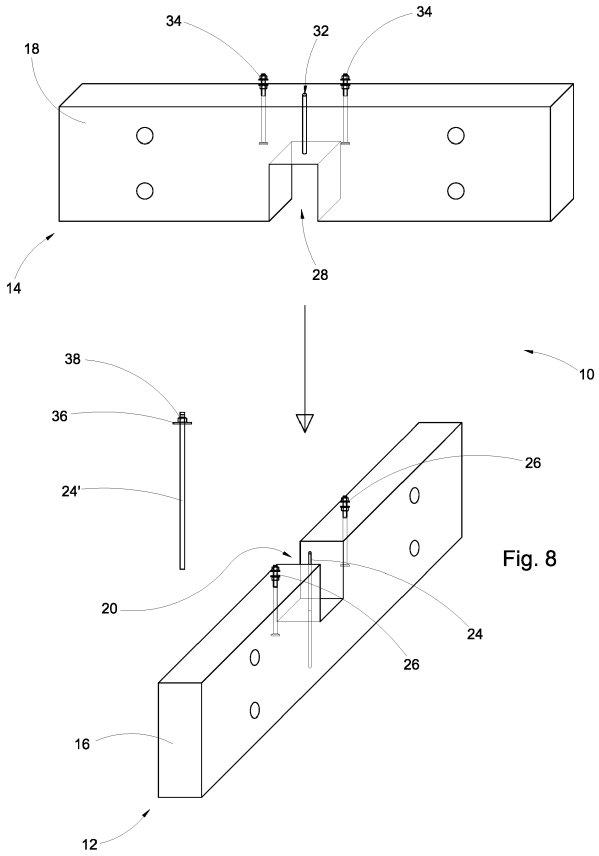

Fig. 8

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Description

[0001] The present invention relates, in general, to a plinth and a foundation system comprising said plinth. More particularly, it relates to a plinth, and to a foundation system comprising said plinth, having characteristics such as to improve its construction, transport and assembly with respect to plinths of known type.

[0002] As is known, in the construction sector, foundation plinths are used for the construction of foundation systems on which to place pillars, usually consisting of a reinforced concrete block in the shape of a parallelepiped.

[0003] More specifically, according to the known technique, there are basically three foundation systems for precast pillars.

[0004] The first foundation system according to the known technique involves a cast-in-place socket plinth.

[0005] Specifically, the elements of this first system are:

- a sub-plinth, i.e. an initially cast plinth that serves as a working surface on which to build the plinth;
- an in-situ plinth consisting of a parallelepiped-shaped foundation and a socket element;
- a prefabricated pillar.

[0006] According to this first foundation system, the prefabricated pillar is inserted directly into the socket element of the plinth, levelled and solidified with an expanding mortar casting.

[0007] This foundation system requires a rather deep excavation that on average exceeds 2 metres; consequently, it is costly and time-consuming to construct.

[0008] In order to reduce the construction time, this first foundation system can provide for the plinth, consisting of the parallelepiped-shaped foundation and the socket element, to be prefabricated.

[0009] In other words, the plinth is manufactured at the factory and then is transported and laid directly onto the sub-plinth. As a result, there is a saving in site time, but at the expense of greater problems in transporting an element that is bulky and heavy.

[0010] The second foundation system according to the known technique involves the plinth being cast in situ and incorporating corrugated pipes, also known as 'armoured pipes'.

[0011] Specifically, the elements of this second system are:

- a sub-plinth, i.e. an initially cast plinth that serves as a working surface on which to build the plinth;
- a plinth built on site, formed only by the parallelepiped-shaped foundation and therefore, compared to the first foundation system, devoid of the socket element;
- corrugated pipes ("armoured pipes") embedded in the foundation in a vertical position;
- a prefabricated pillar;
- reinforcement bars exiting from the lower base of the pillar.

[0012] In this foundation system, the prefabricated pillar is first connected to the plinth by inserting the reinforcement bars exiting the pillar directly into the corrugated pipes.

[0013] The pillar is then levelled and solidified with an expanding mortar casting inside the tubes.

[0014] Compared to the first foundation system, this second system requires a shallower excavation depth and involves reduced time and costs as the socket element is not required.

[0015] This foundation system is also optimal in terms of seismic resistance, so much so that it is equivalent to pillars built in situ.

[0016] It does, however, have one major disadvantage: the height of the in-situ foundation is conditioned by the length of the reinforcement bars protruding from the pillar.

[0017] The third foundation system according to the known technique requires that the plinth be cast in situ and that mechanical connection devices, known as 'little shoes' and 'anchor bolts', be arranged.

[0018] In particular, the elements of this third system are:

- a sub-plinth, i.e. an initially cast plinth that serves as a working surface on which to build the plinth;
- a plinth made on site, formed by the parallelepiped-shaped foundation alone;
- steel anchor bolts, embedded in the foundation, protruding approximately 15 cm, and threaded;
- a prefabricated pillar;
- metal little shoes embedded in the base of the pillar.

[0019] In this foundation system, the prefabricated pillar is mechanically connected to the foundation by bolting the metal little shoes to the anchor bolts protruding from the plinth foundation, levelled and completed by pouring expanding mortar in the space between the pillar and the foundation.

[0020] Compared to the previously illustrated foundation systems, the third foundation system requires a foundation with a lower height.

[0021] Furthermore, the foundation system is easy to lay, as no shoring is required.

[0022] This foundation system, however, has significant costs due to the use of the mechanical connection devices illustrated.

[0023] In addition, the connection obtained has a lower seismic resistance than pillars made in situ.

[0024] The purpose of the present invention is to provide a plinth and foundation system that overcomes the problems of plinths and foundation systems according to the known technique.

[0025] Another purpose of the invention is to provide

a plinth and foundation system that is simple to construct.

[0026] A further purpose of the invention is to provide a plinth that is convenient to manage in its handling.

[0027] A further purpose of the invention is to provide a plinth that is easy to assemble in its foundation system.

[0028] These and other purposes are achieved, according to the invention, by a foundation plinth, capable of forming the support for a prefabricated pillar, which is characterised by comprising a lower element and an upper element.

[0029] The lower element comprises a lower body in which there is a transverse upper recess and in which a threaded bar is partially embedded, vertically arranged and coaxial to the central axis of the same lower body.

[0030] The upper element comprises an upper body in which there is a transverse lower recess, there being present in the upper body a vertical hole, preferably a through-hole, coaxial to the central axis of the upper body, below communicating with the lower recess.

[0031] In particular, the lower element and the upper element are capable of being coupled to each other by means of the interlocking of a portion of the lower body of the lower element in the lower recess of the upper element, and by means of the interlocking of a portion of the upper body of the upper element in the upper recess of the lower element.

[0032] Furthermore, when the lower element and the upper element are coupled together, the threaded bar passes through the vertical hole, exiting at the top.

[0033] In addition, since the lower element and the upper element are elongated in shape and fit together perpendicular to each other, a cross-shaped structure is overall created.

[0034] The plinth according to the invention can be easily realised by manufacturing single elongated bodies, which can also be conveniently transported, assembled and installed.

[0035] In order to securely fasten the lower element and the upper element together, once they are coupled, a bolt can be screwed and tightened to the threaded bar, above the upper element.

[0036] This fastening can be further improved, as a plate, threaded into the threaded bar, can be present between the bolt and the upper element.

[0037] Advantageously, at least one mounting bar, arranged laterally of the upper recess and/or the lower recess, may be embedded in the lower element and/or the upper element, suitable for fastening a prefabricated pillar in a practical and fast manner

[0038] The purposes of the invention are also achieved by a foundation system comprising a plinth, as defined above, and a sub-foundation, on which the plinth is arranged.

[0039] In particular, the sub-foundation may be reinforced.

[0040] This configuration of the sub-foundation and the plinth allows for a foundation system that is less costly and faster in terms of construction time.

[0041] Furthermore, such a sub-foundation is an integral part of the foundation system according to the invention, with static functions, unlike the systems according to the known technique according to which merely a non-returnable casting floor without static functions was considered.

[0042] Furthermore, the height of the sub-foundation can be taken into account in the height of the plinth when calculating the foundation system as a whole.

[0043] Advantageously, the foundation system can comprise a prefabricated pillar with coupling devices that can be coupled to one or more plinth mounting bars.

[0044] The coupling of the prefabricated pillar to the plinth is thus practical and fast.

[0045] Furthermore, coupling devices can include at least one metal shoe for this purpose.

[0046] In order to achieve a stronger coupling between the pillar and the plinth, it is preferable for the pillar itself to have at least one anchor bar protruding below it.

[0047] Advantageously, an upper concrete casting, arranged above the substructure, may be included in the foundation system. In such an upper casting, an upper reinforcement may be arranged, so that the plinth, the coupling devices and the at least one anchor bar may be embedded in said upper casting, thus making the foundation structure into a single body.

[0048] The foundation system according to the invention comprises a series of construction steps, at least five, for assembling the prefabricated pillar plinth.

[0049] Further features and details may be better understood from the following description, given as a non-limiting example, as well as from the accompanying drawing tables, in which:

Figures 1 and 2 are side and top views, respectively, of a lower element, forming part of the foundation plinth according to the invention;

Figures 3 and 4 are side sectional views of the lower element of Figure 1 according to a sectional plane A-A and according to a sectional plane B-B respectively shown in Figure 1;

Figures 5 and 6 are side and top views respectively of an upper element forming part of the foundation plinth according to the invention;

Figure 7 is a side sectional view of the upper element of Figure 5 according to a sectional plane C-C indicated in Figure 5;

Figure 8 is a schematic axonometric view of the plinth according to the invention, in an assembly stage;

Figures 9, 10, 11 are top, first side and second side views, respectively, of a foundation system according to the invention in the first fabrication stage;

Figures 12, 13, 14 are views respectively from above, from a first side and from a second side of a foundation system according to the invention in the second embodiment stage;

Figures 15, 16, 17 are views respectively from above, from a first side and from a second side of a

foundation system according to the invention in the third embodiment stage;

Figures 18, 19, 20 are views respectively from above, from a first side and from a second side of a foundation system according to the invention in the fourth embodiment stage;

Figure 21 is a detailed view of Figure 20;

Figures 22, 23, 24 are views respectively from above, from a first side and from a second side of a foundation system according to the invention in its fifth and final embodiment.

[0050] With reference to the appended Figures, in particular Figure 8, a plinth according to the invention, formed of a lower element 12, illustrated individually in Figures 1, 2, 3 and 4, and an upper element 14, illustrated individually in Figures 5, 6 and 7, is indicated as a whole by 10.

[0051] The lower element 12 comprises a concrete lower body 16 of parallelepiped shape in which a transverse upper recess 20 of rectangular cross-section and four transverse holes 22, preferably through holes, are provided.

[0052] A threaded bar 24 is embedded in the lower body 16. Said threaded bar 24 has an orientation, substantially vertical and coaxial with respect to the central axis of the same lower body 16, so as to partially protrude from the same lower body into the upper recess 20.

[0053] Two mounting bars 26, arranged on either side of the upper recess 20, are partially embedded in the lower body 16, from which they protrude above.

[0054] The upper element 14 comprises a parallelepiped-shaped concrete upper body 18 in which there is a transverse lower recess 28 of rectangular cross-section and four transverse holes 30, preferably through holes.

[0055] In the upper body 18 there is a vertical hole 32, coaxial to the central axis of the same upper body 18, inferiorly communicating with the lower recess 28. Said hole 32 is a through hole.

[0056] Two mounting bars 34, present on either side of the lower recess 28, are partially embedded in the upper body 18, from which they protrude above.

[0057] As shown in Figure 8, the lower element 12 and the upper element 14 are coupled to each other by embedding a portion of the lower body 16 of the lower element 12 in the lower recess 28 of the upper element 14 and by embedding a portion of the upper body 18 of the upper element 14 in the upper recess 20 of the lower element 12.

[0058] In this manner, the threaded bar 24 passes through the vertical hole 32, from which it exits at the top.

[0059] The lower element 12 and the upper element 14 are mutually fixed to each other by means of a plate 36 on the top of the upper element 14 at the threaded bar 24 and by means of a bolt 38 in tightening on the same threaded bar 24.

[0060] The plinth 10 according to the invention, which has a cross-shaped construction, is thus realised.

[0061] The foundation system 40 according to the invention, illustrated in its entirety in Figures 21, 22 and 23, is realised using the previously illustrated plinth 10 according to a series of steps which are described below.

[0062] In a first embodiment, illustrated in Figures 9, 10 and 11, a reinforced subfoundation 52 comprises a bottom pour 54 of concrete in which a bottom reinforcement 56 is embedded.

[0063] The reinforced sub-foundation 52 further comprises a connection reinforcement 58 protruding from the lower casting 54.

[0064] In the second stage of realisation of the foundation system 40 according to the invention, as shown in Figures 12, 13 and 14, the lower element 12 is supported on the reinforced sub-foundation 52, once it has solidified.

[0065] In the third stage of realisation of the foundation system 40 according to the invention, as per Figures 15, 16 and 17, the upper element 14 is coupled to the lower element 12 and the fixing of the same elements takes place, as described above, by positioning the plate 36, threaded into the threaded bar 24 to which the bolt 38 is screwed and tightened.

[0066] In the fourth stage of realisation of the foundation system 40 according to the invention, as shown in Figures 18, 19 and 20, a prefabricated pillar 60 provided with coupling devices, specifically four metal shoes 62, embedded in the base of the abutment 60 itself, is installed.

[0067] In order to fix the pillar 60 to the plinth 10, the metal shoes 62 are fixed to the mounting bars 26, 34 which protrude from the lower element 12 and the upper element 14, as illustrated in Figure 21.

[0068] In addition, anchor bars 64 protrude from the pillar 60, which, once the pillar 60 is mechanically fixed to the plinth 10, are arranged free and laterally to the lower element 12 and to the upper element 14, serving as reinforcement for the subsequent casting.

[0069] In fact, in the fifth stage of realisation of the foundation system 40 according to the invention, as shown in Figures 21, 22 and 23, a top pour 66 of concrete is performed in which an upper reinforcement 68 is arranged.

[0070] The connection reinforcement 58 of the reinforced sub-foundation 52 is thus embedded in the top pour 66.

[0071] Then, by means of the fourth and fifth steps, the precast pillar 60 is first assembled and mechanically connected to the foundation by attaching the four metal shoes 62 to the four mounting bars 26, 34 of the plinth 10, and then is solidified to the sub-foundation 52 by the top four 66 of concrete.

[0072] In this way, the anchor bars 64 of the pillar 60 are solidified to the subfoundation 52 and to the same top pour 66, in addition to the same plinth 10 becoming an integral part of it.

[0073] Once the top pour 66 of concrete has been made, in fact, the subfoundation 52, the plinth 10, the

metal shoes 62, the mounting bars 26, 34 and the anchor bars 64 become a single body, thus creating the foundation system 40.

[0074] The foundation system 40 thus obtained combines all the advantages of the systems according to the known technique, eliminating, or at least reducing, all their limitations.

[0075] In fact, the foundation system according to the invention is less expensive and faster in terms of construction time.

[0076] In addition, the sub-foundation 52 is an integral part of foundation system 40 with static functions, in contrast to the systems according to the known technique according to which it was merely a non-returnable casting plane without static functions.

[0077] Furthermore, the height of the sub-foundation 52 is taken into account in the plinth height when calculating the foundation system as a whole.

[0078] Furthermore, there may be variants which are to be considered within the scope of the invention.

[0079] For example, the arrangement of reinforcement, metal shoes 62, mounting bars 26, 34, anchor bars 64 may be different from that illustrated and described above.

Claims

1. Foundation plinth (10) suitable for forming the support for a prefabricated pillar (60), **characterized in that** it comprises a lower element (12) and an upper element (14), wherein the lower element (12) comprises a lower body (16) in which a transversal upper recess (20) is obtained and in which a threaded bar (24), vertically arranged and coaxial to the central axis of the same lower body (16), is partially embedded; wherein the upper element (14) comprises an upper body (18) in which is obtained a transversal lower recess (28), being obtained in the upper body (18) a vertical hole (32), coaxial to the central axis of the upper body (18), inferiorly communicating with the lower recess (28);

   being the lower element (12) and the upper element (14) suitable to be coupled to each other by means of the embedding of a portion of the lower body (16) of the lower element (12) in the lower recess (28) of the upper element (14) and by means of the embedding of a portion of the upper body (18) of the upper element (14) in the upper recess (20) of the lower element (12);
   wherein, when the lower element (12) and the upper element (14) are coupled together, the threaded rod (24) passes through the vertical hole (32), exiting at the top;
   in which, since the lower element (12) and the upper element (14) are elongated and fit together perpendicular to each other, a cross-shaped structure is created overall.

2. Plinth (10) according to the preceding claim, wherein, when the lower element (12) and the upper element (14) are coupled to each other, a bolt (38) is screwed and tightened to the threaded bar (24) superiorly to the upper element (14).

3. Plinth (10) according to the preceding claim, wherein a plate (36) is disposed between the bolt (38) and the upper element (14), threaded into the threaded bar (24).

4. Plinth (10) according to any of the preceding claims, wherein in the lower element (12) and/or in the upper element (14) is embedded at least one mounting bar (26, 34), disposed laterally of the upper recess (20) and/or the lower recess (28); said at least one mounting bar (26, 34) being suitable for fixing a prefabricated pillar (60).

5. A foundation system comprising a plinth (10) according to any one of the preceding claims and a sub-foundation (52), on which the plinth (10) is disposed.

6. Foundation system according to any of the preceding claims, wherein the subfoundation (52) is reinforced.

7. Foundation system according to claim 5 or 6, further including a pillar (60) prefabricated provided with coupling devices (62) suitable to be coupled to the at least one mounting bar (26, 34) of the plinth (10).

8. Foundation system according to any preceding claim, wherein the coupling devices comprise at least one metal shoe (62).

9. Foundation system according to claim 7 or 8, wherein the abutment (60) shows at least one anchor bar (64).

10. Foundation system according to any one of claims 5 to 9, wherein is included a top pour (66) of concrete disposed superiorly to the sub-foundation (52) and wherein is disposed a top reinforcement (68), said top pour (66) suitable for embedding the plinth (10), the coupling devices (62) and the at least one anchor bar.

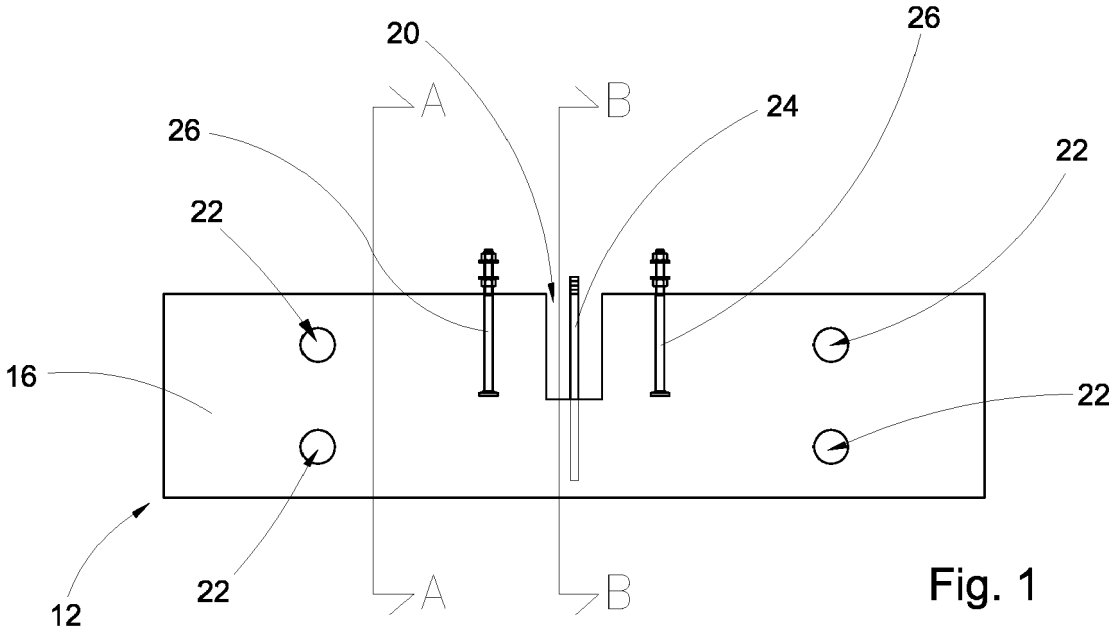

Fig. 1

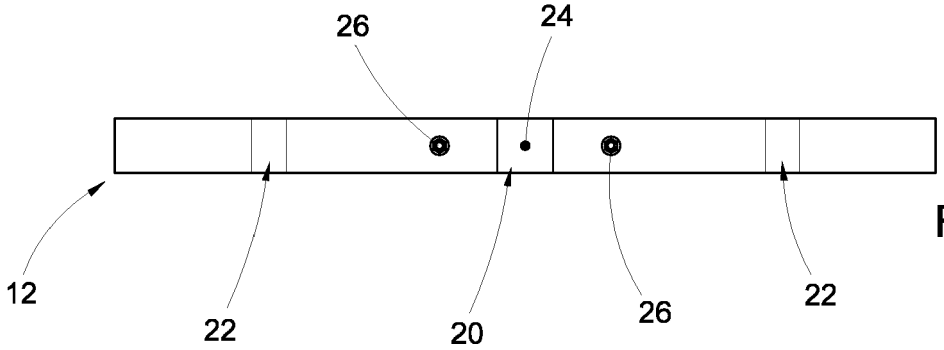

Fig. 2

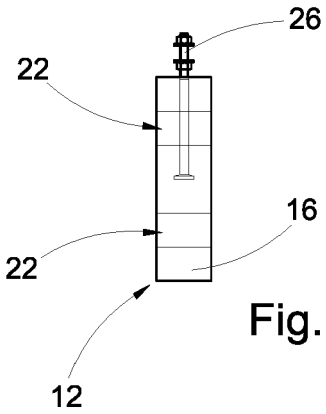

Fig. 3

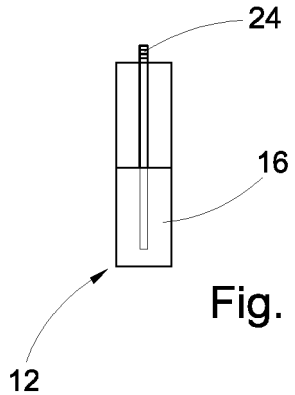

Fig. 4

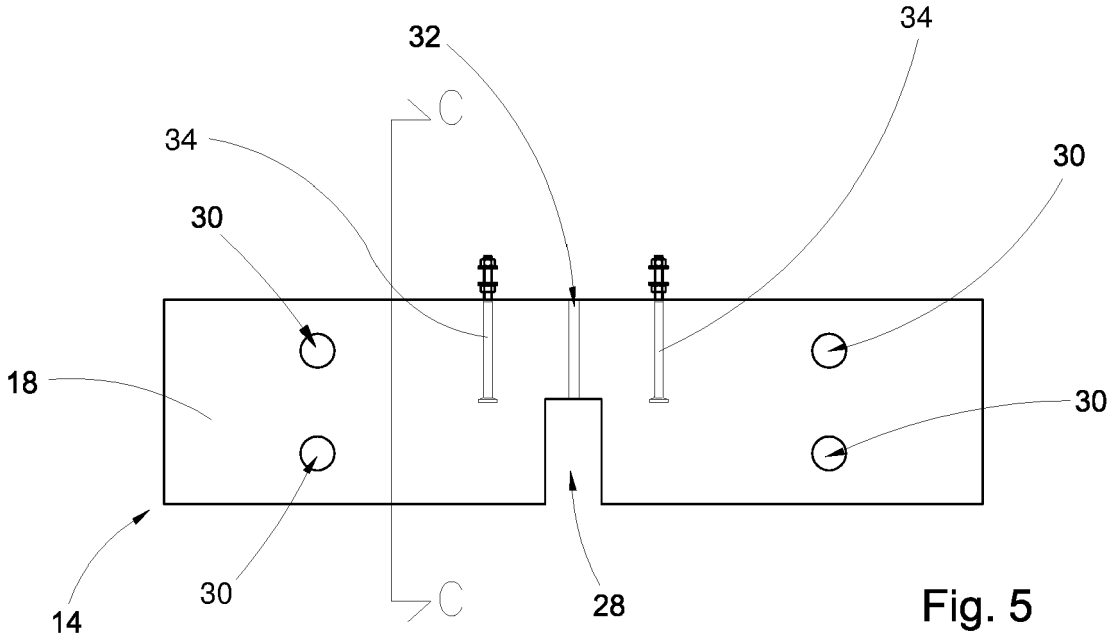

Fig. 5

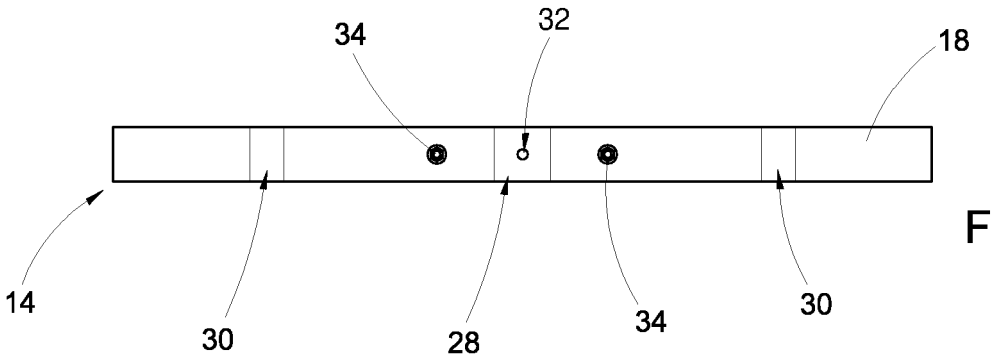

Fig. 6

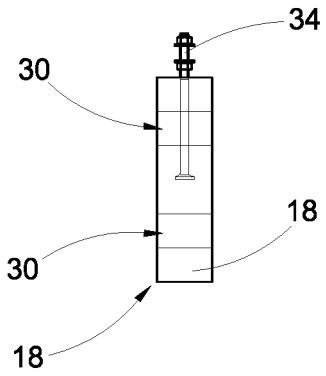

Fig. 7

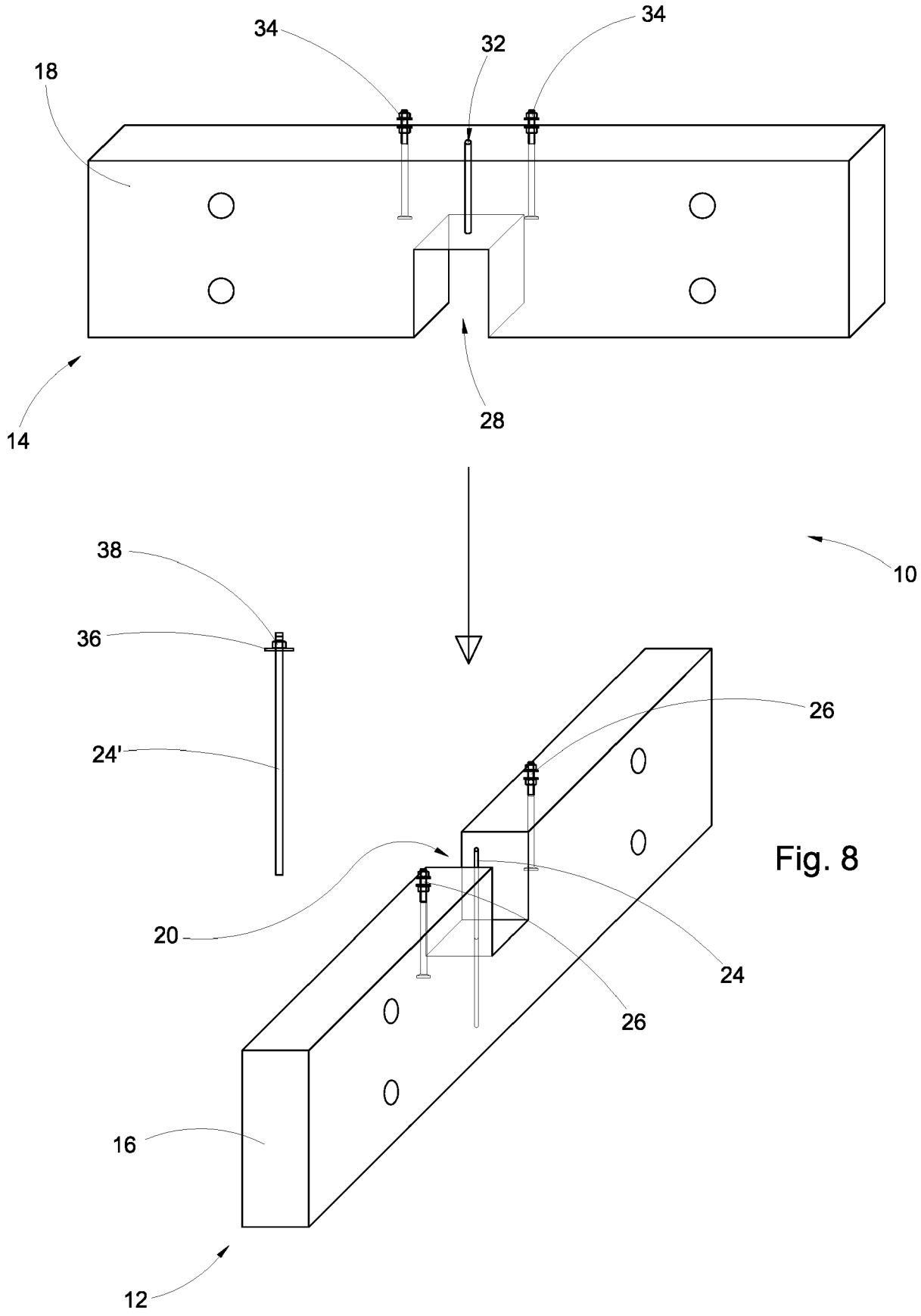

Fig. 8

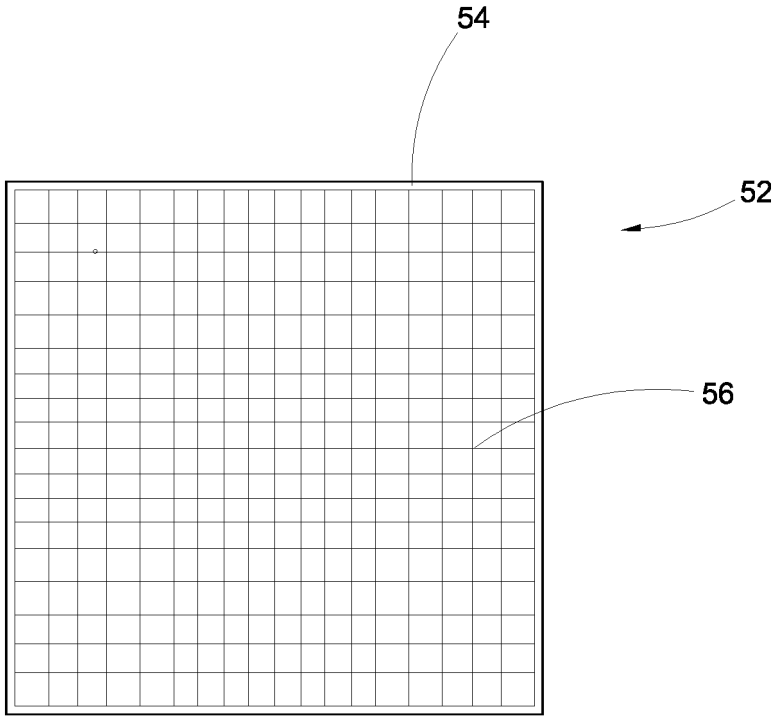

Fig. 9

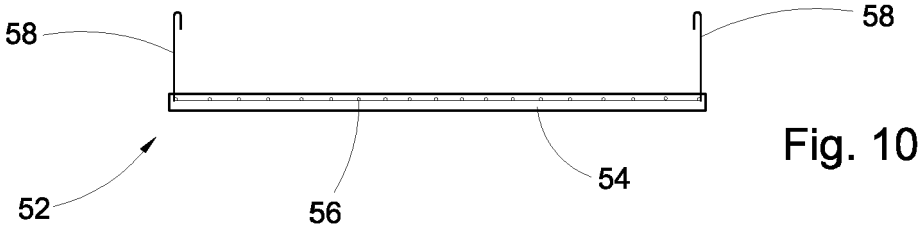

Fig. 10

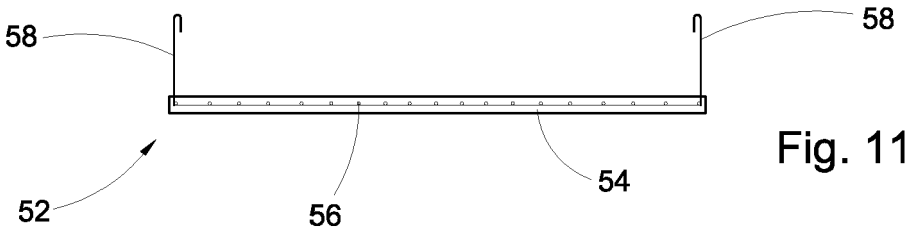

Fig. 11

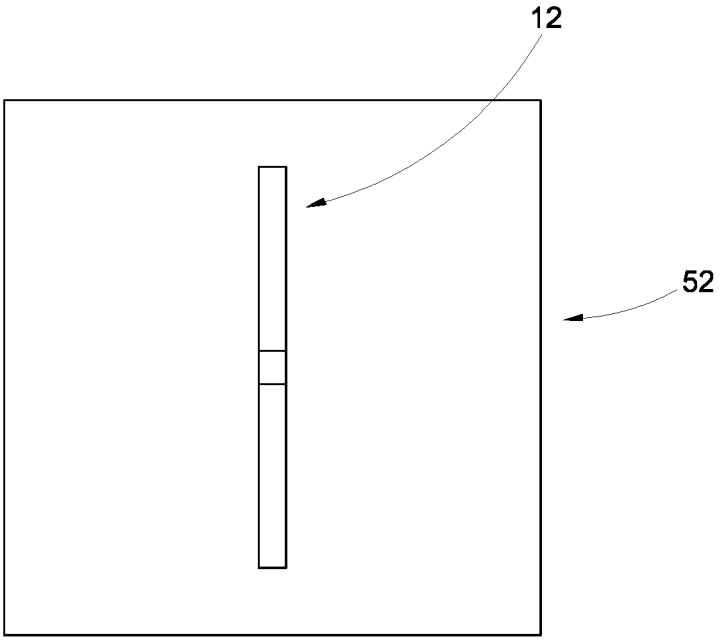

Fig. 12

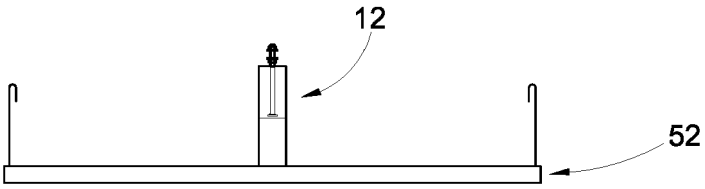

Fig. 13

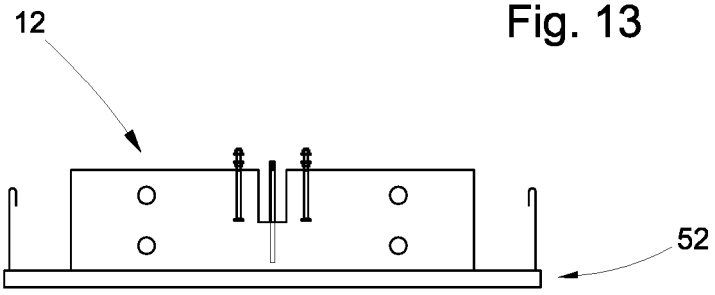

Fig. 14

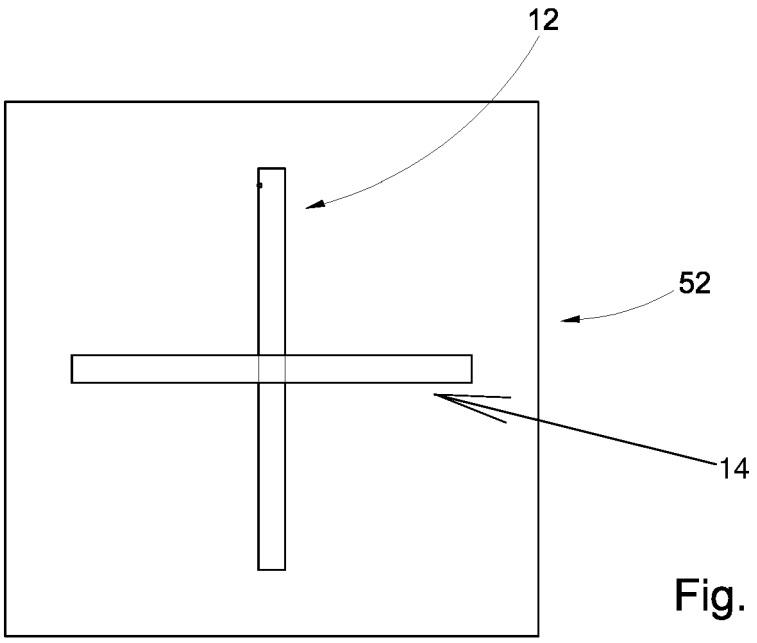

Fig. 15

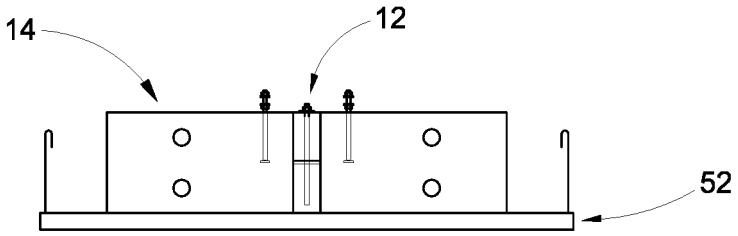

Fig. 16

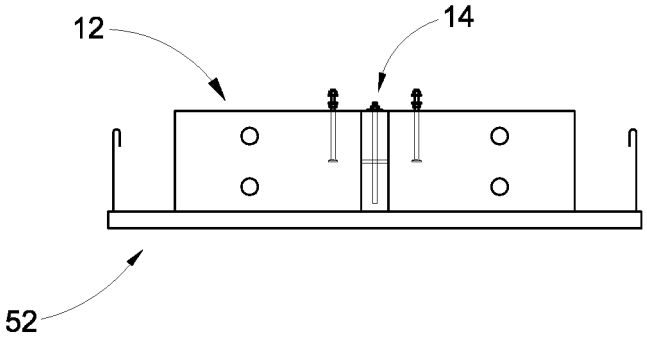

Fig. 17

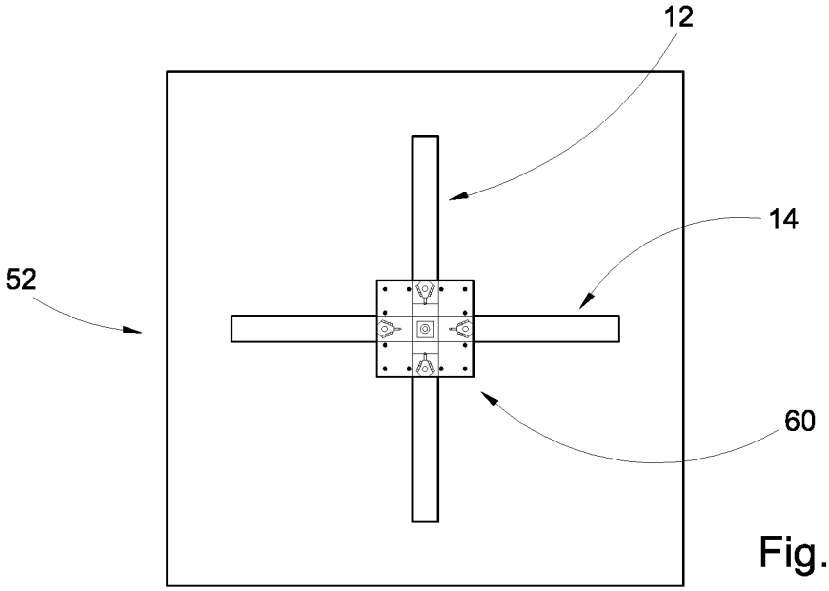

Fig. 18

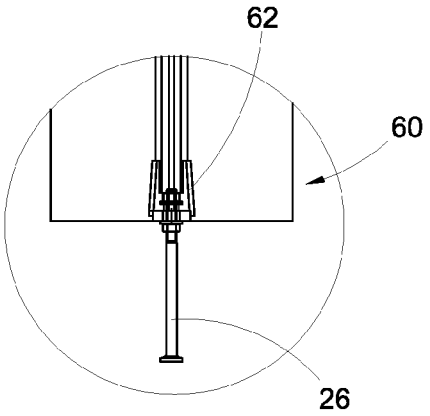

Fig. 21

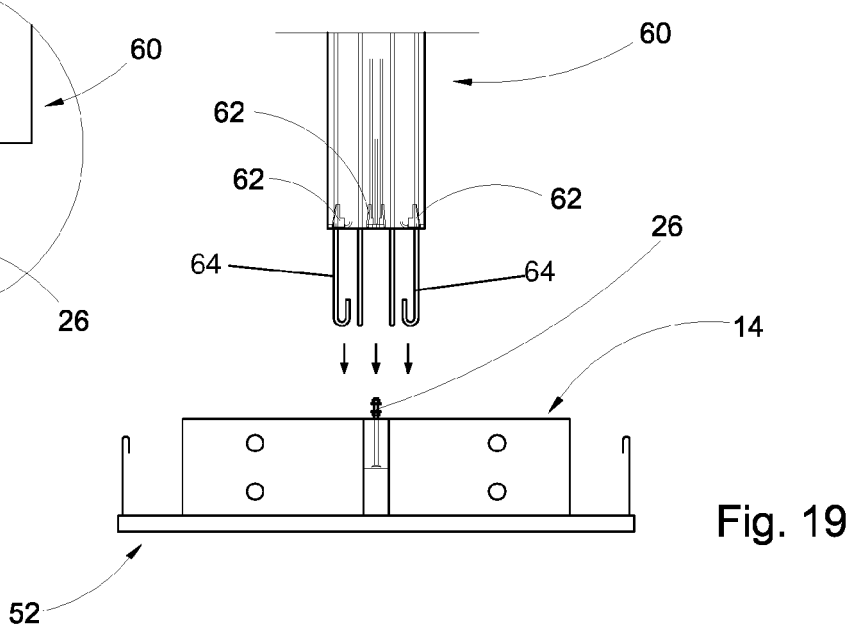

Fig. 19

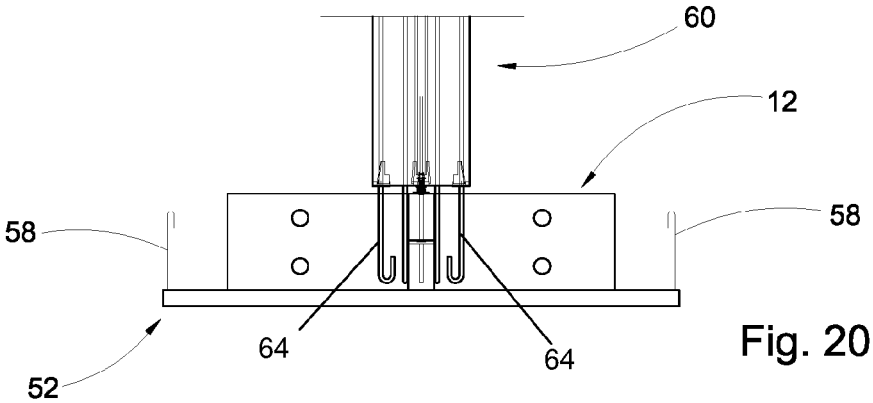

Fig. 20

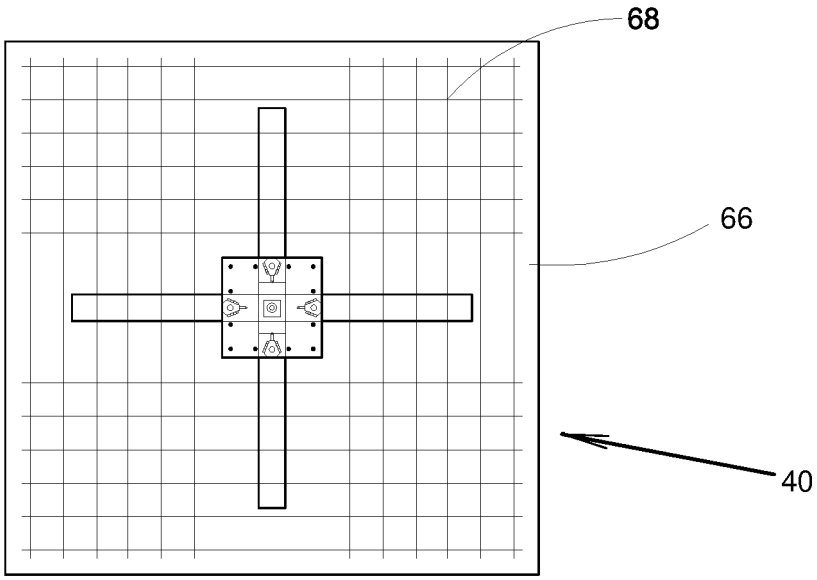

Fig. 22

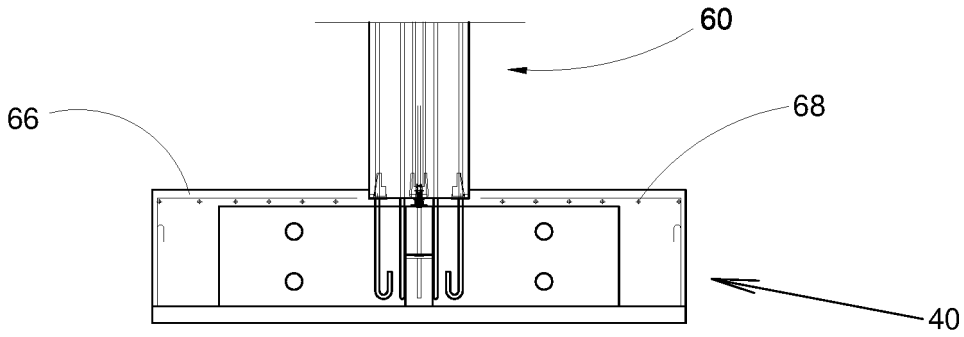

Fig. 23

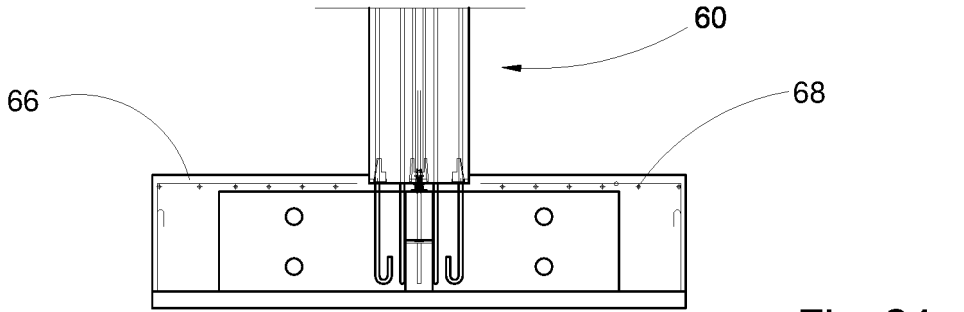

Fig. 24

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EUROPEAN SEARCH REPORT

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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	22 September 2022	Koulo, Anicet

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