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(71) Applicant: **Tecnostrutture SRL**
30020 Noventa Di Piave VE (IT)

(72) Inventors:
- **Daniele, Franco**
  30020, Eraclea (VE) (IT)
- **Biondo, Paolo**
  30020, Fossalta di Piave (VE) (IT)
- **Tasca, Massimo**
  31050, Vedelago (TV) (IT)
- **China, Stefano**
  30027, San Donà di Piave (VE) (IT)
- **Bozzo, Massimo**
  30020, Eraclea (VE) (IT)

(74) Representative: **Petraz, Gilberto Luigi et al**
GLP S.r.l.
Piazzale Cavedalis 6/2
33100 Udine (IT)

(54) **System of seismic-resistant prefabricated elements for the building trade, and relative laying method**

(57) System of prefabricated elements for the building trade, comprising at least a pillar of the steel-concrete mix type (50) and a girder (40). The system comprises at least an anti-seismic device, consisting of an anti-seismic element (30) having at least a central element (31) associated with respective upper (34) and lower (35) plates. The plates (34, 35) include seatings to house respective anchoring elements, respectively upper (36) and lower (37). The anti-seismic device also consists of at least a distancing plate (43, 44, 60) able to anchor the anti-seismic element (30) to a support base (45), or to the lower part of the girder (40), or to the upper or lower part of the pillar (50). The plate (43, 44, 60) defines a free space to house operating equipment.

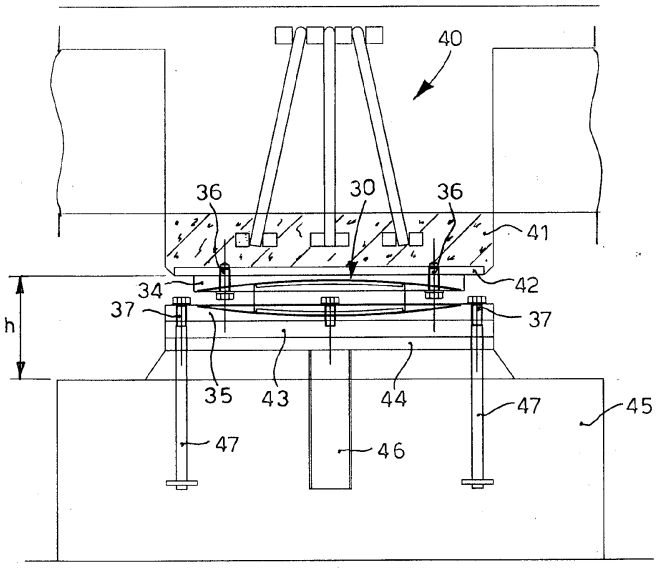

fig. 2

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Description

FIELD OF THE INVENTION

[0001] The present invention concerns a system of prefabricated elements, of the type with girders and pillars, earthquake-resistant already at the provisional or assembly step of the building structures, such as for example an anti-seismic device, a pillar, a column, a girder or other, and the relative laying method, using systems of vertical alignment and industrialized centering.

[0002] In particular, the present invention is applied preferably in the laying of pillars of mixed steel and concrete, mono-storey and multi-storey, and in the coupling to relative girders, able to be used in seismic risk zones and/or designed to have optimum behavior in fire. Such seismic devices, which for example use insulators or dissipaters, together with relative pillars and girders, are widely used in building structures, mono-storey and multi-storey, public and private, such as hospitals, strategic buildings, covered car parks or other.

BACKGROUND OF THE INVENTION

[0003] It is known to use pillars of mixed steel and concrete in association with relative girders in order to make building structures, in particular in high-risk earthquake zones and/or designed to have an optimum behavior in fire. This type of pillar is widely used for public and/or private multi-storey building structures, such as hospitals, strategic buildings, car parks or other.

[0004] A pillar of this type normally comprises a metal reinforcement consisting of an external shell or casing, generally made of steel and with a circular or square profile, or another profile available commercially, and metal cage disposed inside the external shell. Once the reinforcement has been laid, the concrete is cast inside the shell and, when it sets, is anchored to the internal cage.

[0005] The metal reinforcement normally has at least a base plate that serves as a support on the laying plane in the first steps of preparing the pillar.

[0006] By laying plane we mean the plane on which the pillar rests, having the task of supporting the weight of the pillar and coinciding, according to the traditional laying solutions, with the walkable plane, that is, the plane that is directly walked on or on which vehicles or other transit.

[0007] One advantage of the mixed steel and concrete pillar is that it guarantees high structural resistance during normal operations. In fact, when the temperature of the outside environment increases, for example, but not only, due to a fire, the steel that makes up the external shell is progressively weakened and, at the same time, the structural load supported by the pillar is distributed mainly on its concrete core.

[0008] The attachment of the pillar to the walkable plane is guaranteed, in the state of the art, by a force clamping system, disposed on the portion of the pillar nearest the walkable plane.

[0009] The clamping system comprises the base plate, which has attachment holes into which a plurality of clamping and/or drawing elements are inserted associated with the plate, such as for example bolts, set screws, tie bars or other, clamped by nuts or suchlike.

[0010] The base plate is normally attached to the external shell of the pillar on site by means of welding, and to the walkable plane by means of the clamping and/or drawing elements.

[0011] To allow the plate to be attached to the walkable plane, for each hole in the plate into which the clamping and/or drawing elements are inserted, a corresponding housing seating is made for the clamping and/or drawing elements under the walkable plane.

[0012] One disadvantage of this clamping system is that at least part of the clamping and/or drawing elements, for example the nuts, and the holed plate remain visible and in relief on the walkable plane; consequently, there is a waste of space near the pillar which could be made over to other uses and which can cause obstacles to the movement of persons and/or vehicles near the pillar.

[0013] The clamping system is also anti-aesthetic due to the presence of the visible external elements and this makes it unsuitable for use inside building structures.

[0014] Another disadvantage of this clamping system is that it does not provide any device able to compensate for any possible inclinations, imperfections or ridges present on the laying plane by varying the inclination of the pillar with respect to said plane during the laying of the pillar.

[0015] Another disadvantage of the traditional clamping system as described above is that it needs to create housing seatings in the foundation layer under the laying plane in order to insert the clamping and/or drawing elements.

[0016] Another disadvantage of traditional solutions is that the attachment characteristics of the pillars to the laying plane can vary according to the ability and experience of the operators, since they depend to a considerable extent on the force applied on the clamping and/or drawing elements in order to attach the plate to the laying plane.

[0017] Another disadvantage of known solutions is that, in the event that anti-seismic elements or absorption plates are to be inserted in correspondence with the girder-pillar nodes, or in zones where the girders or pillars are directly supported on floors, reinforced concrete supports or possible ventilated loose stone foundations, auxiliary operations are required for the positioning, alignment, coupling and attachment of the various prefabricated elements: all these operations have to be carried out on site with the risk of inaccuracies, longer operating times, erroneous positioning and connections, and still other disadvantages.

[0018] A first purpose of the present invention is to guarantee ease and speed in laying prefabricated ele-

ments such as pillars, girders, anti-seismic devices etc., even in correspondence with the anti-seismic nodes between elements.

[0019] Another purpose is to ensure that such elements can be inspected and maintained even after laying.

[0020] Another purpose of the present invention is to allow the repeatability of the operations to attach pillars to a laying plane and to the relative girders with anti-seismic elements interposed, without any risk of inaccuracies and operating problems.

[0021] Another purpose of the present invention is to guarantee the attachment of a pillar of the type described above to the walkable plane, without having recourse to the aid of clamping and/or drawing elements that remain in relief and external to said plane.

[0022] Another purpose of the present invention is to allow to compensate, when the pillar is laid, possible inclinations, imperfections or ridges present on the laying plane, suitably regulating the inclination of the pillar with respect to the laying plane.

[0023] A further purpose is to reduce the times and complexity of laying and attaching the pillar to the laying plane by the operator.

[0024] A further purpose is to ensure both stability and anti-seismic conditions already in the assembly stage without needing to wait for the concrete to mature.

[0025] The Applicant has devised, tested and embodied the present invention to overcome the shortcomings of the state of the art indicated above and to obtain these and other purposes and advantages.

SUMMARY OF THE INVENTION

[0026] The present invention is set forth and characterized in the independent claims, while the dependent claims describe other characteristics of the invention or variants to the main inventive idea.

[0027] In accordance with the above purposes, the system according to the invention comprises an anti-seismic device, consisting of at least an anti-seismic element, with which are associated both with adjustable upper and/or lower positioning and attachment elements and also an upper and/or lower distancing plate, which together define a free space to house operating equipment of an adjustable height.

[0028] In particular, the anti-seismic device by itself creates, after laying, a space between the laying plane and the walkable plane defining a technical compartment for housing jacks.

[0029] The positioning and attachment elements can be of the provisional type, that is, removable after they have been coupled with the relative structural element, pillar or girder, or the definitive type.

[0030] According to one embodiment of the invention, the anti-seismic device is made as a finished element in itself, able to be coupled on site with a relative pillar, mono- or multi-storey, or with a girder, or again laid and attached to a reinforced concrete support, a floor or other structural element, definitive or provisional.

[0031] In another form of embodiment, the anti-seismic device is coupled in the plant and made solid with a relative structural element such as a mono- or multi-storey pillar, or a girder so that, on site, the installation and laying of the structural element already determine the correct positioning of the anti-seismic device, without requiring supplementary positioning and attachment operations.

[0032] The girder can be of any type available on the market, for example of the mixed type with a concrete core (REP®), or of the type with a steel plate, or again with a solid core, for example H-shaped or other, or again with a box-like section and electro-welded of steel, or another type again.

[0033] The pillar too can be of any type and shape available on the market, for example cylindrical, square, polygonal, H-shaped or other.

[0034] According to another feature of the present invention, a reinforcement is associated with the pillar and comprises an external shell or casing, with a circular, square or generally polygonal section, and hollow inside, or with another shape, that extends along a longitudinal axis.

[0035] The reinforcement has a first end which is upper during use and a second end that is lower during use, and at least a base plate holed at the center and disposed substantially orthogonal to the external shell and passed through by it, on a lower face of which a plurality of anchoring elements are fixed, to anchor to a laying plane, said anchoring elements being disposed substantially parallel to the longitudinal axis of the external shell.

[0036] By laying plane, in this specific case, we mean the plane on which the pillar rests, disposed under the walkable plane, which instead is the visible ground plane, that is to say, the one on which persons walk.

[0037] According to a characteristic feature of the present invention, the base plate is disposed at a certain distance from the lower end of the external shell; this distance defines the portion of the shell that is then drowned inside a foundation layer that defines on its upper part the walkable plane and on its lower part the laying plane. The plate, in use, is positioned flush below the walkable plane, also drowned in the foundation layer. In this way, neither the plate nor the anchoring elements disposed below it protrude above the walkable plane.

[0038] According to a variant of the present invention, the reinforcement comprises or is associated with adjustable elements resting during use on the laying plane and acting on at least a structural element of the reinforcement, for example the base plate or another plate, insert, reinforcement or other, associated with the base plate, in order to guarantee that the pillar and laying plane are orthogonal with respect to each other when there are irregularities in the ground.

[0039] According to another variant of the present invention, the adjustable elements are little feet, adjustable in height, disposed parallel to the longitudinal axis of the

structural element. The feet can rest directly on the layer of lean concrete, for example fixed with blocks to guarantee the stability of the whole element.

[0040] According to a variant of the present invention, there are two base plates, one which is upper during use and disposed near the walkable plane, and one which is lower during use and disposed near the laying plane; the base plates are advantageously disposed parallel to each other.

[0041] According to another variant of the present invention, the anchoring elements are connection elements, each attached to one end of the upper plate.

[0042] According to another variant of the present invention, the anchoring elements are adjustable in height, and their function is to anchor the base plate to the foundation layer and also, if necessary, to adjust the height.

[0043] According to another variant, each adjustment element is mounted on the lower plate.

[0044] According to another variant, the reinforcement used for laying the structural elements comprises a centering element positioned centrally on the surface of the lower end of the shell and associated with a centering element positioned in a desired position on the laying plane.

[0045] The laying method that uses the structural elements according to the invention comprises a first operation to position a portion of the reinforcement resting on the laying plane, a second operation to adjust the inclination of the reinforcement with respect to the laying plane by means of the adjustment elements, allowing to obtain a substantially orthogonal position of the reinforcement and the laying plane, and a third operation of drowning the reinforcement portion comprised between the lower end of the shell and the at least one base plate by a cast of concrete, which defines the foundation layer, in turn defining the walkable plane on its upper part. The anchoring and adjustment elements, and the possible other structural elements associated with the at least one base plate, are located below the walkable plane and do not protrude from it.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] These and other characteristics of the present invention will become apparent from the following description of a preferential form of embodiment, given as a non-restrictive example with reference to the attached drawings wherein:

- fig. 1 is a section view of an anti-seismic element used in an anti-seismic device according to the present invention;
- fig. 2 is a section view of the anti-seismic device according to the invention made solid with a girder;
- fig. 3 is a section view of the anti-seismic device according to the invention made solid with a pillar, in this case multi-storey;
- fig. 4 is a front view, partly sectioned, of a reinforcement for a pillar according to the present invention;
- fig. 5 is a view from above of the reinforcement in fig. 4.

DETAILED DESCRIPTION OF A PREFERENTIAL FORM OF EMBODIMENT

[0047] With reference to fig. 1, an anti-seismic element 30 is shown, used in the system of prefabricated elements for the building trade according to the present invention. In particular, the anti-seismic element 30 can be associated at the lower part of a girder 40 (fig. 2) so as to constitute a prefabricated element that can be laid directly on site, as will be seen clearly hereafter, or is associated at the upper part (fig. 3) of a pillar 50 so that, in this case too, it constitutes a prefabricated element that can be laid directly on site without having recourse to supplementary operations other than those usual for laying the pillar.

[0048] The anti-seismic element 30 can also constitute, in association with assembly plates such as 43 and 44 in fig. 2 or 60 in fig. 3, an anti-seismic device that is finished in itself, suitable to be installed directly on a base, for example the reinforced concrete support 45 in fig. 2, as a finished prefabricated element, since the plates 43, 44 and 60, together with threaded assembly, adjustment and positioning elements 36 and 37, 47 and 63, described hereafter, define a technical space for the installation of the jacks that allow the prefabricated element to be assembled.

[0049] To assemble the anti-seismic device, the system according to the invention provides connector elements 47 (fig. 2) of the threaded and adjustable type, which anchor directly on the lower part of the anti-seismic element 30 and allow it to be installed, provisionally or definitively.

[0050] The anti-seismic element 30 consists, in the case shown as an example only and in a substantially known manner, of a central element 31 with substantially spherical external surfaces, and coupled at the lower and upper part with respective pads 32 and 33, the whole being closed by concave plates, respectively upper 34 and lower 35, to form substantially a cage around the central element 31.

[0051] The concave plates 34, 35 include housing seatings for threaded anchoring elements, respectively upper 36 and lower 37.

[0052] The anti-seismic element 30 in fig. 1, associated with a plate 43, 44 in fig. 2, or with the plate 60 in fig. 3, can be made as a prefabricated element finished in itself, and able to be laid autonomously; for example, once the plate 43, 44 has been associated by means of the attachment elements 37 to form an anti-seismic device, it can be installed in a laying plane under a walkable plane, having for example the function of a technical compartment, without needing to have recourse to the elements usually provided in the state of the art for this function.

[0053] As can be seen in the solution in fig. 2, an anti-

seismic element 30 can be associated on the contrary directly below the concrete bottom 41 of a girder 40, for example of the REP®) type, anchoring the upper attachment elements 36 to a metal plate 42 solid below the bottom 41, and its lower attachment elements 37 to the first metal adjustment plate 43 and the second metal laying plate 44.

[0054] As said, even if fig. 2 shows a girder 40 of the type with a concrete bottom, any other type of girder can be used in the context of the present invention.

[0055] Furthermore, even if not shown, an anti-seismic device can also be associated with both the ends of a girder 40, or to one only of said ends.

[0056] The metal plates 43 and 44 are anchored, in the case shown here, to a reinforced concrete support 45 by means of a central connection element 46 and the connectors 47.

[0057] Between the upper surface of the reinforced concrete support 45 and the lower surface of the concrete bottom 41 of the girder 40 an empty space is defined with a height "h", which can perform, as we said, the function of a technical compartment in the event of an installation in the base plane of the building structure made, or to create an empty space available for positioning jacks or other equipment necessary for maintenance operations and/or operations connected to the laying.

[0058] The fact that the connector elements 47 are adjustable allows to position the anti-seismic element in height so as to define a height "h" of the technical compartment that can be varied as desired.

[0059] In the solution shown in fig. 3, the anti-seismic element 30 is associated with the upper part of the mixed steel-concrete pillar 50, described in more detail hereafter, creating the necessary upper connection to a trunk of the pillar 70 which constitutes a part of the upper level. Similarly, the lower attachment elements 37, solid with the concave lower plate 35 of the anti-seismic element 30, are anchored to a metal plate 60 provided on the upper part of the pillar 50 and connected to its lateral wall by means of reinforcement ribs 61. The upper attachment elements 36 of the anti-seismic element 30 anchor to an upper metal adjustment plate 62 of the trunk of the upper pillar 70.

[0060] The plate 60 can also have a hole, not shown, for the cast of concrete.

[0061] Threaded bars 63 are also provided, the function of which is to adjust the vertical position of the anti-seismic element to define the height "h" of the technical compartment.

[0062] In this way, the pillar 50 can already be provided in the plant, at its top, with the anti-seismic element 30, so that it is positioned on site in a substantially conventional manner, and the attachment to the trunk of the pillar 70 above automatically determines the correct positioning of the anti-seismic element 30. Between the upper plate 60 of the pillar 50 and the lower surface of the bottom of the girder 40 in this case too a free space is defined, to position auxiliary operating equipment, such as jacks or suchlike.

[0063] The trunk of the pillar 50 may also be prefabricated in the plant, provided at its upper part with the anti-seismic element 30, and also the trunk of the pillar 70, so as to allow to achieve a prefabricated multi-storey pillar complete with its anti-seismic equipment. This concept can be repeated for three or more storeys, so as to achieve an anti-seismic structure with prefabricated pillars having a height correlated to the building to be built.

[0064] With regard to the lower part of the pillar 50, we shall now refer to figs. 4 and 5.

[0065] The pillar 50 substantially consists of a reinforcement 10, which comprises a steel cylindrical casing or shell 17 with a longitudinal axis Y; the end 28 which is lower in use consists of a base plate 12, orthogonal to the longitudinal axis Y of the shell 17, and three support plates 14, attached below the base plate 12.

[0066] Each support plate 14 is disposed orthogonal with respect to the base plate 12.

[0067] Moreover, the three support plates 14 are disposed radially with respect to each other at 120° one from the other, and at least partly pass through the shell 17 so as to rejoin each other at the center of it.

[0068] The base plate 12 has at least a hole through which the cylindrical shell 17 is made to pass, a plurality of reinforcement ribs 22, a plurality of anchoring elements 11, a plurality of adjustment elements 15 and a centering element 16 to center the reinforcement 10 on the ground.

[0069] The base plate 12 is attached to a portion of the shell 17 near its lower end 28, so that it is drowned in a foundation layer 26, defining on its upper part a laying plane 18 and on its lower part a walkable plane 19.

[0070] By laying plane we mean, here and hereafter, the support plane of the reinforcement 10 on which the latter rests, whereas by walkable plane 19 we mean the plane that is directly walked on or on which vehicles or other transit, positioned above the laying plane 18.

[0071] Inside the cylindrical shell 17 a metal cage is generally disposed, consisting of elements 24 with a mainly longitudinal development drowned in a block 25 of concrete, or other metal reinforcement elements for the vertical structure for the building trade.

[0072] With reference to fig. 4, in this case, the base plate 12 is positioned during use above the support plates 14, that is to say, nearer the walkable plane 19 and below it, at a distance "1" from the lower end 28 of the shell 17, and has no structural elements associated with it protruding from the walkable plane 19. This ensures a greater safety for the people walking on the walkable plane 19 near the structural elements, and improves the aesthetic characteristics of the structural elements when installed.

[0073] With reference to figs. 4 and 5, reinforcement ribs 22 are disposed below the base plate 12, radially with respect to each other, and connect at least partly the lower surface of the base plate 12 to the shell 17, giving greater stability and security to the attachment of the base plate 12 to the shell 17.

[0074] Structural elements are associated with the base plate 12, such as for example anchoring elements 11 or feet, drowned in the foundation layer and each one attached at one end to the base plate 12, while at the free end of each element 11 an anchoring plate 21 is mounted, to increase the holding surface of the anchoring elements 11 inside the foundation layer 26.

[0075] On the support plates 14, instead, angular inserts 23 are mounted, able to house adjustment and support elements 15, or feet, protruding from below the support plates 14 and extending toward the laying plane 18, on which they rest. The adjustment and support elements 15 can also be anchored on the foundation layer with blocks that increase their stability.

[0076] Each element 15 is at least partly threaded externally and supports part of the reinforcement 10 on the laying plane 18; it is selectively adjustable, and can be lengthened or shortened, according to the irregularities present on the laying plane 18.

[0077] Each element 15 is adjusted by means of clamping elements 27, such as for example a nut and lock nut, screwed to the threaded portion of the adjustment and support element 15 and cooperating with the angular inserts 23.

[0078] In this way it is possible to modify the inclination of the reinforcement 10, guaranteeing that the reinforcement 10 is substantially vertical.

[0079] The centering element 16 is attached to the support plates 14 of the reinforcement 10, centrally with respect to the reinforcement 10, and couples with a centering element 13 attached to the laying plane 18 and which functions as a reference for the correct positioning of the reinforcement 10 on the laying plane 18.

[0080] The laying method provides a first operation to position the reinforcement 10 resting on the laying plane by coupling the two centering elements 13 and 16, a second operation to adjust the inclination of the reinforcement 10 with respect to the laying plane 18 by screwing or unscrewing the elements 15 inside the angular inserts 23, a third operation of drowning the reinforcement portion 10 by a cast of concrete defining the foundation layer 26, which in turn defines the walkable plane 19 on its upper part, so that the base plate 12, the adjustment elements 15 and the anchoring elements 11 and any other possible structural elements associated with it lie below the walkable plane 19.

[0081] It is clear that modifications and/or additions of parts may be made to the prefabricated elements for the building trade and the relative laying method as described heretofore, without departing from the field and scope of the present invention.

Claims

1. System of prefabricated elements for the building trade, comprising at least a pillar of the steel-concrete mix type, one-storey (50) or multi-storey (50-70) and a girder (40), **characterized in that** it comprises at least an anti-seismic device, consisting of:

   - an anti-seismic element (30) having at least a central element (31) associated with respective upper (34) and lower (35) plates, in which said plates (34, 35) include seatings to house respective anchoring elements, respectively upper (36) and lower (37), and of
   - at least a distancing plate (43, 44, 60) able to anchor, by means of respective threaded attachment and adjustment elements (47, 63), the anti-seismic element (30) to a support base (45), or to the lower part of the girder (40), or to the upper or lower part of the pillar (50), or in an intermediate position between two trunks of said multi-storey pillar (50-70), said attachment and adjustment elements (47, 63) defining an empty space with a height (h) having the function of a technical compartment to house operating equipment, with respect to an adjacent structural element, such as a reinforced concrete support (45), or a bottom of a girder (41, 42).

2. System as in claim 1, **characterized in that** said central element (31) has a substantially spherical shape, and said upper (34) and lower (35) plates have a concave shape mating with the spherical shape of the central element (31).

3. System as in claim 1 or 2, **characterized in that** between the central element (31) and the relative plates (34, 35) there are respective pads (32, 33).

4. System as in any claim hereinbefore, **characterized in that** said anti-seismic device (30; 43, 44, 60) is made as a prefabricated finished element.

5. System as in any claim from 1 to 3, **characterized in that** said girder (40) incorporates in its lower part at least one of said anti-seismic devices (30), so as to constitute a prefabricated finished element.

6. System as in any claim from 1 to 3, **characterized in that** said pillar, one-storey (50) or multi-storey (50-70) incorporates either in its lower or upper part or in an intermediate position between two of its trunks (50 and 70), said anti-seismic device (30) so as to constitute a prefabricated finished element.

7. System as in any claim hereinbefore, wherein the pillar (50) comprises a laying reinforcement (10) comprising an external shell or casing (17) with a longitudinal axis (Y), hollow inside and having a first end that is higher, during use, and a second end (28) that is lower during use, and a base plate (12), centrally holed and disposed substantially orthogonal to

the external shell (17) and passed through thereby, on a lower face of which a plurality of elements (11) are attached in order to anchor the reinforcement to a foundation layer (26), said foundation layer (26) being delimited at the lower part by a laying plane (18) and at the upper part by a walkable plane (19), **characterized in that** said base plate (12) is disposed at a certain distance ("l") from the lower end (28) of the shell (17), said distance ("l") defining the portion of the shell (17) which is then drowned inside the foundation layer (26) and said base plate (12), during use, being positioned below the walkable plane (19), which is also drowned in the foundation layer (26).

8. System as in claim 7, **characterized in that** it comprises or is associated with adjustment elements (15), resting during use on the laying plane (18) and acting on at least one structural element (14) of the reinforcement associated with the base plate (12) to guarantee that the cylindrical shell (17) and the laying plane (18) are orthogonal to each other even if the ground is irregular.

9. System as in claim 8, **characterized in that** the adjustment elements (15) are little feet, adjustable in height and disposed parallel to the longitudinal axis (Y) of the cylindrical shell (17).

10. System as in claim 8, **characterized in that** said at least one structural element is a support plate (14) disposed substantially orthogonal to the laying plane (18) and below said base plate (12).

11. System as in claim 8, **characterized in that** said at least one structural element is a plate attached externally to the shell (17) in proximity to its lower end (28) and parallel to the base plate (12).

12. System as in claim 7, **characterized in that** the anchoring elements are connectors (11), each attached at one end to the base plate (12), and can be adjusted in height, carrying out both the function of anchoring the base plate (12) to the foundation layer (26) and, if necessary, adjusting the height.

13. System as in claim 7, **characterized in that** it comprises a centering element (16) positioned centrally inside the shell (17), attached to the at least one structural element (14), and associated with a centering element (13) positioned in a desired position on the laying plane (18).

14. System as in claim 7, **characterized in that** reinforcement ribs (22) are associated with the base plate (12), disposed below the base plate (12) and radially with respect to each other, and at least partly connecting the lower surface of the base plate (12) to the shell (17).

15. Method for laying structural elements constituting a system as in any of the claims hereinbefore, for the construction of multi-storey buildings, **characterized in that** it provides to anchor an anti-seismic device comprising at least an anti-seismic element (30) and made as a prefabricated finished element, directly to a support made of reinforced concrete (45) which constitutes at least part of the support of the base plane of the multi-storey structure, by means of at least a distancing plate (43, 44) which defines a free space to house operating equipment, the bottom (41) of a relative girder (40) then being directly anchored on the upper surface of said anti-seismic device (30).

16. Method for laying structural elements constituting a system as in any claim from 1 to 14, for the construction of multi-storey buildings, **characterized in that** it provides to anchor an anti-seismic device to the lower part of a girder (40), so as to constitute a prefabricated finished element, in which said anti-seismic device incorporates in its lower part the anchoring means (37) and distancing means (43, 44) to/from a reinforced concrete support (45) in order to directly anchor said girder (40) to said support (45).

17. Method for laying structural elements constituting a system as in any claim from 1 to 14, for the construction of multi-storey buildings, **characterized in that** it provides to anchor an anti-seismic device to the upper or lower part of a pillar (50), or in an intermediate position between two trunks of a pillar (50, 70), in which said anti-seismic device (30) incorporates in its lower or upper part the anchoring means (37, 36) and distancing means (60, 63) to/from the surface of a girder (40) for the direct anchorage of said girder (40) and said pillar (50) in correspondence with a node.

18. Method for the laying of a pillar (50) of a system as in any claim from 1 to 14, by means of a reinforcement, comprising a cylindrical shell (17), hollow inside and having a first end that is higher, during use, and a second end (28) that is lower during use, and a base plate (12), centrally holed and disposed substantially orthogonal to the external shell (17) and passed through thereby, on a lower face of which a plurality of elements (11) are attached in order to anchor the reinforcement to a foundation layer (26), said foundation layer (26) being delimited at the lower part by a laying plane (18) and at the upper part by a walkable plane (19), said method comprising a first operation to position a portion of the reinforcement, in proximity to the lower end (28) resting on the laying plane (18), **characterized in that** it comprises a second operation to adjust the inclination of

the reinforcement with respect to the laying plane (18) by means of the adjustment elements (15), allowing to obtain that the reinforcement and the laying plane (18) are substantially orthogonal with respect to each other, and a third operation to drown the portion of reinforcement comprised between the lower end (28) of the shell (17) and the base plate (12) by means of a cast of concrete, which defines the foundation layer (26), the anchoring elements (11) and the adjustment elements (15) and the possible other structural elements (14) associated with the at least one base plate (12) being located below the walkable plane (19), drowned in the foundation layer (26).

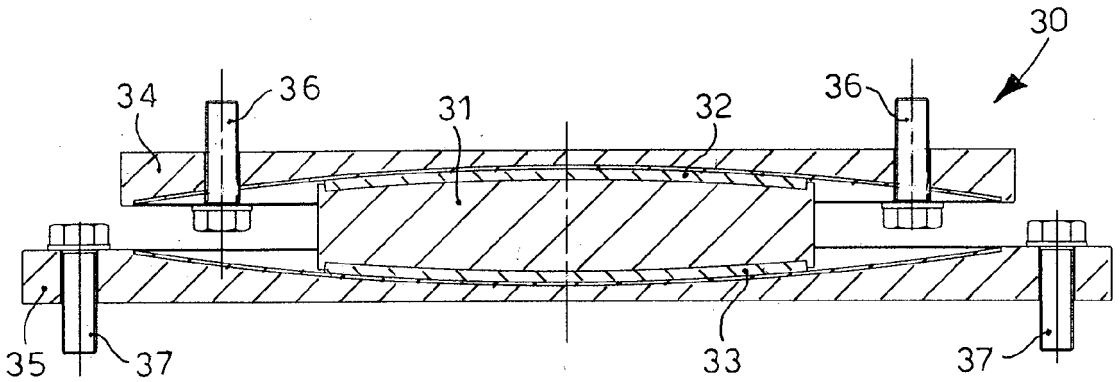
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fig. 1

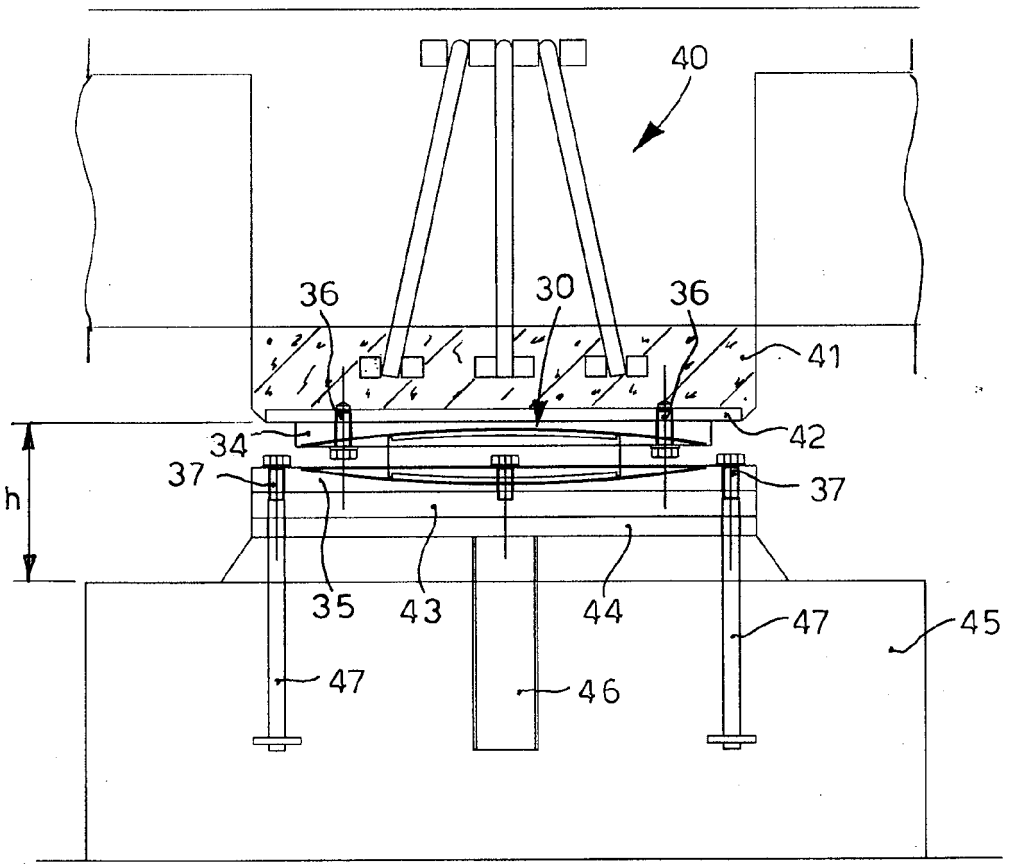
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fig. 2

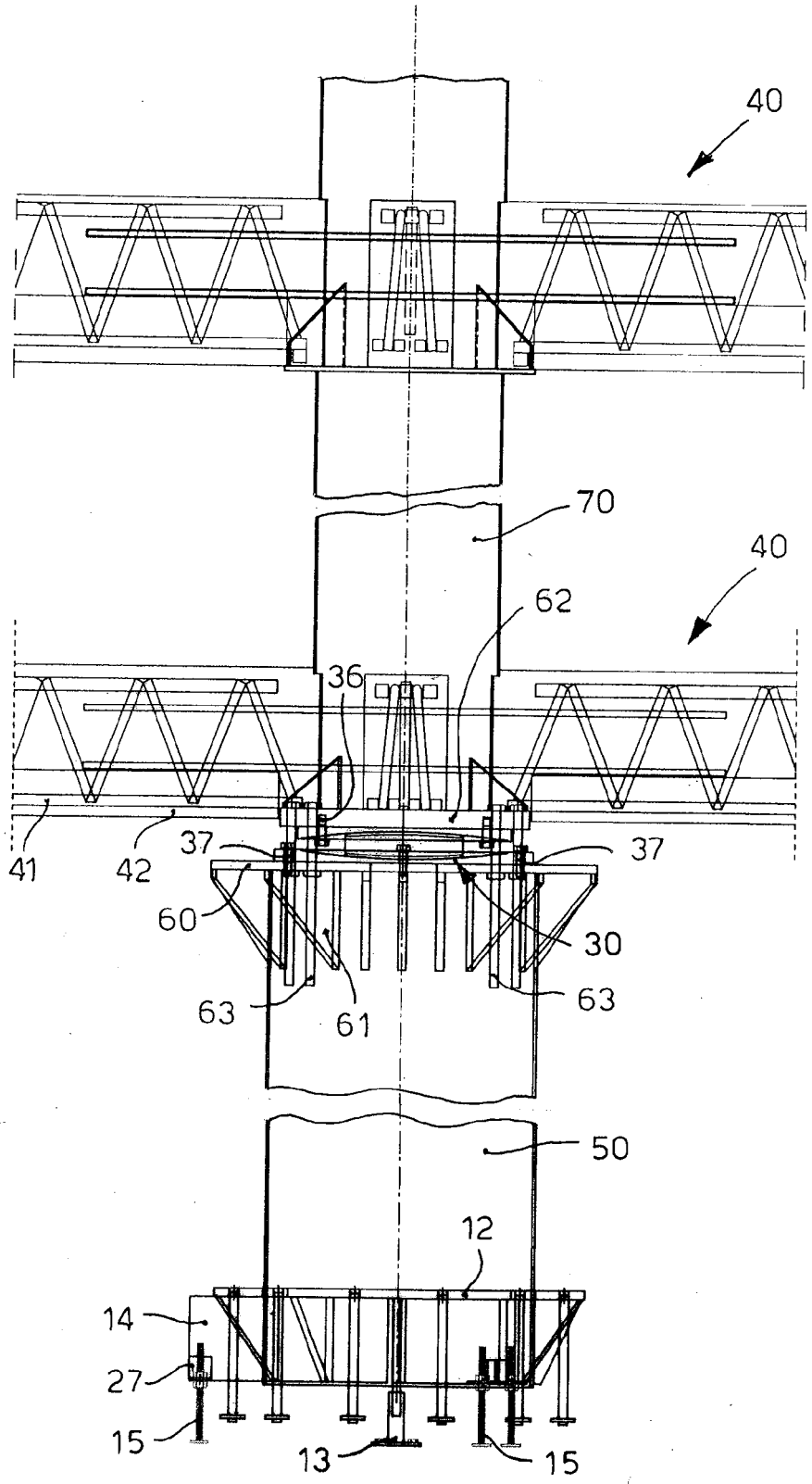

fig. 3

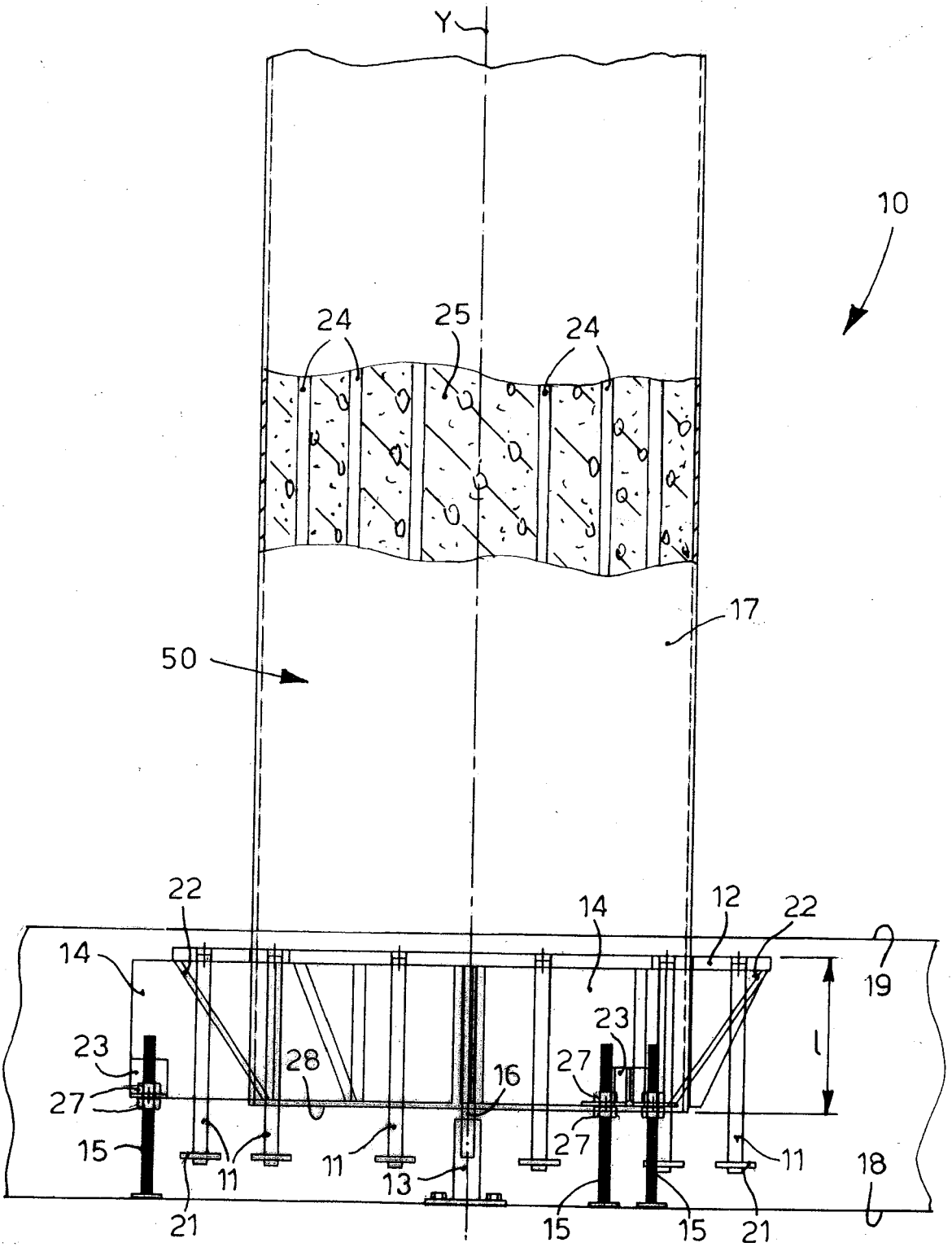
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fig. 4

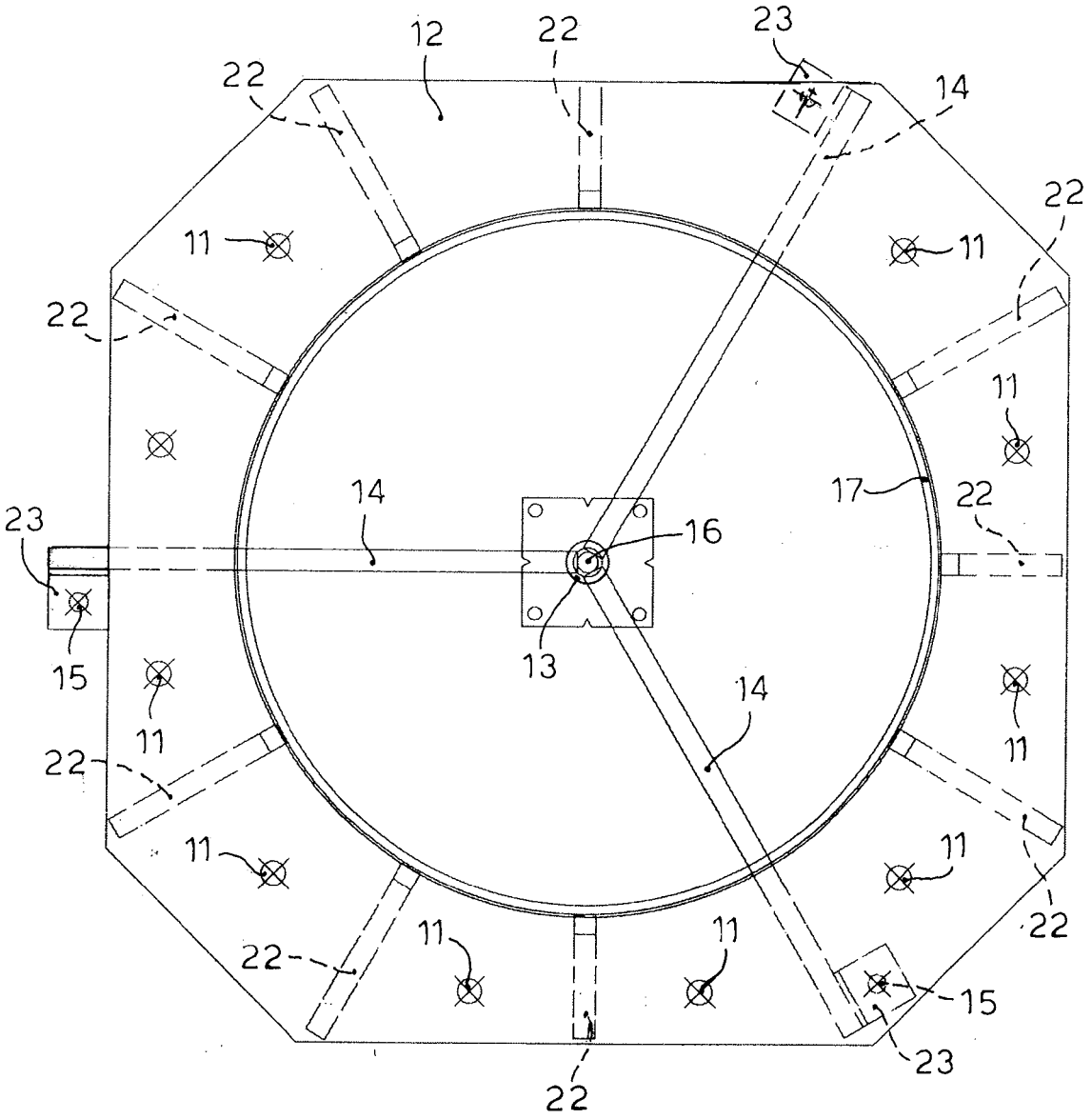
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fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 10 19 1249

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 2005 240815 A (IAU KK; KITAMURA JIRO) 8 September 2005 (2005-09-08) * figures 511,512 * -----	1-6, 15-17	INV. E04H9/02

TECHNICAL FIELDS SEARCHED (IPC)

E04H

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	14 December 2010	Topcuoglu, Sadik Cem

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

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European Patent Office
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Application Number
EP 10 19 1249

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-6, 15-17

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 10 19 1249

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6, 15-17

   System with an anti-seismic device anchored to a structural element and method of anchoring of an anti-seismic device to a structural element

   ---

2. claims: 7-14, 18

   System with a pillar and a foundation to which the pillar is anchored and a method for anchoring a pillar to a foundation

   ---

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 10 19 1249

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-12-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2005240815 A	08-09-2005	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82