



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.06.2016 Bulletin 2016/23

(51) Int Cl.:
E04G 11/48 (2006.01) **E04G 11/50** (2006.01)
E04G 13/04 (2006.01)

(21) Application number: **14744610.8**

(86) International application number:
PCT/ES2014/070551

(22) Date of filing: **07.07.2014**

(87) International publication number:
WO 2015/015026 (05.02.2015 Gazette 2015/05)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventors:
• **XAMMAR BOVE, Pedro**
08110 Montcada i Reixac (Barcelona) (ES)
• **ARDILA LOPEZ, German**
08110 Montcada i Reixac (Barcelona) (ES)

(30) Priority: **29.07.2013 ES 201331166**

(74) Representative: **Carvajal y Urquijo, Isabel et al**
Clarke, Modet & Co.
Suero de Quiñones, 34-36
28002 Madrid (ES)

(71) Applicant: **Inveral S.L.**
08022 Barcelona (ES)

(54) **FORMWORK FOR A HANGING BEAM**

(57) Formwork for a hanging beam protruding below a floor slab, which comprises a plurality of lateral panels separated from one another by lower panels, which may be affixed to the same in a height-adjustable manner. Each lower panel is composed of two semi-panels, the first semi-panel being longer than the second semi-panel, wherein each semi-panel comprises a connecting transverse edge connected to the transverse edge of the other semi-panel, wherein the two semi-panels may be removably coupled to one another to constitute the lower panel through removable attaching means, configured for their connecting transverse edges to be attached by flat contact, wherein the connecting transverse edge of the first semi-panel forms an obtuse angle with its inner face, and the connecting transverse edge of the second semi-panel forms an acute angle that is supplementary to the aforementioned obtuse angle.

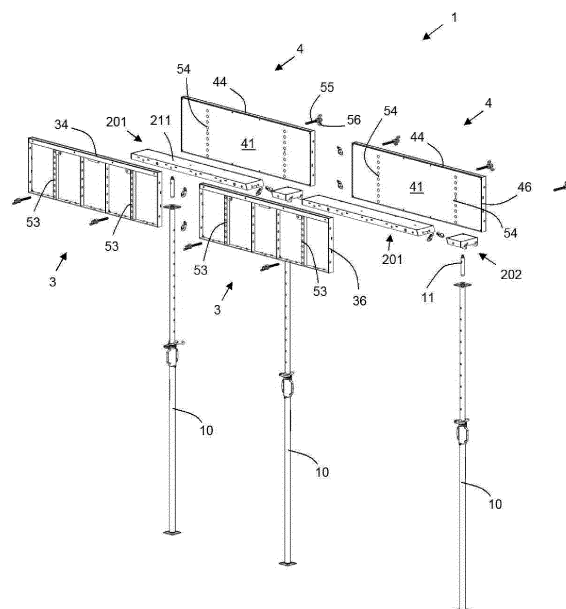


Fig. 2

Description

Technical sector of the invention

[0001] The present invention relates to a formwork for a hanging beam, particularly of a beam protruding below a floor slab. The formwork comprises at least two rectangular lateral panels and one lower panel, each one of these panels having an inner face forming a respective face of the beam, an outer face opposite to the form face and provided with transverse ribs, and two longitudinal edges and two transverse edges. When the formwork object of the invention is in the operating formwork position, the two lateral panels are arranged vertically and parallel to each other, separated from one another by the lower panel in turn arranged horizontally, such that each one of the two longitudinal edges of the lower panel is in flat contact with the inner face of a respective lateral panel through mutual affixing means.

Background of the invention

[0002] In countries or regions affected by seismic movements, it is common to resort to a construction typology based on concrete walls and hanging beams for the support of the corresponding floor slabs instead of pillars, wherein the girders or beams are known as hanging girders or beams because they have an edge that is greater than the floor slab they support, and because they protrude below the same.

[0003] Traditionally, within the formwork of hanging beams, it is common to arrange a series of wooden panels partially reproducing the outer contour of the hanging beam, specifically a bottom board for forming the lower face of the beam, two lateral boards nailed vertically to the bottom board for forming the two lateral faces, and finally two upper boards nailed from the upper rims of the lateral boards for forming a filling area as a transition with the rest of the floor slab of the structure.

[0004] In addition to the wooden boards for the formwork, the lateral boards need to be laterally braced to counteract the lateral force of the concrete that will be poured between them and the bottom board. Timbers are often used as lateral bracing elements, which usually lean against the outer surfaces of the lateral boards and are parallel to the longitudinal direction of the hanging beam. In order to ensure the position of these timbers and the fastening thereof, multiple solutions are improvised based on wooden framing squares or shorter timbers arranged diagonally, which rest on an extension of the formwork board of the bottom of the beam, or on other boards or propped wood resting on the lower floor slab. In general, the components used in the lateral bracing and the fastening thereof are attached through nails, which, added to the multiple pieces used, involves a considerable amount of time in the mounting process, with often uncertain results in terms of its stability. In addition, it should be mentioned that the majority of the elements

for lateral bracing are not reusable, given that they are frequently cut to size for the formwork of one particular beam, or are simply based on the materials available at the construction site at the time.

[0005] In addition, there are more complete formworks for hanging beams, which have devices intended for lateral bracing, such as the formwork described in patent ES8207259, provided with a clamp, the core of which may be brought closer to the lateral formwork elements from below its affixing position.

[0006] On the other hand, when the projected hanging beams at a construction site have the same cross-section, or their thickness and height are a multiple of another, it is possible to use formwork systems based on metal panels and robust attachment devices similar to those used in wall formwork. Some examples of panel-based formworks for hanging beams are contained in patent documents CN 1 02116080A, KR20100123232A.

[0007] The advantages of panel-based formworks include an improvement in the stability of the set of panels mounted around the faces of the beam that is to be formed, in addition to the fact that its mounting follows an error-proof pattern. In terms of cost, panel-based formwork entails higher material and rental costs in order to be used at construction sites, in comparison with wooden board-based formworks, bearing in mind that the use of the panels must be paid for from the time they are mounted until they are dismantled on site, once the poured concrete has completely set and the lateral and bottom panels can be removed.

[0008] It would be desirable to have a formwork for a hanging beam made up of formwork panels that could be assembled with one another, and were easy and quick to mount and dismount, and above all, that allowed for a degree of modulation among its components in order to optimize their usage, such that, depending on the progress of the concrete setting, certain components could be removed in order to be reused elsewhere at the construction site without having to wait for the conventionally established time period to remove the entire formwork.

Explanation of the invention

[0009] With the purpose of providing a solution to the problems proposed above, a formwork for a hanging beam protruding below a floor slab is disclosed in the invention. The formwork comprises a plurality of lateral and lower panels, each one of which presents an inner face forming a respective face of the beam. In an operating formwork position, the lateral panels of each side (forming two opposite lateral faces of the hanging beam) are arranged vertically and parallel to each other, separated from one another by the lower panels arranged horizontally, such that the longitudinal edges of the lower panels are in flat contact with the inner faces of the lateral panels through mutual affixing means.

[0010] In essence, the formwork is characterized in

that the affixing of the lower panels with respect to the lateral panels is height-adjustable in order to adapt the formwork to hanging beams with different heights. In addition, each lower panel is composed of two semi-panels, the first semi-panel being longer than the second semi-panel. Each semi-panel comprises an inner forming face, an outer face, two longitudinal edges, an end transverse edge, and a connecting transverse edge, which connects to the other connecting transverse edge of the other semi-panel, wherein the two semi-panels can be removably coupled to one another to constitute the lower panel through removable attaching means, configured for their connecting transverse edges to be attached by flat contact. The connecting transverse edge of the first semi-panel forms an obtuse angle with its inner face and the connecting transverse edge of the second semi-panel forms an acute angle supplementary to the aforementioned obtuse angle, that is to say, the sum of the aforementioned angles is 180°. All of the foregoing is configured in such a way that when the two semi-panels are in a coupling position, the inner faces and outer faces of the two semi-panels are flush, constituting the inner face and the outer face of the lower panel, respectively, the longitudinal edges of the two semi-panels being arranged in a coplanar manner constituting the longitudinal edges of the lower panel, and the end transverse edge of the first semi-panel and the end transverse edge of the second semi-panel constituting the two transverse edges of the lower panel.

[0011] It must be understood that the longitudinal edges are the walls that make up the perimeter frame of a panel or of a semi-panel, edges which extend in a direction parallel to the direction of the length of the beam, and that the transverse edges extend in a perpendicular direction. For the purpose of clarity, it should be noted that hereinafter, the interior of the panel or semi-panel will be understood as the outward-facing open space delimited by the outer face and by the longitudinal and transverse edges of the panel or semi-panel in question. Preferably, all longitudinal and transverse edges of the lower and lateral panels are made up of respective flat faces perpendicular to the inner faces of the panels, and extend beyond the outer faces of the panels from said inner faces.

[0012] The fact that each lower panel is made up of two semi-panels coupled to one another through one of their transverse edges, known as the connecting edges, and that said connecting transverse edges are configured as walls forming an acute angle and a supplementary obtuse angle with the inner face of the panel, enables the partial dismounting of the lower panel once the concrete has sufficiently set. Specifically, when the concrete has become somewhat resistant, the obtuse angle configuration of the first semi-panel, the longest one, enables the decoupling of this first semi-panel from the rest of the formwork (after previously removing the lateral panels), leaving only the second semi-panels of the lower panels to form the lower face of the hanging beam until the con-

crete of the hanging beam fully acquires the resistance for which the beam has been projected. Therefore, the first semi-panels can be removed three days after concreting, without interfering with the position of the second semi-panels, and may be used elsewhere at the construction site or returned to the formwork supplier, thereby saving on rental costs.

[0013] According to another characteristic of the invention, the second semi-panel of each lower panel is provided with housing means to removably couple, in the second semi-panel, the end of a bolt or peg which can be inserted by its other end into the upper end of a shoring prop or support, said housing means being coupled below the outer face and arranged so that they can rotate around a transverse axis parallel to the direction towards which the end transverse edge of the second semi-panel extends, configured in such a way that the shoring prop or support inserted into the housing means through the bolt or peg is able to adopt a position ranging from at least an acute angle up to a right angle with respect to the outer face of the second semi-panel.

[0014] These housing means enable, among other things, the second semi-panels to continue forming part of the lower face of the hanging beam and to be supported by the shoring props coupled to the second semi-panels through the housed bolts or pegs upon the removal of the first semi-panels. In the operating formwork position, the shoring prop will be arranged so as to form a right angle with the outer face of the second semi-panel.

[0015] By contrast, the first formwork semi-panels do not require, at any time during the formwork process, to be supported by any shoring prop, except the initial first semi-panel, that is to say, the one located after the pillar from which the hanging beam extends. This initial first semi-panel is provided with housing means, in order to removably couple therein the end of a bolt or peg that can be inserted by its other end into the upper end of a shoring prop or support, said housing means being firmly attached below the outer face.

[0016] This way, in the operating formwork position, each one of the lower panels is supported by a shoring prop, specifically coupled to its second semi-panel, except for the initial lower panel, which is supported by two shoring props, one in each semi-panel. It is provided that, once twenty-four hours have elapsed since the hanging beam was concreted, the lateral panels shall be removed, and, after three days, the first lower semi-panels, including the initial lower semi-panel. Meanwhile, the beam will be shored by the shoring props coupled to the second semi-panels for twenty-eight days, which is when the second semi-panels are removed, thereby completing the stripping of the beam. We can see that the formwork object of the invention prevents having to shore the hanging beam once again during the stripping phases, given that a shoring prop does not have to be removed and placed one more time. Instead, the shoring props coupled to the second semi-panels do not undergo any changes; they remain in their position from the moment

they are placed at the beginning of the formwork process until the completion of the stripping, which simplifies the entire process.

[0017] The housing means of the second semi-panels and the initial first semi-panel, provided for the removable coupling of a bolt, shank or peg, comprise a nut, the hole of which is threaded according to the worm of the upper end of a bolt or peg. Therefore, the coupling of the shoring props to the semi-panels, either the first or second, is easily and quickly carried out through bolts, pegs or shanks provided with a threaded end with a worm that matches the worm of the inner thread provided in the respective housing means provided in the lower panels, specifically accessible from below when the panels are in the operating position (arranged horizontally and parallel to the lower face of the hanging beam).

[0018] According to another characteristic of the invention, each lower panel is provided with hooking means and with suspending means located in a respective transverse edge, through which a lower panel can, in a non-operating mounting or dismounting position of the formwork, be suspended, with the capacity to swing from another lower panel adjoined to the first when the hooking means of a lower panel are adapted to receive the coupling of the suspending means of the adjoined lower panel, or vice versa.

[0019] Preferably, the hooking means are provided in the end transverse edge of the second semi-panel of a lower panel and the suspending means are provided in the end transverse edge of the first semi-panel.

[0020] The coupling of the lower panels through the hooking means and the suspending means facilitates the mounting of the lower formwork of the hanging beam, given that once a first lower panel is placed, supported by at least one shoring prop, the following lower panel is simply placed by hanging it by its suspending means from the hooking means of the end transverse edge of the lower panel that has already been placed. In that position, the second lower panel can swing with respect to the first, and it will be sufficient to rotate the same by raising the free end, pushing it by the shoring prop coupled to the second semi-panel of the second lower panel (coupled by the housing means with rotating capacity described above), until the inner faces of the two lower panels are flush. Then, the shoring prop coupled to the second semi-panel is adjusted so as to remain perpendicular in order to support the second lower panel placed adjoining to the first.

[0021] According to another characteristic of the invention, the hooking means comprise at least two hooks that extend in the longitudinal direction of the lower panel, protruding from the lower rim of the end transverse edge of one of the semi-panels forming the lower panel towards the exterior of the semi-panel, and the hook opening of which is oriented upwards, directed towards the inner face of the semi-panel. As for the suspending means, they comprise two portions of sectioned cylindrical bars arranged on the lower rim of the end transverse edge of

the other semi-panel of the lower panel and that extend aligned and parallel to the direction of said end transverse edge, configured such that each portion of sectioned cylindrical bar comprises a convex cylindrical surface protruding below the lower rim of the end transverse edge and extending towards the interior of the semi-panel, the opening of each hook being adapted so as to receive the support of a corresponding portion of sectioned cylindrical bar and to enable rotation and swinging, within the opening, of said portion, around the transverse axis of the portion, when the portion rests on its convex cylindrical surface. In addition, two suspending through-holes are each arranged after a corresponding portion of cylindrical bar, extending towards the top of the end transverse edge, said suspending holes being adapted to house the free ends of the hooks of the hooking means in a non-operating mounting or dismounting position, wherein a lower panel is suspended, with the capacity to swing with respect to an adjoining lower panel, particularly when a lower panel is suspended by forming an approximately right angle with respect to the adjoining lower panel.

[0022] In line with another characteristic of the invention, the hooking means and the suspending means comprise mutual retaining means through which a lower panel is able to go from being suspended, in a non-operating mounting or dismounting position of the formwork, to being retained without the possibility of swinging in an operating formwork position with respect to an adjoining lower panel, the inner faces of the two adjoining lower panels being arranged so as to be flush in said operating formwork position when the hooking means of a lower panel receive the coupling of the suspending means of an adjoining lower panel and the suspending means adopt a retaining position.

[0023] In accordance with another characteristic of the invention, the retaining means of the hooking means are constituted by a tip of the free end of each hook with an arrowhead configuration, whereby the free end presents an inclined surface configuring a narrowing of the opening of the hook in the opposite direction to the arrowhead, connecting the inclined surface with the rest of the hook through a flat retaining surface parallel to the inner face of the semi-panel from which the hooks protrude, the flat retaining surface forming a retaining arris with the rest of the hook. In turn, each portion of sectioned cylindrical bar of the suspending means presents a complementary flat retaining face, located after the convex cylindrical surface with which it forms a complementary retaining arris, the complementary flat retaining face being parallel to the inner face of the semi-panel on which the suspending means are arranged, and the complementary flat retaining face being located in the interior of the corresponding semi-panel and separated at a certain distance from the lower rim of its end transverse edge. All of the foregoing is configured in such a way that the suspending means of a lower panel are able to adopt a retaining position wherein each portion of sectioned cylindrical bar of a low-

er panel fits in the opening of a corresponding hook of the adjoining lower panel by direct contact of the flat retaining surface with the complementary flat retaining face, and wherein the complementary retaining arris is arranged parallel to the retaining arris.

[0024] Optionally, the suspending means comprise guiding means for the coupling of the portions of sectioned cylindrical bars in the corresponding openings of the hooks of an adjoining lower panel. The guiding means are arranged internally (in the space comprised between the outer face of the panel or semi-panel and the longitudinal and transverse edges) in the semi-panel, on the upper rim of the same end transverse edge wherein the portions of sectioned cylindrical bars are provided. These guiding means comprise a corner piece and a stop piece for each portion of sectioned cylindrical bar, the corner piece being provided with an inclined plane arranged perpendicular to the outer face of the semi-panel, attaching the aforementioned end transverse edge to the adjacent longitudinal edge, with which it forms an inner corner in the semi-panel, at an angle. The stop piece is arranged in the aforementioned end transverse edge above the portion of sectioned cylindrical bar, maintaining a separation from the corner piece, the dimensions of which are adapted to house the arrowhead configuration tip of the free end of a hook of the adjoining lower panel, which tip can be slid along the length of the inclined plane of the corner piece until making contact with the stop piece, and the complementary flat retaining piece of the portion of sectioned cylindrical bar is oriented towards the guiding means.

[0025] In this way, the guiding means will help the operator mounting the formwork to place the lower panels, one adjoining panel after the other, in the correct position such that the newly placed lower panel swings with respect to the adjoining lower panel that has already been placed in the horizontal (formwork) position. Therefore, we can consider a situation wherein a lower panel has already been placed in the operating formwork position with its inner face in the horizontal position. The arrowhead tips of the hooks of the hooking means, protrude from said lower panel. The operator comes with a lower panel that must be hung from the one that was already placed, such that the lower panel to be placed can swing with respect to the one that was placed before it. The lower panel in the hands of the operator comprises, near the end transverse edge corresponding to the first semi-panel, two spaces delimited by the corresponding corner pieces and stop pieces. The operator must be able to house the arrowhead of the end transverse edge of the adjoining panel that was previously placed in these spaces so it can swing with respect to the other. The guiding means allow the operator to place the lower panel correctly without having to see where the spaces and the arrowheads are located.

[0026] According to another characteristic of the invention, the hook opening of each hook of the hooking means of a lower panel is adapted to house the thickness of the

end transverse edge of the adjoining lower panel and the respective portion of sectioned cylindrical bar arranged in the aforementioned end transverse edge.

[0027] In line with another characteristic of the invention, the end transverse edge of the second semi-panel has a height equivalent to the sum of the height of the end transverse edge of the first semi-panel plus the distance by which one of the portions of sectioned cylindrical bar of the suspending means arranged in the first semi-panel protrudes below said end transverse edge. The height of the end transverse edge of the first semi-panel is lower than the height of the second semi-panel, given that this way, two adjoining semi-panels can swing with respect to one another, specifically the first semi-panel of one lower panel with respect to the second semi-panel of another lower panel, the lower panels being separated by a minimum distance marked by the opening of the hooks of the hooking means of the second semi-panel.

[0028] In accordance with another characteristic of the invention, the mutual affixing means between the lower panels and the lateral panels comprise at least two through-holes, distributed in each one of the longitudinal edges of the lower panels, and at least two series of through-holes through the inner face and outer face of each lateral panel. The holes of the series are distributed linearly in the direction parallel with respect to the transverse edges of the lateral panels. The separation between one series and the other is equivalent to the distance separating the through-holes of one same longitudinal edge of a lower panel. The mutual affixing means also comprise sets of threaded or dywidag bars and wing nuts with threads that correspond to the worm of the bars for their mutual adjustment, all of which is arranged in such a way that in the operating formwork position, each through-hole of a lower panel overlaps one of the holes of the lateral panels, both holes being crossed through by a corresponding bar provided with a wing nut on one of its ends, which maintains the longitudinal edge of a lower panel in flat contact with the inner face of a lateral panel or with the inner faces of two adjoining lateral panels, depending on whether part of one same lower panel is affixed on each side to the same lateral panel or to two adjacent lateral panels.

[0029] This way, the series of distributed through-holes crossing through the inner and outer faces of the lateral panels ensure that the formwork is valid for a range of hanging beams of different heights. The relative position of the lower panels with respect to the lateral panels can be adjusted, given that the operator, according to the height of the projected hanging beam, will place the through-holes of the lower longitudinal edges of the lower panel overlapping the corresponding through-holes of the series of faces of the lateral panels, those that are located at a distance from the rim of the upper longitudinal edge equal to the height by which the projected hanging beam will protrude from the floor slab. Thereafter, it will cross through the same the corresponding bars that will be tightened with the wing nuts such that the inner faces

of the lateral panels press against the longitudinal edges of the lower panels. It should be mentioned that the wing nuts can be firmly attached to one of the ends of the bars, thereby forming a single piece.

[0030] According to another characteristic of the invention, the mutual affixing means also comprise, for each one of the through-holes distributed in each one of the longitudinal edges of the lower panel, a nut that is firmly attached to the inner side of said longitudinal edge of the lower panel, with the threaded hole of the nut placed after and overlapping the through-hole, and the thread of which corresponds to the worm of the bars for tightening them together. Given that the lower panels are provided with nuts that are firmly attached to their longitudinal edges, the affixing of the lateral panels to the lower panels is more comfortable and easier for the operator, since the number of independent pieces is reduced.

[0031] In line with another characteristic of the invention, each transverse edge connecting the two semi-panels forming one same lower panel is provided with at least one through-hole which, in the operating formwork position, overlaps the through-hole of the connecting transverse edge of the corresponding semi-panel, said through-holes being adapted for the passage of the removable attaching means for the attachment by flat contact of the connecting transverse edges in the operating formwork position.

[0032] In accordance with another characteristic of the invention, the upper longitudinal edges of the lateral panels, intended to be the longitudinal edges furthest away from the lower panel, are provided with a filling, along their rims, of a material such as wood, which can directly support, and be attached to, a horizontal formwork board of the floor slab to which the hanging beam belongs, through the insertion of nails.

Brief description of the drawings

[0033] The drawings attached illustrate, as a non-limitative example, a preferred embodiment of the formwork for a hanging beam object of the invention. In said drawings:

Fig. 1 is a perspective view of the formwork object of the invention, in an operating formwork position supported by three shoring posts;

Fig. 2 is an exploded view of the formwork in Fig 1;

Figs. 3 and 4 are perspective views of the first semi-panel of the lower panel of the formwork in Fig. 1, seen from below and from above, respectively;

Figs. 5 and 6 are perspective views of the second semi-panel of the lower panel of the formwork in Fig. 1, seen from below and from above, respectively;

Fig. 7 is a perspective view from below of the coupling of the first semi-panel of Fig. 3 with the second semi-panel of Fig. 5, wherein a peg has been coupled in the second semi-panel for its coupling to a shoring post;

Fig. 8 is a detail view of the hooking means provided in the end transverse edge of the second semi-panel of Fig. 6;

Fig. 9 is a detail view of the hooking means provided in the end transverse edge of a second semi-panel and of the suspending means provided in the end transverse edge of a first semi-panel belonging to an adjoining lower panel, in an operating formwork position.

Fig. 10 is a perspective view from below of the coupling between two adjoining lower panels of the formwork of Fig. 1 in an operating formwork position, wherein the removable attaching means in the connecting transverse edges of the two semi-panels of the first lower panel have not been represented;

Fig. 11 is another perspective view of Fig. 10, but in a non-operating mounting position, wherein one of the two lower panels swings with respect to the other; Fig. 12 is a perspective view of how a lower panel is adjustably affixed to a lateral panel;

Fig. 13 is another perspective view from below of how the inner panel is affixed to the lateral panel in Fig. 12;

Figs. 14 and 15 are perspective views of one of the lateral panels of the formwork in Fig. 1;

Fig. 16 is a perspective view from below of a variant of the lower panel, composed of two semi-panels that are different from those depicted in Figs. 3-6;

Fig. 17 is a view of the peg coupled in the second semi-panel shown in Fig. 7; and

Fig. 18 is a view of an assembly made up of a threaded bar and a wing nut forming part of the mutual affixing means between the lower panels and the lateral panels.

Detailed description of the drawings

[0034] Fig. 1 shows a formwork 1 for a hanging beam of the type that protrudes below a floor slab (not represented), mounted and arranged in an operating formwork position, prepared to form the concrete to be poured, thereby forming the lower face and the two lateral faces of the hanging beam (the upper face is considered as the face to be attached to the floor slab of the floor to be concreted after or together with the hanging beam).

[0035] As shown in Figs. 1 and 2, the formwork 1 represented therein comprises two lower panels 2 and four lateral panels 3, 4, although depending on the length of the beam, sets of a lower panel 2 and two lateral panels 3 and 4 can be added to the formwork 1, to be arranged adjacently to the panels represented herein. All panels 2, 3 and 4 present a smooth inner face 21, 31, 41, intended to make contact with the concrete in order to form the corresponding face of the hanging beam. In the operating formwork position (see Fig. 1), the two lateral panels 3 and 4 are arranged vertically and parallel to each other, and are separated from each other by the lower panel 2, which is arranged horizontally.

[0036] The front lateral panel 3 and the rear lateral panel 4 are exactly identical to one another, due to which a description of one of them is valid for the other as well. Figs. 14 and 15 show that the lateral panel 4 is rectangular in shape, and is made up of an inner forming face 41, with a smooth surface, of an outer face 42, opposite to the inner face, provided with transverse ribs (see Fig. 15) with two longitudinal edges 43 and 44 and two transverse edges 45 and 46. The lower longitudinal edge 43, the upper longitudinal edge 44, the front transverse edge 45 and the rear transverse edge 46 are made up of respective faces that are perpendicular to the inner face 21 and extend from the inner face 41 beyond the outer face 42, due to which they constitute a kind of perimeter frame. The lateral panels 4 are attached to one another by their transverse edges 46 and 45, arranged facing each other and removably attached by hook-shaped pieces that will be described below. Fig. 15 shows in detail that the upper longitudinal edge 44 is provided in its interior with a filling 12 of a material such as wood, which allows longitudinal edge 44 to be attached, through nails, to a board or a horizontal formwork element of the floor slab from which the hanging beam protrudes, said horizontal formwork element being arranged in a perpendicular position with respect to the lateral panel 4 and resting on its upper rim. Taking into account that the upper longitudinal edge 44 protrudes from the plane of the outer face 42, the filling 12 can occupy the entire section of the longitudinal edge 44, thereby making it possible to nail in the nails both from below and from above.

[0037] Fig. 15 shows four transverse ribs, two of which are constituted by a C-profile bar or a bar with a tubular and rectangular cross-section, provided with a series of equidistant through-holes 54. In fact, the through-holes 54 cross through the ribs, the outer face 42 of the lateral panel 4 and the inner face 41, as shown in Fig. 14. The through-holes 54 are part of mutual affixing means through which the lateral panels 3 and 4 are attached in the operating formwork position to the lower panels 2, the longitudinal edges 23, 24 of the lower panels 2 in particular remaining in flat contact and pressed against the inner faces 31, 41 of the lateral panels 3 and 4 through the mutual affixing means. One way of carrying out this arrangement is the one shown in Fig. 1 and in Figs. 12 and 13. The separation space between one through-hole 54 and the next enables precise adjustment of the position that the lower panel 2 should have with respect to the lateral panels 3 and 4 for the formwork of a hanging beam that protrudes by a certain distance (the height of the hanging beam) from a floor slab.

[0038] With respect to the lower panel 2 of the formwork 1, Fig. 2 shows that each lower panel 2 is composed of two semi-panels 201 and 202 that can be coupled to one another, the first semi-panel 201 being longer than the second semi-panel 202. In general, it has been envisaged that the length of the second semi-panel should make up between 10% and 30% of the total length of the lower panel (the sum of the lengths of the first and second

semi-panels), preferably between 15 % and 25 %. Each semi-panel 201; 202 comprises an inner forming face 211; 212, an outer face 221; 222, two longitudinal edges 231, 241; 232, 242, an end transverse edge 251; 262 and a connecting transverse edge 271; 272 (see Figs. 3 to 6). The first semi-panel 201 and the second semi-panel 202 can be coupled to one another to constitute one lower panel 2 through their respective connecting transverse edges 271, 272, arranged so that they are facing each other, overlapping, and attached to one another through removable attaching means 6 configured for the attachment of said connecting transverse edges 271, 272, as shown in detail in Fig. 7.

[0039] In the coupling position of the two semi-panels 201 and 202, the inner faces 211, 212 and the outer faces 221, 222 of the two semi-panels 201 and 202 are flush, thereby constituting the inner face 21 and the outer face 22 of a lower panel 2, respectively; the longitudinal edges 231, 241, 232, 242 of the two semi-panels 201 and 202 are arranged coplanar to each other, constituting the longitudinal edges 23, 24 of the lower panel 2; and the end transverse edge 251 of the first semi-panel 201 and the end transverse edge 262 of the second semi-panel 202 respectively constitute the transverse edge 25 and the transverse edge 26 of the lower panel 2.

[0040] The connecting transverse edge 271 of the first semi-panel 201 forms an obtuse angle with its inner face 211 (see Figs. 3 and 4) and the connecting transverse edge 272 of the second semi-panel 202 forms an acute angle (see Figs. 5 and 6) supplementary to the aforementioned obtuse angle of the first semi-panel 201 (see Figs. 7 and 10). Therefore, while the longitudinal edges 231, 241, 232, 242 and the end transverse edges 251 and 262 of the two semi-panels 201 and 202 are defined by surfaces perpendicular to the inner faces 211 and 212 of the semi-panels 201 and 202, the connecting transverse edges 271, 272 are defined by inclined planes that make it possible, as shall be explained below, for the first semi-panels 201, starting from an operating formwork position, to be easily removed by being decoupled from the second semi-panels 202, allowing the second semi-panels 202 to remain in the operating formwork position after having previously removed the lateral panels 3 and 4. As provided above, the first semi-panels 201 are considerably longer than the second semi-panels 202, and it has been verified that once the concrete has acquired a certain resistance, the hanging beam can remain in the formwork without losing its shape with its lower face resting only on the second semi-panels 202, which are in turn supported by the corresponding shoring posts 10. Not having to use the first semi-panels 201 during the entire setting times entails a reduction in costs, given that the shoring posts 10 supporting the same will not be necessary either.

[0041] In fact, it has been envisaged that, starting from the time the hanging beam is concreted, the lateral panels 3 and 4 should be removed after twenty-four hours, and the first semi-panels 201 of the lower panels 2 after three

days, while the beam is still shored by the shoring posts 10 coupled to the second semi-panels 202. As shown in Fig. 1, the distance between the shoring posts 10 coupled to the second semi-panels 202 is considerable, due to which the construction site personnel can move and cross below the formwork 1 of the hanging beam without hindrance. The foregoing has the advantage that it avoids shoring the formwork structure 1 once again because the position of the shoring posts 10 supporting the second semi-panels 202 remains unaltered and the same are not manipulated in any other way upon the removal of the first semi-panels 201, which is not the case in other formwork systems for hanging beams. Finally, after twenty-eight days, the shoring posts 10 and the second semi-panels are removed, i.e. the hanging beam itself bears no load until that point.

[0042] For the support of the semi-panels 201 and 202 while the concrete is being poured, the semi-panels 201 and 202 are provided with respective housing means 29 and 20 (see Figs. 3, 5 and 7) to removably couple therein, when necessary, the end of a bolt, shank or peg 11, inserted by the other end in the upper end of a shoring post 10. The housing means 29 are firmly attached below the outer face 221 of the first semi-panel, what would be referred to as the interior of the panel (flanked by the perimeter frame constituted by the transverse and longitudinal edges). The housing means 20 and 29 comprise a nut, the hole of which is threaded according to the worm of the upper end of a bolt or peg 11 such as the one represented in Fig. 17. It should be mentioned that the housing means 29 of all the first semi-panels 201 constituting the formwork 1 will not receive the coupling of a peg 11 and a corresponding shoring post 10; this will only happen in the case of the initial first semi-panel 201, the one closest to the pillar from which the formwork 1 of the hanging beam extends out. Only the initial first semi-panel 201 needs to be supported by a shoring post 10; the rest of the first semi-panels 201 do not use the housing means 20 or may even lack the same altogether, given that they do not require shoring. In Figs. 1 and 2, the shoring post 10 located on the left end corresponds to the shoring post 10 coupled to the initial first semi-panel 201, while the other two shoring posts 10 are coupled to the second semi-panels 202.

[0043] As for the housing means 20 of the second semi-panel 202, which are coupled below the outer face 222, they are arranged so that they can rotate around a transverse axis parallel to the direction towards which the end transverse edge 262 extends. The rotating arrangement of the housing means 20 is shown in detail in Figs. 5 and 7, and makes it possible, by coupling them to the peg 11 and the corresponding shoring post 10 to said peg 11, for both the peg 11 and the shoring post 10 to rotate with respect to the second semi-panel 202 and with respect to the lower panel 20 when the semi-panels 201 and 202 are coupled to each other, ranging from an acute angle up to a right angle, the latter being the position wherein the shoring post 10 is perpendicular to the

inner forming face 21, and wherein the shoring post 10 supports the second semi-panel 202 from the operating formwork position until the moment when it is finally dismounted, once the concrete has acquired its final resistance twenty-eight days after the concreting process. The fact that the housing means 20 are conveniently located in one of the ends of the lower panel 2 makes it easier to handle the position of the lower panel 20 by fastening and tilting the shoring post 10 coupled to the same when mounting the formwork 1, as shall be explained further on.

[0044] As shown in Figs. 3 and 5, each connecting transverse edge 271, 272 of the two semi-panels 201, 202 forming the same lower panel 2 is provided with two through-holes 27, which, in the operating formwork position, overlap the through-hole 27 of the connecting transverse edge 271, 272 of the corresponding semi-panel 202, 201. Said through-holes 27 are adapted for removable attaching means 6 to pass through the same for the attachment, by flat contact, of the connecting transverse edges 271, 272 in the operating formwork position.

[0045] The removable attaching means 6 are constituted by pieces configured in the shape of a hook, wherein at the end opposite to the point of the hook, they have a tail with a curved termination that is less thick than the rest of the piece, adapted to cross through the through-holes 27 overlapping the connecting transverse edges 271; 272 of the two semi-panels 201, 202 and to rotate limitedly around their central axis and the axis of the point of the hook. The curved termination of the tail and the point of the hook are provided with respective supporting surfaces, which are both intended to make contact against the same inner face of one of the two connecting transverse edges 271; 272.

[0046] In Fig. 11, the removable attaching means 6 have been rotated once the tail has crossed through the through-holes 27 to adopt an operating attachment position. Prior to the placement of the lower panels 2 on shoring posts 10 for the mounting of the formwork 1 in the operating position, the operator will have proceeded to attach the semi-panels 201 and 202 forming a lower panel 2, by placing the connecting transverse edges 271 and 272 facing and overlapping each other, and inserting the curved termination of the tail through the through-holes 27, and rotating the hook-shaped piece until the two supporting surfaces of the removable attaching means 6 enter into contact and remain pressed against the same inner face of one of the two connecting transverse edges 271 or 272 (in Fig. 10, the inner face is the face of the connecting transverse edge 272), thereby securing the attachment of the two semi-panels 201 and 202. Once the concrete has been poured and has begun to harden, as commented above, the operator can proceed to remove the first semi-panels 201, leaving only the second semi-panels 202, for which he or she will have to undo the attachment by removing the removable attaching means 6 and carrying out the operation in the

opposite order to the one used to attach the two semi-panels 201 and 202.

[0047] In the mounting of the formwork 1, in order for it to adopt its operating formwork position, each lower panel 2 (its first semi-panel 201 already being attached to its second semi-panel 202) is removably coupled to an adjoining lower panel 2 and already placed in a horizontal position supported by a shoring post 10 (coupled to the second semi-panels 202, except for the initial lower panel, which is supported by two shoring posts 10). In order to couple the two lower panels 2, each lower panel 2 is provided with hooking means 70 and suspending means 80, located respectively in the rear transverse edge 26 and in the front transverse edge 25, or vice versa. Specifically, in the formwork 1 represented in the drawings, the hooking means 70 are provided in the end transverse edge 262 of the second semi-panel 202 (see Figs. 3 and 4) and the suspending means 80 are provided in the end transverse edge 251 of the first semi-panel 201 (see Figs. 5 and 6).

[0048] The hooking means 70 of a lower panel 2 are adapted to receive the coupling of the suspending means 80 of an adjoining lower panel 2, as shown in Figs. 11 and 10. Fig. 11 corresponds to a non-operating mounting position of the formwork 1, specifically to the mounting and coupling of the lower panels 2, wherein the right lower panel 2 is suspended or hung from the hooking means 70 of the left lower panel 2 and is capable of swinging with respect to the same. Starting from the position of Fig. 11, if a shoring post 10 is coupled to the housing means 20 of the second semi-panel 202 of the right lower panel (as shown in Fig. 7), the operator can swing the right lower panel by pushing the shoring post 10 upwards until the inner face 21 thereof is flush with the inner face 21 of the left lower panel 2. Finally, the operator must finish rotating the shoring post 10 until it is arranged perpendicularly to said inner faces 21 and rest the base plate of the shoring post 10 on the ground or on the underlying concrete floor. Next, the end transverse edges 262 and 251 of both adjoining lower panels 2 are attached through the arrangement of removable attaching means 6 thereby acquiring the position represented in Fig. 10, in which the lower panels 2 must be while in the operating formwork position. Another adjoining lower panel 2 may be hung in the same way from the hooking means 70 of the right lower panel 2, and so on and so forth if the length of the hanging beam so requires it, until the full formwork of the lower face of the beam is complete.

[0049] The hooking means 70 and their relationship with the rest of the components of the formwork 1 are shown in detail in Figs. 5 to 11. In the case represented in the drawings, the hooking means 70 are made up of two hooks that extend in the longitudinal direction of the lower panel 2, protruding from the lower rim of the end transverse edge 262. The opening of each hook is oriented upwards (taking into account that the inner face 21 is up and the outer face 22 is down).

[0050] As shown in detail in Fig. 8, the hooking means

70 are provided with a tip at the free end of each hook with an arrowhead configuration. Thus, the free end presents an inclined surface 72 configuring a narrowing of the opening of the hook in the opposite direction to the arrowhead, i.e., taking into account the segment with the inclined surface 72, the lower it gets, the greater the decrease in the distance between the arrowhead and the end transverse edge 262. The inclined surface 72 connects with the rest of the hook through a flat retaining surface 73 parallel to the inner face 212 of the semi-panel 202, which flat retaining surface 73 forms a retaining arris 74 with the rest of the hook.

[0051] In turn, as shown in Figs. 3, 4, 9, 10 and 11, the suspending means 80 comprise two portions of sectioned cylindrical bars 8 arranged on the lower rim of the end transverse edge 251 of the first semi-panel 201, which extend in alignment with each other and parallel to the direction of said end transverse edge 251. Each portion of sectioned cylindrical bar 8 presents a convex cylindrical surface 81 protruding below the aforementioned lower rim and extending towards the interior of the first semi-panel 201. In addition, the figures also show that each portion of sectioned cylindrical bar 8 presents a complementary flat retaining face 83, located after the convex cylindrical surface 81, and with which it forms a complementary retaining arris 84. The complementary flat retaining face 83 is parallel to the inner face 211 of the first semi-panel 201 and is located in the interior of the semi-panel 201 and separated at a certain distance from the lower rim of its end transverse edge 251.

[0052] The opening of each hook is adapted so as to receive and support a corresponding portion of sectioned cylindrical bar 8 and to enable rotation and swinging, within the opening, of said portion, around the transverse axis of the portion, when the portion rests on its convex cylindrical surface 81, as shown in Fig. 11. As shown in Figs. 3, 4 and 10, the suspending means are also provided with two suspending through-holes 9, which have a rectangular shape, each one of which is arranged after a corresponding portion of sectioned cylindrical bar 8 extending towards the top of the end transverse edge 251. These suspending holes 9 are adapted to house the free ends of the hooks of the hooking means 70 in a non-operating mounting or dismounting and removal position of the first semi-panels 201, wherein a lower panel 2, or its first semi-panel 201, is suspended, with the capacity to swing with respect to an adjoining lower panel 2, a situation represented in Fig. 11. When the first semi-panel 201 is located perpendicularly with respect to the lower panel 2 from which it hangs, the ends of the arrowhead tips will be inside the suspending holes 9.

[0053] It is also worth mentioning that, as shown in Figs. 9 and 11, the opening of each hook is adapted to house the thickness of the end transverse edge 251 of the adjoining lower panel 2 and the respective sectioned portion of cylindrical bar 8 arranged in the aforementioned end transverse edge 251 of the aforementioned adjoining lower panel.

[0054] In Fig. 10, corresponding to an operating formwork position, the adjoining coupled lower panels 2 cannot swing with respect to one another, not only due to the arrangement of the removable attaching means 6, but also because, prior to the placement of the removable attaching means 6, the suspending means must have first adopted a retaining position wherein each portion of cylindrical bar 8 is fitted in the opening of a corresponding hook of the adjoining lower panel 2 due to the direct contact of the flat retaining surface 73 and the complementary flat retaining face 83, and wherein the complementary retaining arris 84 is arranged parallel to the retaining arris 74. In this retaining position, a lower panel 2 cannot rotate with respect to an axis parallel to one of its longitudinal edges 23, 24; instead, it is secured and contributes to the safety of the operators and the stability of the formwork 1.

[0055] Fig. 10 shows that the end transverse edge 262 of the second semi-panel 202 has a height equivalent to the sum of the height of the end transverse edge 251 of the first semi-panel 201 plus the distance by which one of the sectioned portions of cylindrical bar 8 of the suspending means 80 arranged in the first semi-panel 201 protrudes below said end transverse edge 251. The height of the end transverse edge 251 is shorter than the height of the end transverse edge 262 because this way, two adjoining lower panels 2 can swing with respect to one another, as shown in Fig. 11, keeping the lower panels 2 separated by a minimum distance marked by the opening of the hooks of the hooking means 70 of the second semi-panel 202.

[0056] The suspending means 80 comprise guiding means for the coupling of the sectioned portions of cylindrical bars 8 in the corresponding openings of the hooks of an adjoining lower panel 2. The guiding means are arranged internally in each semi-panel 201, that is to say, in the space comprised between the outer face 221 and the longitudinal edges 231, 241, the end transverse edge 251 and the connecting transverse edge 271, specifically on the upper rim of the end transverse edge 251 wherein the sectioned portions of cylindrical bars 8 are provided. These guiding means are clearly shown in Figs. 9 and 10, and are made up of a corner piece 82 and a stop piece 85 for each sectioned portion of cylindrical bar 8.

[0057] Each corner piece 82 is constituted by an inclined plane arranged perpendicular to the outer face 221, and which attaches the end transverse edge 251 to the longitudinal edge 231 or 241, with which it forms an inner corner in semi-panel 201, at an angle. Each stop piece 85 is arranged in the aforementioned end transverse edge 251 just above a sectioned portion of cylindrical bar 8, maintaining a separation from the corner piece 82. The dimensions of said separation are adapted to house the arrowhead configuration tip of the free end of a hook of the adjoining lower panel 2. Said tip can slide along the length of the inclined plane of the corner piece 82 until butting up against the stop piece 85. The stop

piece 85 has a partially cylindrical configuration such that its cylindrical surface also contributes to the guiding of the arrowhead towards the space comprised between the stop piece and the corner piece 82. As shown in Fig. 9, the arrangement is such that the complementary flat retaining face 83 of the portion of cylindrical bar 8 is oriented towards the guiding means.

[0058] This way, the guiding means will help the operator mounting the formwork 1 to place the lower panels 2, one adjoining panel after the other, in the correct position such that the newly placed lower panel 2 swings with respect to the adjoining lower panel that has already been placed in the horizontal (formwork) position. Let us consider a situation wherein a lower panel 2 has already been placed in an operating formwork position with its inner face 21 in the horizontal position, the initial lower panel 2, for example. The arrowhead tips of the hooks of the hooking means 70 protrude from said lower panel 2. The operator comes with a lower panel 2 that must hang from the one that has already been placed, such that the lower panel 2 to be placed can swing with respect to the one that was placed before. The lower panel 2 in the hands of the operator comprises, near the end transverse edge 251, two spaces delimited by corresponding corner pieces 82 and stop pieces 85. The operator must be able to house the arrowhead of the end transverse edge 262, of the adjoining lower panel that has already been placed, in these spaces such that one can swing with respect to the other. The guiding means allow the operator to place the lower panel 2 correctly without having to look where the spaces and arrowheads are, simply by groping for and slightly moving the lower panel 2 he or she is holding, given that there will be a moment when an arrowhead will rest on the inclined plane of the corner piece 82 or on the cylindrical surface of the stopping means, and in that moment it will be directly guided to be housed in the corresponding space in order to be correctly coupled to the portions of cylindrical bars 8.

[0059] Given that the lateral panels 3 and 4 and the lower panel 2 have been described above on an individual basis, we shall proceed to explain the mounting of the lower panel 2 with respect to the lateral panels 3 and 4 in order to adopt the operating formwork position in Fig. 1. As shown in Fig. 1, the two lateral panels 3 and 4 are arranged vertically and parallel to each other, separated from one another by the lower panel 2 arranged horizontally, such that each one of the two longitudinal edges 23, 24 of the lower panels 2 is in flat contact with the inner faces 31, 41 of the lateral panels 3, 4 through mutual affixing means. This arrangement is also shown in Figs. 12 and 13, wherein, for the purpose of clarity and in order not to hide certain parts, lateral panel 3 has not been drawn.

[0060] It should be highlighted that, in the example represented in the drawings, the lower panels 2 and the lateral panels 3 and 4 have been arranged in such a way that a lower panel 2 is affixed to a respective lateral panel 3 and a respective lateral panel 4, such that the longitu-

dinal edges 231 and 232 of the semi-panels 201 and 202 are fully in contact with the inner face 31 of one same lateral panel 3 and the longitudinal edges 241 and 242 are fully in contact with the inner face 41 of one same lateral panel 4.

[0061] However, this is not the only way to mount the formwork 1, rather, it is also possible that, for example, considering one same lower panel 2, the longitudinal edges 231 and 242 of its first semi-panel 201 may each be in contact with the inner face 31 and the inner face 41 of respective lateral panels 3 and 4, but that the longitudinal edges 232 and 242 of its second semi-panel 202 are in full or partial contact with the inner face 31 and the inner face 41 of other lateral panels 3 and 4 located after the lateral panels 3 and 4 to which the first semi-panel 201 is affixed. This mounting arrangement can reinforce the structural integrity of the overall formwork 1, helping the multiple panels 2, 3 and 4, which are mounted to one another, to maintain a single, straight direction, as it strengthens the attachment between two adjoining lateral panels 3 or 4 belonging to one same side, by virtue of both being affixed along one same lower panel 2.

[0062] The mutual affixing means between each lower panel 2 and its corresponding lateral panels 3 and 4 comprise at least two through-holes 52 distributed in each one of the longitudinal edges 23 and 24 of the lower panel 2 (see Figs. 3 and 4) and at least two series of through-holes 53 and 54 (preferably arranged in the transverse ribs of the lateral panels 3 and 4) through the inner face, 31, 41 and outer face 32, 42 of each lateral panel 3, 4 (see Figs. 14 and 15). Specifically, in the lower panel 2, the semi-panels 201 and 202 of which have been represented in Figs. 3 to 6, it can be observed that the through-holes 52 are exclusively located in the longitudinal edges 231 and 241 of the first semi-panel 201, two holes 52 per side. As shown in Figs. 14 and 15, the holes 53, 54 of the series are distributed linearly in the direction parallel with respect to the transverse edges 35, 36; 45, 46, and the separation between one series and the other, within one same inner face 31, 41, is equivalent to the distance separating the through-holes 52 of one same longitudinal edge 23, 24 of the lower panel 2.

[0063] The mutual affixing means, between the lateral panels 3 and 4, to the lower panel 2, also comprise sets of threaded or dywidag bars 55 (see Figs. 2, 12, 13 and 18) and wing nuts 56 with threads that correspond to the worm of the bars 55 for tightening them together. In the operating formwork position, each through-hole 52 of the lower panel 2 overlaps one of the holes 53, 54 of one of the lateral panels 3, 4, both overlapping holes being crossed through by a corresponding bar 55 provided with a wing nut on one of its ends, arranged so that it faces the outer face 32, 42 of the corresponding lateral panel 3, 4, which maintains the longitudinal edge 23, 24 of a lower panel 2 in flat contact with the inner face 31, 41 of the lateral panel 3, 4.

[0064] In addition, as shown in Figs. 3 and 13, the mutual affixing means also comprise, for each one of the

through-holes 52 distributed in each one of the longitudinal edges 23 and 24 of the lower panel 2, a nut 57 that is firmly attached to the inner side of the respective longitudinal edge 23, 24 of the lower panel 2, with the threaded hole of the nut 57 placed after and overlapping the through-hole 52, and the thread of which corresponds to the worm of the bars 55 for tightening them together. The rotation of the wing nuts 56 of each side will result in the lower panel 2 being pressed against the inner faces 31 and 41 of the lateral panels 3 and 4.

[0065] Fig. 16 shows another variant of the lower panel 2, wherein not only the first semi-panel 201 is provided with through-holes 52, but also the second semi-panel 202 comprises a through-hole 52 in each one of its longitudinal edges 232 and 242. This distribution of the through-holes 52 between the two semi-panels 201 and 202 is especially recommended, given that the forces are better distributed and the bending and deformation of their components is reduced when the through-holes 52 are distributed and separated by smaller distances.

[0066] In summary, mounting the formwork 1 would, then, entail the following steps. In the first place, a first semi-panel 201 is firmly coupled to a second semi-panel 202 through removable attaching means 6 in order to constitute a lower panel 2. In fact, all lower panels 2 should already be coupled with their semi-panels 201 and 202. One of these lower panels 2 is the initial lower panel, which is placed first and is the only one with a shoring post 10 coupled to its first semi-panel 201 through the housing means 29.

[0067] The initial lower panel 2 is placed in the horizontal position, supported by two shoring posts 10, one coupled to the first semi-panel 201 and the other coupled to the housing means 20 of the second semi-panel 202. Subsequently, another lower panel 2 is placed next to the first, hung from the hooking means 70 through its suspending means 80. The second semi-panel 202 of this new lower panel 2 will first hang, such that it can swing, from the first horizontal lower panel. The operator, having coupled another shoring post 10 to the second semi-panel 202 of the new lower panel 2, will raise the shoring post 10, which can rotate with respect to the lower panel 2 by virtue of being coupled to the housing means 20 through the peg 11, and thus will push the second lower panel 2 until it is flush with the other lower panel 2. All lower panels 2 must be mounted in the same manner. Then, on each side, the lateral panels 3 and 4 will be mounted vertically by inserting the bars 55 in the through-holes 53, 54 and 52 and by rotating the corresponding wing nuts 56, the free ends of the bars 55 thus being screwed into the nuts 57 of the lower panels, as shown in Fig. 13. As shown in Fig. 1, the lateral panels of one same side, i.e., all lateral panels 3 or all lateral panels 4, connect to each other through the removable attaching means 6 described for the attachment between the lower panels 2.

[0068] Then, the concreting process will take place, and once the time necessary for the concrete to acquire

a certain resistance has elapsed, specifically twenty-four hours after concreting, firstly all of the lateral panels 3 and 4 can be removed by unscrewing the wing nuts 56 and by extracting the bars 55 from the through-holes 52. Then, three days after the concreting, the shoring of the formwork 1 can be partially removed by removing the first semi-panels 201 (including the initial semi-panel) leaving only the second semi-panels 202 to hold up the concreted hanging beam. The removal of the first semi-panels 201 is carried out by removing the removable attaching means 6 that attach the first semi-panels 201 to the second semi-panels 202, and by pulling downwards (grasping them by a handle provided for said purpose, see Fig. 7) from the end transverse edge 271 in order for the semi-panel 201 to swing with respect to the second semi-panel 202 next to the one that is suspended. Once the first semi-panel 201 swings, it can be easily taken out from the hooks. The only semi-panel 201 that is not removed as provided above is the initial semi-panel, which is removed by lowering the shoring post 10 coupled to the same, reducing the length thereof and pulling the semi-panel 201 downwards, given that it is the only one that is not suspended in order to swing from an adjoining second semi-panel 202. The second semi-panels 202 are removed twenty-eight days after concreting, when the concrete has acquired its final resistance.

Claims

1. Formwork (1) for a hanging beam protruding below a floor slab that comprises a plurality of lateral panels (3, 4) and lower panels (2), wherein each panel has an inner face (21, 31, 41) forming a respective face of the beam, and wherein, in an operating formwork position, the lateral panels (3, 4) of each side are arranged vertically and parallel to each other, separated from one another by the lower panels (2) arranged horizontally, such that the longitudinal edges (23, 24) of the lower panels (2) are in flat contact with the inner faces (31, 41) of the lateral panels (3, 4) through mutual affixing means (52, 53, 54, 55, 56, 57), **characterized in that** the affixing of the lower panels (2) with respect to the lateral panels (3, 4) is height-adjustable in order to adapt the formwork to hanging beams with different heights, and **in that** each lower panel (2) is composed of two semi-panels (201, 202), the first semi-panel (201) being longer than the second semi-panel (202), wherein each semi-panel (201; 202) comprises a connecting transverse edge (271; 272) which connects to the other connecting transverse edge (272; 271) of the other semi-panel (202; 201), wherein the two semi-panels (201, 202) can be removably coupled to one another to constitute the lower panel (2) through removable attaching means (6) configured for their connecting transverse edges (271, 272) to be attached by flat contact, wherein the connecting transverse edge (271) of the first semi-panel (201) forms an obtuse angle with its inner face (211) and the connecting transverse edge (272) of the second semi-panel (202) forms an acute angle supplementary to the aforementioned obtuse angle.
2. Formwork (1) according to claim 1, **characterized in that** each semi-panel (201; 202) comprises an inner forming face (211; 212), an outer face (221; 222), two longitudinal edges (231, 241; 232, 242), an end transverse edge (251; 262), and a connecting transverse edge (271; 272) that connects to the connecting transverse edge (272; 271) of the other semi-panel (202; 201), with which it forms one same lower panel (2), wherein the interior of a semi-panel is made up of the outward-facing open space delimited by its outer face and by its longitudinal edges and transverse edges, all of which is configured in such a way that in the coupling position of the two semi-panels (201; 202) of one same lower panel (2), the inner faces (211; 212) and outer faces (221; 222) of the two semi-panels are flush, constituting the inner face (21) and the outer face (22) of the lower panel (2), respectively, the longitudinal edges (231, 241; 232, 242) of the two semi-panels being arranged in a coplanar manner constituting the longitudinal edges (23, 24) of the lower panel (2), and the end transverse edge (251) of the first semi-panel (201) and the end transverse edge (262) of the second semi-panel (202) constituting the two transverse edges (25, 26) of the lower panel (2).
3. Formwork (1) according to claim 2, **characterized in that** the second semi-panel (202) of each lower panel (2) is provided with housing means (20) to removably couple, in the second semi-panel, the end of a bolt or peg (11) which can be inserted by its other end into the upper end of a shoring post (10) or support, said housing means (20) being coupled below the outer face (222) and arranged in a rotary manner around a transverse axis parallel to the direction towards which the end transverse edge (262) of the second semi-panel extends, configured in such a way that the shoring post (10) or support inserted in the housing means (20) through the bolt or peg (11) is able to adopt a position wherein it ranges from at least an acute angle up to a right angle with respect to the outer face (222) of the second semi-panel (202).
4. Formwork (1) according to claim 2 or 3, **characterized in that** each lower panel (2) is provided with hooking means (70) and with suspending means (80) located in a respective transverse edge (25, 26), by means of which a lower panel (2) can, in a non-operating mounting or dismounting position of the formwork (1), be suspended, with the capacity to swing, from another lower panel (2) adjoined to the

first, since the hooking means (70) of a lower panel are adapted to receive the coupling of the suspending means (80) of the adjoining lower panel (2), or vice versa.

5. Formwork (1) according to claims 3 and 4, **characterized in that** the hooking means (70) comprise at least two hooks that extend in the longitudinal direction of the lower panel (2), protruding from the lower rim of the end transverse edge (251, 262) of one of the semi-panels (201, 202) forming the lower panel (2), towards the exterior of the semi-panel, and the hook opening of which is oriented upwards, directed towards the inner face (211, 212) of the semi-panel and adapted to receive the coupling of the suspending means (80) of the adjoining lower panel (2) and to enable rotation and swinging thereof within the opening.
6. Formwork (1) according to claim 5, **characterized in that** the suspending means (80) comprise two portions of sectioned cylindrical bars (8) arranged on the lower rim of the end transverse edge (262, 251) of the other semi-panel (202, 201) of the lower panel (2), and which extend aligned and parallel to the direction of said end transverse edge, configured such that each portion of sectioned cylindrical bar (8) comprises a convex cylindrical surface (81) protruding below the lower rim of the end transverse edge (262, 251) and extending towards the interior of the semi-panel (202, 201), the opening of each hook of the hooking means (70) being adapted to receive and support a corresponding portion of sectioned cylindrical bar (8) and to enable rotation and swinging, within the opening, of said portion, around the transverse axis of the portion, when the portion rests on its convex cylindrical surface (81), and **in that** two suspending through-holes (9) are each arranged after a corresponding portion of cylindrical bar (8), extending towards the top of the end transverse edge (262, 251) and being adapted to house the free ends of the hooks of the hooking means (70) in a non-operating mounting or dismounting position, wherein a lower (2) panel is suspended, with the capacity to swing, with respect to an adjoining lower panel.
7. Formwork (1) according to claim 6, **characterized in that** the hooking means (70) and the suspending means (80) comprise mutual retaining means through which a lower panel (2) is able to go from being suspended, in a non-operating mounting or dismounting position of the formwork (1), to being retained without the possibility of swinging in an operating formwork position with respect to an adjoining lower panel (2), the inner faces (21) of the two adjoining lower panels (2) being arranged so as to be flush in said operating formwork position when the hooking means (70) of a lower panel receive the

coupling of the suspending means (80) of an adjoining lower panel (2) and the suspending means (80) adopt a retaining position.

8. Formwork (1) according to claim 7, **characterized in that** the retaining means of the hooking means (70) are constituted by a tip of the free end of each hook with an arrowhead configuration, whereby the free end presents an inclined surface (72) configuring a narrowing of the opening of the hook in the opposite direction to the arrowhead, connecting the inclined surface (72) with the rest of the hook through a flat retaining surface (73) parallel to the inner face (212, 211) of the semi-panel (202, 201) from which the hooks protrude, the flat retaining surface (73) forming a retaining arris (74) with the rest of the hook, and **in that** each portion of sectioned cylindrical bar (8) of the suspending means (80) presents a complementary flat retaining face (83), located after the convex cylindrical surface (81) with which it forms a complementary retaining arris (84), the complementary flat retaining face (83) being parallel to the inner face (211, 212) of the semi-panel (202, 201) on which the suspending means (80) are arranged, and the complementary flat retaining face (83) being located in the interior of the corresponding semi-panel (202, 201) and separated at a certain distance from the lower rim of its end transverse edge (262, 251), all of which is configured in such a way that the suspending means (80) of a lower panel (2) are able to adopt a retaining position wherein each portion of sectioned cylindrical bar (8) of a lower panel (2) fits in the opening of a corresponding hook of the adjoining lower panel (2) by direct contact of the flat retaining surface (73) with the complementary flat retaining face (83), and wherein the complementary retaining arris (84) is arranged parallel to the retaining arris (74).
9. Formwork (1) according to claim 8, **characterized in that** the suspending means (80) comprise guiding means for the coupling of the portions of sectioned cylindrical bars (8) in the corresponding openings of the hooks of an adjoining lower panel (2).
10. Formwork (1) according to claim 9, **characterized in that** the guiding means are arranged internally in the semi-panel (201; 202) on the upper rim of the same end transverse edge (251; 262) wherein the portions of sectioned cylindrical bars (8) are provided, and comprise a corner piece (82) and a stop piece (85) for each portion of sectioned cylindrical bar (8), the corner piece (84) being provided with an inclined plane arranged perpendicular to the outer face (221; 222) of the semi-panel (201; 202), attaching, at an angle, the aforementioned end transverse edge (251; 262) with the adjacent longitudinal edge (231, 241; 232, 242) with which it forms an inner

corner in the semi-panel (201; 202), the stop piece (85) being arranged on the aforementioned end transverse edge (251, 262) above the portion of sectioned cylindrical bar (8), and maintaining a separation from the corner piece (82), the dimensions of which are adapted to house the arrowhead configuration tip of the free end of a hook of the adjoining lower panel (2), which tip is able to slide along the length of the inclined plane of the corner piece (82) until butting up against the stop piece (85), and the complementary flat retaining piece (83) of the portion of sectioned cylindrical bar (8) is oriented towards the guiding means.

11. Formwork (1) according to any one of the claims 6 to 10, **characterized in that** the hook opening of each hook of the hooking means (70) of a lower panel (2) is adapted to house the thickness of the end transverse edge (262, 251) of the adjoining lower panel (2) and the respective portion of sectioned cylindrical bar (8) arranged in the aforementioned end transverse edge.
12. Formwork (1) according to any one of the claims 1 to 11, **characterized in that** each lateral (3, 4) or lower (2) panel has an inner face (21, 31, 41) forming a respective face of the beam, an outer face (22; 32; 42) provided with transverse ribs, and with longitudinal (23, 24; 33, 34; 43, 44) and transverse (25, 26; 35, 36; 45, 46) edges, wherein the interior of a panel is made up of the outward-facing open space delimited by its outer face and by the longitudinal and transverse edges, and **in that** all the longitudinal (23, 24; 33, 34; 43, 44) and transverse (25, 26; 35, 36; 45, 46) edges of the lower (2) and lateral (3, 4) panels are made up of respective flat faces perpendicular to the inner faces (21; 31; 41) of the panels, and extend from said inner faces to beyond the outer faces (22; 32; 42) of the panels.
13. Formwork (1) according to claim 12 and to any one of the claims 4 to 12, **characterized in that** the hooking means (70) are provided in the end transverse edge (262) of the second semi-panel (202) of a lower panel (2) and the suspending means (80) are provided in the end transverse edge (251) of the first semi-panel (201).
14. Formwork (1) according to the claims 12, 13 and to any one of the claims 6 to 11, **characterized in that** the end transverse edge (262) of the second semi-panel (202) has a height equivalent to the sum of the height of the end transverse edge (251) of the first semi-panel (201) plus the distance by which one of the portions of sectioned cylindrical bar (8) of the suspending means (80) arranged in the first semi-panel (201) protrudes below said end transverse edge (251).

15. Formwork (1) according to claim 12 and to any one of the preceding claims, **characterized in that** the mutual affixing means (52, 53, 54, 55, 56, 57) between the lower panels (2) and the lateral panels (3, 4) comprise at least two through-holes (52), distributed in each one of the longitudinal edges (23, 24) of the lower panels (2), and at least two series of through-holes (53, 54) through the inner faces (31, 41) and outer faces (32, 42) of each lateral panel (3, 4), the holes (53, 54) of the series being distributed linearly in the direction parallel with respect to the transverse edges (35, 36; 45, 46) of the lateral panels (3, 4), and wherein the separation between one series and the other is equivalent to the distance separating the through-holes (52) of one same longitudinal edge (23, 24) in a lower panel (2), and **in that** the mutual affixing means also comprise sets of threaded or dywidag bars (55) and wing nuts (56), the threads of which correspond to the worm of the bars (55) for tightening them together, all of which is arranged in such a way that in the operating formwork position, each through-hole (52) of a lower panel overlaps one of the holes (53, 54) of the lateral panels (3, 4), both holes being crossed through by a corresponding bar (55) provided with a wing nut on one of its ends, which maintains the longitudinal edge (23, 24) of a lower panel (2) in flat contact with the inner face (31, 41) of a lateral panel (3, 4) or with the inner faces of two adjoining lateral panels (3, 4).
16. Formwork (1) according to claim 15, **characterized in that** the mutual affixing means (52, 53, 54, 55, 56, 57) also comprise, for each one of the through-holes (52) distributed in each one of the longitudinal edges (23, 24) of the lower panel (2), a nut (57) that is firmly attached to the inner side of said longitudinal edge (23, 24), with the threaded hole of the nut (57) placed after and overlapping the through-hole (52), and the thread of which corresponds to the worm of the bars (55) for tightening them together.
17. Formwork (1) according to any one of the preceding claims, **characterized in that** each connecting transverse edge (271; 272) of the two semi-panels (201, 202) forming one same lower panel (2) is provided with at least one through-hole (27) which, in the operating formwork position, overlaps the through-hole (27) of the connecting transverse edge (272; 271) of the corresponding semi-panel (202, 201), said through-holes (27) being adapted for the removable attaching means (6) to pass through them for the attachment by flat contact of the connecting transverse edges (271, 272) in the operating formwork position.
18. Formwork (1) according to any one of the preceding claims, **characterized in that** the upper longitudinal edges (34, 44) of the lateral panels (3, 4), intended

to be the longitudinal edges furthest away from the lower panel (2), are provided with a filling (12), along their rims, of a material such as wood, which can directly support, and be attached to, a horizontal formwork board of the floor slab to which the hanging beam belongs, through the insertion of nails.

10

15

20

25

30

35

40

45

50

55

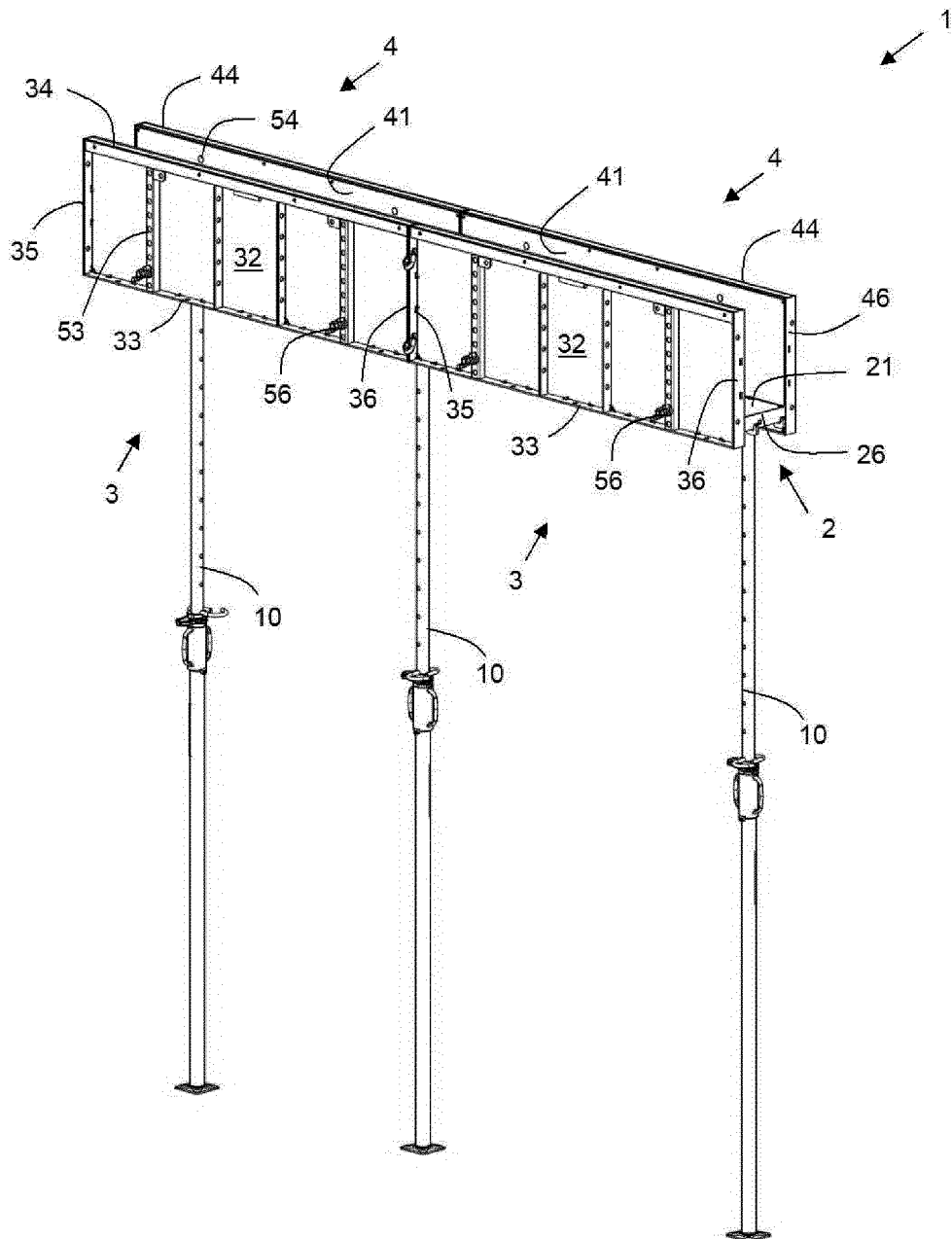


Fig. 1

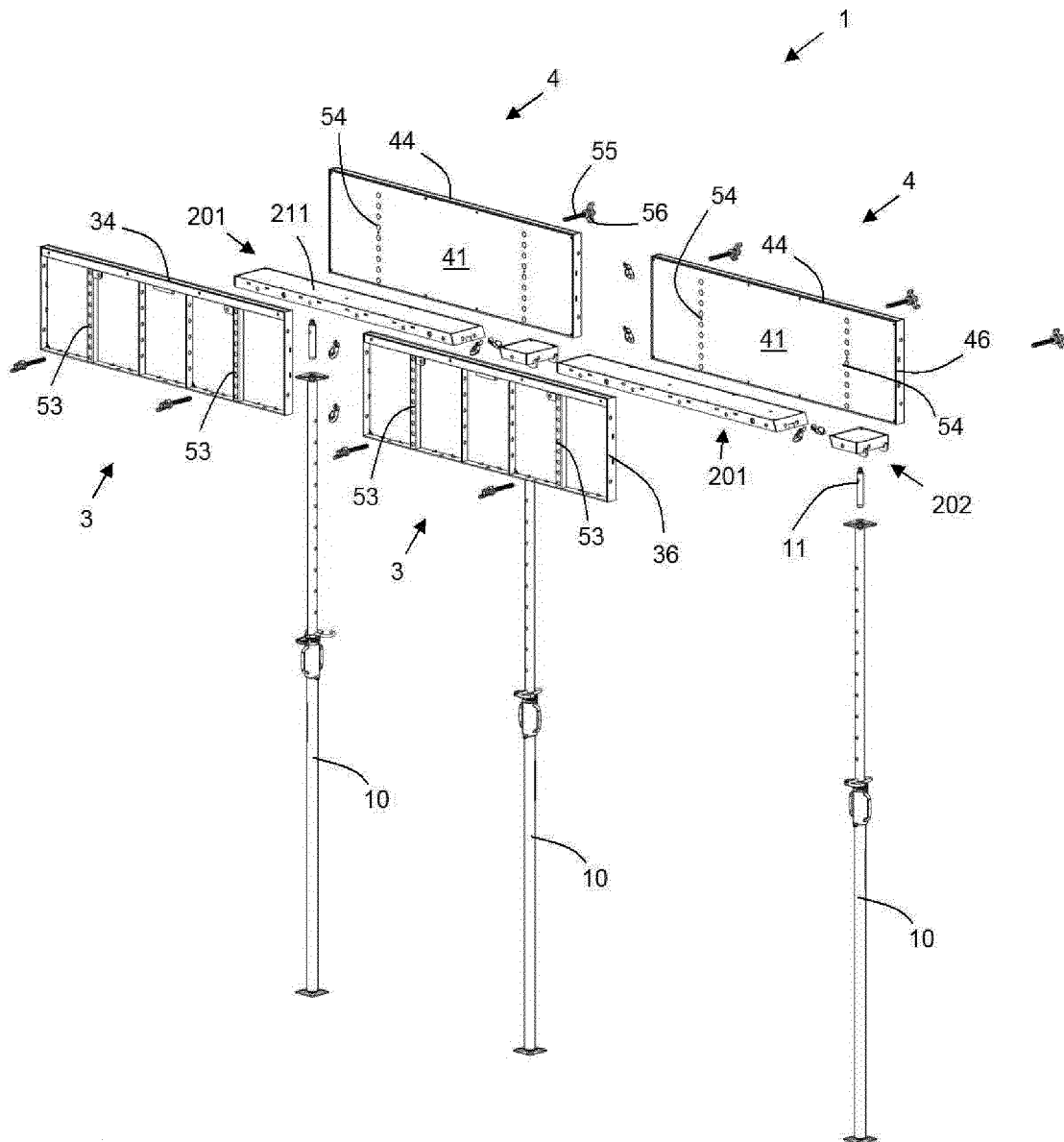


Fig. 2

Fig. 3

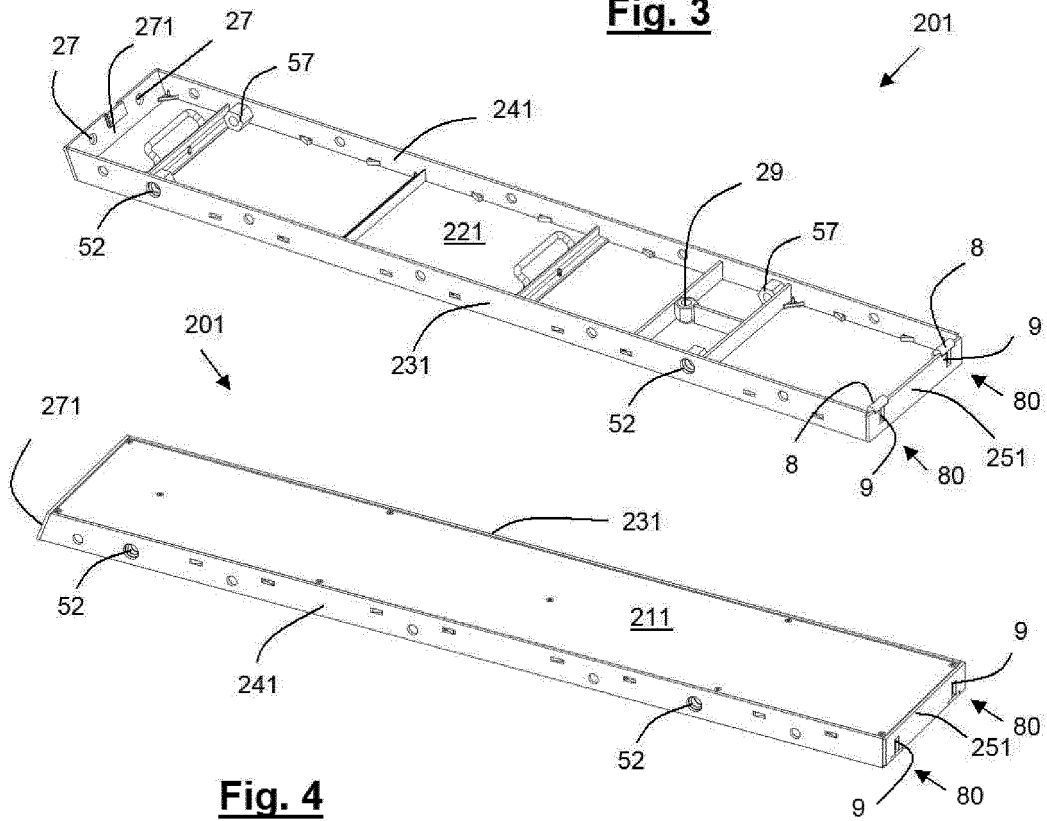


Fig. 4

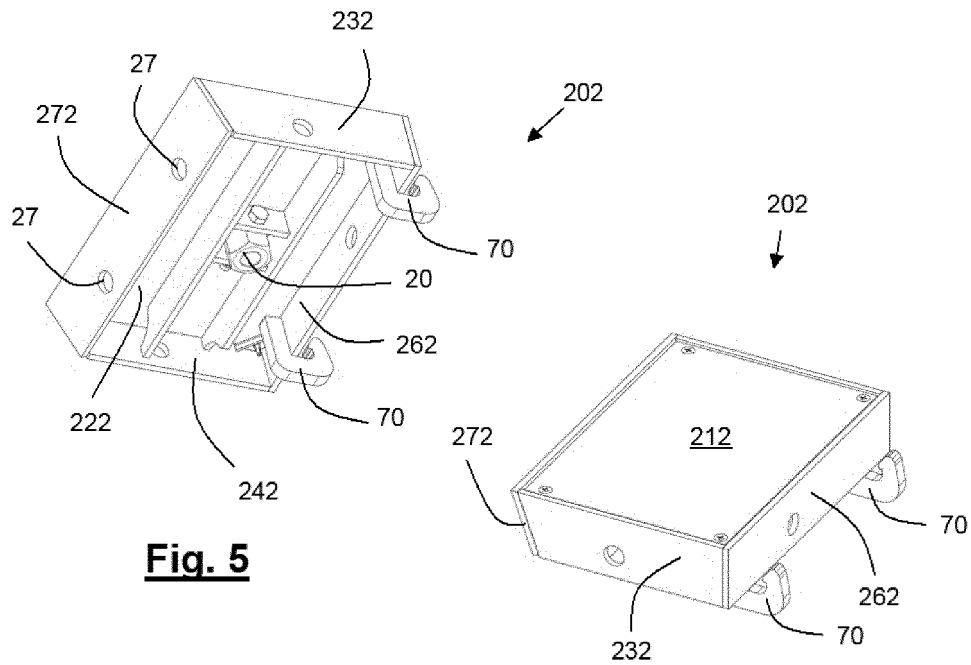
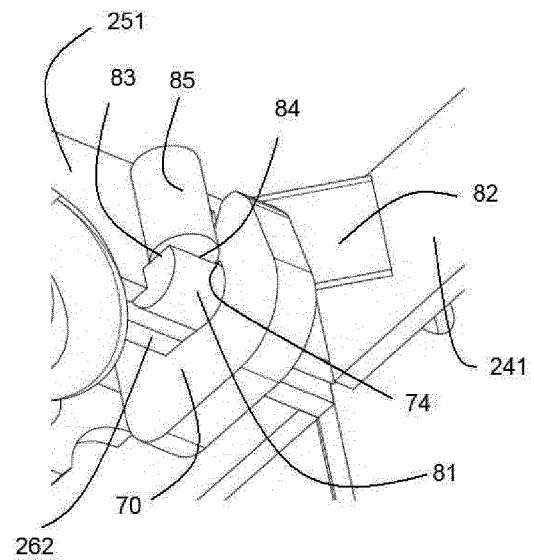
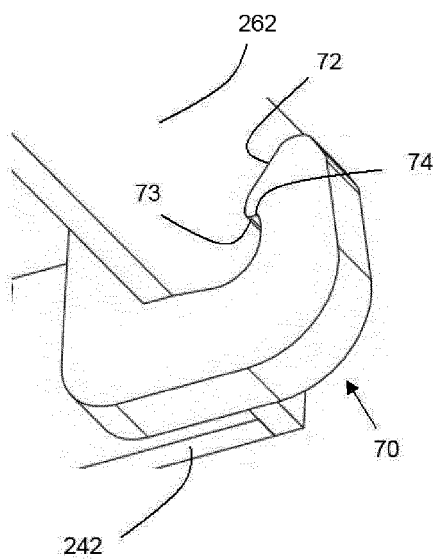
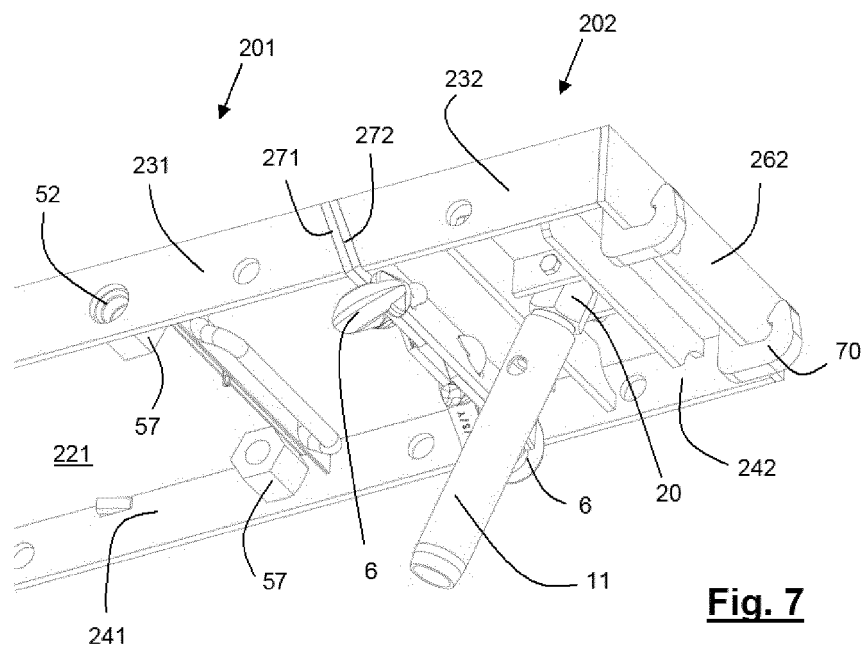


Fig. 5

Fig. 6



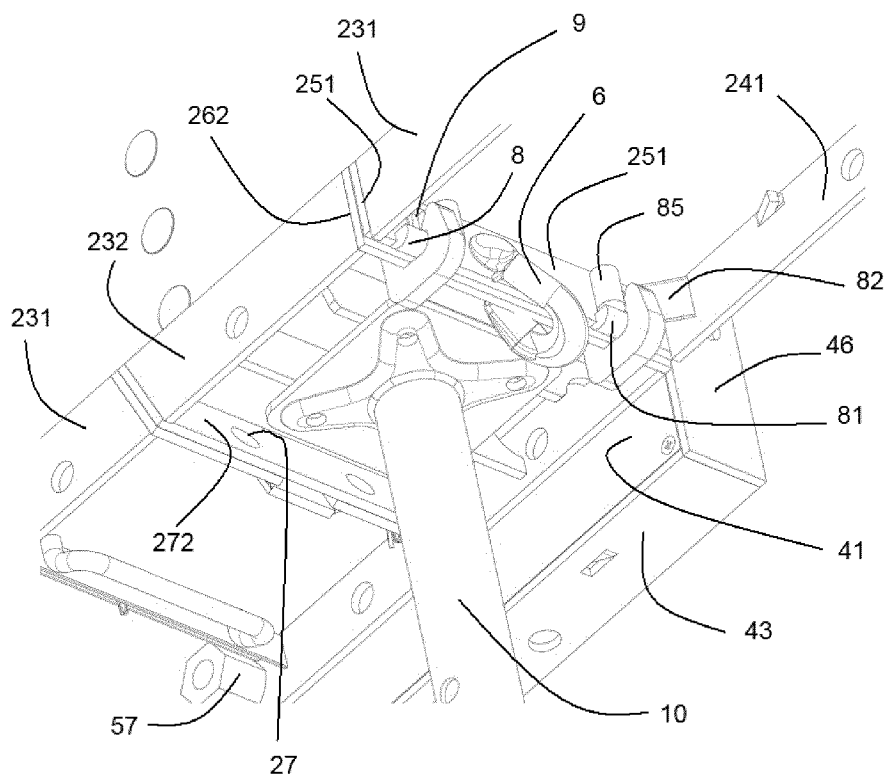


Fig. 10

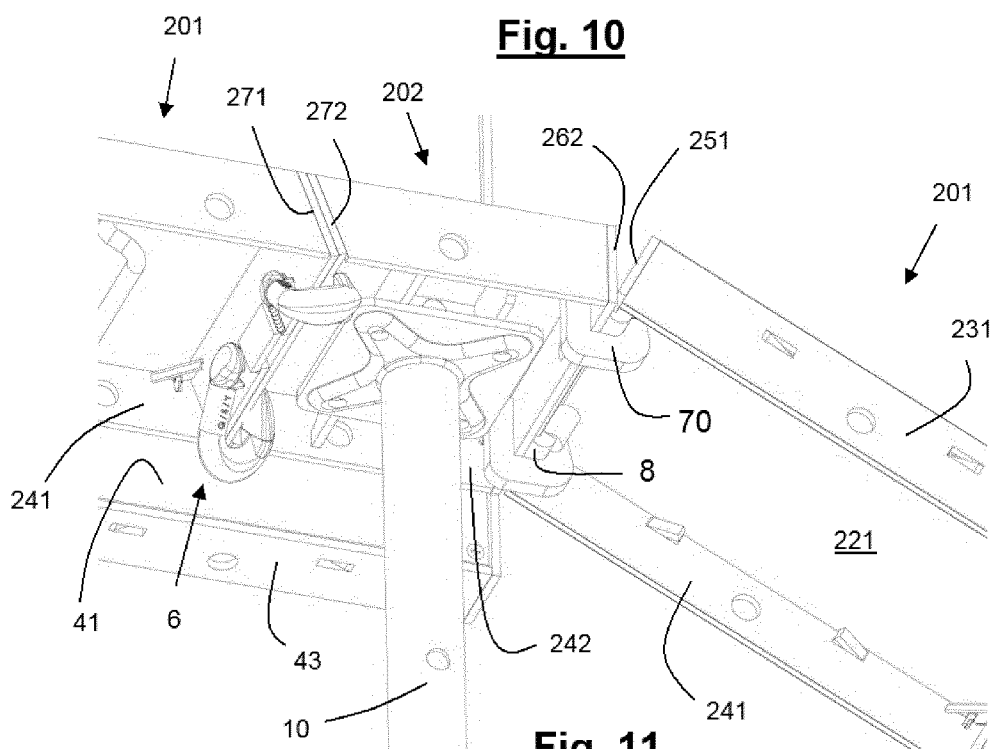


Fig. 11

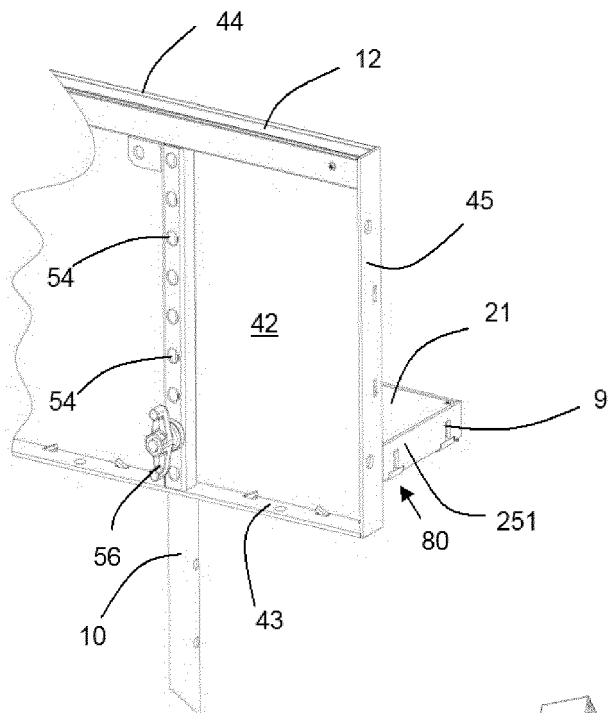


Fig. 12

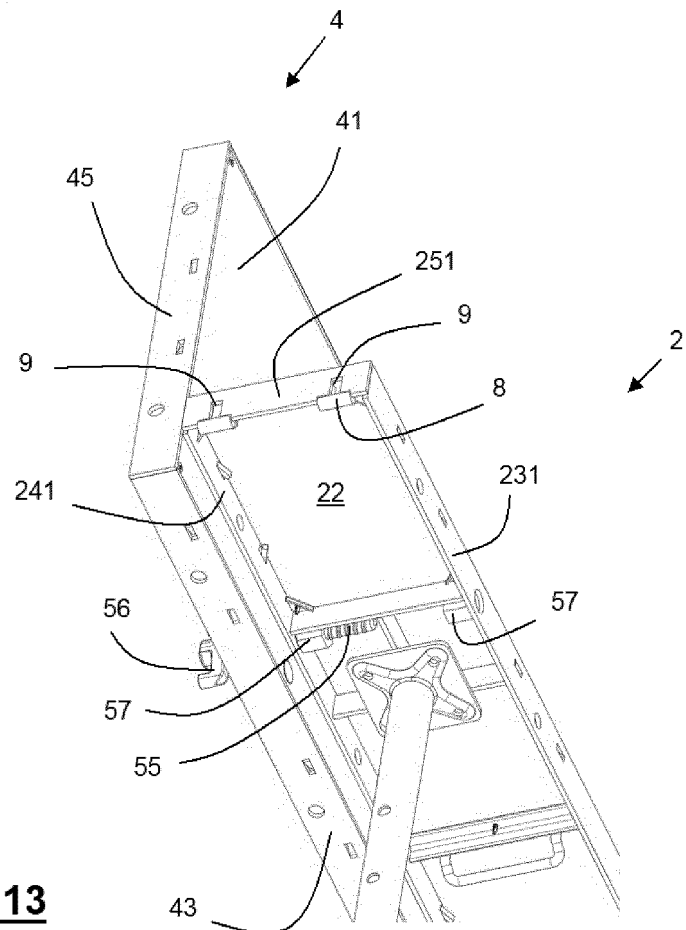


Fig. 13

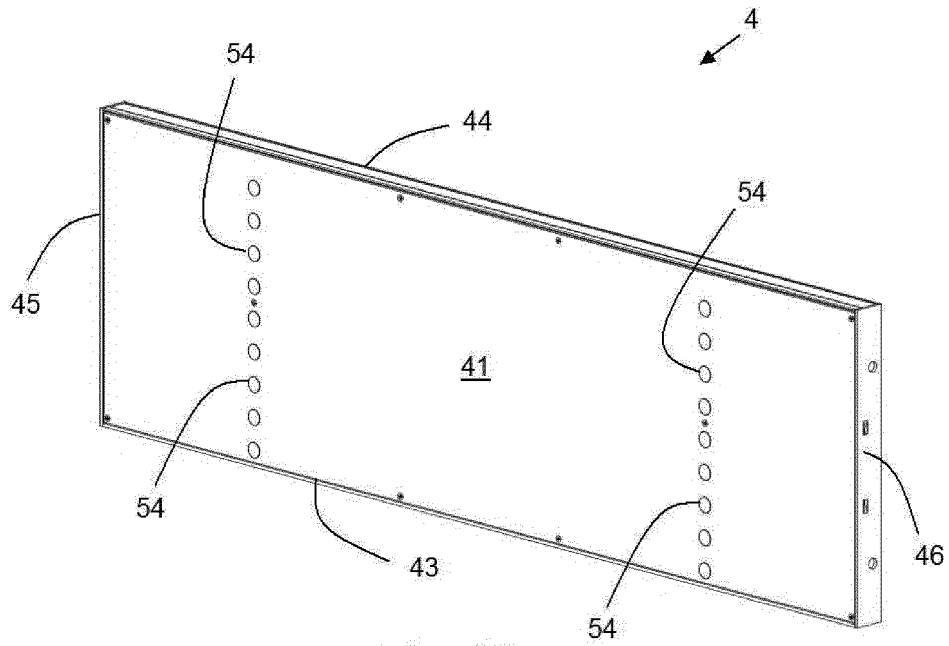


Fig. 14

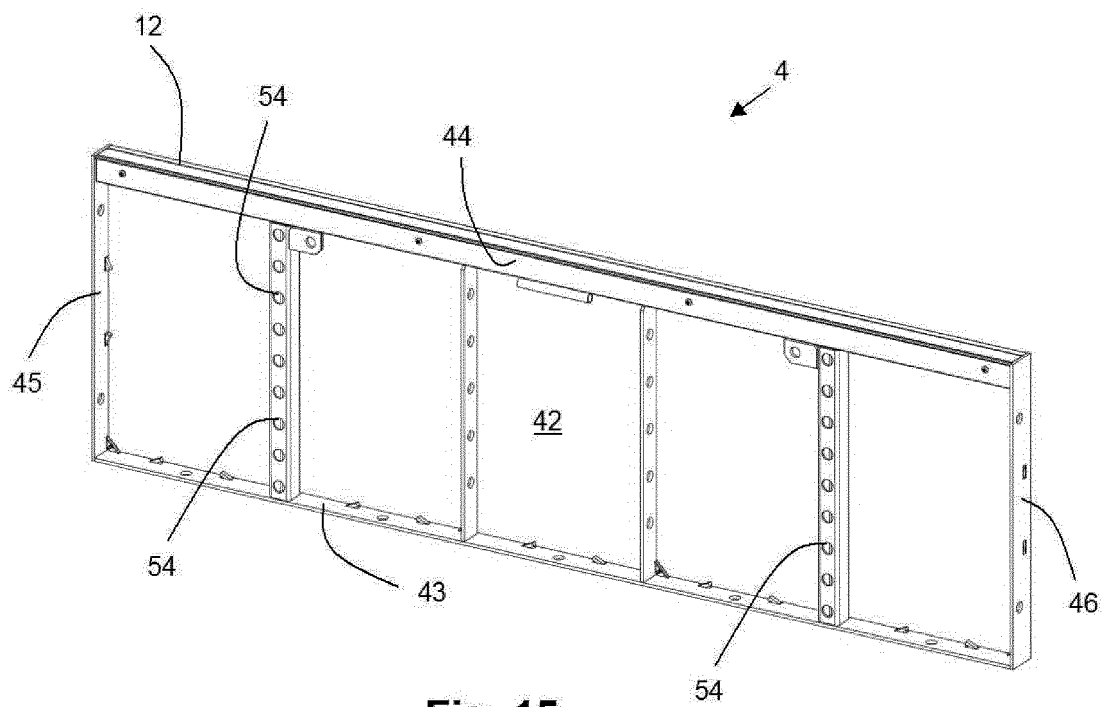


Fig. 15

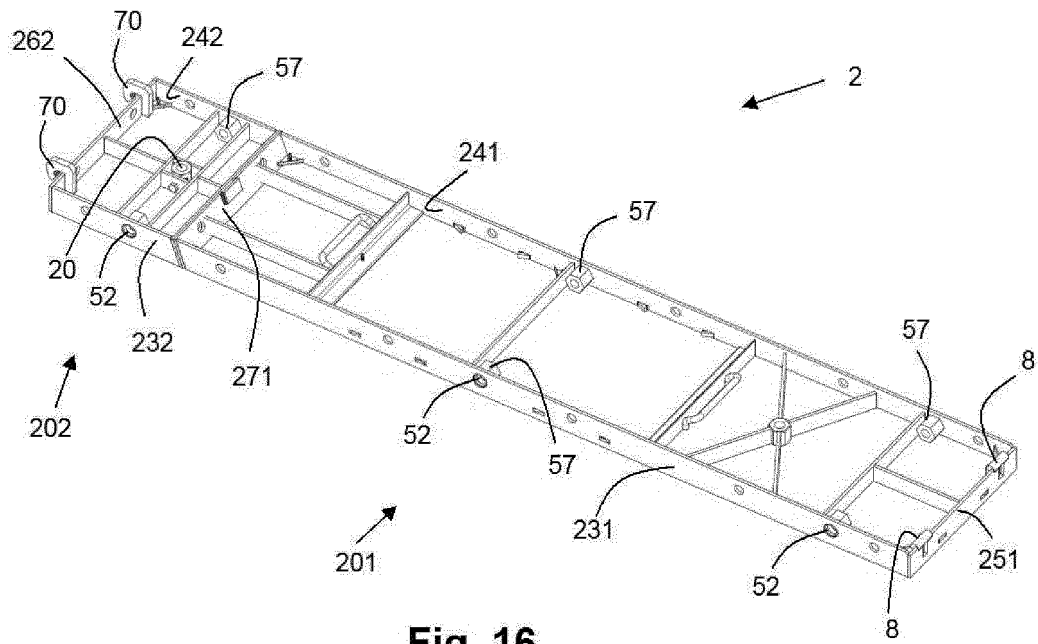


Fig. 16

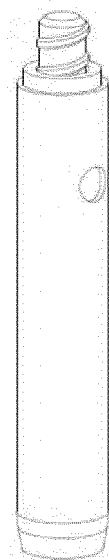


Fig. 17

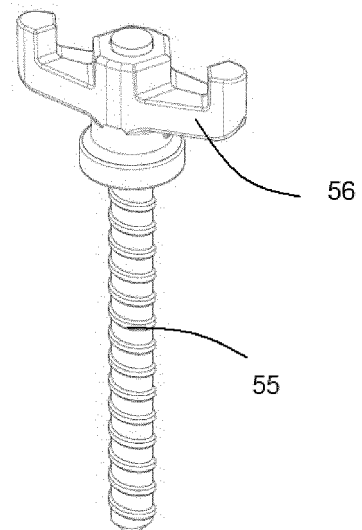


Fig. 18

INFORME DE BÚSQUEDA INTERNACIONAL

Solicitud internacional N°

PCT/ES2014/070551

A. CLASIFICACIÓN DEL OBJETO DE LA SOLICITUD

INV. E04G11/48 E04G11/50 E04G13/04

De acuerdo con la Clasificación Internacional de Patentes (CIP) o según la clasificación nacional y CIP.

B. SECTORES COMPRENDIDOS POR LA BÚSQUEDA

Documentación mínima buscada (sistema de clasificación seguido de los símbolos de clasificación)

E04G B28B

Otra documentación consultada, además de la documentación mínima, en la medida en que tales documentos formen parte de los sectores comprendidos por la búsqueda

Bases de datos electrónicas consultadas durante la búsqueda internacional (nombre de la base de datos y, si es posible, términos de búsqueda utilizados) EPO-Internal, WPI Data

C. DOCUMENTOS CONSIDERADOS RELEVANTES

Categoría*	Documentos citados, con indicación, si procede, de las partes relevantes	Relevante para las reivindicaciones N°
Y	US 2010/242403 A1 (BREWKA ROMAN [US] ET AL) 30 Septiembre 2010 (2010-09-30) páginas 3-5; figuras 1-8,12-15	1,2,4, 12-18 3,5-11
A	-----	
Y	EP 0 199 893 A2 (MAIER JOSEF) 5 November 1986 (1986-11-05) páginas 1-5; figuras 1-4	1,2,4, 12-18 3,5-11
A	-----	
A	GB 2 078 841 A (MAIER JOSEF) 13 Enero 1982 (1982-01-13) todo el documento	1-18
A	-----	
A	JP 2000 248753 A (YASHIRO SEISAKUSHO KK) 12 Septiembre 2000 (2000-09-12) figuras 4,7	1-18

☐ En la continuación del Recuadro C se relacionan otros documentos ☒ Los documentos de familias de patentes se indican en el Anexo

* Categorías especiales de documentos citados:	"T" documento ulterior publicado con posterioridad a la fecha de presentación internacional o de prioridad que no pertenece al estado de la técnica pertinente pero que se cita por permitir la comprensión del principio o teoría que constituye la base de la invención.
"A" documento que define el estado general de la técnica no considerado como particularmente relevante.	"X" documento particularmente relevante; la invención reivindicada no puede considerarse nueva o que implique una actividad inventiva por referencia al documento aisladamente considerado.
"E" solicitud de patente o patente anterior pero publicada en la fecha de presentación internacional o en fecha posterior.	"Y" documento particularmente relevante; la invención reivindicada no puede considerarse que implique una actividad inventiva cuando el documento se asocia a otro u otros documentos de la misma naturaleza, cuya combinación resulta evidente para un experto en la materia.
"L" documento que puede plantear dudas sobre una reivindicación de prioridad o que se cita para determinar la fecha de publicación de otra cita o por una razón especial (como la indicada).	"&" documento que forma parte de la misma familia de patentes.
"O" documento que se refiere a una divulgación oral, a una utilización, a una exposición o a cualquier otro medio.	
"P" documento publicado antes de la fecha de presentación internacional pero con posterioridad a la fecha de prioridad reivindicada.	

Fecha en que se ha concluido efectivamente la búsqueda internacional

6 Octubre 2014

Fecha de expedición del informe de búsqueda internacional

10/10/2014

Nombre y dirección postal de la Administración encargada de la búsqueda internacional

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Funcionario autorizado

Garmendia Irizar, A

N° de fax

N° de teléfono

Formulario PCT/ISA/210 (segunda hoja) (Julio 2008)

INFORME DE BÚSQUEDA INTERNACIONAL

Información relativa a miembros de familias de patentes

Solicitud internacional N°

PCT/ES2014/070551

US 2010242403	A1	30-09-2010	US WO	2010242403 2009055691	A1 A2	30-09-2010 30-04-2009

EP 0199893	A2	05-11-1986	AU	576670	B2	01-09-1988
			AU	5419286	A	30-10-1986
			DE	3515322	A1	30-10-1986
			DK	174286	A	28-10-1986
			EP	0199893	A2	05-11-1986
			ES	296634	U	01-12-1987
			NO	861640	A	28-10-1986
			PT	82459	A	01-05-1986
			ZA	8509289	A	26-11-1986

GB 2078841	A	13-01-1982	AR	227193	A1	30-09-1982
			AT	374874	B	12-06-1984
			AU	539508	B2	04-10-1984
			AU	7219981	A	07-01-1982
			BE	889394	A1	16-10-1981
			BR	8104072	A	16-03-1982
			CA	1148378	A1	21-06-1983
			CH	651346	A5	13-09-1985
			DE	3024511	A1	28-01-1982
			DK	278881	A	29-12-1981
			ES	268133	U	01-06-1983
			ES	268363	U	16-05-1983
			FI	811860	A	29-12-1981
			FR	2485600	A1	31-12-1981
			GB	2078841	A	13-01-1982
			IL	63135	A	30-09-1984
			IT	1137941	B	10-09-1986
			JP	H0133624	B2	14-07-1989
			JP	S5744064	A	12-03-1982
			MX	152310	A	26-06-1985
			NL	8103109	A	18-01-1982
			NO	812199	A	29-12-1981
			PT	73260	A	01-07-1981
			SE	8104026	A	29-12-1981

JP 2000248753	A	12-09-2000	NINGUNO			

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- ES 8207259 [0005]
- CN 102116080 A [0006]
- KR 20100123232 A [0006]