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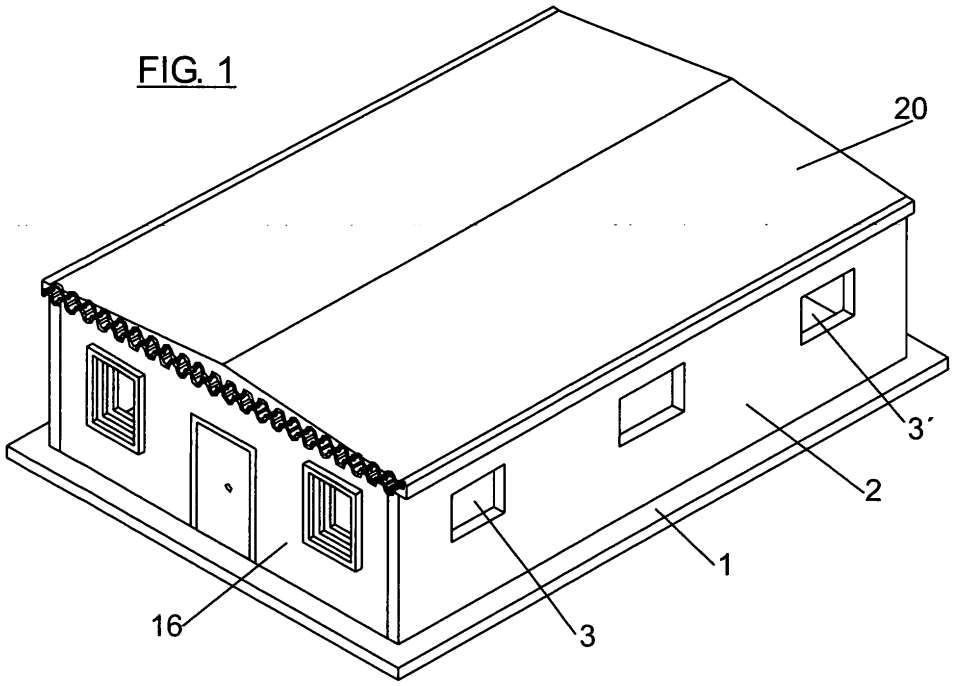
(54) SYSTEM FOR THE CONSTRUCTION OF A SEMI-PREFABRICATED BUILDING

(57) The invention relates to a system for constructing a semi-prefabricated building which is formed by a plurality of slabs corresponding to the outer walls (2-2') and (16-16'), floor (1) and roof (20) of the dwelling. The slabs are molded "in situ" on the construction site itself and the respective erection of the outer slabs (2-2') and (16-16') and the lifting of the slab (21) are carried by means of lifting means (5-6) and (5'-6') located in the gaps (3-4) and (3'-4') and openings (21) of the outer wall slabs and of the roof slab respectively, they first erect the slabs corresponding to the larger outer walls (2-2') and then those corresponding to the smaller walls (16-16') and finally the roof slab (31) is lifted. The mentioned gaps and openings respectively have anchoring elements (7) and (22) for connecting the slabs to the lifting means.

FIG. 1



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Description

Field and Object of the Invention

[0001] The invention is comprised within the field of building construction and more specifically to building construction based on semi-prefabricated concrete slabs, the type of buildings which could be constructed with this process would be buildings with small dimensions as single-family dwellings, small warehouses or industrial premises and workshops.

State of the Art

[0002] Different systems for constructing buildings with reduced dimensions from mass concrete are currently known, which concrete is poured in formwork plates or molds for its subsequent setting, mainly forming the structure of the dwelling such as footings, pillars, floorings, etc.

[0003] Different systems for constructing buildings from prefabricated concrete slabs are also known which are arranged on the sole or floor of the building to directly form the walls, floor and roof thereof. Said slabs are normally brought already shaped to the building site but in some cases they are molded "in situ", such slabs are usually formed leaving gaps therein for the windows and doors of the building.

[0004] The stowing operations of the mentioned slabs, which have large weights, are normally carried out through expensive installations for lifting them such as cranes with a considerable size, which must have a large amount of space in the construction site for their stable locking to the ground, having to use auxiliary means such as for example hooks, straps or similar elements for securing and handling the mentioned slabs during the stowing and transport operations thereof. In addition to the high costs and the large amount of time consumed in the mentioned stowing operations, accidents usually occur during such operations due to the breakage of the auxiliary securing elements which can trigger both personal and material losses if the slab falls from a great height, both the slab itself and the elements of the building being able to be completely or partially lost.

[0005] Due to the above, a need has been detected to provide a process for constructing the mentioned type of buildings which, starting from simple lifting means for lifting the slabs, achieves that the stowing operations are highly simple and with a low cost, to that end the use of a plurality of lifting means fixed to the base or sole of the building has been considered, which means are located in the gaps that the slabs have for the arrangement of windows and doors, anchoring means for anchoring the slab to the mentioned lifting means being arranged in said gaps, the slabs being lifted and placed in an erect position in a controlled and highly safe manner.

[0006] This objective is achieved by means of the invention as it is defined in claim 1, the preferred embodiments of the invention are defined in the dependent claims.

Description of the Invention

[0007] The present invention relates to a system for constructing a semi-prefabricated building which is formed by a plurality of slabs corresponding to the outer walls, floor and roof of the building, the outer wall slabs having a plurality of gaps corresponding to the windows and doors.

[0008] The system is characterized in that two of the outer wall slabs are located parallel to one another in a horizontal position on the floor slab, one of the sides of each wall being aligned respectively with one of the parallel edges of the floor slab, lifting means being fixed on the floor slab, which means have a fixed part and another moving part with respect to said slab, being located in the gaps of the windows of the outer wall slabs and the moving part of said lifting means remaining joined to anchoring elements located in the mentioned gaps and fixed to the slabs, the outer wall slabs being lifted due to the lowering thereof with respect to their lower edge until said slabs are located in an erect position and a support structure subsequently being placed on the gaps of the windows opposing one another of each of the outer wall slabs, which support structure is in turn fixed to both slabs by means of fixing elements, repeating the described operations for the case of the other two outer walls and joining the slabs of the four outer walls to one another.

[0009] Furthermore, the roof slab is located in the gap delimited by the four outer walls, and supported on the floor slab, which roof slab has a plurality of openings located in coincidence with the position of the lifting means used in the previous steps, the moving part of said lifting means being joined to anchoring elements located in the mentioned openings, the roof slab being lifted to a height above the height of the outer wall slabs, the roof slab being joined to the upper edge of the slabs of the four outer walls.

[0010] In this way, due to simple lifting elements, the walls of the building are placed in a vertical position and the roof is lifted quite simply, not being necessary to use expensive lifting means such as cranes. Furthermore, with the described configuration of the system, the same lifting elements can be used to lift both the outer wall slabs and the roof slab.

[0011] The outer wall slabs can have at least one gap for the windows.

[0012] The lifting means can in turn comprise a plurality of hydraulic jacks, at least one of said hydraulic jacks being locates in at least two of the gaps of the windows of the outer wall slabs.

[0013] The system can operate with a single lifting element per outer wall slab (a single gap of a window) provided that the weight of the slab is such that it is supported by the mentioned hydraulic jacks, in the event that said weight is exceeded, more than one lifting elements

must be used for each slab, its number being determined based on the properties of each jack and the weight of the slab.

[0014] To join the outer wall slabs to one another, at least two metal reinforcing bars in the form of an angle bracket can be used, one of them being located on the inner face of the mentioned slabs and the other one on the outer face and being fixed to one another and to the corresponding slab, subsequently pouring mass concrete.

[0015] A stable and safe joining between the slabs of the four outer walls is thus achieved.

[0016] The outer wall and roof slabs can have a plurality of pins perpendicular to the joining edges between said slabs, the ends of said pins being curved.

[0017] With the described shaped and placement of the pins it is achieved that the joinings between slabs are more rigid and resistant to the different stress which the building is subject to.

[0018] The pins corresponding to the roof slab can initially be bent and when the roof slab is lifted above the upper edge of the outer wall slabs, said rods are straightened.

[0019] It is thus possible for the roof slab to fit in the gap left by the slabs of the four outer walls when said roof slab is deposited on the floor slab, to later, once said roof slab has been lifted, straighten said pins which will be useful as resistant elements in the joining of the roof slab with the outer wall slabs.

[0020] The anchoring elements, located in the gaps of the windows of the outer wall slabs and which are connected to the moving part of the lifting means, comprise at least one rod having a curved central portion for its seating on said moving part and the ends of which are joined to the slab in the stage of molding it.

[0021] Said rods are useful for hanging the slabs on the moving part of the lifting means, which moving part will have a stem perpendicular to the direction of movement of said moving part with respect to the fixed part.

[0022] The support structure can further be formed by two parallel bars, on each of which the fixing elements for fixing the support structure to the outer wall slabs are located, said joining means comprising two clamps, one of which is located on the inner face of the wall slab and the other of which is located on the outer face thereof, respective threaded bushings being located after said clamps, which bushings will have the possibility of being threaded on threaded sections made in each of the bars.

[0023] By means of the mentioned clamps, the support structure and the two slabs connected by it are aligned and solidly joined to one another, forming in turn a stable structure preventing said slabs from falling to the ground due to their own weight.

[0024] Finally, the reinforcing bars used for joining the roof slab with the outer wall slabs comprise an inner angle bracket and an outer mold provided on one of its faces with a wavy surface, defining a projection in the cornice of said roof slab after it is joined to the mentioned outer wall slabs by means of mass concrete.

[0025] The integral joining between the roof slab and the outer wall slabs is thus achieved, there being a wavy ending in the cornices of the building which has a great aesthetic value.

Description of the Drawings

[0026] A series of drawings is very briefly described below which aid in better understanding the invention and which are expressly related to several embodiments of said invention, which are set forth as illustrative and non-limiting examples thereof.

Figure 1 shows a perspective view of an example of a building constructed by means of the system object of the present invention.

Figure 2 shows a plan view of an example of a distribution in which the different rooms of a building constructed by means of the system object of the present invention can be seen.

Figure 3 shows an upper plan view of the floor slab and of the two slabs corresponding to two of the parallel outer walls in a first step of constructing the building according to a system object of the present invention.

Figure 4 shows a plan view similar to that shown in Figure 3 for a second variant of the system object of the present invention in which the outer wall slabs and the floor slab will be joined.

Figures 5A to 5C show respective sectional views according to section plane I-I of Figure 3 in which the different stages of assembling two of the outer walls of the system object of the present invention can be seen.

Figure 6 shows a sectional view according to section plane I-I of Figure 3, showing a last step of assembling two of the outer walls when they are erect, as well as a detail of the joining of the auxiliary structure to the outer walls.

Figure 7 shows a plan view of the floor slab and the four slabs corresponding to the outer walls before they are joined.

Figure 8 shows an upper plan view of the floor slab on which the roof slab is located before being lifted on it.

Figures 9A and 9B show a sectional view according to section plane II-II of Figure 8, showing the respective steps of the process for lifting the roof slab with respect to the floor slab and the outer wall slabs.

Description of an Embodiment of the Invention

[0027] Figure 3 shows a plan view of a first step of the building process using the system object of the present invention. Specifically a baseplate (1) is observed which forms the floor of the dwelling and is formed by a prefabricated concrete slab, on which two of the outer walls

(2-2') are arranged, said outer walls (2-2') are also prefabricated concrete slabs and each of them has two gaps (3-4) and (3'-4') respectively for the windows, although it could have any number of windows such as a single window for example.

[0028] The mentioned gaps (3-4) and (3'-4') have been shaped at the same time as the slab itself is shaped by molding by means of mass concrete.

[0029] Inside the gaps left by the windows and anchored to the baseplate (1), there are arranged respective lifting means (5-6) and (5'-6') consisting particularly of hydraulic jacks, also being able to be pneumatic jacks or any other similar lifting means.

[0030] The windows in turn have anchoring elements, said elements, in this embodiment of the invention, are corrugated steel rods (7-7') having a curvature in their central area and which are introduced (inserted) in the concrete in the stage of shaping the outer wall slabs (2-2'). The curved area of said rods (7-7') defines an anchoring point with the lifting means (5-6) and (5'-6') and more specifically with the moving part (8) thereof through a stem (9) perpendicular to said moving part.

[0031] The lifting means (5-5') and (6-6') will be joined to one another by means of respective bars 31, for the purpose of maintaining the relative position between them and will in turn be fixed to the floor slab (1), using to that end known means such as screws and rivets. The lifting means (5-6) and (5-6') have the possibility of rotation with respect to the floor plate (1) thanks to a ball joint (10), said rotation occurring in a plane perpendicular to the floor slab (1) and to the outer wall slabs (2-2') themselves. Given that the outer wall slab (2) is linked the rod (7) which is in turn connected to the moving part (8) of the lifting means and that the lifting means (5-6) remain fixed with respect to the floor slab (1), when said lifting means (5-6) are actuated, the moving elements (8) move with respect to the fixed elements and therefore the floor slab (1) and the outer wall slab (2) rotate or better said, it is lowered with respect to an axis coinciding with one of the lower edges for the support on the floor slab (1).

[0032] This lowering movement can be seen clearly in Figures 5A-5C. The rod (7) will logically be able to rotate with respect to the stem (9) to thus be able to convert the linear movement of the lifting element (5-6) into a lowering movement of the outer wall slab (2).

[0033] The process for lifting is prolonged until it is achieved that the outer wall slab (2) is completely erect and therefore perpendicular to the floor slab (1).

[0034] Both outer wall slabs (2-2') are lifted in one and the same operation, the two standing walls being located in a parallel manner. An auxiliary support structure (11) which is introduced through the gaps (3-3') or (4-4') corresponding to opposing windows corresponding to each of the outer wall slabs (2-2') is used to prevent said outer wall slabs (2-2') from falling due to their own weight.

[0035] Said support structure (11) is formed by at least two parallel bars (30) joined to one another by a plurality of bars which are inclined with respect to them, determining a spatial structure. Joining means for the joining to the windows are arranged on the free ends of each of said bars (30), specifically each of the bars will be joined to one of the lateral sides of the gaps of the windows. The mentioned joining means comprise two clamps (13-14), one of which (14) is located on the inner face of the wall slab and the other of which (13) is located on the outer face thereof, as can be seen in the detail of Figure 6, respective threaded bushings (15) being located after said clamps, which bushings will have the possibility of being threaded on threaded sections made in each of the bars (30). In a preferred embodiment of the invention, the mechanisms that are currently used to place and lift scaffolds, which will be welded to the ends of the bars (30), leaving enough space between them greater than the thickness of the slabs forming the outer walls (2-2'), will be used.

[0036] As a result of the structure (11) and its due fixing to the outer wall slabs (2-2'), it is achieved that the stability of the assembly is greater and that said slabs do not fall to the ground due to their own weight.

[0037] The same process is carried out with the slabs corresponding to the other two outer walls (16-16') of the building which are perpendicular to the slabs (2-2'), i.e. they are located horizontally on the floor slab (1), lifting means (5-6) and (5'-6') being used, being able to use the same elements for the outer wall slabs (2-2') or other independent elements and a similar support structure (11), thus stowing the four outer wall slabs (2-2') and (16-16') of the building to subsequently join them to one another, as can be seen in Figure 6.

[0038] The slabs of the four outer walls (2-2') and (16-16') are joined perpendicular to one another by means of corrugated rod pins (17) with bent ends integrated in the slabs themselves during the process of prefabricating such slabs, such pins (17) correspond to the ends of the mat reinforcement which are included inside the slabs during the "in situ" molding thereof.

[0039] The slabs of the four outer walls (2-2') and (16-16') are joined using respective metal reinforcing bars (18-19) for each of the edges of the building. Specifically, two metal reinforcing bars in the form of an angle bracket will be used, one of them (18) being located on the inner face of the mentioned slabs and the other one (19) being located on the outer face and being fixed to one another and to the corresponding slab to subsequently pour the mass concrete in the gap existing between contiguous slabs and thus join slabs of the four outer walls (2-2') and (16-16') in a safe and long-lasting manner.

[0040] The walls of the house are thus lifted, only the roof remains to be lifted, which is lifted as follows.

[0041] Figure 8 shows how the roof slab (20) is located on the floor slab (1) in the gap left by the four outer wall slabs (2-2') and (16-16') once they have been joined. The roof slab (20) has at least four openings (21), circular in this case, to allow the passage of respective lifting means (5-6) and (5'-6'). Each of the openings (21) has engaging

means similar to those used in the case of the outer wall slabs, which means consist of bent rods (22) introduced in the roof slab (20) itself during the process for molding such slabs, which rods define a connection point with the lifting means (5-6) and (5'-6') such that when the moving part of the four lifting means is lifted at the same time, the roof slab (20) is in turn lifted parallel to the floor slab (1) until reaching a height approximately equal to the height of the outer walls. On this occasion, the lifting means (5-6) and (5'-6') will be fixed to the floor slab (1) such that its rotation with respect to said slab is not possible, using a bushing fixed the floor slab (1) or a similar element which can retain the fixed part of the lifting means (5-6) and (5'-6') without it rotating.

[0042] The roof slab (20) in turn has a plurality of pins (23) by way of a hook made of corrugated steel, integrated in the slab in the molding process using a mat reinforcement, with the particularity that said pins (23) are bent at the time of placing the roof slab (20) on the floor slab (1) so that said roof slab (20) and its corresponding pins (23) fit in the gap between the outer wall slabs. Once the roof slab (20) has been lifted, the mentioned pins (23) are straightened, extending beyond the upper edge of the outer wall slabs (2-2') and (16-16').

[0043] As can be seen in Figure 9A, the upper edge of the outer wall slabs (2-2') and (16-16') and the roof slab (20) are joined due to the mentioned pins (23) and the pins (24) of the slabs forming said outer walls, with the aid of respective metal reinforcing bars that are normally formed as a sheet, one of which (25) is angular and located on the inner face of both the roof slab (20) and of the corresponding outer wall slabs and a caisson (26) or outer mold which is fixed to the outer face of the outer wall slabs, there being defined a space on which the mass concrete will be poured to join the mentioned slabs.

[0044] Figure 4 shows a variant of that shown in Figure 3, in which the floor slab (1) has mortises (27) for introducing the lower pins of the outer wall slabs (2-2') once they have been lowered and completely erected.

[0045] The windows at their upper part can have moldings coupled thereto (Figure 1) with a staggered configuration to make the architectural assembly of the dwelling more aesthetic, such moldings can be independent for each side of the frame of the window or can be one-piece, being coupled directly to the frame of the mentioned window.

[0046] The mentioned caisson (26) used to join the roof slab (20) with the outer wall slabs (2-2') and (16-16') can have a wavy configuration, being able to define a staggering with a wavy profile, as can be seen in Figure 1, to imitate the appearance that a conventional roof formed from tiles would have and thus make the building more aesthetic.

[0047] Figure 2 in turn schematically shows an example of the inner distribution of a building constructed by means of the method object of the present invention, said building having a rectangular prismatic base and in which a series of rooms (40-46) can be seen and in which a plurality of support columns (35) arranged at specific points of the building such that they can support the weight of the roof slab (20) is especially shown. Such columns will be placed immediately before removing the lifting means (5-6) and (5'-6') when the roof slab (20) has been completely lifted and it has been joined with the outer wall slabs (2-2') and (16-16'). The mentioned columns will be securely joined to both the floor slab (1) and the roof slab (20) using known joining means.

Claims

1. A system for constructing a semi-prefabricated building which is formed by a plurality of slabs corresponding to the outer walls, floor and roof of the dwelling, the outer wall slabs (2-2') and (16-16') having a plurality of gaps (3-4) and (3'-4') corresponding to the windows and doors, **characterized in that** two of the outer wall slabs (2-2') are located parallel to one another in a horizontal position on the floor slab (1), one of the sides of each wall (2-2') being aligned respectively with one of the parallel edges of the floor slab (1), lifting means (5-6) and (5'-6') being fixed on the floor slab (1), which means have a fixed part and another moving part (8) with respect to said slab, being located respectively in the gaps (3-4) and (3'-4') of the windows of the outer wall slabs (2-2') and the moving part (8) of said lifting means remaining joined to anchoring elements (7) located in the mentioned gaps and fixed to the slabs, the outer wall slabs (2-2') being lifted due to the lowering thereof with respect to their lower edge until said slabs are located in a vertical position and a support structure (11) being subsequently placed on the gaps (4-4') of the windows opposing one another of each of the outer wall slabs, which support structure is in turn fixed to both slabs (2-2') by means of fixing elements, repeating the described operations for the case of the other two outer walls (16-16') and joining the slabs of the four outer walls (2-2') and (16-16') to one another, and **in that** the roof slab (20) is located in the gap delimited by the four outer walls (2-2') and (16-16') and supported in the floor slab (1), which floor slab has a plurality of openings (21) located in coincidence with the position of the lifting means (5-6) and (5'-6') used in the previous steps, the moving part (8) of said lifting means (5-6) and (5'-6') being joined to anchoring elements (22) located in the mentioned openings, the roof slab (20) being lifted to a height above the height of the outer wall slabs (2-2') and (16-16'), the roof slab (20) being joined to the upper edge of the slabs of the four outer walls (2-2') and (16-16').

2. A system according to claim 1, **characterized in that** each of the outer wall slabs (2-2') and (16-16') has at least one gap for the windows.

3. A system according to claims 1 and 2, **characterized in that** the lifting means (5-6) and (5'-6') comprise hydraulic jacks, at least one of said hydraulic jacks being located in at least two of the gaps of the windows of the outer wall slabs (2-2') and (16-16').

4. A system according to any of the previous claims, **characterized in that** at least two metal reinforcing bars (18-19) in the form of angle bracket are used to join the outer wall slabs (2-2') and (16-16'), one of such bars (18) being located on the inner face of the mentioned slabs and the other bar (19) being located on the outer face, and being fixed to one another and to the corresponding slab, subsequently pouring the mass concrete.

5. A system according to any of the previous claims, **characterized in that** the outer wall slabs (2-2') and (16-16') and the roof slab (20) have a plurality of pins (24) and (23) respectively perpendicular to the edges of said slabs, said pins having curved ends.

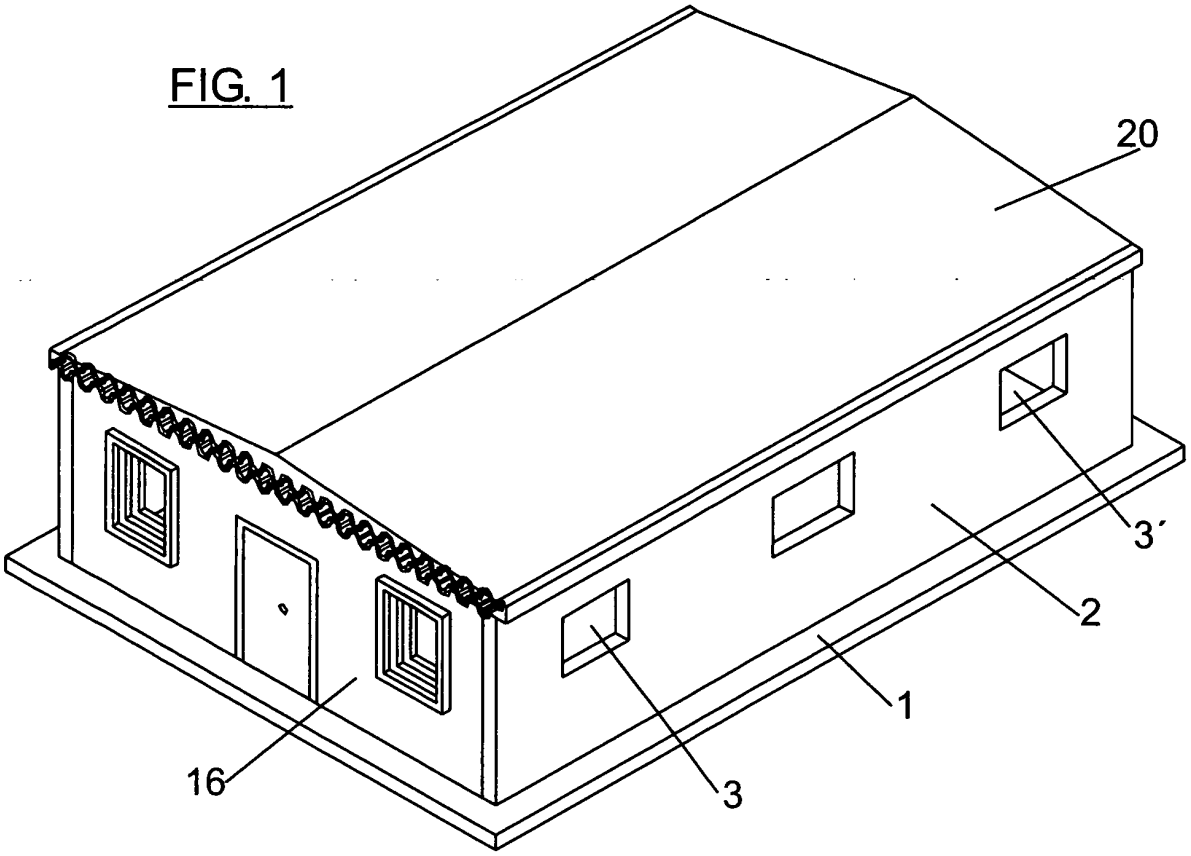
6. A system according to claim 5, **characterized in that** the pins (23) corresponding to the roof slab (20) are initially bent and when the roof slab (20) is lifted above the upper edge of the outer wall slabs (2-2') and (16-16'), said rods (23) are straightened.

7. A system according to any of the previous claims, **characterized in that** the anchoring elements (7), located in the gaps of the windows of the outer wall slabs and connected to the moving part (8) of the lifting means (5-6) and (5'-6'), comprise at least one rod having a curved central portion for its seating on said moving part (8) and the ends of which are joined to the outer wall slab (2-2') and (16-16') in the stage of molding it.

8. A system according to any of the previous claims, **characterized in that** the support structure (11) is formed by two parallel bars (30), the fixing elements for fixing the support structure (11) to the outer wall slabs (2-2') and (16-16') being located on each of such bars, said joining means comprising two clamps (13-14), one of which (14) is located on the inner face of the wall slab and the other of which (13) is located on the outer face thereof, respective threaded bushings (15) being located after said clamps, which bushings will have the possibility of being threaded on threaded sections made in each of the bars (30).

9. A system according to any of the previous claims, **characterized in that** the reinforcing bars used to join the roof slab (20) with the outer wall slabs (2-2') and (16-16') comprise an inner angle bracket (25) and an outer mold (26) provided on each of its faces with a wavy surface defining a projection in the corner of said roof slab (20) after it is joined to the mentioned outer wall slabs (2-2') and (16-16') by means of mass concrete.

FIG. 1



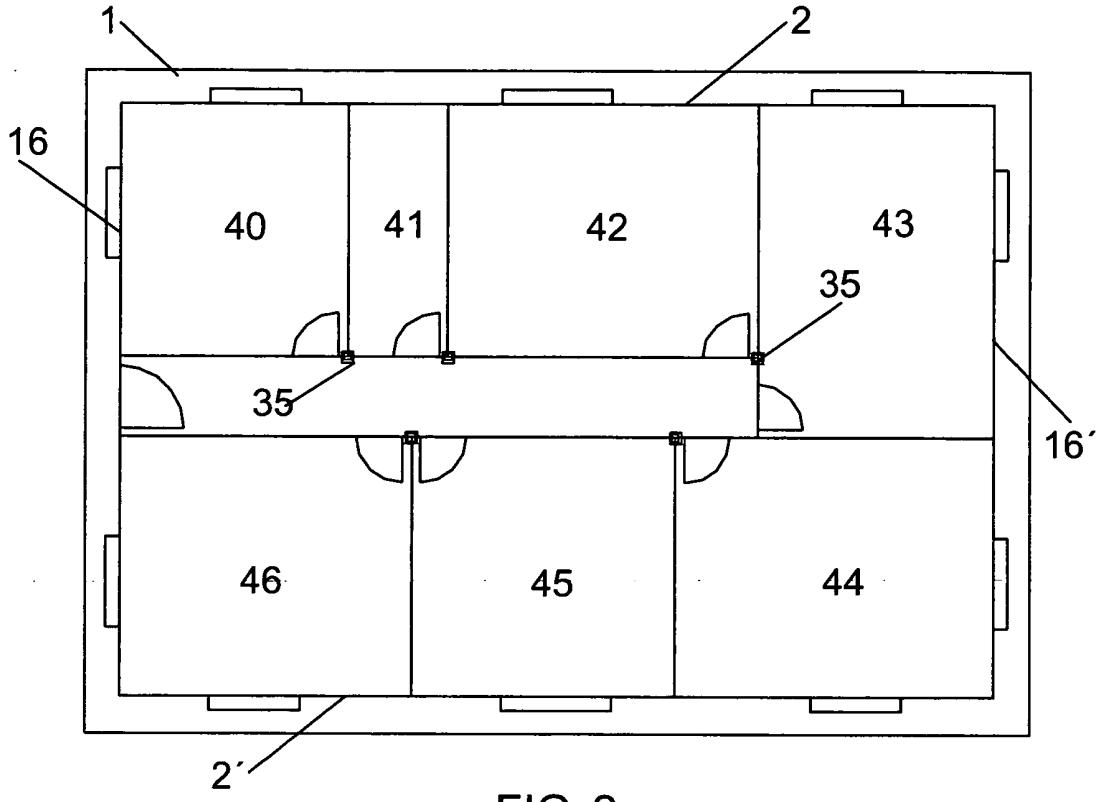


FIG. 2

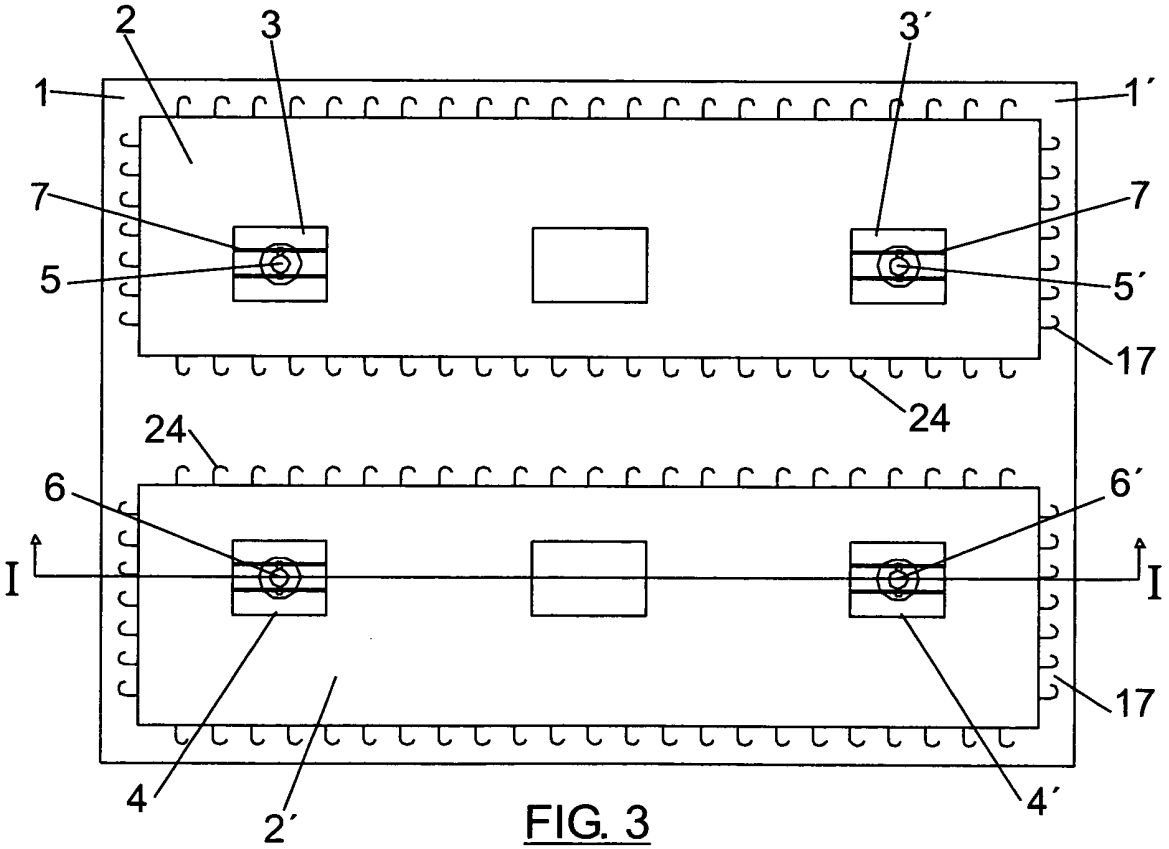


FIG. 3

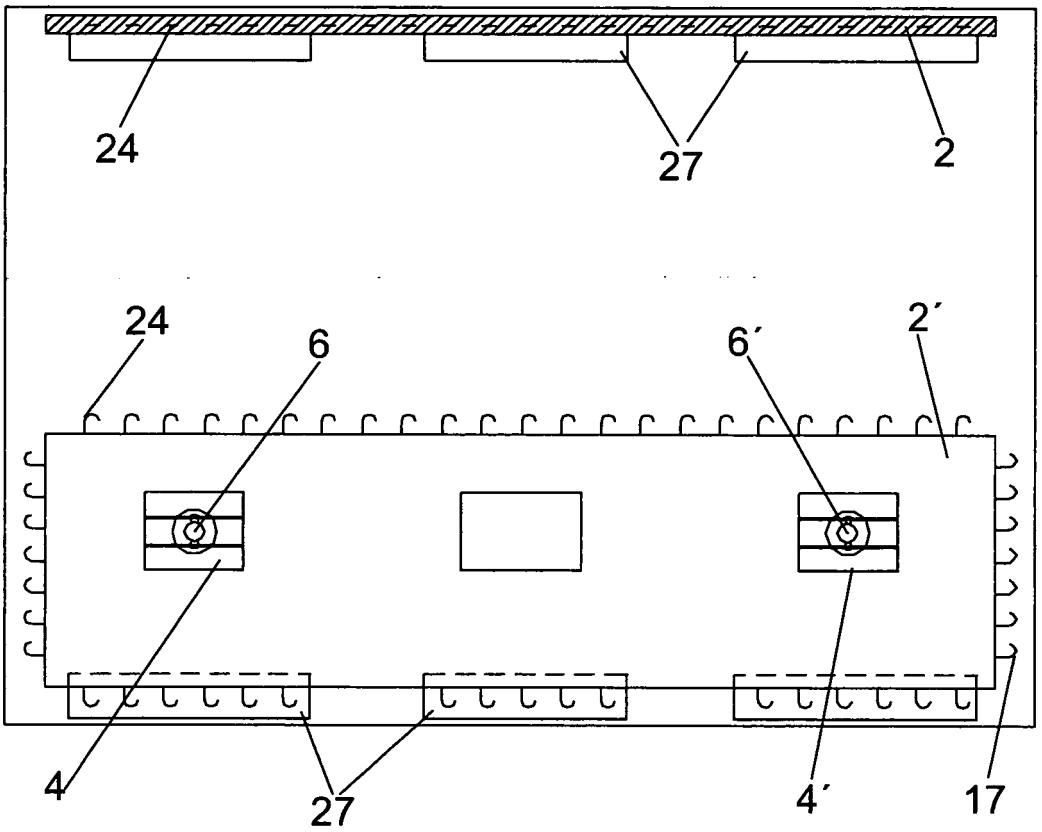


FIG. 4

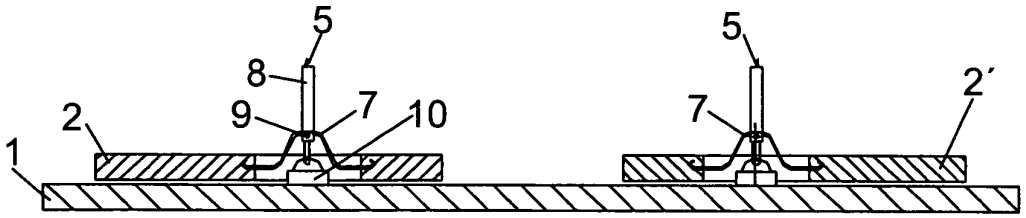


FIG. 5A

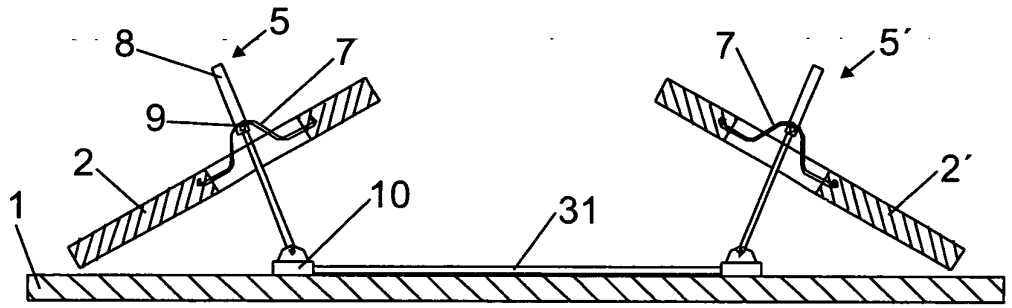


FIG. 5B

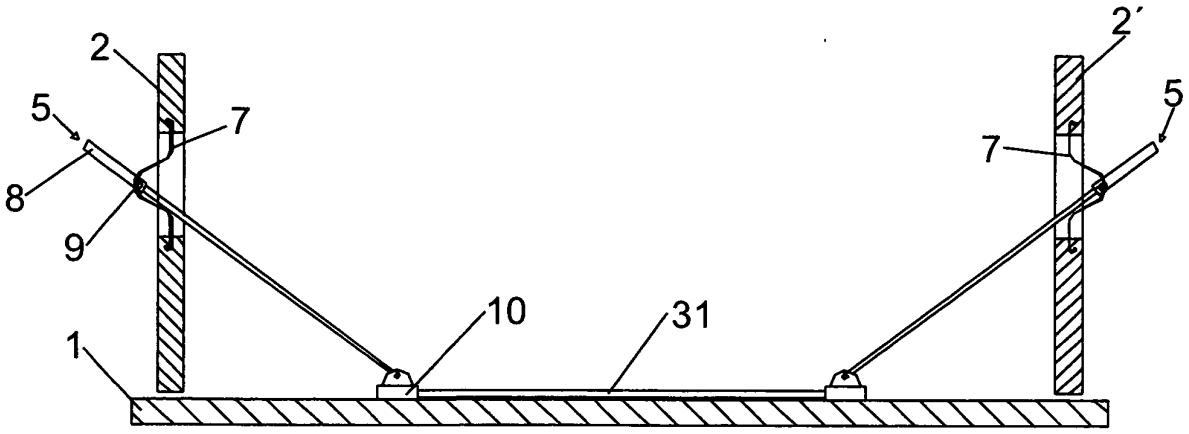


FIG. 5C

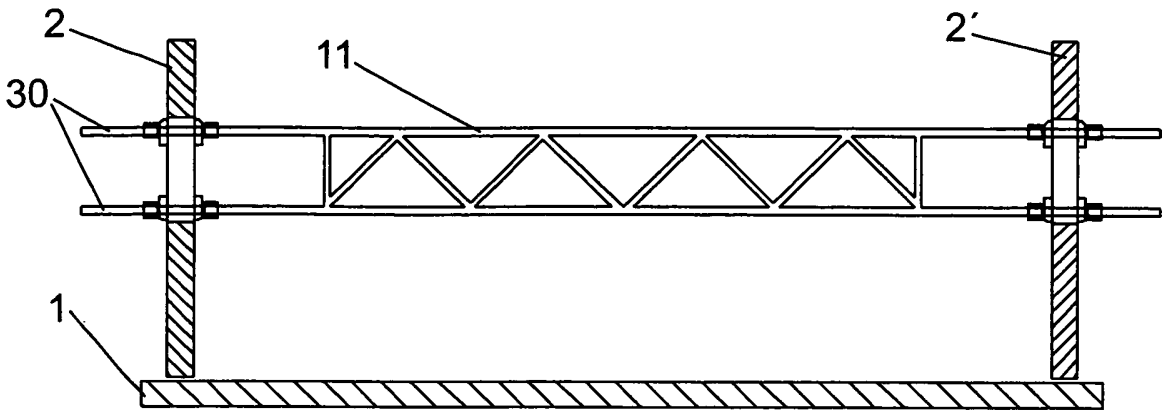


FIG. 6

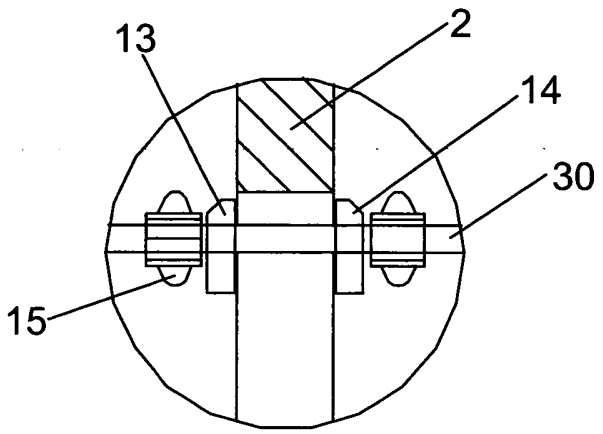
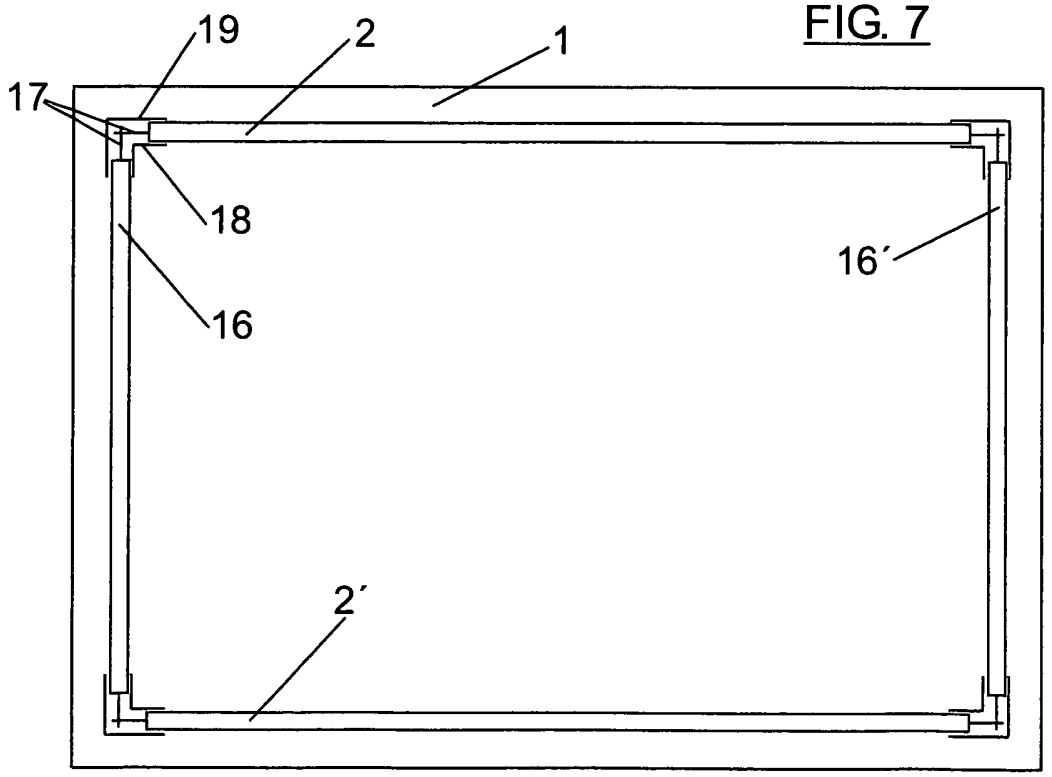


FIG. 7



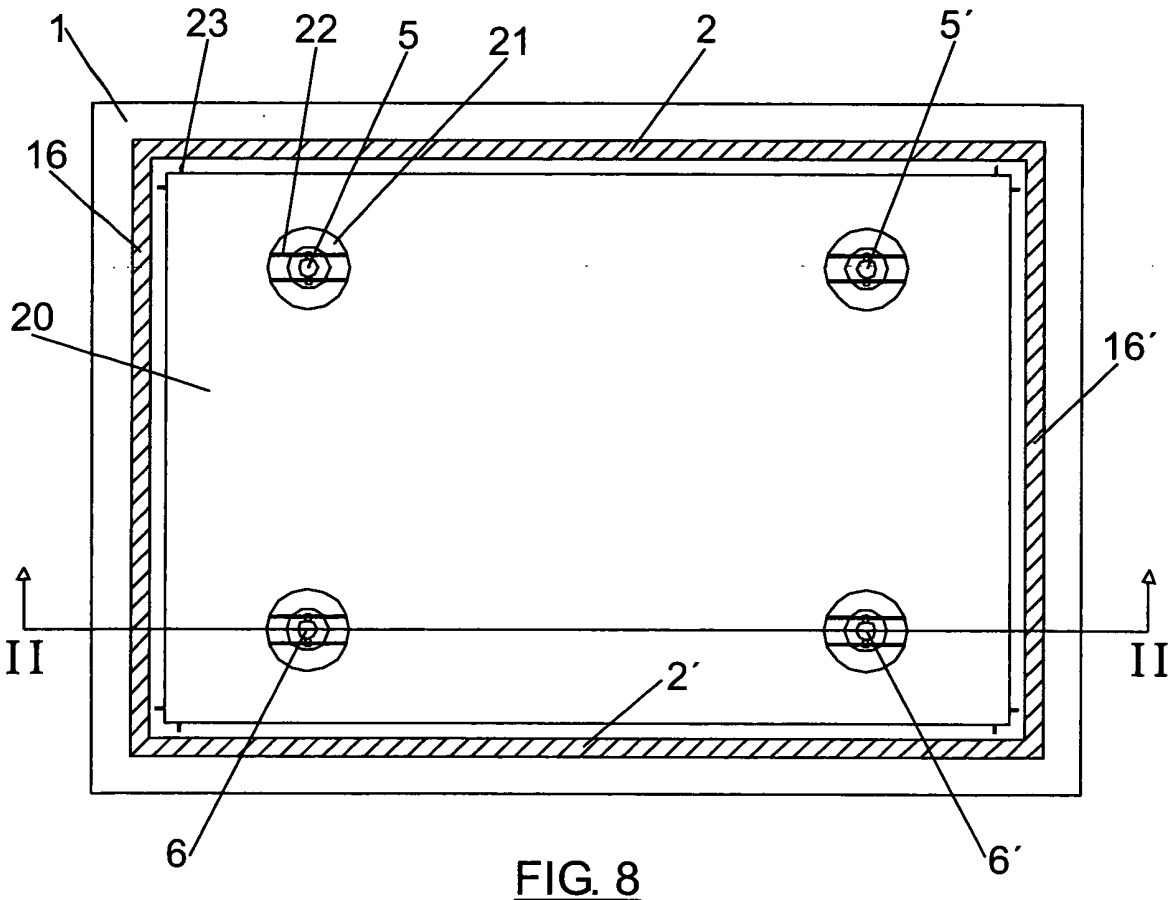


FIG. 8

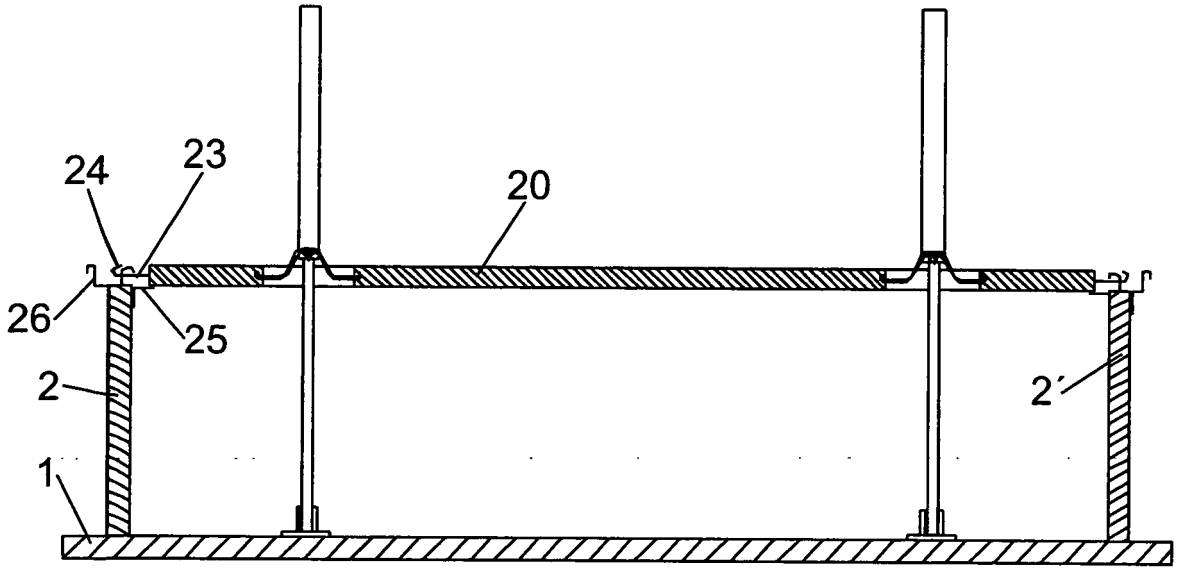


FIG. 9A

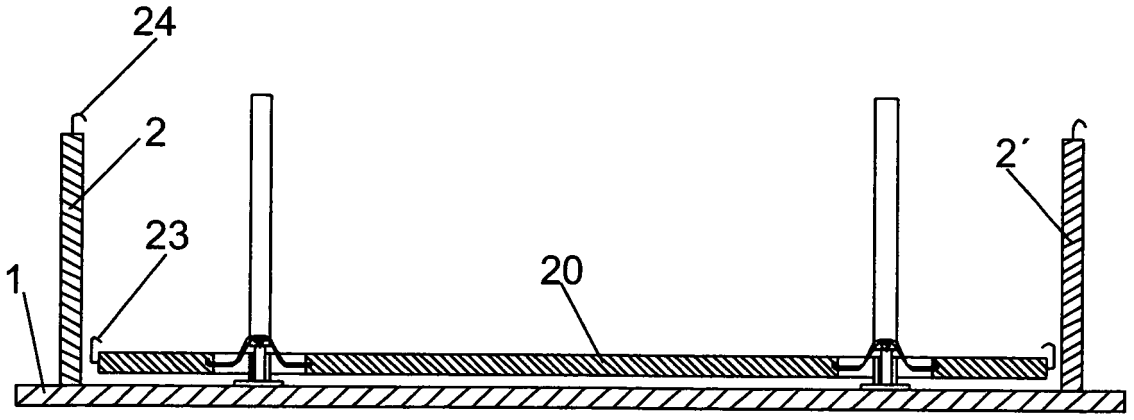


FIG. 9B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2007/000029

A. CLASSIFICATION OF SUBJECT MATTER

E04B 1/35 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E04B, E04G,E04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT,EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2450326 A1 (SERVICES CONSTRUCTION SARL) 26.09.1980, the whole the document.	1-4
A	US 1538815 A (HUNTER et al.) 19.05.1925, the whole the document.	1-5
A	FR 2213388 A1 (WARTELLE RENE) 02.08.1974, the whole the document.	1-3
A	DE 2125803 A1 (KÜPPERS THEODOR) 07.12.1972, figure 1.	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance.
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"P" document published prior to the international filing date but later than the priority date claimed
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 May 2007 (07.05.2007)	(21/05/2007)
Name and mailing address of the ISA/ O.E.P.M. Paseo de la Castellana, 75 28071 Madrid, España. Facsimile No. 34 91 3495304	Authorized officer S. Fernández de Miguel Telephone No. +34 91 349 5437

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/ ES 2007/000029

Patent document cited in the search report	Publication date	Patent family member(s)	Publication date
FR2450326 6 A	26.09.1980	NONE	----------
US1538815 5 A	19.05.1925	NONE	----------
FR2213388 8 A B	02.08.1974	NONE	----------
DE2125803 3 A	07.12.1972	NONE	----------

Form PCT/ISA/210 (patent family annex) (April 2007)