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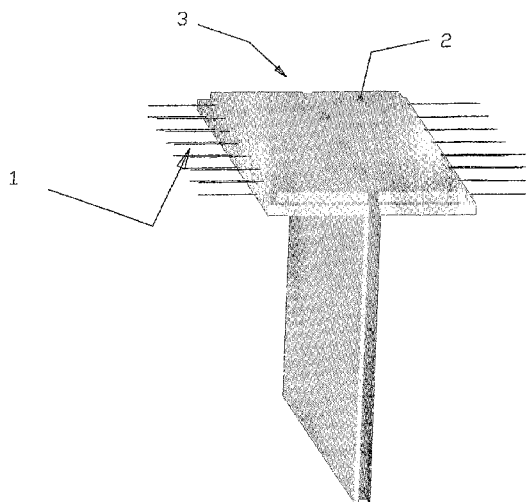
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(54) Title: PRECAST CONCRETE BUILDING UNITS



(57) **Abstract:** This hybrid pre-cast / cast insitu panels invention consists of three, stepped down slabs with protruding steel bars (1) to connect to a central cast insitu sections that allow steel to run not only between the sandwiching panels but also at right angles throughout length of room past the supports and on to the adjacent bays on either side thereby distributing the generated moments to all four room supports and even beyond to the adjacent bays on all sides due to the stiff formed monolithic slab, concurrently shear is reduced by distributing it to not two but all four sides. Walls and column moments are reduced due to their flexible connection to the slabs and due to their running continuously from footings to the roof. Thus this invention widens the scope of applications of structural pre-cast concrete with thinner slabs carrying more loads over longer spans, thinner walls and columns making even the foundations lighter; ideal for high rises and large spaces such as malls and garages that have high stresses using relatively small standard pre-cast off the shelf panels to create large structures.



WO 2008/019699 A1

## PRECAST CONCRETE BUILDING UNITS

### DATAILED DESCRIPTION

#### TECHNICAL FIELD

Concrete pre-cast / cast insitu panels.

#### BACKGROUND ART:

In the previous invention we depended primarily on the rigidity and non-flexibility of joints between the walls and the floor slabs maintained at right angles to redistribute the moments that so often are excessive for varying durations of time (to the adjacent slabs and floors thereby alleviating the slab moments. This redistribution enabled the use of thinner floor slabs. Said invention served its purpose however it had its limitations, as in high rises where redistributing moments from slabs to walls and columns that already have tremendous cumulative axial loads on the walls and columns necessitated much thicker columns which rendered panel economically and esthetically unfeasible. The same applied to large open space slabs such as found in malls and some office buildings where a large space adjacent to a small one exerting severe axial loads and moments.

There were many other limitations for the usage of pre-cast concrete, such as only one way loading (to the two opposite supporting walls or beams such as in hollow core pre-stressed pre-cast ) and the inability to have a rigid continuous floor slab, or a smooth ceiling surface or one that could extend rigidly and continuously in both its horizontal directions; so the need for an "off the shelf" panel that could do all this was needed, one that would almost fit any where ( designed for that class of loadings); one where the structure can be built and the wiring done later with no disturbances to panel or any adjacent panels, where large openings on one side or even an open space garage or mall with standard panel sizes would be constructed with great speed and ease. Since rooms are four sided so if distribution is done to all four sides each side share will be about one quarter of weight and even less for moments (as redistribution to adjacent panels would even reduce moments further). From all the above the need for a new pre-cast concrete system arose, one with thinner slabs columns and walls, one that would redistribute stresses to all four sides and not aggravate (increase) the walls and column moments.

#### DISCLOSURE OF INVENTION

This invention enlarges the scope of applications of an earlier similar pre-cast /cast insitu panel to now include high rises / multiple story buildings and large open spaces in addition to the previous applications - rigid heavy load bearing walls ( which these new panels can also do provided shear is accounted for by other means). Invention serves well that are not necessarily balances on either side of columns /walls and distributes the loads and moments to all four walls rather than two walls or beams such as in the hollow core that like this new system has the advantages of speed of erection and being pre-cast however in this new innovation a rigid robust monolithic fare face ceiling is produced with an even smaller slab depth and a one size fits all panel illuminating the need for several sizes all this is achieved by distributing the weight to all four and redistributing

moments beyond the boundaries of slab to all four adjacent panels as floor acts as one monolithic rigid continuous slab connected flexibly to the walls and columns below in order not to transfer and additional moments to them from the slab above. This system reduces the weight of the slabs and thus the building and its foundations especially in multi stories where slab thickness and weight can accumulate. One can add an extra story every about twenty from the weight and height saved.

This is a composite, pre-cast, cast insitu concrete system with a pre-cast panel having a cross-section in the shape of a capital "T" that forms a room when two such panels are connected by means of a middle cast insitu (cast on site) concrete section. The slab is connected by means of a flexible steel connection to a wall that lies centered below slab. Hollow centered shafts penetrate the panel from its bottom to the top of the slab; when aligned with panels above and below, filled with steel that runs continuously from foundations to roof then concrete is poured on it; a solid continuous column is formed with no interruptions.

This three dimensional panel is used to construct buildings that are essentially horizontal planes (floor slabs) penetrated by vertical walls (or columns). All planes in their respective two dimensions are envisioned rigid, nonflexible; penetrated by planes at right angles to them at the point / lines of intersection of planes yet each plane continues onward unencumbered by the moments of the intersecting plane as the connection between the two planes is a hinge connection restraining only horizontal and thus a vertical movements

The intersecting plane as the slabs resting on the walls / columns do not transfer moments to the vertical members or receive moments from them large building is formed using a one size small off the shelf pre-cast panel that fits almost all cases. These panels provide continuity due to their rigidity by redistributing and transferring parts of the moments to the adjacent slabs on either side of the two forming panels.

In the center part of room that is cast on site, steel bars run perpendicular to the two panels overlapping the steel bars protruding from sandwiching panels on either side, steel bars also run parallel to the panel walls and continue on uninterrupted to the adjacent slabs on either side. This feature transforms the system enabling it to redistribute moments to all four adjacent panels rather just two as the slab is transformed into a monolithic rigid surface over the four room boundaries able to redistribute the moments to all four adjacent slabs to help alleviate the moments. The weight is also distributed to all four sides, cutting down the shear. Since there is a flexible moment connection between slabs and walls / columns, no moment is transferred to walls or columns which is advantages in high rises where axial loadings are already excessive. The same case goes for large slabs that can exert considerable moments on columns if slab column connection is very stiff; these columns are helped in this system by making them continue uninterrupted from footings to roof. Thus slabs and columns are reduced in size using this new system. The square stepped down slab with protruding steel and a column centered under it with at least part of its steel cage is the second panel introduced here where four such panels are placed each in a room corner and as the previous panel, steel is running both horizontal directions also overlapping the panels protruding steel as well as running continuously between panels ( also after placing a form to support steel and pouring concrete on site to connect the four corners making a room also with moments being redistributed to adjacent slabs on all four sides to help alleviate stresses. The third and

last panel is a stepped down slab similar to the first one protruding steel bars extending about half a meter at regular intervals along the longer slab sided, however this one has a monolithic beam cast with and under slab. This panel operated in the same way as the previous two as far as the connecting central cast on site part ,however this panel is used where large openings are necessitated on one side of room.

### **BRIEF DESCRIPTION OF DRAWINGS**

A beam under the slab in a beam-slab composite, cast monolithically with slab running the length of slab if not longer.

#### **FIG - 1**

A square, horizontal panel stepped down to half its thickness about 10 cm. from all four edges reinforced by means of steel bars running horizontally and parallel through slab and protruding about half a meter on all four sides in vertical pairs close to top and bottom slab surfaces.

A hollow column is centered below slab by means of a flexible pinned connection to the slab above. A steel cage in the middle of column is filled with concrete either at site or pre-cast with exterior column concrete shell at factory.

#### **FIG - 2**

1 - Steel reinforcing bar running through short side of slab at regular intervals protruding about half a meter on either side.

2 - One of several hollow shafts penetrating panel both wall and slab centered in wall.

3 - A concave end cavity on either side of panel running the vertically through height of wall.

4 - A non rigid steel connection between slab and wall.

#### **FIG - 3**

1 - Steel reinforcing bars running continuously through slab just inside surface of pre-cast panel protruding about 50 cm on either side as one bar or in sets of two one layer above the other.

2 - Hollow shafts running continuously through entire panel from top to bottom

3 - Concave endings on either side of wall panel.

4 - Steel reinforcing bars running continuously through hollow shafts provided in panels.

5 - Conduits on either side of wall panels running each in two layers at about 30 cm and one meter from bottom of panel.

6 - Opening made by aligning of two adjacent panels' stepped down top half of the slab at panels' wall ends.

7 - Flexible conduit connecting two adjacent panels. It can also be used to connect wiring to center of room, other side of room, floor below, or floor above as well as rooms on either side of panel.

8 – non rigid steel connection between the two planes –slab and wall.

Fig - 4

Pre-cast panel, a typical slab with continuous steel running through protruding about 50 cm on either side.

### **APPLICATION OF INVENTION**

A pre-cast panel in the shape of a “T” in its cross section; consisting of an elongated slab that is halved in thickness 10 cm. from its four edges with steel bars running through it and protruding about 50 cm along the longer sides of rectangle centered under it and connected to it by means of a flexible steel connection is a wall running the length of slab. There are shafts running vertically centered along the walls axes at regular intervals. The two ends of wall are concaved to tie walls on either side or add a column if needed or a conduit shaft. The slabs are rigid resting on walls /columns whereby there is freedom of movement continuity of moment in slabs yet hinge connected to the wall below.

This system is therefore ideal for high rise building providing speed in erection, light weight and longer spans with less slab thickness yet a strong rigid slab that can transfer Wind and earth quake forces to a central core shear wall. The walls and columns also are best served by this system in high rises in that the columns are not carrying additional slab moments from each floor therefore they do not have to be enlarged unnecessarily as the slabs are monolithic and rigid able to carry the lateral forces to the building core that is designed to handle it. The continuous steel columns from foundations to roof is an additional feature helping reduce the wall /column size as columns are not pinned at the top and bottom of each floor but rather run as one continuous column from footings to roof. These advantageous features serve well in any slab that needs to be large with smaller sized columns such as shopping malls theaters office building.

PVC conduits run on either side of wall horizontally at about 30 cm and 110 cm from bottom ending at concave cavities on either side these are used for IT and electric chases.

### CLAIMS

- 1 A pre-cast / cast insitue panel, consisting of a rectangular, horizontal slab, halved in thickness about ten cm from all four edges with equidistantly spaces parallel steel bars penetrating it horizontally and extending out on all four sides formed of one bar or in sets above each other, protruding a distance of about half a meter. A vertical wall or column centered below, perpendicular to slab and attached to slab by means of a flexible non rigid steel connection with shafts extending vertically the height of the panel at regular intervals in its center. Shafts have cages that run continuously the height of building tying building together when concreted thus turning it into one continuous column. A similar mirrored panel sits opposite together they form a room with central cast insitu portion that consists of a horizontal form connected between said two panels with horizontal steel bars running in the direction between the two panels overlapping steel protruding on either side on which concrete is poured forming a room; steel runs also in a horizontal perpendicular direction continuously into the next bays on either side of room creating a two dimensional rigid slab extending over several bays independent in moments from the walls or columns below it.
- 2 A pre-cast / cast insitu panel, rectangular, elongated horizontally extending slab, halved in thickness about ten cm from all four edges with equidistant parallel steel bars penetrating and extending as one or in sets of two, layered above each other, each protruding about 50 cm on either side along the shorter sides extending the length of slab. A vertical wall centered below, perpendicular to slab, attached by a flexible steel connection with hollow shafts extending vertically at intervals and concave ends on either side of panel. A cast insitu central part consisting of a horizontal form tied to said panel and a mirrored opposite one on which steel rebar runs between two panels and also in a perpendicular horizontal direction extending continuously into adjacent bays on either side; walls and columns attached below are flexibly connected to slabs above.
- 3 A pre-cast panel; with a rectangular elongated horizontal slab, halved in thickness ten cm from all four edges with equidistant parallel steel bars penetrating and extending as one or in sets of two layered above each other, each protruding about 50 cm on either side along the shorter sides throughout the length of slab. A monolithically poured beam centered below slab extending about the length of the slab and rigidly attached to slab. When faced with a mirrored panel or mirrored slab or other means of connection and concrete is poured between them on steel bars running horizontally between panels and perpendicular to panels , a room is formed. Walls can have a insulating light weight sheets sandwiched in walls.
- 4 A pre-cast horizontal square slab halved in thickness about ten cm. from all four edges with mostly equidistant parallel steel bars penetrating and extending as one or in sets of two layered above each other, each protruding about 50 cm on all

four sides. A hollow column centered and hinged below with a steel cage that can be pre-cast or concreted on site. Steel reinforcing bars sandwiched between four panels run horizontally overlapping the protruding steel bars from said panels. Steel also runs at right angles where they overlap protruding steel in other horizontal direction. Steel bars also run in center part of formed rooms continuously onto adjacent spaces on all four sides. Thereby forming a room / bay.

- 5 The central cast insitu part of the slab sandwiched between two panels, where steel bars extend horizontally parallel to and overlapping the protruding pre-cast panels bars on either side, in addition to bars running at right angles continuously over the enclosing supports and on to the adjacent slabs on either side. steel extends horizontally but at right angles to previous bars thereby form a rooms slab from off the shelf panels that have a flexibly pre-cast slab wall or column joint
- 6 A step down in the pre-cast elongated slabs at both wall ends (above the concave ends) enabling the wiring to be threaded laterally as well as horizontally to the adjacent panels and to the center of panel as well as other side; also enabling the addition of top steel as an after thought horizontally to carry heavy irregular loads
- 7 Conduits running horizontally just inside on both wall surfaces about one about 30 cm and one meter from bottom leading to concave panel ends on either side of panel
- 8 Columns can run continuously from footings to roof. Floor slabs formed of pre-cast sections form a two dimensional monolithic rigid continuous slab when connected together by means of a central cast insitue middle that consists of steel bar overlapping protruding steel from flanking panels and steel running in a perpendicular direction with concrete poured after securing a horizontal form underneath. intersecting planes exert minimal moments on each other due to the hinged that connects them together.

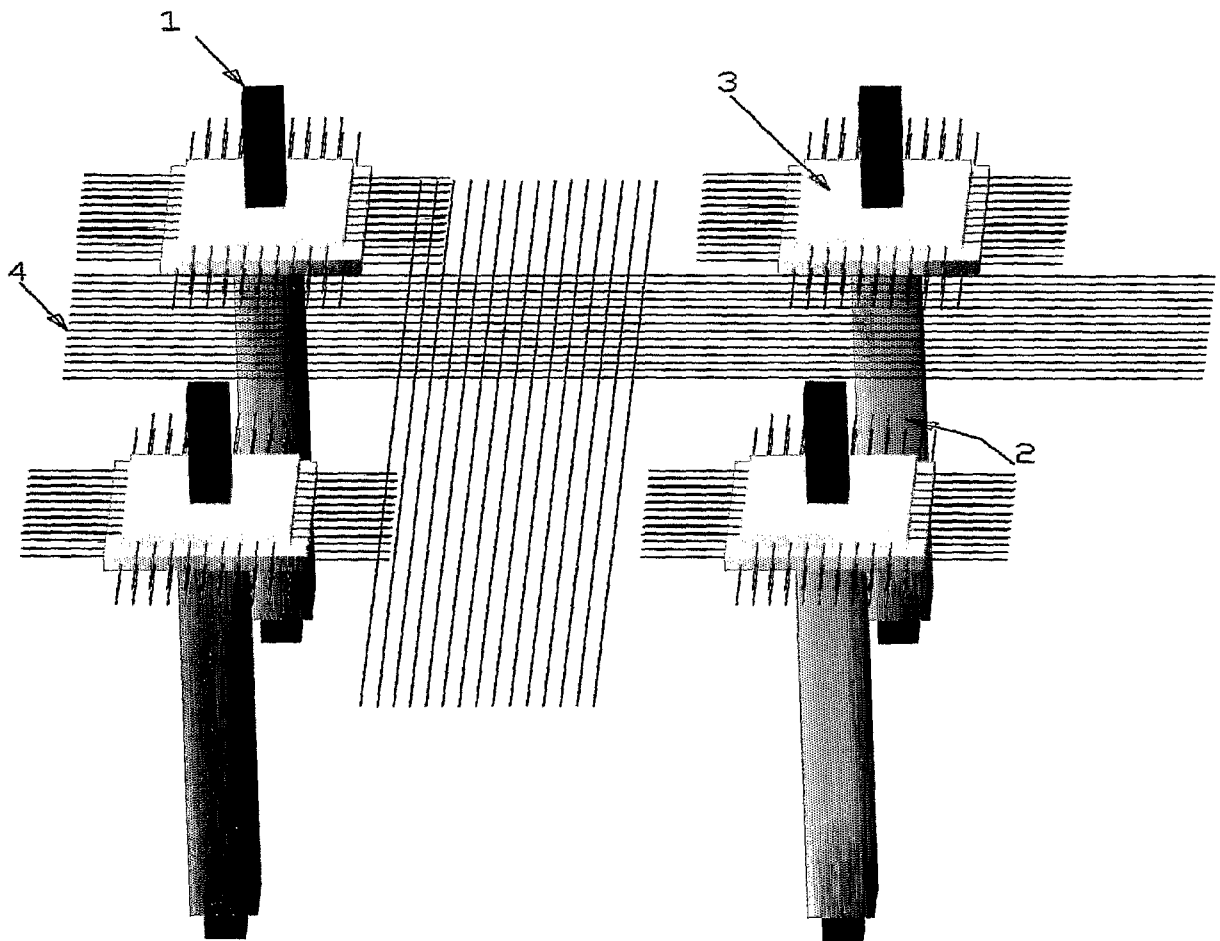


Fig-1

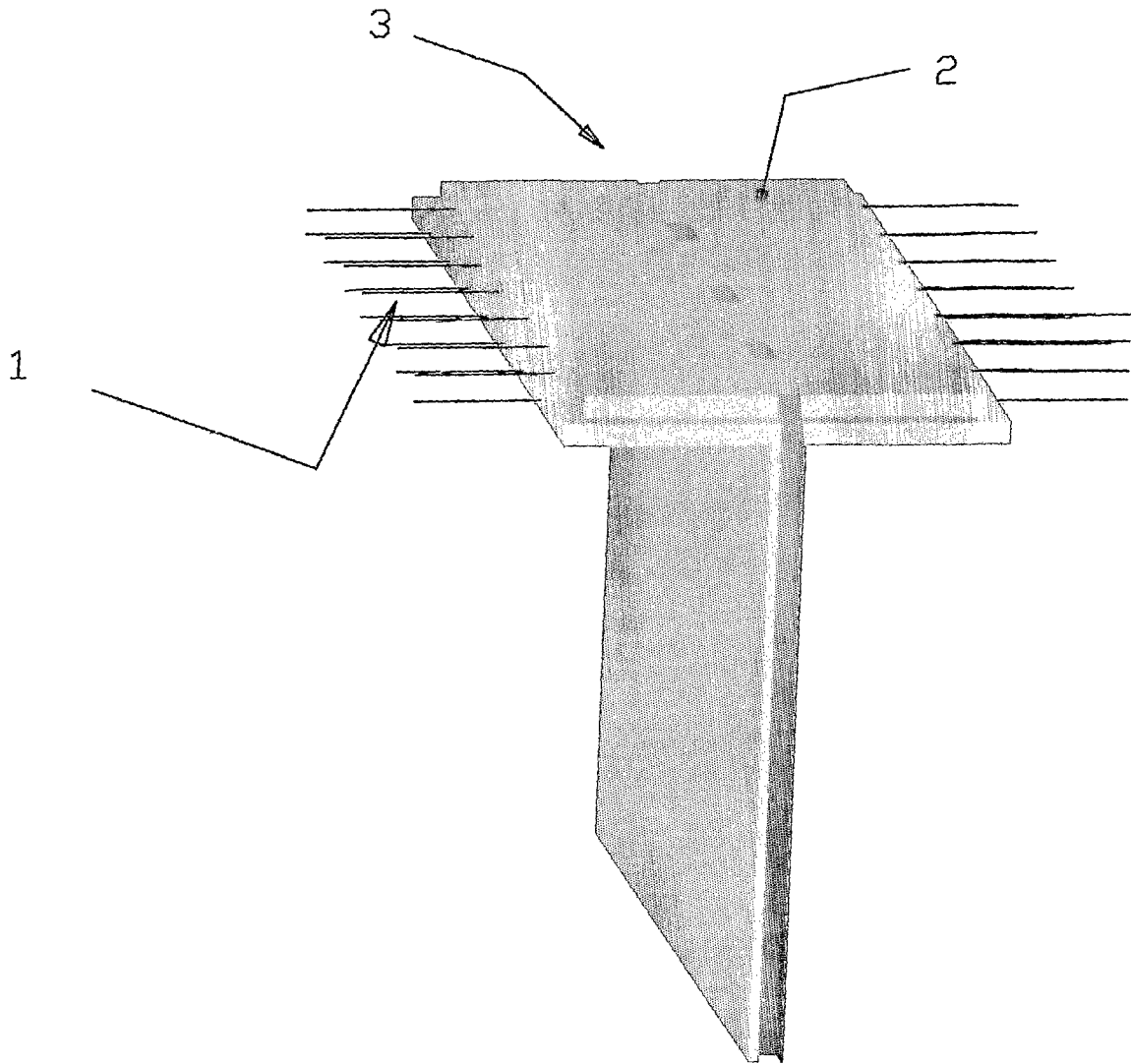
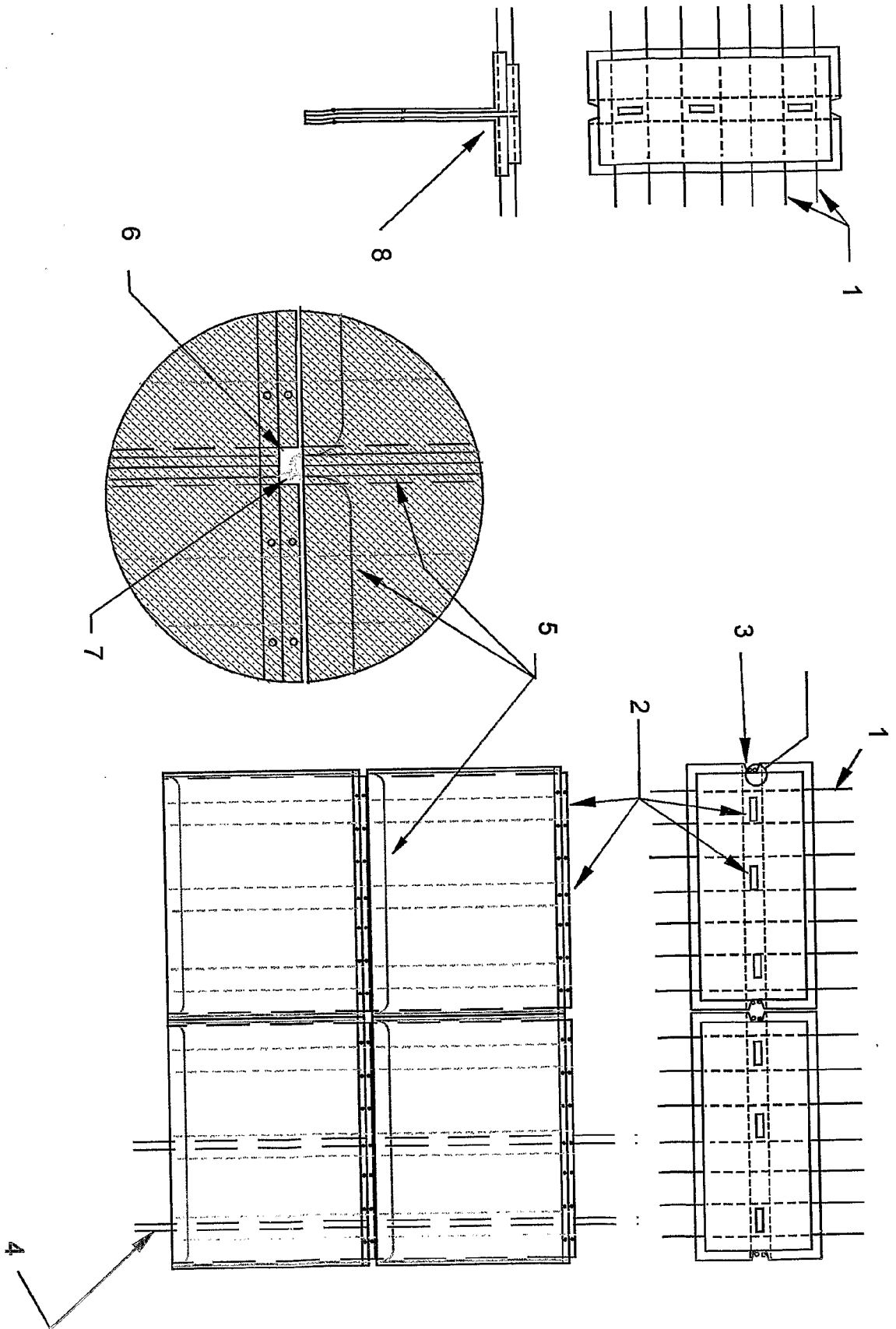


Fig. 2.

FIG 3



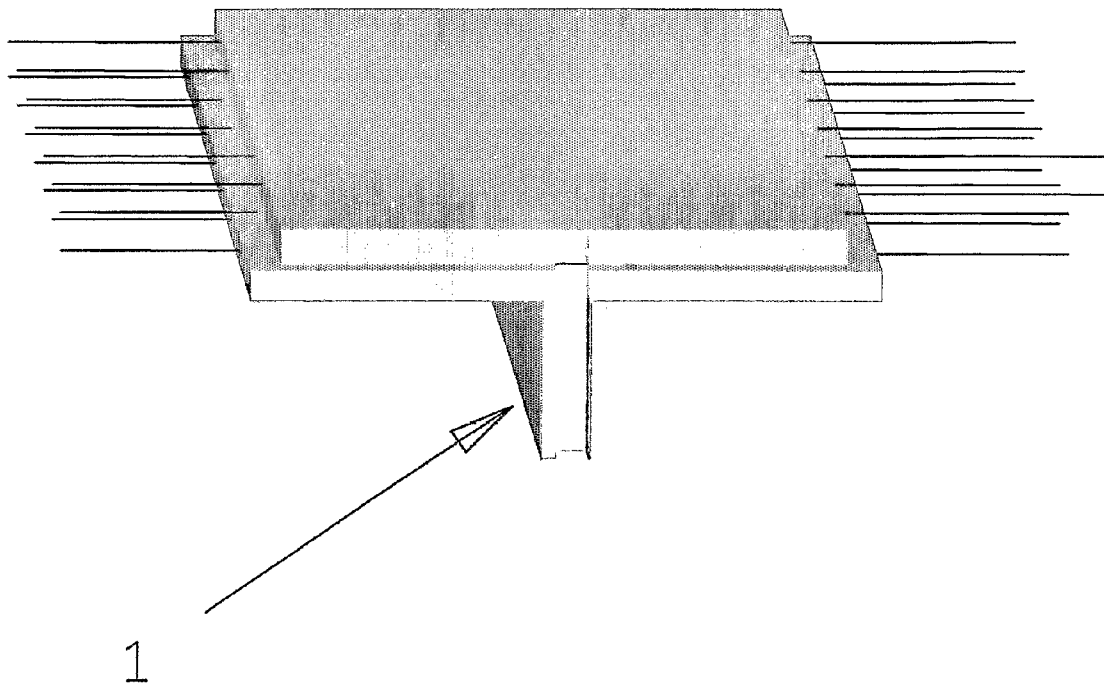


Fig 4

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/EG 2006/000032

A. CLASSIFICATION OF SUBJECT MATTER IPC <sup>8</sup> : <b>E04C 2/06</b> (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) IPC <sup>8</sup> : E04B, E04C, E04G		
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) EPODOC; ECLA; WPI; PAJ		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 2 251 613 A1 (Schmidt) 2 May 1974 (02.05.1974) <i>pages 1-7, claims 1-18, figs. 1-7</i>	1-6
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A	US 3748 805 A (Boros) 31 July 1973 (31.07.1973) <i>abstract, columns 1-6, figs. 1-7</i>	1-6
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A	US 5 809 712 A (Simanjuntak) 22 September 1998 (22.09.1998) <i>abstract, columns 1-6, figs. 1-7</i>	1-6
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p>		
Date of the actual completion of the international search 25 April 2007 (25.04.2007)		Date of mailing of the international search report 22 June 2007 (22.06.2007)
Name and mailing address of the ISA/ AT <b>Austrian Patent Office</b> Dresdner Straße 87, A-1200 Vienna Facsimile No. +43 / 1 / 534 24 / 535		Authorized officer LANG F. Telephone No. +43 / 1 / 534 24 / 385

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2005/007986 A1 (Solicitante..) 27 January 2005 (27.01.2005) <i>abstract, fig.3</i>  -----	1-6

# INTERNATIONAL SEARCH REPORT

Information on patent family members

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WO A 2005007986		CN A 1823203 EP A1 1650371 WO A1 2005007986	2006-08-23 2006-04-26 2005-01-27