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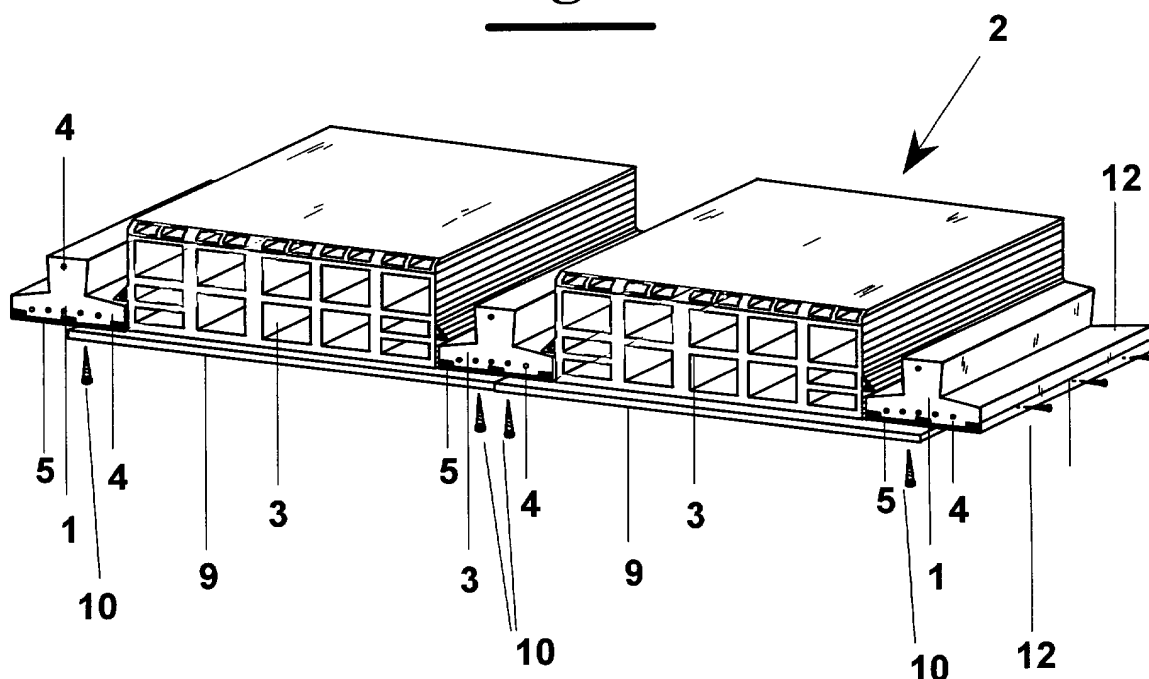
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(54) **Structural element for application of plaster suspended ceilings on floors**

(57) A structural element such as a floor beam reinforced to girder or pre-stressed concrete and the like, for making floors, roofs, comprising a casting (6) in concrete with a lower flat face in which a layer is integrated (5,8) that can be perforated by screws (10) capable of making easier the fastening and of supporting the weight of plaster suspended ceilings (9). The layer that can be perforated by screws is formed by a sheet section (5) in which a layer is present of light material (8) that is set between the concrete and the sheet section,

directly contacting the concrete casting (6). The light material (8) is chosen among foam polystyrene, cellular polyurethane, wood, etc. In use, self tapping screws (10) cross in turn the plaster board (9), the lower face of the sheet section (5) and penetrate all the layer of the light material (8) without forcing, if not at the end of the movement, against the concrete (6). This way a plaster suspended ceiling (9) fastened to the floor lower surface is created directly connected to the concrete beams (1) of the floor (2).

Fig. 2



Description

Field of the invention

[0001] The present invention relates to the field of constructions and more precisely it refers to a structural element such as a ceiling beam in pre-stressed concrete, a "girder" or the like for making floors, suitable for application of plaster suspended ceilings. Among floors to which the invention is related to are comprised flat floors both walkable and not, peaked roofs, floors of roof gardens, shed roofs.

Background of the invention

[0002] For the installation of plaster covered boards for suspended ceilings several known problems arise.

[0003] In fact, the plaster suspended ceilings require metallic frameworks to which plaster covered boards are connected by means of self tapping screws. The frameworks are in turn screwed to the floors by means of screw anchors. In particular, it is difficult the drilling of concrete beams or other structural elements, usually in reinforced concrete. Furthermore it is in any case difficult to arrange metallic frameworks for supporting plaster suspended ceilings.

[0004] An important aspect of the construction of floors is the so called "vapour barrier", i.e. an insulation from humidity and vapour in gaseous phase that can give condensate water. In theory, the vapour barrier should be made at the lowermost surface of the floor. However, with traditional techniques of construction of floors the vapour barrier is made over the upper level of the floor, leaving not protected all the layer of the floor. This fact involves high costs in creating the insulating pack of the floor.

[0005] The vapour barrier normally is a sheet of aluminium integrated to a waterproof membrane. A typical floor, then, starting from the above towards below has a concrete casting with pavement, a waterproof membrane, an heat insulation, the vapour barrier by means of membrane with a sheet of aluminium, a primer, a reinforced concrete and hollow tiles mixed floor, and, at the lowermost surface, a plaster coating.

[0006] Therefore, it would be advantageous to move the vapour barrier towards below, eliminating the membrane with the sheet of aluminium and using plaster covered boards with integrated a sheet of aluminium or other equivalent vapour barrier. It is, however, complicated as above described to install plaster suspended ceilings in a way that is quick and not expensive on the floors lower surfaces.

Summary of the invention

[0007] It is therefore object of the present invention to provide a structural element such as a ceiling beam or girder or pre-stressed concrete beam and similar, for

making floors, roofs, etc., which makes remarkably easier the application of plaster suspended ceilings, without reducing the resistance of the final structure.

[0008] It is another object of the invention to provide a method for the production of this structural element.

[0009] Hereinafter, with the term structural element a desired ceiling beam, girder or the like for floors is intended to define an element that achieves the principles according to the invention as described and claimed below.

[0010] According to a first aspect of the invention, a structural element has a concrete casting with a lower flat face in which a layer is integrated that can be perforated by screws capable of making easier the installation and of supporting the weight of plaster suspended ceilings.

[0011] The layer that can be perforated by screws can be advantageously formed by a sheet section in which a layer is present of light material that is set between the concrete and the sheet section, directly contacting the concrete casting.

[0012] The light material can be chosen among foam polystyrene, cellular polyurethane, wood, etc.

[0013] The layer that can be perforated by screws can be integrated to the concrete at casting the concrete. Alternatively, the layer that can be perforated can be connected to the casting by means of screws or riveting after the casting, through brackets embedded in the casting same. The light material can, in this second case, be integrated at the moment of the casting or at the moment of the fastening of the sheet section to the casting.

[0014] The sheet section, filled with the layer of light material, at the moment of installing the structural element is oriented towards below integrated in the floor or roof and allows thus the easy application of the screws, which cross both the plaster suspended ceilings and the sheet section and can penetrate all the layer of light material without forcing against the concrete. This way, a plaster suspended ceiling can be made directly connected to the lower face of the floor.

[0015] The concrete casting can be made with free or pre-stressed reinforcement bars, in order to obtain in the first case a girder for building industry and in the second case a concrete pre-stressed beam.

[0016] According to another aspect of the present invention, a method for the production of a structural element for making floors has the characteristic that it comprises the following steps:

- prearranging a concrete mould or equivalent material for casting the structural element;
- arranging in said mould a reinforcement of the structural element, for example of iron bars;
- arranging always in said mould, a fastening for a sheet section having a flat face oriented towards below, in said sheet section being pre-arranged a layer of light material.

In a first embodiment of the method, the steps are provided of

- introducing in the mould said sheet section having a flat face oriented towards below that lays on the bottom of the mould, in said sheet section a layer of light material being pre-arranged;
- casting concrete in said mould incorporating said sheet section, said layer and at least part of said reinforcement;
- extracting the structural element after hardening comprising a lower face of sheet section and the layer in light material integrated to the concrete and to the relative reinforcement that is embedded between the concrete and the sheet section.

In a second embodiment of the method, the steps are provided of

- introducing in the mould brackets oriented towards below and capable of protruding from the concrete after the casting;
- casting concrete in said mould incorporating part of said reinforcement and of said brackets;
- after hardening, fastening by means of screws or rivets said sheet section to said brackets, said sheet section having a flat face oriented towards below.

[0017] The light material can, in this second case, be preferably integrated at the moment of the casting, arranged between the brackets. Alternatively, it can be connected at the moment of fastening the sheet section to the casting.

[0018] The length of the sheet section can in a first case extend for all the length of the structural element. In this case, the sheet section has the lower flat face that covers all the bottom face of the concrete casting, whereby the lower face of the structural element is completely a sheet section.

[0019] In a second embodiment a plurality of portions of said sheet section arranged is provided aligned longitudinally, spaced and centred transversally. The width of the portions can be also less than the width of the casting, whereby the lower face of the structural element is made of concrete with at the centre a row of spaced portions of sheet section. It is also possible that the sheet section is continuous instead of discontinuous and of width less than the girder.

[0020] Advantageously, the sheet section is U-shaped. In it the light material lays, in such a way that the wings of the sheet section protrude from the layer of said light material. In the first embodiment, the protruding wings allow to the whole support, consisting in the sheet section and in the polystyrene foam layer, of being connected by means of screws directly to the wall side of the beam. In the second embodiment, the protruding wings offer a steadier fastening to the concrete.

[0021] According to the invention, the plaster suspended ceilings are screwed to the sheet section. In fact, the screws penetrate directly through the plaster board and through the surface of the sheet section into

the light material in it contained.

[0022] In particular, floors made with concrete beams according to the invention, allow a quick installation of the plaster suspended ceilings. In fact, the plaster covered boards are directly connected to the beams of the floor in a steady way and adhere directly to the floor lower surface. With such an installation the working costs mainly given to the installation of a metal framework are eliminated.

[0023] If the plaster suspended ceilings are to be replace or removed, it is sufficient to release the plaster covered boards from the floor lower surface, without affecting further the ceiling beam.

[0024] A further advantage is that of providing a vapour barrier near the lower level of the floor. In this case, plaster suspended ceilings may be used equipped with a sheet in aluminium.

[0025] Furthermore being the girder according to the invention pierceable by the screws, it is possible to bolt it directly to the principal steel structures of the building, such as for example to the steel beams, or it can be connected by epoxy resins.

[0026] Advantageously, the lower parts of the sheet section can be coated of a insulating layer, for example, but not exclusively, adhesive layer of cellular polyethylene with a layer of some mm.

Brief description of the drawings

[0027] Further characteristics and the advantages of the structural element according to the present invention will be made clearer with the following description of an embodiment thereof, exemplifying but not limitative, with reference to the attached drawings, wherein:

- figure 1 shows a sectional view of a portion of floor in direct phase of installation with two structural elements according to the invention;
- figure 2 shows a perspective view of the floor of figure 1 after the application of an plaster covered board;
- figure 3 shows a perspective view of a mould of casting of a structural element according to the invention with pre-arranged a sheet section and a layer of light material;
- figure 4 shows a sectional view of the mould of figure 3 after the casting;
- figure 5 shows an elevational longitudinal view of the structural element according to the invention as resulting after the casting;
- figure 6 shows a perspective view of a mould of casting of a structural element according to the invention with pre-arranged a plurality of sheet section discontinued portions and inside layers of light material ;
- figure 7 shows a sectional view of the mould of figure 6 after the casting;
- figure 8 shows a plan view from below of a different

embodiment of the structural element according to the invention as resulting after the casting according to figures 6 and 7;

- figures 9a and 9b show an elevational view, respectively frontal and longitudinal, of a reinforcement equipped with brackets concerning a different embodiment of the invention;
- figures 10a and 10b show an elevational view, respectively frontal and longitudinal, of the reinforcement of figures 9a and 9b after the application of a layer of light material ;
- figures 11a 11b show an elevational view, respectively frontal and longitudinal, of the reinforcement of figure 10a and 10b after casting of the concrete;
- figures 12a and 12b show an elevational view, respectively frontal and longitudinal, of the ceiling beam of figure 11a 11b to whose base a sheet section has been attached;
- figures 13a and 13b show an elevational view, respectively frontal and longitudinal, of a ceiling beam of pre-stressed concrete to whose base a sheet section has been mounted;
- figures 14 and 15 show respectively a structural element according to the invention in reinforced concrete and in pre-stressed concrete after the fastening to a steel structural beam.

Description of a preferred embodiment

[0028] With reference to figures 1 and 2, a structural element 1 according to the invention is used for making a floor 2 of known type in combination with hollow tiles 3. In particular, is shown a hollow tile 3 resting on two structural elements 1. In the building industry, the structural element of figure 1 is normally defined as "girder", whereas the structural element of figure 2 is normally defined as "ceiling beam" in pre-stressed concrete.

[0029] According to the invention, each structural element 1 consists in a reinforcement 4 and by a sheet section 5, embedded in a concrete casting 6. The sheet section 5 is filled with a layer of light material 8 that is set between the concrete 6 and the sheet section 5 and is oriented in use towards below of the floor for application of plaster suspended ceilings 9 (figure 2).

[0030] In fact, since the sheet section 5 can be easily perforated, for example with self tapping screws 10, and since the light material 8 allows free penetration, the plaster suspended ceilings 9 are easily screwed to the structural elements 1. More precisely, the screws 10 cross in turn the plaster board 9, the lower face of the sheet section 5 and penetrate all the layer of the light material 8 without forcing, unless at the end of the movement, against concrete 6. This way a floor lower surface made of plaster board is created directly connected to the concrete beams of floor 2.

[0031] With reference to figures 3 and 4, to make the girder 1 according to the invention, which can be seen in longitudinal vista also in figure 5, it is sufficient to pro-

vide a mould 7 for casting concrete. In a first step the sheet section 5 with a face 5a oriented towards below is laid onto the base 7a of mould 7. Over base 7a of mould 7, the reinforcement 4 is arranged that, after the casting of concrete 6, becomes the reinforcement of the structural element 1.

[0032] In the embodiment of figures from 1 to 5, the length of the sheet section 5 extends for all the length of the structural element 2.

[0033] Advantageously, the side walls 11 of the sheet section 5 are slightly higher of the layer of the light material 8 in it contained, creating thus two protruding wings 11a. Such protruding wings 11a allow to the sheet section 5 and to the light material 8 to be connected by means of screws 12 directly to the wall side of the floor beam 2 (figure 2 and 5) by means of pins not shown, previously inserted in the mould.

[0034] With reference to figures from 6 to 8, in a second embodiment of the invention, the structural element 1' comprises a plurality of portions 5' of sheet section arranged aligned longitudinally, spaced and centred transversally for a width less than that of the structural element 1'. The portions of sheet section 5' are inserted in the mould 7 alternated before casting the concrete (figure 6 and 7). This way, a structural element is obtained that has a lower face in concrete 6 (figure 8), discontinued by the portions of sheet section 5', which can be used for fastening plaster covered boards.

[0035] Figures from 9A to 11B show in turn the steps of a further embodiment of the invention. With reference to figures 9A and 9B, respectively in front and longitudinal view, a reinforcement 4 is arranged, of traditional type, to which brackets 13 are welded. Blades 14 are also provided that define the position of the sheet of light material 8 (Figure 10A and 10B). In particular, the brackets 13 are welded to reinforcement 4 spaced as shown in figure 9B.

[0036] As shown in figures 11A and 11B it is sufficient to put the reinforcement thus equipped in a mould for casting the concrete 6. To make the base in sheet section on the girder 1, as shown in figure 12A and 12B, it is sufficient to fasten by means of screws 12 the sheet section 5, which is put on the floor beam, causing the self tapping screws 12 to penetrate brackets 13 and then blades 14.

[0037] The same method can be used for making a floor beam of pre-stressed concrete 1", shown in figures 13A and 13B.

[0038] Structural elements 1, 1' or 1", thus made, can be easily connected to a structural H beam 16 of steel, as shown in figures 14 and 15. In fact, it is sufficient to use screws 15 that penetrate the sheet section 5.

[0039] Structural elements 1 thus made allow a quick fastening of the ceiling of plaster covered boards 9 directly to the lower surface of the floor. This way, it is not necessary to install additional frameworks to the plaster suspended ceilings 9.

[0040] The possibility of coating the lower surface of

the floor with plaster covered boards 9 connected with screws 10 (figure 2) is particularly advantageous, since the traditional concrete beams of reinforced concrete cannot be pierced by the screws. The advantages are not only in quicker installation, but also in a less operative work, with a subsequent reduction of the costs of construction. A further advantage, furthermore is the possibility of using plaster covered boards 9 with embedded sheet of aluminium to provide the vapour barrier at the lowermost level of the floor.

[0041] In a way not shown, finally, the lower face of the sheet section 5 may be coated with an insulating layer, in species cellular polyethylene some mm thick. This way, the heat bridge that usually affect floors near the beams is eliminated, caused by the higher heat conductivity of the concrete beams with respect to the rest of the floor, which comprises hollow tiles.

[0042] The foregoing description of a specific embodiment will so fully reveal the invention according to the conceptual point of view, so that others, by applying current knowledge, will be able to modify and/or adapt for various applications such an embodiment without further research and without parting from the invention, and it is therefore to be understood that such adaptations and modifications will have to be considered as equivalent to the specific embodiment. The means and the materials to realise the different functions described herein could have a different nature without, for this reason, departing from the field of the invention. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Claims

1. A structural element such as a floor reinforced girder or pre-stressed concrete beam and similar, for making floors, roofs, etc., **characterised in that** it comprises a casting (6) in concrete with a lower flat face to which a layer is integrated (5,8) that can be perforated by screws (10) capable of making easier the fastening and of supporting the weight of plaster suspended ceilings (9).
2. Structural element according to claim 1, wherein said layer that can be perforated by screws is formed by a sheet section (5) in which a layer is present of light material (8) that is set between the concrete and the sheet section, directly contacting the concrete casting.
3. Structural element according to claim 2, wherein said layer of light material (8) is chosen among foam polystyrene, cellular polyurethane, wood.
4. Structural element according to claim 2, wherein the lower part of said sheet section (5) is coated of a

insulating layer, in species cellular polyethylene some mm thick.

5. Structural element according to claim 2, wherein said sheet section (5) a U shaped cross section, in it said light material (8) being laid, in such a way that the wings (11) of the sheet section protrude with respect to the layer of said light material (8), said wings (11) being connected to said casting (6) by means for fastening it to the concrete.
6. Method for the production of a structural element for making floors having the characteristic that it comprises the steps of:
 - prearranging a mould (7) for casting the structural element;
 - arranging in said mould a reinforcement (4) of the structural element, for example of iron bars,;
 - arranging, always in said mould, a sheet section (5) having a flat face oriented towards below, in said sheet section a layer of light material being pre-arranged(8).
7. Method according to claim 6, wherein the further steps are provided of:
 - introducing in the mould said sheet section (5) having a flat face oriented towards below that lays on the bottom of the mould (7), in said sheet section a layer of light material being pre-arranged(8);
 - casting concrete in said mould incorporating said sheet section, said layer (8) and at least part of said reinforcement (4);
 - extracting the structural element (1) after hardening comprising a lower face in sheet section (5) and the layer in light material (8) integrated to the concrete (6) and to the relative reinforcement (4) that is set between the concrete and the sheet section (5).
8. Method according to claim 6, wherein the further steps are provided of:
 - introducing in the mould (7) a reinforcement (4) having a plurality of brackets (13) oriented towards below and capable of protruding from the concrete (6) after casting;
 - putting on the bottom of said mould (7) and between said brackets (13) a layer of light material (8);
 - casting concrete (6) into said mould (7) incorporating part of said reinforcement (4) and of said brackets (13) and, beneath, said layer of light material (8);
 - once the casting (6) is hardened, fastening by

means of screws (12) or rivets said sheet section (5) to said brackets (13), said sheet section (5) having a flat face oriented towards below and enclosing said layer of light material (8).

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9. Method according to claim 6, wherein the length of the sheet section (5) extends for all the length of the structural element, said sheet section (5) having a lower flat face that covers all the bottom of the mould (7), whereby the lower face of the structural element is completely of sheet section (5).

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10. Method according to claim 6, wherein a plurality of portions (5') is provided of said sheet section arranged aligned longitudinally, spaced and centred transversally, the width of said portions being less than the width of said mould (7), whereby the lower face of the structural element (1') is of concrete alternated to a row of spaced portions of sheet section (5).

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Fig. 1

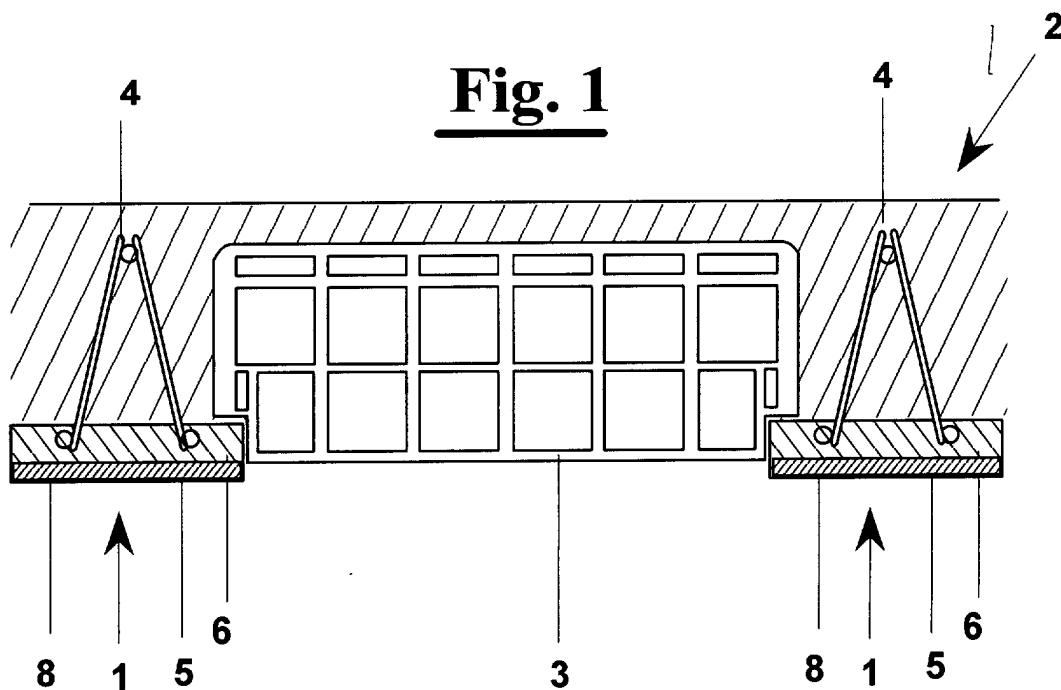


Fig. 2

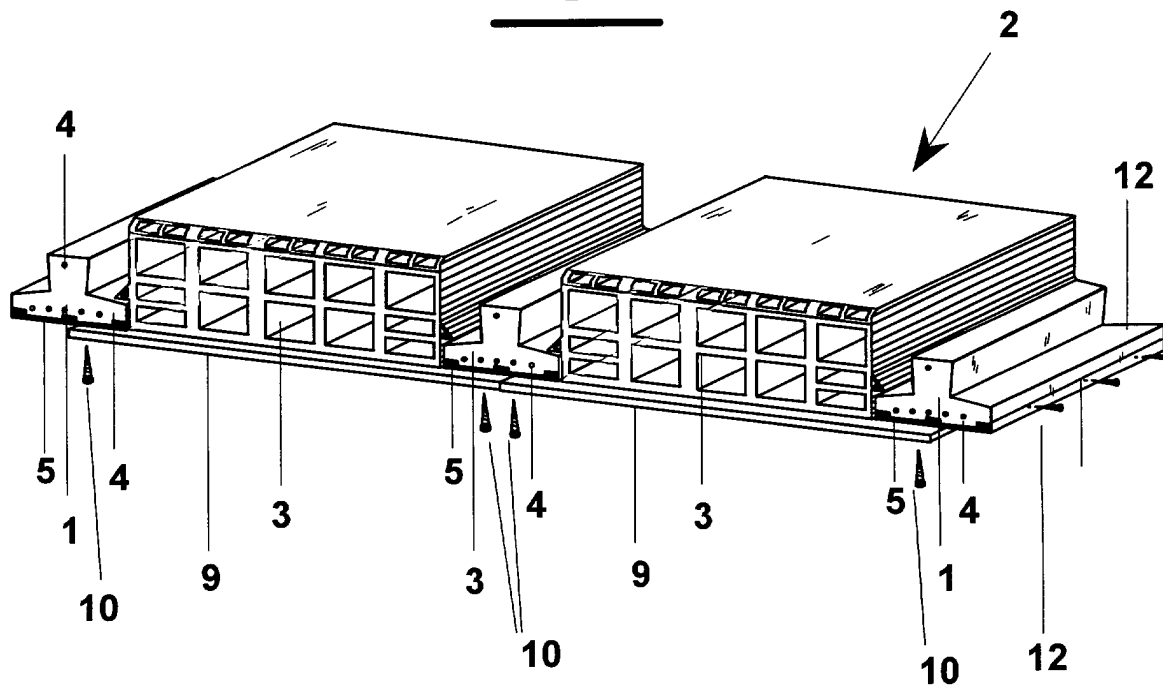


Fig. 3

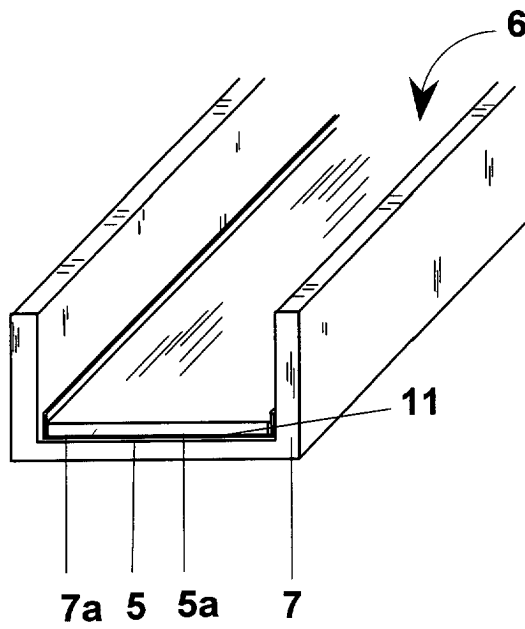


Fig. 4

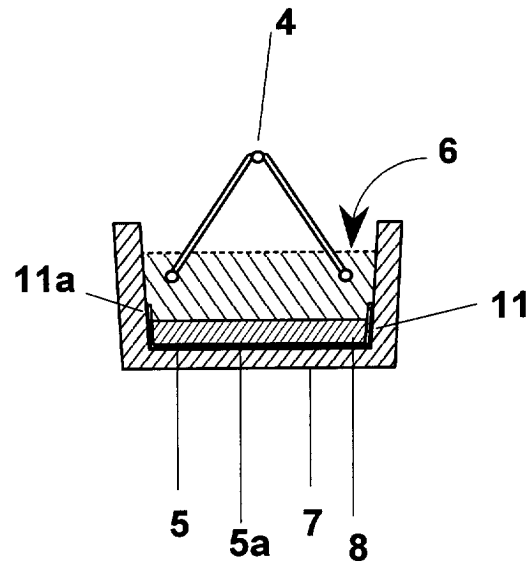


Fig. 5

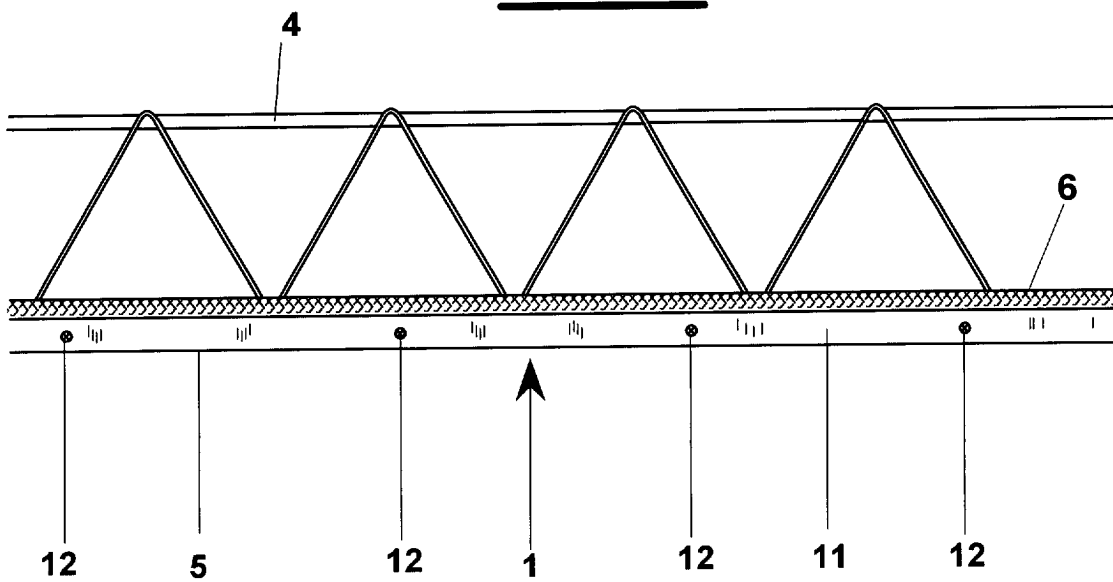


Fig. 6

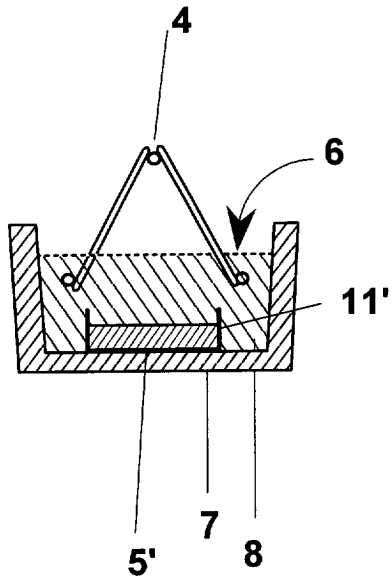


Fig. 7

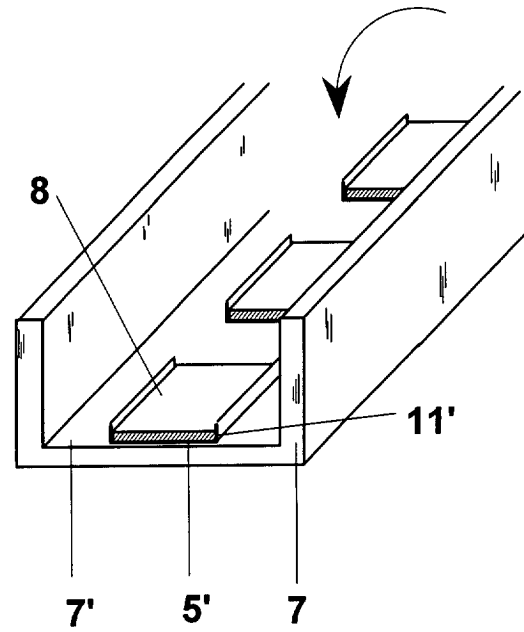
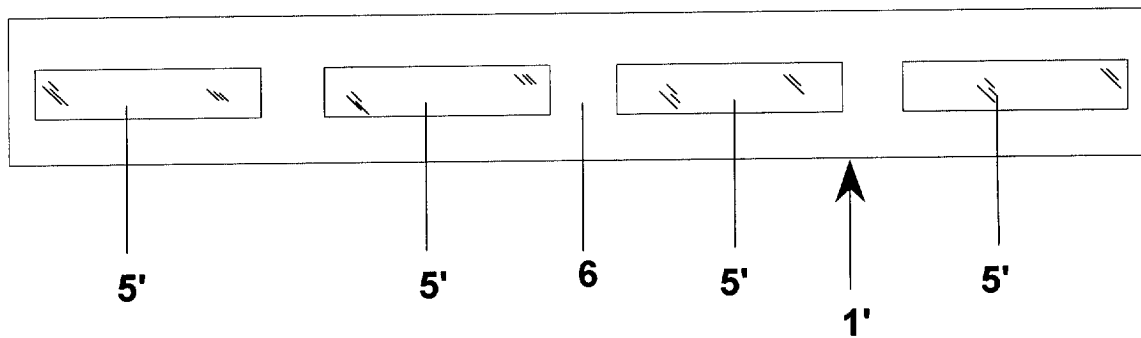


Fig.8



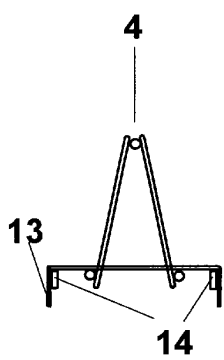


Fig. 9A

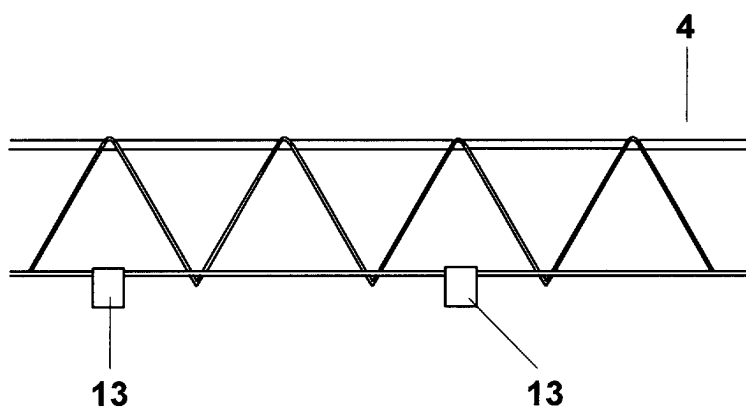


Fig. 9B

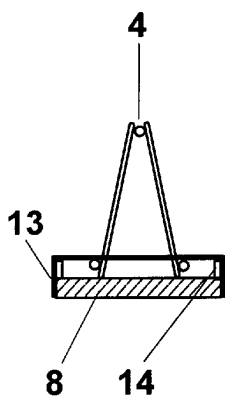


Fig. 10A

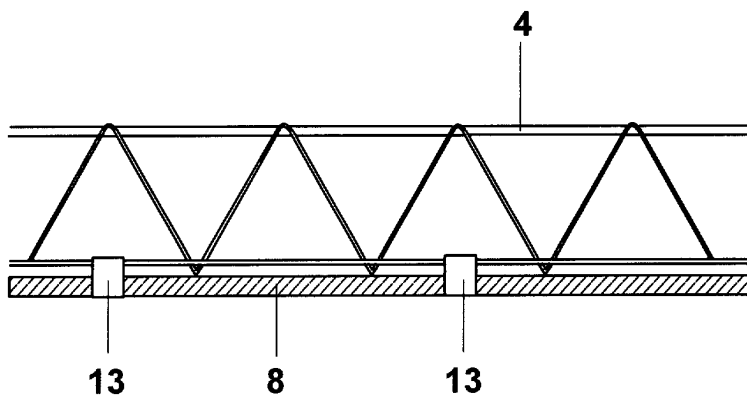


Fig. 10B

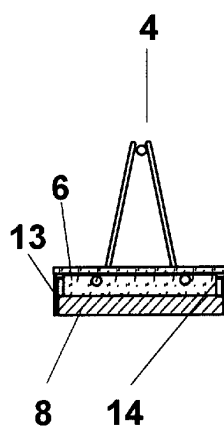


Fig. 11A

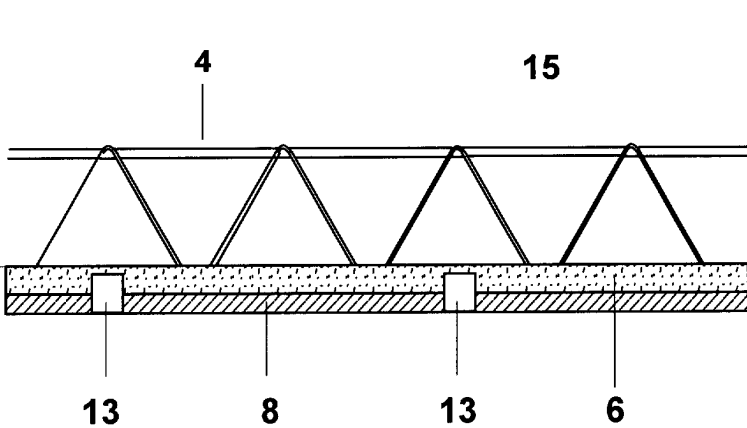


Fig. 11A

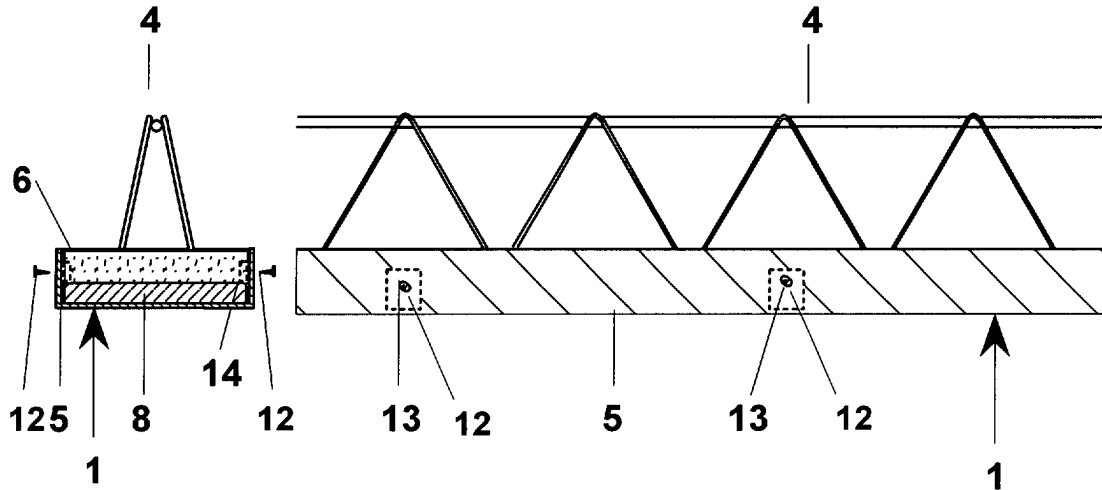


Fig.12A

Fig.12B

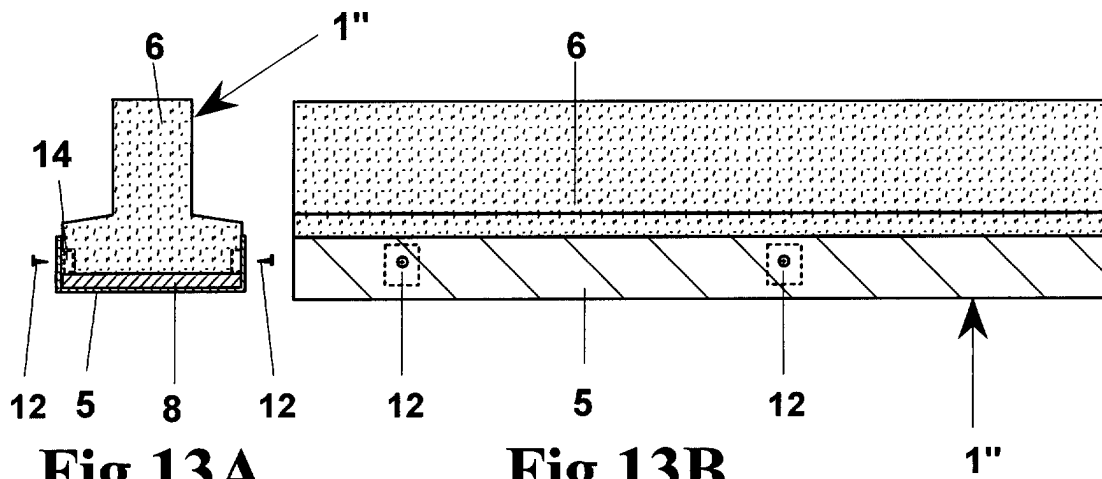
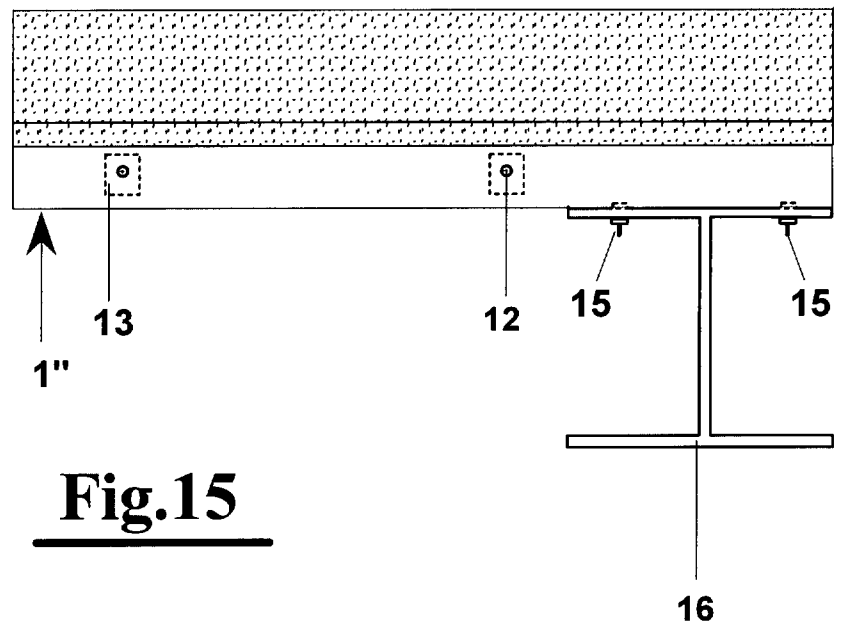
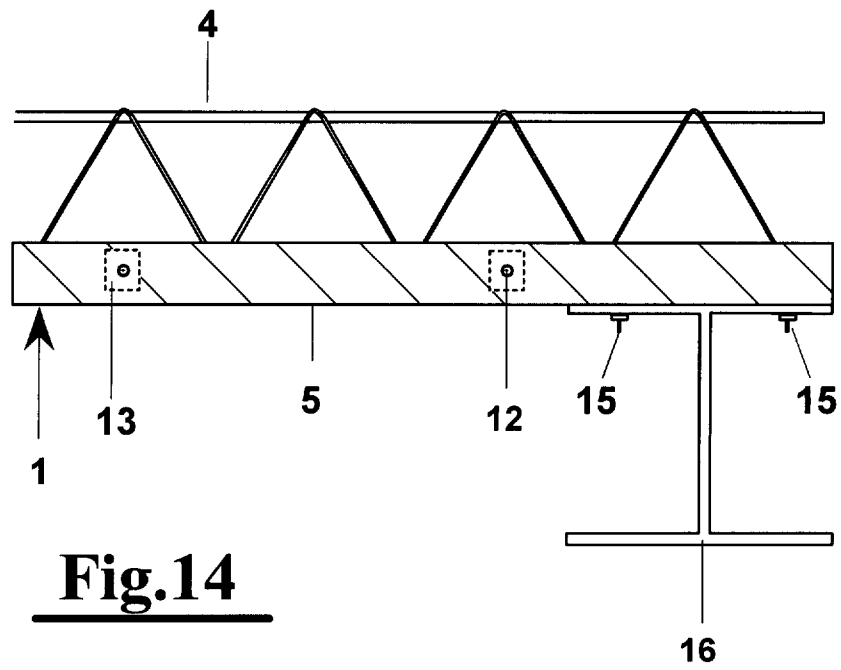


Fig.13A

Fig.13B





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 83 0105

DOCUMENTS CONSIDERED TO BE RELEVANT			
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Y	* column 7, paragraph 2 - column 8, paragraph 2; figures 3-5 *	9	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 13 July 2001	Examiner Righetti, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 01 83 0105

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