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(54) **Ceramic slab for flat coverings**

(57) This invention relates to a ceramic slab (1) for flat roof coverings, which is intended to be directly applied over the thermal insulating layer. The ceramic slab is essentially **characterized in that** it comprises a flat upper surface (2) which has a polygonal configuration and a lower surface (3) which comprises reinforcing ribs (4) and settlement parts or supports (5), said elements ensuring the load distribution over the roof covering and a separation from the insulating layer providing an air-lock for the purposes of ventilation and shadowing.

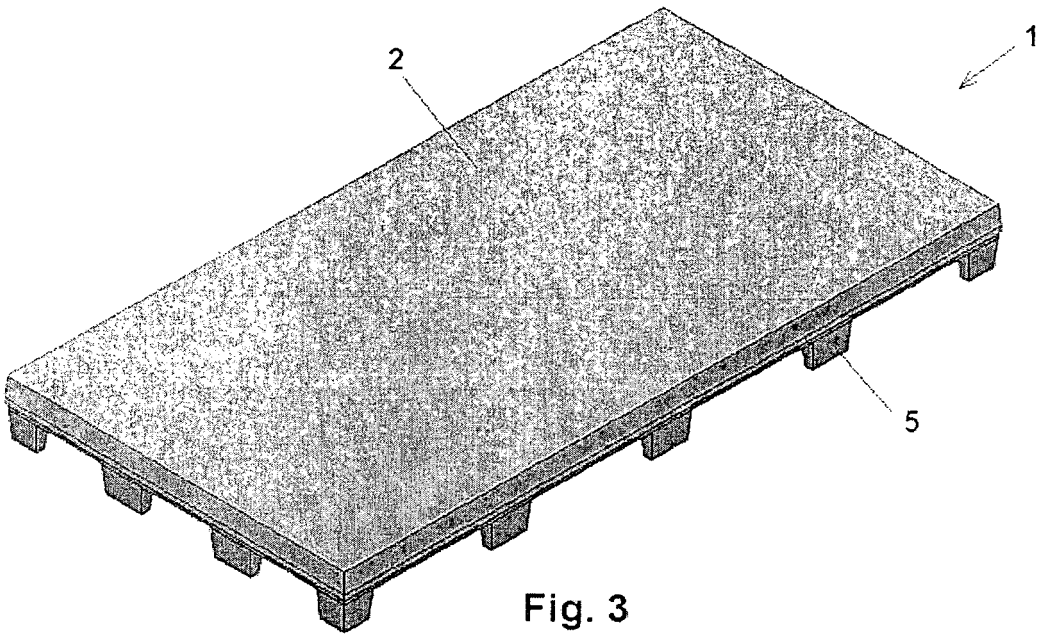

Fig. 3

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Description

Scope of the invention

[0001] Most of the large buildings, both residential buildings and office buildings, are currently provided with flat roof coverings.

[0002] Almost all of these roof coverings are comprised of a massive or lightened concrete slab whose imperviousness is obtained by the use of waterproof sheeting. It is also possible to use metal plates, the latter being in general made of materials which are highly resistant to atmospheric agents, such as zinc or copper. However, the price of these metals makes it a very expensive solution and its use is thus very limited.

[0003] Since the water-resistant thermal insulating materials (e.g. expanded or extruded polystyrene or polyurethane) have been disclosed, the most common construction technique - also considered as the most efficient one - is currently named as "inverted roofing", wherein the thermal insulation is laid over the waterproofing membrane.

[0004] But the thermal insulation must also be protected. Otherwise, its specific reduced weight would cause it to be removed under the action of the wind, since it does not have the minimum required mechanical strength in order to support the applied loads when servicing the roof covering, even if this is not on a daily basis and which is the case of most of them. Additionally, the aforementioned insulating materials become damaged due to direct sun incidence.

Previous art

[0005] There are different finishing forms for these flat roof coverings not being subject to the normal circulation of people, and which will be hereinafter described mentioning both their advantages and disadvantages:

1 - Gravel layer

[0006] Usually, gravel is employed which has a granulometry ranging from 16 to 32 mm and a minimum thickness of 6 cm, with a geotextile fabric being laid over the thermal insulation. This process is very much inexpensive, easy to execute, but the main disadvantages are the difficulties as regards the cleaning operations of the roof coverings, mostly because the leaves of trees, and also the risk of frequently appearing mosses and spontaneous vegetation.
In case a repair is needed in the waterproof sheeting, the removal of gravel without damaging the geotextile fabric, or even the insulation itself, is not easy nor is it simple.

2 - Thin screed or continuous concrete slab

[0007] In this construction technique, a geotextile fabric is also laid over the thermal insulation. Then a slightly reinforced concrete layer is laid, with a welded netting (malhasol®) having a minimum thickness of 5 cm.

[0008] This process, whose cost is much higher than that of the previously mentioned process, presents as main advantages the easiness of cleaning and the unlikely occurrence of spontaneous vegetation.

[0009] In addition to representing an overload of more than 100 kg/m2, a major inconvenience is the access to the waterproof sheeting; in case a repair work is required, the pricking-up of the concrete layer will certainly cause damages to the waterproof sheeting, even in areas where it is in a good state of conservation.

[0010] For this reason, when using this finishing, a servicing operation will often lead to the complete removal and replacement of the waterproof sheeting and the thermal insulating material.

3 - Prefabricated concrete slabs

[0011] These can be applied directly over the thermal insulation.

[0012] They have the advantages already referred to in section 2 as regards the finishing with thin screed, and they represent an identical overload to the roof covering.

[0013] However, even if their handling is not easy due to their weight, they can be displaced if the waterproof sheeting requires servicing, thus allowing local interventions to take place without the need to replace both the entire sheeting and the thermal insulation.

4 - Prefabricated concrete slabs laid over supports

[0014] These have the same characteristics of the solution described in section 3, having as an advantage the fact that, by separating the slabs from the insulating layer, they create an air-lock and provide a shadowing to the thermal insulation, significantly increasing its performance in the most critical periods of sun and heat.

[0015] The disadvantage of this system is an increase in costs, not only because of the price of the spacing parts, which in a simplified version may be prefabricated concrete cubes, but also due to the amount of labour required in order to correctly lay the supports, followed by the laying of slabs.

Summary of the invention

[0016] Sloping roofs covered with ceramic tiles exist for more than two thousand years.

[0017] The characteristics of the ceramic material, namely its high resistance to weathering factors is daily proven and illustrated by the existing centenary roof coverings which remain well preserved.

[0018] The new technological processes for the preparation of slurries as well as of pressing and backing have also improved the characteristics of the materials, thus increasing their mechanical strength and ensuring a favourable behaviour even in case of extreme tempera-

tures, with resistance to frost, or in adverse environments, with resistance to salinity.

[0019] Therefore, the ceramic material has all the characteristics for a good performance as a coating for roof coverings.

[0020] However, it has never been used as coating for flat roof coverings, obviously excepting the situations where the thin screed or continuous concrete slab mentioned in section 2 is coated with ceramic floor, whose purpose is merely decorative.

[0021] This invention provides new ceramic slabs which are aimed at being applied over the thermal insulation layer.

[0022] Since the ceramic material is moldable before the drying and baking steps, slabs will be manufactured which incorporate on the same piece the settlement parts or supports in a sufficient number to ensure the required stability and mechanical strength of the ceramic slab, as well as the reduction of loads resulting from the weight of the piece itself and the overloading to which it is subject when servicing the roof covering, so that the thermal insulation layer is not damaged.

[0023] There are several and relevant advantages which are associated to the use of ceramic slabs. Among those advantages, reference is herein made to the following:

- Reduction of overloads on the roof covering. The use of ceramic slabs will reduce by more than 50% the value of the overload generated by the roof coating: from more than 100 kg/m2 - as is the case of the aforementioned and currently existing solutions - to values which will not exceed 40 kg/m2.

- Easy handling of the pieces. The weight of each ceramic slab, considering 4 to 8 pieces/m2, depending on the models to be developed, will not exceed 10 kg/piece, and so it is easy to handle.

- Elimination of settlement parts or supports. By including on the ceramic slab the props which ensure its separation from the insulating layer, and thus keeping all of the thermal advantages associated to an air-lock for the purposes of ventilation and shadowing, the times (and costs) for installing slabs on the roof covering will be significantly reduced.

- Easy servicing of the roof covering. Given the simplicity of handling, due to the reduced weight and non-existing additional elements, the ceramic slabs can be easily displaced when the waterproof sheeting needs to be repaired, thus allowing local interventions to take place without the need to replace both the entire sheeting and the thermal insulation.

- Improvement of the thermal behaviour of roof coverings. The ceramic slabs can be manufactured with a white clays-based composition, resulting in a pale beige slurry having a good reflection capacity of sun light; however, this characteristic can still be optimized by applying to the upper surface of pieces a glass or ceramic slip with a higher reflection finishing and colour, and which is also highly resistant to shock and attrition.

Brief description of the drawings

[0024] The following description is based on the enclosed drawings, which, with a non-limiting character, represent an embodiment of the invention. Therefore:

- Figure 1 is a plan view of a set of slabs according to the invention;
- Figure 2 is an isometric view of the precedent figure;
- Figure is an isometric view of a single slab;
- Figure 4 is a lower isometric view of a single slab;
- Figures 5a-b, and c are, respectively, a plan view, a cross-sectional view taken along the line AA and a cross-sectional view taken along the line BB of a single slab; and
- Figures 6 and 7 are, respectively, a perspective view of slabs according to the invention but which are perforated and have a ribbed upper surface.

Detailed description of the invention

[0025] As can be observed, the ceramic slab (1) for flat roof coverings and intended for direct application over the thermal insulating layer, is **characterized in that** it comprises a flat upper surface (2) which has a polygonal configuration and a lower surface (3) which incorporates reinforcing ribs (4) and settlement parts or supports (5) ensuring the load distribution on the roof covering, and a separation from the insulating layer, providing an air-lock for the purposes of ventilation and shadowing.

[0026] The slab configuration is preferably rectangular. However, it can have another shape, such as for instance, quadrangular.

[0027] Since the ceramic slab (1) is moldable before the drying and backing steps, the settlement parts (5) are incorporated when moulding each piece (1) before the drying operation. For that purpose, a special mould is used in which a given number of plates are provided with a preset height. As will be understood by any skilled person, this slab can be manufactured with a red clay or white clays-based composition. Subsequently, a finishing can be applied to the slab with a glass or ceramic slip in the upper surface (2), which will generate a varied range of colours and aesthetic effects and also ensure its high resistance to shock and attrition.

[0028] Due to some building requirements, the settlement parts (5) are deployed at the intersection between said reinforcing ribs (4) on the lower surface (3) of the slab (1). It is thereby ensured a high mechanical strength and a good stability of the slab when laid. The shape of the settlement parts (5) is not a critical aspect. They will

preferably be cross-shaped in the centre and T- and L-shaped on the periphery, as shown in figure 4.

[0029] The existing settlement parts (5) at a preset height will provide an air-lock for the purposes of ventilation between the lower surface (2) and the thermal insulating layer (not shown) thus allowing the air to circulate along the entire lower surface.

[0030] As can be concluded from the figures 1 and 2, the settlement of slabs (1) over the insulating layers is carried out by respecting a given interval (6) between their edges. This procedure, which conveniently generates a gap for eventual expansions in order to ensure a dimensional stability, will promote the air circulation and, consequently, the desired ventilation will improve the insulating layer's performance.

[0031] Considering the existence of four to eight pieces per m^2 on a flat roof covering, the slab's weight shall be in the range of about 5 to 10 kg/piece.

[0032] As can be observed, other embodiments of the invention are illustrated in figures 6 and 7. The ceramic slab (1) can be perforated or have a ribbed upper surface (2). The perforation of the slab shown in figure 6 is made by an appropriate number of evenly distributed holes and its main advantage is that it provides for more ventilation and less weight. The ribs at the upper surface of the slab in figure 7 will allow non-skid pathways to be created.

Claims

1. A ceramic slab (1) for flat roof coverings, intended to be directly applied over the thermal insulating layer, **characterized in that** it comprises a flat upper surface (2) which has a polygonal configuration and a lower surface (3) which comprises reinforcing ribs (4) and settlement parts or supports (5), said elements ensuring the load distribution over the roof covering and a separation from the insulating layer providing an air-lock for the purposes of ventilation and shadowing.

2. A ceramic slab (1) for flat roof coverings according to claim 1, **characterized in that** the settlement parts (5) are incorporated when moulding each piece (1) before the drying operation.

3. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** the settlement parts are incorporated at the intersection between the reinforcing ribs (4) existing on the lower surface (3) of the slab (1).

4. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** the settlement parts (5) are cross-shaped in the centre and T- and L-shaped on the periphery, or they can have other shapes, both in the centre and on the periphery, such as the "star", "Y" or "I" shape.

5. A ceramic slab for flat roof coverings according to the previous claims, **characterized in that** the settlement parts (5) have a height which ensures the air circulation along the entire lower surface.

6. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** it has a rectangular or square configuration.

7. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** its settlement is carried out by respecting a given interval (6) between its edges.

8. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** its weight is equal to or less than 10 Kg, considering the existence of four to eight pieces per m^2.

9. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** it is manufactured with red clay.

10. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** it is manufactured with white clays.

11. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** it is provided with a glass or ceramic slip finishing on its upper surface.

12. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** it is perforated with evenly distributed holes.

13. A ceramic slab (1) for flat roof coverings according to the previous claims, **characterized in that** the upper surface (2) is ribbed.

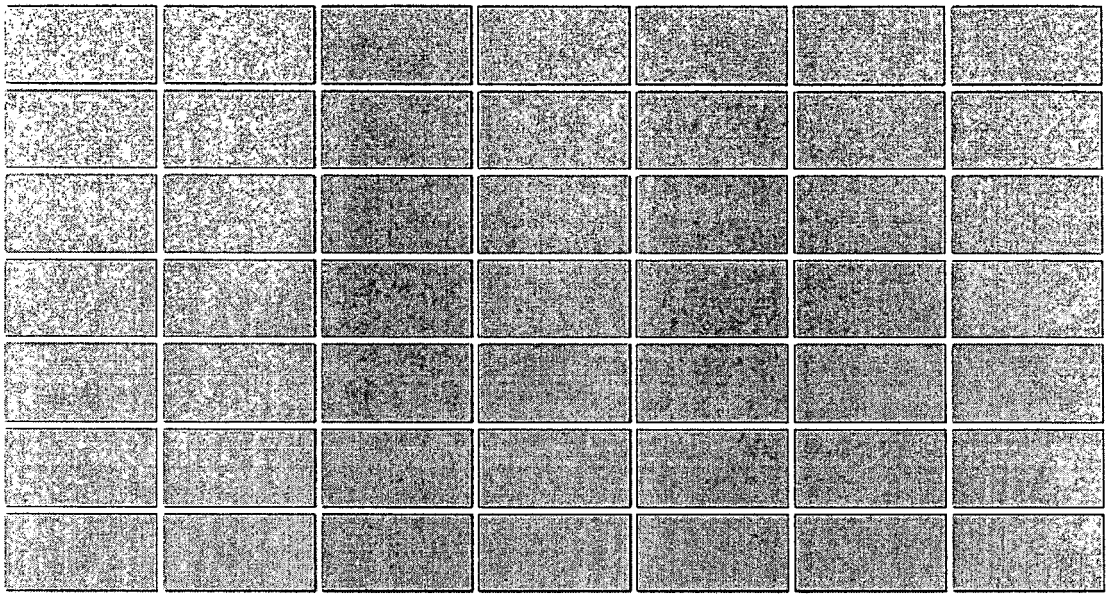

Fig. 1

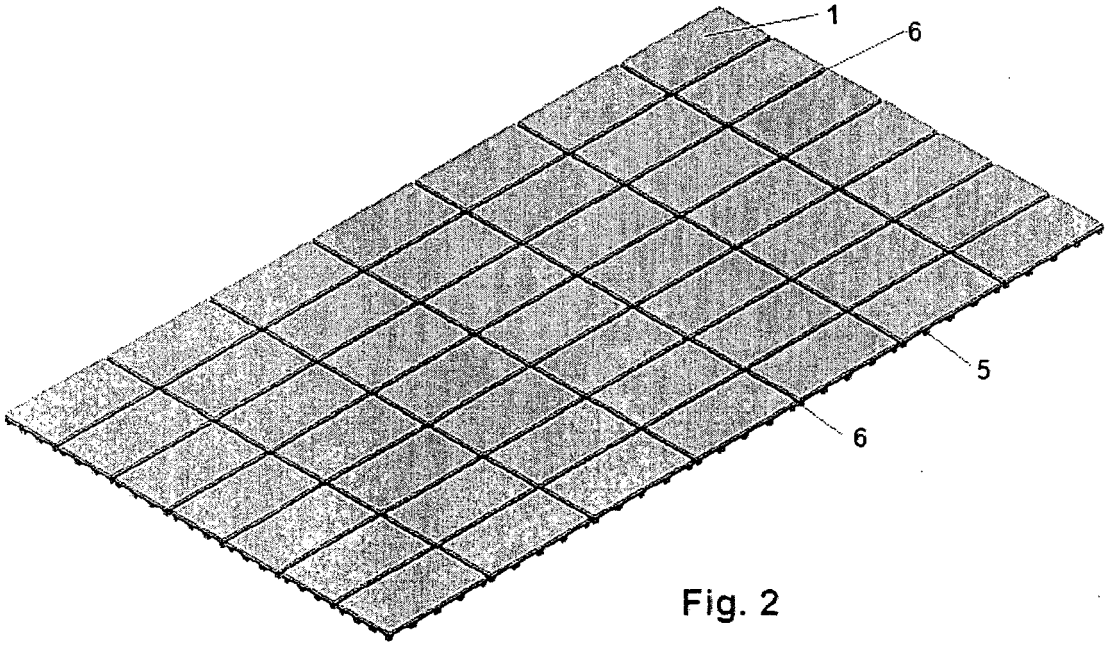

Fig. 2

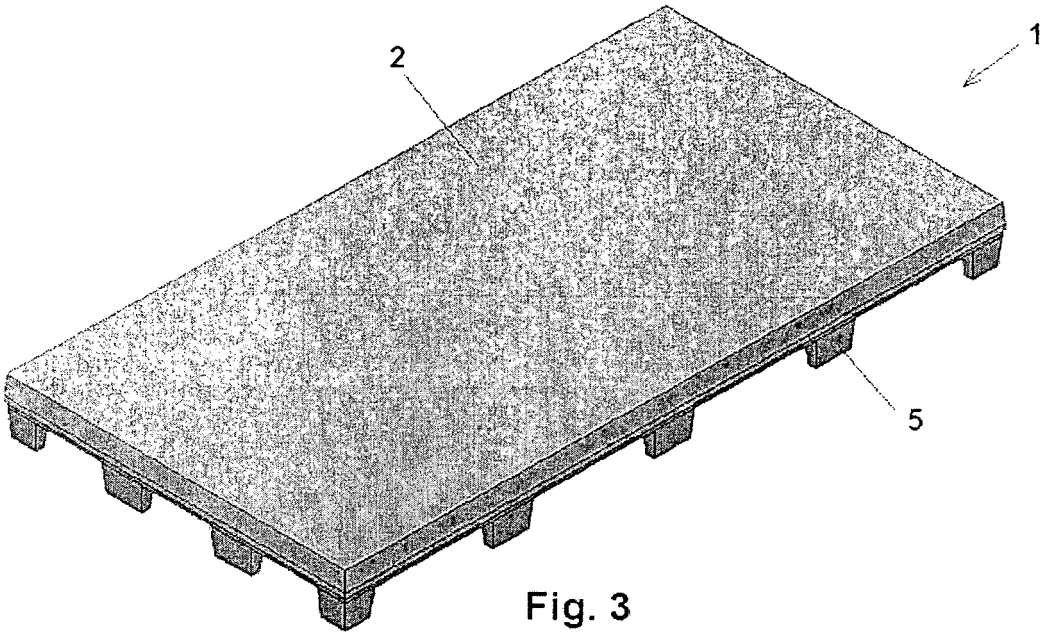

Fig. 3

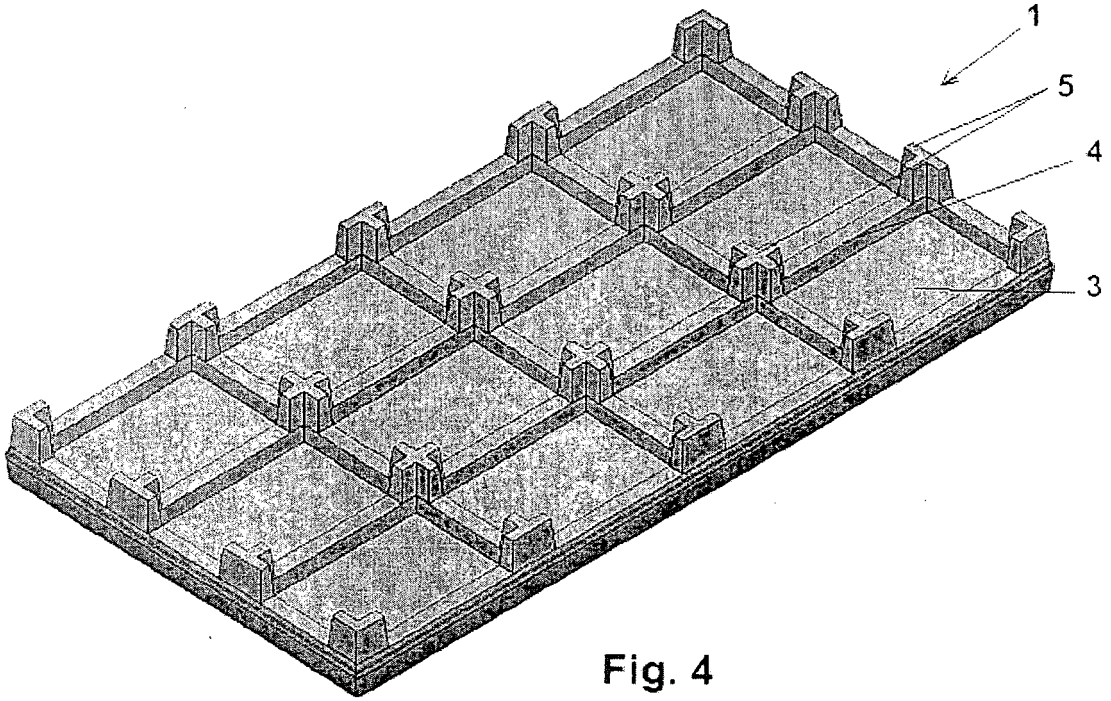

Fig. 4

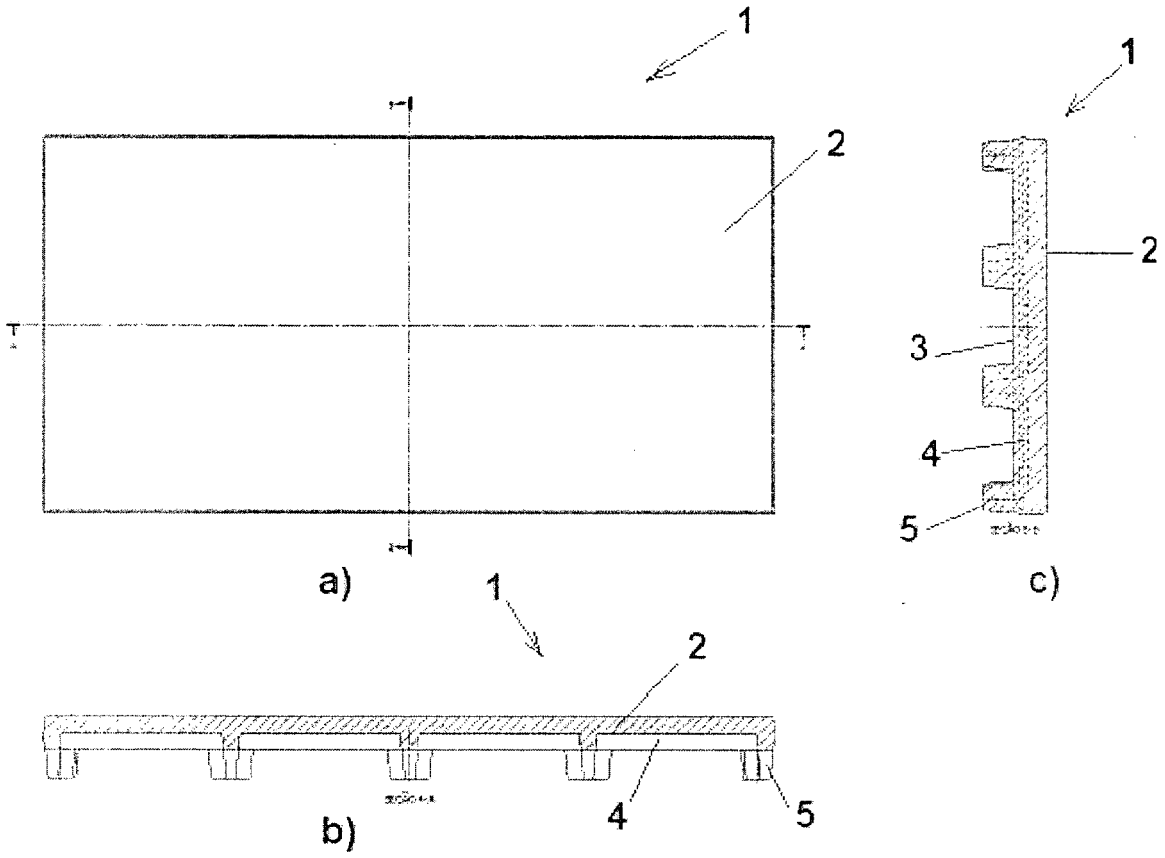

Fig. 5

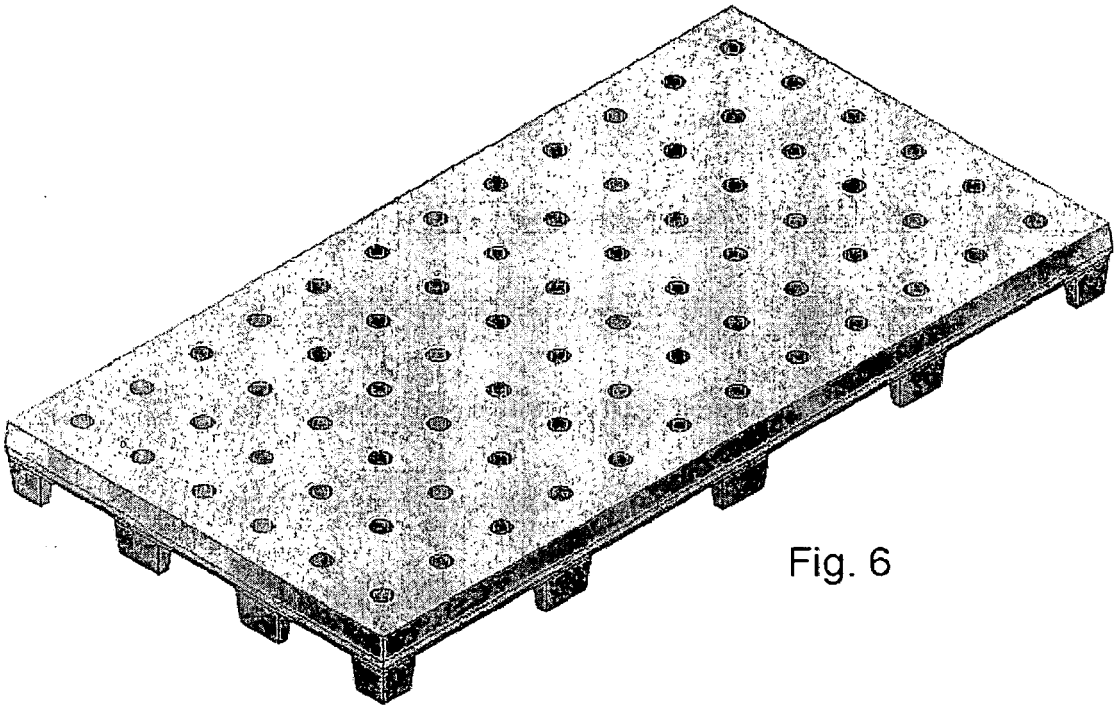

Fig. 6

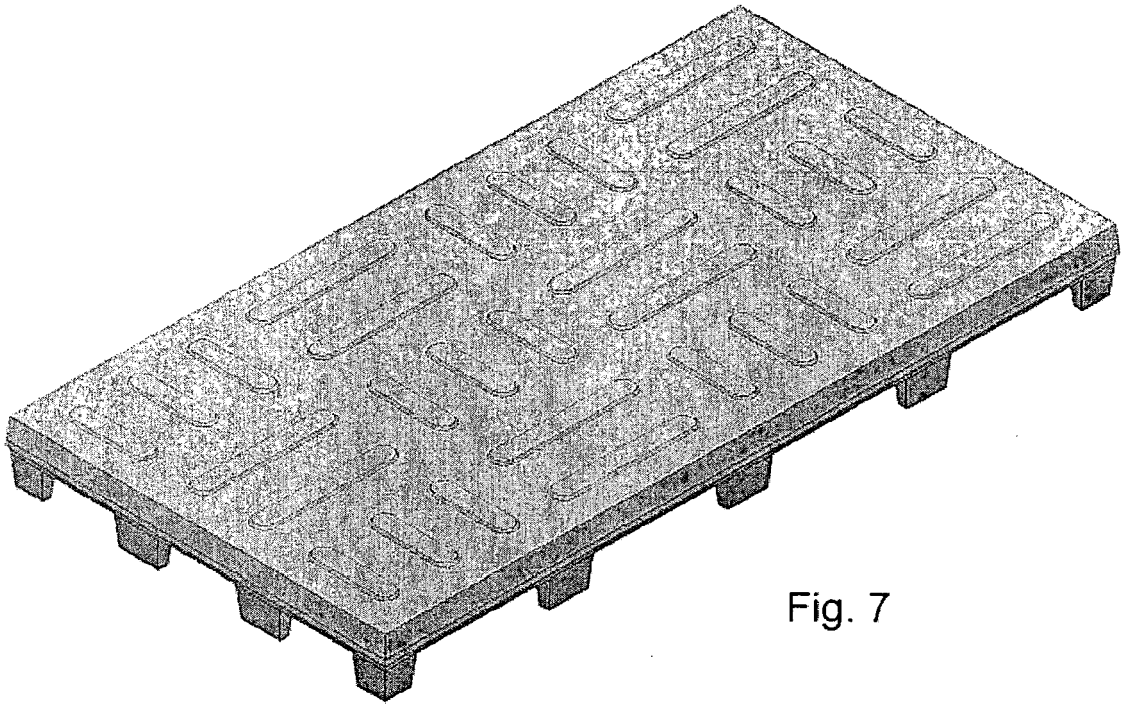

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 09 39 8003

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	DE 43 00 227 A1 (KLEIN WINFRIED [DE]) 14 July 1994 (1994-07-14) * column 1, line 26 - line 28; claim 2 *	2	
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Y	DE 197 35 088 A1 (RAUPACH BODO [DE]) 18 February 1999 (1999-02-18) * column 1, line 54 - line 61 * * column 2, line 20 - line 28 *	13	TECHNICAL FIELDS SEARCHED (IPC) E04D E04F
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 October 2009	Giannakou, Evangelia

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82