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(54) **Self-supporting sandwich panel of plasterboard with polyurethane core**

Selbsttragende Sandwichplatte aus Gipsplatten mit Polyurethankern

Panneau sandwich autoportant de plâtre et noyau de polyuréthane

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Description

OBJECT OF THE INVENTION

[0001] The invention refers to, as expressed on the wording of this descriptive report, an auto load-bearing "sandwich" type panel, applicable as thermal and acoustic insulation, and to the process for its obtaining.

[0002] More specifically, the object of the invention consists of a panel for construction essentially composed by two external parts prefabricated in two faces plaster or laminated plaster, and optionally, additional insulating materials such as acoustic blanket, rock wool, acoustic sheet, etc., and an internal part made of a mixture of polyol and isocyanate and a fill element with mineral, synthetic and/or vegetal origin, which may vary depending on the function of the physical characteristics desired.

FIELD OF APPLICATION

[0003] The field of application of this invention is the sector of the industry dedicated to the manufacturing of materials for construction.

BACKGROUND OF THE INVENTION

[0004] It is well known the existence of fibre boards able to be used in the construction sector, in different places as insulation against external agents.

[0005] The use of polyurethane as insulating agent is also known, although it has been traditionally used projected or injected.

[0006] On the other hand, we know about a patent related to an application similar to the one herein presented, specifically, patent ES 2167226, referred to an improved panel applicable as thermal and acoustic insulation with, however, certain limitations where its application is concerned, which are improved by means of this invention. More precisely, the mentioned patent advocates a pressing process whilst this invention presents a contention of the chemical reaction, meaning a substantial improvement of the process mechanization and a reduction of production costs, besides of implying an essential change since in this case we advocate the industrial production of a "sandwich" type panel finished for direct installation.

[0007] It has to be mentioned also that we have knowledge of the following documents related to this invention.

[0008] Patent document US4025687 describes a panel in which the external part is made of plaster (plaster-board) and the internal layer is made of isocyanurate foam, i.e., polyol and isocyanate, the inner layer consisting of a solid fill of mineral origin (glass) or synthetic origin (plastic fibers).

[0009] Although the panel described in US4025687 panel has apparent similarities in the parts that form it in respect of the one herein claimed, their differences are remarkable where the composition and functionality of

such parts are concerned.

[0010] The nucleus of the panel described in US4205687 patent is composed almost exclusively by rigid foam based on polyurethane, which lacks of the density and structural resistance necessary to provide auto load-bearing characteristics to the whole, is not a good acoustic insulation and has not good behaviour against fire by itself.

[0011] The external layers described in US4025687 patent do not provide structural functionality to such laminated panel, but its function is such of additional insulation or protection of the nucleus from impacts, fire, etc.

[0012] And patent DE19849135, where a construction material is described based on polyurethane foam improved with the incorporation of glass foam. Also, the use of such material is shown as insulating layer put between the external and internal parts of the external closure of a prefabricated concrete building.

[0013] Patent DE19849135 discloses a panel the external part of which is made of plaster and the internal part of which is made of polyol and isocyanate (polyurethane foam material), having a solid fill of mineral origin (glass foam).

[0014] Both patents propose panels or construction materials which are not designed to be auto load-bearing, and that, by the nature of the materials of which they are made, are essentially thermal insulators, not acoustic. Thus, the said panels or construction materials must be mounted as another layer supported or adhered over other structural elements.

EXPLANATION OF THE INVENTION

[0015] Thus, the improved panel proposed by the invention means an evident innovation within its application field thanks to a series of advantages which require a detailed explanation.

[0016] Firstly, it is pertinent to stress that it allows the achievement of a more effective insulation against noise or thermal fluctuations, using lighter elements.

[0017] Consequently, it is necessary to mention that using panels with thickness similar to the conventional ones but with a lower weight, a higher degree of protection is provided, being such aspect the pillar which supports the key of the invention.

[0018] The mixture of polyurethane components is well known by industry long since, being applied nowadays mainly injected or projected over a surface. The object of the invention is to have controlled the mixture so that it can be made by casting (poured in a mould), adding any type of fill which boosts, increases and improves its insulating physical characteristics.

[0019] Specifically, the mixture is beaten, afterwards it is poured between the external pre-formed layers of plaster, laminated plaster and/or insulating material, into a mould. Such mixture expands within and after a period of time when an expansion occurs due to the chemical reaction of the mixture of polyol and isocyanate, which

is controlled by such mould. Once this process is finished, the interior layer compacts with the two external layers, sealing and sticking the external layers with the internal one resulting in a "sandwich" type panel.

[0020] The mould admits multiple shape designs so the thickness, width and length of the piece obtained may be varied according to the target intended.

[0021] The new "sandwich" type auto load-bearing panel applicable as thermal and acoustic insulation and its obtaining process represent, consequently, an innovation of structural and constitutive features unknown so far to such end, reasons which together with its practical utility, provide the invention enough ground to obtain the privilege of the exclusivity requested.

DESCRIPTION OF THE DRAWINGS

[0022] In order to complement the description being made and to help a better comprehension of the characteristics of the invention, attached to this descriptive report, and as a part of the same, is a set of layouts on which the following was represented with illustrative non-limitative character:

Figure number 1.- It shows a perspective sight of an example of the making of the load-bearing "sandwich" type panel applicable as thermal and acoustic insulation, where we can see the parts composing it as well as its configuration and disposition.

Figure number 2.- It shows a detail of a section sight of the panel represented in figure 1.

PREFERENTIAL EXECUTION OF THE INVENTION

[0023] In the light of the descriptive figures, and according to their numbering, it may be seen that the panel (1) in question formed by:

- Two external parts (2) formed by a material mainly manufactured with plaster or laminated plaster in two layers and, in some cases, additional insulating materials (acoustic blanket or sheet, rock wool, fibre glass, etc.).
- And an internal part (3) made with a mixture of:

Polyol, in an approximate percentage of 20%.
Isocyanate, in an approximate percentage of 20%

[0024] Fill (expanded perlite, expanded clay, polystyrene, graphite, fibres or any other mineral, vegetal and/or synthetic fill or a mixture of them, depending on the intended physical features), in an approximate percentage of 60%.

[0025] It has to be mentioned that the internal part (3) is formed by the pre-mixture of polyol and isocyanate.

Once the mixture of the two mentioned components is produced, it has to be immediately beaten with the fill.

[0026] The percentages may vary depending on the type of fill to be used.

[0027] After this operation, the compound, in the conditions determined by the previous steps, is poured between the two external layers (2) into a mould, which is closed in order to contain the expansion produced by the chemical reaction of the polyurethane.

[0028] Once 15-20 minutes approximately have elapsed, the internal layer and the external ones get compact, sealed and stuck, without the intervention of any other type of additive.

[0029] Consequently, at that moment the formation of the plaques which develop the function of thermal and acoustic insulation takes place.

[0030] The resulting width of the "sandwich" panel (1) depends on the insulation required by each specific circumstance and, consequently, the mould used shall depend on the same.

[0031] In the internal part (3) of the panel (1), the use of one material or another as fill, or the mixture of several of them, shall be determined by the characteristics required in each case, for example:

In order to improve fire resistance: Use of fireproof materials with very high melting and softening points (expanded clay, vermiculite, expanded perlite) or which protect the mixture as a whole due to its intrinsic properties (graphite).

In order to improve the acoustic insulation: Use of materials which break the sound waves by means of superimposed layers of mineral, vegetal and/or synthetic fibres (fibre glass, rock wool, etc.), and/or use of materials which, due to its porous nature, act as acoustic insulators (expanded perlite, expanded clay, etc.).

[0032] In order to improve the thermal insulation: Use of materials which join the considerable thermal insulation inherent to polyurethane, either due to their fibrous composition (rock wool, fibre glass) or their porous nature (expanded perlite, expanded clay, etc.).

[0033] Although for certain situations, when additional levels of insulation are required, specific materials to such end will be used in the external layers, thus achieving higher thermal and/or acoustic insulation, as well as more fire, impact, humidity resistance, etc.

[0034] The invention advocated may be directly used as partition wall and for the insulation of the floor or ceiling of a house.

[0035] Its load-bearing character is also advocated since the density of the material achieved during the process allows its installation without need of frame structural elements.

[0036] Having described the nature of this invention as well as the way to put it into practice, it is not considered necessary to extend further its explanation for an exper-

tise in the field to understand its reach and derived advantages, indicating that, within its essentiality, it might be put in practice under other ways of making differing in detail from the one stated as an example, which will also be covered by the protection applied for provided that its fundamental principle as defined by the appended claims is not altered, changed or modified.

Claims

1. AUTO LOAD-BEARING IMPROVED "SANDWICH" TYPE PANEL, APPLICABLE AS THERMAL AND ACOUSTIC INSULATION, of the type constituted by two external parts (2) shaped by a material mainly manufactured from plaster or laminated plaster and, in some cases, additional insulating materials, such as acoustic blanket or sheet, rock wool, fibre glass, etc., and by an internal layer (3) made with the mixture of polyol and isocyanate with a solid fill of mineral or synthetic origin **characterized by** the fact that in addition to the solid fill of the internal layer (3) being expanded perlite, vermiculite or expanded clay when it is of mineral origin, it is, also or alternatively, of vegetal origin, or is made from a mixture of the same, according to the sought physical features of fire-resistant, acoustic or thermal insulation.
2. AUTO LOAD-BEARING IMPROVED "SANDWICH" TYPE PANEL, APPLICABLE AS THERMAL AND ACOUSTIC INSULATION, according to claim 1, **characterized by** the fact that the mineral, synthetic and/or vegetal fill of the internal part (3) constitutes approximately 60% of the total mixture.
3. AUTO LOAD-BEARING IMPROVED "SANDWICH" TYPE PANEL, APPLICABLE AS THERMAL AND ACOUSTIC INSULATION, according to claim 1, **characterized by** the fact that the component of liquid polyurethane used, the polyol, constitutes approximately 20% of the total of the mixture of the internal part (3).
4. AUTO LOAD-BEARING IMPROVED "SANDWICH" TYPE PANEL, APPLICABLE AS THERMAL AND ACOUSTIC INSULATION, according to claim 1, **characterised by** the fact that the component of liquid polyurethane used, the isocyanate, constitutes approximately 20% of the total of the mixture of the internal part (3).
5. PROCESS FOR THE OBTAINING OF AN AUTO LOAD-BEARING IMPROVED "SANDWICH" TYPE PANEL, APPLICABLE AS THERMAL AND ACOUSTIC INSULATION, according to claims 1 to 4, **characterised by** the fact of consisting of:

- Firstly, a pre-mixture of polyol with isocyanate

is made.

- Immediately then, such pre-mixture is beaten with the fill.

- Afterwards, the mixture obtained is poured like casting between the external layers (2), within a mould which is closed to restrain the expansion produced by the chemical reaction of the polyurethane.

- After approximately 15-20 minutes, the internal and external layers get compact, sealed and stuck, without any type of additive.

Patentansprüche

1. Verbessertes selbsttragendes Sandwich-Paneel, welches als thermische und akustische Isolierung verwendbar ist, der Art bestehend aus zwei Außenteilen (2) geformt aus einem hauptsächlich aus Gips oder blättrigem Gips hergestellten Material und, gegebenenfalls, zusätzlichen isolierenden Materialien, wie einer Schalldämmmatte oder -folie, Steinwolle, Glasfaser, usw.; und aus einer Innenschicht (3) hergestellt aus einer Mischung von Polyol und Isocyanat mit einem festen Füllstoff mineralischen oder synthetischen Ursprungs, **dadurch gekennzeichnet, dass** zusätzlich dazu dass wenn der feste Füllstoff der Innenschicht (3) mineralischen Ursprungs ist, es Bläherlit, Vermiculit oder Blähton ist, es auch oder alternativ pflanzlichen Ursprungs, oder aus einer Mischung derselben hergestellt ist, gemäß der angestrebten physikalischen Merkmale der feuerbeständigen, akustischen oder thermischen Isolierung.
2. Verbessertes selbsttragendes Sandwich-Paneel, welches als thermische und akustische Isolierung verwendbar ist, nach Anspruch 1, **dadurch gekennzeichnet, dass** der mineralische, synthetische und/oder pflanzliche Füllstoff des Innenteils (3) etwa 60% der gesamten Mischung beträgt.
3. Verbessertes selbsttragendes Sandwich-Paneel, welches als thermische und akustische Isolierung verwendbar ist, nach Anspruch 1, **dadurch gekennzeichnet, dass** die eingesetzte Komponente aus flüssigem Polyurethan, das Polyol, etwa 20% der gesamten Mischung des Innenteils (3) beträgt.
4. Verbessertes selbsttragendes Sandwich-Paneel, welches als thermische und akustische Isolierung verwendbar ist, nach Anspruch 1, **dadurch gekennzeichnet, dass** die eingesetzte Komponente aus flüssigem Polyurethan, das Isocyanat, etwa 20% der gesamten Mischung des Innenteils (3) beträgt.
5. Verfahren zum Erhalten eines verbesserten selbsttragenden Sandwich-Paneel, welches als thermische und akustische Isolierung verwendbar ist, nach

den Ansprüchen 1 bis 4, **dadurch gekennzeichnet, dass** es folgende Schritte umfasst:

- zuerst wird eine Vormischung aus Polyol mit Isocyanat vorbereitet;
- direkt danach wird die genannte Vormischung mit dem Füllstoff gerührt;
- anschließend wird die erhaltene Mischung wie beim Giessen zwischen den Außenschichten (2) innerhalb einer Form gegossen, welche geschlossen ist um die von der chemischen Reaktion des Polyurethans hervorgerufene Ausdehnung einzuschränken;
- nach etwa 15-20 Minuten werden die Innen- und Außenschichten kompaktiert, abgedichtet und angehaftet, ohne jegliche Art von Additiven.

Revendications

1. Panneau de type sandwich amélioré autoporteur, applicable comme isolement thermique et acoustique, du type constitué par deux pièces externes (2) conformées par une matière principalement fabriquée à partir de plâtre ou plâtre laminé et, dans quelques cas, des matières d'isolement additionnelles, tels que un matelas ou une toile d'isolement, de la laine de roche, de la fibre de verre, etc., et par une couche interne (3) réalisée avec le mélange de polyol et isocyanate avec une charge solide d'origine minérale ou synthétique **caractérisé en ce que**, outre le fait que la charge solide de la couche interne (3) est de la perlite expansée, de la vermiculite ou de l'argile expansée lorsqu'elle est d'origine minérale, elle est, également ou alternativement, d'origine végétale, ou elle est réalisée à partir d'un mélange de ceux-ci, selon les caractéristiques physiques souhaitées d'isolement résistant au feu, acoustique ou thermique.
2. Panneau de type sandwich amélioré autoporteur, applicable comme isolement thermique et acoustique, selon la revendication 1, **caractérisé en ce que** la charge minérale, synthétique et/ou végétale de la partie interne (3) constitue environ 60% du mélange totale.
3. Panneau de type sandwich amélioré autoporteur, applicable comme isolement thermique et acoustique, selon la revendication 1, **caractérisé en ce que** le composant de polyuréthane liquide utilisé, le polyol, constitue environ 20% du total du mélange de la partie interne (3).
4. Panneau de type sandwich amélioré autoporteur, applicable comme isolement thermique et acoustique, selon la revendication 1, **caractérisé en ce que** le composant de polyuréthane liquide utilisé, l'iso-

cyanate, constitue environ 20% du total du mélange de la partie interne (3).

5. Procédé pour l'obtention d'un panneau de type sandwich amélioré autoporteur, applicable comme isolement thermique et acoustique, selon les revendications 1 à 4, **caractérisé en ce qu'il** consiste à :

- tout d'abord, réaliser un pré-mélange du polyol avec de l'isocyanate,
- immédiatement après, ce pré-mélange est battu avec la charge.
- ensuite, le mélange obtenu est versé du moule entre les couches externes (2) à l'intérieur d'un moule qui est fermé pour limiter l'expansion produite par la réaction chimique du polyuréthane.
- après environ 15-20 minutes, les couches interne et externes se compactent, se scellent et se collent sans aucun type d'additif.

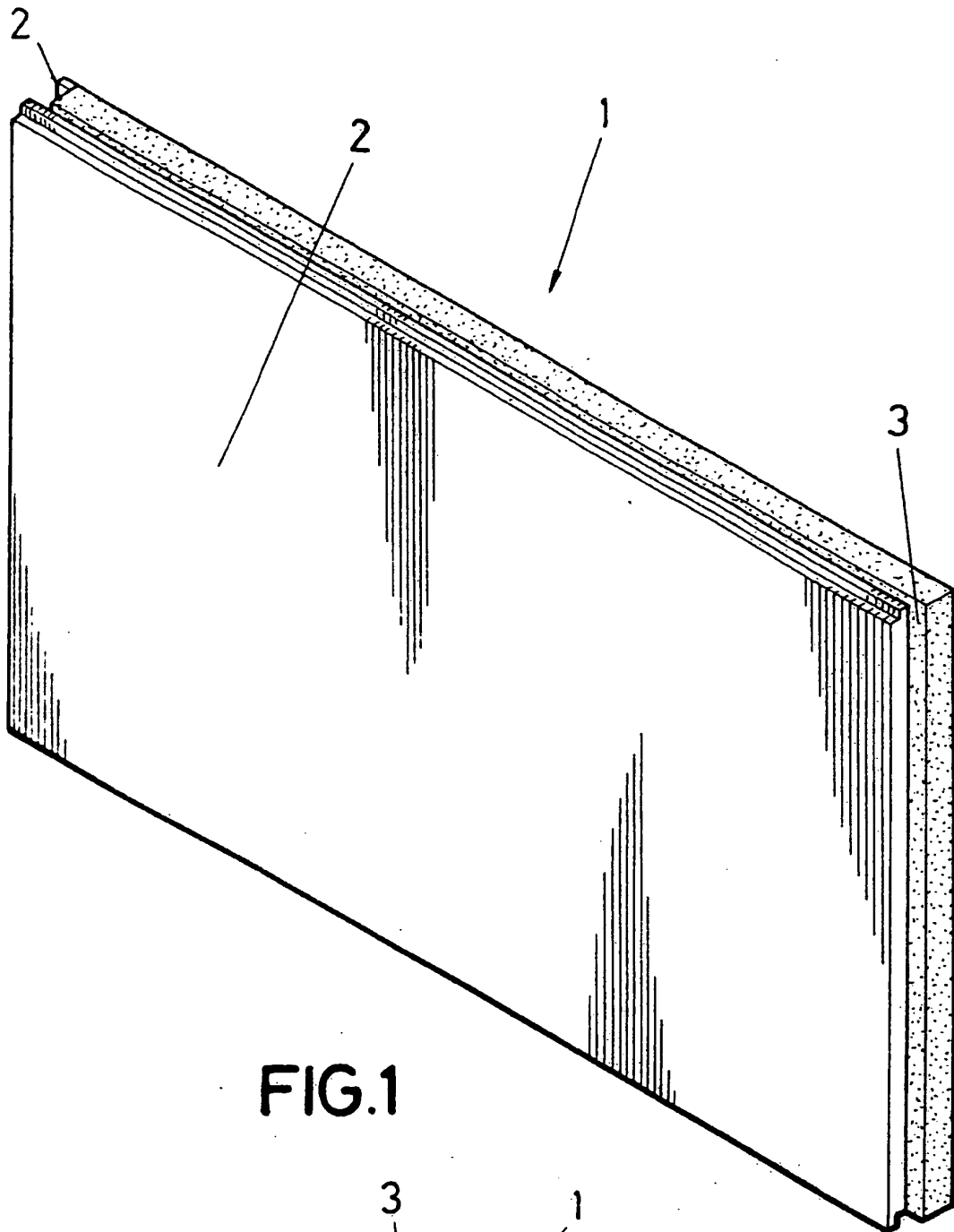


FIG.1

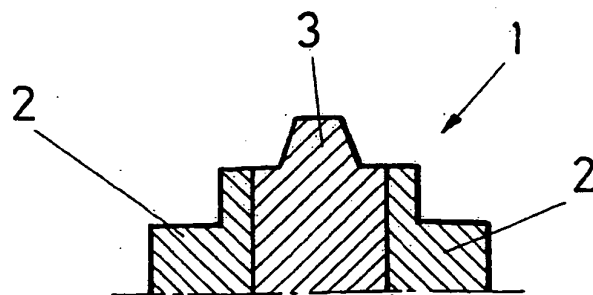


FIG.2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 4025687 A [0008] [0009] [0011]
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