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(54) **Thermally insulating, soundproofing, and shock-absorbing modular panel**

Thermisches, akustisches und vibrationsabsorbierendes modulares Paneel

Panneau modulaire d'isolation thermique, acoustique et vibratoire

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Description

[0001] The present invention relates to a soundproofing, thermally insulating, and shock-absorbing modular panel, particularly having a rubber base, and to a method for manufacturing it.

[0002] The field of application of these panels is, particularly but not exclusively, the field of constructions, namely residential and industrial buildings, for the thermal insulation, soundproofing, and shock-absorption of walls, garrets, and floors.

[0003] Panels of the above mentioned type are known which are formed by a layer of cuttings made of rubber or of mixtures of rubber and rubber with cork that are aggregated by hot molding.

[0004] In order to manufacture insulating coverings, the conventional panels are usually arranged side by side on a supporting surface so that their respective edges are in mutual contact.

[0005] A drawback of conventional panels is that they do not ensure stability with respect to the supporting surface, because they can move under the action of mechanical stresses, caused for example by settling of the building, and consequently move mutually apart along their plane of arrangement, because a certain relative play is provided for during installation. This causes wide cracks or gaps to open, causing a significant decrease in the insulating power of the covering.

[0006] In order to obviate this drawback, known panels are usually fixed to the supporting surface by glueing or with metal screws and staples.

[0007] It is evident that this solution, too, entails the drawback of a considerable increase in time and costs for the installation of conventional panels, which is usually performed by specialized workers.

[0008] Prior art document US-4,287,693 discloses an interlocking rubber mat as defined in the preamble of claim 1.

[0009] WO-A-9 115 631 discloses a process for producing a railroad crossing means in which resilient moldings are used as track crossings and wherein the molding has a rubber surface layer which is bonded to a body formed fro scrap rubber.

[0010] DE-A-1 720 116 discloses the use of rubber granules for flooring panels.

[0011] GB-A-2 057 354 discloses a floor covering in which rubberised cork granules are used.

[0012] The aim of the present invention is to eliminate the drawbacks described above by providing a modular insulating panel that features quick installation and allows to reduce laying costs.

[0013] An object of the invention is to provide a manufacturing method that allows to automatically obtain modular panels of the above mentioned type that have a high quality standard and a low cost.

[0014] This aim, this object, and others which will become apparent hereinafter are achieved by a modular insulating panel according to the accompanying claim 1.

[0015] The panel according to the invention reduces laying costs considerably, allowing to achieve coverings that feature perfect mechanical stability, thermal insulation, and soundproofing without having to resort to glueing, mechanical anchoring, and/or sealing operations.

[0016] Further characteristics and advantages of the invention will become apparent from the following description of a preferred but not exclusive embodiment of a panel according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

Figure 1 is a partially sectional perspective view, taken along a transverse plane, of two identical panels according to the invention, disengaged from each other;

Figure 2 is a perspective view of the panel according to a further aspect of the invention;

Figures 3 to 8 are, respectively, schematic views of still further embodiments of a detail of the panel according to the invention.

[0017] With reference to the above figures, the modular panels according to the invention are preferably but not exclusively used for the construction of coverings and floorings of a known type.

[0018] Figure 1 illustrates a portion of a covering, which shows two modular panels according to the invention that are generally designated by the reference numerals 1 and 1' and are mutually coupled along their edges.

[0019] Reference is made, for the description, to panels that have a substantially rectangular plan shape, but this shape may vary and be for example square, hexagonal, circular, et cetera, without thereby abandoning the scope of the invention.

[0020] Panel 1 includes a main body 2 formed by at least one layer of rubber or by a mixture of rubber, rubber-cork, and other materials that have insulating properties, in cuttings, with resins and/or binders and fire-retardant substances.

[0021] In order to increase the thermal insulation power of the panel, the mixture can include granules of foamed clay, of the "Leca" type, in a proportion that is variable according to the desired final characteristics.

[0022] Body 2 of panel 1 has two substantially flat and parallel faces 3 and peripheral edges 4 that allow its coupling in series to other co-planar panels of the same type.

[0023] According to a particular characteristic of the invention, edges 4 have a connecting means 5 that is suitable to prevent relative sliding and mutual spacing of panels 1 and 1' along the common plane of arrangement.

[0024] Connecting means 5 includes at least one longitudinal protrusion 6 adapted to engage at least one

longitudinal recess 7' that is formed correspondingly along the edge of the adjacent panel 1'.

[0025] Protrusion 6 and recess 7' are shaped so as to generate, on the coupled panels 1 and 1', opposite lateral forces that are suitable to keep in mutual contact edges 4, 4' of the panels.

[0026] By virtue of this configuration, edge 4 of panel 1 has, in a position that is adjacent to protrusion 6, a recess 7 that is identical and symmetrical with respect to recess 7' formed on panel 1'. Likewise, edge 4' of panel 1' has a protrusion 6', in a position that is adjacent to recess 7'. Protrusion 6' is identical and symmetrical with respect to protrusion 6 of panel 1. In this manner, it is possible to couple edges 4 and 4' of the respective panels 1 and 1' regardless of their orientation.

[0027] More specifically, in a first embodiment, shown in Figure 1, protrusion 6 is substantially continuous along the entire perimeter of the panel and includes an end portion 8, which is substantially perpendicular to faces 3 of the panel, and an intermediate connecting portion 9, which is substantially parallel to faces 3.

[0028] Preferably, the average thickness s of protrusion 6 is approximately equal to half of the maximum thickness S of the panel. In this manner, by coupling edges 4 and 4' of the two panels 1 and 1', the panels are co-planar and their faces are perfectly aligned and form no steps.

[0029] After the mutual connection of the adjacent panels 1 and 1', the respective protrusions 6 and recesses 7 apply a mechanical action that prevents the relative sliding of panels 1 and 1' along the common plane of arrangement and simultaneously provide an excellent and substantially uniform insulation even in the joint regions, without necessarily requiring glueing or filling of the joints.

[0030] Advantageously, this configuration of edges 4 and 4' allows to compensate for small errors in the shape and size of the panels, facilitating mutual coupling during installation.

[0031] It is noted that, although protrusion 6 is preferably provided directly during the production of panel 1, it can also be formed subsequently, before installation, by mechanically removing a portion of the peripheral edges, without thereby abandoning the scope of the invention.

[0032] Protrusions 6 and recesses 7 are constituted by discontinuous parts that have, for example, a substantially dovetail plan shape with radiused corners.

[0033] The panel according to the invention can include stiffening parts, not shown in the drawings, that are embedded in the base material. These stiffening parts can, for example, be constituted by wires or laminar metallic frames, or by textile fibers, which cooperate with the base material to constitute a composite unit that is substantially self-supporting.

[0034] Conveniently, provision is made for impregnating the panel with fire-retardants mixed in with the base material, and/or for covering the surfaces with a film of fire-resistant material.

[0035] A method for manufacturing thermally insulating and soundproofing panels of the above described type includes the following steps:

- -- preparation of a mixture of rubber, cork, foamed clay, and similar materials in cuttings, with resins and/or binders and/or fire-retardants;
- -- preparation of a mold whose shape is suitable to obtain the connecting means along the edges of the panel;
- -- placing, in the mold, a uniform layer of the mixture that has a controlled thickness;
- -- closing and heating the mold until an at least partial crosslinking of the resins and the possible vulcanization of the rubber are achieved.

[0036] As an alternative, provision is made for depositing in the mold, prior to closure, an additional unitary layer of rubber in the crude state to obtain a panel in which at least one face is impermeable to liquids and highly wear-resistant.

[0037] The base material is mixed and deposited in the mold with automatic machines to achieve uniformity in the composition of the panel, a substantially uniform thickness, and a mass per unit volume that is substantially constant in every point.

[0038] This method allows to obtain a panel with high-level insulating characteristics that is easy to install 1 and offers perfect mechanical stability, thermal insulation, and soundproofing.

[0039] The panel according to the invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept expressed in the accompanying claims.

[0040] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the scope of each element identified by way of example by such reference signs.

Claims

1. A thermally insulating, shock-absorbing, and soundproofing modular panel, particularly for house, civil, and industrial building, comprising a main body (2) that is formed by at least one layer of cuttings made of rubber, rubber-cork, and/or foamed clay and/or similar materials, and substantially flat faces (3) and substantially straight peripheral edges (4) for mutual coupling with other adjacent co-planar panels (1') of the same type, said pe-

ripheral edges (4) having connecting means (5) adapted to prevent the mutual spacing of the panels (1, 1') on their common plane of arrangement, the stepped peripheral edges of adjacently arranged panels mutually overlapping along the entire contact region of the adjacent panels, so as to prevent liquid leakages between the panels, said connecting means (5) comprising, on each panel, at least one longitudinal protrusion (6) adapted to engage in a longitudinal and complementarily shaped recess (7') formed along the edge (4') of an adjacent panel (1'), wherein said longitudinal protrusion (6) and said recess (7') are of finite length and have a substantially dovetail shape in respect of the plan view of the panel, with sharp or radiused corners, and that both the base and the outer edges of the recesses along one stepped edge of the panel are set back from the edge of the panel, and the corresponding projections on the other edge of the panel extend outwardly past the abutting lower face of the stepped edge.

2. The panel according to claim 1, **characterized in that** said longitudinal protrusion (6) and said recess (7') are shaped so as to generate, on adjacent panels (1, 1'), upon their coupling, opposite transverse forces that are suitable to keep the edges (4, 4') of said panels in mutual contact and with perfect insulation.

3. The panel according to claim 1, **characterized in that** the average thickness (s) of said protrusion (6) is approximately equal to half of the maximum thickness (S) of said main body (2).

4. The panel according to claim 1, **characterized in that** said protrusion (6) has an end portion (8) that lies substantially at right angles to the faces (3) and an intermediate portion (9) that is substantially parallel to said faces (3).

5. The panel according to claim 1, **characterized in that** said main body (2) comprises stiffening parts that are embedded in the base material so as to constitute a substantially self-supporting unit.

6. The panel according to claim 5, **characterized in that** said stiffening parts are constituted by natural or synthetic flexible fibers and/or by rigid or semirigid wirelike and/or laminar frames.

7. The panel according to claim 1, **characterized in that** said main body (2) comprises at least one second unitary layer of vulcanized rubber that faces said at least one layer of cuttings, to make said panel impermeable to liquids on at least one of the faces (3).

Patentansprüche

1. Thermisches, akustisches und vibrationsabsorbierendes modulares Panel, im wesentlichen für den Haus-, Verwaltungs- und Industriebau, welches einen durch wenigstens eine Lage von Zuschnitten aus Gummi, Gummi-Kork und/oder geschäumtem Ton und/oder ähnlichen Materialien geformten Hauptkörper 2, im wesentlichen flachen Stirnseiten 3 und zum gegenseitigen Verbinden mit anderen benachbarten koplanaren Panelen 1' derselben Art im wesentlichen geraden äußeren Kanten 4 aufweist, wobei die äußeren Kanten 4 Verbindungsmittel 5 aufweisen, welche vorgesehen sind den gegenseitigen Abstand der Panele 1, 1' in deren gemeinsamer Eingriffsebene zu verhindern, wobei sich die gestuften äußeren Kanten von benachbart angeordneten Panelen gegenseitig entlang des gesamten Berührungsbereiches der benachbarten Panele überlappen, so daß ein Eindringen von Flüssigkeiten zwischen die Panele verhindert wird, wobei die Verbindungsmittel 5 an jedem Panel wenigstens einen länglichen Vorsprung 6 aufweisen, welcher zum Eingriff in eine längliche und komplementär geformte Einbuchtung 7', die entlang der Kante 4' eines benachbarten Panels 1' geformt ist, vorgesehen ist, wobei der längliche Vorsprung 6 und die Einbuchtung 7' von endlicher Länge sind und bezüglich der Aufsicht auf das Panel eine im wesentlichen schwalbenschwanzartige Form mit scharfen oder gerundeten Ecken haben und daß die Basis und die äußeren Kanten der Einbuchtungen entlang der einen gestuften Kante des Panels von der Kante des Panels zurückgesetzt sind und die korrespondierenden Projektionen auf die andere Kante des Panels über die anstoßende untere Fläche der gestuften Kante hinausragen.

2. Panel nach Anspruch 1, **dadurch gekennzeichnet, daß** der längliche Vorsprung 6 und die Einbuchtung 7' so geformt sind, daß an benachbarten Panelen 1, 1' durch deren Verbindung entgegengesetzte Querkräfte erzeugt werden, welche dazu geeignet sind, die Kanten 4, 4' der Panele in gegenseitigen Kontakt und mit perfekter Isolierung zu halten.

3. Panel nach Anspruch 1, **dadurch gekennzeichnet, daß** die durchschnittliche Dicke s des Vorsprungs 6 ungefähr gleich der Hälfte der maximalen Dicke S des Hauptkörpers 2 ist.

4. Panel nach Anspruch 1, **dadurch gekennzeichnet, daß** der Vorsprung 6 einen im wesentlichen in einem rechten Winkel zu den Stimseiten 3 liegenden Endteil 8 und einen zwischenliegenden Teil 9, der im wesentlichen parallel zu den Stimseiten 3 ist, hat.

5. Panel nach Anspruch 1, **dadurch gekennzeichnet, daß** der Hauptkörper 2 versteifende Teile aufweist, die in dem Basismaterial eingebettet sind, so daß eine im wesentlichen selbsttragende Einheit gebildet wird.

6. Panel nach Anspruch 5, **dadurch gekennzeichnet, daß** die versteifenden Teile durch natürliche oder synthetische flexible Fasem und/oder durch feste oder halbfeste drahtähnliche und/oder laminare Rahmen gebildet sind.

7. Panel nach Anspruch 1, **dadurch gekennzeichnet, daß** der Hauptkörper 2 wenigstens eine zweite einteilige Läge aus vulkanisiertem Gummi aufweist, welche der wenigstens einen Lage der Zuschnitte gegenüberliegt, um das Panel an wenigstens einer der Stimseiten 3 undurchdringlich für Flüssigkeiten zu machen.

Revendications

1. Panneau modulaire d'isolation acoustique, d'absorbsion de chocs et d'isolation thermique, en particulier pour la construction de maisons, d'ouvrages du génie civil et de bâtiments industriels, comprenant un corps principal (2) formé d'au moins une couche de morceaux découpés constitués de caoutchouc, de caoutchouc-liège et/ou d'argile alvéolaire, et/ou de matériaux similaires, ainsi que des faces sensiblement planes (3) et des bords périphériques sensiblement rectilignes (4), pour un accouplement mutuel avec d'autres panneaux coplanaires contigus (1') du même type, lesdits bords périphériques (4) ayant des moyens de connexion (5) conçus pour empêcher l'écartement mutuel des panneaux (1, 1') selon leur plan d'agencement commun, les bords périphériques épaulés de panneaux contigus se recouvrant mutuellement sur toute la région de contact des panneaux contigus, de façon à empêcher des fuites de liquides entre les panneaux, lesdits moyens de connexion (5) comprenant, sur chaque panneau, au moins une saillie longitudinale (6) adaptée pour être en prise dans un évidement longitudinal de forme complémentaire (7') formé le long du bord (4') d'un panneau contigu (1'), dans lequel ladite saillie longitudinale (6) et ledit évidement (7') ont une longueur finie et ont sensiblement une forme de queue d'aronde dans la vue en plan du panneau, avec des coins aigus ou arrondis, et dans lequel la base et les bords extérieurs de l'évidement formé le long d'un bord épaulé du panneau sont en retrait par rapport au bord du panneau, et les saillies correspondantes sur l'autre bord du panneau s'étendent vers l'extérieur au-delà de la face de butée inférieure du bord épaulé.

2. Panneau selon la revendication 1, **caractérisé en ce que** ladite saillie longitudinale (6) et ledit évidement (7') sont conformés de façon à générer, sur des panneaux contigus (1, 1'), lors de leur accouplement, des forces transversales opposées qui sont appropriées pour maintenir les bords (4, 4') desdits panneaux en contact mutuel et avec une isolation parfaite.

3. Panneau selon la revendication 1, **caractérisé en ce que** l'épaisseur moyenne (s) de ladite saillie (6) est approximativement égale à la moitié de l'épaisseur maximale (S) dudit corps principal (2).

4. Panneau selon la revendication 1, **caractérisé en ce que** ladite saillie (6) a une partie d'extrémité (8) qui s'étend sensiblement à angle droit par rapport aux faces (3), et une partie intermédiaire (9) qui est sensiblement parallèle auxdites faces (3).

5. Panneau selon la revendication 1, **caractérisé en ce que** ledit corps principal (2) comprend des parties de renforcement qui sont noyées dans le matériau de base, de façon à constituer une unité sensiblement autoporteuse.

6. Panneau selon la revendication 5, **caractérisé en ce que** lesdites parties de renforcement sont constituées de fibres flexibles naturelles ou synthétiques et/ou de structures filiformes et/ou laminaires rigides ou semi-rigides.

7. Panneau selon la revendication 1, **caractérisé en ce que** ledit corps principal (2) comprend au moins une seconde couche solidaire de caoutchouc vulcanisé, qui fait face à ladite au moins une couche de morceaux découpés, pour rendre ledit panneau imperméable aux liquides sur au moins l'une des faces (3).

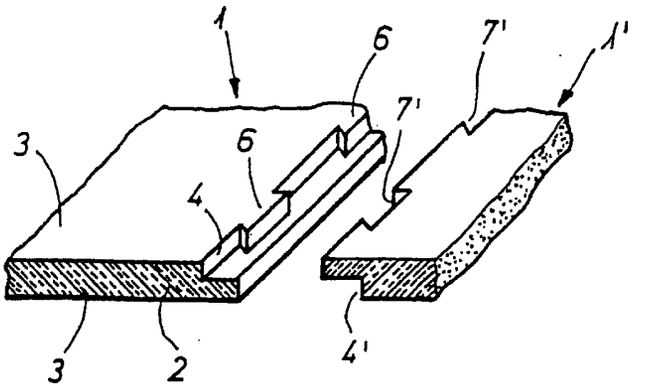

FIG. 1

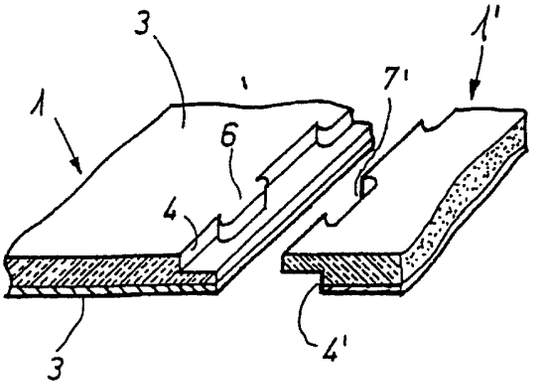

FIG. 2

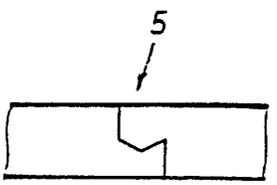

FIG. 3

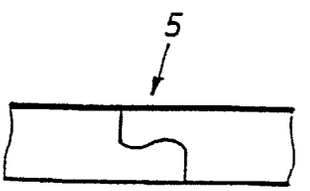

FIG. 4

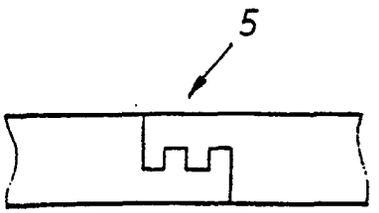

FIG. 5

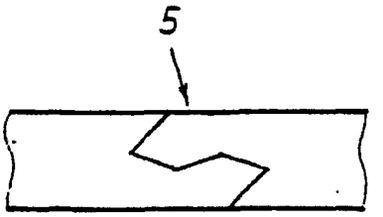

FIG. 6

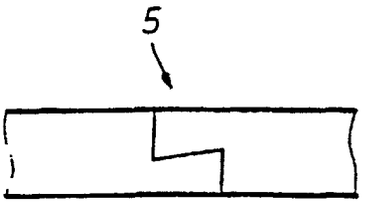

FIG. 7

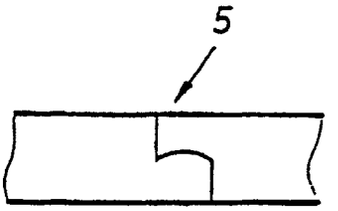

FIG. 8