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(54) **Reinforced concrete wall provided with insulating panels on the underside and a method of making such wall**

(57) The invention relates to a reinforced concrete wall comprising a reinforced concrete slab (10) provided with insulating panels (12) based on mineral fibres, fixed in the lower surface of the concrete slab by anchoring elements (14) and serving as shuttering when the concrete is poured. Each of the insulating panels (12) comprises

an insulating base layer (16) of mineral fibres and a rigid surface layer (18), the base layer (16) being arranged underneath the reinforced concrete slab (10) and the rigid surface layer (18) being arranged under the insulating base layer (16) to form an outer facing. The invention applies particularly to ceilings of cellars or car parks.

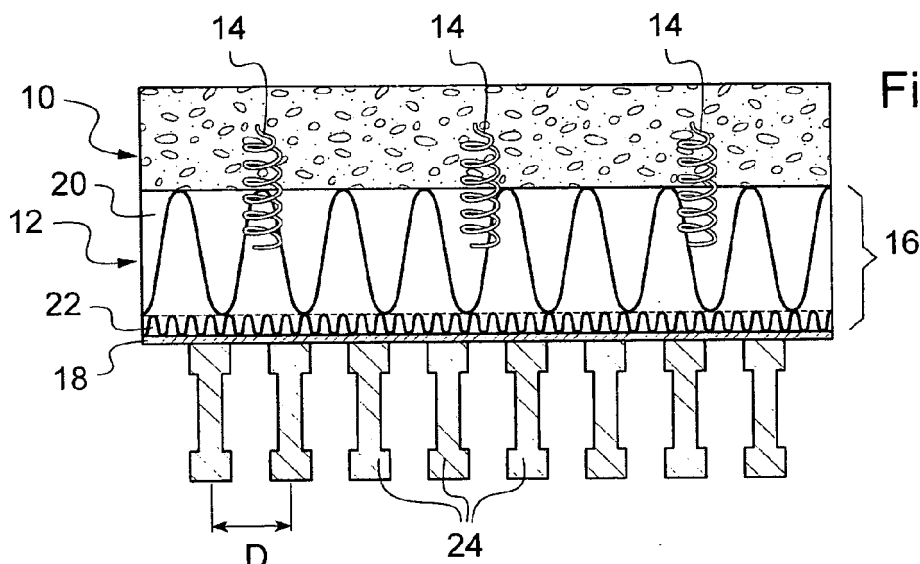


Fig.1

Description

[0001] The invention relates to a horizontal or sloping reinforced concrete wall provided with insulating panels on its underside which form shuttering for pouring the concrete.

[0002] It also relates to a process of making such wall.

[0003] It is known to provide heat and sound insulation for reinforced concrete walls in this way, particularly ceilings for cellars or car parks located in the basements of dwelling houses or commercial premises.

[0004] The insulating panels then provide heat and sound insulation for the reinforced concrete ceilings between these cellars or car parks and the premises located immediately above them on an upper floor.

[0005] Ideally, these panels should have good fire resistance and for this reason it is increasingly common to use panels based on mineral fibres, notably rock wool.

[0006] In a conventional application as taught for example by the publication WO 2008/055653 A1, the insulating panels are finally added underneath a slab of reinforced concrete which has previously been poured and hardened.

[0007] This solution has the disadvantage of requiring fixing systems such as metal lugs or the like which are the source of heat bridges and moreover project below the panels.

[0008] Another solution is to use the insulating panels as shuttering elements for pouring the concrete which will form the ceiling of the cellar or car park.

[0009] The present invention belongs to this second solution. The insulating panels therefore serve first of all as shuttering elements for pouring the concrete slab and secondly as insulation once the concrete has set.

[0010] In this particular case the insulating panels have to be placed horizontally on a strong load-bearing structure. Hitherto this has required placing a certain number of struts or vertical uprights of adjustable height on which horizontal girders are then placed at a suitable spacing from one another. Then, on these girders is placed a shuttering surface made up of metal plates or panels of wood, chipboard or the like. The insulating panels are then arranged adjacent to one another on the shuttering surface before the concrete is poured.

[0011] The result is that the positioning of the insulating panels is onerous to implement because a horizontal shuttering surface has to be provided, in particular.

[0012] Moreover, as the insulating panels form shuttering elements and have to support the weight of the poured concrete which is to form the concrete slab, they have to be particularly resistant to compression.

[0013] The publication EP 0427596 B1 describes a process for the insulation of the underside of the ceilings, particularly ceilings of cellars or car parks, in which the insulating panels are first placed on a shuttering table, which has the disadvantages mentioned above.

[0014] In this known solution, the insulating panels may be formed from two insulating layers but in every case

this requires a finishing off of the lower surface of the insulating panels.

[0015] In fact, once the concrete has set and the load bearing structure and shuttering surface have been removed, the lower surface of the insulating panels remains visible and may thus be subjected to impact or scrapes.

[0016] This is particularly true of the risk of scraping by the aerials on vehicles travelling in the car parks.

[0017] In other words, the solution provided by the publication EP 0427596 B1 requires that an outer protective facing be positioned underneath the insulating panels to provide a surface finish and protect them from external impact.

[0018] This known solution requires the use of fixing elements or anchoring elements to provide a permanent connection between the reinforced concrete slab and the insulating panels.

[0019] It is known to use, for this purpose, anchoring elements in the form of corkscrews which are implanted by screwing into each of the insulating panels and are then invisibly embedded within the thickness of the concrete slab.

[0020] The publication FR 2624154 B1 discloses a device for fixing panels of insulating material to a concrete slab provided with internal reinforcements that uses a support forming a thickness wedge and an anchoring element adapted to be positioned through the support and introduced blind into the panel in order to attach the panel securely to the concrete slab.

[0021] This solution also requires the use of a shuttering surface for the positioning of the insulating panels before the concrete is poured and the use of a protective facing once the shuttering surface has been removed.

[0022] The publication WO 2007/045744 A1 also shows insulating panels applied to the underside of a reinforced concrete slab. However, this solution requires a metal shuttering profile which at the same time at least partly forms the lower surface of the panels.

[0023] This solution also has the disadvantage of producing thermal bridges and of reducing the heat insulation properties of the insulating panels.

[0024] It is moreover known that insulating panels made of mineral materials, for example rock wool, are now used increasingly in the light of their heat and sound insulating properties and fire resistance. They are, furthermore, much easier to handle than fibreglass panels and can be produced to different density and thickness levels to suit the particular purpose.

[0025] Mention may be made for example of the publication EP 1180182 B1 which discloses insulating panels of this type intended to be used for roofs or facades. However, there is neither description nor a suggestion that panels of this kind might be used on the underside of ceilings.

[0026] The publication WO 2010/130416 discloses insulating panels based on mineral wool. The panels have two facings, one of which is provided with openings or holes to improve acoustic insulation. It is this latter facing

that is oriented towards the cellar or car park that is to be insulated.

[0027] The aim of the invention is to overcome the disadvantages of the known solutions as mentioned hereinbefore.

[0028] It sets out in particular to provide a horizontal or sloping reinforced concrete wall, particularly the ceiling of a cellar or car park, comprising a reinforced concrete slab provided with insulating panels based on mineral fibres, fixed on the lower surface of the concrete slab by anchoring elements and serving as shuttering during the pouring of the concrete.

[0029] The invention furthermore sets out to provide a wall of this type wherein the insulating panels have improved resistance to compression, improved resistance to impact, notably to scrapings caused by vehicle aerials, and further have an improved final appearance.

[0030] A further aim of the invention is to provide a reinforced concrete wall of this kind wherein the positioning of the insulating panels before the pouring of the concrete is achieved in simplified manner compared with the known solutions, such as those taught for example by the publication EP 0427596 B1.

[0031] The invention provides for this purpose a reinforced concrete wall of the type mentioned above wherein each of the insulating panels comprises an insulating base layer of mineral fibres and binder and a rigid surface layer, the base layer being arranged underneath the reinforced concrete slab and the rigid surface layer being arranged beneath the insulating base layer forming an outer facing, the rigid surface layer comprising a mineral material and a binder.

[0032] By the phrase "horizontal or sloping wall" is meant a wall which may be horizontal, such as a ceiling, for example, or a sloping wall such as staircase wall, for example. The angle of inclination, measured from a horizontal direction, of the wall may range from 0° to approximately 90°.

[0033] One of the preferred applications of the invention is to the ceilings of cellars or car parks.

[0034] The insulating base layer which forms the majority of the insulating layer is particularly resistant to compression and is used directly for pouring the concrete slab.

[0035] The rigid surface layer performs at least a double function. First of all, by virtue of its rigidity, it enables a simplified load bearing structure to be used, i.e. without a shuttering surface.

[0036] In fact, the respective rigid surface layers of the different insulating panels are placed directly on a support which has a discontinuous contact surface such as, for example, girders which are themselves supported by props or the like. These girders may be suitably spaced to enable these rigid surface layers to bear the weight of the poured concrete without any notable sagging.

[0037] Additionally, this rigid surface layer then directly forms an outer final facing for the insulating panels after the removal of the shuttering. As this surface layer is

particularly rigid, it is resistant to impact and scrapes. It is thus of particular value in car parks, in order to resist scraping as mentioned previously.

[0038] It is advantageous for the insulating base layer to have at least two layers of different densities, the layer of lower density being located immediately below the reinforced concrete slab and the layer of greater density being adjacent to the rigid surface layer. Preferably, the insulating base layer comprises two layers of different densities, namely a first layer of lower density and a second layer of higher density. By way of example, the first layer of the insulating base layer may have a density of from 50 to 150 kg/m³ and a thickness of from 35 to 300 mm, while the second layer of the insulating base layer may have a density of from 100 to 300 kg/m³ and a thickness of from 10 to 40 mm.

[0039] In a preferred embodiment, the insulating base layer forms a unified structure in which the layers are joined together by the binder. The different layers that make up the insulating base layer are then joined together to form a unified structure when the binder hardens.

[0040] Alternatively, it is possible to produce the layers separately and then assemble them, for example by adhesive bonding.

[0041] The insulating base layer advantageously comprises rock wool fibres joined together by a suitable binding agent.

[0042] In a first embodiment the rigid surface layer comprises mineral fibres. In this case, this layer has a density that is higher than the mean density of the base layer. By way of example, the rigid surface layer will have a density of at least 450 kg/m³ and a thickness of from 5 to 40 mm.

[0043] In this first embodiment the rigid surface layer will advantageously comprise rock wool fibres joined together by a suitable binding agent.

[0044] In a second embodiment of the invention the rigid surface layer will comprise grains of mineral material joined together by a suitable binding agent. They may be, for example, grains of quartz sand joined together by the binding agent.

[0045] The grain size of quartz sand is preferably 1-2 mm, and the density of the rigid surface layer is preferably from 1,000 to 1,500 kg/m³.

[0046] The two embodiments may be combined, with the mineral material of the rigid surface layer then comprising rock wool fibres and/or grains of mineral material such as grains of quartz sand.

[0047] The rigid surface layer may be reinforced with a reinforcement or armature such as a glass fibre lattice or nonwoven.

[0048] The quantity of organic binder in the rigid surface layer may be at least 3% by weight of said layer, such as at least 8% by weight of said layer, and the total quantity of mineral materials in said layer may be from 50 to 90% by weight of said layer.

[0049] The insulating panels may comprise a fire retardant. A fire retardant of this kind may be added in order

to improve the fire rating of the panels by lowering the effect of their calorific content, taking into account their high content of combustible organic binder.

[0050] Improving the fire rating of the panels means that they can be installed on sites which have strict fire safety standards such as hospitals, schools, airports, etc. Appropriate fire retardants include, for example, suitable endothermic materials such as materials that break down into H₂O or CO₂. Examples include mirabilite, brucite, gibbsite, aluminium trihydrate or magnesium hydroxide. When materials of this kind are exposed to high temperatures they release water, for example, and the process becomes endothermic, which means that it absorbs energy. The fire retardant can be incorporated in the insulating base layer and/or in the rigid surface layer.

[0051] In the invention, the anchoring elements may be elements of the helical spring or corkscrew type, which are known *per se*, implanted in the insulating base layer of the panels, opposite the rigid surface layer, and adapted to be embedded invisibly in the concrete.

[0052] The invention also provides that the anchoring elements are cavities such as grooves formed in the insulating base layer of the panels, opposite the rigid surface layer, and adapted to be filled with concrete when the concrete is poured.

[0053] This solution does away with the need to provide added elements and does require particular machining of the insulating base layer on its side opposite the rigid surface layer.

[0054] In another aspect, the invention relates to a method of manufacturing a reinforced concrete wall, particularly a wall of a cellar or car park, as defined hereinbefore, this process comprising the following steps:

- a) providing a multiplicity of insulating panels each comprising an insulating base layer of mineral fibres and a rigid surface layer and each comprising anchoring elements in the base layer;
- b) using the insulating panels directly as a shuttering surface, the base layer being disposed above the rigid surface layer and the rigid surface layer being placed directly on a support with a discontinuous contact surface;
- c) pouring concrete and providing reinforcement for the concrete onto the base layer of the insulating panels so that the anchoring elements are embedded in the concrete; and
- d) removing the support after the concrete has hardened, thus exposing the rigid surface layer of the insulating panels to form an outer facing on the underside of the insulating panels.

[0055] The above-mentioned support may be formed, for example, by a set of girders spaced from one another, a perforated metal sheet, a mesh, grating, etc. This does away with the need for a support having a continuous contact surface as is the case with conventional shuttering boards.

[0056] The manufacturing process may be carried out either in the factory, in the case of prefabricated products, or on the installation site, as necessary.

[0057] In the detailed description that follows, which is provided solely by way of example, reference is made to the attached drawings, wherein:

- Figure 1 is a partial section through a reinforced concrete slab provided on its underside with insulating panels based on mineral fibres, the insulating panels resting on girders for the shuttering, and being fixed to the concrete slab by corkscrew-type anchoring elements; and
- Figures 2 and 3 are views analogous to Figure 1 of two alternative embodiments in which the anchoring elements are cavities or grooves provided in the insulating base layer opposite the rigid surface layer.

[0058] Reference is made first of all to Figure 1 which shows a reinforced concrete ceiling 10, such as a ceiling of a cellar or car park, constituting a horizontal wall and comprising a reinforced concrete slab provided with reinforcements (not shown) embedded in the concrete in conventional manner.

[0059] The ceiling 10 is provided on its underside with insulating panels 12 based on mineral fibres fixed to the lower surface of the concrete slab by anchoring elements 14, in this instance elements of the corkscrew or helical spring type. These anchoring elements 14 are implanted by screwing into the thickness of the insulating panel so as to have a portion projecting at the top. This projecting portion is intended to be embedded invisibly in the reinforced concrete slab. These anchoring elements 14 are arranged at regular intervals and are provided in numbers of five to ten, for example, per square metre of panel.

[0060] Each of the insulating panels 12 comprises an insulating base layer 16 of mineral fibres and a rigid surface layer 18 of mineral material, the composition of which will be described hereinafter.

[0061] The base layer 16 is itself advantageously made up of at least two different layers of different densities, the lower density layer being located immediately below the reinforced concrete slab and the higher density layer being adjacent to the rigid surface layer.

[0062] In the example, the insulating base layer is a double density layer and comprises a first layer 20 of lower density and a second layer 22 of higher density.

[0063] These layers 20 and 22 are advantageously formed from mineral fibres, preferably rock wool fibres. The first layer 20 has a density of from 50 to 150 kg/m³ and a thickness of from 25 to 300 mm. As for the second layer 22, it has a density of 100 to 300 kg/m³ and a thickness of 10 to 40 mm.

[0064] The rigid surface layer 18 is advantageously produced on the basis of mineral fibres, generally rock wool fibres, and has a density that is higher than the mean density of the base layer. By way of example, the rigid surface layer has a density of at least 450 kg/m³

and a thickness of from 5 to 40 mm.

[0065] However, it is also within the scope of the invention to produce the rigid surface layer from grains of mineral material bound together by a binder, for example grains of quartz sand.

[0066] It is also possible to combine these two embodiments so that the mineral material of the rigid surface layer comprises rock wool fibres and grains of quartz sand.

[0067] This rigid surface layer is particularly strong mechanically and rests directly on girders 24 for the shuttering. As already mentioned hereinbefore, it is then no longer necessary to use a horizontal shuttering board as in the prior art.

[0068] The girders 24 are I-section girders which may be made of metal or wood, for example, and are conveniently spaced apart by an interval of size D which is typically of the order of 15 to 20 cm. These girders are placed on a suitable support structure, for example props or up-rights that are adjustable in height (not shown).

[0069] The girders 24 could be replaced by any support with a discontinuous contact surface such as a perforated metal sheet, grid, grating, etc.

[0070] The process for manufacturing the reinforced concrete ceiling in Figure 1 comprises first of all a step a) in which a multiplicity of insulating panels 12 made of mineral fibres are provided, each having an insulating base layer of mineral fibres and a rigid surface layer and each comprising anchoring elements 14 in the base layer.

[0071] In the embodiment shown, the anchoring elements 14 are previously placed in the insulating base layer 16.

[0072] In the following step b), the insulating panels 12 are used directly as a shuttering base, the base layer 16 being arranged above the rigid surface layer 18. The latter is placed directly on a support with a discontinuous contact surface, in this case the assembly of girders 24, without using any shuttering boards, thus simplifying the shuttering operations.

[0073] In the following step c) concrete is poured and reinforcement (not shown) is provided for the concrete onto the base layer of the insulating panels 12 such that the anchoring elements 14 are embedded invisibly in the concrete.

[0074] The following step d) then consists in removing the support with a discontinuous contact surface, in this case the set of girders 24, after the setting of the concrete, thus exposing the rigid surface layer 18 of the insulating panels to form an outer facing on the underside of the insulating panels.

[0075] The outer facing has particular mechanical strength. It is resistant to scratching, for example the scratching caused by the aerials of motor vehicles as mentioned hereinbefore.

[0076] The outer facing has a finished appearance and can be used as it is. However, it is also possible to apply paint, a rough cast, a coating or any other covering to

this facing to provide a different finish, if desired.

[0077] When positioned on the support with a discontinuous contact surface, in this case the girders 24, the insulating panels are arranged adjacent to one another to prevent the concrete, once poured, from infiltrating into the interstices between the panels.

[0078] These panels may be made in different sizes. They are typically rectangular in shape, with a length of 1200 mm for a width of 600 mm or 1000 mm. However, other sizes may be used.

[0079] Insulating panels of this type are already known from the publication EP 1180182 B1 to which reference may be made for more information. However, this publication neither teaches nor describes the use of panels of this kind on the underside of horizontal or sloping walls such as ceilings, particularly the ceilings of cellars or car parks. Nor is there any teaching of the use of these panels directly on support girders with a view to provide shuttering.

[0080] Generally, it is preferable to use mineral wool, especially rock wool, for the insulating layer, having regard to its advantageous properties of heat and sound resistance and also fire resistance. Moreover, the rock wool has a high compression resistance and is able to withstand the weight of the concrete when it is being poured. The thickness of the concrete slab is typically from 16 to 23 cm, generally 20 cm.

[0081] Reference is now made to Figure 2 which shows an alternative embodiment of the invention in which the anchoring elements are grooves 26 in the shape of an inverted V the arms of which form an angle of 90° between them. The two arms of each groove may be produced by a rotary tool such as a circular saw or the like having a blade arranged at 45° to the upper surface of the insulating panel. Thus the groove may conveniently be produced on the finished panels or, as required, directly at the end of the manufacturing process.

[0082] Figure 3 shows yet another alternative embodiment in which the anchoring elements are grooves 28 in the shape of a dovetail. The grooves are produced by a suitable tool such as a router moved parallel to the plane of the panel. Here again, this machining may be done either on the finished panel or directly at the end of the manufacturing process.

[0083] In the case of Figures 2 and 3, the grooves 26 or 28 are filled with concrete when the concrete is poured. Once the concrete has set it forms particularly strong retaining elements. This solution thus avoids the use of added on anchoring elements of the corkscrew-type, for example, as in Figure 1. On the other hand, it does require special machining of the insulating panels as mentioned previously.

[0084] The insulating panels themselves are preferably made from rock wool, particularly basalt rock essentially consisting of silica and alumina and other oxides as are well known in the art. They are formed by the melting of basalt rocks at temperatures of the order of 1500°C in suitable kilns. The mineral fibres thus produced are suit-

ably cut up and mixed together and bound with appropriate binders, for example binders of the phenol-formaldehyde, phenol-urea, acrylic copolymer, resorcinol and furan type, etc. These binders are preferably thermoset, as well known in the art. The layers of different densities are superimposed and bound as the binder hardens.

[0085] However, and as mentioned hereinbefore, the layers that make up the insulating base layer may also, according to an alternative feature, be produced separately and assembled, for example by adhesive bonding.

[0086] When the rigid surface layer is also formed from rock wool, preferably the same binder is used.

[0087] However, this rigid surface layer may be formed from grains of mineral material, particularly grains of quartz sand. The binder may then be different from the one used for the base layer. It is also possible to combine rock wool and grains of quartz sand.

[0088] In each case it may be useful to reinforce this rigid surface layer with a glass fibre reinforcement, as is well known in the art and also taught by the publication EP 1180182 B1 mentioned previously. Advantageously a lattice is used with a mesh size of 5 mm. Alternatively, a fleece can be used which has a more closed structure.

[0089] In one embodiment of the invention, each insulating panel 12 has a total thickness of 150 mm, comprising 145 mm for the base layer 16 and 5 mm for the rigid surface layer 18. The base layer 16 is made up of a first layer 20 which has a thickness of 120 mm and a density of 150 kg/m³ and a second layer 22 having a thickness of 25 mm and a density of 200 kg/m³.

[0090] The rigid surface layer 18 has a density of 560 kg/m³.

[0091] This rigid surface layer 18 is formed from ground-up rock wool waste and mixed in a suitable mixer with a binder as mentioned previously. Advantageously a sheet or lattice or fleece of glass fibres is used to ensure that this rigid surface layer has good characteristics.

[0092] As mentioned previously, the rigid surface layer 18 may be covered with paint or any other suitable covering.

[0093] It is also within the scope of the invention to form perforations in this rigid surface layer 18 to improve its sound resistance properties.

[0094] The invention is of particular use in insulating horizontal or sloping walls, such as the ceilings of cellars and car parks, staircases, lining segments etc.

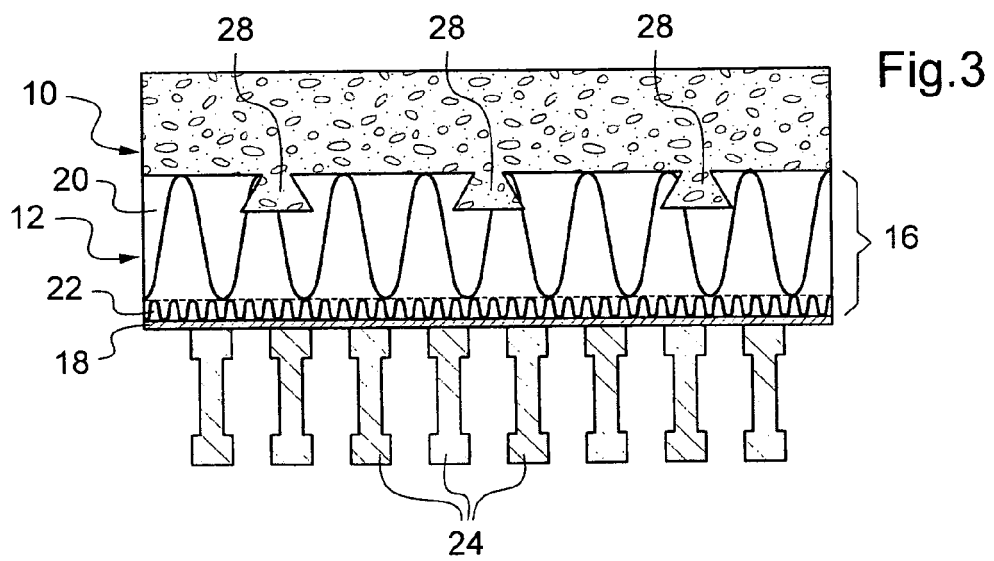
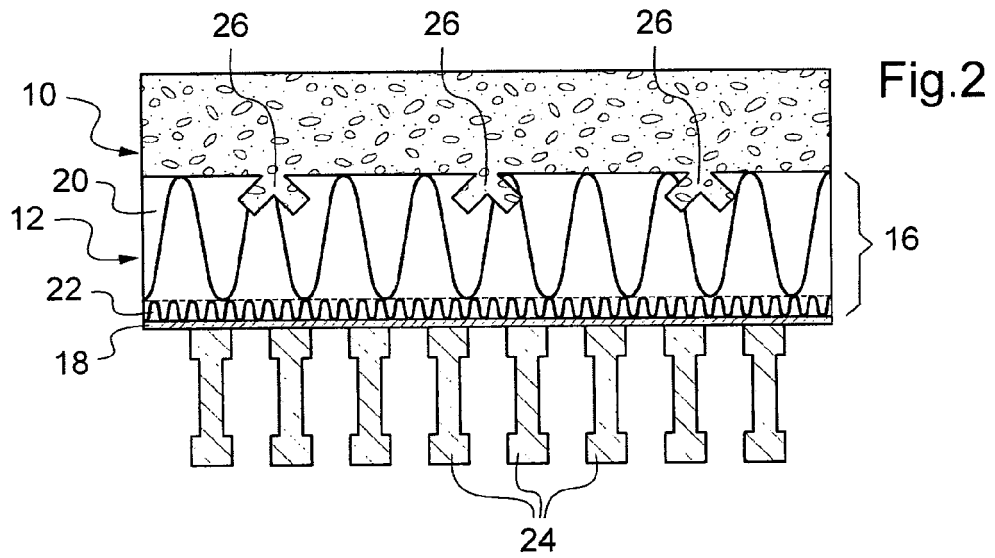
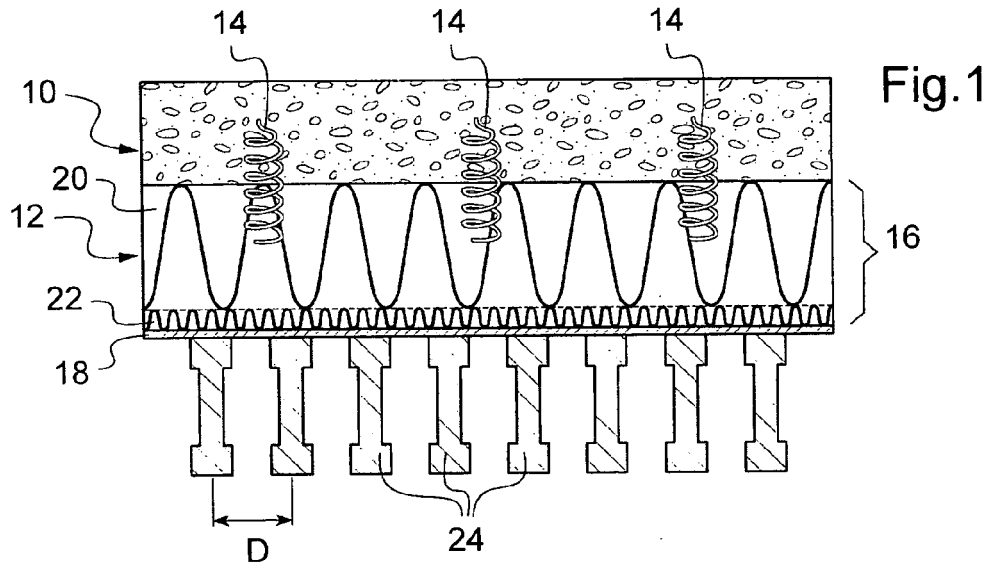
Claims

1. Reinforced concrete wall, horizontal or sloping, particularly the ceiling of a cellar or car park, comprising a reinforced concrete slab (10) provided with insulating panels (12) based on mineral fibres, fixed in the underside of the concrete slab by anchoring elements (14; 26; 28) and serving as shuttering during the pouring of the concrete, **characterised in that** each of the insulating panels

(12) comprises an insulating base layer (16) of mineral fibres and binder and a rigid surface layer (18), the base layer (16) being arranged underneath the reinforced concrete slab (10) and the rigid surface layer (18) being arranged underneath the insulating base layer (16) forming an outer facing, the rigid surface layer comprising a mineral material and a binder.

2. Reinforced concrete wall according to claim 1, **characterised in that** the insulating base layer (16) comprises at least two layers (20, 22) of different densities, the lower density layer (20) being located immediately below the reinforced concrete slab (10) and the higher density layer (22) being adjacent to the rigid surface layer (18).
3. Reinforced concrete wall according to claim 2, **characterised in that** the insulating base layer (16) comprises two layers (20, 22) of different densities, namely a first layer (20) of lower density and a second layer (22) of higher density.
4. Reinforced concrete wall according to claim 3, **characterised in that** the first layer (20) of the insulating base layer (16) has a density of 50 to 150 kg/m³ and a thickness of 25 to 300 mm, and the second layer (22) of the insulating base layer (16) has a density of 100 to 300 kg/m³ and a thickness of 10 to 40 mm.
5. Reinforced concrete wall according to one of claims 2 to 4, **characterised in that** the insulating base layer (16) forms a unified structure in which the layers (20, 22) of said insulating base layer (16) are joined together by the binder.
6. Reinforced concrete wall according to one of claims 1 to 5, **characterised in that** the rigid surface layer (18) comprises mineral fibres and has a density that is higher than the mean density of the base layer (16).
7. Reinforced concrete wall according to claim 6, **characterised in that** the rigid surface layer (18) has a density of at least 450 kg/m³ and a thickness of 5 to 40 mm.
8. Reinforced concrete wall according to one of claims 6 and 7, **characterised in that** the mineral material of the rigid surface layer (18) comprises fibres of rock wool and/or grains of quartz sand.
9. Reinforced concrete wall according to one of claims 6 and 7, **characterised in that** the quantity of organic binder in the rigid surface layer (18) is at least 3% by weight of said layer, such as 8% by weight of said layer, and the total quantity of mineral materials in said layer is from 50 to 90% by weight of said layer.

10. Reinforced concrete wall according to one of claims 1 to 9, **characterised in that** the insulating panels (12) comprise a fire retardant.
11. Reinforced concrete wall according to one of claims 1 to 10, **characterised in that** the anchoring elements are elements of the helical spring or corkscrew type (14) implanted in the insulating base layer of the panels, opposite the rigid surface layer, and adapted to be embedded invisibly in the concrete. 5 10
12. Reinforced concrete wall according to one of claims 1 to 10, **characterised in that** the anchoring elements are cavities (26; 28) formed in the insulating base layer of the panels, opposite the rigid surface layer, and adapted to be filled with concrete during the pouring of the concrete. 15
13. Process for the production of a horizontal or sloping reinforced concrete wall, particularly a ceiling of a cellar or car park, according to one of claims 1 to 12, **characterised in that** it comprises the following steps: 20
- a) providing a multiplicity of insulating panels (12) each having an insulating base layer (16) of mineral fibres and a rigid surface layer (18) and each comprising anchoring elements (14; 26, 28) in the base layer; 25
 - b) using the insulating panels (12) directly as a shuttering base, the base layer (16) being arranged above the rigid surface layer (18) and the rigid surface layer (18) being placed directly on a support (24) with a discontinuous contact surface; 30 35
 - c) pouring concrete and providing reinforcement for the concrete (10) onto the base layer (16) of the insulating panels (12) so that the anchoring elements (14; 26, 28) are embedded in the concrete; and 40
 - d) removing the support (24) after the concrete has hardened, thus exposing the rigid surface layer of the insulating panels to form an outer facing on the underside of the insulating panels. 45
14. Process according to claim 13, **characterised in that**, in step a), the anchoring elements are elements of the helical spring or corkscrew type (14) implanted in the insulating base layer (16) of the insulating panels, opposite the rigid surface layer (18). 50
15. Process according to claim 13, **characterised in that**, in step a) the anchoring elements are cavities (26; 28) provided in the insulating base layer (16) of the insulating panels, opposite the rigid surface layer (18) and adapted to be filled with concrete during the pouring of the concrete. 55





EUROPEAN SEARCH REPORT

Application Number
EP 11 29 0478

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	* column 2, line 57 - column 3, line 52; claim 1; figures 1,2 *	11,12,15	
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A	* column 5, lines 22-42; claims 1,3,5; figures 3,4 *	2-5,10, 14	TECHNICAL FIELDS SEARCHED (IPC) E04B E04C
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	* column 5, lines 4-8; figure 7 *		
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 18 April 2012	Examiner Rosborough, John
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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EPO FORM 1503 03.82 (P04C01)

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

EP 11 29 0478

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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