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(54) **Acoustic absorbing panel provided with a decorative design pattern and a method and apparatus for manufacturing the panel**

(57) An acoustical absorbing panel (1) with a decorative design pattern, said panel comprising a board (2) comprising mineral fibres, said board (2) having two major surfaces and four minor side surfaces. Said panel further comprising a fleece layer (3) attached to at least one major surface of the mineral fibre board (2), and a layer of paint (4) applied to said fleece layer (3) on at

least a major surface. Wherein said fleece layer (3) comprises lasting changes (10) made by a laser beam, said lasting changes are in the form of a decorative design pattern, and said pattern is visible through said layer of paint (4). The invention also concerns a method and an apparatus for manufacturing the acoustical absorbing panel.

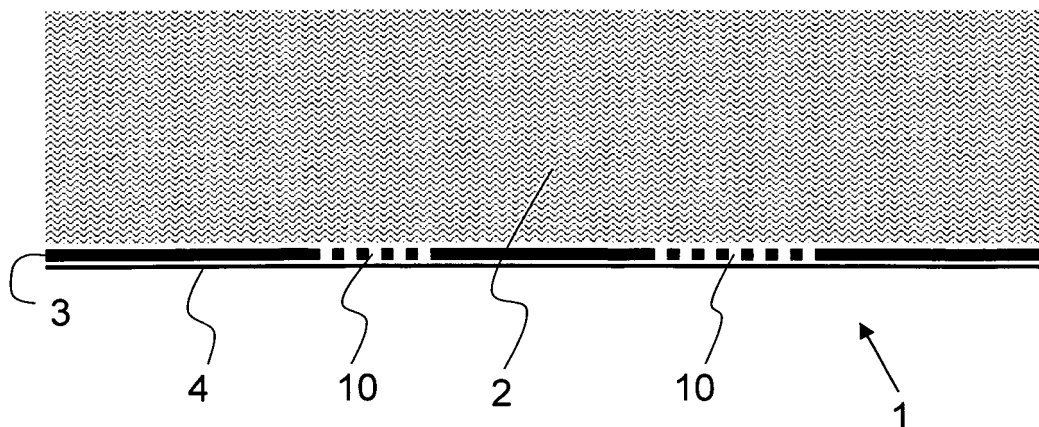


Fig. 2

Description

[0001] The invention concerns an acoustic absorbing panel with a decorative design pattern comprising a board comprising mineral fibres, said board having two major surfaces and four minor side surfaces. Said panel further comprising a fleece layer attached to at least one major surface of the mineral fibre board, and a layer of paint applied to said fleece layer on at least a major surface. The invention also concerns a method and an apparatus for manufacturing the acoustical absorbing panel.

[0002] This type of acoustical absorbing panel is known from ceiling panels provided with a painted fleece layer and a decorative design pattern. The decorative design pattern has been provided by applying the paint layer by use of a rotating drum having the pattern on its outside surface, whereby this pattern is printed in the paint layer.

[0003] This technique is relatively difficult to control and results in a paint layer which is not as homogenous as preferred. The technique is also relatively expensive due to waste of paint.

[0004] These problems have been solved by an acoustic absorbing panel according to the invention where the fleece layer comprise lasting changes made by a laser beam, said lasting changes are in the form of a decorative design pattern, and said pattern is visible through said layer of paint.

[0005] With this solution it will be possible to apply a homogenous layer of paint by a more efficient technique.

[0006] In a preferred embodiment of the invention the lasting changes which is forming said pattern in the fleece layer, is a changed colour or a changed tint of the fleece layer.

[0007] In a further embodiment of the invention the lasting changes which is forming the pattern in the fleece layer, is a changed texture, or, it is material removed from the fleece layer. This embodiment may result in a different visual effect than that obtained by a changed colour or tint. Often the two effects will be combined, i.e. the heating effect of the laser will result in a changed texture as well as a changed colour or tint.

[0008] In a further embodiment of the invention the mineral fibre board is being open to air diffusion and said fleece layer is being open to air diffusion. This will give the best sound absorbing properties for the sound absorbing panel. Preferably, also the paint layer should be open to air diffusion.

[0009] In a further embodiment of the invention the acoustical absorbing panel is prepared for being a ceiling panel to be arranged in a grid as part of a suspended ceiling. Such suspended ceilings are widespread, and often there is a wish for providing such suspended ceilings with a decorative design pattern.

[0010] The invention is also related to a method of providing a decorative design pattern to the surface of an acoustic absorbing panel, said acoustic absorbing panel

comprises a board comprising mineral fibres. This method is comprising a step of: applying a laser heat treatment, by use of a laser beam, to the fleece layer, said laser heat treatment is performed by scanning the laser beam over the fleece layer in a pre-selected pattern resulting in lasting changes in the fleece layer forming the decorative design pattern. The method also comprise a step of securing a fleece layer to at least one surface of the mineral fibre board, either before, during or after said laser heat treatment. The method also comprises a step of applying a layer of paint to said fleece layer after said laser heat treatment of the fleece layer. Finally, the method comprises the step of drying said applied paint, thereby forming a painted surface with the visible decorative design pattern.

[0011] In a preferred embodiment the laser heat treatment is performed after the fleece layer has been attached to the mineral fibre board.

[0012] In a further embodiment of the method according to the invention the applied paint layer is applied by moving the panel with the attached fleece layer through a curtain coat section, in which the flow of the falling paint in the curtain coat together with the speed of the passing panel defines the thickness of the applied paint layer.

[0013] In a further embodiment of the method according to the invention the applied paint layer is applied as two separate layers.

[0014] The invention is also related to an apparatus for manufacturing an acoustical absorbing panel, said acoustic absorbing panel comprising a board comprising mineral fibres and a fleece layer, said apparatus comprising: a production line for transporting a mineral fibre board; and the apparatus comprises fleece attachment means for attaching a fleece layer to at least one surface of said mineral fibre board; and the apparatus comprises a laser prepared for scanning a laser beam over the fleece layer in a pre-selected pattern, said laser beam performing a heat treatment in the fleece layer resulting in lasting changes in the fleece layer, thereby forming a pattern of a decorative design pattern; and the apparatus comprises painting means for applying a layer of paint to the fleece layer.

[0015] Embodiments of the invention will now be described with reference to the figures, where

Figure 1 illustrates a cross-sectional view of a panel with a painted fleece layer.

Figure 2 illustrates a cross-sectional view of a panel where lasting changes in the fleece layer have been indicated.

Figure 3 illustrates a schematic process line for manufacturing a panel according to an embodiment of the invention.

[0016] Figure 1 shows a typical panel for acoustic absorption of noise. The panel 1 comprises a porous ma-

terial such as board 2 of mineral fibres with a binder added. On at least one of the major surfaces of this board 2 a fleece layer 3 is secured by some adhesive. The fleece layer 3 is painted, thus forming a paint layer 4. This type of panel will often have the form of ceiling panels or ceiling tiles, which when installed are arranged in a grid as a suspended ceiling. For this purpose the side surfaces i.e. edges of the panels may also be provided with shapes or profiles making them fit with different types of grid profiles. Such acoustic absorption panels are also known from panels to be arranged on a wall in a room where improved sound absorption is needed.

[0017] Figure 2 shows an acoustic absorbing panel 1 according to an embodiment of the invention. It is illustrated that the fleece layer 3 has been provided with lasting changes 10 by a laser. These lasting changes 10 can be in the form of changed colour or tint of the fleece material due to the heating effect by the laser. The change in colour or tint will occur due to partly burn of the glass fibres or of the binder.

[0018] The lasting change may also be a change in the texture, e.g. due to removal of material of the fleece layer by evaporation of glass fibre and/or binder material from the fleece layer. In some cases material may be removed to an extent such that the fleece layer 3 is perforated. In figure 2 a layer of paint 4 is illustrated on the fleece layer 3.

[0019] These lasting changes in the fleece layer may be arranged in any possible pattern.

[0020] The laser used for the purpose is any commercially available laser having sufficient power to burn material in the fleece such that its colour or tint is changed. The laser is arranged to cooperate with an optical system guiding the laser beam to the right spot on the fleece layer. The laser may be a pulsed laser, with a well-defined amount of energy in each pulse. The laser is arranged to cooperate with optical components, such as lenses and mirrors, guiding and forming the laser beam for optimal performance in the scanning and heat treatment.

[0021] The fleece layer is preferably a standard glass fibre fleece, comprising glass fibres and a binder. The amount of binder will often be 10 - 30 %. The fleece will preferably not comprise any oil, which is typically added to the mineral fibre material. The surface weight of the fleece will be in the range 60 - 200 g/m². Example of an applicable fleece materials of glass fibres is the product A75 from Owens Corning in US having a binder content of 25 %, and a calorific value of 5,3 MJ/kg.

[0022] An example of a useful paint is a water based paint with approximately 50 % dry material and approximately 10 % binder, e.g. known under the trade name Rofa 8 which is manufactured by Soframap in France. The amount of wet paint applied will preferably be in the range 50 - 150 g/m³, even more preferably in the range 80 - 120 g/m³.

[0023] In order to be sufficiently sound absorbing the sound absorbing panel should be open to air diffusion. This means that the applied paint layer also must be open

to air diffusion. This will be the case if e.g. small holes are formed in the paint during application or drying up.

[0024] Figure 3 schematically illustrates a production line 20 for manufacturing a panel 1 according to an embodiment of the invention. The boards 2 of mineral fibres are moved from left to right. In one step the fleece layer 3 is attached to a major surface of the board 2. The fleece layer is supplied from a roll of fleece 23 and is attached by use of an adhesive. In a following step a laser unit 21 is used for performing a heat treatment of the fleece layer 3. This heat treatment will induce lasting changes 10 forming a predetermined pattern in the fleece layer 3. These lasting changes 10 may be in the form of a changed colour or changed tint. The changes may also be in the form of a changed texture of the fleece layer 3, where part of the fleece is burnt away or evaporated.

[0025] In a following step a layer of paint 4 is applied. This layer must have a composition and/or a thickness such that the changes of the fleece layer are visible through the layer of paint. Often the paint layer is applied in two separate steps, with the second layer being applied before the first layer has dried.

[0026] For the application of the one or two paint layers, a curtain coat has been found to give a good result with a smooth paint layer. A curtain coat is a well established method of painting an acoustical absorbing panel, where paint is flowing from a container 22 with a constant flow over an edge, arranged such that the flow on every part of this edge will be the same. The edge over which paint is flowing must have a width equivalent to the width of the panels to be painted. The flow of the falling paint in the curtain coat together with the speed of the passing panel defines the thickness of the applied paint layer. Furthermore, the process of the curtain coat is stable and easy to control.

[0027] When the paint is applied in two steps, i.e. to layers of paint, the panel will typically pass through two curtain coat sections.

Claims

1. An acoustical absorbing panel (1) with a decorative design pattern, said panel comprising

- a board (2) comprising mineral fibres, said board (2) having two major surfaces and four minor side surfaces,
- a fleece layer (3) attached to at least one major surface of the mineral fibre board (2),
- a layer of paint (4) applied to said fleece layer (3) on at least a major surface,

characterised in that

said fleece layer (3) comprises lasting changes (10) made by a laser beam, said lasting changes are in the form of a decorative design pattern, and said pattern is visible through said layer of paint (4).

2. A panel according to claim 1, wherein said lasting changes (10) forming said pattern in the fleece layer (3) is a changed colour or a changed tint of the fleece layer (3).
3. A panel according to claim 2, wherein said fleece layer (3) comprise a binder and wherein said change of the colour or change of the tint of the fleece layer (3) is obtained by a changed colour or a changed tint of the binder.
4. A panel according to claim 1, wherein said lasting changes (10) forming said pattern in the fleece layer (3) is a changed texture, or, it is material removed from the fleece layer (3).
5. A panel according to any one of the previous claims, wherein said mineral fibre board (2) is being open to air diffusion and said fleece layer (3) is being open to air diffusion.
6. A panel according to any one of the previous claims, wherein the acoustical absorbing panel (1) is prepared for being a ceiling panel to be arranged in a grid as part of a suspended ceiling.
7. A method of providing a decorative design pattern to the surface of an acoustic absorbing panel (1), said acoustic absorbing panel comprising a board comprising mineral fibres (2) and a fleece layer (3), said method comprising the steps of
- applying a laser heat treatment, by use of a laser beam, to the fleece layer (3), said laser heat treatment is performed by scanning the laser beam over the fleece layer (3) in a pre-selected pattern resulting in lasting changes (10) in the fleece layer (3) forming a decorative design pattern;
 - securing the fleece layer (3) to at least one surface of the mineral fibre board (2), either before, during or after said laser heat treatment;
 - applying a layer of paint (4) to said fleece layer (3) after said laser heat treatment of the fleece layer;
 - drying said applied paint, thereby forming a painted surface (4) with the visible decorative design pattern.
8. A method according to claim 7, wherein the applied paint layer (4) is applied by moving the panel with the attached fleece layer through a curtain coat section (22), in which the flow of the falling paint in the curtain coat together with the speed of the passing panel defines the thickness of the applied paint layer (4).
9. A method according to claim 7 or 8, wherein the applied paint layer (4) is applied as two separate layers.
10. An apparatus for manufacturing an acoustical absorbing panel (1), said acoustic absorbing panel (1) comprising a board comprising mineral fibres (2) and a fleece layer (3), said apparatus comprising
- a production line (20) for transporting a mineral fibre board (2);
 - fleece attachment means for attaching a fleece layer (3) to at least one surface of said mineral fibre board (2);
 - a laser (21) prepared for scanning a laser beam over the fleece layer (3) in a pre-selected pattern, said laser beam performing a heat treatment in the fleece layer resulting in lasting changes (10) in the fleece layer (3), thereby forming a pattern of a decorative design pattern;
 - painting means for applying a layer of paint (4) to the fleece layer (3).

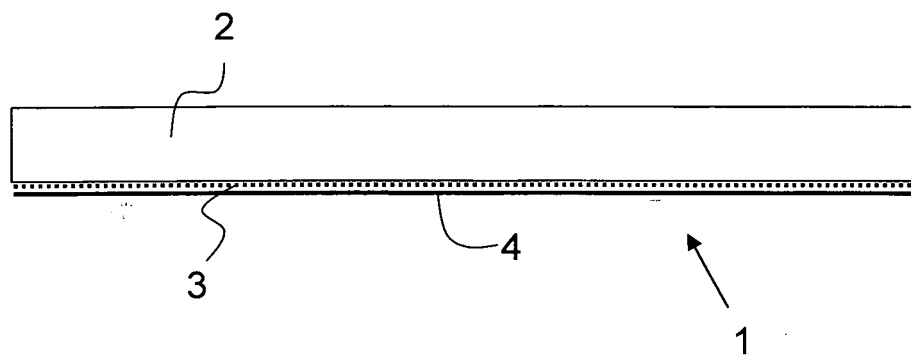


Fig. 1

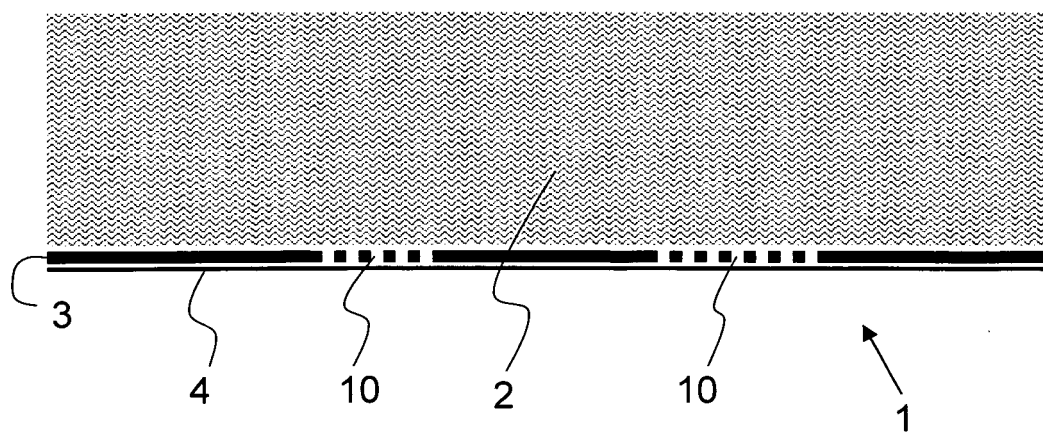


Fig. 2

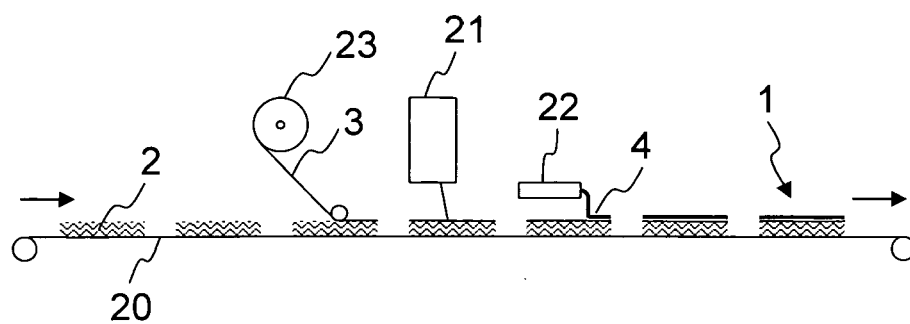


Fig. 3



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 38 8079

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Place of search Munich		Date of completion of the search 24 April 2008	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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 07 38 8079

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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