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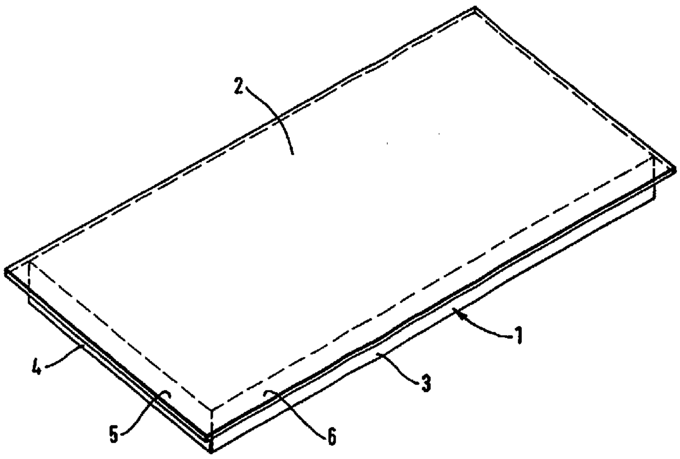

(57) Abstract

The present invention relates to a façade system with a translucent porous insulating material of mineral or organic fibres for passive solar energy utilization, the insulating material having on the outside a coloured layer (2) for design purposes and for controlling the light transmittance. The façade system is formed from a multiplicity of preferably factory-prefabricated façade insulating boards (1). The coloured layer (2) can, moreover, be designed in such a way that it protrudes beyond the insulating layer along two board edges (3, 4). Consequently, when the façade insulating boards (1) are applied to the building wall, the abutting edges in the region of the joins between neighbouring insulating boards are covered by the overlapping protruding coloured layer (2).

Description

Façade system with a translucent porous insulating material

The present invention relates to a façade system with a translucent porous insulating material of mineral or organic fibres according to the precharacterizing clause of Claim 1.

A generically determinative façade system is known from EP 0 362 242. This known façade surfacing has an insulating layer of heat-insulating material with light-admitting weatherproofing provided on the outside in the form of a transparent outer covering, produced for example from silicate glass or synthetic glass. The insulating layer, which may be produced, for example, from a multiplicity of factory-prefabricated glass-fibre or mineral-fibre insulating boards which are fastened on the outer wall of the building adjacently in a surface-covering manner, is designed in such a way that a temperature profile can be adjusted, when there is usable solar irradiation, with a maximum value within the insulating layer. For this purpose, the insulating layer is designed to be opaque or translucent between its outer and inner bounding surfaces, with a transmittance τ of less than 10% and an absorbance a of more than 15%.

The innovative façade surfacing has proved to be entirely serviceable, but has the disadvantage that, with the outer covering with which it is provided, designed as a transparent layer and made, for example, of silicate glass, synthetic glass or weatherproof sheetings, it is not possible to achieve building façades which are visually and/or aesthetically pleasing for the house owner or viewer. This is true because in the case of such a configuration of the known façade system there can in any event be clearly seen the outer or viewer-side surface of the insulating layer, which lies behind the transparent weatherproofing layer or outer covering and the surface structure of which cannot lend a building façade a pleasing exterior appearance. Although it has already been proposed in EP 0 362 242 to tint the outer covering by colouring the panels forming it, this is very costly and is not possible in any desired colour. Alternatively, it has been proposed in EP 0 362 242 to colour or pattern the outer surface of the insulating layer or provide it with motifs. Quite apart from the fact that this proposal has not proved to be feasible in practice, colouring the outer insulating layer does not in any way have the effect of lending its surface a different appearance than that which is predetermined by the structure or position of the fibres forming the insulating layer. As already stated above, the latter is, however, not satisfactory from a visual and/or aesthetic viewpoint.

A further problem is the appearance of the region where the insulating boards are joined. Here there is the great risk that, in particular, with a dark outer surface of the insulating layer, if the insulating boards are not laid in line or accurately, the mineral wool lying behind, which for example is lighter, becomes visible and, as a light line, additionally has an adverse effect on the overall appearance of the façade.

This gives rise to the object of the present invention of further developing the generic façade system in such a way that an appearance which is visually and/or aesthetically satisfactory or pleasing to the viewer can be produced.

According to the present invention, there is provided a facade system including:

a porous insulating material of mineral or organic fibres for passive solar energy utilisation;

wherein the insulating material has bonded to the outside a separate porous coloured layer for design purposes and for controlling the light transmittance τ,

said coloured layer being formed by a coloured glass-fibre felt which is laminated on the insulating layer; and

wherein said system further includes transparent weatherproofing.

The fact that the insulating material or the insulating layer of the façade system according to the invention is for the first time provided with a coloured layer on the outside allows the unsightly surface structure of the insulating layer to be replaced by a visually and/or aesthetically pleasing surface structure which, moreover, can be provided with any desired tinting. This advantageously makes it possible, in addition, to use this externally applied coloured layer for design purposes in any form and at the same time specifically control the light transmittance τ with this coloured layer.

Further advantageous embodiments of the present invention are the subject of the subclaims.

For example, controlling the light transmittance τ can take place in a particularly good way by means of a different colour graduation of the coloured layer. Consequently, allowance can be advantageously made for different angles of incident light radiation and radiation intensities by appropriate tinting. This makes it possible for the first time to control the light transmittance τ by increased light reflection or light absorption a. The light reflection or absorption of the coloured layer can be advantageously controlled here by a suitable pigmentation of the respectively chosen colour or by the incorporation of metal particles in the coloured layer. This opens up a wide range of possible variations with regard to the surface design of the coloured layer, the choice of colour and colour intensity and also the controlling of the light transmittance τ in every respect.

A particularly low-cost alternative is the laminating of a coloured glass-fibre felt onto the insulating material in order to apply the coloured layer according to the invention. The coloured layer or the coloured glass-fibre felt may, for example, be adhesively attached to the insulating layer or be applied in some other way. In the case of adhesive attachment, a foam adhesive which has been specially developed for this purpose and is the subject of German Patent Application DE 197 46 442.4 of the same applicant, to the full content of which reference is made, has proved to be particularly advantageous. This special foam adhesive does not show through the felt to be adhesively attached when it is applied, which is quite possible in the case of a conventional full-surface adhesive and may, as a result, spoil the uniform coloration or colour appearance.

It is at the same time also of advantage that the coloured layer can for the first time be of a colour-fast design with respect to UV irradiation. What is more, in the case of a further embodiment, a clear cost reduction is evident if a glass panel, in particular a commercially available glass panel, is provided as the transparent weatherproofing or transparent outer covering, since tinted types of glass are more expensive than clear types of glass. For the visual and/or aesthetic design of the façade to be further optimized, there may additionally be the case in the façade system according to the invention that the glass panel itself is provided with a pattern, in particular with a grid-shaped or symbolic pattern.

The fact that the light transmittance τ is for the first type controlled by means of the coloured layer makes it possible to ensure in an aesthetically particularly pleasing way that in the summer there is no overheating of the building wall adjoining the façade system. This takes place in a particularly advantageous way by the insulating layer with the coloured layer being designed such that a temperature profile can be achieved, when there is usable solar irradiation, with a maximum value within the insulating layer, a light transmittance τ of less than 10% being set between its outer and inner bounding surfaces.

The façade system can be constructed in a quick and efficient way, by applying the insulating layer and the coloured layer together in the form of factory-prefabricated façade insulating boards. When doing so, the coloured layer preferably protrudes beyond the insulating layer along two board edges.

In a particularly advantageous embodiment, the coloured layer is designed in such a way that, for example along two angularly neighbouring board edges, it protrudes beyond the latter. Consequently, when the façade insulating boards are applied to the building wall, the abutting edges in the region of the joins between neighbouring insulating boards are covered by the overlapping protruding coloured layer. Consequently, the occurrence of differently coloured or light lines is eliminated in a particularly advantageous way, so that the overall appearance of the façade is not adversely affected if, for example, the joins of the façade insulating boards are not in line, since the joins between the insulating boards are covered by the overlap and are consequently not visible. A façade which appears uniformly of the desired colour throughout is the result.

In a further advantageous embodiment, the coloured layer is applied to the prefabricated façade insulating board in such a way that, similar to the lamination of an edge strip mat, it protrudes parallel to and along two opposite board edges beyond the latter. Consequently, abutting edges in the region of the join between neighbouring insulating boards are likewise covered by the overlapping protruding coloured layer, which presupposes, however, that the individual façade insulating board is of a square design and, when being applied to the building wall can be turned alternately through 90°, so that, in a way analogous to the imbricated overlapping explained above, complete coverage of all the joins is likewise achieved. What is more, a square form with parallel projections makes it possible for the façade insulating boards to be produced at low cost, since, starting with an initially endless mineral wool web, the latter can be continuously laminated with the coloured felt directly on the line and subsequently divided into the finished façade insulating boards.

A further advantage is that, in the case of the façade insulating board according to the invention, with a transparent or translucent coloured layer for improving the visual appearance of the joins, it is not required for a felt strip to be stuck over the joins at the site.

The invention is explained in more detail below on the basis of two exemplary embodiments with reference to the drawing, in which:

Figure 1 shows a perspective view of a first, rectangular embodiment of a façade insulating board according to the invention;

Figure 2 shows a plan view of a detail of a façade insulated with the façade insulating boards shown in Figure 1;

Figure 3 shows a perspective view of a second, square embodiment of a façade insulating board according to the invention; and

Figure 4 shows a plan view of a detail of a façade insulated with the façade insulating boards shown in Figure 3.

Figure 5 shows a side view of the facade as shown in Figure 4.

Shown in Figure 1 in a perspective view is a rectangular facade insulating board 1, which is laminated with a coloured felt 2. The felt 2 protrudes along two angularly neighbouring board edges 3 and 4 beyond the latter, to be precise denoted by 5 and 6.

In Figure 2, in the plan view shown of a detail of a façade insulated with the façade insulating boards 1, in which the insulating boards 1 are arranged adjacently with their joins offset, the joins of the insulating boards 1 are represented by dashed lines and are denoted by 7. The visible felt limitations are denoted by 8. The respective projections 5, 6 of the coloured felt 2 thereby form an imbricated overlap similar to a slate-covered roof.

Shown in Figure 3 in a perspective view is a square façade insulating board 1', which is laminated with a coloured felt 2'. The felt 2' protrudes along two parallel opposite board edges 9 and 10 beyond the latter, to be precise denoted as projections 11 and 12.

In Figure 4, in the plan view shown of a detail of a façade insulated with the façade insulating boards 1', in which the square insulating boards 1' are arranged adjacently and alternately turned through 90°, the joins between the insulating boards 1' are represented by dashed lines and are denoted by 13. The felt limitations denoted by 14 cannot, however, be seen as such in the overall appearance of the façade, which instead appears as a uniform coloured surface on account of the respective overlaps of the coloured felt.

In Figure 5, each facade insulating board of a building's wall (15) comprises a porous insulating material of mineral or organic fibres (1) for passive solar energy utilisation and a transparent glass cover (16) for protection against atmospheric influences in the form of an external cover provided on its outer side. Between the transparent glass cover (16) and the porous insulating material (1) a separate coloured layer (2) is arranged wherein the insulating material (1) has bonded to the outside said separate porous coloured layer (2) for design purposes and for controlling the light transmittance τ.

The results of a test investigating the façade insulating boards 1 and 1' according to the invention from their physical aspects relating to construction are also presented below. The test served for determining characteristic optical and radiation-physical variables according to DIN 67507, June 1980 edition, and in particular for determining the radiant absorbance. Used as samples were five specimens with a mineral wool thickness of about 4 mm and a sample size of $5 * 5\ cm^2$ for a measuring area of $1 * 1\ cm^2$. The specimens differed in the colours of the sample outer surfaces, which were red (RAL 3002), blue (RAL 5019), green (RAL 6016), yellow (RAL 1021) and grey (RAL 7035).

The radiant transmittance τ_e, the radiant reflectance ρ_e and the radiant absorbance $a_e = 1 - \tau_e - \rho_e$ of the test material were calculated from spectral measurements in the wavelength range from 280 nm to 2500 nm and the spectral energy distribution for perpendicularly incident global radiation. The transmitted or reflected radiation was spatially integrated here in the spectral measurement ("Ulbricht sphere"). Furthermore, the radiant absorbance is given only as an overall value, i.e. the local distribution of the absorption over the cross-section of the sample has not been determined.

The test produced the following results:

Sample	Radiant transmittance τ_e	Radiant reflectance ρ_e	Radiant absorbance a_e
red (RAL 3002)	0.06	0.48	0.46
blue (RAL 5019)	0.04	0.18	0.78
green (RAL 6016)	0.05	0.30	0.65
yellow (RAL 1021)	0.07	0.49	0.44
grey (RAL 7035)	0.05	0.45	0.50

These measurement results are given by way of example for an embodiment of the invention. As already explained at length above, the radiant transmittance can be specifically controlled by the type and structure of the coloured layer 2 or 2', for instance a transition from blue to yellow approximately doubling the transmittance τ_e, far more than doubling the reflectance ρ_e and approximately halving the absorbance a_e. Therefore, a variety of changes or modifications are possible without leaving the scope of the invention.

For the purposes of this specification it will be clearly understood that the word "comprising" means "including but not limited to", and that the words "comprise" and "comprises" have a corresponding meaning.

It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents forms part of the common general knowledge in the art, in Australia or in any other country.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A facade system including:

a porous insulating material of mineral or organic fibres for passive solar energy utilisation;

wherein the insulating material has bonded to the outside a separate porous coloured layer for design purposes and for controlling the light transmittance τ,

said coloured layer being formed by a coloured glass-fibre felt which is laminated on the insulating layer; and

wherein said system further includes transparent weatherproofing.

2. Facade system according to claim 1, in which the controlling of the light transmittance τ takes place by different colour graduations of the coloured layer.

3. Facade system according to claim 1 or 2, in which the control takes place by increased light reflection.

4. Facade system according to claim 3, in which the light reflection of the coloured layer is controlled by a suitable pigmentation of the colour.

5. Facade system according to any one of claims 1 to 4, in which the coloured layer is of a colour-fast design with respect to UV irradiation.

6. Facade system according to any one of claims 1 to 5, in which the transparent weatherproofing is a glass panel.

7. Facade system according to any one of claims 1 to 6, wherein the transparent weatherproofing is provided with a grid-shaped pattern.

8. Facade system according to any one of claims 1 to 7, in which the colour-influenced light transmittance τ is controlled in such a way that in summer there is no overheating of the building wall adjoining the facade system.

9. Facade system according to any one of claims 1 to 8, in which the insulating layer with the coloured layer

is designed with a light transmittance τ of less than 10% between its outer and inner bounding surfaces for achieving a temperature profile, when there is usable solar irradiation, having a maximum value within the insulating layer.

10. Facade system according to any one of claims 1 to 9, in which the insulating layer with the coloured layer is designed as a facade insulating board in which the coloured layer protrudes beyond the insulating layer along two board edges.

11. Facade system according to claim 11, in which the facade insulating board is square and the coloured layer protrudes along and beyond two opposite board edges.

12. Facade system according to claim 11, in which the coloured layer protrudes along and beyond two angularly neighbouring board edges.

13. Facade system according to any one of claims 1 to 13, in which metal particles are incorporated in the coloured layer.

14. A facade system including a porous insulating material of mineral or organic fibres for passive solar energy utilisation and a transparent protection against atmospheric influences in the form of an external cover provided on its outer side, wherein between said external cover and said porous insulating material a separate coloured layer is arranged for design purposes and for controlling the light transmittance τ.

15. A facade system including a porous insulating material of mineral or organic fibres for passive solar energy utilisation and a transparent protection against atmospheric influences in the form of an external cover provided on its outer side, wherein between said external cover and said porous insulating material a separate coloured layer is arranged wherein the insulating material has bonded to the outside said separate porous coloured layer for design purposes and for controlling the light transmittance τ.

16. The facade system according to claim 1, wherein the coloured layer is of a colour-fast design with respect to UV irradiation.

17. A facade system, substantially as herein described with reference to the accompanying drawings.

Dated this 12th day of March 2002

ISOVER SAINT-GOBAIN

By their Patent Attorneys

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Fellows Institute of Patent and

Trade Mark Attorneys of Australia

Fig. 1

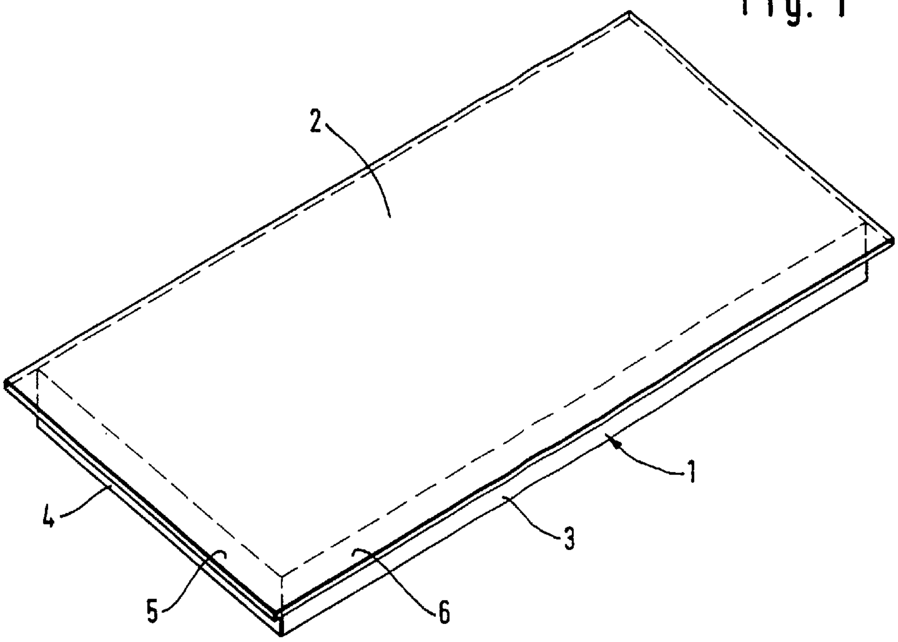

Fig. 2

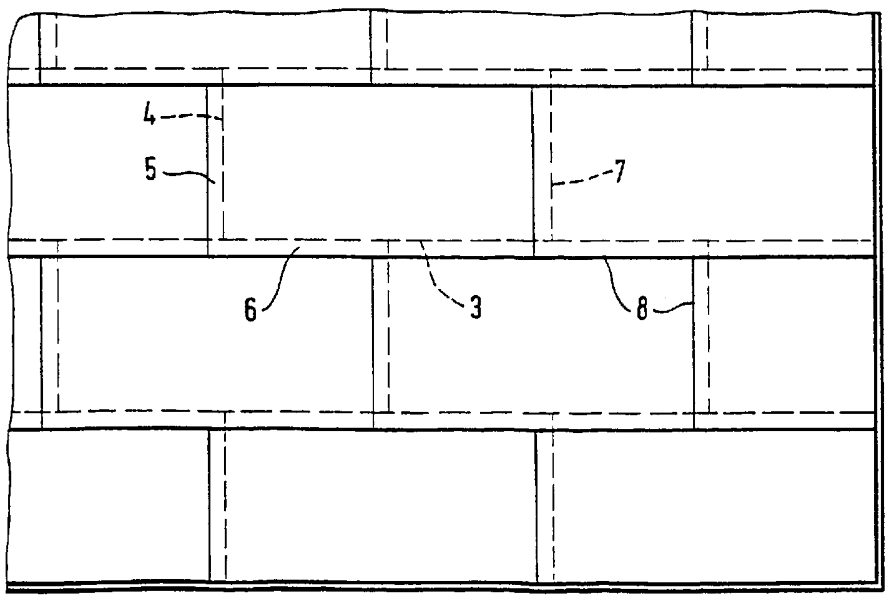

Fig. 3

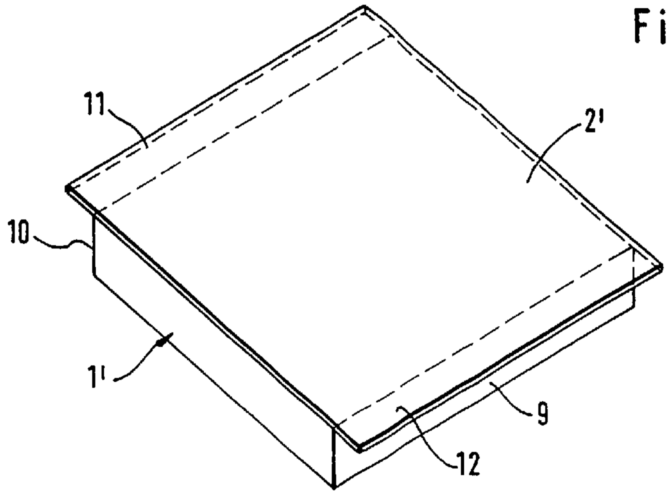

Fig. 4