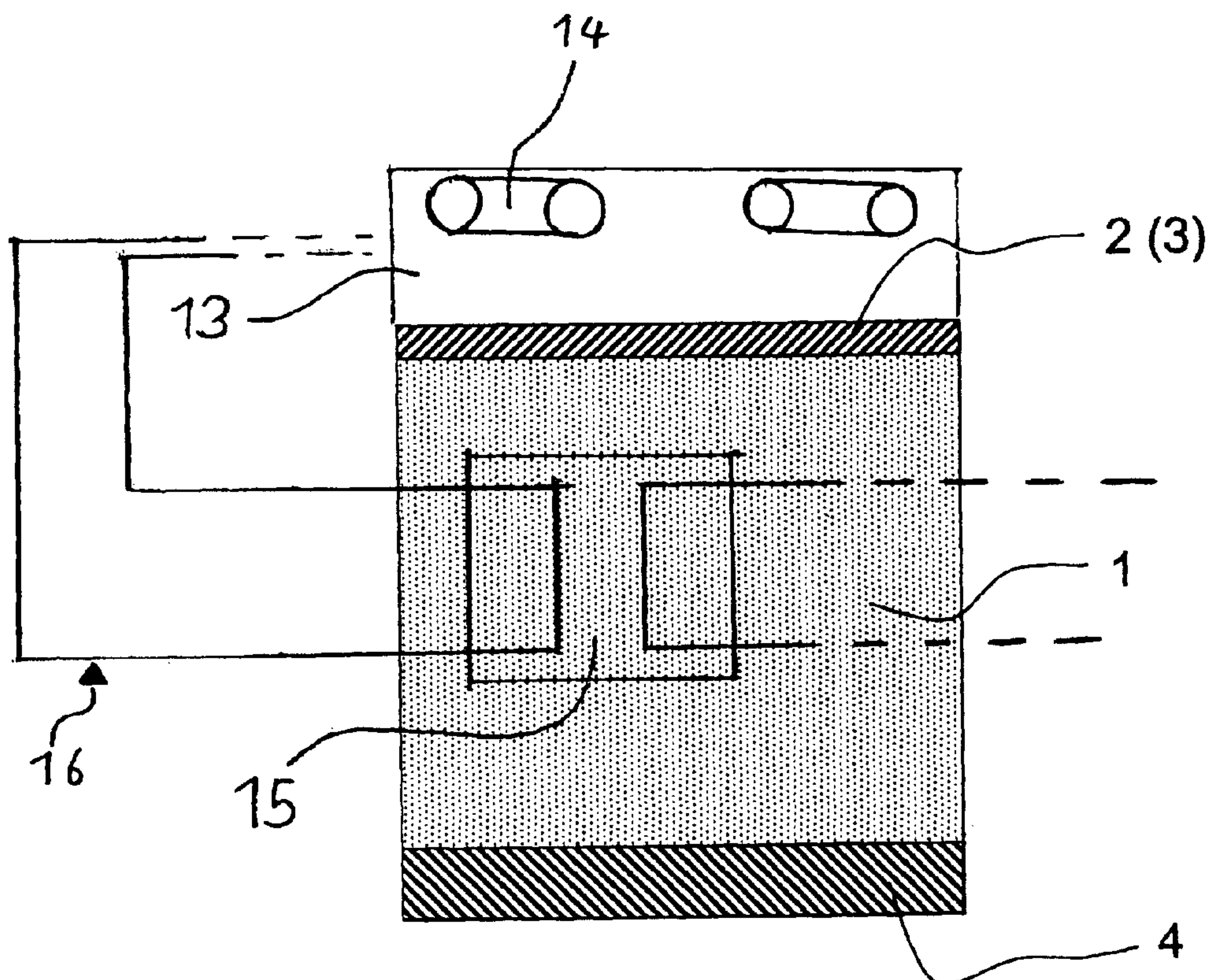




(86) Date de dépôt PCT/PCT Filing Date: 2008/11/12
(87) Date publication PCT/PCT Publication Date: 2009/05/22
(45) Date de délivrance/Issue Date: 2014/08/26
(85) Entrée phase nationale/National Entry: 2010/09/10
(86) N° demande PCT/PCT Application No.: EP 2008/009547
(87) N° publication PCT/PCT Publication No.: 2009/062689
(30) Priorité/Priority: 2007/11/14 (EP07120672.6)

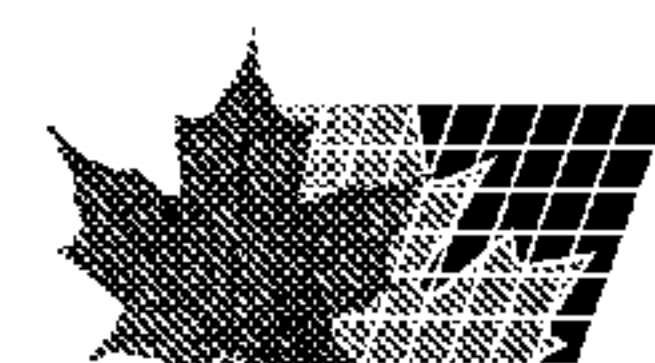
(51) Cl.Int./Int.Cl. *E04D 3/35* (2006.01),
B29C 44/12 (2006.01), *E04B 1/94* (2006.01),
E04C 2/296 (2006.01), *E04D 13/18* (2014.01),
H02S 40/42 (2014.01)
(72) Inventeurs/Inventors:
BURKHARDT, HOLGER, DE;
GLANZMANN, ARTHUR, CH
(73) Propriétaire/Owner:
LUXIN (GREEN PLANET) AG, CH
(74) Agent: SIM & MCBURNEY

(54) Titre : PANNEAU DE TOIT OU DE FACADE A PANNEAU SOLAIRE
(54) Title: ROOF OR FACADE PANEL WITH SOLAR PANEL



(57) Abrégé/Abstract:

A roof or façade panel has at least one surface panel which can be attached to buildings. The surface panel is directly foamed with a support layer of foamed synthetic material. The surface panel comprises a solar panel. A metal grating is foamed in the support layer.



ABSTRACT

A roof or façade panel has at least one surface panel which can be attached to buildings. The surface panel is directly foamed with a support layer of foamed synthetic material. The surface panel comprises a solar panel. A metal grating is foamed in the support layer.

Roof or façade panel with solar panel

[0001] The present invention relates to a roof or façade panel having a surface panel [which] is directly foamed with a support layer from foamed synthetic material, and a process for
5 production thereof and a construction element comprising the roof or façade panel.

[0002] According to the prior art, relatively thick panels, for example of granite, marble, stone, steel, metal, are usually produced for façade panels. Sufficient thickness for these panels is necessary in that bores are produced in these panels using complex processes and
10 the attachment elements for attaching the panels to the building are subsequently disposed in these bores.

[0003] Since sufficient thickness for the façade panels is essential, known façade panels have considerable weight per square meter. Known façade panels are thus also only small in
15 format since otherwise transportation and especially attachment to the building, i.e. mounting, would be too difficult and troublesome.

[0004] Drilling the façade panels in order to fit the attachment elements is also associated with a considerable risk since the panel can easily fracture if care is not taken.

[0005] Façade panels and floor panels are also known from the prior art, wherein a surface layer is directly foamed with a support layer. This surface layer is of granite, marble, stone, ceramic or metal and is to constitute the outer façade of the building or a floor covering.

[0006] However, roof panels with a surface layer directly foamed on a support layer are not known from the prior art.

[0007] Furthermore, in accordance with the prior art it is possible subsequently to attach solar or photovoltaic panels to a building.

[0008] Solar or photovoltaic panels are further understood to be a solar module, a photovoltaic module or a solar generator. These convert sunlight directly into electrical energy. A solar panel or module essentially comprises - starting on the side facing the sun - a pane of glass, a transparent synthetic material layer, into which the monocrystalline or

polycrystalline solar cells are embedded, wherein the solar cells are electrically connected to each other by so-called solder strips, rear-side lamination which has a weather-proof synthetic material composite film, a connection socket and a connection terminal and an (aluminium profile) frame. Of particularly critical importance for a solar panel are a
5 transparent, radiation-resistant and weather-proof covering, protection of the solar cell against mechanical influences, protection of the components, in particular of the solar cells and electrical connections against moisture, also robust electrical connections, sufficient contact protection of the electrically conductive components, also sufficient cooling of the solar cells, and handling and attachment capabilities.

10

[0009] In particular, the cooling of solar modules is a decisive factor for high-level, consistent performance. For example, when using solar modules in particularly hot areas the surface temperatures of the solar modules can reach over 400°C, which can lead to a drop in performance of more than 40%. The cooling of solar modules can thus have a considerable
15 influence on the efficiency thereof. However, not only is cooling critical in and of itself but also in particular keeping the temperature constant in order to achieve truly efficient use of the module.

[0010] Solar cells are currently usually produced from semi-conductor materials,
20 predominantly silicon. As already mentioned, these semi-conductor solar cells are connected to large solar modules in order to generate energy. For electrical connection purposes the cells are connected in series to conductive tracks, i.e. the previously mentioned solder strips on the front and rear side (so-called front and rear side contact), whereby the voltage of the individual cells is combined and thinner wires can be used than in the case of a parallel
25 circuit.

[0011] Furthermore, in order now to attach solar or photovoltaic panels to a building in accordance with the said prior art these panels are subsequently attached for this purpose in a known manner to the façade or façade panels or to the roof or roof panels. To this end,
30 attachment elements are additionally attached to the solar panels in order to be able to connect them to the façade or the roof of a building. This requires additional work and consequently also leads to higher costs. Moreover, there is a danger of damaging the solar panels by reason of, or during the attachment of separate attachment elements. Furthermore, the electrical connections must be reliably protected against moisture or even contact. In

addition, an addition, adequate cooling means must be attached to the solar panel.

[0012] The object of an aspect the present invention is therefore a novel roof or façade panel with a solar panel, which can be produced and mounted simply and securely.

5 [0013] In accordance with an aspect, there is provided a roof or façade panel having at least one surface panel which can be attached to buildings. The surface panel is directly foamed with a support layer from foamed synthetic material. The surface panel has a solar panel.

[0014] The support layer is advantageously foamed with an under layer on its side opposite the surface panel, wherein the under layer is preferably formed from a fire-retarding material such as calcium sulphate.

10 [0015] The support layer is advantageously a foamed rigid or rigid integral polyurethane foam.

[0016] In a particularly advantageous manner, suspension or mounting means for attachment of the roof or façade panel to the building, metal gratings, tongue and groove elements, pipes, electronic components and/or other components or elements are foamed in the support layer.

15 [0017] The pipes are preferably connected to the pipe system of a heating arrangement, for example floor heating, and/or of a hot water supply, either directly or indirectly via heat exchangers.

[0018] In a particularly preferred embodiment the pipes have cooling coils.

20 [0019] In accordance with a further aspect, there is provided a roof or façade panel having at least one surface panel which can be attached to buildings, wherein the surface panel is directly foamed with a support layer of foamed synthetic material, wherein the surface panel comprises a solar panel, and wherein a metal grating is foamed in the support layer.

[0020] Furthermore, a preferred process for producing the roof or façade panels in accordance with the invention is described.

[0021] In yet another embodiment, there is provided a construction element composed of a roof or façade panel as described, wherein the construction element is attached directly to structural elements of a building.

[0022] The roof or façade panel described herein in accordance with the invention has at least one surface panel which is directly foamed with a support layer from foamed synthetic material, wherein the surface panel has a solar panel. The solar panel can therefore be attached directly to a building as a complete roof or façade panel. In this way the subsequent attachment of solar panels to the façade or to the roof of a building is avoided as they are directly integrated into the roof or façade panel. The roof/façade panel, insulation and solar cell are therefore unified to form a single component. This integration of the solar panel considerably reduces mounting time. The roof or façade panel can therefore be attached directly to structural elements of a building, for example laid directly on the roof battens or attached to further parts of a static building construction of a building such as beams or reinforced concrete columns. In this way, for instance, it is possible also to save on the additional covering of a roof, for example with roof tiles, or the erection of an external façade since the panel can be used as a complete roof or façade element. It is therefore possible to save on the whole substructure of a roof or of a façade.

[0023] Since the panels have a particularly planar surface with no substantial impact surface, for example with respect to wind, the roof or façade panels in accordance with the invention are much less susceptible to such environmental influences in comparison to roofs covered with tiles or the like or solar panels subsequently attached to the roof or façade. For example, in the case of a storm, the risk of damage to the roof or façade construction and also the risk to passers-by from falling roof or façade elements (for example tiles) are therefore considerably reduced.

[0024] Furthermore, the panel in accordance with the invention is extremely thin and light in comparison to a roof or façade with a subsequently attached solar panel, whereby it is additionally possible to achieve a considerable weight saving compared with a conventional roof or façade.

[0025] In addition it is possible in a simple manner to foam together different surface panels to form a larger roof or façade element, whereby it is possible to avoid additional effort

required during mounting to align the surface panels on the roof or on the façade. The effort involved in mounting as a whole is therefore reduced by a multiple of the mounting effort conventionally required for roofs or façades.

5 [0026] By foaming-in the solar panel on the back, protection of the rear of the solar cells against mechanical influences and protection of the rear contacts against moisture is also achieved at the same time. Moreover, the electrical connections can be designed less robustly, provided they are embedded in the support layer. Similarly, owing to the support layer, sufficient rear protection of the electrically conductive components against contact is
10 also provided at the same time so that it is possible to dispense with further protection at this location.

[0027] For example, in the case of renovation of an old building it is possible in a single operation to improve the insulation of the roof or of the façade and at the same time to
15 construct and attach solar cells or solar modules in a simple manner.

[0028] The support layer is also preferably foamed with an under layer on its side opposite the surface panel. By means of this additional layer the roof or façade element can fulfil further requirements such as certain fire-protection requirements. To this end, the under
20 layer is formed in a particularly advantageous manner as a calcium sulphate plate which has a particularly fire-retarding effect. Other fire-retarding materials are also feasible.

[0029] Furthermore, rigid or rigid integral polyurethane foam is also preferably proposed as a foamable synthetic material. This synthetic material is principally characterised by its
25 great strength in the foamed region, its good heat-insulating properties and its rapid bonding and hardening capability. This foam is also watertight, which means that the solar cells and the electrical contacts do not require additional protection against moisture, for example by a further protective layer, at least on the rear of the solar panel. The penetration of water, for example rain water, can thereby easily be prevented. Owing to its low delta T, condensation
30 of, for example, water in the system can also be avoided so that the formation of mould or moss, which occurs for example in the case of subsequently attached solar panels on a roof or façade, can be effectively avoided

[0030] Suspension or mounting means for attachment of the roof or façade panel to the

building, metal gratings, tongue and groove elements, pipes, electronic components and/or other components are preferably foamed in the support layer.

[0031] Incorporation of attachment elements such as hooks, threads, etc, into the foam structure by means of a single fully automatic process during foaming leads to a tough, high-strength bond after the foam has hardened, which connects the surface panel to the foamed synthetic material and at the same time encloses the attachment elements. The sensitive solar panels as surface panels with the brittle solar cells thus do not have to be provided with additional holding elements or drilled holes in order to be attached, nor do they need to be drilled themselves or in their frames since the attachment elements are already anchored in the support layer. All the forces acting on the roof or façade panel are therefore shifted into the support layer. The risk of damage or breakage of a solar panel is therefore minimised and the handling and attachment means which are usually attached directly to the solar panels can be omitted.

[0032] The use of polyurethane foam as the support layer means that this can also be used for heat insulation. The support layer therefore not only serves for non-positive breakage prevention of the solar panel but also to receive the attachment elements and also as insulation against heat and cold.

[0033] Metal gratings can also preferably be foamed into the support layer and increase the strength of the support layer and can additionally serve to reinforce the support layer of particularly heavy roof or façade panels.

[0034] Tongue and groove elements are advantageously foamed into the support layer and can facilitate the installation of the roof or façade panel and ensure that the panels hold together in a stable manner.

[0035] In a particularly preferred embodiment pipes are foamed into the support layer. The pipes have cooling coils or cooling agent coils in one particularly preferred embodiment. In this way the cooling device necessary to, and adequate for, solar cells is integrated directly and simply into the support layer and therefore does not have to be additionally integrated or attached. By the integrated discharge of heat the efficiency of the solar panel can therefore be increased considerably more.

[0036] The heat-carrying agent circulating in the cooling coils can also preferably be used via an attached heat exchanger, for example for the supply of hot water. For this purpose the cooling coils can be connected directly to a hot water supply installation or to a heating installation.

[0037] It is also feasible for the heated cooling agent fluid also to be used alternatively or additionally via turbines to produce electricity, whereby the efficiency of the solar panels can be increased still further. The cooling of the solar panels can therefore be exploited in numerous ways for heating, for hot water supply or even for the production of electricity.

[0038] Alternatively, the possibility exists of applying a further translucent layer to the surface layer for cooling purposes. This layer, for example of glass, contains channels such as pipes, which in a particularly preferred embodiment have cooling coils or cooling agent coils. The pipes can be attached in the same way directly to the additional layer. Heat exchangers which discharge heat and are connected to the pipes can additionally be foamed into the support layer.

[0039] It is also feasible instead of the pipes to use an aeration system in the translucent layer. The thermal arising therein can then be rendered useable with a heat exchanger in the manner described above.

[0040] In a very general way it is possible to foam a wide range of components and elements into the support layer. This principally also includes electronic components of any type since, owing to their small size, they can very easily be introduced into foaming moulds.

[0041] The process for producing the roof or façade panel as described is totally unaffected by the solar panels being of different thicknesses. Even if a solar panel has portions of non-uniform thicknesses, for example at the connection points of individual solar cells or on the rear contacts of a solar cells the roof or façade panels produced by means of the process in accordance with the invention always have a constant overall thickness since the thickness of the rigid or rigid integral polyurethane foam can vary. Roof or façade elements which appertain to a roof or façade of a building can thereby all be produced with an absolutely identical thickness.

[0042] Further features, advantages and properties of the invention will now be explained with the aid of exemplified embodiments and the figures of the accompanying drawings.

5 [0043]

Figure 1 shows a roof or façade element in accordance with the invention, and

Figure 2 shows a construction element in accordance with the invention with cooling coils foamed in.

10

[0044] Figure 1 shows a roof or façade element in accordance with the invention having at least one surface panel 2 foamed directly with a support layer 1. The surface panel 2 comprises a solar panel 3.

15

[0045] Foaming a solar panel 3 with a support layer 1 as a roof or façade panel means that the solar panel does not additionally have to be mounted onto the roof or façade of a building. The solar module itself therefore no longer has to be fitted with its own handling and attachment means. Furthermore, at the same time the rear of the solar cells is at least protected against mechanical influences and the rear contacts are at least protected against moisture and other influences. Moreover, if the electrical connections are also embedded into the support layer they can also be less robust. Since the electrically conductive components are foamed into the support layer at least on the rear of the solar module, sufficient contact protection is also provided at the same time at that location so that it is possible to dispense with further protection at these points.

25

[0046] The electrical connections of the solar panels 3 for carrying away the generated electricity can be led out of the foamed synthetic material mass during the foaming process so that the electricity can easily be discharged from the solar modules and, for example, stored or used directly by consumers. A connection socket with a diode and/or the connection terminal of the solar panel 3 are preferably disposed and foamed-in in such a way that they are accessible from the inside of the roof or façade panel. The connections of the solar panels 3 are therefore easily accessible and are securely protected from the weather on the inside of the panel.

30

[0047] It is also feasible for the connection socket and/or the connection terminal, additionally or alternatively, to be accessible after foaming-in on at least one side on which the roof or façade panel is to be connected to a further panel. These connection elements are preferably designed as a plug connection. It is therefore possible to connect in series a
 5 plurality of solar panels on a plurality of roof or façade panels simply and directly during attachment of the roof or façade panel, whereby mounting of the panels is further simplified.

[0048] The support layer 1 is a foamed synthetic material, advantageously a foamed rigid or rigid integral polyurethane foam. This synthetic material is characterised in particular by its
 10 high level of strength, its good heat-insulation properties and its rapid bonding and hardening capability. The support layer 1 serves both for non-positive breakage-prevention of the solar panel 3 and also as thermal insulation, i.e. as insulation against heat and cold. The rigid or rigid integral polyurethane foam is also watertight so that the solar cells and the electrical contacts do not have to be additionally protected against moisture at least on the rear of the
 15 solar panel 3, for example, by a further protective layer. Similarly, condensation in the system is prevented owing to the low delta T so that the formation of mould or moss can be effectively prevented. It is also feasible for other foamable materials to be used as the support layer.

[0049] Components or elements are preferably foamed in the support layer 1. These can be, for example, suspension or mounting means for attachment of the roof or façade panel to the building, metal gratings, tongue and groove elements, pipes, heat exchangers, electronic components and/or other components or elements. In addition to its properties of preventing breakage and of heat insulation the support layer therefore also serves to receive components
 20 and elements.
 25

[0050] Foaming metal gratings, for example steel mesh gratings such as construction steel gratings, into the support layer 1 of the roof or façade element can increase the strength of the support layer 1. In the case of particularly heavy roof or façade panels a metal grating of
 30 this type can thus also serve as reinforcement of the support layer 1.

[0051] In a preferred embodiment, for example, tongue and groove elements are foamed into the support layer. For this purpose wire meshes or mesh tubes of HPL ("high pressure laminate") material strips are preferably foamed in as tongue and groove elements which are

provided with holes in order to achieve a non-positive connection to the (polyurethane) foam of the support layer 1. The wire mesh or the HPL grating then serves to increase the load-bearing capacity of the roof or façade panel. The tongue and groove element facilitates the installation of the roof or façade panel and ensures that mutually connected panels hold
 5 together in a stable manner.

[0052] Pipes preferably foamed into the support layer 1 preferably have cooling coils or cooling agent coils 8 as shown in Figure 2. The cooling coils 8 foamed into the support layer 1 preferably have a heat-carrying agent flowing through them when the roof or façade panels are in the mounted state. In this way the cooling which is necessary to, and adequate for,
 10 solar cells is integrated directly and simply in the support layer. It is therefore possible to dispense with additional attachment of a cooling means, which makes mounting easier and also leads to savings in costs and materials. In a preferred embodiment the cooling coils 8 are attached, preferably welded, to a heat-conducting plate 9 preferably made from a highly
 15 heat-conductive material. The heat-conducting plate 9 is in turn preferably disposed or attached on the rear to the solar panel 3 and therefore ensures uniform heat distribution of the heat discharged from the solar panel 3. The heat can then simply be transferred from the solar panel 3 via the heat-conducting plate 9 to the cooling coils 8 and therefore to the heat-carrying agent in the cooling coils 8 and can be discharged.

[0053] The heat transferred from the roof or façade panels via the solar panel 3 to the heat-carrying agent in the cooling coils 8 can furthermore be transferred directly or indirectly preferably via heat exchangers 10 into or onto the circuit 11, 11' of a (floor) heating system 12 or into or onto the water circuit for supplying hot water (not shown). Figure 2 illustrates,
 25 for example, indirect heat transfer by means of heat exchanger 10, wherein the circuit 11 shows the cooling agent circuit of the solar panel 3, and the circuit 11' illustrates the utility circuit, in this case the heating circuit. The circuits 11, 11' are only shown schematically. The broken lines are intended to indicate that the cooling coils 8 are integrated into the cooling agent circuit 11.

[0054] The cooling coils 8 therefore ensure improved heat discharge through the roof or façade sandwich panels, whereby on the one hand the degree of efficiency of the solar cells is increased. On the other hand, different degrees of expansion owing to stresses which arise in the solar or photovoltaic panels 3 by reason of temperature swings can in this way reliably

be reduced. In addition, the heated cooling agent from the cooling coils 8 can be further used for hot water supply or for heat exchangers.

[0055] The cooling agent fluid heated after the cooling process can also be used to produce electricity by means of turbines. In this way the efficiency of the solar panels can be considerably increased further. The cooling arrangement of the solar panels 3 can therefore be used in many alternative ways, for example for heating, for hot water supply or even to produce more electricity.

[0056] In order to simplify the cooling system or connection thereof, the cooling coils 8 can be foamed into the support layer 1 in such a way that at least one end of the cooling coils 8 in each case is disposed so that it leads to the edge of the roof or façade panel and is accessible from outside. The ends of the cooling coils 8 are preferably led to at least one side of the roof or façade panel on which this is to be connected to a further one so that the cooling coils 8 of a roof or façade panel can easily be connected, during mounting, to those of a further panel. For this purpose the pipes or cooling coils 8 are connected at the corresponding connection points preferably with connection elements, for example screw or plug connections, in order to considerably simplify further the mounting of roof or façade panels which are provided with solar panels 3 and have an integrated cooling system.

[0057] In a further embodiment the pipes, preferably cooling coils or cooling agent coils 14, are located in or immediately adjoining an additional layer 13 as shown in Figure 1. This preferably translucent layer 13, for example of glass, is attached to the solar or photovoltaic panel 3.

[0058] The heat transferred from the roof or façade panels via the solar panel 3 to the heat-carrying agent in the cooling coils 14 can also be rendered usable as described above, directly or indirectly preferably via the heat exchanger 15 foamed in the support layer.

Figure 1 shows by way of example an indirect heat transfer by means of heat exchanger 15.

The broken lines are intended to indicate that the cooling coils 14 are integrated into the cooling agent circuit 16.

[0059] It is also possible to use an aeration system in the translucent layer instead of the pipes. The thermal arising therein can then be rendered usable by the heat exchanger in the manner

described above.

[0060] Furthermore, other components and elements can also be foamed into the support layer 1 as desired. In a particularly advantageous embodiment, electronic components are foamed into the support layer 1. The connection lines can be led out of the foamed synthetic material mass even during the foaming process so that connection of these components can easily be effected after the respective panel has been produced. It is also possible to provide corresponding connection elements in the support layer 1 which then, like the solar panel 3, are easily accessible, for example, from the inside of the roof or façade panel.

[0061] A wide range of possibilities exist with respect to the electronic components, in particular in domestic technology. Thus, for example, light or temperature sensors which control automatic curtains, blinds, air conditioning or heating can be foamed in. Since the rigid polyurethane foam is also watertight, these sensors do not need to be additionally protected against moisture.

[0062] It is also possible to integrate radio antennas, for example for wireless networks and wireless internet access but also for mobile telephony, into the foamed synthetic material layer 1. The radio antennas would then be integrated in the roof or in the house façade and would not impair the visual appearance of the roof or façade. Furthermore, the electricity from the solar panels can be used directly for the components integrated in the support in order thereby to improve, for example, the reception or transmission strength or quality.

[0063] The support layer 1 is also preferably foamed with an under layer 4 on its side opposite the surface panel 2 or the solar panel 3. This lower layer 4 serves, for example, for visual purposes or other specific requirements, such as preferably fire-protection requirements. The under layer 4 is preferably formed as a calcium sulphate plate which has special fire-retarding properties. However, other layer materials with advantageous properties for roof or façade panels are also feasible.

[0064] In a further embodiment the layer 4 can also be foamed with the support layer 1, for example, on at least one of the lateral outer regions thereof in order to exploit its properties in these regions as well (cf. Fig. 2). In particularly preferred manner, a plate, preferably a calcium sulphate plate, is preferably disposed on each side of the support layer 1 with the

exception of the front side.

[0065] In order to lead or render accessible any electrical connections or connection elements through the under layer 4, access points, for example in the form of holes, can be provided in the under layer 4 at defined positions. These are preferably selectively closable with a cover, for example, by means of a simple screw or plug connection. The cover is preferably made of the same material as the under layer 4.

[0066] By integration of the solar panel 3 into the roof or façade panel, the solar panel 3 can in this way be attached directly to a building as a complete roof or façade panel, which makes subsequent attachment of solar panels 3 to the roof or to the façade of a building superfluous. Therefore a roof/façade panel with insulation and a solar cell and possible further properties, for example fire-protection properties, can be united to form a single component. In so doing, it is thus possible to make savings on the entire substructure of a roof or façade, which considerably reduces both production costs and also mounting time of a roof or façade construction fitted with solar cells.

[0067] The solar panels themselves can also be formed in a much more simple and cost-effective manner since it is possible to dispense with additional protection means such as protection against mechanical influences, moisture and contact at least on the rear of the solar panel, and also to dispense with additional cooling means and further handling and attachment means on the solar panels themselves.

[0068] The properties and functionality of the roof or façade panel in accordance with the invention can be considerably improved further in that any other desired components and elements can be foamed into the support layer 1 in order, for example, to simplify the attachment of suspension and mounting elements, to improve the discharge of heat and to exploit the discharged heat or to integrate electrical components in a concealed manner.

[0069] A production process for a roof or façade panel in accordance with the invention is described hereinunder.

[0070] The surface panel 2, which comprises the solar panel 3, is first placed into a mould which is then closed. Two liquid components are then injected into the mould, which react

with each other and foam. After foaming, the synthetic material, preferably a polyurethane synthetic material, hardens automatically. The resulting connection to the solar panel 3 is principally characterised by its very high level of strength.

5 [0071] The process in accordance with the invention permits the use of solar panels 3 with an insulation layer as a complete unit for a roof covering or façade. By reason of its small thickness and its low weight, since, for example, it is possible to dispense entirely with further outer materials such as roof tiles or façade panels, a major part of the material costs, such as for example expensive surface materials, is saved and mounting is considerably
10 facilitated. Furthermore, irregularities in the solar panels, for example at the connection points between individual solar cells or on the rear contacts of a solar cell, do not affect the finished roof or façade panel since, after foaming with the support layer 1, each roof or façade panel produced in this way, preferably in the same or an identical mould, always has the set, uniform, constant overall thickness. Varying thicknesses in a solar panel 3 are
15 therefore automatically corrected in that the support layer 1 is formed thinner at the corresponding points depending on the enclosing mould.

[0072] By positioning attachment elements such as hooks, threads etc in the mould, these can also be foamed into the support layer 1. By incorporating attachment elements into the
20 foam structure by means of a single fully automatic process during foaming, a tough, high-strength connection is produced after the foam hardens, which connects the solar panels 3 to the foamed synthetic material and at the same time receives the attachment elements. The surface panels 2 or the solar panels 3 thus do not need to be provided with additional holding elements or drilled holes in order to be attached, nor do they need to be drilled themselves or
25 in their frames since the attachment elements are already anchored in the support layer. The loading of the whole roof or façade element therefore takes place in the stable support layer 1 and not in the surface panel 2, i.e. the solar panel 3, whereby the risk of damaging or breaking a solar panel 3 is minimised.

30 [0073] The roof or façade panels in accordance with the invention can on the one hand be used as panels which are aerated from behind (Fig. 1). On the other hand, however, it is preferably also possible to attach the roof or façade panels directly to existing roof battens or existing masonry. Therefore, for example for the purposes of renovating an old building or in new builds, these panels can serve as an actual roof covering or outer wall (Fig. 2) and at

the same time can consequently naturally also serve as insulation and as an internal wall or internal ceiling, i.e. as a so-called construction element. The insulation of the roof or the façade is therefore improved and at the same time solar cells are attached in a single operation. In the case of the construction element the support layer 1 is formed substantially thicker (preferably ca. 100-200mm of rigid or rigid integral polyurethane foam) than in the case of use as roof or façade panels aerated from the rear (preferably ca. 20-50mm rigid or rigid integral polyurethane foam).

[0074] As a construction element the roof or façade panel is additionally foamed with the under layer or inner layer 4 on the inside of the support layer 1, i.e. on the [side] opposite the surface layer 2. The under layer 4 is advantageously formed as a fire-retarding calcium sulphate plate and also preferably has a thickness of ca. 25-45mm. The under layer 4 preferably has a smooth surface and can be suitable for wallpapering over, for which reason it is particularly suitable as an internal wall or internal ceiling.

[0075] The size of the roof or façade element or construction element also differ depending on the function of the roof or façade element, i.e. on whether the roof or façade element is to be suspended as a roof or façade element which is aerated from the rear on an existing roof or an existing external wall or on whether it is to be used as a construction element. A construction element preferably has a size of ca. 2-3m x 1.5m, whereas a roof or façade element for use as a roof or façade element which is aerated from the rear is preferably produced substantially smaller, for example in the range of 120cm x 60cm or 120cm x 120cm. With the process it is also possible in a particularly simple manner to foam a plurality of surface panels, i.e. solar panels, together to form a larger roof or façade element, whereby additional mounting effort imposed by alignment of the surface panels on the roof or on the façade can be avoided. Since savings can be made on the whole substructure, the effort involved in mounting is therefore also reduced by a multiple of the mounting effort conventionally required for roofs or façades.

[0076] Furthermore, the stability of the roof or façade panels increases the thicker the support layer 1 is. It is therefore possible as the thickness of the panels increases to attach the roof rafters at a greater distance from each other and therefore also to save costs in the actual construction of the house. These panels are then also suitable in particular for larger expanses such as, for example, factory or works premises. Using a thick support layer 1 all

attachment parts, such as screws or other anchoring means, can additionally be mounted with sufficient stability in this roof or façade construction.

[0077] The construction element is preferably attached directly to structural elements 5 of a building i.e. for example, the roof battens or supports or reinforced concrete columns of a static building construction. To this end it is possible to provide a recess 6. Attachment is effected, for example, by means of a metal bracket 7 which is connected to the structural elements 5. All feasible types of mounting such as, for example, welding, screwing, bonding or suspension attachments are possible. The overall thickness of the construction element is for example 35cm (8cm calcium sulphate panel 3, 1cm surface panel 2, i.e. the solar panels 3, and 26cm rigid or rigid integral polyurethane foam layer 1), wherein the thickness of the respective layers can vary depending on the area of usage and the materials used. The panel in accordance with the invention is extremely thin and light in comparison to a roof or a façade with a subsequently attached solar panel, whereby it is possible to achieve a great weight saving with respect to a conventional roof or façade, which in turn has the overall effect of making these panels easier and better to handle.

[0078] In the case of roof or façade panels in accordance with the invention provided with a cooling means it is possible to mount these panels closer together because they expand less, and therefore to reduce the expansion gaps. The lower level of expansion also means that wear on the roof or façade panels is reduced, whereby the service life thereof is in turn increased.

[0079] Provision is preferably made to fill the gaps between the panels with conventional expanding foam or similar suitable materials once the roof or façade panels have been laid. In this way any penetration, for example, of rain water between the panels is also prevented. When the roof or façade panels can be mounted closer to each other owing to the cooling arrangement in accordance with the invention, it is also possible in this way to save on expanding foam owing to the narrower expansion gaps.

30

[0080] The roof or façade panels form, in particular also in the mounted state, a particularly uniform surface over all panels of a composite arrangement and therefore offer a clearly smaller impact surface, for example with respect to wind for instance, than tiles or similarly covered roofs or also solar panels subsequently attached to the roof or façade. The

likelihood of damage to the roof or façade construction, for example during/by reason of a storm is therefore clearly reduced.

5 [0081] With the roof or façade panels a large number of visual effects can also be achieved on the surface of the solar cells, for example, by means of a special polishing of the glass or by using dye-sensitised solar cells. Dye-sensitised solar cells use an organic dye for conversion of light into electrical energy, wherein different dyes and degrees of transparency permit a variety of design possibilities. For example, a simulated roof or façade (for example, tiled roof or slate roof effect) can be achieved by the said grinding of the glass or
10 also the dyes. This is then particularly advantageous if, for example, in spite of building regulations (for example for the protection of historic buildings), a certain roof structure or façade structure is required without dispensing with solar energy. It is also possible by the same means to blend in the solar panels in such a way that disruption of the surroundings owing to the reflected sunlight can be avoided.

15

[0082] The invention is not limited to the limitations described above. Any type of foamable materials for the support layer and all materials which are suitable for the under layer are feasible. All feasible components or elements can also be foamed into the said support layer. Furthermore, the panels can be attached to all parts and areas of a building.

Reference list

- | | | |
|----|-------|----------------------------------|
| | (1) | Support layer |
| | (2) | Surface layer |
| 5 | (3) | Solar panel |
| | (4) | Under layer |
| | (5) | Structural element of a building |
| | (6) | Recess |
| | (7) | Metal bracket |
| 10 | (8) | Cooling (agent) coils |
| | (9) | Heat-conducting plate |
| | (10) | Heat exchanger |
| | (11) | Cooling media circuit |
| | (11') | Utility circuit |
| 15 | (12) | Heating |
| | (13) | Translucent layer |
| | (14) | Cooling (agent) coils |
| | (15) | Heat exchanger |
| | (16) | Cooling media circuit |

What is claimed is:

1. A roof or façade panel having at least one surface panel which can be attached to buildings, wherein the surface panel is directly foamed with a support layer of foamed synthetic material, wherein the surface panel comprises a solar panel, and wherein a metal grating is foamed in the support layer.
2. The roof or façade panel as claimed in claim 1, wherein on its side opposite the surface panel the support layer is foamed with an under layer.
3. The roof or façade panel as claimed in claim 2, wherein the under layer is formed from calcium sulphate or another fire-retarding material.
4. The roof or façade panel as claimed in claim 1, wherein a further translucent layer is attached to the surface panel.
5. The roof or façade panel as claimed in any one of claims 1 to 4, wherein the support layer is foamed rigid or rigid integral polyurethane foam.
6. The roof or façade panel as claimed in any one of claims 1 to 5, wherein suspension or mounting means for attaching the roof or façade panel to the building are foamed in the support layer.
7. The roof or façade panel as claimed in any one of claims 1 to 6, wherein tongue and groove elements are foamed in the support layer.
8. The roof or façade panel as claimed in any one of claims 1 to 7, wherein pipes are foamed in the support layer.
9. The roof or façade panel as claimed in claim 8, wherein the pipes are located in a translucent layer or are directly attached thereto.
10. The roof or façade panel as claimed in claim 8, wherein the pipes are connected to a pipe system of floor heating either directly or indirectly via heat exchangers.

11. The roof or façade panel as claimed in claim 8, wherein the pipes are connected to a pipe system of a water supply either directly or indirectly via heat exchangers.
12. The roof or façade panel as claimed in any one of claims 8 to 11, wherein the pipes comprise cooling coils.
13. The roof or façade panel as claimed in claim 4, wherein the translucent layer comprises an aeration system which leads to a cooling means for the solar panel and renders the thermal which arises usable by heat exchangers.
14. The roof or façade panel as claimed in claim 10, 11 or 13, wherein the heat exchangers are foamed into the support layer.
15. The roof or façade panel as claimed in any one of claims 1 to 14, wherein electronic components are foamed in the support layer.
16. A construction element composed of a roof or façade panel as claimed in any one of claims 1 to 15, wherein the construction element is attached directly to structural elements of a building.
17. The construction element as claimed in claim 16, wherein the construction element has a recess which can be attached to two adjacent sides of the structural elements.
18. The construction element as claimed in claim 17, wherein the recess is lined with a metal bracket.
19. The construction element as claimed in any one of claims 16 to 18, wherein the structural elements include supports or roof battens of the building.
20. The construction façade element as claimed in any one of claims 16 to 19, wherein a calcium sulphate plate is disposed on each side of the support layer except the front side.

21. A process for producing the roof or façade panel as claimed in any one of claims 1 to 15, wherein the surface panel, comprising the solar panel, is introduced into a mould and then at least two liquid components are injected into the mould, which foam upon contact to form a rigid or rigid integral foam forming the support layer, wherein the metal grating is foamed in the support layer.

22. The process as claimed in claim 21, wherein roof or façade panels which belong together and are produced for the same building are always introduced into the same or an identical mould and thus the thickness of the mould is always kept constant regardless of the thickness of the solar panel.

23. The process as claimed in claim 21 or 22, wherein the two liquid components are polyol and isocyanate.

FIG. 1

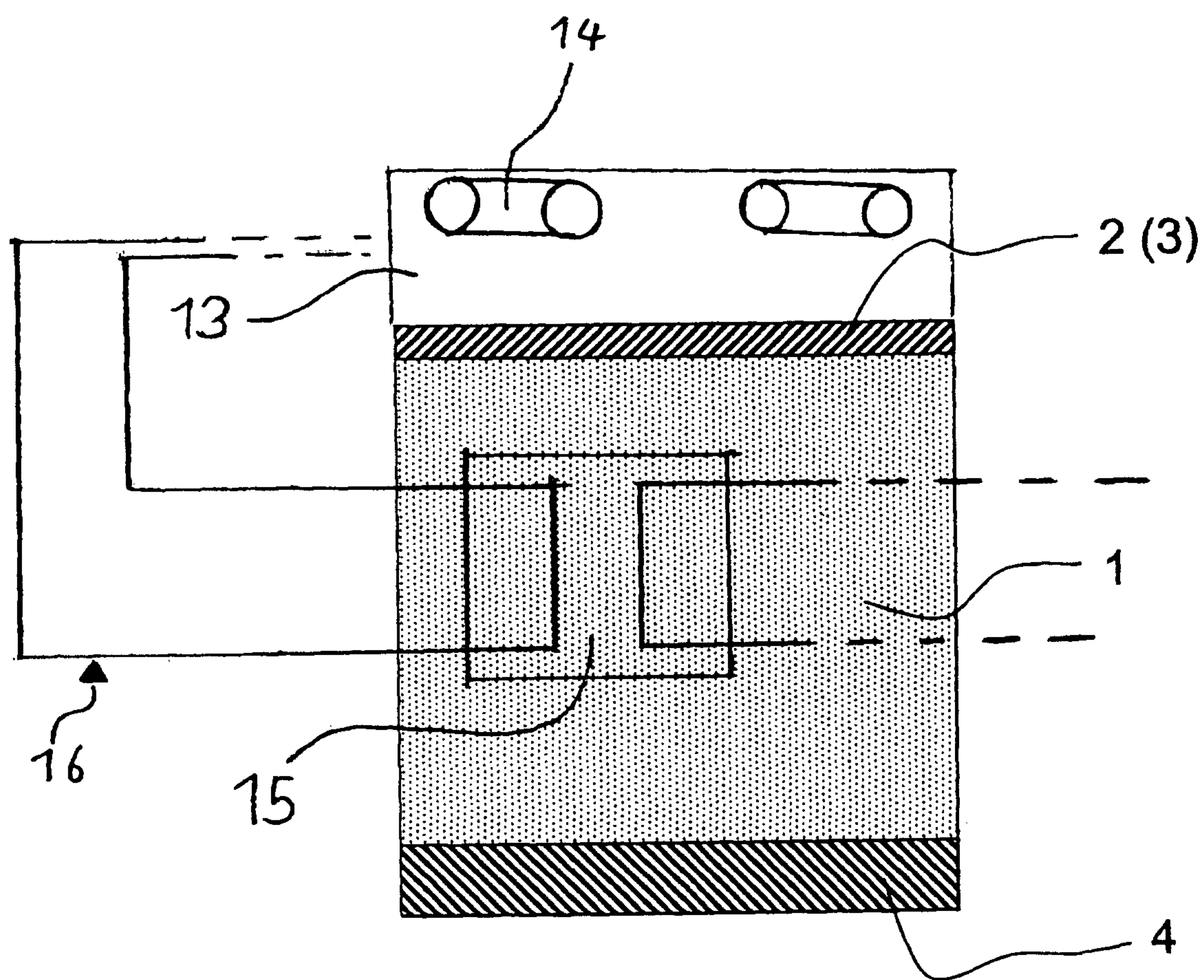


FIG. 2

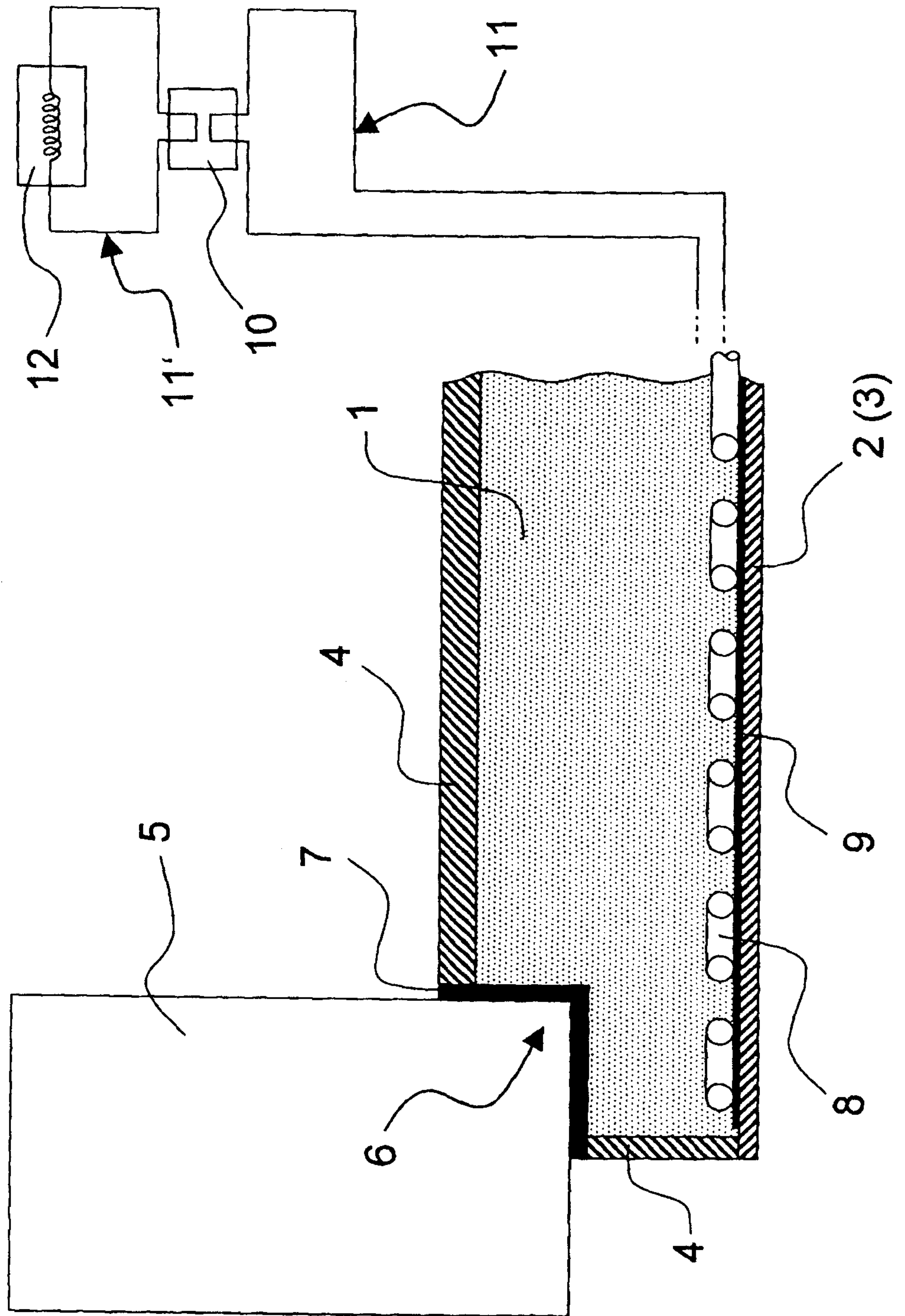


FIG. 1

