(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 933 489 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
11.06.2003 Bulletin 2003/24

(51) Int Cl.[7]: **E04C 2/54**

(21) Application number: **99200224.6**

(22) Date of filing: **26.01.1999**

(54) **Extruded alveolar panel with parallel sheets and ribs made with materials having different optical and mechanical properties**

Extrudierte Stegmehrfachplatte aus Materialien mit verschiedenen optischen und mechanischen Eigenschaften

Panneau alvéolaire en matériaux ayant des caractéristiques optiques et mécaniques différentes

(84) Designated Contracting States:
BE CH DE DK ES FI FR GB GR IE IT LI NL PT SE

(30) Priority: **30.01.1998 CH 22398**

(43) Date of publication of application:
04.08.1999 Bulletin 1999/31

(73) Proprietor: **Politec Polimeri Tecnici S.A.**
6855 Stabio (CH)

(72) Inventor: **Conterno, Cosimo**
6850 Mendrisio (CH)

(74) Representative: **Zanardo, Giovanni et al**
Ing. Barzanò & Zanardo
Milano S.p.A.,
Via Borgonuovo 10
20121 Milan (IT)

(56) References cited:
US-A- 4 443 987
US-A- 5 580 620

EP 0 933 489 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention relates to the field of the building industry and more specifically to the sector relating to prefabricated panels of synthetic materials obtainable by co-extrusion and generally used to obtain curtain walling and/or roofing.

[0002] For some types of application such as greenhouses, winter-gardens and the like the said panels must have good transparency and thermal insulation properties, so that the environments they delimit may make use of the well-known "greenhouse effect".

[0003] In contrast, however, in the above-mentioned application examples it is sometimes found that the sun's rays incident upon the external surface of the panels proceed towards the inside of the environments after having been refracted in anomalous and non-uniform manner, this mainly being due to dimensional dissimilarities of the parts (particularly the ribs) which make up the panels, to the incomplete homogeneity of the material which makes up various zones thereof and/or generally to the path which the rays have to follow.

[0004] Consequently it is found that, because of a kind of lens effect, concentrated rays of light strike some zones inside the said environments and may damage the plants or the objects housed in the said environments.

[0005] Screening systems of the blinds, sheets of opaque material or screened woven materials etc. type are normally used to solve these problems.

[0006] US-A-4,443,987 discloses an unitary solar window panel comprising an essential clear and planar inner and outer face and a plurality of ribs connected to and extending between the inner and outer faces. Some of the ribs are transparent and some of the ribs are opaque to solar radiation.

[0007] US-A-5,580,620 describes a multiple void layer synthetic resin panels with first and second exterior plates and at least two spaced apart interior plates located within a space. The plates are interconnected by a plurality of walls extending in a direction perpendicular to the planes of the plates forming a plurality of continuous cellular voids.

[0008] The scope of the present invention is that of devising a type of alveolar panel, obtainable by co-extrusion, which would enable this disadvantage to be remedied.

[0009] As is known, in fact, there is currently no alveolar panel capable of achieving this objective.

[0010] On the other hand it is known that some transparent non-alveolar prototypes have been obtained by incorporating a plurality of laminae which are parallel to each other and perpendicular to the said sheets, these laminae having different optical properties, so that the sunlight which passes through them obliquely is reflected at a pre-determined angle towards the inside of the environment which they delimit, this being obtained in a particularly evident and advantageous manner when the sheets form a roofing surface.

[0011] The applicant of the present invention then sensed that if, in the alveolar panels, the stiffening ribs which space apart and connect their transparent external sheets are made with a pre-determined material which is different from that of which the latter are made and thus has different optical light diffusion and reflection properties, these panels, known to be of extremely low weight in themselves, diffuse and/or reflect the solar radiation in the most appropriate manner inside the environment covered or more generally delimited by them.

[0012] Consequently the applicant has devised an extruded alveolar panel as described in the pre-characterizing clause of the accompanying Claim 1, characterized by the characterizing clause of the said Claim.

[0013] A more detailed description of an embodiment of a panel according to the present invention will now follow, and this description will also refer to the accompanying drawings in which:

Figure 1 shows a view of the cross-section of a panel according to the invention;
Figure 2 shows an enlarged detail of the view according to Figure 1;
Figure 3 shows the same detail shown in Figure 2 in which the paths of the rays of light are marked according to their inclination.

[0014] With reference to Figure 1 it will be noted how an extruded alveolar panel 1 according to the invention does not at first glance differ from a panel of traditional type with the same dimensions.

[0015] The differences will become apparent, however, if the enlarged detail of the section of a panel which appears in Figure 2 is considered: in this view it will be seen how the two parallel flat sheets 2, 3 which define the shape of the panel 1 do not form a single body with the plurality of parallel ribs 4i of height h which connect them and define the distance between them: these ribs 4i, although being co-extruded together with the said sheets 2, 3, are made up of a different material: the material which makes up the sheets 2, 3 must in fact have predominant transparency properties so as to reflect the light rays to the outside solely to a very limited extent, enabling them to pass to the inside, whereas the material which makes up the ribs 4i must be opaque, and its molecular structure must be such as partially to reflect but predominantly diffuse the said light rays.

[0016] In this way, as will be explained in greater detail below with reference to Figure 3, one avoids "the lens effect" mentioned above and caused by refractive anomalies which occur when, as in the traditional panels, a ray of light consecutively passes through the outermost sheet 2, a rib 4i and the innermost sheet 3.

[0017] The panel according to the invention thus obtains a more uniform distribution of the solar radiation towards the inside of a greenhouse or an environment of similar type.

[0018] In an embodiment proposed by the applicant the parallel flat sheets 2, 3 are of polycarbonate, and the ribs 4i of crystalline P.E.T. (polyethylene terephthalate).

[0019] The materials which make up the flat sheets 2 and 3 and the ribs 4i are of different type, even though compatible for weld-joining during co-extrusion: a further development of the present invention suitable for affording the assembly greater solidity is provided by the applicant by securing the parallel flat sheets 2, 3 and the ribs 4i together to a greater degree by the application of a layer 5 of a further type of transparent material, having pre-determined rigidity and mechanical strength, on the entire external surface of the panel 1, this layer 5 thus coming to envelop the assembly from the outside.

[0020] By using a suitable material this layer 5, which is transparent, has a thickness and consequently a weight which is very limited and yet affords the panel 1 a high degree of stability.

[0021] According to a preferred embodiment, the applicant proposes using the following materials: amorphous polyethylene terephthalate (P.E.T.) for the two parallel flat sheets 2, 3; crystalline polyethylene terephthalate (P.E.T.) for the ribs 4i; polycarbonate for the covering layer 5 enveloping the whole.

[0022] To obtain the P.E.T. in the two different forms mentioned above it may also be sufficient, in the course of the said co-extrusion, to use different temperature values and/or cooling methods in the act of extruding: other procedures may, however, be advantageously applied.

[0023] With reference to Figure 3 it will be seen how the rays of light A, B having an angle of incidence included within the sector denoted by α, pass approximately linearly through the two flat sheets 2, 3 but without passing through any of the ribs 4i and not giving rise to the above-mentioned disadvantages: rays of light C having a different angle do, however, strike the ribs 4i, passing through the panel, and are partially diffused, as shown in the drawing, and partially, but to a lesser extent, reflected towards the inside.

[0024] In this case also, therefore, the part of the light rays which is not diffused does not consecutively pass through the flat panels 2, 3 and the ribs 4i.

[0025] The effect desired by the applicant, i.e. that of preventing the passage of anomalous rays of light with the potential negative effects but not reducing the total quantity of the rays which penetrate towards the inside of an environment covered or delimited by extruded alveolar panels, is thus obtained.

[0026] It is obvious that the size of the said sector α may be modified as desired, by varying the height h of the ribs and their pitch p; finally the said ribs 4i do not necessarily have to be perpendicular to the said parallel flat sheets 2, 3 but, on the contrary, use may be made of connecting angles β different from 90° when, for example, the position of the panels 1 is such that only the solar radiation of a certain part of the day may strike them: in this case, by suitably inclining the ribs 4i the effect of proportioning the diffusion and the reflection of the rays of light as desired may also be obtained.

[0027] The case in question has not been illustrated in view of the fact that it is obvious to a person skilled in the art.

[0028] Further embodiments which may be obtained according to the teachings of the accompanying Claim 1 and which differ from those described and illustrated thus far also come within the scope of the protection afforded by the accompanying patent application.

[0029] It should be noted that the present invention offers notable results from the mechanical point of view, which are manifested in the fact that in an alveolar panel according to the invention, the ribs 4i, being made of crystalline P.E.T., have a modulus of elasticity, and hence a bending strength, greater than that of the ribs of conventional panels made of polycarbonate.

[0030] Similarly, the resistance to thermal distortion and softening of a panel according to the invention is greater than that of a conventional polycarbonate panel. By means of the invention a panel has thus been obtained which, while being transparent to the rays with excellent optical properties on the terms already described above, also demonstrates superior properties in the field of dimensional stability and load-bearing capacity with reference to its weight. In the final analysis a synergy has been achieved between optical and mechanical factors, as desired by the applicant.

Claims

1. Extruded alveolar panel (1) comprising two parallel flat sheets (2, 3) spaced apart from each other and connected by a plurality of ribs (4i) parallel to each other and incident with respect to the said two sheets, the said two sheets being made of transparent material, and the said ribs being made of opaque material suitable for reflecting and/or diffusing to a pre-determined extent the rays of light incident thereon, increasing dimensional stability and load-bearing capacity, **characterized in that** the said ribs (4i) are made of crystalline polyethylene terephthalate and the said two sheets (2, 3) are made of amorphous polyethylene terephthalate and **in that** the said ribs (4i) and the said sheets (2, 3) are secured together also by the effect of a covering layer (5) made of polycarbonate having pre-determined rigidity and enveloping the said sheets from the outside, the said ribs (4i), the said two sheets (2, 3) and the said covering layer (5) form a whole, the panel (1) being obtained by co-extrusion by using different temperature values and/or cooling methods.

Patentansprüche

1. Extrudierte alveolare Platte (1), mit zwei parallelen flachen Tafeln (2, 3), die voneinander beabstandet und durch eine Mehrzahl von zueinander parallelen und auf den beiden Tafeln aufstehenden Rippen (4i) verbunden sind, wobei die beiden Tafeln aus transparentem Material hergestellt sind, und wobei die Rippen aus opakem Material hergestellt sind, welches geeignet ist, die auf es einfallenden Lichtstrahlen in einem vorbestimmten Maß zu reflektieren und/oder zu streuen, wodurch die Formstabilität und Lastaufnahmefähigkeit verbessert wird,
dadurch gekennzeichnet, dass die Rippen (4i) aus kristallinem Polyethylen-Therephthalat hergestellt sind und die beiden Tafeln (2, 3) aus amorphem Polyethylen-Therephtalat hergestellt sind, und dass die Rippen (4i) und die Tafeln (2, 3) auch durch die Wirkung einer Decklage (5) aus Polykarbonat aneinander befestigt sind, welche eine vorbestimmte Steifigkeit aufweist und die Tafeln gegenüber der Außenseite umhüllt, wobei die Rippen (4i), die beiden Tafeln (2, 3) und die Decklage (5) eine Einheit bilden und die Platte (1) durch Koextrusion unter Verwendung verschiedener Temperaturwerte und/oder Kühlverfahren erhalten wird.

Revendications

1. Panneau alvéolaire extrudé (1) comprenant deux feuilles planes, parallèles (2,3), espacées l'une de l'autre et raccordées par une pluralité de nervures (4i) parallèles entre elles et en incidence par rapport auxdites deux feuilles, lesdites deux feuilles étant réalisées à partir d'un matériau transparent et lesdites nervures étant réalisées à partir d'un matériau opaque apte à la réflexion et/ou diffusion jusqu'à un degré prédéterminé des rayons de lumière en incidence sur celles-ci en augmentant la stabilité dimensionnelle et la capacité portante,
caractérisé en ce que lesdites nervures (4i) sont réalisées en téréphtalate de polyéthylène cristallin et lesdites deux feuilles (2,3) sont réalisées en téréphtalate de polyéthylène amorphe et **en ce que** lesdites nervures (4i) et lesdites feuilles (2,3) sont fixées ensemble également grâce à une couche de recouvrement (5) réalisée en polycarbonate ayant une rigidité prédéterminée et enveloppant lesdites feuilles depuis l'extérieur, lesdites nervures (4i), lesdites deux feuilles (2,3) et ladite couche de recouvrement (5) forment un ensemble, le panneau (1) étant obtenu par co-extrusion en utilisant différentes valeurs de température et/ou procédés de refroidissement.

Fig.1

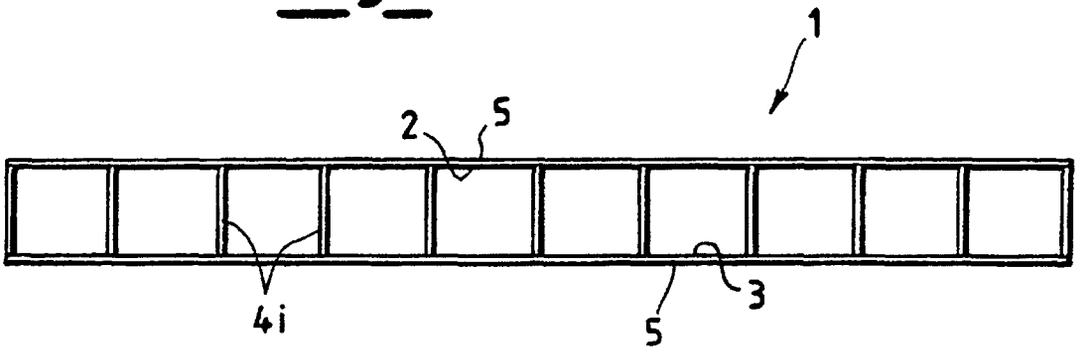

Fig.2

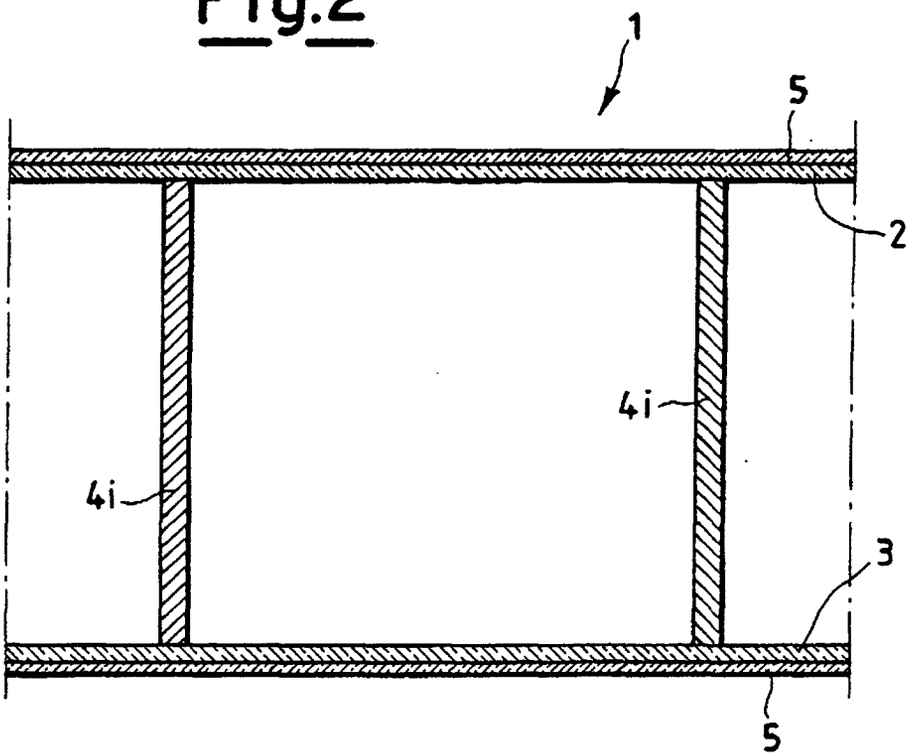

Fig.3