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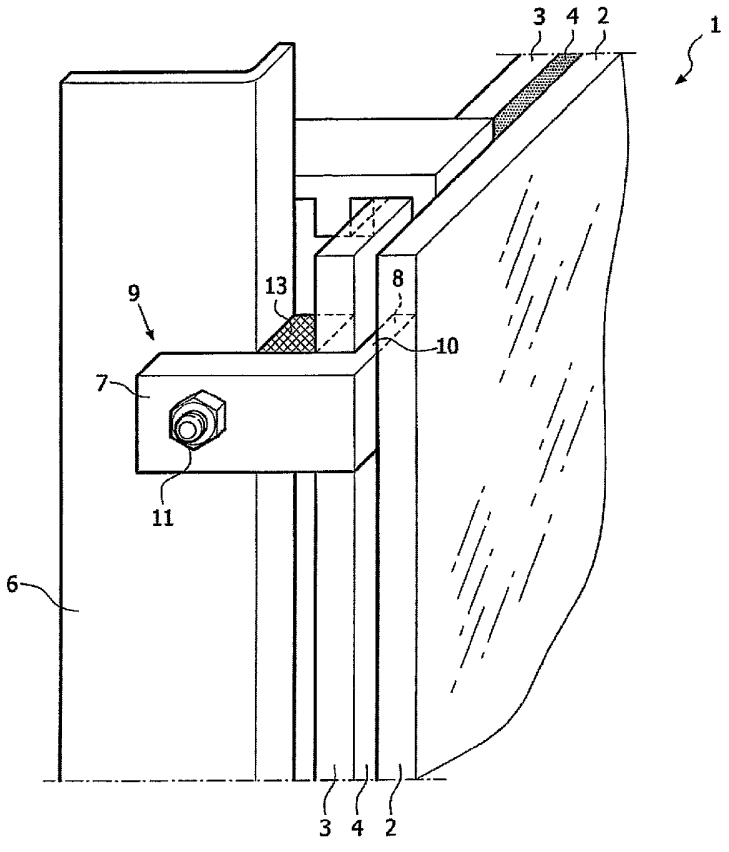
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(54) Title: EXTERIOR WALL CONSTRUCTION WITH INVISIBLE MOUNTING OF GLASS PLATES



(57) Abstract: The invention relates to an exterior wall construction, comprising at least one glass plate, wherein the at least one glass plate comprises at least two glass layers connected by at least one intermediate layer, a support construction for supporting the at least one glass plate, and holding means connected to the support construction for fixedly holding the at least one glass plate, wherein the holding means comprise at least two claws which each extend to a position between the glass layers and the intermediate layer is absent at least at the position of the claws. It is hereby possible to fasten such plates without parts protruding outside the outer surface of the outer glass plate. The invention also relates to a method for constructing such an exterior wall construction.

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Exterior wall construction with invisible mounting of glass plates

The invention relates to an exterior wall construction, comprising: at least one glass plate, wherein the at least one glass plate comprises at least two glass layers connected by at least one intermediate layer, a support construction for supporting the at least one glass plate, and holding means connected to the support construction for fixedly holding the at least one glass plate.

Use is increasingly being made in recent times of exterior wall constructions which are covered on the outside with glass plates. These glass plates are mounted in different ways. It is for instance possible to mount glass plates by means of glue. In many countries however, legislation requires that a glass frontage has a demonstrable lifespan of at least 50 years. Using glue connections it has heretofore not been possible to meet this requirement. In practice this requirement thus comes down to a requirement for a form-fitting connection.

Under the above stated condition it is possible to mount glass plates by means of holes arranged in the glass plates. Bolts or other fastening means herein extend through the glass plates. The bolt head is visible here on the outside. It is also known to mount glass plates by means of profiles extending around the edges of the glass plates. In both cases the fastening means are visible from the outside.

In order to improve the appearance of such exterior walls there is a need for an invisible mounting of glass plates in exterior walls. Invisible is here understood to mean that no fastening elements protrude outside the outer surface of the glass plates.

This object is achieved in that the holding means comprise at least two claws which each extend to a position between the glass layers and in that the intermediate layer is absent at least at the position of the claws.

In glass plates for use inside exterior walls use is generally made of laminated glass. Laminated glass consists of two or more glass layers which are connected by an intermediate layer situated between the glass layers. This intermediate layer prevents large fragments of glass from falling off the exterior wall when the glass plate breaks. It

is however also possible for the intermediate layer to fulfil other functions. The measures according to the invention make it possible to provide a form-fitting connection which is invisible from the outside. There are after all no parts of the connection which protrude outside the outer surface of the glass plate.

A construction is known from EP-A-0 392 145 which makes use of this intermediate layer by having this intermediate layer extend outside the glass plates. The fastening means herein engage on that part of the intermediate layer which extends outside the glass plates. These profiles are also visible here; not so much because they protrude outside the outer surface of the glass plates but rather because they must have a certain dimension in the plane of the glass plate to be sufficiently strong.

According to a first embodiment, the claws each extend over only a small part of the length of the edge of the glass plate, and the intermediate layer is provided with notches at the position of the claws. It is possible here to make use of brackets, the ends of which are formed by claws, so that an easy assembly is possible. Because the claws are in contact with the glass layers over only a small surface area, this construction is only suitable for glass plates which are not too heavy and have a limited surface area.

According to another preferred embodiment, the claws each extend over a substantial part of the length of the glass plate and, at least at the position of the claw, the intermediate layer extends less far toward the edge of the glass plate than the glass layers. A fixing of the glass plate over a larger part of the length of the edge of the glass plate is hereby obtained, so that this embodiment is more suitable for glass plates having a larger surface area.

It is also pointed out that it is possible to combine the two above stated embodiments by for instance fastening the lower edge of the glass plate with a claw extending over the whole or a substantial part of the length of the lower edge and by fastening the side edge and upper edge by means of claws extending over only small parts of the length of the relevant edge.

The thickness of the claw is preferably smaller than the thickness of the intermediate layer. The removal of the intermediate layer is not always easy. By making the

thickness of the claw smaller than that of the intermediate layer it is possible to insert the claw between the glass plates even when the intermediate layer is not removed completely.

The claw is usually formed by a folded piece of material. Folding results in a curve on the inner side of the folding seam. If the folded claw were to be forced closely against the glass layer on the side of the folding seam, a very small contact surface would result between the glass and the claw, which can result in a high surface pressure and thereby in splintering of the glass. Space is formed for the curve of the folding seam by placing the claw at a distance from the relevant glass plate, thereby obviating the above stated problems.

Yet another preferred embodiment provides the measure that the material of the intermediate layer is present on at least one side of the claw. The space between the glass plates and the claw is hereby filled, so that forces between claw and glass layers in transverse direction can be properly transmitted without damaging the glass layers.

The above shows that the invention can only be applied with glass plates which consist of two or more glass layers and wherein an intermediate layer is arranged between the glass layers. According to the invention the claws extend between the glass layers. This means that the intermediate layer between the glass layers must be absent at the position of the claws. This absence can be achieved in that the intermediate layer has a smaller surface area than the glass layers. This measure requires that this method of mounting, by using an intermediate layer which is smaller than the glass plates, must already be taken into account in the manufacture of the glass plate, which is per se possible but which can cause organizational and logistical problems.

For this purpose a preferred embodiment provides the measure that the intermediate layer is removed locally by a machining operation. This measure causes fewer organizational problems because it can after all be carried out on the construction site, although it does require the use of machining equipment either on site or in the factory.

In many cases it will be easier to make use of the measure that the intermediate layer is manufactured from a thermoplastic material and that the intermediate layer is removed

by heating at the position of the claws. It can after all suffice for this purpose to make use of a simple heating device and a knife or of a thin, heated object.

Although it is possible in principle for material to be removed from the space between the glass layers during the removal of the thermoplastic material by heating, it is recommended that the material is merely displaced. This will particularly be the case with claws which extend over only a part of the length of the relevant edge, since the space required for the claws is then only small and this can be created easily by displacing the thermoplastic material.

Although the measures according to the invention can be applied in exterior wall constructions with the most diverse configurations of windows, the advantages of the invention are most clearly manifest when the exterior wall construction comprises more than a single glass plate and when the outer wall of the glass plates lies in the same plane. In these configurations fastening elements possibly protruding outside the outer surface of the glass plates cause the greatest visual disruption, so that the absence of these elements results in a great improvement in the appearance.

The claws of the fastening elements are subjected to great mechanical forces. They must moreover be able to withstand long-term contact with rainwater. It has been found by the inventors that a tough material such as stainless steel is the best suitable for this application. It is also possible to manufacture the claws from fibre-reinforced plastic.

The invention relates not only to the completed exterior wall construction but also to the components applied in the exterior wall construction, such as the holding means and the glass plates which are prepared for accommodation in such an exterior wall construction.

The invention also relates to a method for building an exterior wall construction comprising glass plates, wherein the glass plates comprise at least two glass layers and an intermediate layer placed between the glass layers, wherein the method comprises of constructing a support construction, fixing holding means to the support construction and fastening glass plates to the support construction by means of the holding means,

wherein the method is characterized in that the glass plates are fastened by means of claws extending between the glass layers and forming part of the holding means.

The operations for creating the space between glass layers for the claws and placing the claws in this space are relatively simple and require few tools, so that they can be carried out easily at the construction site.

The present invention will be elucidated hereinbelow on the basis of the accompanying drawings, in which:

Figure 1 is a schematic perspective view of a glass plate fastened by measures according to the invention;

Figure 2 is a variant of the embodiment shown in figure 1;

Figure 3 is a cross-sectional view of a construction according to the present invention;

Figure 4 is a cross-sectional view of a variant of the construction shown in figure 3;

Figure 5 is a perspective view of a first embodiment of a glass plate for use in the present invention;

Figure 6 is a perspective view of a second embodiment of a glass plate; and

Figure 7 is a cross-sectional view of a third embodiment.

Figure 1 shows a glass plate designated in its entirety with 1, which is formed by an outer glass layer 2, an inner glass layer 3 and an intermediate layer 4 placed therebetween. Intermediate layer 4 connects glass layers 2 and 3 to each other. This intermediate layer is preferably manufactured from a plastic such as a foil made from a thermoplastic material. This intermediate layer 4 furthermore serves for instance to fix fragments in the possible case the glass plate breaks.

This glass plate can be placed on or in an exterior wall construction of which a post 6 forms part. For the purpose of arranging the glass plates on the support construction use is made of clamps which are designated as a whole with 7. These clamps are preferably manufactured from stainless metal such as stainless steel. It is also possible to manufacture the clamps from a different material, such as fibre-reinforced plastic.

In the present exemplary embodiment recesses 8 are arranged in intermediate layer 4, which otherwise extends up to the edge of the glass construction. These recesses serve to receive the corresponding parts of clamps 7. These recesses 8 can be arranged during

the assembly of the glass plate by making use of an intermediate layer which is already provided with the relevant recesses 8. It is otherwise also possible to arrange the recesses 8 afterward, i.e. after the assembly of the glass plate. It is possible here for the relevant parts of the foil to be removed in the glass factory, after the glass plate has been assembled; it is however also possible for the foil to be removed only in the construction workshop or even only at the construction site.

For removal purposes use can be made of a machining operation such as milling. It is however simpler to make use of a heated displacing element such as a heated knife. Notches 8 are made by pressing such a heated knife between glass layers 2 and 3 at the position of a claw 10 to be arranged later as part of clamp 7. The intermediate layer 4 must herein be formed from a thermoplastic material.

It is otherwise pointed out that the drawings give an incorrect impression of the thickness of the intermediate layer; intermediate layer 4 is many times thinner than glass layers 2, 3. Intermediate layer 4 is only drawn thick for the purpose of elucidating the invention. In view of this small thickness it is therefore very surprising that it has been found possible to construct a claw with sufficient strength to hold the glass plates fixedly. Such a claw is loaded exceptionally heavily due to its small thickness, so that the strongest types of metal must be used for this purpose.

As stated above, use is made of the clamps 7 to fasten glass plate 1 to post 6. In the present embodiment these clamps 7 have a substantially L-shaped configuration. A leg of the L-shaped configuration forms a claw 10 which is placed in recess 4. The glass plate is then positioned and clamp 7 is fixed to post 6 by means of a bolt 11. It will be apparent that a number of such clamps 7 must be used for a durable fastening of glass plate 1 to the support construction. Such clamps 7 will thus have to be placed along at least three of the edges of the glass plate. A cushion 13 is generally arranged between the glass plate and the post.

In the above elucidated embodiment small clamps 7 are applied. This is understood to mean clamps 7 with a length which is small in the direction of the relevant edge of glass plate 1.

It is also possible to make use of clamps 14 which extend over a considerable part of the length of glass plate 1. An example hereof is shown in figure 2. The edge of intermediate layer 4 is herein retracted relative to glass layers 2,3 over the full length of the relevant glass plate 1 in order to create space for a claw 15 of clamp 14. Use can here also be made during manufacture of glass plate 1 of the possibility of already making use of an intermediate layer 4 having a smaller surface area than glass layers 2,3. It is however also possible to remove the intermediate layer 4 afterward in the vicinity of the edge of glass plate 1 by the methods described in the foregoing exemplary embodiment. Such claws 13 extending over the whole length of the edge are for instance applied with large, heavy glass plates 1. They are preferably also applied on the underside because - provided no other provisions are made for supporting the weight of glass plate 1 - this weight rests substantially on clamps 14 on the underside and these clamps are heavily loaded.

In the above elucidated exemplary embodiments there is in each case a single glass plate 1, i.e. a glass plate without insulating layer. The invention can however also be applied to glass plates which are provided with such an insulating layer. Figure 3 shows an example of such an insulating glass plate 16 which is formed by a first glass layer 17, an intermediate layer 18, a second glass layer 19 and a third glass layer 21 separated from second glass layer 19 by a spacer 20. An air or gas-filled cavity is formed in the space between second glass layer 19, third glass layer 21 and spacer 20. A sealing layer 22 arranged outside spacer 20 seals this cavity. As in the previous embodiments, intermediate layer 19 is removed locally to provide space for a claw 23 of a clamp 24. The clamp 24 used here differs from the clamp used in figures 1 and 2 in that it is Z-shaped instead of L-shaped. The form of the clamps can otherwise be adjusted to the shown construction.

The configuration shown in figure 4 substantially corresponds with the configuration shown in figure 3, with the understanding that the outer glass sheet also consists of two glass layers separated by an intermediate layer. The outer sheet comprises the third glass layer 21, a second intermediate layer 25 and a fourth glass layer 26. The second intermediate layer 25 is removed locally to provide space for claw 23 of clamp 24. Claw 23 can of course be modified to engage in the space between the first and second glass plates 17 and 18. It is moreover possible to reverse the configuration of figure 3, i.e. to

give the inner sheet of the glass plate a single form and the outer sheet a double form. Other variations are by no means precluded.

The configurations of the cavities arranged in intermediate layer 4 are shown more clearly in figures 5 and 6. Figure 5 shows the glass plate 1 which is also shown in figure 1. Figure 5 shows clearly that intermediate layer 4 is removed locally at the position of two recesses 27. The claws of the clamps can be placed in these recesses 27. Figure 6 shows the glass plate 1 which is also shown in figure 2.

In this embodiment the intermediate layer 4 is absent over the whole length of the edge. A claw 14 of the type shown in figure 2 can hereby be used to fixedly clamp glass plate 1, although it is also possible for one or more claws 7 of the type shown in figure 1 to be used.

Figure 7 shows a third embodiment of the invention. In this third embodiment clamp 7 is formed by a folded piece of metal, whereby the clamp describes a curve 30 on the inner side of the folding seam. In order to provide space for this curve 30 a distance is maintained between glass layer 3 and claw 10 of clamp 7.

The above embodiments all have a right-angled claw engaging in the space between the glass sheets. It is possible to apply other forms of claw, such as rounded, oval or tipped forms.

Claims

1. Exterior wall construction, comprising:
at least one glass plate, wherein the at least one glass plate comprises at least two glass layers connected by at least one intermediate layer;
a support construction for supporting the at least one glass plate; and
holding means connected to the support construction for fixedly holding the at least one glass plate, characterized in that the holding means comprise at least two claws which each extend to a position between the glass layers, and that the intermediate layer is absent at least at the position of the claws.

2. Exterior wall construction as claimed in claim 1, characterized in that the claws each extend over only a small part of the length of the edge of the glass plate, and that the intermediate layer is provided with notches at the position of the claws.

3. Exterior wall construction as claimed in claim 1, characterized in that the claws each extend over a substantial part of the length of the glass plate, and that, at least at the position of the claw, the intermediate layer extends less far toward the edge of the glass plate than the glass layers.

4. Exterior wall construction as claimed in any of the foregoing claims, characterized in that the thickness of the claw is smaller than the thickness of the intermediate layer.

5. Exterior wall construction as claimed in claim 4, characterized in that on the mounting side of the claw the claw is located at a distance from the glass plate.

6. Exterior wall construction as claimed in claim 4 or 5, characterized in that the material of the intermediate layer is present on at least one side of the claw.

7. Exterior wall construction as claimed in any of the foregoing claims, characterized in that the intermediate layer is manufactured from a thermoplastic material and that the intermediate layer is removed by heating at the position of the claws.

8. Exterior wall construction as claimed in claim 7, characterized in that the intermediate material is displaced by heating.

9. Exterior wall construction as claimed in any of the claims 1-6, characterized in that the intermediate layer is removed locally by a machining operation.

10. Exterior wall construction as claimed in any of the claims 1-6, characterized in that the intermediate layer has a smaller surface area than the glass layers.

11. Exterior wall construction as claimed in any of the foregoing claims, characterized in that the exterior wall construction comprises more than a single glass plate and that the outer surface of the glass plates lies in the same plane.

12. Exterior wall construction as claimed in any of the foregoing claims, characterized in that the clamps are manufactured from stainless metal.

13. Exterior wall construction as claimed in any of the claims 1-11, characterized in that the clamps are manufactured from fibre-reinforced plastic.

14. Glass plate, characterized in that it is adapted for use in an exterior wall construction as claimed in any of the foregoing claims.

15. Holding means, characterized in that they are adapted for use in an exterior wall construction as claimed in any of the claims 1-13.

16. Method for building an exterior wall construction comprising glass plates, wherein the glass plates comprise at least two glass layers and an intermediate layer placed between the glass layers, wherein the method comprises the following steps of:
- constructing a support construction;
- fixing holding means to the support construction; and
- fastening glass plates to the support construction by means of the holding means, characterized in that the glass plates are fastened by means of claws extending between the glass layers and forming part of the holding means.

17. Method as claimed in claim 16, characterized in that prior to fastening of the glass plates to the holding means the intermediate layer is removed at the anticipated position of the claws.

18. Method as claimed in claim 17, characterized in that the intermediate layer is manufactured from a thermoplastic material and the intermediate layer is removed by means of locally heating and subsequently pressing aside the intermediate layer.

19. Method as claimed in claim 18, characterized in that removal of the intermediate layer takes place at the construction site.

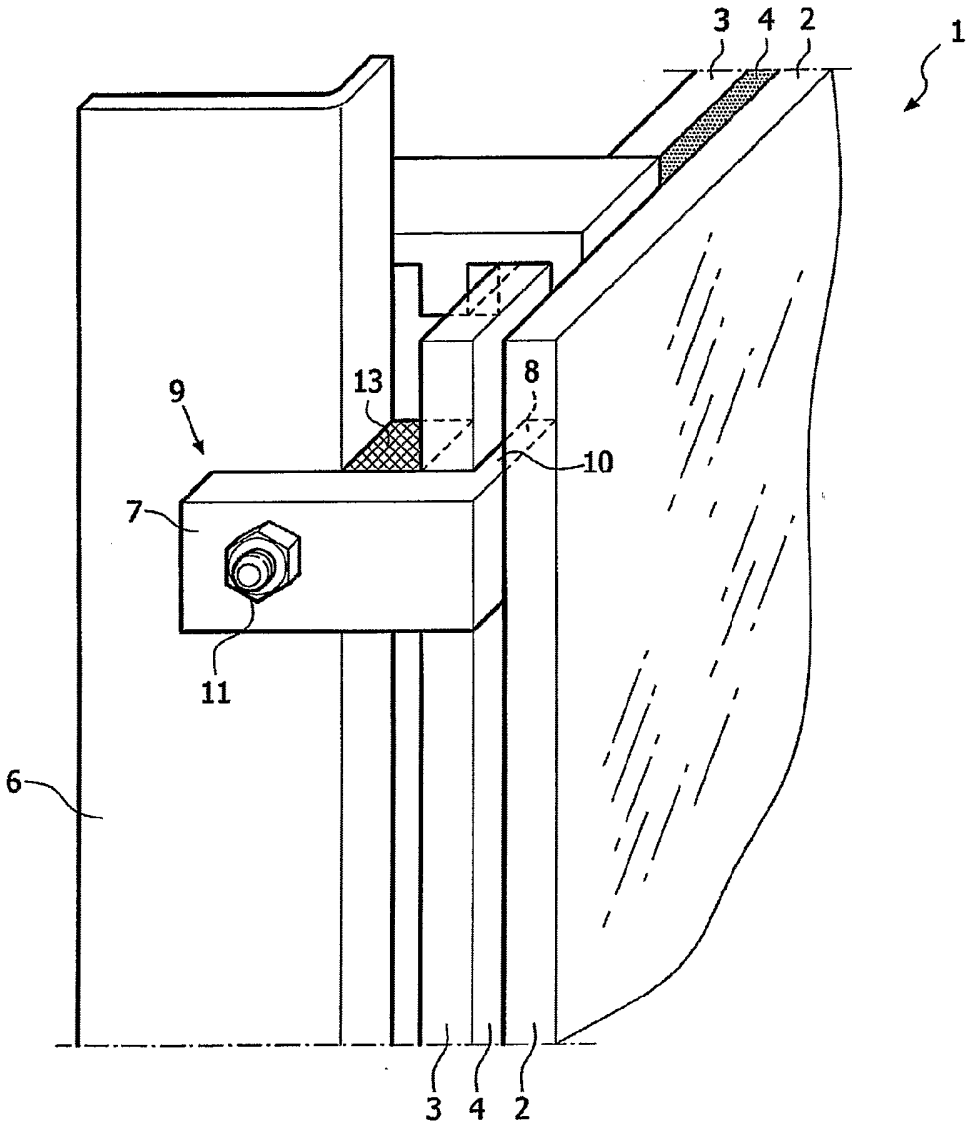


FIG. 1

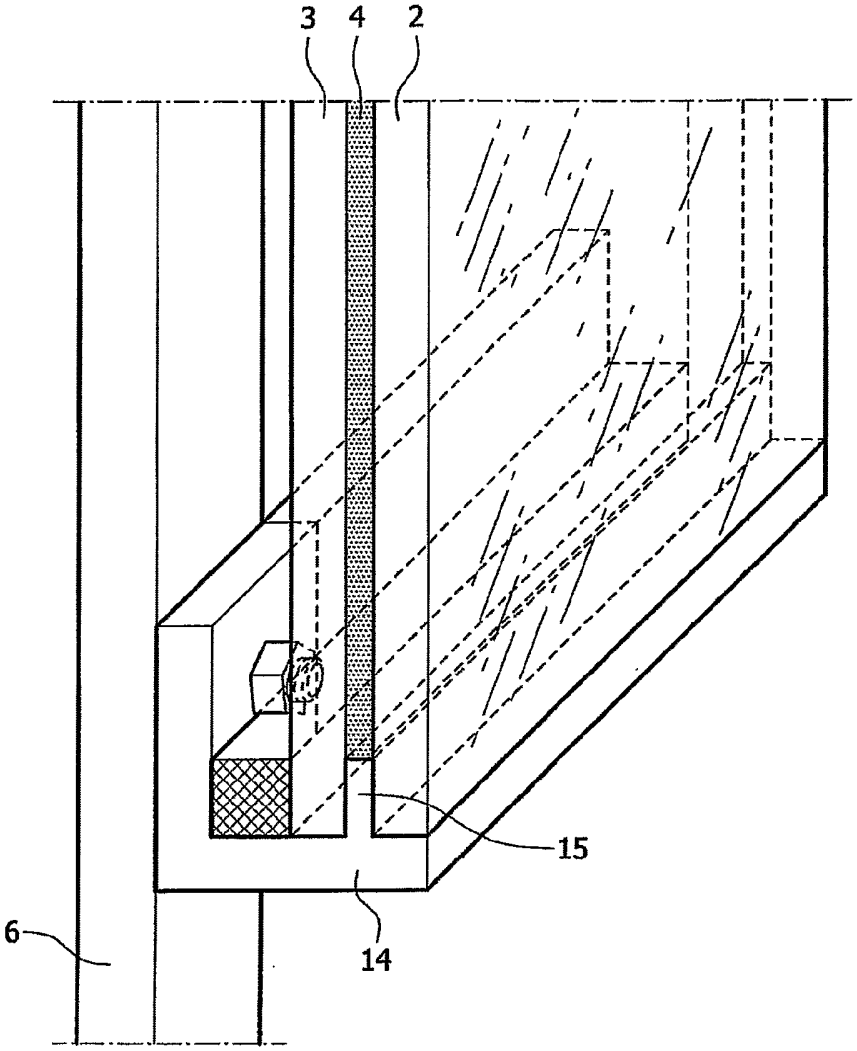


FIG. 2

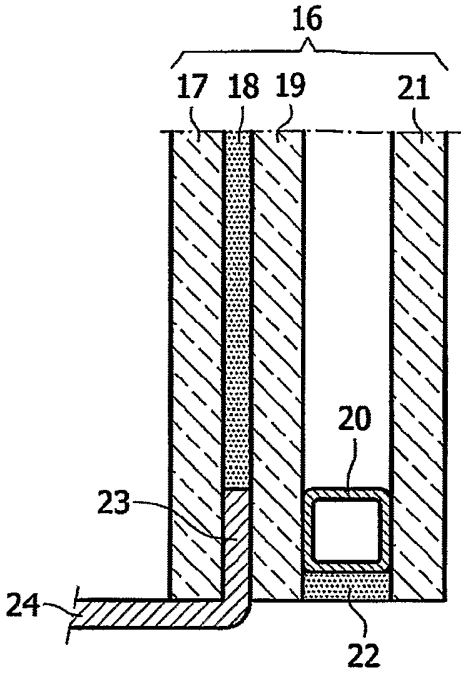


FIG. 3

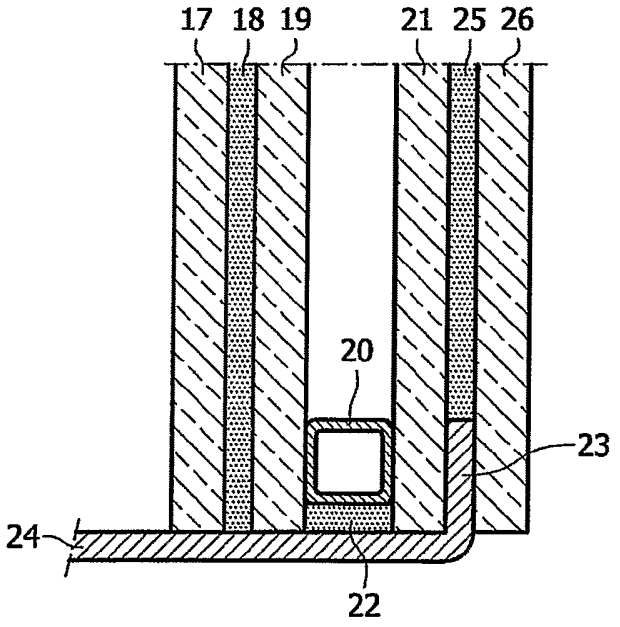


FIG. 4

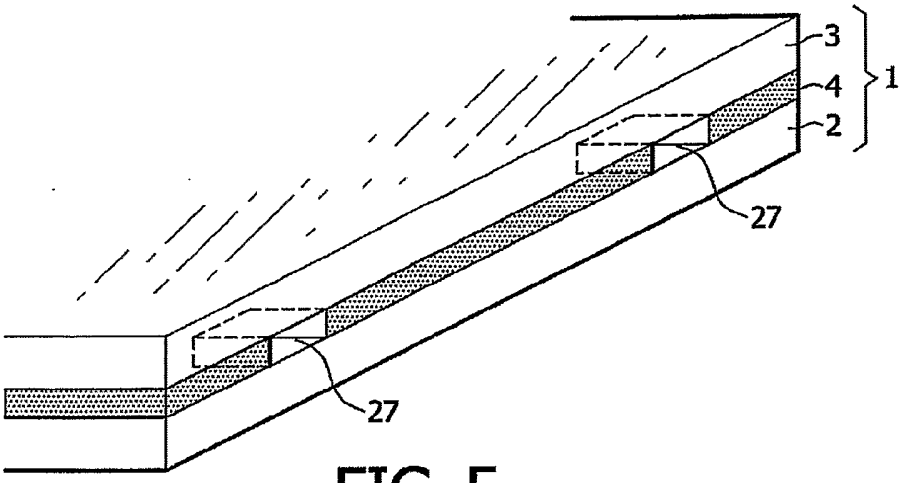


FIG. 5

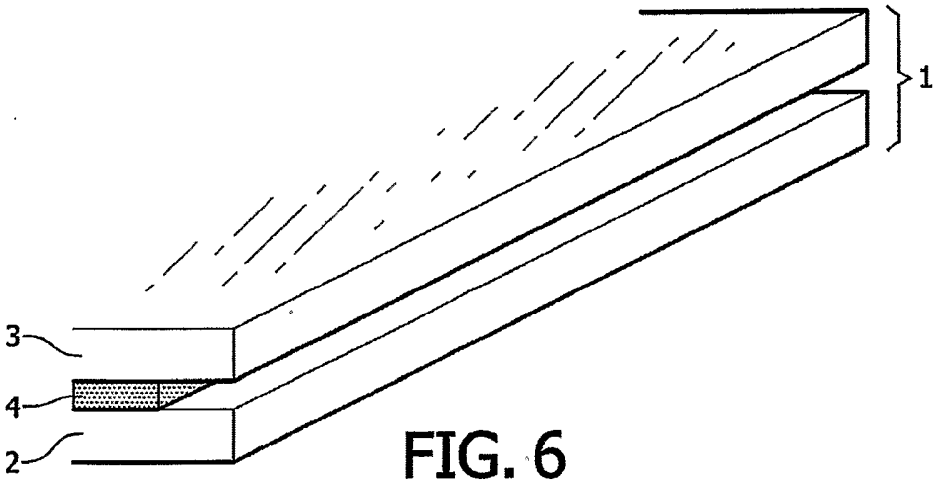


FIG. 6

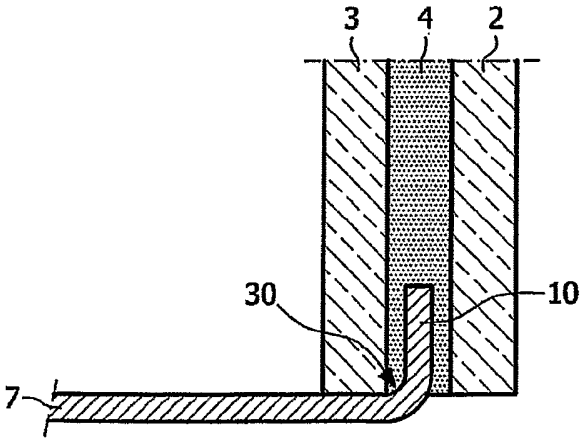


FIG. 7