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(54) Method for joining hollow frame members together at an angle

(57) The invention provides a method for joining hollow frame members together at an angle for the purpose of producing frames, comprising the steps of

- positioning the frame members into abutment with each other at the aforesaid angle, with a seam being present along the circumference of the boundary surface between the frame members,
- joining the frame members thus positioned relative to each other,
- positioning a double-sided adhesive layer between the frame members before the frame members are positioned into abutment with each other for effecting an adhesive joint between the frame members, with the adhesive layer extending along at least part of the seam, for the purpose of providing a seal at the location of the seam between the frame members,
- providing the adhesive layer before the frame members are positioned into abutment with each other, in a condition such that the adhesive layer is affixed to a shape element, projecting at least outside a circumference of said shape element,
- moving the shape element relative to the cavity of a frame member so as to effect an adhesive joint between the projecting part of the adhesive layer and the frame member.

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Description

[0001] The present invention relates to a method for joining hollow frame members together at an angle for the purpose of producing frames, comprising the steps of

- positioning the frame members into abutment with each other at the aforesaid angle, with a seam being present along the circumference of the boundary surface between the frame members,
- joining the frame members thus positioned relative to each other,
- positioning a double-sided adhesive layer between the frame members before the frame members are positioned into abutment with each other for effecting an adhesive joint between the frame members, with the adhesive layer extending along at least part of the seam, for the purpose of providing a seal at the location of the seam between the frame members.

[0002] The joining of hollow frame members at an angle takes place in the production of frames for doors or windows, with the frame members usually being (composite) extruded aluminium frame members; within the framework of the present invention, the term frames is to be understood to include not only those parts that are fixed to a building but also the parts that are capable of (pivoting) movement relative to the building for opening or closing a window or a door. At least four frame members are needed for forming a rectangular frame, which members are usually cut off at their ends at a mitre angle of 45°. The mitred ends of the four frame members are positioned into abutment with each other so as to obtain the rectangular shape of the final frame, after which the frame members thus positioned are joined together, for example by means of a tenon joint and/or by means of a pressure fit. To prevent (rain) water from undesirably finding its way into the cavity (cavities) of one or more frame members of the frame, it is very important to seal the seam that extends along the circumference of the boundary surface between the abutting frame members. To that end a sealant is used at the location of the seam, after which the frame members in question are forced together, using an angle press, so as to obtain an optimally liquid-tight connection between the frame members. The excess sealant needs to be removed afterwards in view of the visual requirements that are made of frames. In practice, two operators are usually simultaneously involved in the production of frames, more specifically in carrying out the operations as briefly described above, especially in the case of relatively large frames, because of the large number of manipulations of frame members required to produce a frame.

[0003] A method as referred to in the introduction is known from FR-A1-2 832 172, which describes the manner in which metal sections are joined together at right angles by using a double-sided adhesive layer at the location of the boundary surface between two sections, where the sections are mitred at 45°. In practice it is difficult to place the adhesive layer between the two sections with a sufficient degree of precision, which may lead to visually unacceptable results as well as to leakage.

[0004] The object of the present invention is to provide a significant improvement as regards the manner of producing frames from hollow frame members, in particular the manner in which the seal at the location of the seams between the frame members is realised, all this with a view to speeding up the production process and render it less labour-intensive. To accomplish this object, the method according to the invention comprises the steps of

- providing the adhesive layer before the frame members are positioned into abutment with each other, in a condition such that the adhesive layer is affixed to a shape element, projecting at least outside a circumference of said shape element,
- moving the shape element relative to the cavity of a frame member so as to effect an adhesive joint between the projecting part of the adhesive layer and the frame member.

[0005] This provides the important advantage that the positioning of the adhesive layer between the frame members with a sufficient degree of precision can take place in a simple and quick manner.

[0006] When using shape elements according to the above preferred embodiment, it is furthermore preferable to remove a protective layer from the projecting part of the adhesive layer on the side of the shape element once the adhesive layer has been provided in a condition in which it is affixed to a shape element. This prevents the projecting part of the adhesive layer from prematurely adhering to parts other than the frame member at the intended position, which might render the adhesive layer unusable for effecting an adhesive joint with the frame member or, perhaps even worse, to an adhesive joint being effected between the projecting part of the adhesive layer and the frame member indeed, but of such a poor quality that the sealing action of the adhesive joint is inadequate. In an extreme case, the latter situation might even make it necessary to remove a frame again after it has been installed and either to replace said frame or repair it, which involves a great deal of expense, of course.

[0007] Furthermore preferably, the protective layer is only removed from the projecting part of the adhesive layer directly prior to or even during said moving of the shape element relative to the cavity of a frame member, so that the time that passes between the removal of the protective layer from the projecting part of the adhesive layer and the contact between the adhesive layer and the frame member is kept as short as possible, thus minimising the risks as described in the foregoing.

[0008] In order to make it easier to obtain a correct orientation of the adhesive layer and the frame member relative to each other for effecting an adhesive joint ther-

ebetween, it is quite preferable if the shape element is accommodated in the frame member in a shape-locked manner, at least perpendicular to the direction of movement, after being moved into the cavity of the frame member. The shape-locked contact between the shape element and the frame member can further contribute to the stiffness and the stability of the frame members and of the joint between the frame members.

[0009] To obtain a correct orientation of the adhesive layer on the shape element it is very advantageous if the shape element is provided with at least one protrusion on its side facing towards the adhesive layer, which protrusion extends through at least one hole in the adhesive layer in a shape-locked manner, when the adhesive layer is being provided in a condition in which the adhesive layer is affixed to a shape element.

[0010] The adhesiveness of the adhesive layer can furthermore be utilized for effecting a connection between the adhesive layer and the shape element. Accordingly, a further preferred embodiment of the method according to the invention is characterized in that the adhesive layer adheres to the shape element when the adhesive layer is being provided in a condition in which the adhesive layer is affixed to a shape element.

[0011] In addition to the adhesion between the adhesive layer and the frame member, in may furthermore be very advantageous if a snap connection is effected between the shape element and the frame member upon movement of the shape element into the cavity of the frame member. Such a snap connection can relieve the load on the adhesive connection between the adhesive layer and the frame member in a very efficient manner, so that the forces being exerted when the frame members are being manipulated during the assembly thereof or when mechanical loads are being exerted on the frame, more specifically on the joints between the frame members thereof, will be exerted on the snap connection between the shape element and the frame member rather than on the adhesive connection.

[0012] The snap connection between the shape element and the frame member is obtained in an advantageous manner if the snap connection is effected in that teeth on the shape element engage behind an engagement edge on the frame member, which can be accomplished in a constructionally simple manner.

[0013] It is advantageous in that connection if the engagement edge has been formed by providing a bore in the frame member through an edge that extends inwardly within a hollow channel of the frame member.

[0014] It is possible to realise two engagement edges, using only one bore, if the diameter of the bore is greater than the thickness of the edge.

[0015] The efficiency of the production process can be further enhanced if, in the situation in which the frame members each comprise a number of hollow channels separated from each other by an internal wall, a shape element is moved relative to at least two hollow channels, which shape elements have been joined together via the adhesive layer prior to being moved into the hollow channels. In practice, the cavity of a frame member generally comprises a number of hollow channels, and the frame members are generally made up of at least two individual extruded aluminium sections, between which an insulating element is present so as to prevent the occurrence of thermal bridge effects.

[0016] If the frame members each comprise a number of hollow channels separated from each other by an internal wall, an advantageous alternative in such a situation will be to remove the internal wall at least partially at the location of the boundary surface so as to provide space for the shape element after said relative movement of the shape element within the frame member at the location of two hollow channels thereof. Said removal of at least part of the internal wall at the location of the boundary surface takes extra time, of course, but on the other hand a single shape element will suffice, which shape element may be provided with a bridge portion at the location at which the internal wall has been removed to a depth less than the length of the shape element.

[0017] The frame member might be further adapted for use with the method according to the invention in that an internal wall is left out altogether rather than being removed locally. This would imply that two hollow channels merge into one compound hollow channel, as it were. In that light the frame members preferably each comprise a hollow channel whose cross-section has a shape substantially different from the shape of a rectangle and similar to the shape of the outer circumference of at least two abutting rectangles. It will be apparent that also in that case a single shape element will suffice for the hollow channel in question, which shape element need not be provided with a bridge member as suggested in the foregoing.

[0018] In another preferred embodiment, the frame member is built up (seen in cross-sectional view) of a web member which extends perpendicularly to the main plane of a frame when forming part thereof, and two stop members which each extend perpendicularly to the web member from one end thereof, of which at least one stop member, to be referred to below as the outer a stop member, is located on the outer side of the frame, wherein at least part of the hollow channel, or at least one of the hollow channels, at least substantially defines the outer stop member.

[0019] It is very advantageous if the adhesive layer extends within the circumference of the boundary surface when the frame members are being positioned into abutment with each other. The fact is that this obviates the need to remove any parts of the adhesive layer projecting outside the frame members after the frame members have been positioned into abutment with each other.

[0020] A very important preferred embodiment of the method according to the invention is further characterized by

- providing the adhesive layer before the frame mem-

bers are positioned into abutment with each other, in a condition such that the adhesive layer is present between two shape elements which are joined at an angle corresponding to the angle of the frame members to be joined together, projecting at least outside the circumferences of said shape elements,

- moving the two respective shape elements relative to the cavities of the two frame members so as to effect adhesive joints on two opposite sides of the adhesive layer between opposite sides of the projecting part of the adhesive layer and the respective frame members.

[0021] The use of two such shape elements as proposed above offers significant advantages as regards the correct positioning of frame members with respect to each other, with the two shape elements functioning as guide elements. This makes it possible to realise a further significant saving on labour. When snap connections are used between the two shape elements and the respective frame members in which the shape elements can be moved, it is thus possible to realise the seal at the location of the seam between the frame members while using a minimum number of operations, because of the adhesive connections between the adhesive layer and the respective frame members, whilst on the other hand also the frame members in question are firmly joined together. As far as the latter is concerned, a firm connection must exist between the two shape elements as well in order to achieve this, of course.

[0022] Such a firm connection between the shape elements could be achieved if the two shape elements are joined together by means of a snap connection if the adhesive layer is provided in a condition such that the adhesive layer is present between two shape elements, with at least one protruding snap element of a shape element extending through at least one hole in the adhesive layer into at least one recessed snap element of the other shape element.

[0023] It is furthermore preferable in that case if said at least one protruding snap element extends through said at least one hole in the adhesive layer in a shape-locked manner.

[0024] It may furthermore be preferable to join the frame members together by means of at least one screwed connection, which may or may not be done as an addition to the snap connections between the shape elements and the frame members as suggested above.

[0025] In order to hide the adhesive layer from view as much as possible, without harming the sealing effect thereof, the adhesive layer is preferably made of a transparent material or has a colour that corresponds to that of the frame members and/or has a thickness of maximally 0.5 mm, more preferably maximally 0.3 mm, so that it at least looks as if the frame members are joined almost seamlessly.

[0026] The present invention also relates to frame members for use with the method according to the present invention. More in particular, the present invention furthermore relates to frame members for use with methods as described above, wherein the channel portions thereof form an aspect.

[0027] The invention will now be explained in more detail by means of a description of the preferred embodiments of the invention, in which reference is made to the following figures:

Figures 1, 2 and 3 schematically show the manner in which two frame members are joined at right angles;
Figure 4 is a cross-sectional view of a frame member;
Figure 5 shows a frame on a working table for carrying out the method according to the invention;
Figure 6a is a vertical view of a frame member to be joined;
Figure 6b shows the two shape elements for use with the frame member that is shown in figure 6a;
Figure 6c is a vertical view of a double-sided adhesive sticker sheet for use with the frame member that is shown in figure 6a and the shape elements that are shown in figure 6b;
Figure 7 is an isometric, partially exploded view of the manner in which two frame members are joined at right angles according to an alternative embodiment;
Figure 8 is an isometric, fully exploded view of the elements used for effecting the right-angled joint that is shown in figure 7;
Figure 9 is a vertical view of a frame member of the joint of figure 7;
Figure 10 is a view corresponding to figure 9, part of which is shown in sectional view;
Figure 11 shows a detail of figure 10.

DESCRIPTION OF THE FIGURES

[0028] Figure 5 shows a window frame 1 present on a table 2 whose dimensions are larger than those of the frame 1, so that the frame 1 can readily be manipulated on the table 2. The frame 1 is made up of four extruded aluminium sections 3a, 3b, 3c, 3d (to be jointly referred to below as sections 3), which jointly define a rectangular main shape of the frame 1. Each frame member 3 joins two adjacent frame members 3 at right angles with its ends, for which purpose said ends are mitred, as shown in the regions 4 encircled by dotted lines in figure 5.

[0029] The present invention in particular relates to the manner in which adjacent frame members are joined together at an angle, a right angle in this case, and especially to the manner in which the seam between two frame members 3 is sealed.

[0030] Figure 1 shows two parts of frame members 3 that are to be joined together at right angles. The frame members 3, which are made of aluminium and which have been obtained by means of an extrusion process, have a substantially T-shaped cross-section. The vertical

part of the T-shape extends perpendicularly to the main plane of the frame 1 in the final frame 1, whilst the horizontal part of the T-shape extends parallel to the main plane of the frame 1, functioning as a stop for a window pane to be mounted in the frame on one side of the vertical part of the T-shape and as a setting frame surrounding the frame 1 on the other side of the T-shape. As those skilled in the art will know, alternative main shapes for the sections of aluminium frames are widely known, all of which comprise a web (corresponding to the vertical part of the T-shape) and at least one stop portion (corresponding to the horizontal part of the T-shape), which extends perpendicularly to the web on at least one side thereof.

[0031] The frame members 3 have a circumferential wall 5, which defines the T-shape. In the present example it is assumed for the sake of simplicity that no transverse walls are present within the circumferential wall 5, unlike the frame member whose cross-section is shown in figure 4, which does have transverse walls.

[0032] A connecting piece 7 is used for joining two mitred ends of frame members 3 together at right angles. The connecting piece 7 comprises two shape elements 8a, 8b (to be jointly referred to as shape elements 8), which are made of solid plastic material. The shape elements have a limited length 9, for example 10 cm. Like the frame members 3, the shape elements each have a mitred end, which ends join each other at right angles within the connecting piece 7. Like the frame members 3, the shape elements 8 have a substantially T-shaped cross-section, the dimensions being such that the shape elements 8 can be moved into the cavity 6 of the frame members 3 with a close fit.

[0033] Besides two shape elements 8, a connecting piece 7 also comprises a double-sided adhesive layer 12, which is disposed between the shape elements 8 at the location of the mitred ends thereof. The adhesive layer 12 has a T-shape similar to that of the frame members 3, the dimensions of which correspond to those of the outer circumference of the frame members 3, i.e. said dimensions are larger than the outer circumference of the shape elements 8, the difference being equal to the thickness of the circumferential wall 5 of the frame members 3.

[0034] Initially the adhesive layer 12 is affixed to the mitred end of the shape element 8b, with the adhesive layer 12 projecting from the circumference of the shape element 8b to the same extent on all sides. To obtain a correct positioning for that purpose, two small pins 10 are provided on the mitred end of the shape element 8b, which pins slip into two holes 11 formed in the adhesive layer 12. To accommodate the pins 10, recesses (not shown in figure 2) are provided in the mitred end of the shape element 8a.

[0035] After the adhesive layer 12 has been affixed to the shape element 8b, the second protective layer is removed from the adhesive layer 12, after which the shape element 8a is affixed to the side of the adhesive layer 12 that has thus been uncovered, with the pins 10 functioning to ensure that the shape element 8a is correctly positioned with respect to the shape element 8b.

[0036] In those cases in which only the adhesive power of the double-sided adhesive layer 12 is used for joining the shape elements 8a and 8b together in the present example, it is alternatively also possible to make use of a snap connection as a supplement to said adhesive power, with the pins of the shape element 8b and the recesses in the mould of element 8a mating to form a snap connection. According to a further alternative, such mating might even obviate the need to use the adhesive power of the adhesive layer 12 for joining the shape elements 8a and 8b together. For reasons yet to be explained in more detail, it remains important with all variants that the adhesive layer 12 project outside the circumference of the shape elements 8a and 8b to an extent that preferably corresponds exactly to the wall thickness of the circumferential wall 5 of the frame members 3.

[0037] As a next step in the production process of the frames 1, frame members 3 are slid over the shape elements 8 of the connecting piece 7 as indicated by the arrows 13. The mitred ends of the frame members 3 meet at the location of the adhesive layer 12 and are glued together along a circumferential wall 5 via the part of the adhesive layer 12 that projects outside the shape elements 8. As a result of the double-sided adhesiveness of the adhesive layer 12, the seam between the two frame members 3 is properly sealed. The situation that is obtained in this manner is shown in figure 3.

[0038] The use of the double-sided adhesive layer 12, by means of which an adhesive connection between the frame members 3 is effected, obviates the need to use a sealant and the related processing steps, as a result of which a significant saving with regard to the amount of labour required for producing a frame can be achieved. Because of its nature, the adhesive layer 12 provides a seal, although it must be ensured, of course, that the adhesive layer be resistant against weather influences.

[0039] Four threaded holes 14 are formed in the vertical part of the T-shape of (at least) one frame member 3. The adhesive connection between the shape elements 3 is further strengthened and ensured by effecting a screwed connection via said threaded holes 14 by means of screws 15, with the screws 15 extending over the seam between the two frame members 3. The ends of the screws 15 engage in threaded passages (not shown in any one of the figures 1-3) that form an integral part of the section of the frame member 3 other than the section in which threaded holes 14 are formed. The section that is shown in figure 4, however, shows a possible configuration of such threaded passages.

[0040] The method of joining two frame members together as described above can be used at the location of the four corner points of the frame 1, of course, in which case a table 2 as shown in figure 5 may be of great benefit. An automated screwing device 16 is present in one corner of the table 2, by means of which device the screws

15 can be tightened. The screwing device is movable along the frame members 3c and 3d via guide means (not shown).

[0041] The table 2 is provided with a series of adjustable stops 19, 20 both along one long side 17 and along one short side 18, by means of which stops the frame 1 or at least the frame members 3 thereof can be manipulated in the direction of the screwing device 16 of the surface of the table 2. The stops 19, 20 can be operated by remote control to push the frame 1 against the main stops 21, 22.

[0042] Figure 4 shows by way of example the cross-section of a frame member 21 that might be used in practice. The frame member 21 is made up of two extruded aluminium sections 22, 23, which are interconnected via an insulating member 24, for example made up of polyamide walls 28, which function to prevent or at least reduce the occurrence of thermal bridge effects between the outside 25 and the inside 26 of the final frame of which the frame members 21 form part. The extruded members 22 and 23 each comprise two opposed threaded passages 27, which function to join two frame members together at an angle by means of a screwed connection, using screws similar to the screws 15 that are shown in figure 1. The extruded member 23 is internally provided with a transverse wall 29, as a result of which two hollow channels 30, 31 are present within the extruded member 23. The extruded member 22 comprises only one hollow channel 32, whilst a hollow channel 33 is also present between the extruded members 22 and 23 and the walls 28 of the insulating member 24.

[0043] The seal at the location of the seam between two frame members 21 of a frame functions to prevent moisture, such as rain water, from finding its way into the interior of one of the hollow channels 30-33. To seal all these hollow channels, a circumferential seal needs to be realised along the continuous dashed line 34. A practical problem in this connection is the presence of the transverse wall 29 and of the transverse walls 35, 36, which make it impossible to follow the line 34 completely on the inner side with a single shape element.

[0044] A solution to this might be to use frame members 21 not provided with transverse walls, such as the transverse walls 29, 35 and 36. Alternatively it would be possible to remove the transverse walls 29, 35 and 36 at the location of the mitred end of the frame members 21. Depending on the length along which the transverse walls can be removed, the shape element that is moved into the cavity of the frame member 21 may comprise bridge elements, in which case the length of the shape element at the location of the transverse walls will be shorter than that of the parts of the shape element located on either side of the transverse walls 29, 35, 36, or the shape element may be configured more or less as a solid block without such bridge elements. According to a yet another alternative, use is made of four (in this case) shape elements whose outer circumference joins the inner circumference of each of the hollow channels 30-33, which four shape elements are joined together at their mitred ends by means of a single double-sided adhesive layer. A comparable option is shown in figures 6a-6c.

[0045] Figure 6a is a vertical view of a part of a frame member 41 having a mitred end 42. The frame member 41 comprises two extruded aluminium members 43, 44, with an insulating member 45 present therebetween. The extruded member 44 has a substantially T-shaped cross-section, without internal transverse walls being present. The extruded member 43 has a rectangular cross-section. To join two frame members 41 together at an angle, use is made of a connecting piece that extends into both frame members 41, into the hollow channels 56, 57 of the extruded members 43 and 44, respectively. The presence of transverse walls 46, 47 makes it impossible to use a single shape element for each frame member 41 for that purpose. Instead, two shape elements 48, 49 are used for each frame member 41, the outer circumference of which shape elements connects to the hollow channels 56, of 57 of the members 43 and 44. Two shape elements 48 and two shape elements 49 are provided for each connecting piece, the shape elements 48 being joined at right angles via the double-sided adhesive layer 50 and the shape elements 49 likewise being joined at right angles via the same adhesive layer 50. Said joint is not shown in figure 6b, to be true, which shows only one side of the connecting piece, but it is comparable to the embodiment of the connecting piece 7 that is shown in figure 1. The double-sided adhesive layer 50 thus ensures the correct positioning not only of the shape elements that are provided on either side of the adhesive layer 50 but also of the shape elements 48, 49 provided on the same side of the adhesive layer 50.

[0046] Of course it is possible to strengthen the joint between similar shape elements 48, 49 additionally by means of the same kind of snap connection as proposed with regard to the connecting piece 7 in figures 1-3. In addition to that it is also conceivable to make use of a snap connection for the connection between the connecting piece and the frame members 41. Holes 51, 52 are provided in the frame members 41 for that purpose, through which holes spherical protrusions 53, 54 on the respective shape elements 48, 49 may extend after the shape elements 48, 49 in question have been moved into the hollow channels of the extruded members 43, 44. The use of such a snap connection might even obviate the need for additional screwed connections between right-angled frame members, providing of course that the right-angled connection between the similar shape elements 48, 49 on either side of the adhesive layer 50 is sufficiently strong. Obviating the need for a screwed connection between the frame members 41 would mean a significant additional saving on processing time, whilst in addition less sophisticated tools are required.

[0047] Figure 6c is a more detailed view of the adhesive layer 50, in which dotted lines 58, 59 indicate the imaginary positions of the transverse walls 46, 47 in the final, assembled condition. As usual, the double-sided

adhesive layer 50 is initially provided with a protective layer on both sides, which layer must be pulled off to uncover the adhesive layer. Said protective layer is provided with a perforation line 55. In forming the connecting piece consisting of the four shape elements 48 and 49 and the adhesive layer 50 it might initially suffice to remove only the part of the protective layer that is located within the circumferential perforation line 55. Alternatively it will even be possible not to remove this part of the protective layer and to effect the connection between the shape elements 48, 49 solely on the basis of a snap connection: Subsequently the part of the protective layer located on the outer side of the perforation line 55 can be removed just before the shape elements 48, 49 are moved into the frame members 41, or even during said movement, so that objects or dust are as much as possible prevented from undesirably adhering to the area of the adhesive layer located on the outer side of the perforation line 55 and the adhesive layer will provide an optimum sealing effect.

[0048] A connecting piece is used for realising the angle joint between two frame members 71, 72, of which only part of the length near the corner is shown in figures 7 and 8, which frame members 71, 72 are formed by extruded aluminium sections. The connecting piece 73 is made up of a number of parts, as will be described in more detail yet hereinafter. The assembly of the connecting piece 73 may take place at a location different from the one at which the frame members 71, 72 are joined together by means of the connecting piece 73; normally it will not take place immediately before the frame members are joined together.

[0049] The connecting piece 73 first and foremost comprises shape elements 74, 75, which are accommodated with a closed fit within the hollow channels 76, of 77, respectively, of the frame member 72 in the final angle joint, as well as shape elements 78, 79, which are accommodated within the hollow channels 80, 81 of the frame member 71 in a similar manner in the final joint. Like the frame members 71, 72, the shape elements 74, 75, 78 and 79 are extruded aluminium sections whose facing ends are mitred.

[0050] The connecting piece 73 further comprises two aluminium corner pieces 82, 83 having right-angled legs 84, 85 and 86, 87, respectively. In addition to that, the connecting piece 73 comprises two fitted dowel pins 88, 89 having right-angled legs 90, 91 and 92, 93, respectively. The fitted dowel pins 88, 89 lie in the same plane parallel to the main plane of the frame defined by the frame members 71,72.

[0051] To join the shape elements 74 and 78 and the shape elements 75 and 79 together, the leg 84 and the legs 90, 92 are first moved into the hollow channels 94, 95, 96, respectively, and the leg 86 is moved into the hollow channel 97 of the shape element 75. Subsequently (or, alternatively, prior thereto) a double-sided adhesive layer 98, which is (still) provided with a protective foil on both sides, is moved over the legs 85, 87, 91 and 93 until the adhesive layer 98 abuts against the mitred ends of the shape elements 74, 75. The adhesive layer 98 is to that end provided with openings, whose position and circumference correspond to those of the legs 85, 87, 91 and 93, seen in diagonal direction. The adhesive layer 98 is made of a transparent material and has a thickness of 0.25 mm, so that it will hardly be visible, if at all, in the final joint between the frame members 71 and 72. The circumference of the adhesive layer 98 corresponds to that of the (mitred) ends of the frame members 71 and 72, and consequently it is larger than that of the joint (mitred) circumference of the shape elements 74, 75 or 78, 79, outside which the adhesive layer 98 extends, therefore. Subsequently, the shape elements 78 and 79 are moved over the vertical (in figures 7 and 8) legs 85, 87, 91 and 93, after which said legs extend to within the hollow channels 101, 102 and 103, 104, respectively, of the associated shape elements 78, 79.

[0052] The final connection between the shape elements 74 and 78 and also between the shape elements 75 and 79 can be effected by using the double-sided adhesiveness of the adhesive layer of 98, for example, by removing the protective foil on either side of the adhesive layer 98, at least insofar as it extends within the outer circumference of the shape elements 74, 75, 78, 79. Preferably, a circumferential perforation line comparable to the perforation line 55 in figure 6c, whose circumference corresponds to the outer circumference of the shape elements 74, 75, 78, 79, will to that end be provided in both protective foils. Alternatively, or in combination therewith, a connection between the shape elements 74, 75, 78, 79 on the one hand and the associated corner pieces 82, 83 on the other hand can be effected by means of one or more screws that are screwed from the outside through a wall of shape elements 74, 75, 78, 79 into the material of the respective corner piece 82, 83 that extends within the shape element in question. According to another alternative, the connection between the corner pieces 82, 83 can be effected in a manner that corresponds to the manner in which the connecting piece 73 is connected to the frame members 71, 72 by means of holes 122, 123, as will be explained in more detail yet hereinafter. In this way neither an adhesive layer 98 nor separate screwed connections are used or, in any case, such use is not necessary.

[0053] The connecting piece 73 finally comprises eight U-shaped sections 105-111 of plastic material, which are accommodated in respective U-shaped recesses 113-120 on the outer side of the various shape elements 74, 75, 78, 79. The connection between the U-shaped sections 105-112 of plastic material and the associated shape elements 74, 75, 78, 79, which can be effected already before the shape elements 74, 75, 78, 79 are joined together, can be effected by means of a glued joint or by means of a snap connection, for example, using a snap pin 121 (see figures 9 and 10), for example, which extends through a snap hole that has been formed in the wall of the shape elements 74, 75, 78, 79 in the web of

the U-shaped recess 113-120 for that purpose. This prevents movement in longitudinal direction of the sections 105-113 with respect to the associated shape element 74, 75, 78, 79.

[0054] Especially with reference to figures 9-11, holes 122, 123 have been drilled in the frame members 71, 72, which holes extend through inwardly extending edges 124, 125 of the frame members 71, 72, in which edges 124, 125 cylindrical passages 126, 127 are provided, which, if the frame members 71, 72 are joined together in a conventional manner, function as threaded passages in which screws can engage for joining the frame members 71, 72 together. Similar holes (not shown in figures 7 and 8) are provided at corresponding positions on the outer sides of the frame members 71, 72. The holes 122, 123 form local interruptions of the edges 124, 125, so that two sharp points 128, 129 positioned opposite each other are formed within the length of the edges 124, 125.

[0055] As figure 11 shows, the vertical legs of the U-shaped sections 105-113 are slightly thickened at one of their ends and provided with teeth 130. When the frame members 71, 72 are moved over the respective shape elements 78, 79 and 74, 75 with the U-shaped sections 105-113 of plastic material that are connected thereto, the respective teeth 130 will hook behind the associated sharp points 128, 129 of the holes 122, 123, as a result of which a solid connection between the frame members 71 and 72 is effected via the connecting pieces 73 without the use of screwed connections that engage the frame members 71, 72 being required. In this way the frame members 71, 72 can be joined together in a simple, quick and nevertheless accurate manner, with the seal between the frame members 71, 72 being effected by means of the adhesive layer 98. It will of course be necessary to remove the protective foil from the adhesive layer 98, at least insofar as they extend outside the outer circumference of the shape elements 74, 75, 78, 79, before the frame members 71, 72 are moved into abutment with each other over the shape elements 74, 75, 78, 79.

Claims

1. A method for joining hollow frame members together at an angle for the purpose of producing frames, comprising the steps of

   - positioning the frame members into abutment with each other at the aforesaid angle, with a seam being present along the circumference of the boundary surface between the frame members,
   - joining the frame members thus positioned relative to each other,
   - positioning a double-sided adhesive layer between the frame members before the frame members are positioned into abutment with each other for effecting an adhesive joint between the frame members, with the adhesive layer extending along at least part of the seam, for the purpose of providing a seal at the location of the seam between the frame member, **characterized by** the steps of
   - providing the adhesive layer before the frame members are positioned into abutment with each other, in a condition such that the adhesive layer is affixed to a shape element, projecting at least outside a circumference of said shape element,
   - moving the shape element relative to the cavity of a frame member so as to effect an adhesive joint between the projecting part of the adhesive layer and the frame member.

2. A method according to claim 1, **characterized by** removing a protective layer from the projecting part of the adhesive layer on the side of the shape element once the adhesive layer has been provided in a condition in which it is affixed to a shape element.

3. A method according to claim 2, **characterized by** removing the protective layer from the projecting part of the adhesive layer directly prior to or during said moving of the shape element relative to the cavity of a frame member.

4. A method according to claim 1, 2 or 3, **characterized in that** the shape element is accommodated in the frame member in a shape-locked manner, at least perpendicular to the direction of movement, after being moved into the cavity of the frame member.

5. A method according to claim 1, 2, 3 or 4, **characterized in that** the shape element is provided with at least one protrusion on its side facing towards the adhesive layer, which protrusion extends through at least one hole in the adhesive layer in a shape-locked manner, when the adhesive layer is being provided in a condition in which the adhesive layer is affixed to a shape element.

6. A method according to any one of the claims 1-5, **characterized in that** the adhesive layer adheres to the shape element when the adhesive layer is being provided in a condition in which the adhesive layer is affixed to a shape element.

7. A method according to any one of the claims 1-6, **characterized by** effecting a snap connection between the shape element and the frame member upon movement of the shape element into the cavity of the frame member.

8. A method according to claim 7, **characterized in that** the snap connection is effected **in that** teeth on the shape element engage behind an engagement

edge on the frame member.

9. A method according to claim 8, **characterized in that** the engagement edge has been formed by providing a bore in the frame member through an edge that extends inwardly within a hollow channel of the frame member.

10. A method according to claim 9, **characterized in that** the diameter of the bore is greater than the thickness of the edge.

11. A method according to any one of the preceding claims, **characterized in that** the frame members each comprise a number of hollow channels separated from each other by an internal wall, wherein a shape element is moved relative to at least two hollow channels, which shape elements have been joined together via the adhesive layer prior to being moved into the hollow channels.

12. A method according to any one of the preceding claims, **characterized in that** the frame members each comprise a number of hollow channels separated from each other by an internal wall, wherein the internal wall is at least partially removed at the location of the boundary surface so as to provide space for the shape element after said relative movement of the shape element within the frame member at the location of two hollow channels thereof.

13. A method according to any one of the preceding claims, **characterized in that** the frame members each comprise a hollow channel whose cross-section has a shape substantially different from the shape of a rectangle and similar to the shape of the outer circumference of at least two abutting rectangles.

14. A method according to claim 11, 12 or 13, **characterized in that** the frame member is built up (seen in cross-sectional view) of a web member which extends perpendicularly to the main plane of a frame when forming part thereof, and two stop members which each extend perpendicularly to the web member from one end thereof, of which at least one stop member, to be referred to below as the outer a stop member, is located on the outer side of the frame, wherein at least part of the hollow channel, or at least one of the hollow channels, at least substantially defines the outer stop member.

15. A method according to any one of the preceding claims, **characterized in that** the adhesive layer extends within the circumference of the boundary surface when the frame members are being positioned into abutment with each other.

16. A method according to any one of the preceding claims, **characterized by**

- providing the adhesive layer before the frame members are positioned into abutment with each other, in a condition such that the adhesive layer is present between two shape elements which are joined at an angle corresponding to the angle of the frame members to be joined together, projecting at least outside the circumferences of said shape elements,
- moving the two respective shape elements relative to the cavities of the two frame members so as to effect adhesive joints on two opposite sides of the adhesive layer between opposite sides of the projecting part of the adhesive layer and the respective frame members.

17. A method according to claim 16, **characterized in that** the two shape elements are joined together by means of a snap connection if the adhesive layer is provided in a condition such that the adhesive layer is present between two shape elements, with at least one protruding snap element of a shape element extending through at least one hole in the adhesive layer into at least one recessed snap element of the other shape element.

18. A method according to claim 17, **characterized in that** said at least one protruding snap element extends through said at least one hole in the adhesive layer in a shape-locked manner.

19. A method according to any one of the preceding claims, **characterized by** joining together the frame members by means of at least one screwed connection.

20. A method according to any one of the preceding claims, **characterized in that** the adhesive layer is made of a transparent material.

21. A method according to any one of the claims 1-19, **characterized in that** the adhesive layer has a colour that corresponds to that of the frame members.

22. A method according to any one of the preceding claims, **characterized in that** the adhesive layer has a thickness of maximally 0.5 mm, more preferably maximally 0.3 mm.

23. A frame member for use with a method according to any one of the preceding claims, in particular for use with a method according to any one of the claims 11-14.

24. A combination of at least one shape element and an adhesive layer affixed thereto, said adhesive layer

projecting outside a circumference of said at least one shape element, said combination being intended for use with a method according to any one of the claims 1-22.

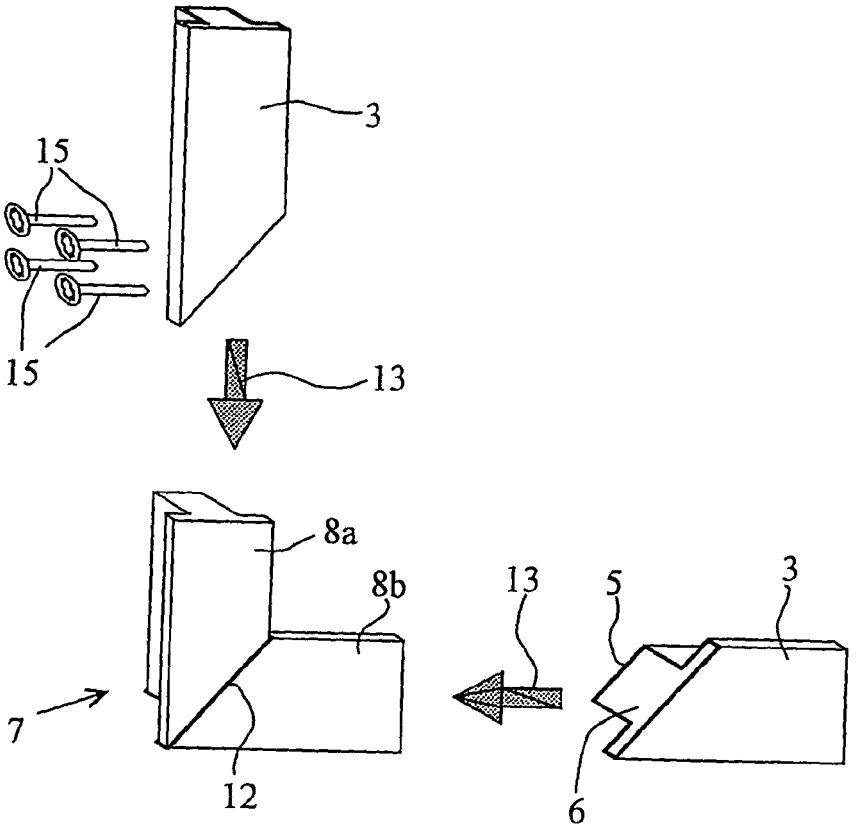

Fig. 1

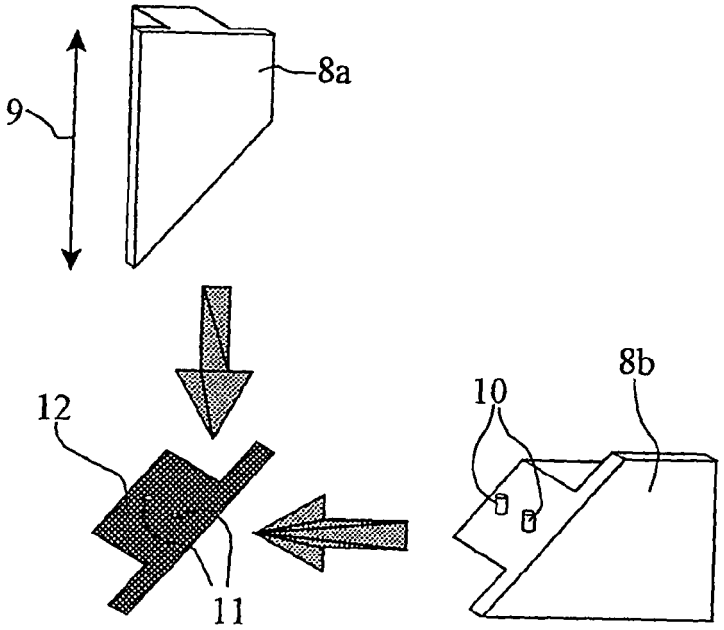

Fig. 2

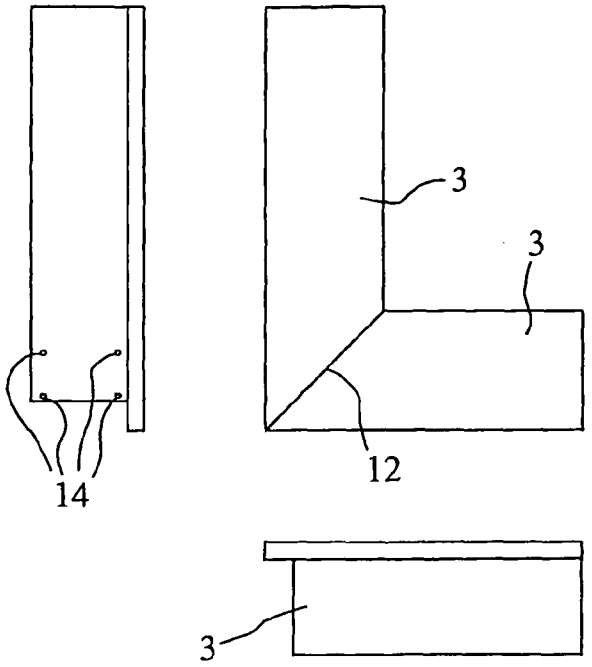

Fig. 3

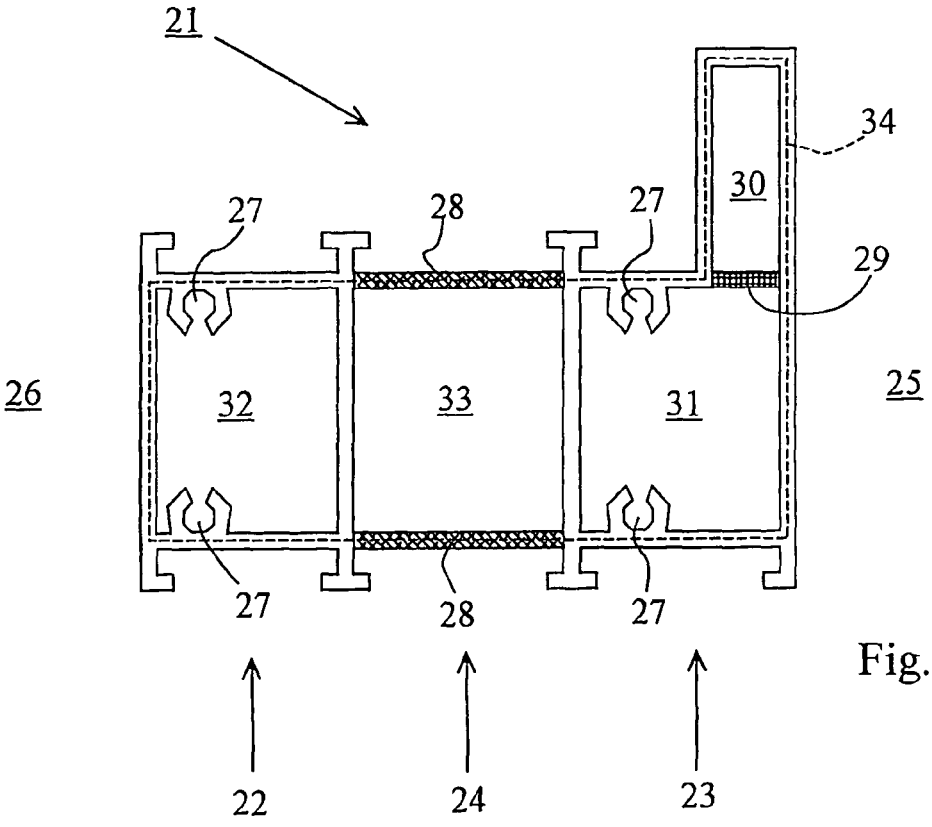

Fig. 4

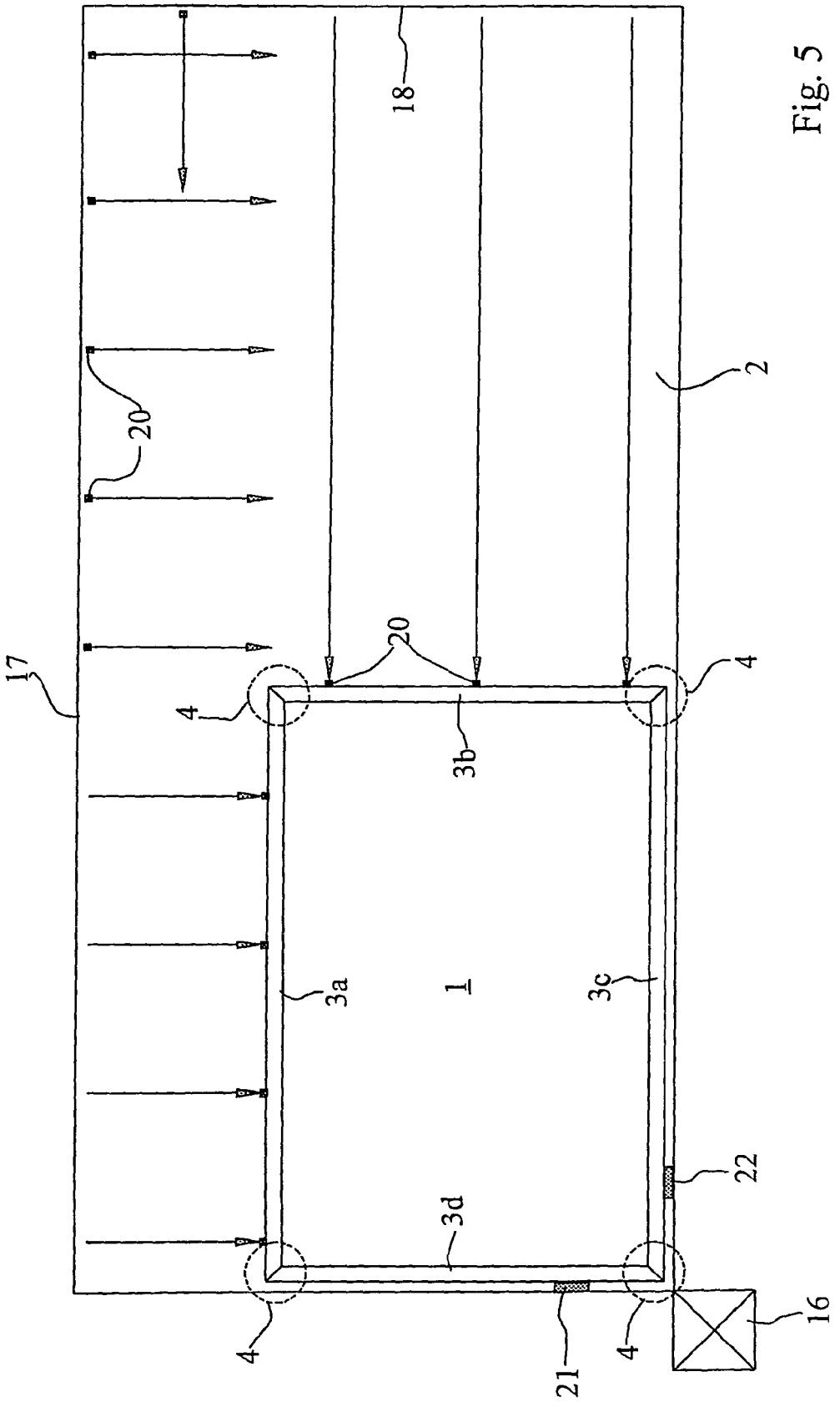

Fig. 5

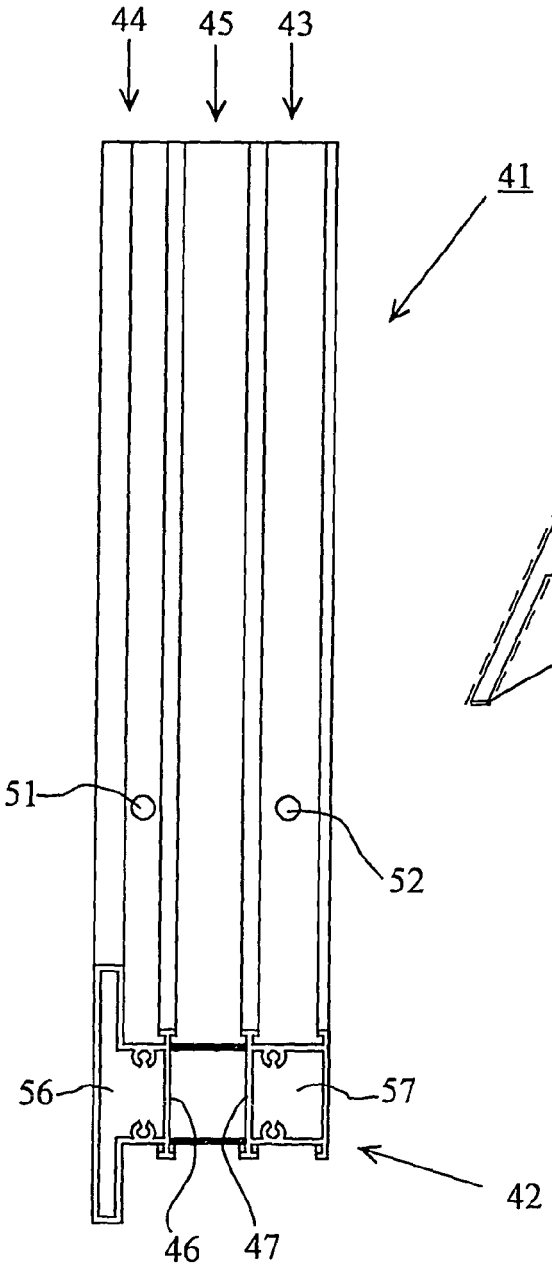

Fig. 6a

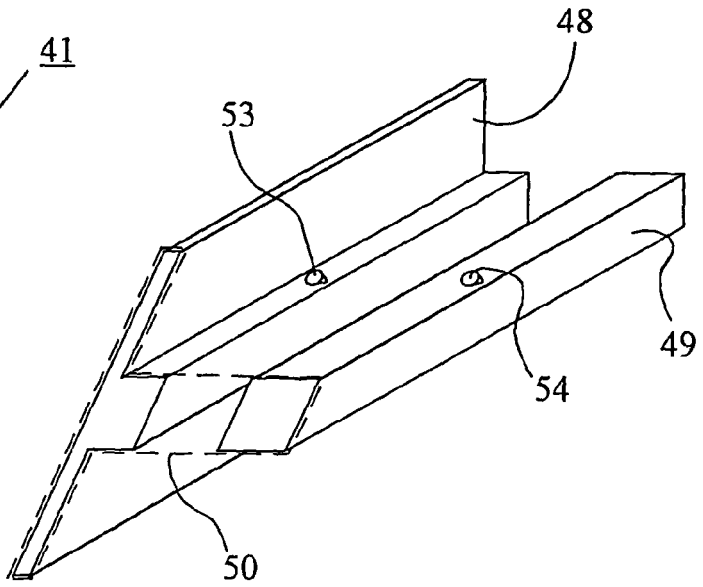

Fig. 6b

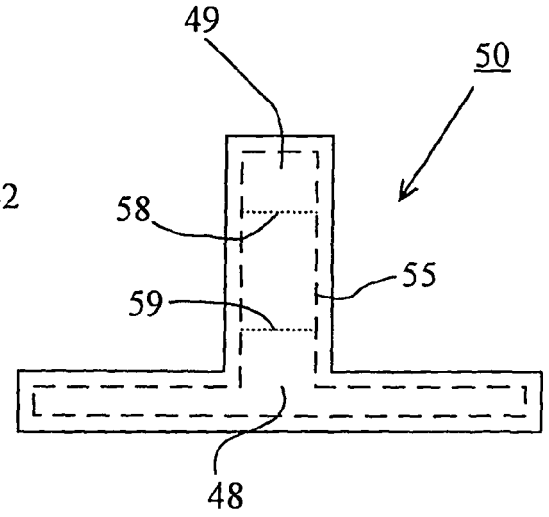

Fig. 6c

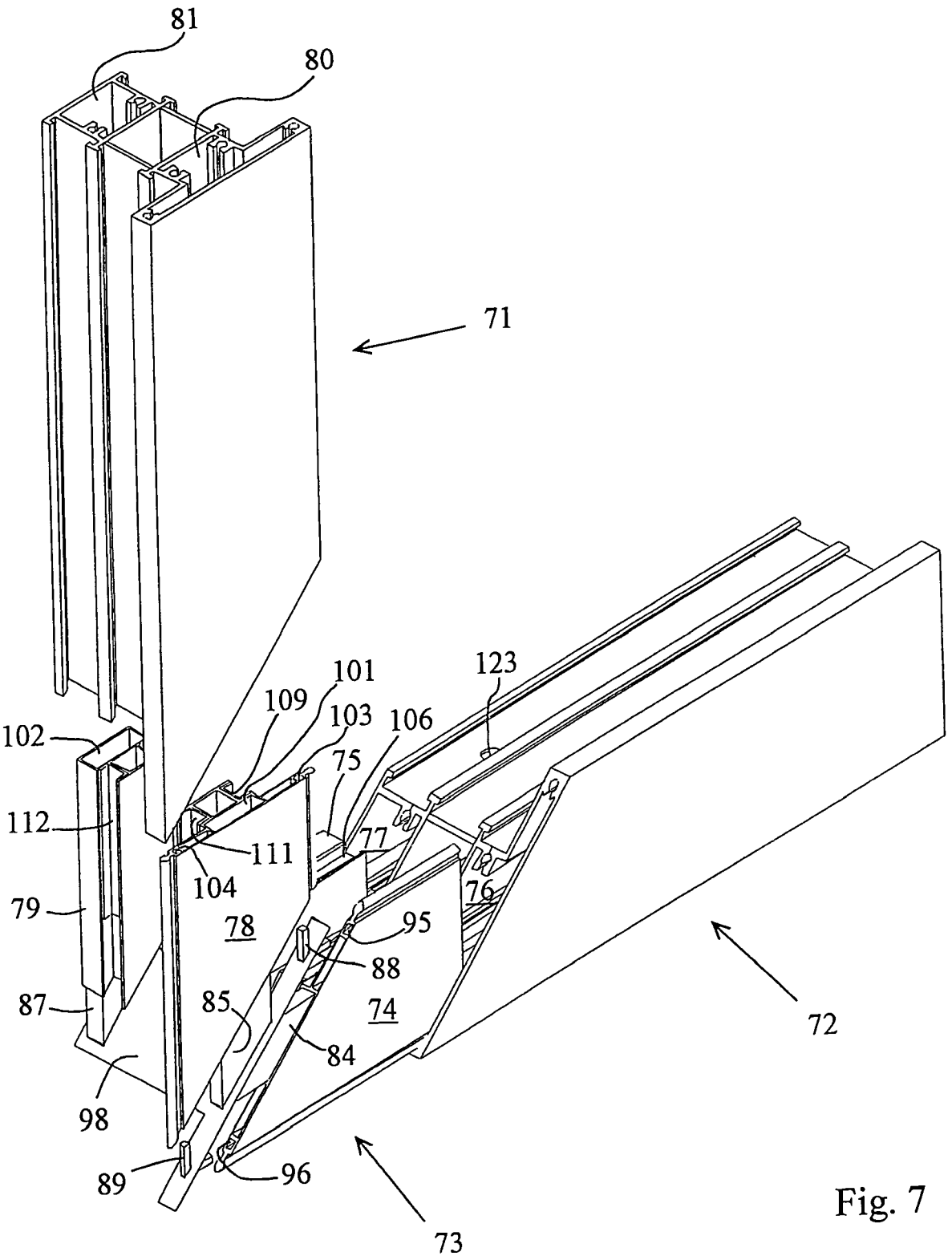
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Fig. 7

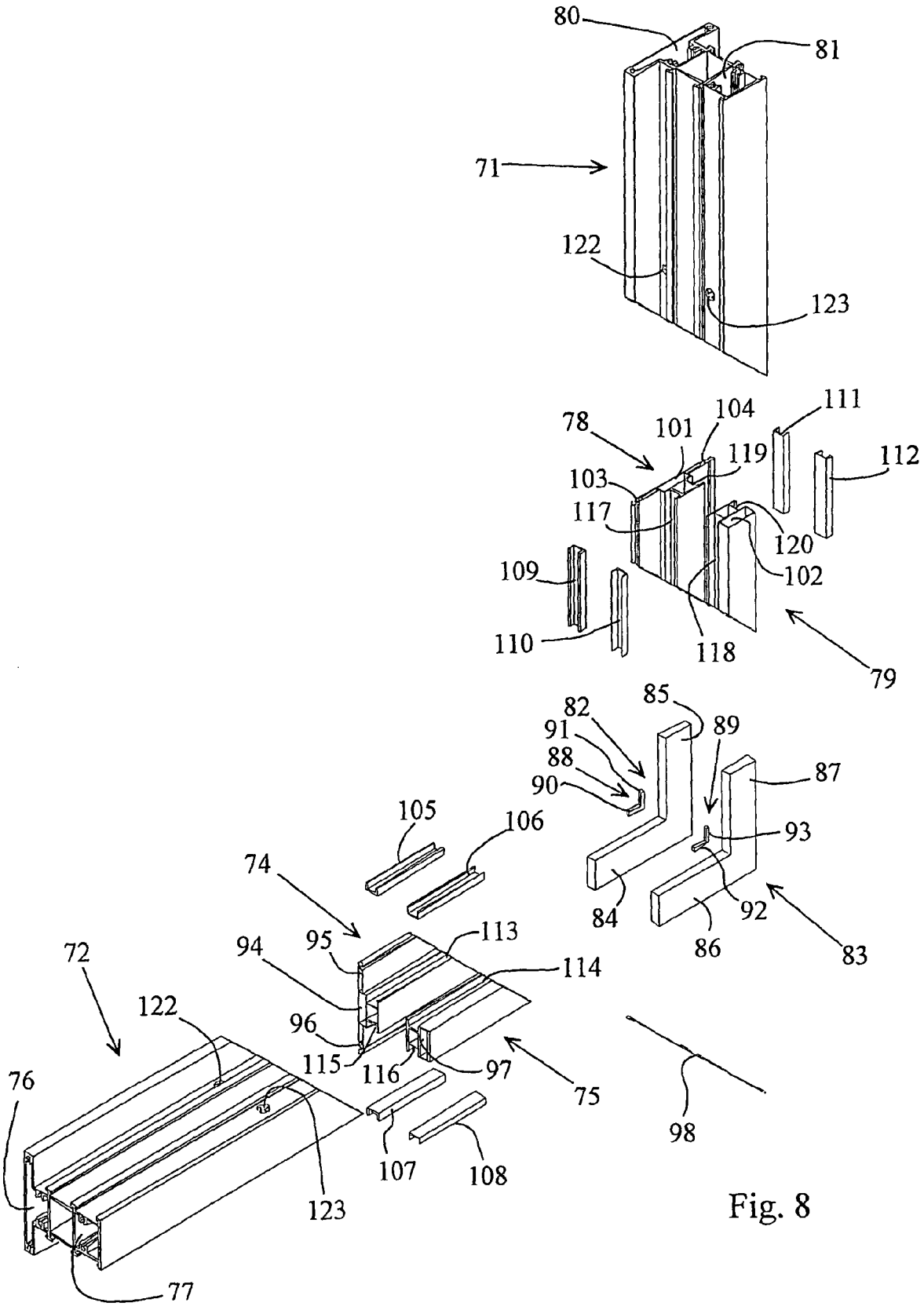
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Fig. 8

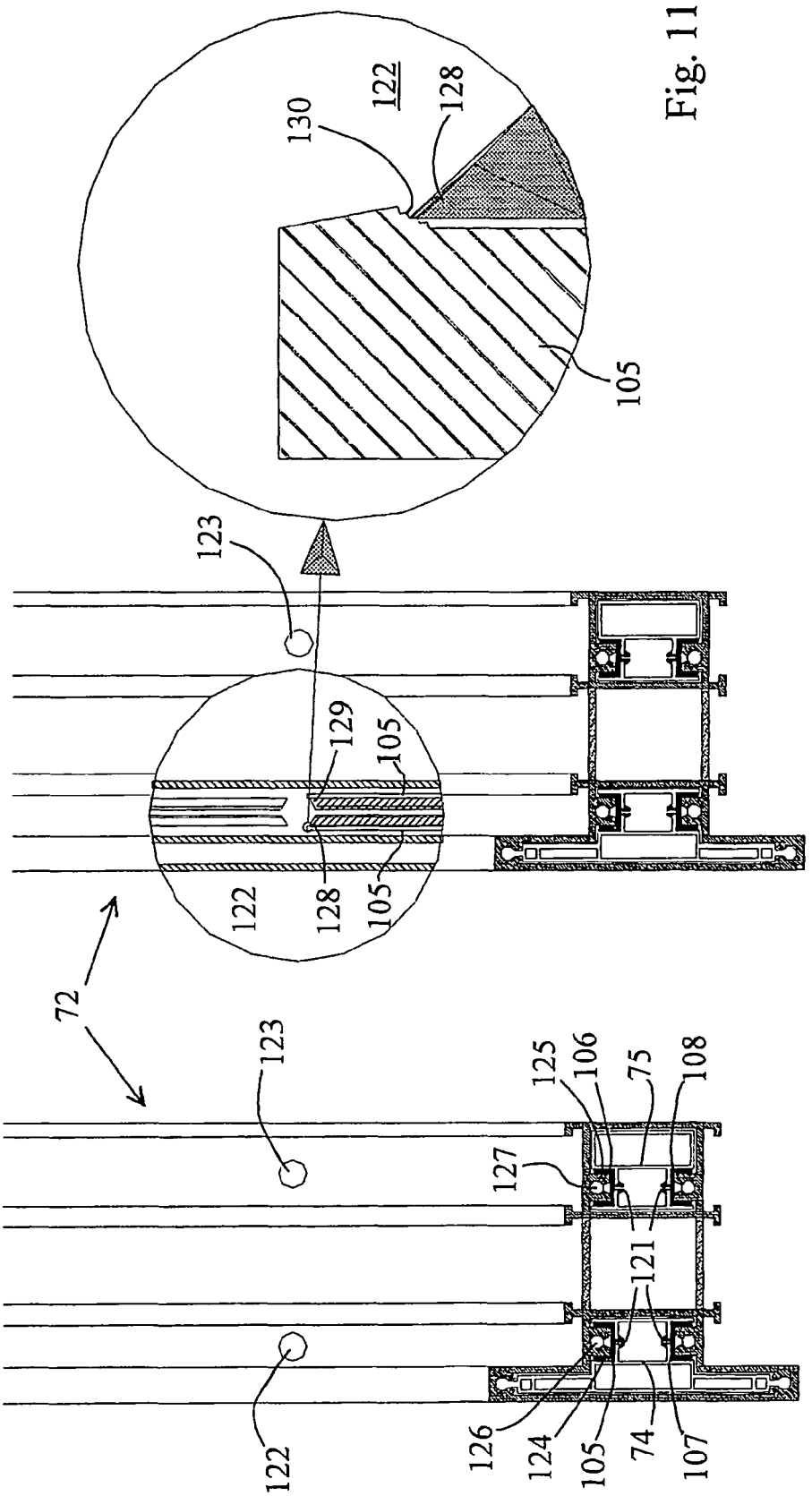

Fig. 9

Fig. 10

Fig. 11

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Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	5 January 2006	Verdonck, B

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