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(54) Security door.

(57) A security door comprises first and second sheet metal door panel members (10, 20), a pair of internal side rails (30, 31) and a top and bottom rail (40, 41). Each of the door panel members (10, 20) has overturned lip formations (11, 21) along its edges, the free ends of which overlie their respective door panel member (10, 20) in spaced-apart relationship thereto. The rails (30, 31, 40, 41) have a pair of longitudinal grooves (32, 42) along at least one of their faces, which grooves receive the overturned lip formations (11, 21) of respective door panel members (10, 20). Between their grooves (32, 42), the rails may have recesses (33, 34) adapted to receive hinges, locking mechanisms or the like. The rails may be double-sided with different recess formations on opposite sides. The constructional features of the door are concealed from view when the door is closed in use and hence are not vulnerable to attack. For aesthetic purposes, a capping member (50) may be attached around the door periphery.

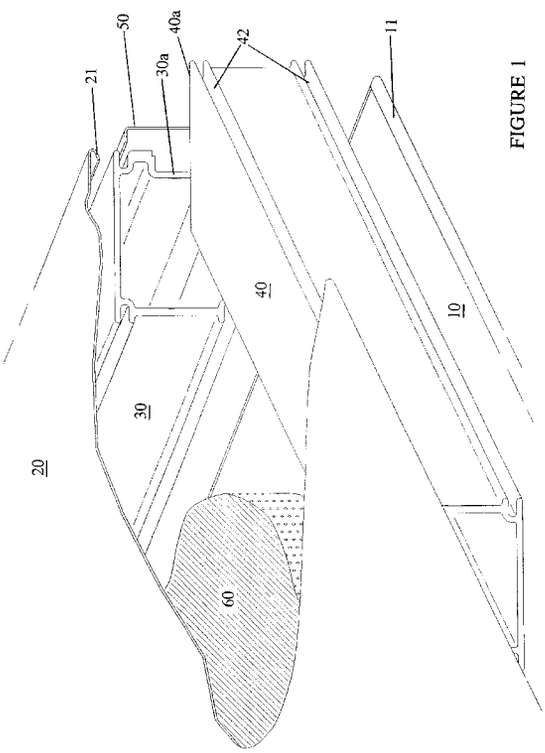

FIGURE 1

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The present invention relates to doors and in particular to security doors of the type which may be fitted in secure premises. Such doors may also find use as domestic front entry doors and in community housing projects where added security is desired.

A security door is known from granted European Patent No. 0 392 700 B in which the leaf is constructed from a minor sheet metal tray and a major sheet metal tray, each of which is formed with lip portions receivable in slotted internal frame members. The respective trays are effectively bent metal sheets and the internal frame members are elongate metal extrusions. The cavity inside the assembled door may be filled under pressure with a curable foam material.

One of the disadvantages of a door of this known construction is the fact that its two faces are different in appearance. The outer face of the major tray presents a unitary panel to the viewer and in use it will be this side which is generally offered as the external panel of the door. The reverse, which is therefore generally the internal panel, comprises the outer face of the minor tray surrounded by a returned portion of the major tray. There is a visible seam around the entire periphery of the minor tray. In practice, this means that the external and internal panels of the door must be given the same finish, which may not be to the personal taste of the user. Also, the seam is a point of vulnerability.

Another drawback of this prior art door is the "wrap-around" construction of the major tray. This makes it particularly difficult to form the corners of the major tray. If the material from which the door is constructed is a plastic-coated steel such as "Plastisol" (Registered Trade Mark), the corners of the major tray will need to be secured using fasteners such as pop rivets, rather than using a stronger welded construction. Moreover, because of the returned portions, it is necessary to rotate the internal frame members into position under the returned lips. This is not possible in the corners, which are therefore unreinforced and a potential site of weakness.

The wrap-around construction of the major tray may also mean that it is not possible for a would-be customer to obtain doors of sufficient width, since the returned portions account for between 10 and 15cm of the metal sheet from which the door is constructed. Many sheet materials are supplied in standard widths and it may therefore be the case that a door cannot be made to the prior art design in the material of choice.

It is therefore an object of the present invention to provide a security door which avoids the drawbacks outlined above.

The invention is a door comprising first and second sheet metal door panel members, a pair of side rails and a top and bottom rail, each of said door panel members having overturned lip formations around each of its edges, the free ends of said overturned lip formations overlying their respective door panel members and being spaced therefrom, and each of said rails having a pair of parallel longitudinal grooves along at least one common face thereof dimensioned to receive the overturned lip formations of corresponding edges of each of said first and second door panel members.

A door in accordance with the invention has none of its constructional features exposed on its faces. This offers the advantage that, when such a door is in the closed condition, its construction is hidden by the surrounding door frame and is therefore not vulnerable to attack .

In a preferred construction, at least one of the pairs of oppositely-disposed rails includes extension means. This not only allows the ends of a rail to be urged into positive engagement with the ends of its neighbours for imparting improved rigidity to the door, but also means that one size of rail can be used to make doors of various dimensions. In practice, it will usually be the top and bottom rails which are provided with extension means since there tends to be greater standardisation in door heights than there is in door widths. Nevertheless, either or both pairs of rails may include extension means. Preferably, the extension means comprise telescopic portions built into the rails. The telescopic portion is lockable in its extended condition to maintain the desired degree of separation between the rail ends. Alternatively, the extension means may be an insert portion. Insert portions of different lengths can be employed with standard-sized rails to achieve a range of different sizes. The insert portions and rails may have complementary bevelled formations to assist in urging the rail ends into their respective corners of the door panel members through a wedging action.

In an especially preferred form of the invention, the rail ends are formed with mitres. In combination with rail members having extension means, this enables the rails to extend fully into the corners of the door. This design therefore has particularly strong corners. Alternatively, adjacent rail ends may be formed with bevelled portions of complementary angles other than 45°, to suit particular application requirements.

Advantageously, the rail material is an elongate metal extrusion. Between the parallel longitudinal grooves formed along at least one face thereof for receipt of the overturned lip formations of the door panel members, the rail may have a longitudinal recess. In an especially preferred form, the rail has the longitudinal grooves formed along two opposite faces and a longitudinal recess of a different depth formed between each pair of parallel grooves. In this preferred rail, one of the recesses may be of a depth suitable to receive hinges on which the door would be suspended, whilst the recess along the opposite face may be dimensioned to receive

a multi-point locking mechanism as known in the art. Such a dual-faced rail offers the advantage that only a single extrusion needs to be stocked by the door manufacturer to accommodate a variety of ironmongery.

Where a lower level of security can be tolerated, it is possible to form the elongate rail members from a suitable plastics material.

In order to give an attractive finished appearance to the door, the edge portions may be fitted with a capping member to cover the exposed rails. This not only helps to prevent the ingress of dust and dirt, but also offers protection from injury in the event of a collision with the door panel member edges. Where doors according to the present invention are installed as fire doors, the capping member may be of a contrasting colour to assist in identifying the escape passage during an emergency.

Conveniently, the capping member may be adapted to engage with the parallel grooves of the rail members or with the door panel overturned lip formations. The capping member may contribute to the retention of the door panel overturned lip formations within the grooves by being an interference fit therewith.

Preferably the overturned lip formations are continuous around the entire periphery of the respective door panel members and the cavity between the door panel members is filled with a curable foam material which may be injected under pressure. When set, the foam secures the rails and door panel members in place relative to each other and improves the structural integrity of the door. Keying projections may be provided on the rails to assist in this process. In the dual-faced rails mentioned above, the keying function may be fulfilled by the second pair of longitudinal grooves and their associated recess.

Alternatively, the cavity between the door panel members may be packed with an infill of a non-curable material, for example, a fibrous fireproof material such as Rockwool (Registered Trade Mark). In view of the fact that a dry infill of this type is not expansible, an alternative method must be used for urging the internal framework of the door into firm engagement with the overturned lip formations of the panel members. One method of doing this is to use one or more jacking mechanisms extending across the interior of the door cavity, the slabs of infill material being positioned in the spaces between the top and bottom rails of the door and respective jacking mechanisms.

Conveniently, the jacking mechanism comprises a jacking rod accommodated in the centre void of spacer means, for example formed from lengths of the same material used to form the rail members. An intermediate portion of the jacking rod is secured against rotation relative to the spacer means and each of its ends is provided with a screw thread which is adapted to receive a cooperating jacking member. Upon rotation of the jacking members relative to the fixed jacking rod, the side rails are caused to move away from each other and are thereby urged into firm engagement with the overturned lip formations of the door panel members. In a variation of this arrangement, one end of the jacking rod may be fixed to one of the side rail members so that only one jacking member is necessary for each jacking rod.

In a door having a dry infill, the door panel members are preferably affixed, for example by adhesives, to intermediate spacers. In the arrangement described above, the spacers may also serve as housings for the jacking rods. Intermediate bracing of this type serves to minimise inward and outward flexure (so-called "panting") of the door panels and helps to improve overall structural integrity of the door.

The invention will now be described by way of example only with reference to the drawings, in which:

Figure 1 is an exploded view of a portion of a door constructed in accordance with the present invention;

Figure 2 is a cross-section through one edge of a door constructed in accordance with the present invention;

Figure 3 (views (a) and (b)) is a cross-section through a telescopic rail in accordance with a preferred embodiment of the present invention;

Figure 4 is a cross-section through a dual-faced rail in accordance with another preferred embodiment of the present invention;

Figure 5 is an exploded view of a portion of another embodiment of door constructed in accordance with the present invention, and

Figure 6 is a part exploded and simplified cross-sectional view of the embodiment depicted in Figure 5.

Referring now to Figure 1, a door constructed in accordance with the invention comprises a pair of "Plastisol" (Registered Trade Mark) door panel members 10, 20, and rail members 30, 40 of extruded aluminium arranged to be disposed between the panel members. The rail members have their ends 30a, 40a cut at complementary angles to facilitate formation of rigid corner joints for maximum strength. The panels 10, 20 are shown with overturned lip formations 11, 21, respectively, around their peripheries.

Each rail member has a pair of longitudinally-extending parallel grooves along at least one face, which grooves are oriented to receive the overturned lip formations of a respective door panel. Polyurethane foam 60 fills the void between the panel members in the finished door assembly and secures them against inward and outward flexure, or "panting". A capping member 50 is shown overlying one of the rail members.

Assembly of the door is accomplished by laying first panel member 10 horizontally to form a shallow tray.

Four rail members are placed on the tray, corresponding to the two side rails and a top and bottom rail of the finished door. The second panel member 20 is then placed on top of the rail members, which are each slid outwardly until the overturned lip formations of the respective panel members are received in the grooves of the rail members.

The operation of sliding the rail members into engagement with the overturned lip formations of the panel members may be performed by a variety of methods, depending on the particular configuration of the rail members used. If rail members having bevelled ends are used, as in the present example, it is necessary to use extension means to expand the rails into the corners of the door panel members. One example of suitable expansion means is described below with reference to Figure 3.

In Figure 2 is shown a cross-section through the door of Figure 1 after assembly. The foam filling 60 has been omitted for clarity. This view shows a pair of opposed rails 40, 41b with a pair of parallel grooves 42 formed on one face thereof in which are received the overturned lip formations 11, 21 of the respective panel members 10, 20. In this embodiment, capping members 50 are formed with returned edge portions 51 which are also received in the grooves of the rail members. The overturned lip formations of the panel members and the returned edge portions of the capping members together form an interference fit in respective grooves of the rail members.

Figures 3(a) and 3(b) are cross-sectional views through an edge of a door constructed in accordance with the present invention, showing a rail member 40 with expansion means in the form of a telescopic portion 43 inserted between its two ends 48 and 49. The telescopic portion includes an inner sleeve 44 which is permanently secured through fixing means 45 to a first end 48 of the rail member. At its free end, the inner sleeve is slidably received in the other end 49 of rail member 40 and is releasably securable thereto in a selected position by means of releasable fastening means 46.

In an especially preferred form of the present invention, a door is constructed from rail members having mitred corners. Preferably the side rail members of the door are non-extensible and the top and bottom rail members are formed with telescopic portions in accordance with Figure 3. During initial assembly of the door, the four rail members are placed on the first panel member 10 with the telescopic portions in the unextended condition. After placement of the second panel member 20 over the rail members lying on the first panel member 10, the side rail members are first manoeuvred into engagement with the overturned lip portions of the panel members. Then the top and bottom rail members are positioned in engagement with the overturned lip portions of the panel members and their telescopic portions are extended to bring the mitred ends of all four rails into contact.

Prior to attachment of capping members around the periphery of the door, it may be desired to fill the void between the panel members with foam material. The door is held between the platens of a press and then a curable foam material such as polyurethane is injected into the cavity between the panel members through a hole or holes provided in the rail members. After curing, the door is released from the press. It is necessary to apply external pressure to the door panels during this operation in order to prevent undesirable bulging in the finished article. In practice, it is possible to stack a number of doors together and to fill each of them with foam for treatment in a single curing step.

Figure 4 shows a particularly preferred form of the rail member extrusion 30. This rail member has two opposed faces of dissimilar section, each of which is provided with a pair of longitudinally-extending parallel grooves 32. Between each of the pairs of grooves 32 is formed a longitudinally-extending recess 33, 34. One of the recesses 33 is relatively shallow and is configured to receive hinges for suspension of the door. The recess 34 along the opposite face of the rail is relatively narrow and much deeper in comparison to recess 33. This deeper recess is suitable for accommodating a multi-point locking mechanism. Such locking mechanisms are well known in the art and need not be described in detail here. Upstanding projections 35, 36, or 35, 37 on the face of the rail member facing inwardly from the door periphery may assist in keying the foam material to the structural members of the door.

Referring now to Figure 5, there is shown an exploded view of another embodiment of door constructed in accordance with the invention. In this Figure, like reference numerals are used to denote components and features in common with the first embodiment described above in relation to Figures 1 to 4.

The Figure 5 embodiment differs from the first embodiment in that it uses a dry infill 70 of fibrous material such as Rockwool (Registered Trade Mark). In this arrangement, jacking devices 80 are provided for urging the side rail members 30, 31 into firm engagement with the overturned lip formations 21 of the respective door panel members 10, 20. The end rail members 40, 41 (only one shown) are unmodified from the arrangement used in the first embodiment and will not be described further.

As shown, at least one intermediate spacer member 90 is inserted across the door panel 20, substantially perpendicular to the long edges of the door. The intermediate spacer member 90 is formed from a length of the same extrusion used to make the side and end rail members 30, 31, 40, 41. A jacking rod 81 is inserted

into the centre void of the spacer member 90 and protrudes at one end 82 into a slot (38, see Figure 6) in the side rail member 30. The jacking rod 81 is secured against rotation and is provided with an external screw thread onto which a jacking member 85 is threadedly engaged.

Referring now Figure 6, this shows a simplified view of the jacking device 80 and side rail members 30, 31 with the door panel members 10, 20 omitted for clarity. Jacking member 85 is shown as having a threaded bore 86 for engagement on the externally threaded jacking rod 81 and has a free end 87 adapted to be engageable by the blade of a screwdriver or similar tool. Between the threaded bore 86 and the free end 87, the jacking member 85 is provided with a shoulder 88 which acts as the thrust surface during the jacking procedure. A standard washer 89 may be interposed between the side rail member 31 and the shoulder 88 of the jacking member 85.

The free end 87 of the jacking member 85 is accessible through a pair of aligned holes 39 provided in the edge of the side rail 31.

By rotation of the jacking member 85 relative to the jacking rod 81, the side rail member 31 can be caused to move away from side rail 30 in such a way that the respective side rails are urged into firm engagement with the overturned lip formations 11, 21 of the door panel members 10, 20.

In the final door assembly, access holes 39 and jacking member free ends 86 are concealed by capping member 50. Also, the door panel members 10, 20 may be glued to the intermediate spacer 90 to brace them against inward and outward flexure. This is why it is convenient for the spacers 90 to be formed from a length of the same material as used elsewhere in the door construction for the top, bottom and side rails, since the rails determine the separation between the door panel members.

In a variation of this construction, the jacking rods 81 may be threaded at both ends, each of which receives a jacking member 85. In such an arrangement, the jacking rods 81 may be secured against rotation by affixing them to the spacers 90.

In a further embodiment of the invention (not shown), in which the rail ends are simply butted in the corner regions, a temporary pulling arrangement is required to slide each rail into engagement with the respective overturned lip formations. This may comprise, for example, an arrangement of threaded bolts engaged in threaded holes provided through the external groove-bearing faces of the rail members.

Unlike the arrangement where the rail members are formed with complementary angled corners, butted rail members need to be permanently secured to the panel member overturned lip formations, otherwise there is a danger that they will slide out of position between the panel members. This permanent attachment may be effected by the foam filling, as discussed above. Alternatively, the rail and panel members may be fixed to each other using a suitable adhesive or mastic composition.

Whilst the invention has been particularly described with reference to a number of specific embodiments, other variations in construction will be apparent to persons skilled in the art without departing from the scope of the claims which follow.

Claims

1. A door comprising first and second sheet metal door panel members (10, 20), a pair of side rails (30, 31) and a top and bottom rail (40, 41), characterised in that each of said door panel members (10, 20) is provided with overturned lip formations (11, 21) around each of its edges, the free ends of said overturned lip formations (11, 21) overlying their respective door panel members (10, 20) and being spaced therefrom, and in that each of said rails (30, 31, 40, 41) is provided with a pair of parallel longitudinal grooves (32, 42) along at least one common face thereof dimensioned to receive the overturned lip formations (11, 21) of corresponding edges of each of said first and second door panel members (10, 20).

2. A door as claimed in claim 1 wherein at least one of the pairs (30 and 31, 40 and 41) of oppositely-disposed rails includes extension means (43, 44, 45).

3. A door as claimed in claim 2 wherein said extension means comprise telescopic portions (43) incorporated into the rails.

4. A door as claimed in claim 2 wherein the extension means comprise insert portions for incorporation between the rail ends.

5. A door as claimed in claim 4 wherein the insert portions and rails have complementary bevelled formations to assist in urging the rail ends into respective corners of the door panel members through a wedging ac-

tion.

6. A door as claimed in any preceding claim wherein said rails (30, 31, 40, 41) are formed with a pair of said longitudinal grooves (32) along two opposite faces and with a longitudinal recess (33, 34) of a different depth formed between each pair of said longitudinal grooves (32).

7. A door as claimed in any preceding claim wherein the rails (30, 31, 40, 41) are formed of an elongate metal extrusion.

8. A door as claimed in any preceding claim wherein a capping member (50) is attached around the periphery of the door.

9. A door as claimed in claim 8 wherein the capping member (50) has returned edge portions (51), said returned edge portions (51) and said overturned lip formations (11, 21) together forming an interference fit in said parallel grooves (32, 42).

10. A door as claimed in any preceding claim wherein the overturned lip formations (11, 21) are continuous around the entire periphery of said first and second door panel members (10, 20).

11. A door as claimed in claim 10 wherein the cavity between said panel members (10, 20) is filled with a curable foam material (60).

12. A door as claimed in any one of claims 1 to 10 wherein the cavity between said panel members is filled with a non-curable material (70).

13. A door as claimed in claim 12 wherein jacking mechanisms (80) are provided for urging the rails (30, 31, 40, 41) into firm engagement with said overturned lip formations (11,12).

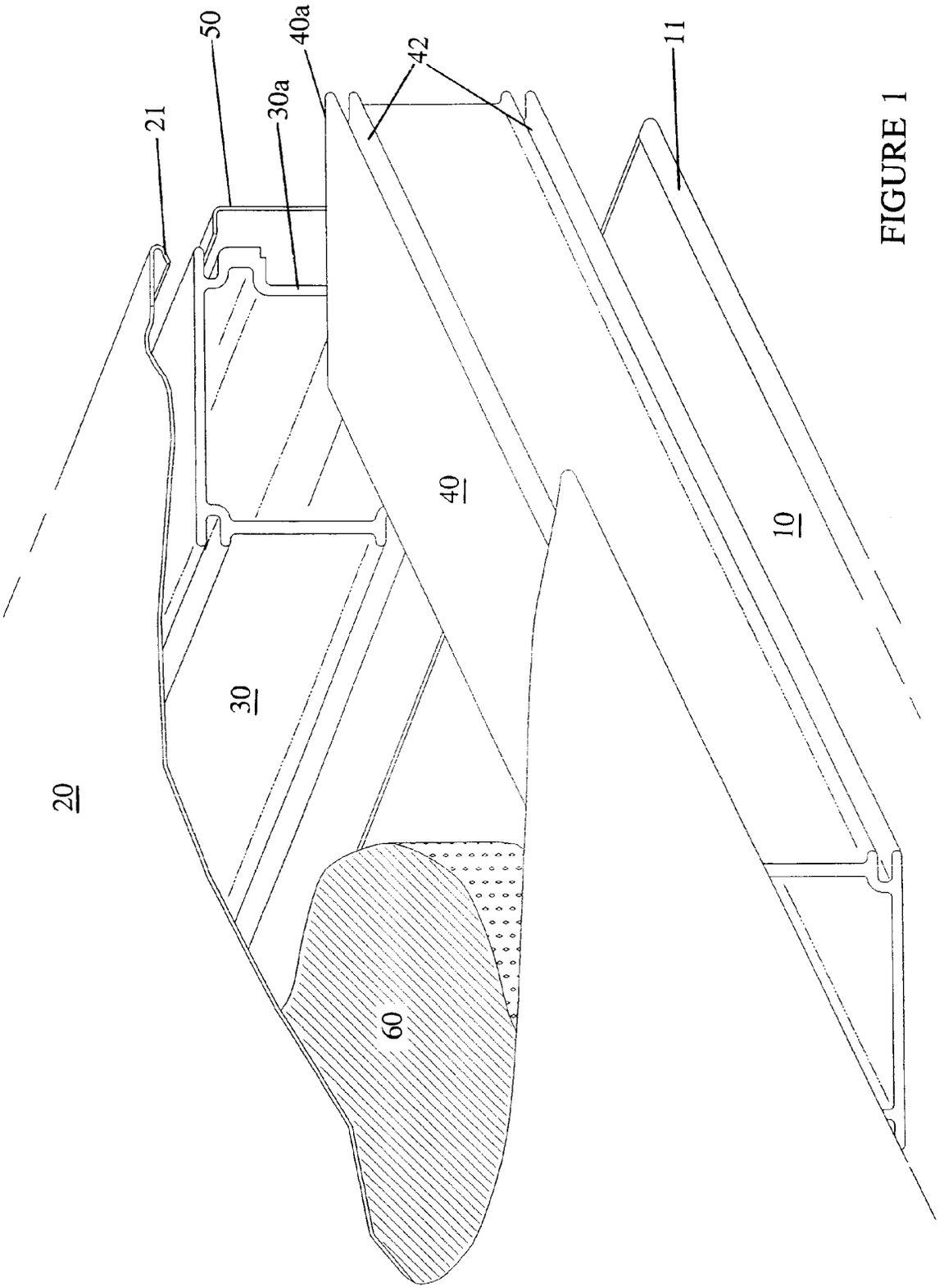

FIGURE 1

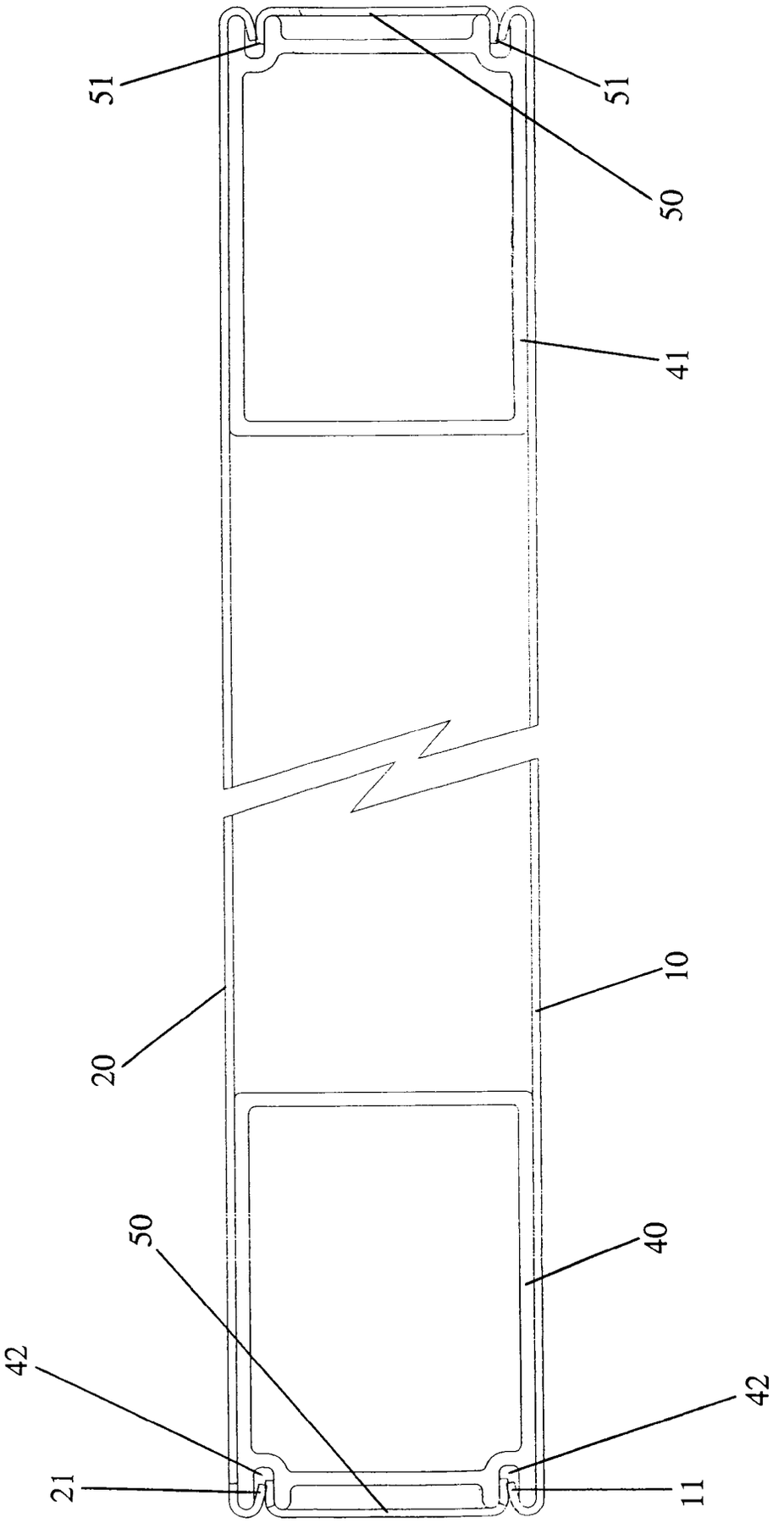

FIGURE 2

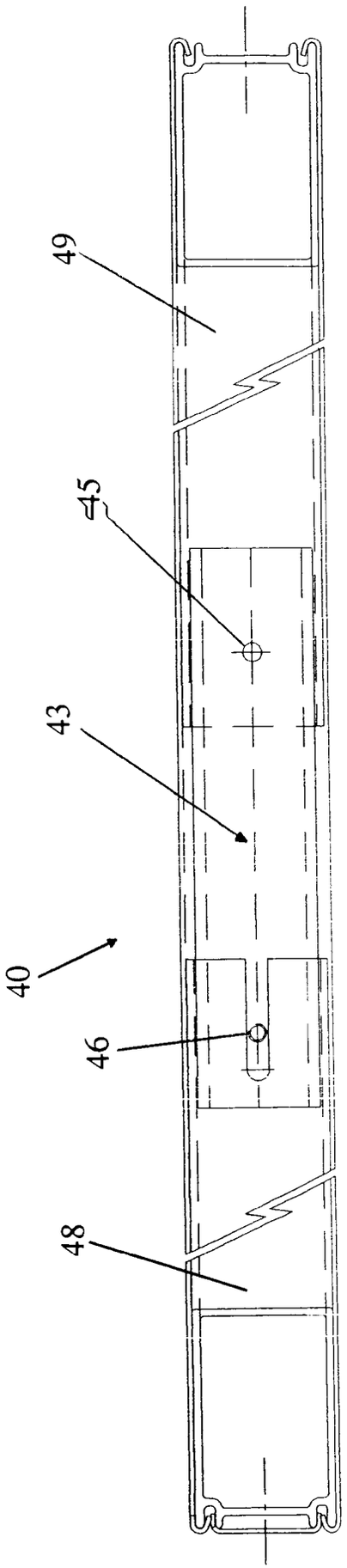

FIGURE 3a

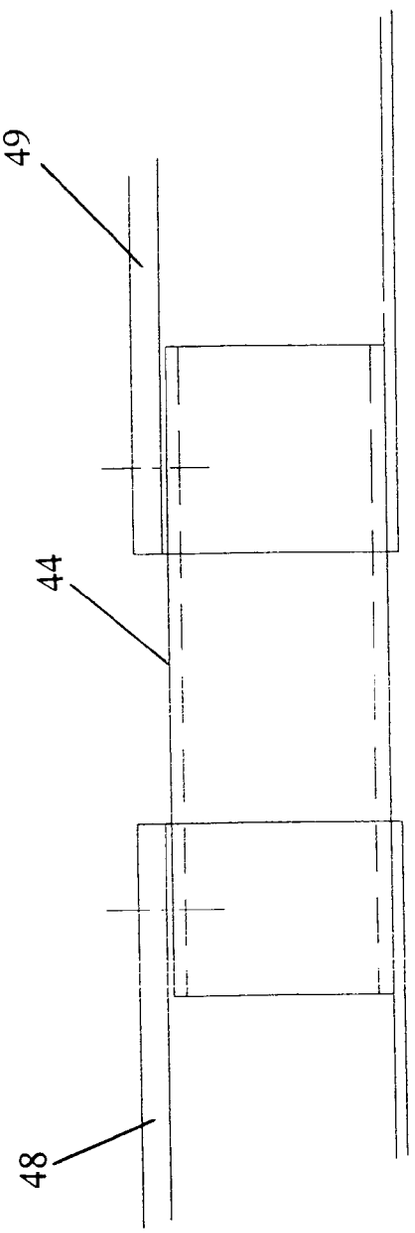

FIGURE 3b

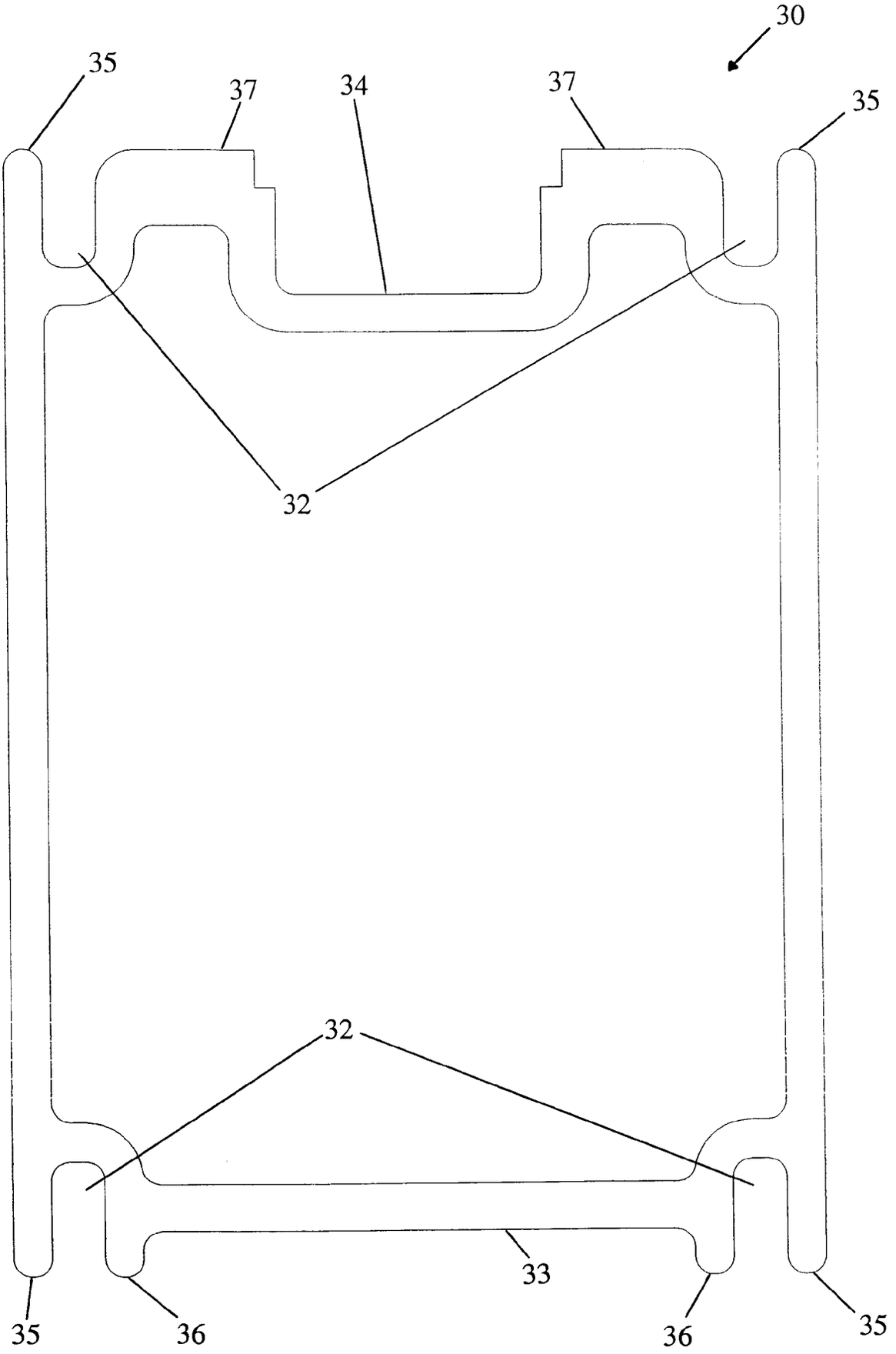

FIGURE 4

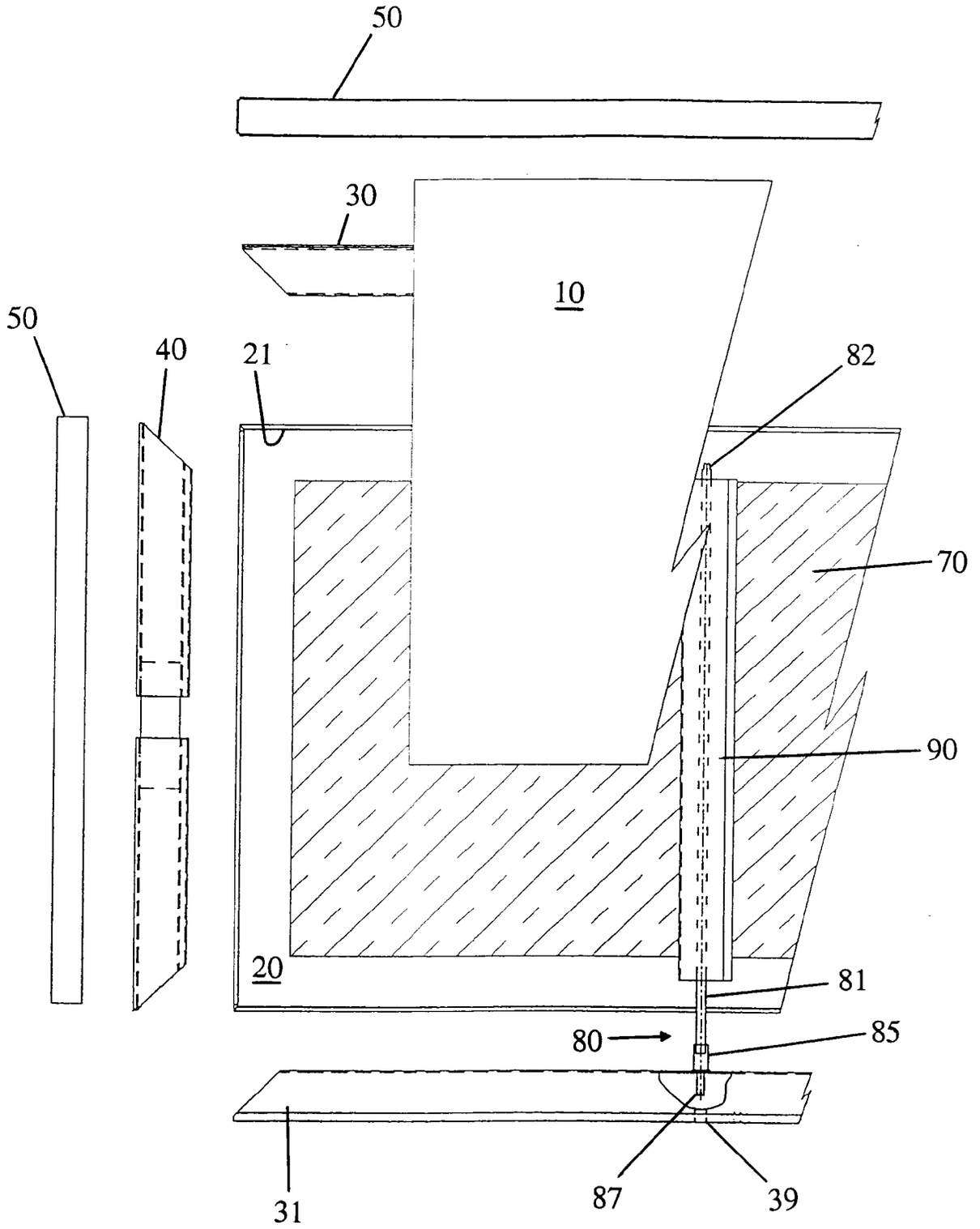

FIGURE 5

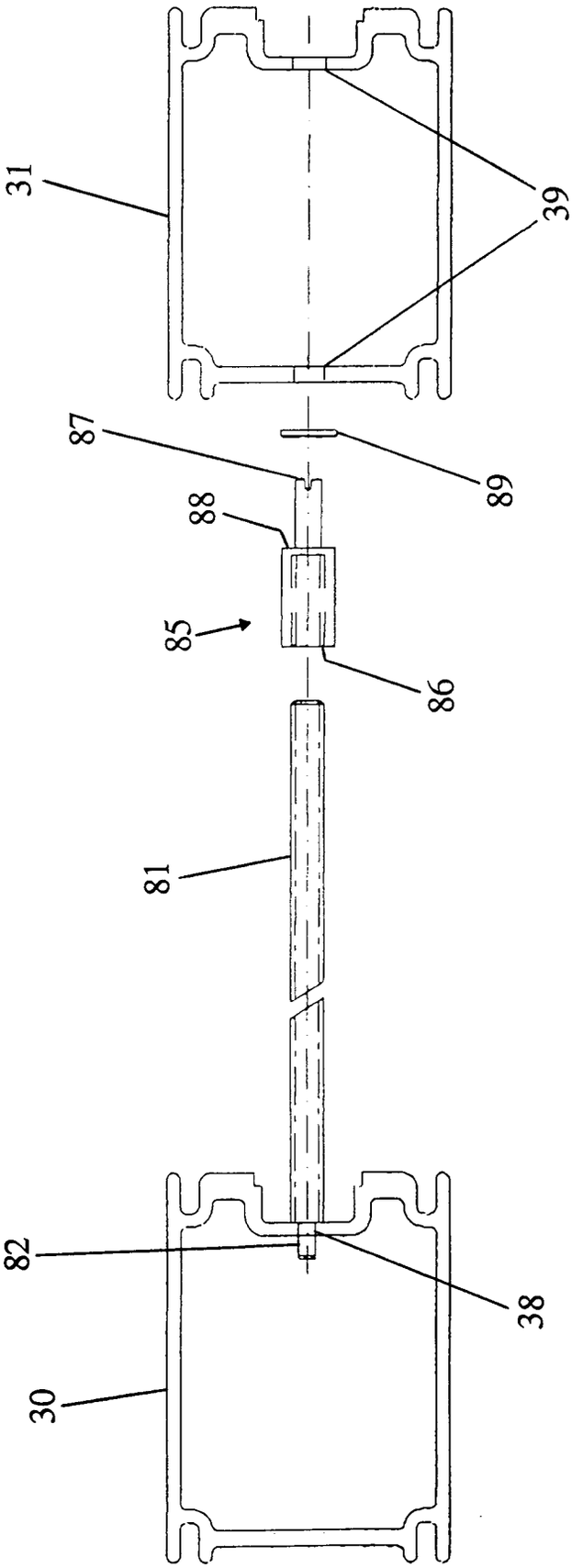

FIGURE 6