

Oct. 1, 1968

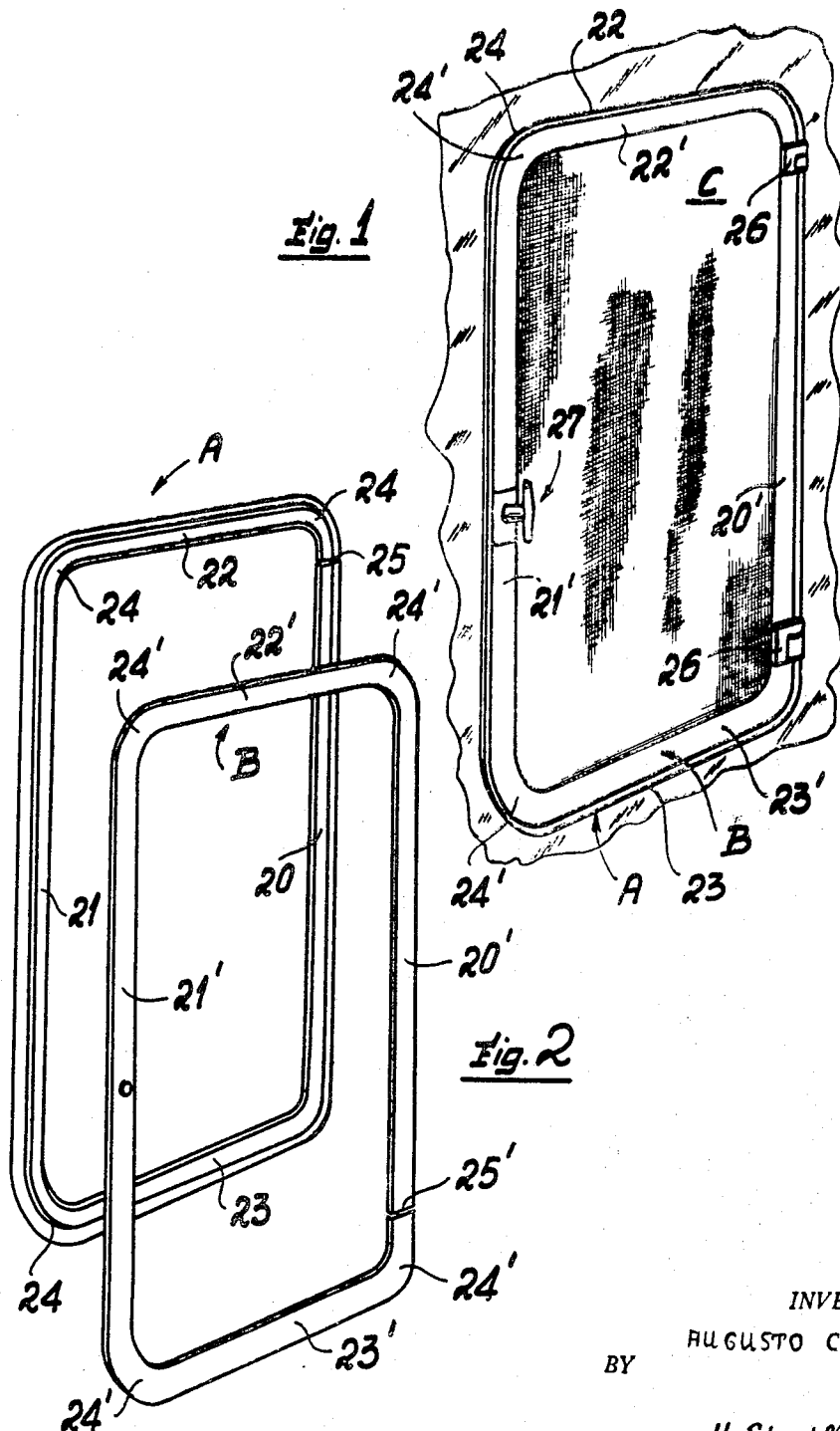
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3,403,476

WINDOW AND DOOR STRUCTURES

Filed July 13, 1966

4 Sheets-Sheet 1



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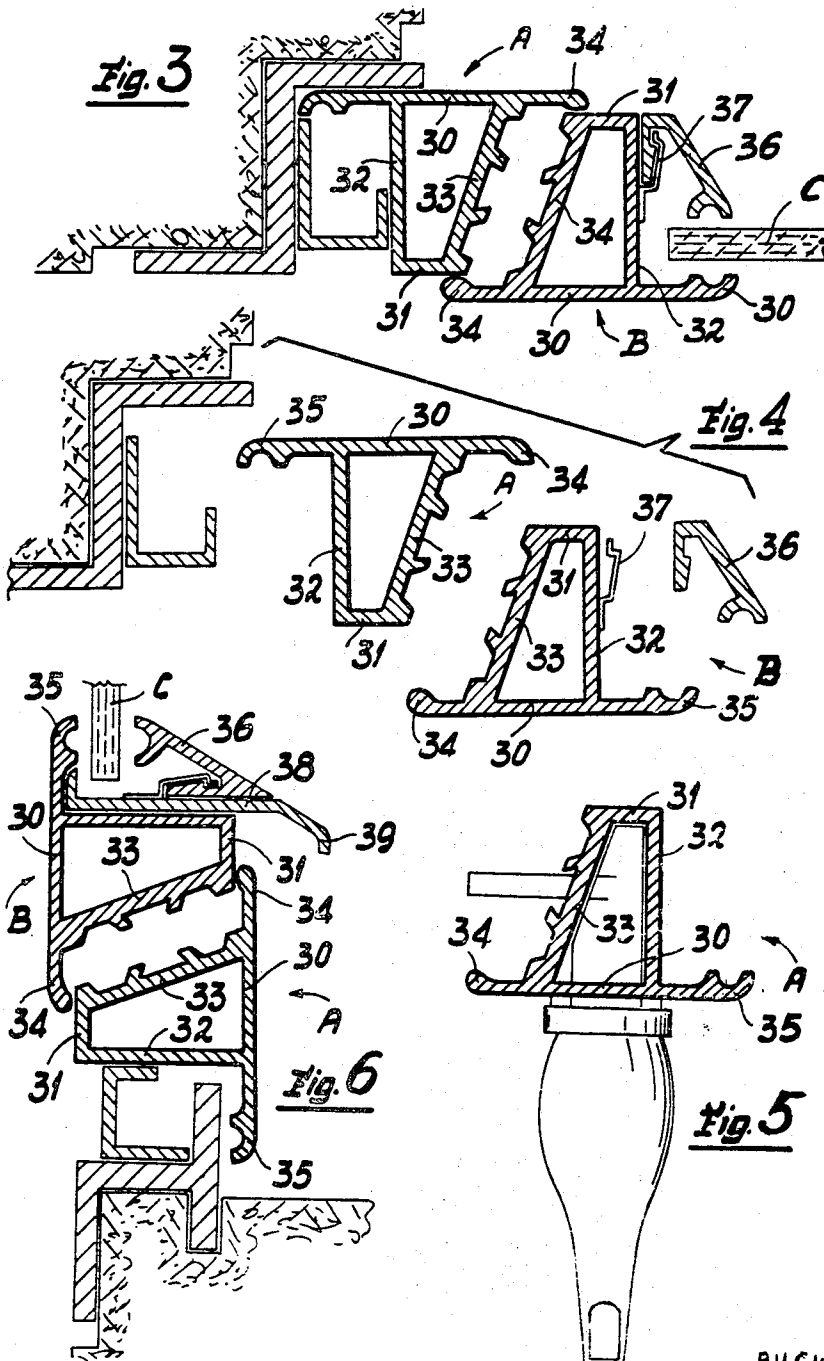
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WINDOW AND DOOR STRUCTURES

Filed July 13, 1966

4 Sheets-Sheet 2



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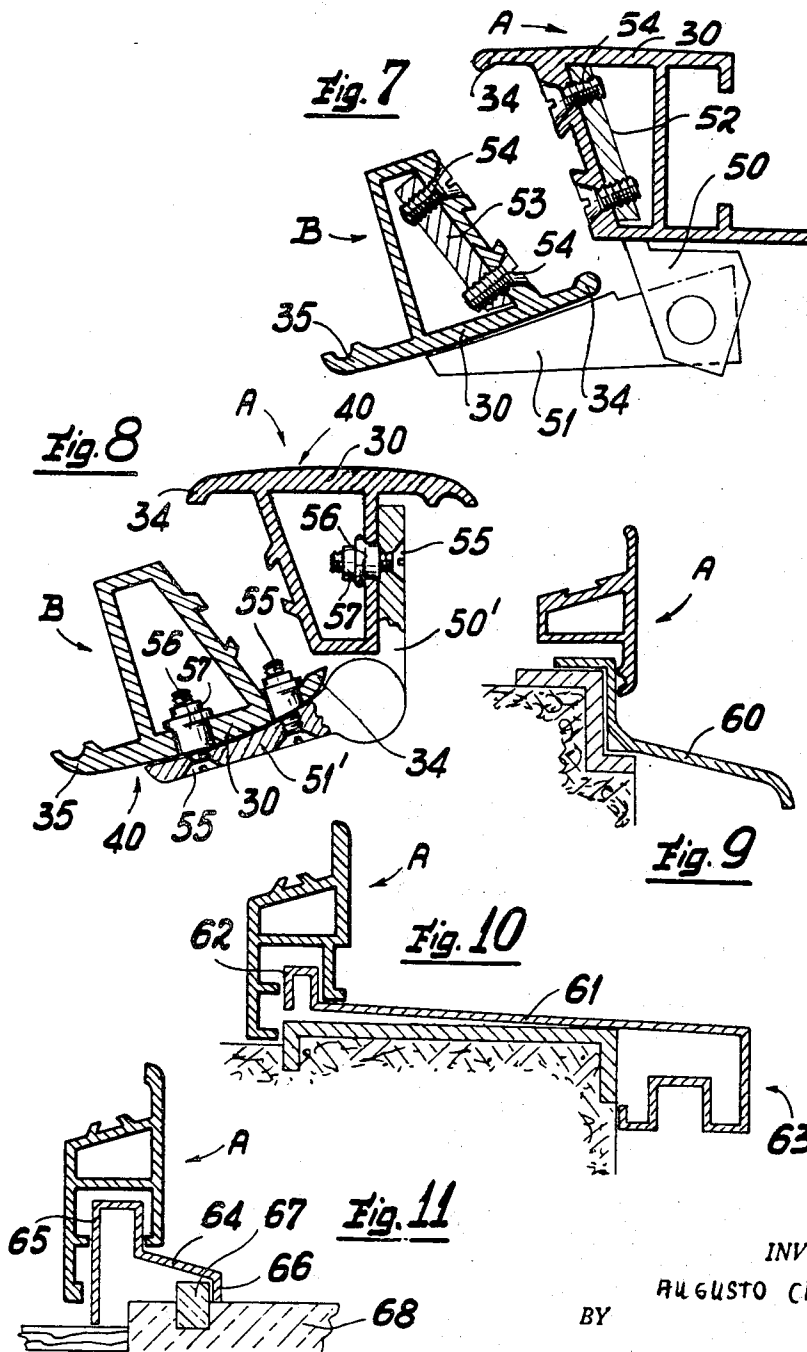
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WINDOW AND DOOR STRUCTURES

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4 Sheets-Sheet 3



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WINDOW AND DOOR STRUCTURES

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Filed July 13, 1966, Ser. No. 564,847

Claims priority, application Italy, July 21, 1965,

16,491/65

2 Claims. (Cl. 49—401)

ABSTRACT OF THE DISCLOSURE

Window and door frames whose fixed and mobile elements are formed of closed-section metal parts, essentially of trapezoidal shape and preferably scalene trapezoidal. In both the fixed and mobile elements, the skew side of the section is in parallel and juxtaposed to the coupled corresponding element. The element is coplanarly extended to the larger base of the trapezoidal section and thus forms a projection capable of meeting the smaller base of the trapezoidal part of the associated element with a certain tolerance for reciprocal positioning.

The invention relates to window and door structures, more particularly, to light metal frames. The invention, furthermore, pertains to a method of producing the fixed and mobile elements and their hinge connections.

One of the objects of the invention is the use of extruded structural elements, made of aluminum or other light metal alloys.

The utilization of light metals for structural shapes is well known per se and has a number of obvious advantages over more conventional structural elements made, e.g., of iron or wood. The light metal elements permit opened and closed sections of frames to obtain good abutment and register.

In general, according to the state of the art, both the mobile and fixed parts of frames form angular structures, essentially rectangular. Each side is fabricated of one length of a structural element. The contouring corners are formed by rigid connections between the extremities, cut at 45 or 90 degrees. These connections frequently are unsatisfactory, and difficulties have been encountered in making good and rigid connections between the frame elements. Moreover, for esthetic reasons, the frames usually carry a surface finish, e.g., a coating, and a loose connection becomes clearly visible after finishing. Welding is not a proper solution because the unevenness of the weld obviates a good surface covering. These connections therefore usually are made by mechanical means which do not assure permanent rigidity of the finished structure nor constant and continuous coplanarity of the attendant elements.

Furthermore, in order to avoid the formation of steps, fissures and other defects regarding coplanarity and continuity of the surfaces, the connection must be made in a very precise manner.

One of the objects of the invention is to provide a method for producing metal frames which not only avoids the disadvantages mentioned above, but which has advantages of manufacture and of economics, as will be set forth below in greater detail. This object is attained by the formation of fixed and mobile frame elements and structures which are extruded and which have a shape whereby at least a part of the adjacent sides is obtained by bending of the element which is extended at least along two sides and preferably all sides of the structure.

Another object of the invention is to provide a method for producing metal frames wherein the sides of the metal elements are bent, the bends forming the connections,

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element forming the adjacent sides. Particularly, the structural elements are capable of being bent to conform with the special requirements and thus to form the frame.

According to a salient feature of the invention, the fixed and mobile elements of the frame are formed of closed-section metal elements, essentially of trapezoidal shape and preferably of scalene trapezoidal shape, wherein the skew side of the section, in both the fixed and mobile elements, is in parallel and juxtaposed to the skew side of the corresponding element to be coupled thereto. Furthermore, the element is extended coplanarly to the larger base of the trapezoidal section thus forming a projection capable of meeting the smaller base of the trapezoidal part of the associated fixed or mobile element, with a certain tolerance for reciprocal positioning.

These and other objects, features and advantages will best be understood by the following description with reference to the accompanying drawings; however, it should be understood that these are given merely by way of explanation, and not of limitation, and that numerous changes may be made in the details without departing from the spirit and the scope of the invention as herein-after claimed.

In the drawings, FIGS. 1 and 2 show, in perspective and schematically, the salient feature of the invention, a window frame, closed and in its components, respectively;

FIG. 3 is a transverse section of a vertical length in a frame produced according to the invention;

FIG. 4 shows the elements of FIG. 3, removed from each other;

FIG. 5 illustrates the fixing of a handle latch to the frame;

FIG. 6 is a transverse section of the lower horizontal length of the frame;

FIGS. 7 and 8 show, in transverse section, two embodiments of applying hinges to frames formed of elements according to embodiments of the invention;

FIGS. 9–11 show examples of forming drips and connections of elements forming the fixed structure of the frame to window sills;

FIGS. 12 and 13 show, in frontal and simplified view, two examples of forming interior bodies using the frames according to the invention; and

FIG. 14 shows, in horizontal section, an example of hinging and anchoring a door, made, e.g., according to FIGS. 12 or 13, to a wall.

Referring now to these drawings, as shown schematically in FIGS. 1 and 2, the method provides for the formation of at least two, and preferably three or all four sides of the rectangle formed by the structural bays of the elements with solely one length of metal shape, preferably aluminum or other light metal alloy. This applies to the bay or fixed element A as well as to the mobile element B. In order to form the adjacent sides in the contour of said bays, e.g., the longer sides 20, 21 of the fixed bay or 20', or 23', respectively, of only one length of an element, the latter is bent over to correspond with the intermediate parts 24 and 24', respectively, connecting the sides, and bending occurs on the plane of the appertaining bays and with a minimum radius allowed by the characteristics of the element.

The contour of the bay is closed by abutting the ends of the lengths of elements. In the preferred embodiment wherein the bay is formed of a single length, the abutment advantageously is accomplished by approachment in a transverse plane to the element itself, said plane being at right angles to the direction or to the tangent of the straight or bent direction of the element. Preferably, the connection is effected, as shown at 25 and 25' (FIG. 2), in a position coincident with one of the hinges 26 (FIG. 1), or other ancillary element of the frame, so

as to mask the connection and simultaneously to utilize the element as a mechanical restraining means between the connected ends.

The frames are completed by attaching panels or the like C, occupying the space as delimited by the mobile element B, as shown in FIG. 1.

In order to facilitate bending of the material, an element generally is used having, at least in part, a section of closed contour, shaped scalene-trapezoidally. Examples of different sections are shown in FIGS. 3, 11 and 14.

A particularly advantageous embodiment is exemplified in FIGS. 3-6, wherein the structural elements show, in their sections, one closed contour part of scalene-trapezoidal shape, having a larger base 30 and a smaller one 31, one straight side 32, and an oblique one 33. The latter has some projections and/or grooves for the insertion and anchoring of seals made of rubber or other elastic material. The skew sides are mutually opposed when the frame is in closed position, as shown in FIGS. 3 and 6.

An appendix or projection 34 is disposed coplanarly to side 30. The edge of 34 is suitably rounded or similarly shaped and, when the frame is closed, partially overlaps and opposes the smaller base 31 of the associated element. Preferably, a second shaped appendix 35 is present, in coplanar position to the larger base 30, which is capable of acting as one of the sides for the peripheral channel for the glass pane or panel C which closes the space delimited by the mobile element B.

The pane or panel is fixed to the adjacent element by clamps 37 or other suitable means, using the pane-fixing element 36.

If and when desired, a further auxiliary element 38 may be inserted between the element and the pane-fixing device 36, and this may be suited to form the drip 39.

It has been found that the arrangement generally conforming to the embodiments shown in FIGS. 1-9 is particularly suitable for obtaining a band of a comparatively small radius on the plane in which the bases of the trapezoidal part are disposed. Bending also is made easier because the widest part in said plane coincides with the bigger base of the trapezoid.

Another important feature with respect to bending relies on the fact that the section of the element has no undercut or recess on the planes parallel to said bases. This permits bending under favorable conditions between the rollers of a bending machine, placed on the inside and outside of the bend. It also is advantageous for the manufacture of the frames to provide some tolerance or latitude in the overlap of part 34 to the smaller base 31 of the associated elements when forming the frame. It is evident that by having the element bent at a relatively narrow radius for making the fillets between adjacent sides, it may not be feasible to follow these narrow limits of the bending radii. Accordingly, even if there is some unevenness and lack of precision in the mutual adjustment between fixed and mobile bays, with localized variations of overlap between parts 34 and 31, these variations usually are very slight and of no practical consequence.

Furthermore, the strong skew of sides 33 of the trapezoidal parts permits approachment and separation of fixed and mobile elements, meaning an approachment between the skew surfaces relative to the direction of the reciprocal motion thus allowing for a more favorable adherence between the elastic seals or packings, even in the instance of comparatively large tolerance in the mutual positions, when the frame is closed.

When the frames are formed with bent fillets of relatively small radius, the wider lengths, as formed by parts 34, 30 and 35, may undergo a certain deformation, particularly some camber or convexity. In order to minimize this deformation, the external surface 40 of the length (shown in FIG. 8) may originally be of convex shape so that a small variation in the convexity is hardly visible.

The frames according to the invention may be anchored to the masonry by means of shapes or metal elements, particularly those made of iron, in different combinations and arrangements, examples of which are shown in FIGS. 3-6. Other arrangements may be made for special purposes.

Similarly, several ways may be adopted for hinging the mobile elements to the fixed ones. As shown in FIG. 7, elements 50 and 51 of the hinges may be provided with appendices 52 and 53, respectively, which are inserted in the cavities of the corresponding trapezoidal section parts and fixed thereto by means of bolts 54, whose heads are accessible only when the frame is opened so as to ensure their protection and masking in closed state of the frame. The elements 50' and 51' of the hinges (FIG. 8) may also be on the outside of the elements, for instance fastened by bolts 55 which are inserted in tapped holes which preferably, beforehand, are provided with sleeves 56 of an elastic material, rubber, plastic, or other suitable compound. The sleeve is capable of expansion following the axial pressure exerted when tightening the bolts with nuts 57, previously assembled thereon and dimensioned so as to be initially inserted through holes cut into said elements.

In a similar manner, the other ancillary and complementary parts may be connected to the elements, such as latches, handles, and the like. A handle latch connection is shown in FIG. 5.

Drips, gutters and other parts may be provided in correspondence with the lower part of the frames, associated to the fixed element A, as shown, e.g., in FIGS. 9-11. FIG. 9 illustrates a drip 60 projecting at the base of a window, level with the outer surface of a wall. In a similar manner, drips may be placed on the upper part of the window.

FIG. 10 shows the manner in which the fixed element A of a frame (the section of which exemplifies a variation of the shape) may be associated with a sill cover 61 having a shaped part 62 inside the element and an external part 63 forming the drip. A further variation is illustrated in FIG. 11, where the side of the base (and possibly other sides of the contour) are associated with the element by means of a complementary element 64 provided with a part 65 which is disposed inside the shape forming fixed part A, and an external part 66 which straddles a relieved edge 67, made of metal, marble, concrete, or the like, suitably embedded in window sill 68.

As previously mentioned, the method according to the invention readily is adopted for the manufacture of doors, particularly for indoors use. In this instance, it normally is desirable that the vertical uprights of the doorpost get down to the floor forming right angles with the same. In such cases, the fixed structure A of the frame, forming an abutment for the doorpost, may be built of a single length including two straight, vertical parts 20 and 21, similar to the parts shown in FIG. 2, and bent parts of fillet 24, the lower side being open, its part being taken by the floor itself.

The mobile structure placed around panel C is formed by a length which, being bent as 24', forms the upper side 22' and the vertical sides 20' and 21', while the lower side is formed by a second straight length 70, connected squarely at 71 to the lower ends of said vertical sides. An auxiliary panel 72, which may, for instance, be of cast or molded light metal, completes the base of the mobile element of the frame, the whole assembly being shown in FIG. 12.

The contour of panel C may be shaped integrally according to the typical structural arrangement as shown in FIGS. 1 and 2, i.e., of a single length which is bent four times at 24, thus forming all the sides of the bay and in this case the auxiliary panel 72' may have upper side ends bent so as to complete the enclosure of the entire space delimited by the fixed structure of the frame, as shown in FIG. 13.

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The fixed and mobile parts of the door may be hinged in any convenient manner, as previously described. For instance, element 80 of a hinge may be connected to the mobile element as described with reference to FIG. 8, while the second element 81 of the hinge may be fixed, e.g., by the previously described means of using expansion bolts, to an element 82 forming a contour or completion of the doorpost and associated with the contour formed on the opposed side by the fixed element A, the section of which may, for instance, be the one shown in FIG. 14.

What is claimed is:

1. A rectangular frame structure having a fixed and a corresponding mobile element and forming fillets between their adjacent sides, which comprises one length of each said element bent so as to form a rectangle as a single element, the ends of one element abutting substantially at the upper part of one of the long sides of the rectangle, the ends of the corresponding element abutting substantially at the lower part on the same long side of the rectangle, said two elements being connected by hinge means along said one long side; and closing means at the opposite long side of the rectangle; each said single lengths being

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closed contour parts of trapezoidal shape, the inclined sides on both said fixed and mobile element opposing each other when said structure is in closed position; the bend being in a plane parallel to the one by the bases of said trapezoidal shape; said trapezoidal shape being provided, coplanarly to its bigger base, with a protruding part partially overlapping the smaller base of the opposed element when the frame is in closed position; said trapezoidal shape further being provided with at least one projection essentially coplanar to one of the bases of said trapezoidal shape on its bigger base.

2. The structure as defined in claim 1, wherein said shape is scalene trapezoidal.

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