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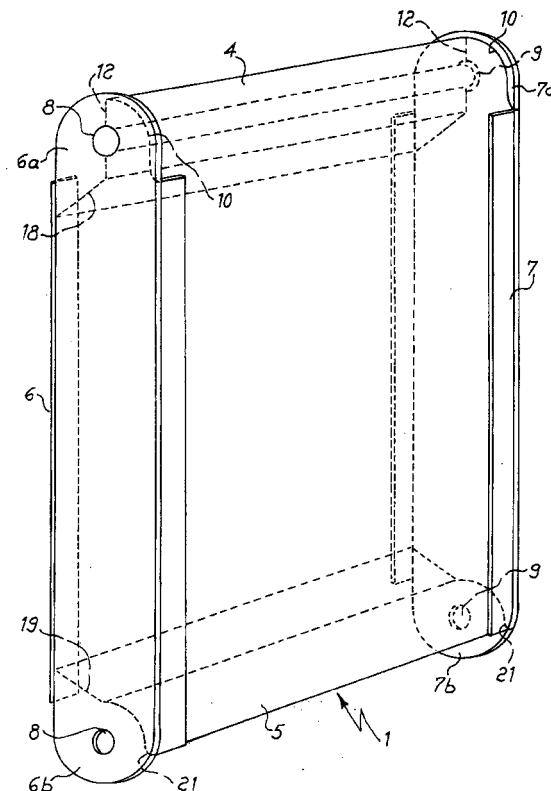
(54) **Panel for sectional doors**

(57) The invention relates to a panel for sectional doors having an inner front wall (2) and an outer front wall (3) facing each other and joined at the top and at the bottom by respective edges, i.e. a top edge (4) and bottom edge (5); said edges have matching profiles with a convex surface (10) in the case of the former and a

concave surface (20) in the case of the latter.

Both the convex surface (10) and the concave surface (20) are joined to the front walls (2,3) by bevelled surfaces (18,19) inclined so as to favour mutual rotation of hinged panels, preventing possible trapping of the hands of a user.

*Fig.1*



## Description

**[0001]** The invention relates to panels used for the construction of sectional doors of industrial or civil structures such as warehouses, garages and the like.

**[0002]** As is known, in these doors the panels are connected to each other in a hinged manner so as to form a folding structure which is guided by guides provided in the adjacent wall, during its movements upwards or downwards in order to open and close the door.

**[0003]** The abovementioned panels have a substantially parallelepiped shape and usually are made externally of sheet metal; they are rendered thermally insulating by injecting polyurethane foam or the like inside them, but there also exist panels which are internally empty or in any case made in a different manner and using other materials (plastic, wood, aluminium, etc.).

**[0004]** What is interesting here is the fact that in order to make the doors safe during the opening and closing operations, generally performed by motorized systems, the edges of the panels herein considered are shaped.

**[0005]** More specifically, the top edge of each of them is profiled with a convex surface while the bottom edge with a matching concave surface, so that when the panels are vertically aligned to form the door, these surfaces rest facing each other; said surfaces also have a centre of curvature which coincides substantially with the axis of rotation of the adjacent hinged panels.

**[0006]** In this way a gap is defined between the two surfaces, which is sufficiently small to avoid that during relative rotation of the panels a person's fingers be accidentally introduced between them.

**[0007]** This configuration of the edges of the panel has been known for long time and is described in several patents including French patent No. 1,310,605, dating back to 1962, and German Utility Model No. 88.00956 of 1988.

**[0008]** The joining hinges of the panels are generally arranged on the inner side thereof, namely on their faces directed towards the inside of the garage, warehouse or other premises closed by the door.

**[0009]** As can be seen from the figures of the aforementioned prior documents, in this manner when the door is open or closed by moving it along the guides provided in the wall, the adjacent panels rotate with respect to each other about the axis defined by the hinges, and their concave and convex surfaces remain facing each other, so as to prevent accidental introduction of a finger between them.

**[0010]** This applies either to the outer and the inner side of the door; in both cases, indeed, the relative rotation of the panels exposes only a part of their concave and convex surfaces, without giving rise to any opening (besides the abovementioned gap) between the two panels which might close up during their relative movement and inside which a person might let their fingers trapped.

**[0011]** There are, however, doors wherein the joining

hinges of the panels are positioned in recesses formed on their inner side.

**[0012]** This is done, for example, to not have hinges projecting off the surface of the panels or, in other cases, to move forwards the axis of rotation thereby facilitating the relative movement of the panels; this solution is advantageous in the case of panels of considerable thickness.

**[0013]** An example of what has been just stated is described in European patent No. 370378.

**[0014]** However, as can be seen also from the drawings of this patent the recesses formed by the stepped zones of the panels create spaces into which a person's fingers can be introduced, with the risk of dangerous injury.

**[0015]** Furthermore, in order to keep the panels vertically aligned in the closed condition of the doors it is necessary to create a stop surface between their mating surfaces, i.e. in the region of their concave and convex surfaces.

**[0016]** Indeed, in the case of panels with recesses the stepped zones or the adjacent concave and convex surfaces must be used to form a stop surface between the panels, in order to keep them vertically aligned in the closed position of the door.

**[0017]** However, contact between the surfaces of the panels may cause deterioration thereof over time; reference could be made, for example, to the case of painted or galvanized surfaces: it can be understood that the bearing contact between one panel and another may damage their surface lining, thereby exposing the panels to the risk of corrosion by the external environment.

**[0018]** The present invention aims at remedying this state of the art.

**[0019]** Namely, its object is to provide a panel for sectional doors in which the axis of rotation is positioned between the planes where its inner and outer faces lie, without giving rise to the risk of injury to a person's fingers when the door is operated and without requiring mutual bearing contact between the panels in order to align them vertically, when the door is in the closed position.

**[0020]** This object is achieved by a panel whose characterizing features set out in the claims accompanying this description.

**[0021]** The invention will be better understood in the light of the description provided below, relating to a preferred and non-exclusive embodiment thereof illustrated in the accompanying drawings wherein:

- Fig. 1 is a perspective view of a panel according to the invention;
- Figs. 2 and 3 show a cross-sectional view of two connected portions of panels according to the invention, respectively in a vertically aligned and in a rotated condition;
- Fig. 4 shows a variation of part of the panel according to the preceding figures.

**[0022]** With reference to these figures, numeral 1 denotes overall a panel according to the invention for sectional doors of industrial warehouses, garages and other similar premises.

**[0023]** The panel 1 has two facing flat walls 2 and 3 which are oriented respectively towards the inside and towards the outside of the area closed by the door and which form the visible surfaces thereof; for this reason, the walls 2 and 3 of the panel will also be called hereafter the inner face and outer face.

**[0024]** The walls 2, 3 are preferably made of sheet metal, as is generally the case with this type of panel, but could also be made of other suitable material (such as plastics, etc.); similarly, the inside of the panel may be filled with any material or may be empty and also reinforced with honeycomb structures and the like.

**[0025]** The panel 1 has a top edge 4 and a bottom edge 5 at the ends of the walls 2 and 3, which are shaped in the manner that will be better explained below; the panel is also closed along its transverse sides by two sections 6 and 7 terminating at the top and at the bottom in respective end parts 6a, 6b and 7a, 7b, wherein holes 8 and 9 are provided.

**[0026]** Considering the profile of the top edge 4 of the panel 1, from the drawings it is possible to see how it has a convex surface 10 situated on the part directed towards the outer face 3 to which it is joined at the bottom by a rounded step 11.

**[0027]** At its opposite end, the convex surface 10 is connected to a flat surface 12 parallel to the faces 2 and 3 of the panel; in accordance with a preferred embodiment of the invention, this flat surface 12 lies on the centre line between the two faces 2 and 3 as well as the centre of rotation of the hinge 15 which connects two adjacent panels in the door shown in Figures 2 and 3.

**[0028]** The centre of rotation of the hinge also coincides with that of the curvature of the convex surface 10; for this purpose, the pivot 16 of the hinge is housed inside a recess 17 formed along the flat surface 12 so that its centre is coplanar with the latter and therefore also lies on the centre line of the panel 1.

**[0029]** The profile of the top edge 4 of the panel 1 terminates in a bevelled surface 18, which is inclined at about 45° with respect to the flat surface 12 and joins the wall 2.

**[0030]** This bevelled surface is identical and symmetrical, with respect to a plane transverse to the vertically aligned panels (like in Fig. 2) passing through the axis of rotation of the hinge 15, to a second bevelled surface 19 present on the profile of the bottom edge 5.

**[0031]** The latter also has a concave surface 20 matching the convex surface of the bottom edge and is connected to the external wall 3 of the panel at a tip 21; preferably the distance between the latter and the rounded step 11 of the top edge of an adjacent panel is such as to prevent a person's fingers from remaining trapped when the panels rotate with respect to each other during closing of the door.

**[0032]** The hinge 15 comprises two arms 28, 29 like to each other and each configured along a broken line which, from the pivot 16, follows the profile of the panels connected by the said hinge.

**[0033]** In particular, a first portion 28a, 29a of these arms extends along the flat surface 12 of the top edge 4 of a panel when the latter is vertically aligned with the adjacent panel as shown in Fig. 2, while a second portion 28b, 29b extends respectively along the bevelled surfaces 18 and 19; the terminal portion 28c, 29c of the hinge arms is then fixed to the inner wall 2 of the panels by means of screws in a manner known per se.

**[0034]** It is important to note that, when the panels are vertically aligned as in the closed condition of the door, the portion 29a of the arm 29 bears against the flat surface 12 so that the latter basically forms a stop abutment for rotations of one panel with respect to the other, in the clockwise direction with reference to Figures 2 and 3.

**[0035]** Last it must be added that the greater is the length of the panels, the greater will be the number of hinges used to connect them; in this context it must be pointed out, however, that according to a preferred embodiment of the invention, the hinged connection of the panels is also ensured by bolts passing through holes 8 and 9 provided in the respective sections 6 and 7.

**[0036]** Indeed, the end parts 6a, 7a of the sections are shaped so as to be arranged alongside those 6b, 7b of the other panel, thereby bringing the respective holes 8, 9 into alignment so that the aforementioned bolts (not shown in the drawings) may be inserted therein.

**[0037]** Moreover, it just has to be mentioned that these holes are also coaxial with the pivots 16 of the hinges 15 which connect the panels and are arranged along the recess 17 of their top edge 4.

**[0038]** From what has been explained hitherto it is possible to understand the functioning of the invention embodiment herein considered.

**[0039]** As regards rotation of the panels, the convex surface 10 and concave surface 20 of each of them allow their relative movement, preventing the introduction of fingers there between, in accordance with the principles of the known art.

**[0040]** Furthermore, the axis of relative rotation of the panels is located in an advanced position with respect to the inner wall 2 thereof, thereby achieving the advantages arising therefrom and mentioned above; however, it can be easily understood that owing to the presence of the bevelled surfaces 18 and 19, all the stepped zones which were present in the panels of the prior art have been eliminated.

**[0041]** In this manner, also on the inner side of the panels there is no space inside which the fingers of a person's hand can be introduced, with the risk of being crushed.

**[0042]** This situation is visible in Figure 3 which shows rotation of an upper panel and lower panel in a door; this rotation occurs in this case through an angle  $\alpha$  of about

75°, but in any case it could arrive up to 90°.

**[0043]** With an opening of 75° a safety distance remains between the bevelled surfaces 18 and 19, so as to prevent injury to fingers which might be accidentally inserted between the panels.

**[0044]** It should be noted in this connection that the angle of inclination of the bevelled surfaces 18 and 19 will be chosen depending on the maximum rotation envisaged for the two panels, so as to maintain the safety distance between them in any condition; preferably, the aforementioned inclination should in any case be such that the bevelled surfaces rest parallel (as in Fig. 3) when the maximum rotation of the panels is reached.

**[0045]** These important results are achieved avoiding the need for having to join the panels together by resting them on each other, in order to obtain vertical alignment thereof when the door is closed.

**[0046]** Indeed, in the present invention when the panels are arranged along the vertical, the portion 29a of the arm 29 of the hinge 15 comes into abutment against the flat surface 12 (cf. Figure 2), ensuring correct alignment of the panels.

**[0047]** In other words, in this invention the hinge 15 provides for halting the relative rotation of the panels, since it acts as an abutment stop owing to a part thereof which comes into abutment against the edge 4 of the same panel where the abovementioned axis of rotation is situated.

**[0048]** This is made possible precisely by the elimination of the stepped zone, lugs or the like, which are present in the bottom edges of the known panels to form male/female joints with the top edge of the adjacent panels.

**[0049]** These zones are present in the panels of the prior art, for example such as those in the abovementioned European patent No. 370,378, and prevent use of the arms of the hinge according to the principle of the present invention.

**[0050]** As can be seen, therefore, the panel for sectional doors according to the invention achieves the object set out initially of having an axis of rotation arranged between the planes of its inner and outer faces, overcoming at the same time the drawbacks relating to the known panels in the art.

**[0051]** There are also some advantageous aspects of the embodiment of the invention considered above.

**[0052]** First of all it is important to mention that the simultaneous use of the hinges and the bolts passing through the holes 8 and 9 of the sections 6 and 7, avoids any problems due to longitudinal flexing of the panels.

**[0053]** Indeed, in principle the aforementioned bolts could be sufficient for the hinged connection of the panels; however, in such a case the panels would be supported only at their ends so that they could bend and touch one another along their respective concave and convex surfaces, if they were long and/or heavy.

**[0054]** In the embodiment of the invention considered above, it may instead be appreciated, that the panel 1

is connected to the adjacent panels in the door, both by means of the hinges 15 and by means of the bolts passing through the holes 8 and 9 in the sections 6, 7; in this manner the hinges are able to avoid longitudinal bending of the connected panels, thereby preventing any possible contact between them.

**[0055]** If this were not the case, it would be necessary to insert a low-friction sliding element on the convex surface 10.

**[0056]** It is also obvious that the number of hinges used in this case is less than that which would be required if the bolts engaged in the holes 8 and 9 of the sections 6 and 7, were not used.

**[0057]** In other words, the present invention can be advantageously applied to panels such as those in the example referred to above, where the transverse sides are formed by sections used for the engagement of bolts or the like, in the hinged connection of the panels.

**[0058]** Another advantage achieved by the invention consists in the possibility of arranging the axis of rotation of the panels, coplanar with the flat surface 12 lying along the centre plane between the inner and outer walls 2 and 3.

**[0059]** Indeed, in this manner the door is centered with respect to the roller guides present in the side wall which defines the opening closed by it; the aforementioned rollers are arranged along the axis of rotation of the panels, in a position away therefrom.

**[0060]** It should also be noted that both the convex surface 10 and the concave surface 20 extend from the outer face 3 of the panel to its centre line; this configuration allows the presence of bevelled surfaces 18, 19, which are symmetrical with respect to a median plane transverse to the walls of each panel, such that when they are vertically aligned they are also symmetrical with respect to the horizontal plane which passes through the axis of rotation of the hinges (cf. Figure 2).

**[0061]** In this way a balanced distribution of the forces is obtained, thereby favouring correct operation of the door.

**[0062]** Obviously, variants of the invention with respect to that described hitherto are possible.

**[0063]** One of them can be seen in Figure 4 which shows, using the same numbering referred to before, a cross-sectional view of the top edge 4 of the panel.

**[0064]** Basically this variant differs from the preceding one in that the convex surface 10 has, formed along it, a groove 30 which runs along the top edge 4 and is used to house a seal between the convex surface and the matching concave surface 20 of an adjacent panel in the door.

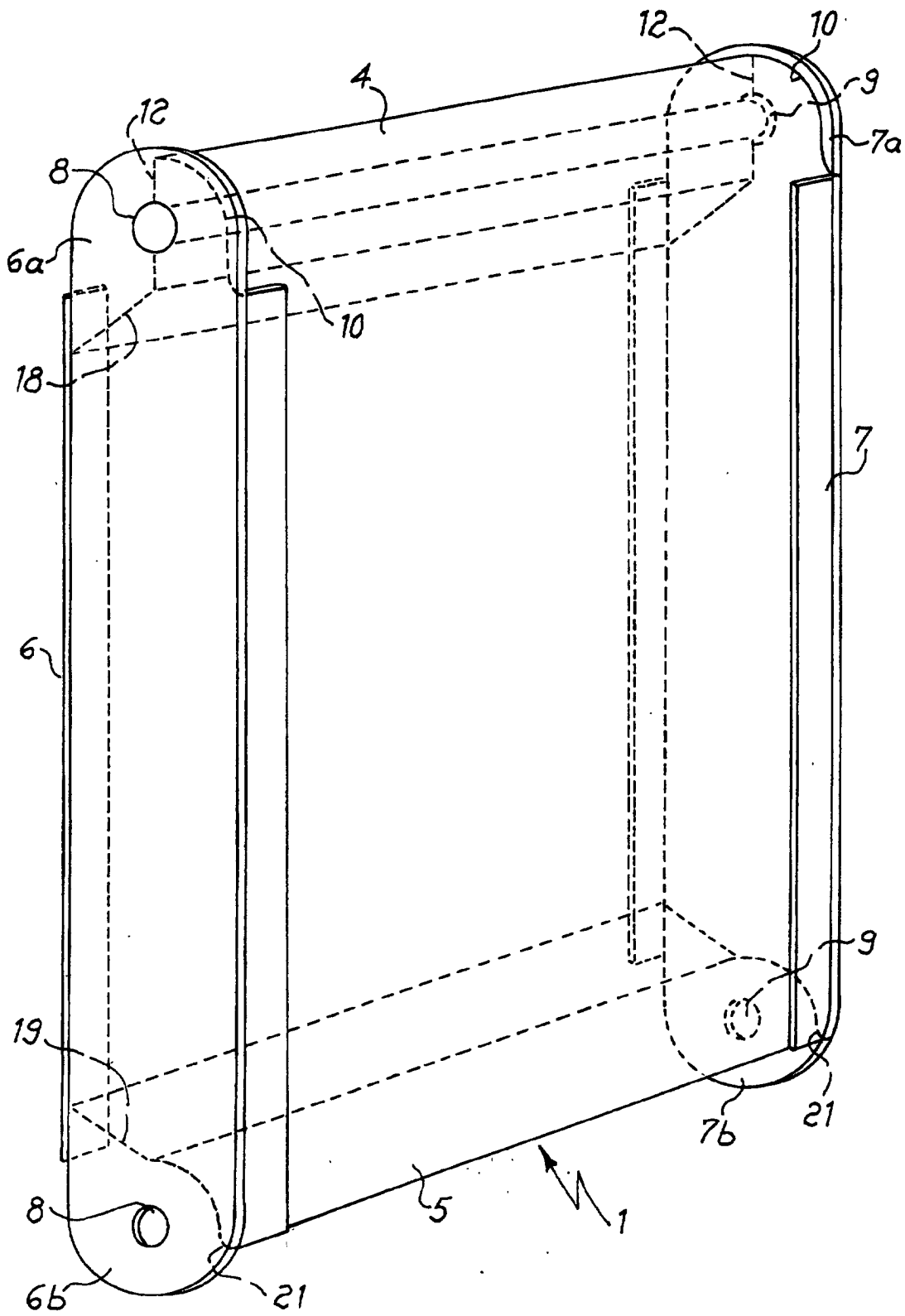
**[0065]** It is also obvious that additional grooves similar to the one above, may be provided in the same surface and that it (or they) may be formed on the concave surface instead of on the convex surface.

**[0066]** These and other possible variants nevertheless fall within the scope of the claims which follow.

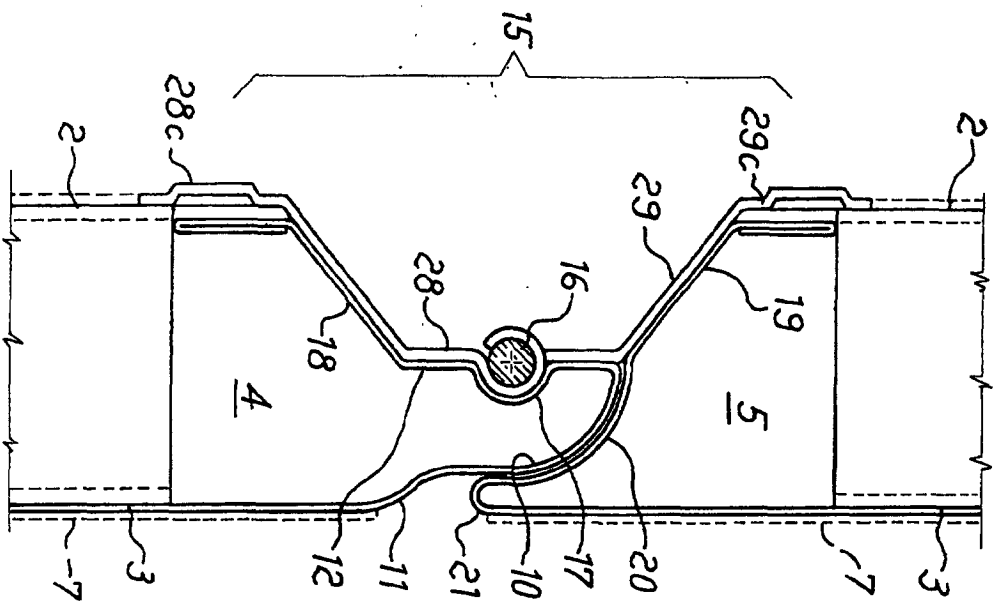
## Claims

1. Panel for sectional doors, comprising an inner front wall (2) and an outer front wall (3) facing each other, a top edge (4) and a bottom edge (5) which delimit these walls at the top and at the bottom and whose profiles comprise respectively a matching convex surface (10) and a concave surface (20) extending from the outer front wall, **characterized in that** the convex surface (10) joins up a flat surface (12) which is substantially parallel to the inner and outer walls of the panel and which is joined to the inner front wall by a bevelled surface (18) inclined towards said bottom edge (5), and **in that** the concave surface of the bottom edge is joined to the inner front wall by a bevelled surface (19) inclined towards the top edge. 5
2. Panel according to Claim 1, wherein the flat surface (12) lies along the centre plane between the inner wall (2) and the outer wall (3). 10
3. Panel according to Claim 2, wherein the concave surface of the bottom edge (5) extends from the outer front wall (3) to the centre plane between the latter and the inner wall (2). 15
4. Panel according to Claim 3, wherein said bevelled surfaces (18, 19) are symmetrical with respect to a median plane of the panel perpendicular to that of the inner wall and outer wall (2, 3). 20
5. Panel according to any one of Claims 1 to 4, wherein a recess (17) for housing pivots (16) of the hinges (15) for connection to an adjacent panel in the door, is present along the flat surface (12) of the top edge (5). 25
6. Panel according to Claim 5, comprising two sections (6, 7) which laterally close the inner and outer front walls (2, 3) at their ends and which are provided with end parts (6a, 7a; 6b, 7b) having holes (8, 9) at locations corresponding respectively, with the recess (17) and the axis of rotation of the panel about an adjacent panel. 30
7. Panel according to any one of the preceding claims, wherein a groove (30) extending along the corresponding edge of the panel is present on the convex and/or concave surface (10,20), for mounting of a seal. 35
8. Sectional door, **characterized in that** it comprises a plurality of panels according to Claims 1 to 7. 40
9. Door according to Claim 8, wherein the panels are connected by hinges (15) having their axes of rotation formed in the aforementioned flat surface (12) and wherein a portion (29a) of an arm (29) of the hinges fixed to the bottom edge (5) of an adjacent panel is in abutment against a part of this flat surface, in order to align vertically the panels in the closed condition of the door. 45
10. Door according to Claim 9, wherein the hinges comprise a first and a second arm (28, 29) symmetrical with respect to the hinge axis of rotation when the panels are aligned vertically, and whose profile follows respectively that of a part of the flat surface (12) and of a bevelled surface (18, 19) of the connected panels. 50
11. Door according to Claim 10, wherein the panels are also connected by bolts fitted in the holes (8, 9) present in the end parts (6a, 7a; 6b, 7b) of the sections (6, 7) which form transverse sides thereof. 55

Fig. 1



*Fig. 2*



*Fig. 3*

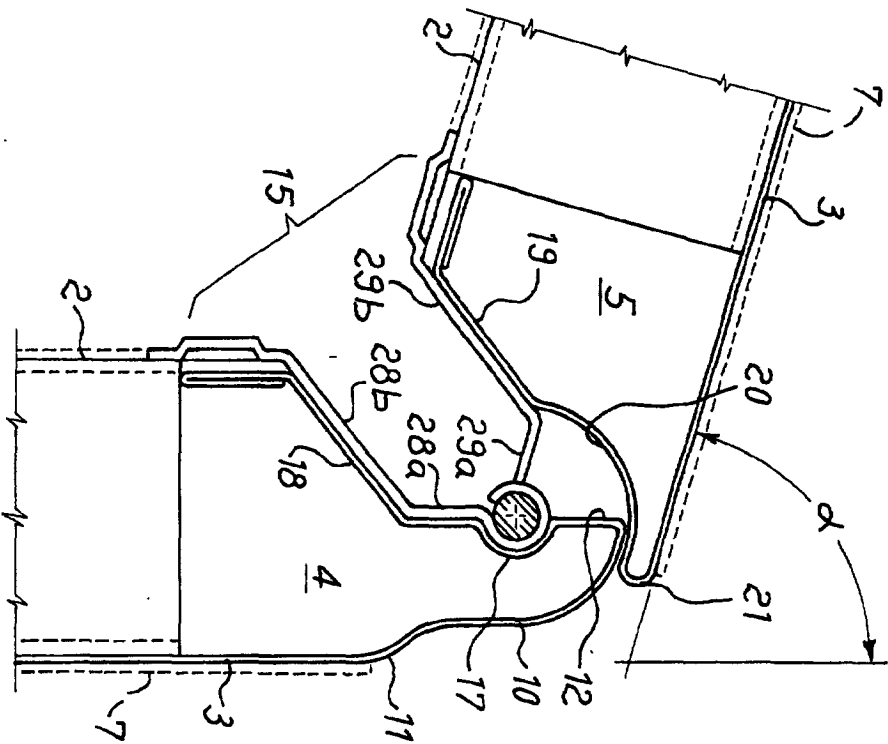
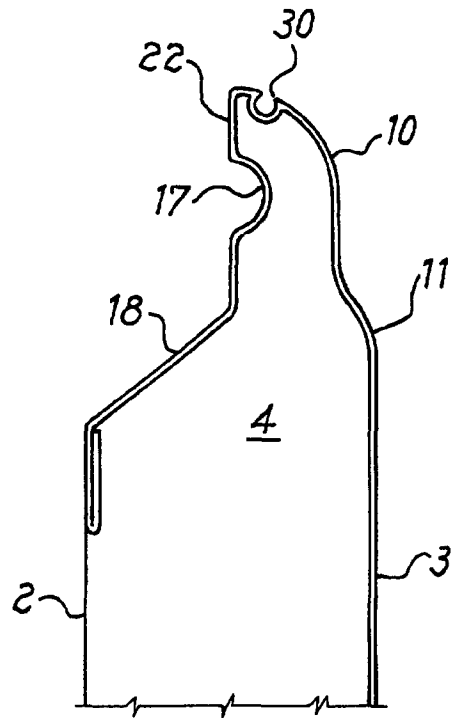


Fig. 4





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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
MUNICH		29 May 2001	Knerr, G
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