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[54] **CURTAIN FACADE FOR SKELETON AND PARTITION-TYPE BUILDINGS**

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[51] **Int. Cl.** **E04b 2/88,** E04c 2/38

[58] **Field of Search** 52/235, 474, 475, 494, 52/495, 498

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[57] **ABSTRACT**

A facade for a building comprising a supporting structure on which facade elements are fixed, the supporting structure which is fixed to the building being formed for several supporting sections which extend behind all the edges of the facade elements and uninterruptedly over at least the length of their edge, which elements are fixed to the supporting structure, with the interposition of continuous sealing strips, by means of fastening means which may be pressure discs disposed at intervals from one another, the facade being made up on a modular basis so as to provide for various types of facade elements such as panels or windows.

13 Claims, 6 Drawing Figures

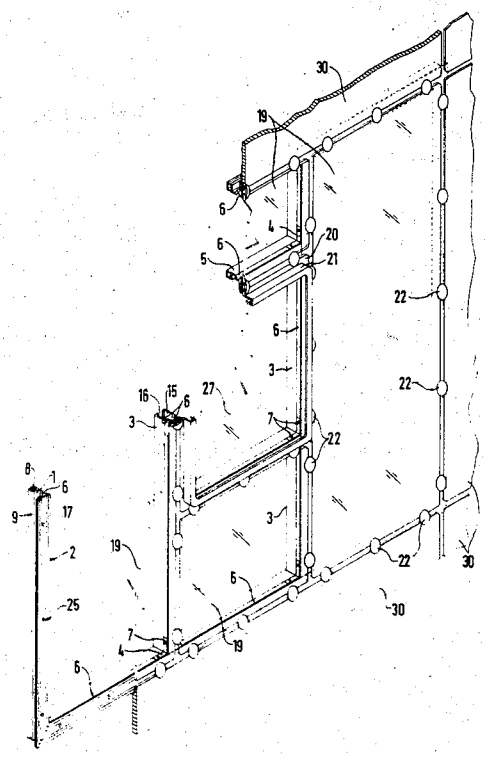
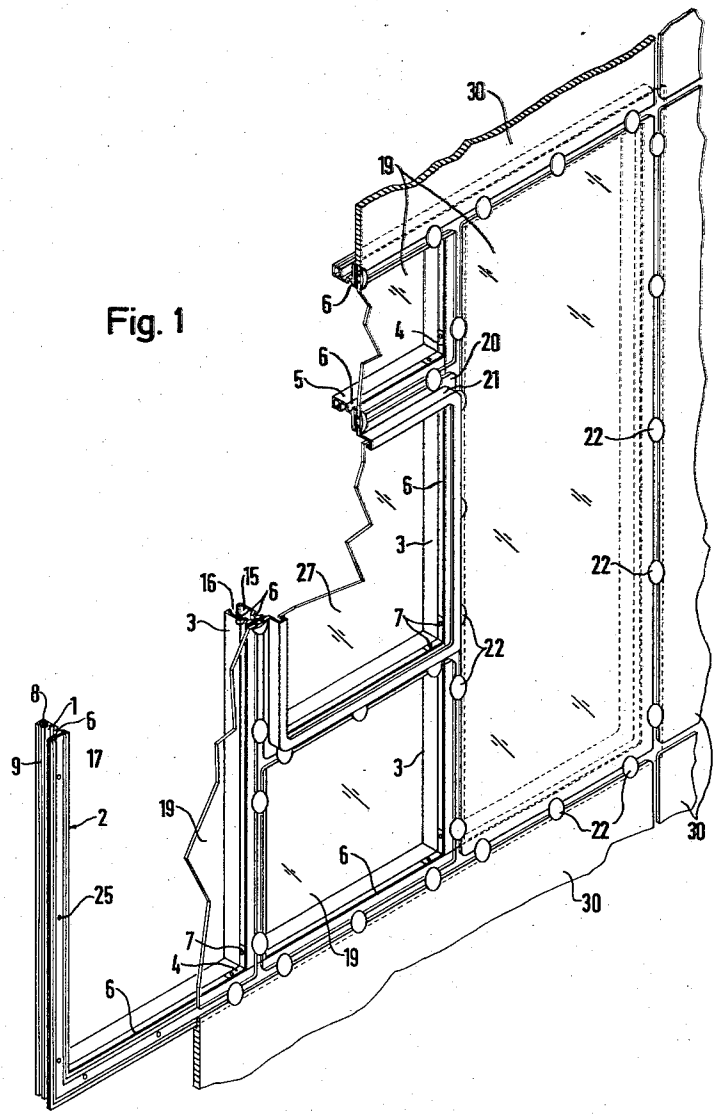


Fig. 1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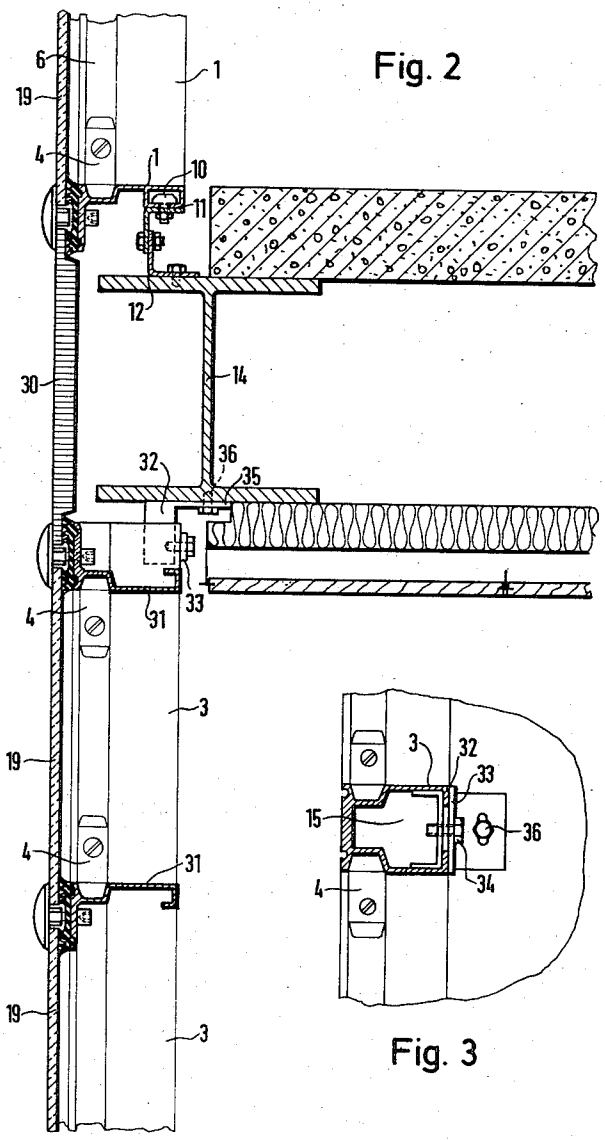


Fig. 2

Fig. 3

Fig. 4

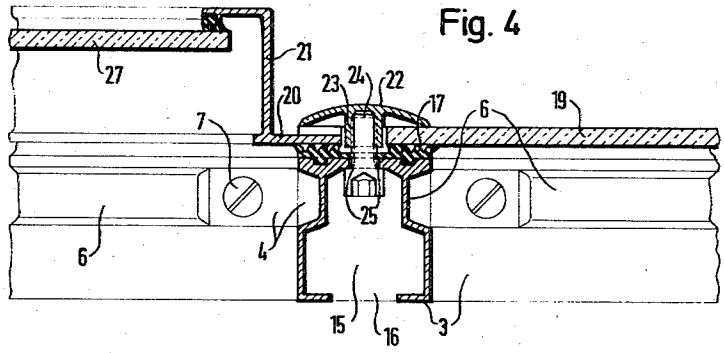


Fig. 5

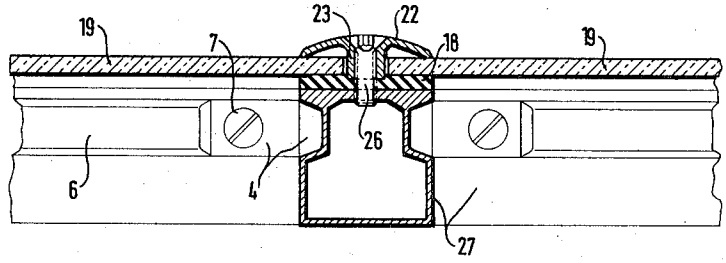
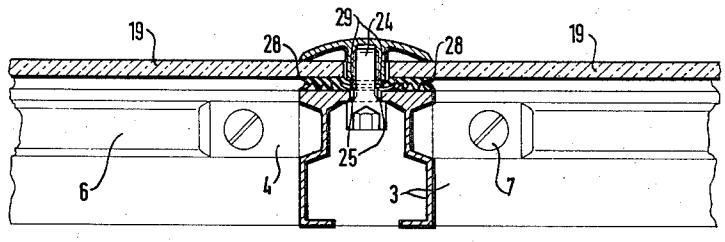


Fig. 6



CURTAIN FACADE FOR SKELETON AND PARTITION-TYPE BUILDINGS

The invention relates to a curtain facade for skeleton and partition-type buildings, which consists of facade elements attached to a supporting structure. This supporting structure may consist of a structure which is separate from the skeleton or partition-type building, but is attached to the latter. Previously known curtain facades of the type initially mentioned are generally very expensive in terms of construction and their use is therefore confined, almost exclusively, to imposing office buildings. In such cases, facade elements which are basically identical in shape are combined to form a so-called "grid facades" which extend in a uniform manner over the entire exterior of the building, since uniform requirements are imposed upon the facades in the case of office buildings. In buildings with various uses, such as residential buildings, having different facades based on varying arrangement and design of windows, doors, balconies and the like, it is generally not possible to use the known uniform curtain facades.

The object of the invention is therefore to provide a curtain facade of the type initially mentioned, which can be used for all types of buildings, and even for apartment buildings with room functions of different kinds, and which is therefore equal to diverse requirements imposed upon the facade of a building, but nevertheless consists of standard elements of the same kind, and is economical. The curtain facade is therefore to be made up from a system of unitary constructional elements which permits a variety of different types of facade by means of the smallest possible number of different standard elements, and which also permits subsequent changes in the facade without great outlay and in the simplest and most economical manner possible. In addition, the facade is to satisfy the usual quality requirements, particularly in respect of weather potection.

The present invention consists in a facade for a building comprising in combination: a supporting structure comprising supporting sections which may be attached to the exterior of the building, facade elements held to the supporting structure with the interposition of a sealing means, a plurality of fastening means disposed at intervals from one another, which at least partially engage with the facade elements to hold the facade to the supporting structure, said supporting sections extending uninterruptedly over at least the length of the edges of the facade elements.

Admittedly, it is already known, in glazing systems for roofs and the like, to secure glass elements in such a way that they are pressed against a supporting structure with the interposition of sealing strips (so-called puttyless, pressure-type glazing systems). In these arrangements, use is made, for attachment purposes, of continuous cover-rails which bear, again with the interposition of sealing strips, against the outer side of the glass elements (see "Baukonstruktionslehre" (the theory of construction) by Martin Mittag, p. 171). In this case, sealing between the individual glass elements is therefore effected by sealing strips which bear, and are pressed, against both the inner and outer sides of the roofing elements, and under these circumstances, the sealing strips must extend continuously over the entire length of the edges of adjoining roofing elements, on both sides of the latter. This gives rise to considerable

difficulties, particularly on the outer side of the elements, in the regions in which two sealing strips meet one another perpendicularly. The same thing applies to the cover rails, which must likewise extend over at least the entire length of the edges of the roofing elements, on the outer side of the latter. This known method of construction therefore involves, not only during manufacture and assembly but also during any subsequent changing of the roofing elements or, above all, when modifying the distribution of the element panels, considerable difficulties or else extra outlay in terms of labour, which is avoided in the case of the curtain facade according to the invention, in which the fastening means are disposed on the outer side of the facade elements and only at intervals from one another, and the sealing of the facade elements in relation to one another and in relation to their supporting structure is effected exclusively by sealing strips disposed on the inner side of the said facade elements.

It is possible for at least some of the supporting sections to form frames, against the sides of which the facade elements are pressed. In this case, the frames are preferably constructed so as to have the same height as a storey, and are to be secured to the ceiling structure of the skeleton or partition-type building at the upper and lower sides of the frame.

When the curtain facade is constructed in this way, it is possible for at least some of the supporting sections of its supporting structure to have continuous hollow compartments in the length of the section, into which bolts with heads, preferably hammer-heads, engage, through a longitudinal slit in the section, for the purpose of securing the supporting sections to the skeleton or partition-type building. As a result of this, longitudinal tolerances are absorbed in a simple manner.

Uprights or transoms located in the plane of the frames may pass across the latter, either entirely or partially, in order to permit the attachment of a number of facade elements side by side or one above the other within one frame. Another construction of the facade dispenses with the frames and provides only vertical sections (uprights) and horizontal sections (transoms), in which case the uprights are connected directly to the support structure of the building, whereas the transoms are merely disposed between them. The sealing strips provided between the facade elements and their supporting structure expediently consist of material having long-term elasticity, for example, polyvinyl chloride, sponge-rubber or the like, and may be constituted by soft foam-rubber sections, compartment-type sections or lip-type sections, against which the facade elements press, while preference is to be given to lip-type sections since they exhibit the greatest degree of elasticity at the lowest pressure per unit of area. The fastening means for the facade elements may, on the other hand, consist of pressure discs which act upon the outer side of the said facade elements and which can be fixedly clamped to the supporting sections, for example by means of fastening bolts which can be screwed into the discs and into the supporting sections and which pass through the gap between two adjacent facade elements and through the sealing strips. The pressure discs preferably consist of a material which is not too brittle, i.e., is elastic, for example a weather-resistant plastics material, or else aluminium having adjusted elasticity, fine steel or the like. The use of plastics discs and bolts has the advantage of eliminating bridges for the cold.

This construction of the sealing strips and fastening elements provides good sealing-off of the elements in relation to one another and in relation to their supporting structure, extending entirely round the perimeter of the said facade elements, even if the fastening means are only disposed at intervals from one another and therefore only exert contact pressure upon the facade elements in places. Naturally, a precondition for this is that the facade elements should have a certain degree of inherent rigidity, which is present in panel-shaped elements made of most of the materials suitable for this purpose, such as for example, metal, plastics material, asbestos cement, glass or the like, without it being necessary for these facade elements to have a special construction of the edges. In spite of the discontinuous pressure of the fastening elements against the facade elements, it is possible, in this way, to ensure uniform sealing-off of the elements from one another and from the supporting structure. Under these circumstances, the facade elements may consist of facade panels or even of window or door elements having a suitable construction at the edges.

By constructing a curtain facade in accordance with the invention, it is possible, in a simple manner, to ensure a completely adequate and absolutely reliable seal between the facade elements or between the latter and their supporting structure, even at the points at which the gaps cross one another, and therefore to permit the most varied and modifiable distribution of the panels of the facade without special outlay and without thereby endangering the weathertightness of the curtain facade. This weathertightness is not even jeopardized by the fact that the supporting sections located on the inside are simple blanks which are not connected directly to one another, since the said sections are completely masked by the sealing strips, which provide a seal between adjacent facade elements which is uninterrupted except by orifices for passage of the previously mentioned fastening means. For their part, the sealing strips are simply to be stuck or welded to one another.

The drawing illustrates examples of embodiment of the curtain facade according to the invention, and these will be described in greater detail below. The features mentioned in the course of this description are regarded as more or less significant for the purposes of the invention. Protection for these features is being sought, even if they are not specially mentioned in the claims.

FIG. 1 shows an oblique, broken-away view of an example of construction of a curtain facade;

FIG. 2 illustrates the connection of the facade elements, or of their supporting structure, to the ceiling of a building, in the form of a cross-section through the structure of the facade in the case of, at the top, a supporting structure having a frame and, at the bottom, a frame-less supporting structure;

FIG. 3 shows a section, along the line III—III in FIG. 2, through the point of connection of the upright to the structure of the building, and

FIGS. 4 to 6 shows three different forms of embodiment of the construction and disposition of an upright or transom, with facade elements bearing against it, in a supporting frame.

In the form of construction illustrated in FIG. 1, there are disposed in a supporting frame 2 formed from sections 1, vertical uprights 3 which are secured to the lower and upper horizontal sides of the frame 2 with the aid of corner angles 4. Horizontal transoms 5, which are likewise fastened to the uprights by corner angles 4, extend between the two vertical uprights disposed in the frame 2. The uprights 3 and transoms 5 consist, like the frame 2, of metallic, extruded sections, while the frame sections 1 and the transoms 5 have a similar cross-section which differs from that of the upright 3. On their sides which are directed towards the inside of the frame, the sections 1 of the frame 2 have, like the side walls of the upright sections 3 and transom sections 5, continuous longitudinal depressions in the form of channels 6 in the sections, which serve, on the one hand, to receive the corner angles 4 in these sections in a flush, countersunk manner and, on the other hand, to collect any condensation which may be present. Through the countersunk arrangement of the corner angles in the channel in the section, the said corner angles are stabilized on the section in such a way that their sides need only be secured by a single bolt 7 in each case.

Within a grid, the uprights 3 and transoms 5 may be secured to the frame sides and uprights respectively, at any intervals from one another which correspond to the desired distribution of the facade, it being possible to make a subsequent modification of the arrangement of the uprights and transoms at any time. For this purpose, holes, which are not illustrated in the drawing, may be provided in the channels 6 in the sections, for the purpose of attaching the corner angles 4 at any desired points on the grid.

The cross-sectional construction of the frame sections 1, upright sections 3 and transom sections 5 is primarily determined by static conditions, but also by the form and method of attachment of the said sections to the skeleton or partition-type building. For the purpose of attaching the frame sections, which are L-shaped in cross-section, to the skeleton or partition-type building, these sections are provided, on their side which is directed towards the inside of the building, with a hollow compartment 8 which has a longitudinal slit 9 which is directed towards the outside of the frame and in which the hammer-head screws 10 for securing corner angles 11 engage (FIG. 2). These corner angles are connected, via attachment bolts 13, to other corner angles 12 which are attached to ceiling girders 14 of the skeleton or partition-type building. The corner angles 11, 12 are expediently provided with slots which extend perpendicularly to one another and through which the fastening means engage, in order to permit precise adjustment of the facade structure in the plane of the facade and perpendicularly to the said plane. The upright sections 3 are likewise provided, although more particularly for static reasons, with a hollow compartment 15 and a longitudinal slit 16 which is directed towards the inside of the building.

In the frame-less variant of the facade, as shown in the lower parts of FIGS. 2 and 3, the hollow compartments 15 in the uprights 3 may likewise have inserted in them, simple fastening elements which are to be secured in the upright elements in a displaceable manner for the purpose of absorbing tolerances in height. In the construction illustrated, these fastening elements consist of U-section pieces 32 which may be secured in the post at any desired vertical position by means of base plates 33, which lie against the outer side of the section 3, and a clamping screw 34. The U-section piece 32 is fastened by a flange 35 to the ceiling girder 14 of the

skeleton or partition-type building. The fastening bolt **36** is located, with a relatively high degree of play, in receiving bore in the flange **35**, in order to obtain precise adjustment of the upright sections **3** in relation to the skeleton or partition-type building.

In this frame-less variant form of the facade, the horizontal transom sections **31** inserted between the vertical upright sections **3** are of somewhat different construction to the transom sections **5** in the supporting structure having a frame, as illustrated in FIGS. **1** and **2** described above.

On their side which is directed towards the outside of the building, the supporting sections **1,3, 5** have a section wall which extends parallel to the plane of the facade and to which sealing strips **17** are attached. Attachment of the sealing strips is effected, in the example illustrated in FIG. **4**, by projections on the sealing strip which engage in longitudinal grooves cut back into the section **3**. However, consideration may also be given to sticking the sealing strip fast to the section with adhesive, as is the case, for example, in the example of construction illustrated in cross-section in FIG. **5**, in which the sealing strip **18** consists of sponge-rubber.

The sealing strips **17** illustrated in FIGS. **1, 3** and **4** are provided, on their two longitudinal edges, with sealing lips against which the facade elements in the form of panels **19** and **30**, or the flanges **20** of window frames **21** having panes **27**, are pressed. The facade panels **19** and window frames **21** are disposed within the frames **2**, whereas the facade panels **30** serve to bridge the gap between two adjacent frames. In accordance with the frame-less variants, however, the division of the facade is also possible in a continuous manner over the whole facade. The sealing strips provided with sealing lips consist of a material having long-term elasticity, for example polyvinyl chloride. The strips may also be constructed as a compartment section in their cross-section. The facade elements **19, 20, 21, 30** are pressed against the sealing strips **17, 18** by means of pressure discs **22** which consist of a material, for example polyamide, which is not too brittle, in order to avoid notch stresses in the facade elements, above all when the latter consist of glass. The pressure discs are arched in cross-section, in such a way that they bear with their rim against the facade elements. They have a shaft portion **23** which, in the example of construction illustrated in FIGS. **1** to **4**, contains a blind bore into which a fastening bolt **24**, which engages through a hole **25** in the supporting section, is screwed. The head of the fastening bolt is accessible through the longitudinal slit **16**, in the case of the upright section **3** shown in FIGS. **1** to **4**.

In the example of construction illustrated in FIG. **5**, the pressure discs **22** are screwed into the supporting structure for the facade elements, not from the inside but from the outside of the building. For this purpose, the shaft portion **23** of the pressure disc **22** is drilled right through, so that the fastening bolts **26** are screwed into the pressure discs from the exterior of the building, and from there into the supporting section **27** which, in this case, may be devoid of the longitudinal slit **16** ensuring accessibility of the bolt head.

In the example of construction illustrated in FIG. **6**, sealing strips **28**, which are made of the same material as the sealing strips **17** and likewise have sealing lips, are stuck to the edges of the facade panels **19** on the sides of the latter which are directed towards the inside of the building. The sealing strips, which are located side by side, of two adjacent facade elements, have flaps **29** which are directed towards one another and engage over one another in the gap between the elements, in order to permit complete sealing between the facade elements, between these elements and the supporting section **3**, or between the supporting sections.

At all events, the sealing strips are constructed in such a way that they extend over the entire wall surface of the supporting sections **1,3,5** which is directed towards the outside of the building, in order to thereby guarantee complete sealing-off of the facade elements from one another and from their supporting structure, and to prevent direct contact of the supporting sections with cold outside air. This largely eliminates any heat bridge via the sections, which might lead to the formation of condensation. Furthermore, the sealing sections serve to seal off the fastening screws **24, 26** for the pressure discs **22**, which engage through the space at the join between the facade elements **19, 21** from the interior of the building. The screw hole in the thermoplastic sealing material can easily be melted out by means of a heated mandrel.

The fastening bolts may consist of any desired material. However, in order to avoid further heat bridges, it may be expedient to make the said bolts from a material having low conductivity, for example plastics material.

In the case of the construction according to the invention, therefore, sealing of the facade is exclusively effected on the inner side of the facade elements, between the said elements and their supporting structure. Under these circumstances, uniform sealing over the entire length of the edges of the elements is guaranteed, in spite of the fact that the pressure of the pressure plates is applied only in places.

The panel-shaped facade elements **19** may be formed by simple blanks of different panel-type materials, for example glass, sheets of asbestos cement or plastics material or the like, and need not have received a special construction at the edges or any additional treatment. They may also consist of sandwich elements.

The construction according to the invention, of a curtain facade economically provides, in addition to a solution to the problem initially described, the advantage that industrial semi-finished products can be prepared for its construction in the simplest possible manner, and can be assembled in the most diverse arrangements. The curtain facade according to the invention is equal to the most varied requirements and remains completely variable. On the basis of its construction, is is also possible, for the purposes of rational assembly, for the facade units to be preassembled, and shifted in position on the building, in the form of complete frame panels.

I claim:

1. A facade for a building comprising in combination:

1. a plurality of generally planar facade elements mounted adjacent to one another in generally planar array by means to be recited;
2. a supporting structure for said facade elements comprising a plurality of supporting sections which are:

a. adapted to be mounted on a building,

b. shaped so that, when said facade is assembled, they extend uninterruptedly around and overlap the perimeter of said generally planar facade elements on the sides thereof internal to the building, and

c. adapted to be interconnected with said generally planar facade elements by means to be recited;

3. a plurality of fastening means for interconnecting said generally planar facade elements to said supporting structure with said fastening means disposed at intervals from one another, each of said fastening means having a first portion adapted to overlap the edges of at least two of said generally planar facade elements on the sides thereof external to the building when said facade is assembled and a second portion disposed generally perpendicular to said first portion and adapted to be interconnected to said supporting structure; and

4. sealing means for sealing the interface between said generally planar facade elements and said supporting structure, said sealing means

a. being adapted to be pressed between said supporting structure and said facade elements by means of said fastening means and

b. comprising continuous strips of sealing material extending entirely around the perimeter of said facade elements on the sides thereof internal to the building and overlapping the interface between adjacent facade elements so as to provide a seal between said facade elements and said supporting sections which is uninterrupted except by orifices for the passage of said second portions of said plurality of fastening means,

whereby the structure for supporting said generally planar facade elements, fastening them to a building, and sealing their edges are separated into mutually exclusive elements.

2. A facade as claimed in claim **1,** wherein some of the supporting sections consist of substantially vertical upright sections, between which substantially horizontal transom sections are inserted.

3. A facade as claimed in claim **1,** wherein the sealing means consist of sponge-rubber.

4. A facade as claimed in claim **1,** wherein the sealing means are attached to the supporting sections.

5. A facade as claimed in claim **1** wherein said supporting sections are adapted to be adjustably mounted on a building by means of angles.

6. A facade as claimed in claim **5** and further comprising a plurality of angles each of which has at least one slot therein for the displaceable reception of a threaded connector, whereby said supporting sections can be mounted on a building via two of said angles having slots therein which are perpendicular to each other in the assembled facade, one of said angles being attached in a displaceable manner to said supporting section and the other of said angles being attached to the building in a displaceable manner.

7. A facade as claimed in claim **1** wherein said strips of sealing material have, on their longitudinal edges, sealing lips adapted to be pressed against said facade elements by means of said fastening means.

8. A facade as claimed in claim **1** wherein at least one of said supporting sections has a continuous hollow compartment extending parallel to the edge of said facade element when said facade is assembled and at least one longitudinal slit providing communication between said continuous hollow compartment and the exterior of said supporting section, whereby said supporting section can be mounted on a building by means of a threaded connector having a head and a shaft, the shaft of which is passed through said longitudinal slit.

9. A facade as claimed in claim **1** wherein said supporting sections have continuous longitudinal depressions in at least one side thereof, whereby said supporting sections can be interconnected with each other by means of angles seated in longitudinal depressions.

10. A facade as claimed in claim **1** wherein said fastening means comprise pressure discs the inner surfaces of which act upon the outer side of said facade element when the facade is assembled.

11. A facade as claimed in claim **10,** wherein the pressure discs are arched and act, with their edge, upon the outside of the facade element without a seal.

12. A facade as claimed in claim **10,** wherein the pressure discs can be clamped fixedly to the supporting sections by fastening bolts which can be screwed into the discs and into the supporting sections and which pass through the gap between two adjacent facade elements.

13. A facade as claimed in claim **10** wherein the pressure discs consist of weather-resistant plastics material.

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