

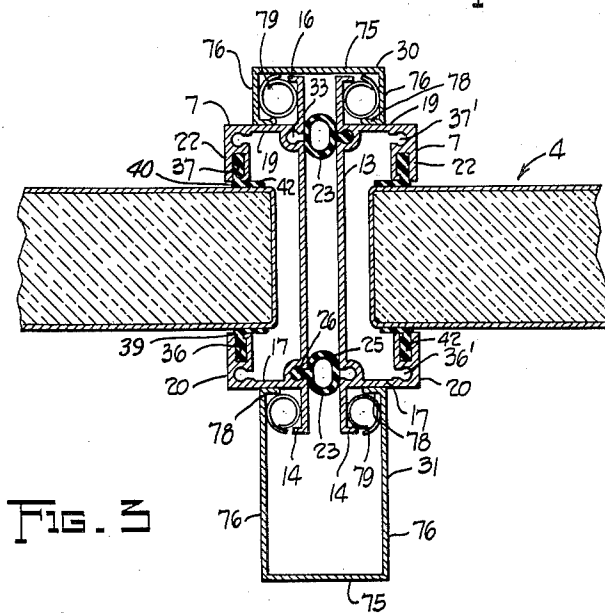
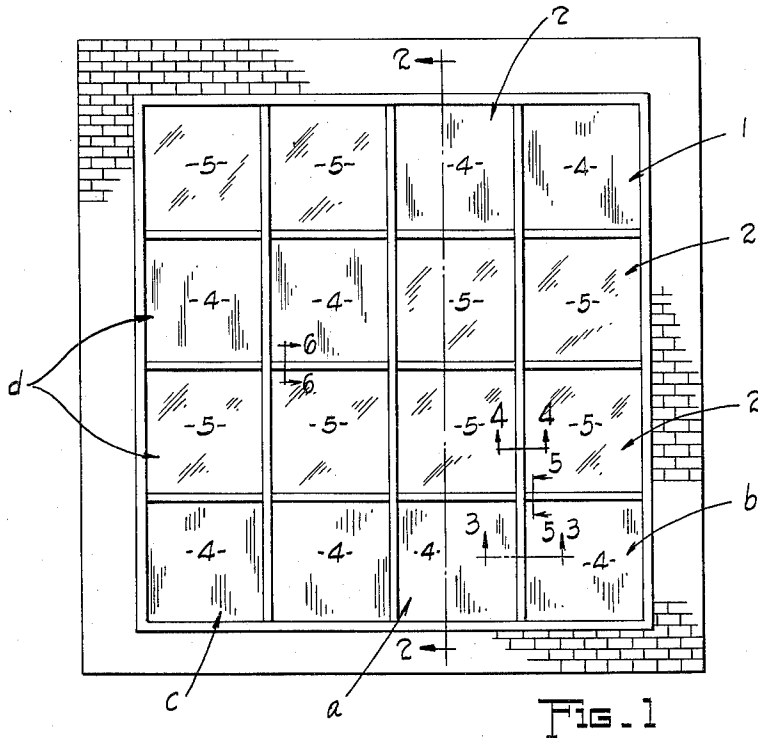
Jan. 1, 1963

G. R. GALL
CURTAIN WALL

3,071,215

Filed April 17, 1957

5 Sheets-Sheet 1



INVENTOR.
GEORGE R. GALL
BY Bosworth, Sessions,
Herrstrom & Knowles
ATTORNEYS

Jan. 1, 1963

G. R. GALL
CURTAIN WALL

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5 Sheets-Sheet 2

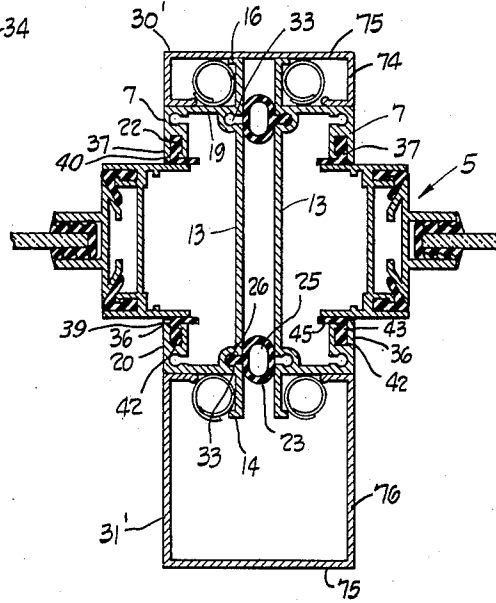
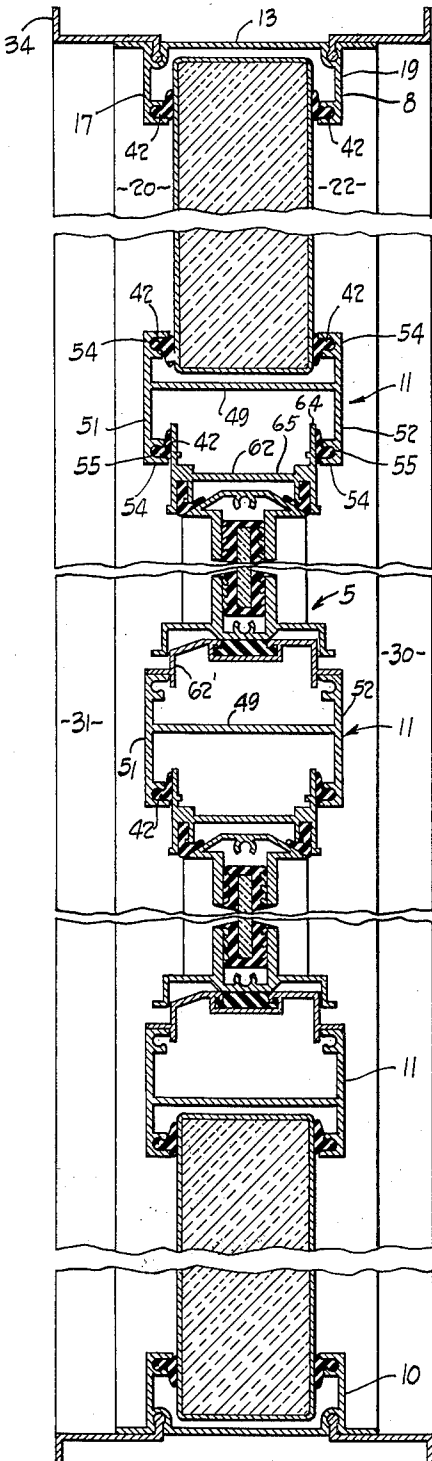


FIG. 4

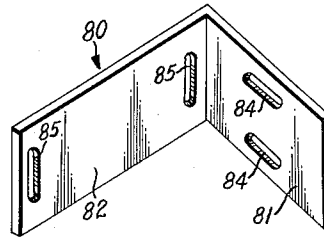


FIG. 7

FIG. 2

INVENTOR.
GEORGE R. GALL
BY Bosworth, Sessions,
Herrstrom & Knowles
ATTORNEYS

Jan. 1, 1963

G. R. GALL
CURTAIN WALL

3,071,215

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FIG. 5

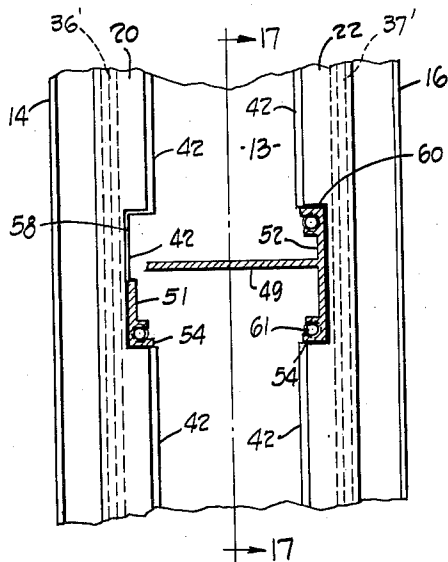


FIG. 6

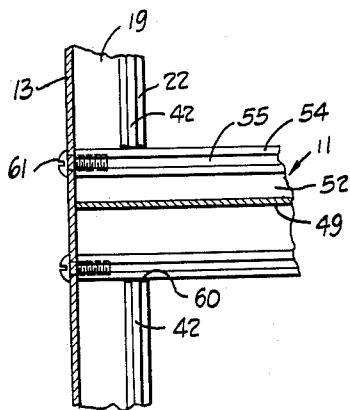
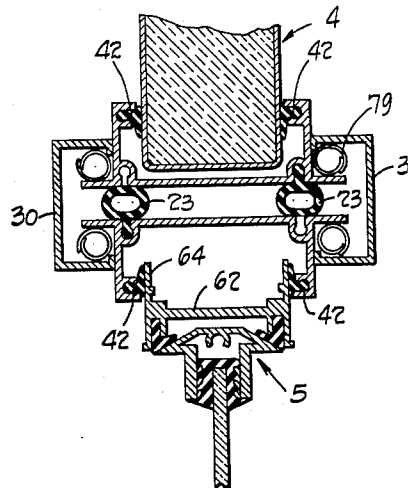


FIG. 17

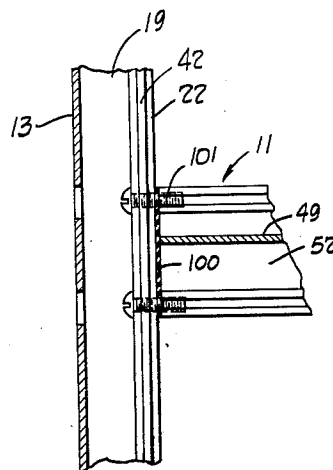


FIG. 16

INVENTOR.
GEORGE R. GALL
BY *Bosworth, Sessions,
Herrstrom + Knowles*
ATTORNEYS

Jan. 1, 1963

G. R. GALL
CURTAIN WALL

3,071,215

Filed April 17, 1957

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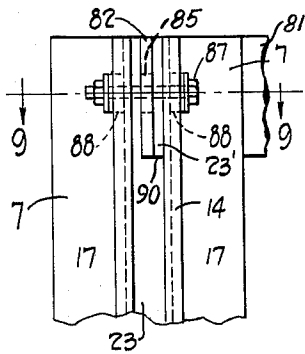


FIG. 8

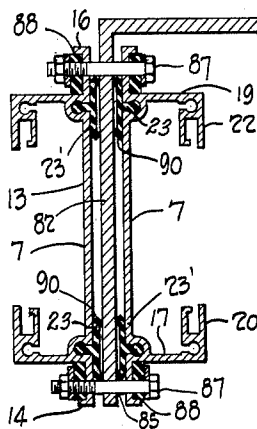


FIG. 9

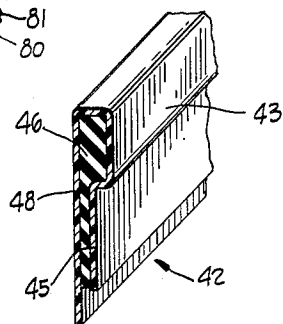


FIG. 10

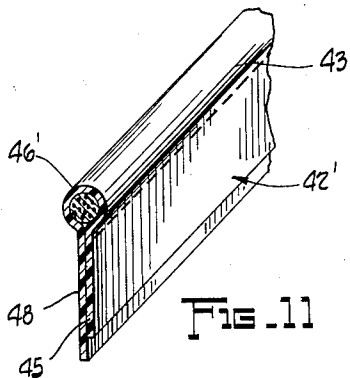


FIG. 11

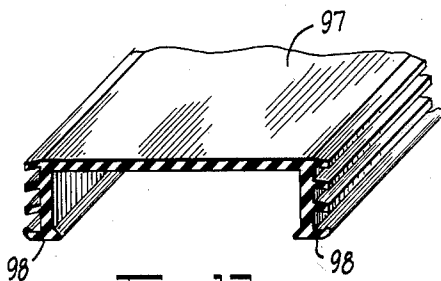


FIG. 12

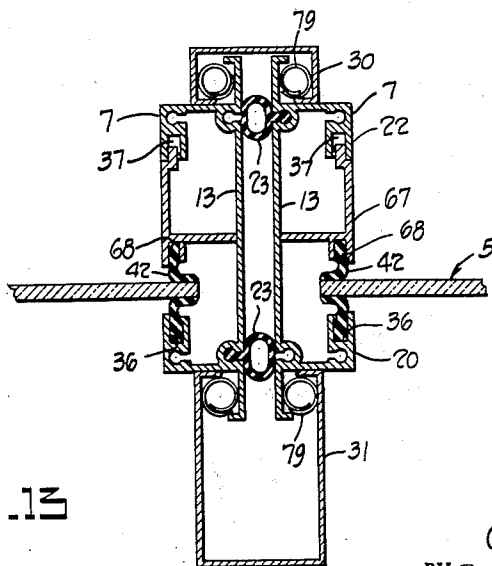


FIG. 13

INVENTOR.
GEORGE R. GALL
BY *Bosworth, Sessions,
Harrington & Knowles*
ATTORNEYS

Jan. 1, 1963

G. R. GALL
CURTAIN WALL

3,071,215

Filed April 17, 1957

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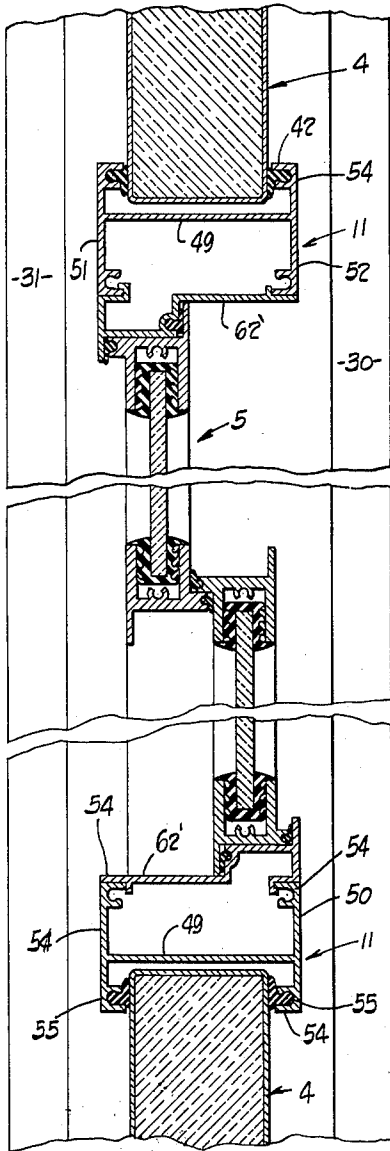


FIG. 14

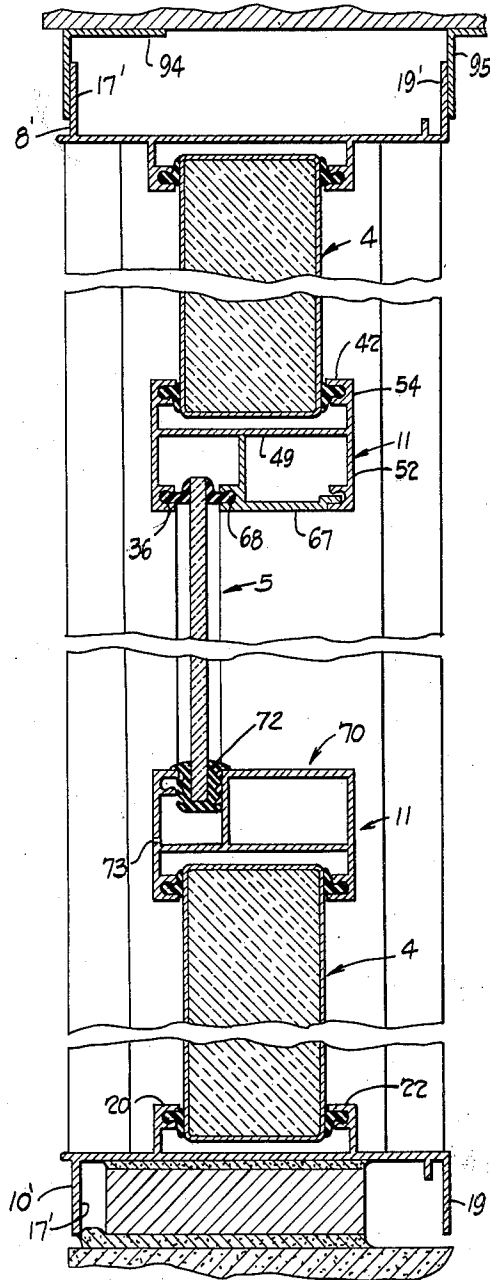


FIG. 15

INVENTOR.
GEORGE R. GALL
BY Bonworth, Sessions,
Herrstrom & Knowles
ATTORNEYS

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3,071,215

CURTAIN WALL

George R. Gall, Moreland Hills, Ohio
(Cannon and Aurora Roads, Bedford, Ohio)

Filed Apr. 17, 1957, Ser. No. 653,483

9 Claims. (Cl. 189—34)

This invention relates to exterior building walls and more particularly to exterior curtain walls formed from a plurality of pre-assembled units, sections, or panels.

Recently there has been a marked increase by architects and builders in the recommendation, use and provision of "curtain walls" in the construction of commercial and office buildings and the like. Broadly "curtain walls" comprise and are formed from a plurality of pre-assembled units, sections or panels which are connected together into a complete wall, facade or portion thereof, as desired, at the building site and which are secured to beams, columns or other structural members by suitable hangers or other means.

Curtain walls are non-load-bearing and a unit or section conveniently is one or more stories high and includes at least one window portion, having fixed or movable sash, and one panel portion having a metal or opaque panel or box which is filled with insulating material and may have an outer or decorative surface of any desired color. Frequently the frame members of each unit or section are formed from one metal, commonly extruded or rolled aluminum, for example, and the panel is made from another metal, enameled steel, for example. The sections or units are bolted, welded or otherwise secured to each other and the structural steel framework of the building.

Difficulty has been experienced with such walls in making them weather-proof so as to positively exclude rain, water, snow and wind. This difficulty has apparently arisen not only because of the inherent difficulty of securing each unit or section to each of the adjacent units or sections with a weather-tight joint but also because of the added burden of making joints between and within the units or sections which remain weather-tight when the units or panels include one or more different materials having co-efficients of expansions which differ from each other and/or differ from that of the structural members of the building. The difficulty has been especially marked where aluminum is used in the curtain wall because it has a relatively large co-efficient of expansion as compared with other building materials.

It is therefore a general object of my invention to provide an improved curtain wall and section or unit thereof which is easily and economically produced, and pleasing in appearance, which is strong and has great utility and which is weather resistant and leakproof in substantially all kinds of weather, in all seasons, at all temperatures and without regard to the temperature differentials between the interior and exterior of the building of which the wall is a part.

A further object of my invention is the provision of a curtain wall which is easily and conveniently assembled and erected at the site from pre-fabricated units or sections, another object of my invention is the provision of a unit or section for a curtain wall and a curtain wall formed from a plurality of such sections in which the panel and/or glass portions of each unit or section float relative to the section and each other and the sections or units are connected together so as to "float" or allow for expansion and contraction therebetween, all without loss of weatherproofness.

Still other objects of my invention include the provision of improved means for mounting and sealing panels and/or glass portions within pre-assembled units or sec-

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tions for curtain walls; the provision of panels, sections and/or units for curtain walls which may be combined with similar units or panels to form a weatherproof wall, which is inherently adjustable without the use of supplementing metallic and/or other fillers or similar devices to compensate for small inaccuracies in the size of the opening provided for the wall; the provision of an improved joint, between the respective rails and between the rails and mullions of pre-assembled units or sections for curtain walls, which is weatherproof and increases the structural stability and resistance to bending, distortion, and the separation of the curtain wall section of which it is a part both during assembly of the section per se and of the wall of which the section is a part and after assembly of the wall when subjected to wind, heat and cold, and other deleterious effects of the weather; the provision of improved means for covering and protecting the joint or juncture between adjacent units or sections of a curtain wall, which contributes to the weatherproof qualities of the wall and permits relative movement of the respective units and sections in response to changing thermal conditions but is, nevertheless, pleasing in appearance and adds to the esthetic characteristics of the wall, which is easily removed and attached and which may take a variety of interchangeable external shapes as the user may desire; the provision of a curtain wall comprising a plurality of sections or units any one of which may be relatively easily removed or replaced in the wall, if desired or if necessary, without necessitating the removal or damage of any other section or unit; and the provision of a curtain wall and/or units or sections thereof having one or more of the characteristics and advantages set forth above.

These and other objects and advantages of my invention will become apparent from the following description of preferred and modified forms of my invention, reference being had to the drawings in which:

FIGURE 1 is a schematic elevation of a building having a curtain wall embodying preferred forms of my invention.

FIGURE 2 is a broken vertical section viewed along the line 2—2 of FIGURE 1.

FIGURE 3 is a horizontal section viewed along the line 3—3 of FIGURE 1.

FIGURE 4 is a horizontal section viewed along the line 4—4 of FIGURE 1 but showing an alternate shape for the mullion cover.

FIGURE 5 is a horizontal section viewed along the line 5—5 of FIGURE 1 and showing a joint between vertical and horizontal mullions of a wall section.

FIGURE 6 is a vertical section viewed along the line 6—6 of FIGURE 1 and showing the juncture between two vertically adjacent wall sections.

FIGURE 7 is an isometric view of a preferred form of hanger plate for fastening the curtain wall units or sections to the structural members of the building.

FIGURE 8 is a broken elevation showing the vertical mullions of two adjacent wall sections and illustrating means for connecting the same together and to a hanger plate.

FIGURE 9 is a horizontal section viewed along the line 9—9 of FIGURE 8.

FIGURE 10 is a fragmentary enlarged view of another preferred form of gasket shown in FIGURE 2 for retaining and sealing the panels, etc., in position.

FIGURE 11 is a modified form of the gasket shown in FIGURE 10.

FIGURE 12 is another means for supporting a panel or glass portion within a unit or section of the wall.

FIGURE 13 is a view similar to FIGURE 3 but showing a mounting for a fixed sash.

FIGURE 14 is a broken vertical section similar to FIGURE 2, showing a unit or section having a double hung window.

FIGURE 15 is a broken vertical section, similar to FIGURE 2, showing for purposes of illustration a unit or section embodying other forms of my invention.

FIGURE 16 is a horizontal section similar to FIGURE 5 but showing another form of joint between vertical and horizontal rails or mullions of a wall unit or section.

FIGURE 17 is a broken vertical section viewed along the line 17—17 of FIGURE 5.

In the various figures similar numbers refer to similar parts.

A composite curtain wall embodying my invention is indicated generally at 1, FIGURE 1. The wall 1 comprises a plurality of juxtaposed units or sections indicated generally at 2 embodying my invention, which are arranged in one or more vertical and/or horizontal rows and are adapted to be secured to the beams and columns comprising the main structural supports of the buildings and are also conveniently adapted to fit in or fill up the wall area within a predetermined masonry or other type of frame. The sections or units 2 may be of any desired size and the number of rows of units is determined by the size of the units relative to the size of the opening to be protected by the wall. My invention is equally applicable whether the relative sizes of the units and opening are such as to admit of only one row of units in either the horizontal or vertical directions, as at *a* in FIGURE 1, which illustrates a wall having a single vertical row of units, or a plurality of rows in either direction, as illustrated by rows *b*, *c*, and *d*, in FIGURE 1. Each unit preferably includes one or more panel portions 4 and one or more glass or window portions 5 as the user may desire arranged in any desired sequence of any desired relative sizes. The panel portions 4, as will hereinafter more fully appear are preferably opaque, but may be translucent or transparent, and have an outer decorative surface of any desired color or texture, and the glass or window portions 5 may be of the fixed, double hung, or reversible window type and may be made with regular or Thermopane type glass or other transparent or translucent material. Each unit or section 2 usually comprises portions, parts and/or members having different coefficients of expansion and it is a feature of my invention that the wall and the individual units 2 remain weatherproof at all temperatures even though the parts thereof expand and contract at different rates and to different degrees.

A representative unit or section 2 is shown in FIGURE 2 and comprises lower and upper panel portions 4 and intermediate glass or window portions 5, although as previously stated the relative size and disposition of the various portions 4 and 5 within a given unit 2 embodying my invention may be varied at the arbitrary discretion and choice of the user, it only being necessary to properly arrange and dispose the rails and mullions of the section in accordance with that choice at the time of manufacture and assembly. Thus, for example, the vertical row *b* is illustrated as two units or sections 2 with the lower unit having a lower panel portion 4 and upper glass portion 5 and the upper unit having a lower glass portion 5 and upper panel portion 4, and vertical row *c* illustrates two units or sections, both of which have a lower panel portion 4 and an upper glass portion 5.

The portions 4 and 5 are located and supported in position and the unit is provided with structural strength by means of column members or side rails 7 (vertical mullions), FIGURES 3 to 6, and horizontal beam members, mullions or top rail 8, bottom rail 10 and one or more intermediate rails 11.

The members 7, 8, 10 and 11 are conveniently and preferably formed from aluminum extrusions and are preferably interfitted and screwed or otherwise fastened

together in accordance with the precepts of my invention to form a substantially rigid unit having leakproof, weatherproof joints and providing channels within which the edges of the panel portions 4 and window portions 5 are disposed.

As best seen in FIGURES 3 through 6 the side rails 7 comprise a flat longitudinally extending web or base portion 13 preferably having at its respective side edges short perpendicular flanges 14 and 16, which extend toward the center of the unit or section. Rails 7 also include longitudinally extending horizontally spaced legs 17 and 19 which extend from the web 13 toward the center of the section and are provided with inturned flanges 20 and 22, respectively, which define a channel for the reception of panel and window portions 4 and 5.

In order to provide a leakproof, weatherproof juncture between the adjacent section or units I provide resilient sealing means secured to each unit and adapted to engage the adjacent unit or section when the wall is assembled. Preferably the sealing means is secured to the outside of the outer rail of one section and engages the outside of the adjacent outer rail of the adjacent section. More particularly I provide a plurality of sealing means between adjacent sections secured to the web portion of the rails so that the sealing means on one section is secured to the inside with respect to the building, of the web and on the adjacent section to the outside of the web, see FIGURES 3, 4 and 6, although alternatively the sealing means may be secured to both sides of both members, see for example FIGURE 9.

I prefer that the sealing means comprise a seal 23 formed from extruded stock of a rubber, rubber substitute or other resilient material and having a hollow cylindrical main body portion 25 and an integral leg portion 26 having an enlarged end.

The leg portion 26 of seal 23 provides convenient means for securing the seal to the web 13 of rail 7 and the hollow body portion 25 of seal 23, effectively engages the adjacent rail of the adjacent section when the wall is assembled to provide a seal therebetween as will hereinafter more fully appear, and also to provide an adjustable joint between the adjacent sections having a sufficient range of adjustment or "play" permitting the effective length of a row of panels to be varied upon installations sufficiently to compensate for small inaccuracies in the size of the wall opening which often exist under or result from present construction methods, and to provide a joint which absorbs the contraction and expansion of the sections and row in response to changes in temperature. In this connection it is a feature of my invention that although the joint between adjacent sections when the wall is assembled is weatherproof, there are no integral metallic or rigid parts which interlock the adjacent sections and prevent the adjustment of the row length upon installation and because there is no integral rigid or metallic interlocking of the sections if one section becomes damaged, as by an object colliding with the building, etc., it may be removed and replaced without removing any other section. The joint between adjacent sections is further weatherproofed and protected and made decoratively acceptable and pleasing by the removable mullion covers 30 and 31, FIGURE 3, 30' and 31', FIGURE 4, as will hereinafter more fully appear.

In order to secure my preferred seal 23 to the rail I provide an elongated groove 33 in the base member 13. The grooves 33 are preferably formed with an enlarged inner end which is the female complement of the leg 26 of seal 23. The seal is secured or mounted on the rail 7 by sliding the leg 26 into and along groove 33 from the one end or the other of the rail. Preferably, where the assembled wall is more than one section or row high the seal is of greater length than the rail by an amount sufficient to permit the side seals of adjacent vertical sections to contact each other across the joint between the vertically adjacent sections.

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The top and bottom rails 8 and 10 are preferably similar to the rail 7 in those respects already described when the rails 8 and 10 are to be adjacent a similar section in the finished wall to which the section they are a part of is to be joined, see for example FIGURE 6. When the rail 8 is the top rail of the uppermost section in a finished wall or the rail 10 is the bottom rail in the lowermost section in a finished wall appropriately shaped adapters 34 are fitted in the groves 33 and these in turn are secured to the building by suitable fastening means. A seal, not shown, may be disposed between the adapters 34 and the building if desired. Alternatively, as will hereinafter more fully appear, the shape of the rails 8 and/or 10 may be modified in certain respects, see FIGURE 15, for example, in order to secure the same to the building in accordance with the desires of the user without departing from the precepts and scope of my invention.

It is a feature of my invention that the panel and window portions 4 and 5 of each section are supported within each section so that the glass and panels may "float" relative to each other and to the rails or mullions so that the different rates and degrees of expansion and contraction of the various members due to different coefficients of expansion do not induce separation of the parts and members with resultant leakage and loss of weatherproofness. To this end I provide means and structure which retains, at least, the non-similar parts and portions of the section or unit in a suspended position relative to the rails and obviates the necessity of direct mechanical engagement between such suspended portions and the rest of the unit or section. Thus at least the non-similar parts and portions may expand and contract without regard to the expansion and contraction of the balance of the unit or section and in effect "float" relative to the unit. I further suspend or "float" such portions and parts of the unit in such a manner and by such means as to insure a weatherproof, leakproof joint or juncture between such portions and parts and the adjacent rails or integral parts of the section respectively. Further means embodying my invention is also useful for providing a weatherproof joint or juncture between parts and portions, of a panel wall section or similar device, which are made of similar material, if desired.

In order to accomplish these objects and provide for my preferred means for suspending and supporting the panel and window portion, I preferably provide the flanges 20 and 22 of the rails 7 with longitudinally extending opposed inwardly facing grooves or channel means 36 and 37 respectively. The grooves or channels 36 and 37 may take any convenient shape and are preferably provided with a neck or opening 39 and 40, respectively, which is narrower or reduced in size relative to the inner portions of the groove or channel.

To seal and support the panel or other member between the flanges 20 and 22, without bottoming the same against the web 13 of the rails (vertical or horizontal as will hereinafter more fully appear), a gasket 42, FIGURES 2 to 6 and 10, is disposed in each of the grooves 36 and 37. The gasket 42 has a male portion 43 which is complementary to the channels 36 and 37 respectively and is positioned therein by sliding the gasket into and along the respective channels from the end of the rail and a resilient leg or flap portion 45 which in its free state extends outwardly from the channel towards the opposite flange and is adapted to be bent to extend toward the web 13 when a panel, etc., is positioned between the flanges 20 and 22.

The gasket 42 (FIGURE 10) preferably comprises a core 46 formed from a resilient elastic material such as neoprene covered by a vinyl impregnated nylon cloth, FIGURE 10. The cloth 48 is mounted so as to be disposed between the core and the panel or other member. Alternatively the gasket 42 may be composed entirely of neoprene, see FIGURE 2 for example, or in some

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instances the core 46 may be formed from a non-elastic material such as rope.

FIGURE 11 discloses a gasket 42' having a rope or similar core 46', for example, about which is wrapped a cloth 48, in which the core 46' is confined to the male portion 43 of the gasket and the flap 45 of the gasket comprises only the free ends of the cloth 48. The selection of the proper form of gasket 42 or 42' to use in any given wall depends on the convenience and necessity of the given installation albeit in general the forms are interchangeable.

Intermediate rails or mullion bars 11 separate and define the horizontal limits of the respective panel and glass portions 4 and 5 of each section or unit and provide channels into which the adjacent edge or member of each said portion is positioned and supported. The mullion bars 11 are carried and supported by the side rails 7, which they interconnect, and the mullion bar channels are similar in function and general configurations to and are adapted to be aligned with the channels formed in the rails by the legs and flanges 17 and 20, and 19 and 22, respectively.

To this end, see FIGURE 2, the bars 11 conveniently comprise a web or base member 49 and parallel sides or leg members 51 and 52. The members 51 and 52 extend at right angles to and in both directions from the web 49. Each side member 51 and 52 is provided at its respective ends with flanges 54, which extend towards the similar flange on the opposite side member and is provided with a groove 55 which opens toward said other flange. The grooves 55 have the same purpose as the grooves 36 and 37 and the same considerations as to size and shape are equally applicable to the grooves 55 as to the grooves 36 and 37. Grooves 55 are adapted to receive gaskets 42, for example, albeit under some circumstances certain members or parts of a glass portion 5, for example, may seat directly on aligned opposite flanges 54 without necessitating the use of gaskets 42. Alternatively gaskets 42' may be used and either of the gaskets may take any of the forms illustrated and discussed above.

The relative depth of the respective mullion channels formed by the web 49 and sides 51 and 52 is determinable at the discretion of the user, however, I prefer that those channels adapted to receive panel portions of the section be only about one half the depth of those adapted to receive glass portions.

In order to prevent leakage of wind and water at the juncture between the adjacent vertical and horizontal rails in each curtain wall section or unit, sections or units embodying my invention are preferably provided with my new improved means for joining such members together in an interlocked, sealed, water and air tight unit.

To this end, as best seen in FIGURES 5 and 17, the flanges 20 and 22 of the side rails, for example, are punched out, as at 58 and 60, respectively, to form apertures. Apertures 58 and 60 are sized to receive in a tight sliding fit either the legs 17 and 19 of a top or bottom rail or the sides 51 and 52 of an intermediate rail or mullion. The width of the flanges 20 and 22 and the depth of the grooves 36 and 37 are so related as to allow the entire area of the punched out sections 58 and 60 to lie within the confines of the grooves 36 and 37 and the punch is made after gaskets 42, preferably having a neoprene or elastic core, similar to that shown in FIGURES 2 or 10, have been inserted in the respective grooves.

As the die punches the flanges and gaskets it stretches the gaskets, while cutting therethrough, and makes a smaller punch therein than in the metal flange surrounding the gasket and when the die is withdrawn the gasket in each groove extends slightly beyond or into the areas 58 and 60 sufficiently to engage the rails or mullions when the same are positioned within the punched opening and seal the joint between such member and the side rail.

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The respective horizontal rails or mullion bars are further secured or fastened to the side rail by means of screws 61 extending through the web 13 of the vertical rail and engaging the circular grooves 55 and 36' and 37' as the case may be. Conveniently screws also extend through the web 13 of a top or bottom rail and engage the respective circular grooves 36' and 37' of the side rail to further strengthen the joint.

The panel portions 4 (see FIGURES 2, 14 and 15) preferably comprise hollow steel panels filled with insulation and having decorative exposed surfaces, conveniently of baked enamel, and are positioned within the section or unit 2 by having their peripheral edges disposed between and frictionally engaged by the opposed gasket 42, for example, to the end that the panels have a "floating" suspension relative to the section or unit and expand and contract independently thereof or of the other members and parts thereof. This mounting is further advantageous because the baked enamel panels and surrounding aluminum rails or mullions merge visually without any seals or gaskets appearing between the visually adjacent edges thereof.

The glass portion 5 of a curtain wall section or unit embodying my invention may as previously stated contain inter alia, a fixed, double hung or pivoted window. Double hung and vertically pivoted windows are preferably supported within the section by means of adapters or modifying members which are supported within the respective mullion and rail channels between the opposed gaskets 42, for example, or conveniently, in the case of the lower adapter for each window, by direct engagement between the adapter and the flanges of the adjacent rail or mullion of a curtain wall unit or section.

FIGURES 2 and 4 disclose, for example, a curtain wall unit or section 2 embodying my invention and equipped with a glass portion 5 having a vertical pivot window and FIGURES 4 and 14 disclose a unit or section 2 having a glass portion 5 having a double hung window.

For the upper and side framing members for a pivoted or double hung window I preferably provide adapters 62, FIGURES 2, 3, 4, and 14 having bifurcated legs 64, which engage and are supported within the channels of the rails or mullions by and between the gaskets 42 by frictional engagement, in a manner substantially similar to that by which the panels 4 are supported, and therefore the pivot and double hung windows "float" or expand and contract independently of the rails and mullions. That portion of each adapter 62, which engages the window and functions as a frame therefor, as opposed to that portion, legs 64 and web 65, which engages the rails and mullions and is disposed between the flanges 20 and 22, is shaped in accordance with the desires of the user and the needs of the particular window to be used and per se forms no part of this invention.

For the lower frame of each double hung or pivot window I preferably provide an adapter 62' which seats upon and is supported by the flanges 54 of an adjacent mullion bar or flanges 20 and 22 of an adjacent bottom rail, FIGURE 14. The configuration of that portion of adapter 62' which engages the window is also determined at the discretion of the user and in accordance with the needs of the particular window to be used.

FIGURES 13 and 15 disclose a fixed glass window, for a curtain wall unit or section embodying my invention, which is mounted, as I prefer, so as to "float" or expand and contract relative to the unit or section independently thereof in substantially the same manner as the panel 4. To this end I preferably provide adapters 67, which close or bridge a portion of the opening of the channels defined by the flanges 20 and 22 and 54 of the respective rails or mullions.

The adapters 67 are supported within the inner grooves 37, for example, of the rail (gasket 42 being omitted for the length of the adapter) and are provided with a

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groove 68, which is substantially similar in all respects to the groove 37, within which the adapter is seated, except that it is laterally nearer the opposite outer groove 36. Groove 68 is adapted to receive a gasket 42, for example, in the same manner and for the same purpose as the inner groove 37 and the pane of glass is disposed between the gaskets 42 in the grooves 36 and 68 and frictionally retained thereby.

Alternatively a mullion or rail the entire length of which is to support a fixed window may have the adapter formed integrally therewith as indicated generally, for example, at 70, FIGURE 15.

As shown in FIGURE 15 the bottom edge of the pane of glass is preferably supported within a gasket 72, which is similar to that disclosed and claimed in my U.S. Patent No. 2,667,951, issued February 2, 1954.

Weep holes 73 may be provided in the exterior legs or sides 17 and 51 respectively of the bottom and intermediate rails or mullions to drain off any liquid seeping past the gaskets.

As previously stated removable mullion covers 30, 31, 30' and 31', for example, see FIGURES 3 and 4, are provided to ensure a more leakproof weatherproof joint between the adjacent units or sections in a finished wall and to make the joints more decoratively acceptable and pleasing to the eye.

The respective mullion covers comprise a web portion 75, having any desired exterior shape, and two inwardly extending transversely spaced legs 76 having reentrant flanges 78 at their respective ends adjacent the sections or units 2. The legs 76 and flanges 78 are adapted to straddle the adjacent flanges 14 or 16, of the adjacent rail 7, for example, and the flanges 78 seat against the legs 17 or 19 thereof. Springs 79 are disposed between the flanges 14 or 16 and the flanges 78 and are adapted to detachably hold the mullion covers in place against the rails. Springs 79 conveniently comprise rolled strips of stainless steel having their ends overlapped and having a greater at rest diameter than the distance between the respective legs 17 or 19 and flanges 14 or 16.

The legs 76 of the mullion covers are spaced apart sufficiently to provide a positive frictional engagement between the respective springs 79, legs 76 and flanges 78, when the mullion covers are fully seated, while permitting the flanges 78 to compress the spring and pass thereover when the mullion cover is pushed towards the rail or pulled therefrom over the springs.

In order to secure a curtain wall embodying my invention to a building I prefer to use hanger plates 80, FIGURES 7, 8 and 9. The plates 80 may be secured to guides, beams or columns or other structural members and comprise a base portion 81, which is secured to the structural member, and an outwardly and vertically extending fin portion 82, which is adapted to fit between the adjacent rails of adjacent units or sections. Normally two plates 80, one near the top and one near the bottom, are disposed between the rails 7 of each pair of laterally adjacent units or sections, albeit more plates may be used, if desired, and plates also may be disposed between vertically adjacent units or sections. As shown in FIGS. 7, 8 and 9; FIG. 8 being a side elevation and FIG. 9 a horizontal section, the base portion 81 of plate 80 is preferably provided with horizontally extending slots 84, which permit lateral adjustment of the plates 80 relative to the building structure to which they are attached. The fin portion 82 is preferably provided with vertically extending slots 85, which allow for the vertical expansion and contraction of the rails of the units or sections relative to the plate and structure; the horizontal contraction and expansion being relieved by the seals 23 as set forth above, and the "floating" suspension of the panel and glass portions.

Where only one seal 23 is mounted on each rail as in FIGURES 3, 4 and 13, the body 25 of the seals 23 is preferably cut in half as at 90, FIGURES 8 and 9, for

the length of fin 82 and a short similarly cut seal 23' is mounted oppositely thereof on the other rail to more adequately center and position the plates 80 relative to the wall sections.

The adjacent sections or units 2 are held together by a plurality of nuts and bolts 87, FIGURES 2 and 9, having resilient washers 88 disposed between the nuts and bolt heads, respectively, and the web 13 of the adjacent rail 7. The resilient washers 88 permit relative movement of the adjacent sections and ensure a tight joint, whether the individual units or sections are expanded or contracted relative to each other, because of variations in temperature. The nuts and bolts 87 are disposed at convenient intervals along the webs 13 between the flanges 14 and 16 and the legs 17 and 19, respectively, and certain of the bolts are also adapted to pass through the slots 84 of plates 80 so as to secure the wall to the building.

As previously noted the resilient joint between adjacent units or sections consequent upon the use of the seals 23 and washers 88 permits of some adjustment of the spacing between the rails of adjacent units or sections in order to allow for irregularities or tolerances in the size of the wall opening.

Further because the adjacent units or sections are not interlocked any given unit or section may be removed, for repairs, or replaced without disturbing adjacent units or sections by simply removing the mullion covers and unbolting the unit or section from its neighbors.

Straps (not shown) may be bolted to the lower rail of the lower unit or section of each vertical row thereof for securing the wall to a concrete or similar base.

FIGURE 2 illustrates adapters 34 by which the top rail 8 of the uppermost unit or section of a vertical row thereof and the outside rail of the outside unit or section of a horizontal row thereof are conveniently secured to the adjacent masonry or building framework. FIGURE 15 illustrates a modified form of top rail 8' having legs 17' and 19' and especially adapted for co-action with mounting strips 94 and 95 for interconnecting or securing the masonry and adjacent rail, suitable fasteners, not shown, and flat sealing strips if desired, ensuring a tight joint between the masonry and mounting strips and rails.

FIGURE 12 illustrates a seal 97 also embodying the disclosures of my U.S. Patent No. 2,667,951, issued February 2, 1954, and adapted with the channel portions for mounting a panel or glass portion of a unit or section on and within the rails or mullions thereof. In use seal 97 is mounted about the peripheral edge of a panel 4, for example, and the panel is then seated directly between the opposed flanges 20 and 22 and 54, respectively, with the seal 97 directly engaging the rail or mullion and the lips 98 of the seal seating upon and being supported by the flanges 20 and 22 and 54.

The seal 97 functions to obtain a result similar to that of the gaskets 42 and 42' except that the lip portions 98 of seal 97 is visible between the line of the rails or mullions and the panel, for example, to those who observe the wall or section thereof containing the same.

FIGURE 16 illustrates alternate means for joining horizontal and vertical rails or mullions. In this instance the horizontal rail 11 is butted against the flanges 20 and 22 of the vertical rail 7, with a seal 100 disposed therebetween, and secured thereto by screws 101 passing through the respective flanges 20 and 22 and engaging the rail in the manner that screws 61 engage grooves 36' and 37'.

In use the individual units or sections 2 are preassembled at a factory or similar place and then individually positioned and secured into the wall and to the building in the manner described in situ, after which the mullion covers are pushed into position, those mul-

lion covers running in one direction being longer than a single unit or section if desired.

Modifications, changes and improvements to the above described and illustrated preferred and modified forms and embodiments of my invention may occur to those skilled in the art without departing from the spirit and substance of my invention. I therefore do not wish to be limited to these forms and embodiments of my invention nor in any manner inconsistent with the advance by which my invention has promoted the art.

I claim:

1. A weatherproof, exterior curtain wall comprising a plurality of adjacent units in a common plane, each said unit comprising intersecting spaced vertical and spaced horizontal rails, adjacent spaced pairs of said rails defining at least one panel portion and at least one glass portion, said rails having channels opening toward said panel and glass portions respectively, resilient sealing means carried by said rails and extending into said channels, panel means in each said panel portion and window means in each said glass portion of each said unit, said sealing means frictionally engaging each said panel means and window means adjacent the periphery thereof, said panel and window means having movement in contraction and expansion independent of said rails, the outermost of said vertical and horizontal rails adjacent adjacent units having resilient sealing means mounted on the outer side thereof and operatively engaging the adjacent outermost rail of the adjacent unit, fastening means interconnecting said adjacent outermost rails and resilient means disposed between said fastening means and said adjacent rails respectively, said resilient means being on the side of each said adjacent rail remote from the other said rail.

2. The wall according to claim 1 on a building with hanger plates securing said wall to said building, each said plate having a first portion extending between adjacent vertical rails of adjacent units and a second portion extending transversely of said first portion, vertically extending slots in said first portion and horizontally extending slots in said second portion, certain of said fastening means extending through said vertical slots and second fastening means extending through said horizontal slots and securing said plate to said building.

3. The wall according to claim 1 with each said rail extending in one direction having flanges extending toward each other and defining the entrance to said channel, mutually facing grooves in said flanges, gaskets in said grooves, apertures in said flanges intersecting said channel and snugly receiving the end of a said rail extending in the transverse direction, said gaskets underlying said flanges respectively adjacent said apertures and extending into said apertures and tightly engaging said transverse rail and sealing the juncture between said rails.

4. A structural unit having a plurality of intersecting vertical and horizontal rails forming a frame for at least one insert portion, each said rail having opposed, spaced flanges extending transversely of the plane of said unit and defining a channel opening toward the interior of said unit, said flanges in certain of said rails having mutually facing apertures therein, said apertures intersecting the said channel defined by said apertured flanges and receiving at least a portion of a said rail extending transversely of a said certain rail respectively and sealing means carried by said certain rails respectively and extending into said apertures respectively and tightly engaging the said transversely extending rails respectively.

5. The structural unit according to claim 4 in which each said flange in said rails has a groove opening toward the adjacent channel, each said groove being of greater depth than the adjacent said aperture and said sealing means is in part disposed within said grooves and extends within each said groove to a greater depth than the depth of the aperture adjacent thereto.

6. A weatherproof exterior curtain wall comprising a plurality of adjacent units in a common plane, each said unit having outer vertical and horizontal rails, said vertical and horizontal rails of each unit being adjacent similar outer rails of an adjacent unit, resilient sealing means disposed between said adjacent rails and of length substantially equal to the length of said rails respectively and being mounted on one said outer rail and extending toward and engaging the adjacent outer rail, resilient fastening means interconnecting and securing said adjacent rails together, said outer rails having a surface extending toward the center of the units, a flange laterally spaced therefrom and parallel therewith and a web extending therebetween, mullion covers overlapping a portion of the said adjacent outer rails of adjacent units respectively and covering said sealing means, said mullion covers having a body portion, spaced parallel leg portions connected therewith and extending toward said surfaces respectively of said adjacent outer rails and a flange at the end of each leg portion, each said mullion cover flange being juxtaposed to and parallel with the adjacent said surface and being more remote from the outer rail adjacent the other said flange of said mullion cover than said adjacent flange of the rail to which the said mullion cover flange is juxtaposed, and means releasably securing mullion cover to said adjacent units comprising tensioned spring means disposed and acting between and engaging said adjacent rail and mullion cover flanges respectively and having an axis extending parallel with the length of said rail and mullion cover flanges, each said unit and said outer rails thereof having movement in expansion and contraction relative to the adjacent units and the adjacent outer rails thereof, respectively, independent of said adjacent units and outer rails and independent of said mullion covers.

7. A weatherproof exterior curtain wall comprising a plurality of adjacent units in a common plane, each said unit having outer vertical and horizontal rails, said vertical and horizontal rails of each unit being adjacent similar outer rails of an adjacent unit, resilient sealing means disposed between said adjacent rails and of length substantially equal to the length of said rails respectively and being mounted on one said outer rail and extending toward and engaging the adjacent outer rail, said adjacent rails having spaced pairs of aligned apertures and resilient fastening means interconnecting and securing said adjacent rails together and comprising bolt means extending through each said pair of aligned apertures, wall means at the ends of said bolt means, respectively, and a resilient washer disposed about said bolt means and intermediate each said wall means and the adjacent rail whereby each said unit and said outer rails thereof have movement in expansion and contraction relative to the adjacent units and the adjacent outer rails thereof, respectively, independent of said adjacent units and outer rails.

8. A weatherproof exterior curtain wall comprising a plurality of adjacent units in a common plane, each said unit having outer vertical and horizontal rails, said vertical and horizontal rails of each unit being adjacent similar outer rails of an adjacent unit, resilient sealing means disposed between said adjacent rails and of length substan-

tially equal to the length of said rails, respectively, and being mounted on one said outer rail and extending toward and engaging the adjacent outer rail, resilient fastening means interconnecting and securing said adjacent rails together, each said unit and said outer rails thereof having movement in expansion and contraction relative to the adjacent units and the adjacent outer rails thereof, respectively independent of said adjacent units and outer rails, and a plurality of hanger plates for mounting said wall on a building, each said plate having a fin portion disposed between adjacent outer rails and a base portion for securing to said building, said fin portion being engaged by said sealing means and having slots extending in length in the direction of the rails between which said fin portion is disposed, a portion of said resilient fastening means extending through said slots and having substantially less thickness in the direction of the length of said slots than the length thereof.

9. A weatherproof structural unit for exterior walls having a plurality of vertical and horizontal rails forming a frame and an insert portion supported therein, each said rail having flanges defining a channel opening toward said insert portion, mutual facing grooves in said flanges, respectively, and opening toward the adjacent channel, sealing means being disposed in said grooves respectively and extending outwardly therefrom into the adjacent channel and frictionally engaging and supporting said insert portion at the periphery thereof, said insert portion having movement in contraction and expansion independent of and relative to said rails and sealing means, said flanges of certain of said rails having apertures for snugly receiving at least a part of the end of a said rail extending transversely of said certain rails, respectively, and said sealing means underlying said flanges adjacent said apertures, respectively, and extending into each said aperture and tightly engaging the said transversely extending rail disposed therein.

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