

Aug. 16, 1966

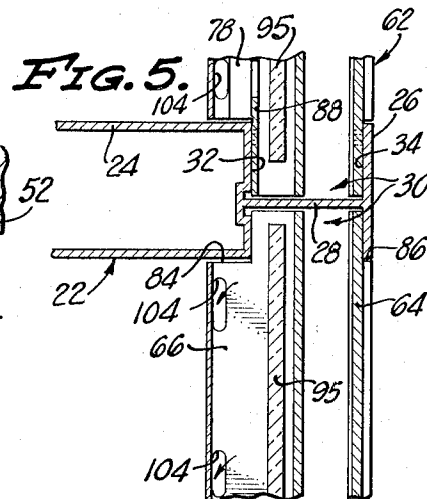
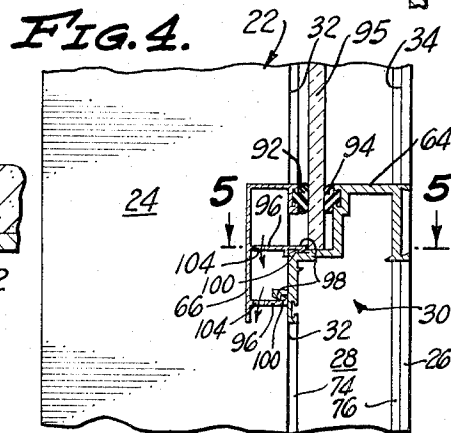
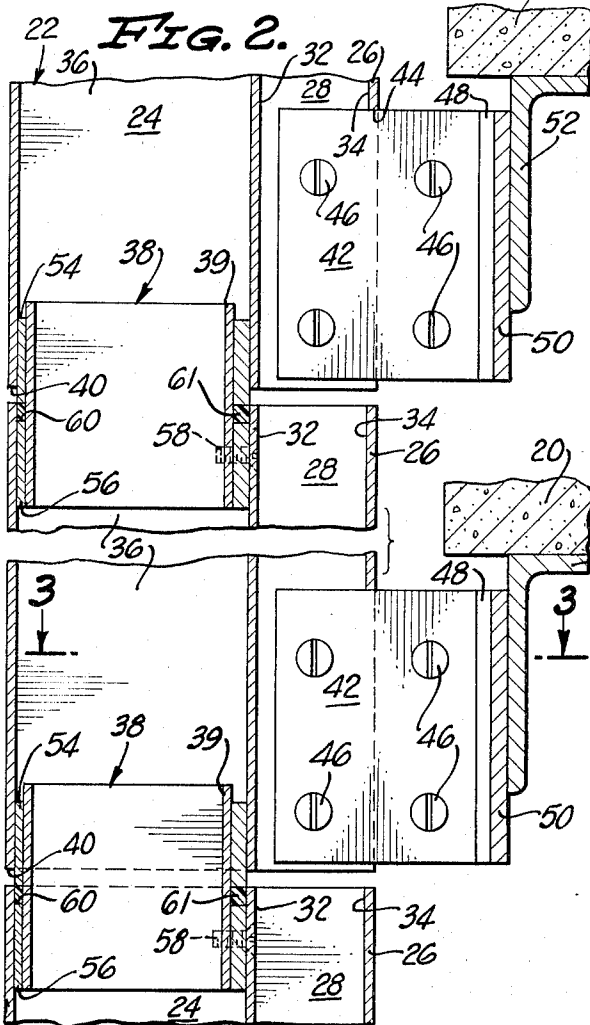
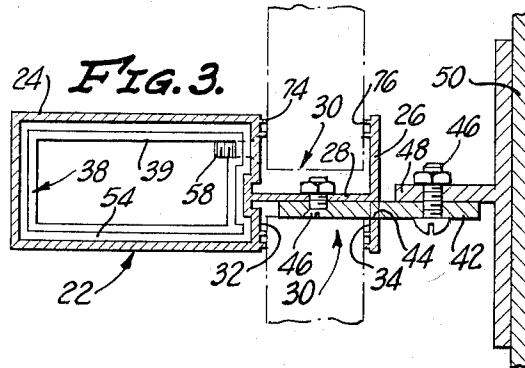
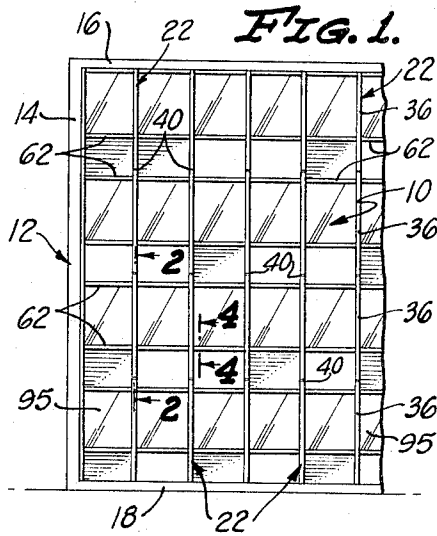
A. GROSSMAN

3,266,210

MULLION AND RAIL COMPOSITE CURTAIN WALL CONSTRUCTION

Filed Dec. 19, 1961

3 Sheets-Sheet 1



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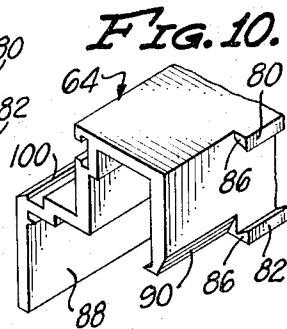
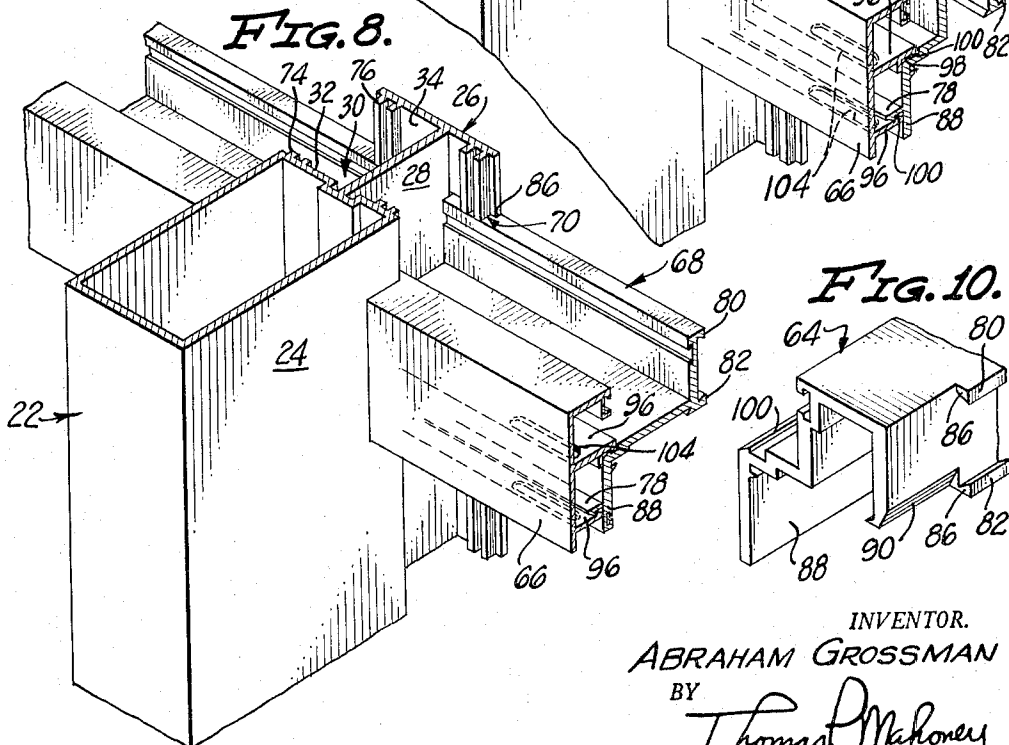
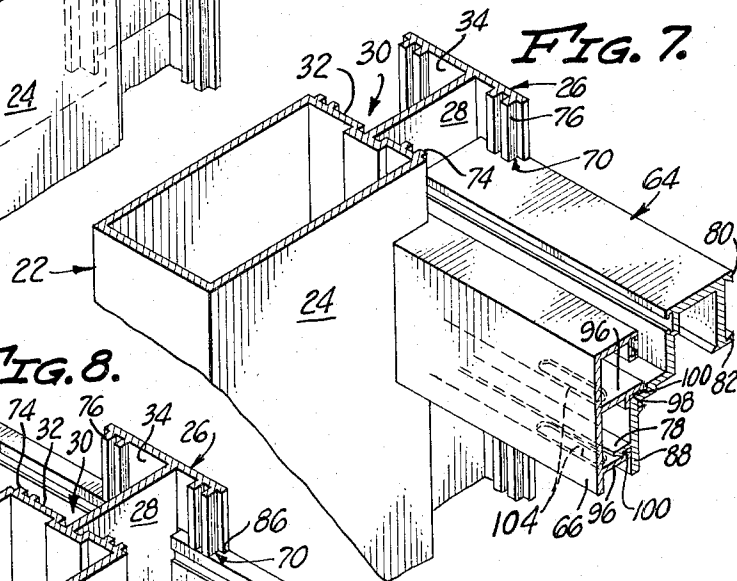
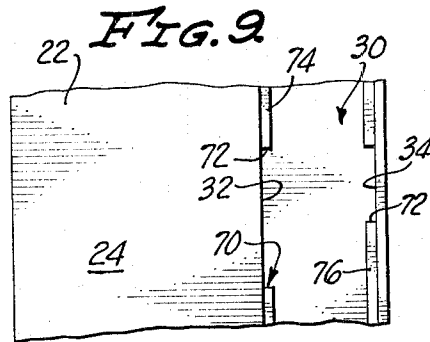
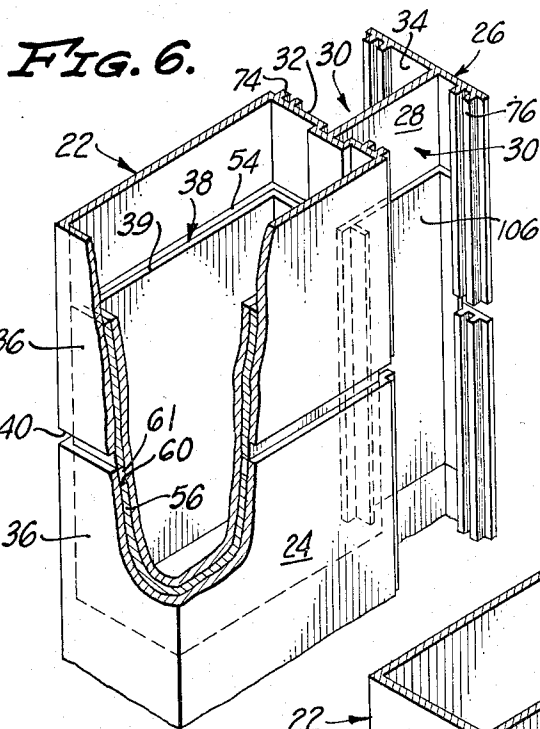
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MULLION AND RAIL COMPOSITE CURTAIN WALL CONSTRUCTION

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3 Sheets-Sheet 2



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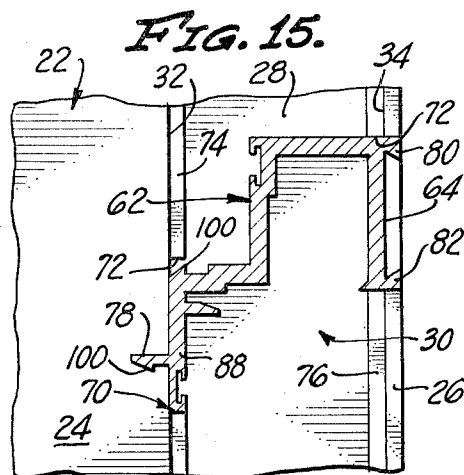
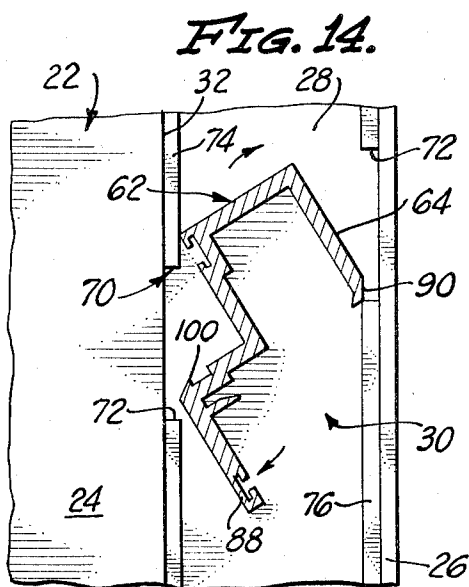
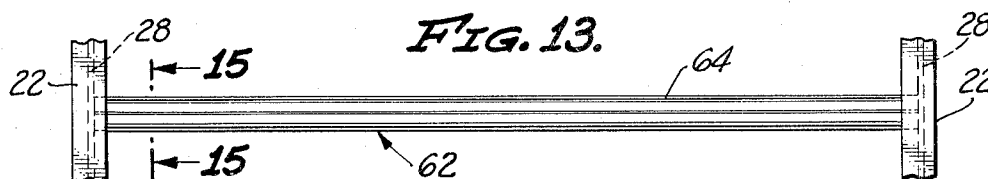
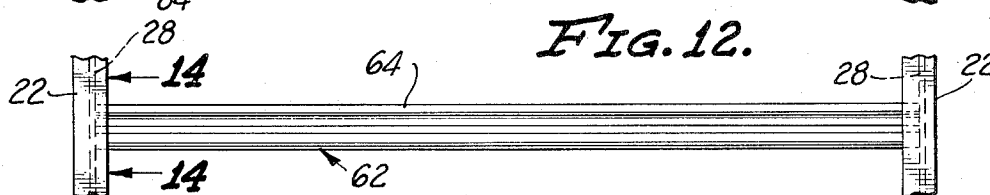
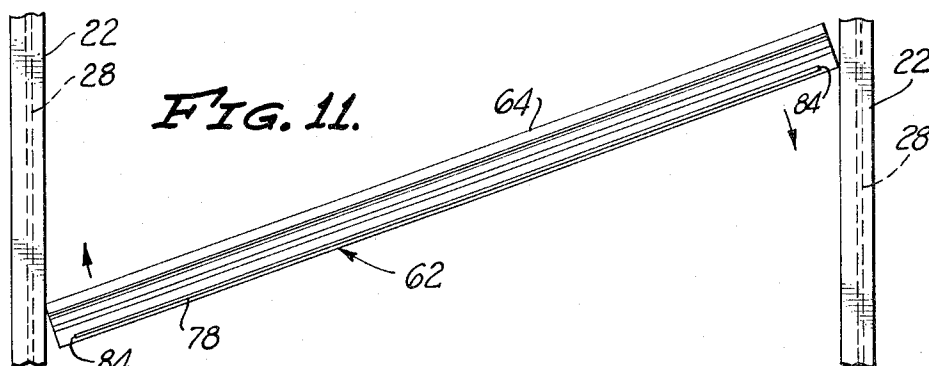
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MULLION AND RAIL COMPOSITE CURTAIN WALL CONSTRUCTION

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3 Sheets-Sheet 3



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MULLION AND RAIL COMPOSITE CURTAIN WALL CONSTRUCTION

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3 Claims. (Cl. 52-690)

The present invention relates to a composite curtain wall and, more particularly, to a curtain wall adapted for assembly upon a building face and constituted by a plurality of multi-sectional components defining a plurality of openings for the reception of closures such as windows, decorative panels, insulating panels, and the like.

Composite curtain walls have been widely used in substitution for brick and masonry to provide decorative and functional building facades. Their attractiveness, relative ease of maintenance, and adaptability to a variety of design concepts suits them well for utilization with new buildings, and they are equally popular for use with older buildings because of the comparative ease with which they can be assembled over existing building walls.

The usual form of prior art curtain wall is constituted by a plurality of vertical mullions which are anchored to the building structure and interconnected by a plurality of horizontally oriented rails extending transversely of the vertical mullions. The mullions and rails define closure receiving openings for supporting a plurality of windows, decorative panels or the like in operative position relative to the building structure, and are conveniently multi-sectional in character to facilitate the handling thereof during assembly of the curtain wall. However, there has not heretofore existed a completely satisfactory means for effecting rapid and simple assembly of the many sections constituting the curtain wall, and particularly assembly of the rails to the mullions subsequent to erection of the mullions.

Accordingly, it is an object of the invention to provide a composite curtain wall which can be quickly and easily assembled upon a building wall, and which includes vertical mullions, each of which consists of a plurality of superimposed sections adapted to be anchored to the building wall at predetermined intervals and which have receptacle portions for receiving the opposite extremities of the horizontal rails. The length of the rails is greater than the horizontal spacing between the mullions, but the mullions include channels in their opposite edges which constitute elongated recesses for receiving the rail extremities. The channel walls, which prevent inward or outward movement of the rails, permit the rails to be diagonally disposed between the rails and thereafter moved to horizontal positions, the rail extremities sliding within the mullion channels in a plane parallel to the vertical plane within which the mullions lie. The rails are then secured upon the receptacle portions to provide a supporting structure for windows, and panels and the like.

Another object of the invention is to provide a curtain wall constituted by a plurality of vertical mullions and horizontal rails of the aforementioned character wherein the mullion receptacle portions are constituted by openings or recesses provided in the opposing walls of the vertically disposed mullion channels, whereby the rail extremities are initially receivable within the mullion channels in oblique relationship therewith, and are rotatable in the vertical plane of the curtain wall to horizontal positions. A salient feature of the rail is its adaptability to rotation about its longitudinal axis for supportive engagement within the mullion receptacle openings.

That is, the rails are sufficiently resilient to deflect upon engagement with the walls of the mullion channels when the rails are rotated about their longitudinal axes, spring-

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ing back to seat the rail extremities within the mullion openings when the rails have received operative, upright positions. Thereafter, it is extremely difficult to rotate the rails to unlocked positions. In this regard it is to be noted that fasteners are completely eliminated since the locked relationship between the rails and mullions is achieved solely by interengagement of contiguous sections thereof.

A most important aspect of my invention lies in the provision of a snap joint between the rails and mullions whereby all of the mullions can be erected and the rails subsequently inserted therein. The snap joint eliminates the necessity for the serial erection of rails and mullions which is necessary with prior art curtain walls.

Moreover, the aesthetically attractive continuity of the curtain wall is, to the casual observer, unbroken since the juncture of the rails and mullions at the receptacle portions or openings are concealed behind the rails. Since no interlocking protuberances or fasteners are necessary, all supportive engagement being effected by the supportive reception of the rails within the mullion receptacle openings, the rails and mullions can be made in the form of relatively inexpensive extrusions of aluminum or the like.

The utilization of multi-sectional components in curtain walls produces joints, and these must be designed to permit relative movement of the rails and mullions during exposure thereof to temperature extremes. That is, the various components constituting the curtain wall and the building structure usually have somewhat different thermal coefficients of expansion, and these must be accommodated in some fashion or the consequent stresses will cause undesirable bending and buckling of the curtain wall, as well as possible structure failure of the closures supported by the curtain wall.

Therefore, another object of my invention is to provide a composite curtain wall of the aforementioned character which includes a plurality of superimposed, multi-sectional mullions having vertically extending, laterally opening rail receiving channels with receptacle openings in the confronting walls thereof to receive opposite extremities of adjacent rails. The rail ends are slidable within the receptacle openings of the mullions and in slightly spaced relationship therewith to permit thermal expansion and contraction of the rails and thereby eliminate any undesirable horizontal deflection of the mullions by the rails.

Another important aspect of the curtain wall of my invention is the provision of expansion joints for coupling the adjacent extremities of the multiplicity of superimposed sections constituting the individual mullions. Each of these expansion joints not only permits thermal expansion and contraction between adjacent mullion sections, but also provides a weather-tight seal to prevent the undesirable ingress of moisture and dirt within the interior of the mullions and the associated rails. By this expedient, the composite curtain wall of my invention is completely free of distortion and buckling.

A further object of the invention is the provision of a curtain wall constituted by a plurality of vertical mullions interconnected by a plurality of horizontally oriented rail members, each of the mullions consisting of a plurality of superimposed sections having hollow extremities for receiving adjacent elements of an expansion joint, and wherein the expansion joints each define a sealant receiving recess with the adjacent extremities of said sections to seal said extremities against the entry of moisture and dirt.

Other objects and advantages of my invention will be apparent from the following specification and the accompanying drawings which are for the purpose of illustration only, and in which:

FIG. 1 is a front elevational view of a curtain wall

constructed in accordance with the teachings of my invention and constituting a building facade;

FIG. 2 is a view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view taken along the line 3—3 of FIG. 2;

FIG. 4 is a view taken along the line 4—4 of FIG. 1;

FIG. 5 is a view taken along the line 5—5 of FIG. 4;

FIG. 6 is an enlarged, fragmentary perspective view, partially in section, showing the expansion joint between superimposed sections of a mullion;

FIG. 7 is an enlarged, fragmentary perspective view, partially in section, showing the reception of a rail extremity within a mullion channel for supporting a window;

FIG. 8 is an enlarged, fragmentary, perspective view partially in section, showing the reception of a rail extremity within a mullion channel for supporting an insulating panel;

FIG. 9 is an elevational view of a curtain wall mullion, particularly illustrating the formation of the receptacle openings or recesses in opposite walls of the mullion channel;

FIG. 10 is an enlarged perspective view of a rail extremity, particularly illustrating receptacle recesses formed therein to facilitate supportive engagement between the rail and mullion;

FIG. 11 is a front elevational view of a pair of curtain wall mullions and a rail disposed diagonally therebetween;

FIG. 12 is a view similar to FIG. 11, but showing the rail rotated in the plane of the curtain wall into a horizontal position, and prior to rotation of the rail about its longitudinal axis;

FIG. 13 is a view similar to FIG. 12, but showing the rail after rotation about its longitudinal axis for seating upon the receptacle portions of the mullions;

FIG. 14 is a view taken along the line 14—14 of FIG. 12; and

FIG. 15 is a view taken along the line 15—15 of FIG. 13.

Referring to the drawings and particularly to FIG. 1 thereof, I show a curtain wall 10 constructed in accordance with my invention and operatively supported by a building structure 12 which includes a pair of side walls, one of which is illustrated at 14, a roof slab 16, and a floor slab 18. Interposed between the roof and floor slabs 16 and 18 is a plurality of floor slabs 20, as best shown in FIG. 2, to which a plurality of vertical mullions 22 are secured.

Each of the mullions 22 is preferably an extrusion constituted by a front portion 24, which is substantially rectangular in transverse cross-section, and a rear portion 26 integrally connected to the front portion 24 by a web or base portion 28. The adjoining sections of the front portion 24, the rear portion 26 and the base portion 28 define a pair of vertically extending channels 30 at the opposite edges of the mullion 22, each channel 30 having opposing walls 32 and 34 with the base portion 28 forming the bottom of the channel 30.

Each mullion 22 is constituted by a plurality of superimposed, hollow sections 36 made of aluminum conveniently cut into twelve-foot sections, the abutting extremities of adjacent sections 36 being maintained in alignment and operative relationship by an expansion joint 38 disposed within the extremities of the adjacent mullion portions 24 and bridging the gap or space 40 therebetween.

The mullions 22 are secured in vertical orientation on the face of the building structure 12 by a plurality of mounting arms 42, each of which is disposed through a slot 44 formed in the rear portion 26 of an adjacent mullion 22. A plurality of fastener assemblies 46 secure the arms 42 to the channel base portions 28 and to projecting flanges 48 of a plurality of T fittings 50, each of which is rigidly secured to a corresponding plurality of horizontally oriented angles 52 which are fixed to the undersides of the floor slabs 20. In this manner, the

various superimposed sections 36 of the mullions 22 are secured by the mounting arms 42 to the undersides of the floor slabs 20 in spaced apart relationship so that the hollow extremities thereof can expand and contract within the spaces 40.

The uppermost mullion sections 36 are mounted to the underside of the roof slab 16 and the lowermost mullion sections 36 are mounted to the upper side of the base floor slab by mounting arms or other suitable means, the particular details of these connections being sufficiently similar to the previously described connections between the sections 36 and the floor slabs 20 that a description thereof is omitted for brevity.

The expansion joints 38 which are operative to maintain the mullion sections 36 in operative alignment while yet permitting relative movement therebetween are each constituted by an upper element 54 and a lower element 56 which are receivable, respectively, within adjacent extremities of the sections 36. As best illustrated in FIG. 3, the upper and lower elements 54 and 56 are rectangularly configured for slidable reception thereof within the adjacent extremities of the mullion sections 36, and for slidable reception therewithin of a substantially rectangularly configured expansion fitting 39.

Each lower element 56 is rigidly secured by a machine screw 58 to the front portion 24 and to the lower extremity of the expansion fitting 39 so that the fitting 39 and lower element 56 move as an integral assembly with the associated section 36 during expansion and contraction thereof with temperature. In contrast, the upper element 54 slidably moves within its associated mullion section 36, and also slides over the upper extremity of the expansion fitting 39. In this way the spaces 40 between adjacent ones of the superimposed mullion sections 36 are bridged by the expansion fittings 39.

The upper extremity of each lower element 56 is located below the upper extremity of the adjacent mullion section 36 so that a sealant receiving recess 60 is formed between the expansion fitting 39 and section 36, the upper extremity of the lower element 56 forming the bottom of the recess 60. A suitable sealant 61 is disposed in the recess 60 to form a sealed joint located between adjacent extremities of the elements 54 and 56, and completely about the periphery of the expansion joint 38 whereby water and dirt are prevented from entering the hollow interior of the mullions 22.

Although the sealant 61 keeps out moisture and dirt, it does not interfere with the expansion or contraction of the adjacent mullion sections 36, so that unwanted thermal stresses cannot build up in the curtain wall 10, the plurality of expansion joints 38 being distributed throughout the extent of the wall 10, as best indicated in FIG. 1 by the locations of the spaces 40 adjacent the expansion fittings 39.

Moreover, since the upper element 54 of the expansion joint 38 floats upon the body of sealant 61 in the recess 60, relative expansion of the adjacent mullion sections 36 does not cause the extrusion of the sealant from the recess 60 as occurs in conventional constructions where the sealant is interposed directly between the confronting extremities of the mullion sections.

Operatively associated with the vertically oriented mullions 22 is a plurality of rails 62, FIG. 7, constituted by a main rail member 64 and an auxiliary rail member 66 for supporting a window (not shown) in operative position. As will be described, a slightly different rail member 68, FIG. 8, is also utilized in combination with the auxiliary rail member 66 for supporting an insulated or decorative panel (not shown) in operative relationship with the curtain wall 10.

The opposite extremities of the rail members 64 are each supportively connected to an adjacent mullion 22 upon a receptacle portion 70 constituted by a pair of receptacle pockets, openings or recesses 72 formed in pairs of confronting, vertically extending, and inwardly dis-

posed projections 74 and 76 which are integral with the opposed channel walls 32 and 34 of the mullion 22. The rail extremities fit very closely within the receptacle recesses 72, but for both installation purposes, and for the purpose of allowing thermal expansion and contraction of the rail member 64, the extremities thereof are spaced a very slight distance from the adjacent channel base portions 28.

More particularly, the rail members 64 are longer than the horizontal distance between adjacent mullions 22 so that when the rail extremities are received within the mullion channels 30, the rail members 64 are constrained against outward movement by the channel walls 32. However, the rail members 64 are each shorter than the distance between adjacent channel base portions 28 to permit expansion and contraction. In addition, this arrangement permits the rail member 64 to be diagonally positioned, as shown in FIG. 11, with the extremities thereof clearing the mullion channel walls 32, so that the rail member can be rotated (in the direction indicated by the arrows in FIG. 11) to the horizontal position shown in FIG. 12. In this latter position the rail extremities are received within the channels 30 so that the channel walls 32 prevent outward movement of the rail member 64, it being noted that the rail member 64 is at this time tilted or cocked about its own longitudinal axis to permit the extremities of the rail member 64 to fit within the channels 30, as illustrated in FIG. 14.

Each rail member 64 includes a forwardly projecting ledge 78 and a pair of rearwardly projecting, vertically spaced flanges 80 and 82 which are longitudinally coextensive with the rail member 64 except for end portions which are cut away, as best illustrated in FIG. 10, to permit the ends of the rail member 64 to fit within an adjacent mullion channel 30. The outer termini of such cut away portions constitute shoulders 84 and 86 which abut against the outward edges of the mullion channel walls 32 and 34, respectively, when the rail member 64 is in the position illustrated in FIG. 7. In addition, the cut away portions forming the shoulders 84 and 86 provide clearance to permit the rail member 64 to be inserted into a mullion channel 30 between the walls 32 and 34 thereof, as best illustrated in FIG. 14, so that the rail member 64 is properly located for rotation about its own longitudinal axis for seating upon the receptacle portion 70, as illustrated in FIG. 15. To facilitate entry of the rail member extremity within the receptacle portion 70, an angle 90, FIG. 14, is provided in the lowermost flange 82 adjacent the shoulder 86, and this angle 90 abuts the channel wall 34 just prior to clockwise rotation of the member 64 into the position shown in FIG. 15.

It is noted that when the angle 90 engages the channel wall 34, a depending leg 88 of the rail member 64 engages the lower terminus of the forwardly located receptacle recess 72, preventing clockwise rotation of the rail member 64. However, the temper or condition of the aluminum material of which the member 64 is made is such that the leg 88 is resiliently deflectable, whereby the leg 88 is adapted to ride over the lower terminus of the forwardly located receptacle recess 72 and into the position shown in FIG. 15. In this position the leg 88 "snaps" back into an undeflected position which prevents counterclockwise rotation of the member 64.

From the above it will be apparent that the rail member 64 is securely held in position upon adjacent mullions 22, with its opposite extremities locked in operative relationship upon the receptacle portions 70 of the mullions 22. No fasteners or fittings are utilized for this interconnection and securement is achieved solely by the provision of the cut away portions in the rail member extremities, and by the portions of the mullions 22 which are removed to provide the receptacle portions 70. Accordingly, standard and relatively inexpensive extrusions

are utilized for both the mullions 22 and the rail members 64.

Of utmost importance is the fact that the cooperating extremities of the rail members 64 and the receptacle portions 70 of the mullions 22 provide snap joints between said rail members and said mullions. These snap joints permit the method of rail installation shown in FIG. 11 of the drawings. In erecting the curtain wall the mullions 22 are first secured to the building structure. After this has been accomplished the individual rails 64 are installed by tilting them, as in FIG. 11, to insert their extremities in the mullion channels 30. The rails 64 are then rotated into the horizontal position of FIG. 12 but rotated into cocked position with respect to the installed position of FIG. 15.

The rails 64 are then rotated about their longitudinal axes to cause the extremities thereof to snap into the receptacle portions 70 of the mullions. The snap joint eliminates the necessity for sliding fitment of the rail extremities in the mullions and also eliminate the necessity for erection of the mullions and rails in series.

The auxiliary rail member 66 is normally located across the forward side of the rail members 64 to help support closures such as windows or panels, and also to provide an unbroken, flush facing for the composite rails 62. Thus, as best viewed in FIG. 4 each member 66 includes a transversely extending groove for receiving a seal strip 92 which, in cooperation with a confronting seal strip 94 carried by the rail member 64, supports a window 95 in position. The auxiliary rail member 66 also includes vertically spaced apart, rearwardly projecting flanges 96 which incorporate at their rearward extremities bayonet fittings 98 which resiliently "snap" into mating bayonet fittings 100 of the member 64 to secure the rail member 66 upon the rail member 64.

With this arrangement, the auxiliary rail member 66 is quickly and easily assembled upon the rail member 64 to form an attractive composite rail 62 by pressing the two together to snap the mating bayonet fittings 98 and 100 together, thereby maintaining the auxiliary rail member 66 in the position illustrated in FIG. 7. As will be apparent from an examination of FIG. 7, it is extremely unlikely that the normal, downwardly directed load forces upon the auxiliary rail member 66 will disengage the member 66 from its associated rail member 64. Moreover, the flush mounting is attractive and provides continuous surfaces which are relatively easy to clean. The window 95 is resiliently supported in position by the seal strips 92 and 94, which tend to prevent entry of water and dirt, and a plurality of drain or weep holes 104 provide a means for draining away any water that may happen to enter.

The auxiliary rail member 66 illustrated in FIG. 8 cooperates with the rail member 68 in a manner identical to that just described in connection with the cooperation of the member 66 with the member 64, and is illustrated to show how a decorative or insulated panel can also be supported in operative position by rails secured to the mullions 22 through the utilization of receptacle portions 70, as previously described.

The bayonet type connections between the auxiliary rail member 66 and the rail member 64 or 68, as the case may be, permit relative movement therebetween to accommodate differential thermal expansion and contraction whereby all portions constituting the curtain wall 10 are capable of independent movement during exposure thereof to temperature extremes.

I thus provide by my invention a composite curtain wall 10 which is characterized by the comparative speed and simplicity of its erection. Because of the nature of the interconnections between the rail members 64 and the mullions 22, the mullions can all be erected first, and the members 64 thereafter diagonally disposed relative to the mullions and pivoted in the plane of the wall 10

to horizontal positions. Subsequently, the members 64 are easily rotatable about their own axes to thereby lock the members 64 upon the mullion receptacle portions 70. Thus, positive fastening means such as rivets or screws are completely eliminated in the securing of the rail members 64 to the mullions 22. The rapid interconnectability of the auxiliary rail members 66 to the rail members 64 further simplifies the assembly of the curtain wall 10, greatly reducing the erection time thereof compared to curtain walls of the prior art. Also of significance is the provision of expansion joints which permit relative movement between the mullion sections without materially affecting the appearance or function of the curtain wall. In this regard, the joints between adjacent mullion sections 36 may be concealed or covered by a plurality of plates 106, FIG. 6, which are resiliently snapped into positions abutting the channel base portions 28. The plates 106 are slidable relative to the base portions 28 so that thermal expansion or contraction of the mullions 22 is not hampered by the plates 106.

While the invention has been described by means of specific examples and specific embodiments, the invention is not limited thereto since obvious modifications and variations will occur to those skilled in the art without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a curtain wall construction for a building, the combination of: a plurality of spaced apart, vertically oriented mullions, each of which includes longitudinally extending, laterally opening channels constituted by confronting side walls and a base portion, said side walls including receptacle means; and a plurality of rails having extremities slidably received within said channels when disposed obliquely relative to said side walls, said rails being rotatable about their longitudinal axes upon registry of said extremities thereof with said receptacle means whereby said rail extremities rotate into and supportively engage said receptacle means and said rails and said mullions define a plurality of closure receiving openings.

2. In a curtain wall construction for a building, the combination of: a plurality of spaced apart, vertically oriented mullions, each of which includes longitudinally extending, laterally opening channels constituted by confronting side walls and a base portion, said side walls including inwardly disposed, longitudinally extending projections interrupted at predetermined intervals to provide

receptacle recesses; a plurality of rails, said rails having opposite extremities slidably received within said channels when disposed obliquely relative to said side walls, said rails being rotatable about their longitudinal axes upon registry of said extremities thereof with said receptacle recesses whereby said rail extremities are snapped into and supported within said receptacle recesses and said rails and said mullions define a plurality of closure receiving openings.

3. In a curtain wall construction for a building, the combination of: a plurality of spaced apart, vertically oriented mullions, each of which includes longitudinally extending, laterally opening channels constituted by confronting side walls and a base portion, said side walls including inwardly disposed, longitudinally extending projections interrupted at predetermined intervals to provide receptacle recesses; a plurality of rails having opposite extremities of said rails slidably received within said channels when disposed obliquely relative to said side walls, said rails being rotatable about their longitudinal axes upon registry of said extremities thereof with said receptacle recesses to bring said extremities within said receptacle recesses, said rail extremities being made of resilient material whereby portions thereof are deflectable upon engagement with portions of said projections, during rotation of said extremities into said receptacle recesses, for snapping back upon supportive disposition of said extremities within said receptacle recesses to thereby prevent opposite rotation of said extremities and removal thereof from said receptacle recesses.

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