

May 5, 1959

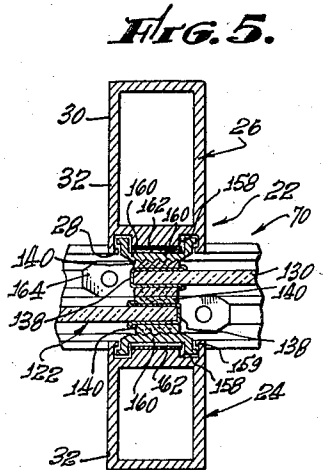
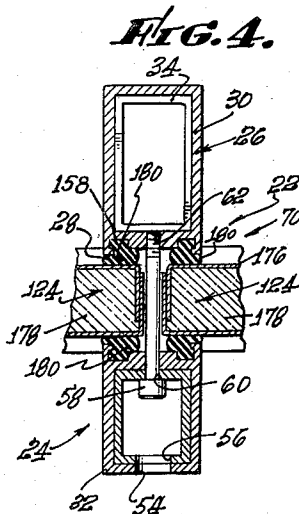
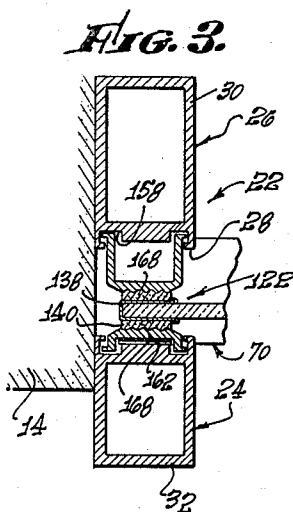
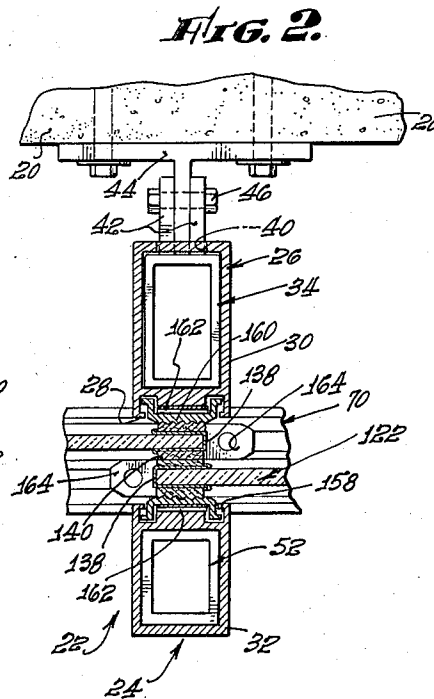
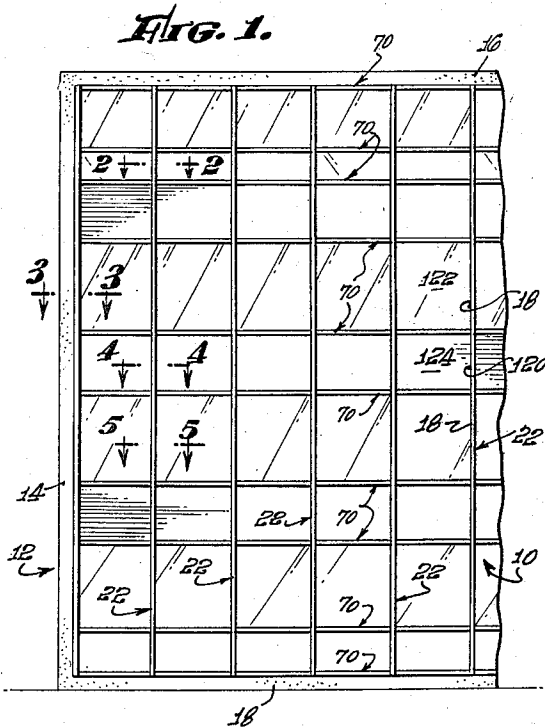
A. GROSSMAN

2,885,040

CURTAIN WALL CONSTRUCTION

Filed April 30, 1956

4 Sheets-Sheet 1



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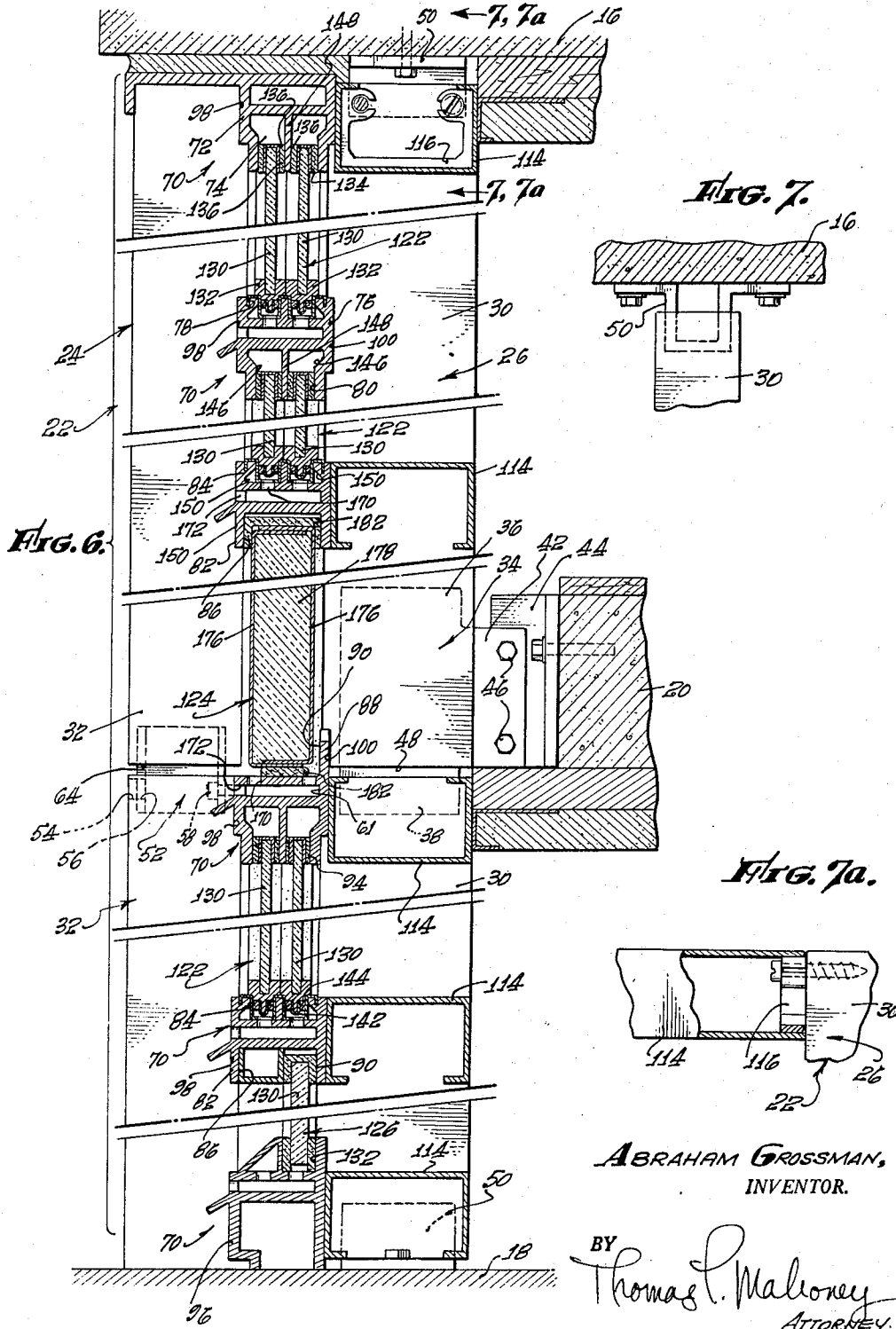
A. GROSSMAN

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CURTAIN WALL CONSTRUCTION

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CURTAIN WALL CONSTRUCTION

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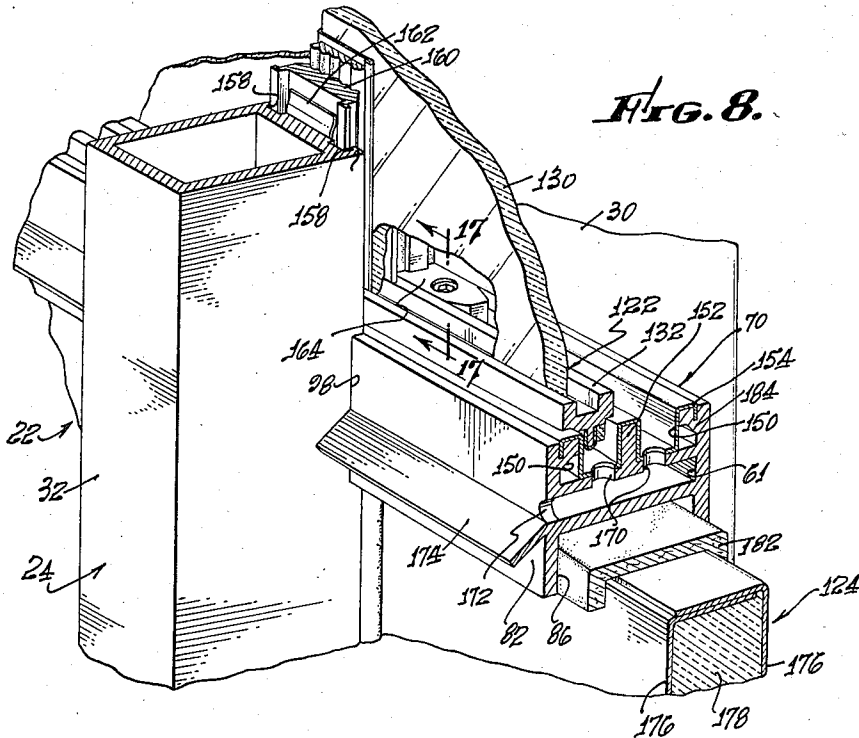


Fig. 8.

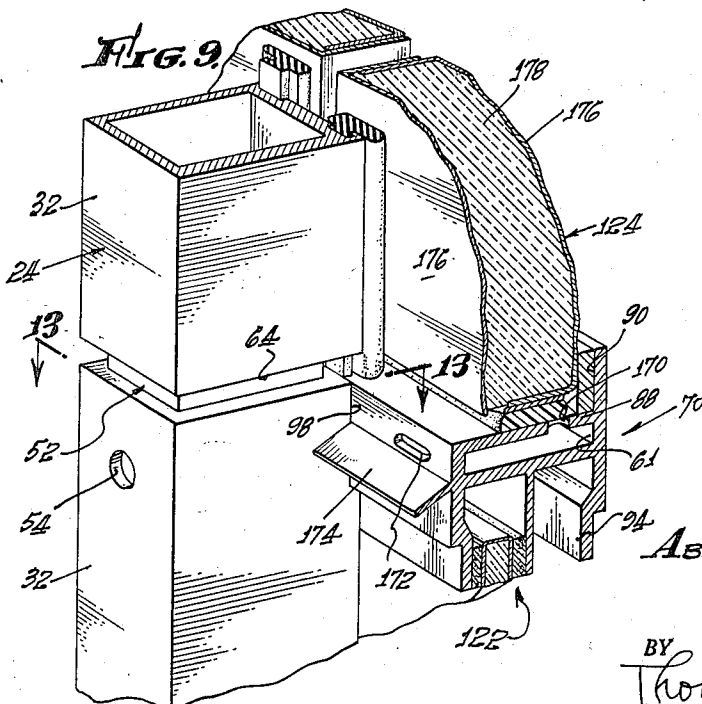


Fig. 9.

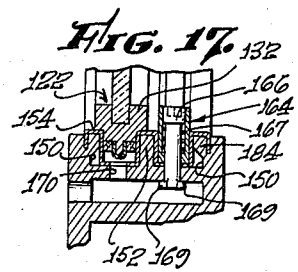


Fig. 17.

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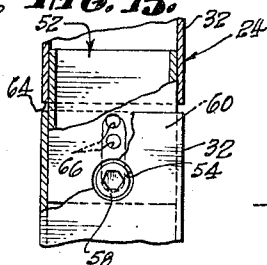
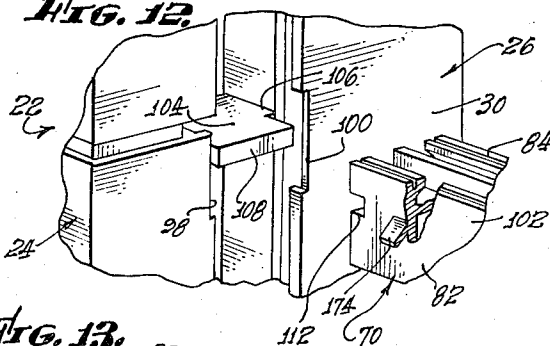
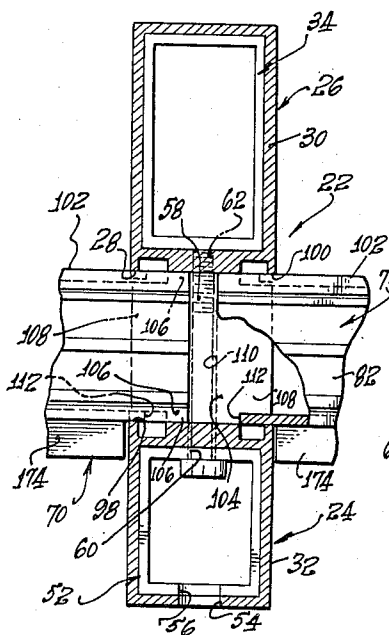
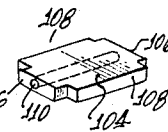
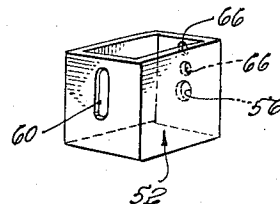
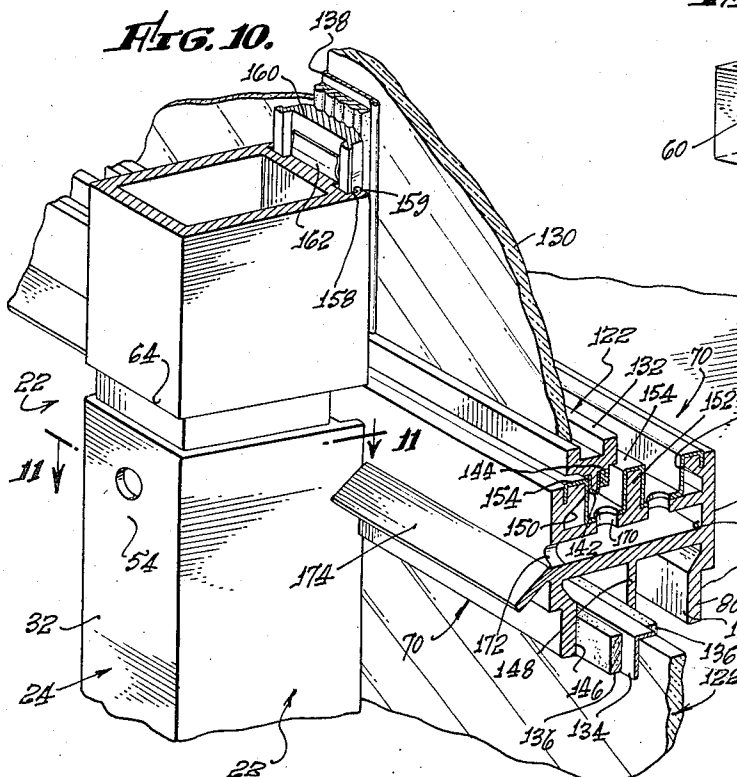
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2,885,040

CURTAIN WALL CONSTRUCTION

Filed April 30, 1956

4 Sheets-Sheet 4



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2,885,040

CURTAIN WALL CONSTRUCTION

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Application April 30, 1956, Serial No. 581,537

19 Claims. (Cl. 189—72)

This invention relates to a curtain wall construction and, more particularly, to a curtain wall construction formed from aluminum extrusions and adapted to be suspended on the face of a building in substitution for the conventional masonry customarily applied thereto.

Although I will describe the principles of my invention as embodied in a curtain wall construction wherein the various structural elements are formed in large part from aluminum extrusions, it is, of course, obvious that other materials such as steel forms and the like might be utilized in substitution for aluminum extrusions while still embodying the principles of my invention.

A recent development in the architectural field has been the substitution of various types of curtain wall constructions which are usually constituted by a plurality of metallic members fastened to the face of a building in substitution for the conventional masonry or brick utilized hitherto and defining a plurality of the openings for the reception of closures such as windows, decorative panels, and the like. Since the use of such curtain walls is a relatively recent innovation, it has been customary for the architects of the individual buildings to design a specific type of curtain wall which is custom built to suit the particular application and it is obvious that such a conventional expedient results in a structure which is expensive and which is limited in its application to the particular building for which it is designed.

It is, therefore, an object of my invention to provide a curtain wall construction which is extremely flexible and universal in character and which can thus be applied with facility to a large number of different types of buildings which are designed for the use of curtain walls. Therefore, the structural elements constituting the curtain wall of my invention can be mass produced on a large scale and the resulting economies can be shared by builders of numerous buildings. Moreover, the design time frequently expended by the architect in custom designing a curtain wall has been eliminated, thus reducing the architectural fee previously incurred in the custom design of conventional curtain walls.

One of the primary considerations dictating the utilization of curtain wall constructions has been the elimination of excessive maintenance on the front wall of buildings which are constantly viewed by the public since it is necessary, at recurring intervals, to point-up or otherwise treat masonry and brickwork structures. Another consideration dictating the utilization of curtain wall constructions is the ease and speed with which such constructions can be erected.

A further object of my invention is the provision of a curtain wall construction adapted to be utilized in conjunction with all types of buildings which is characterized by the elimination of the necessity for maintenance treatment thereof and which is also particularly notable for the ease with which it may be installed in operative relationship with a structure with which it is to be permanently associated. Another important aspect of the curtain wall

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of my invention is the ease with which particular components thereof may be removed from operative relationship therewith in order that re-arrangement of various of the closures supported thereby may be made.

The larger number of commercial buildings constructed today are fabricated from reinforced concrete wherein the floors and the roofs are constituted by reinforced concrete slabs and wherein the curtain wall is applied to the front edges of the slabs and to adjacent surfaces of the roof and ground floor structures. In prior art curtain wall constructions, little consideration has been given to the fact that, since the various components thereof are fabricated from metal, the problem of differential coefficients of expansion between the curtain wall elements and the building structure on which it is supported would arise and thus the prior art curtain wall constructions, when subjected to extremes of temperature, are exposed to stresses and strains arising out of the lack of means for accommodating the differences in the coefficients of expansion of the curtain wall construction and the structure upon which it has been mounted.

Another object of my invention is the provision of a curtain wall construction which includes a plurality of multi-sectional mullions which are vertically oriented with respect to and supported upon a structure with which the curtain wall is associated, the sections of the mullions being operatively connected by expansion joints which accommodate expansion of the mullions due to exposure of the curtain wall to extremes of temperature. Moreover, the curtain wall of my invention incorporates horizontally oriented rail members operatively associated with the aforementioned mullions, said rail members also being multi-sectional and having incorporated between the sections thereof expansion joints which accommodate horizontal expansion of said rail members simultaneously with the accommodation of vertical expansion in the mullions by the expansion joints between the sections thereof. Thus, the curtain wall of my construction is particularly free of internal stresses and strains due to expansion occurring because of subjection to extremes of temperature and thus the tendency encountered in prior art curtain wall constructions for the elements of the curtain wall to twist and become dislocated from operative relationship with the building with which they were associated has been eliminated in the curtain wall of my invention.

One of the principal considerations dictating the utilization of curtain wall constructions in modern commercial buildings has been the fact that the elements of the curtain wall construction impart to the building an aspect of grace and lightness not achievable by the use of conventional architectural expedients. In prior art curtain wall constructions, the effect achieved has been somewhat nullified by the incorporation in the curtain wall of conventional means of fenestration such as conventional steel or aluminum sashes whose horizontal rails and vertical stiles are exposed to the gaze of the casual observer, thus materially reducing the effect of lightness and airy grace which should be imparted by a curtain wall construction.

A further object of my invention is the provision of a curtain wall construction wherein the vertical mullions are split into front and back portions whose transverse cross section presents as narrow a sight as feasible, said front and back portions being disposed in spaced relationship with each other to define laterally opening spaces which receive and thus conceal the vertical stiles of aluminum or other framed or unframed sashes disposed in said spaces so that there is exposed to view only the pane of glass mounted in the sash. Because overlapping stiles of sash are sandwiched between the front and rear portions of the split mullions, the appearance of the grid frame is that of a pure rectangular section with a narrow

face that is not increased, as is usually the case, by the addition of sash or other moldings.

Another object of my invention is the provision of mullions of the aforementioned type wherein the front and rear portions thereof are provided with sealing means adapted to engage the adjacent surfaces of overlapping stiles of window sash disposed therein to prevent the infiltration of air and moisture into the structure with which the curtain wall construction of my invention is associated.

Another significant advantage of my invention is the fact that, since the mullions are split to define a space between the front and rear portions thereof, the sash whose stiles are mounted in overlapping relationship in said spaces may be moved back and forth to facilitate the cleaning thereof.

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 showing a curtain wall constructed in accordance with the teachings of my invention applied to a structure;

Fig. 2 is a transverse, sectional view taken on the broken line 2—2 of Fig. 1;

Fig. 3 is a transverse, sectional view taken on the broken line 3—3 of Fig. 1;

Fig. 4 is a transverse, sectional view taken on the broken line 4—4 of Fig. 1;

Fig. 5 is a transverse, sectional view taken on the broken line 5—5 of Fig. 1;

Fig. 6 is an enlarged, fragmentary, sectional view showing the relationship of a plurality of components of the curtain wall construction of my invention;

Fig. 7 is a vertical, sectional view taken on the broken line 7—7 of Fig. 6;

Fig. 7a is a vertical, sectional view taken on the broken line 7a—7a of Fig. 6;

Fig. 8 is an enlarged, fragmentary, sectional view showing the relationship of various components of the curtain wall of my invention;

Fig. 9 is a view similar to Fig. 8 showing the incorporation of an insulated panel in the curtain wall construction;

Fig. 10 is a view similar to Fig. 9 and showing the manner in which adjacent ends of rail member sections may be operatively connected in association with the vertical mullions;

Fig. 11 is a transverse, sectional view taken on the broken line 11—11 of Fig. 10;

Fig. 12 is a fragmentary, disassembled view of the elements shown in Fig. 11;

Fig. 13 is a reduced, fragmentary, sectional view taken on the broken line 13—13 of Fig. 9;

Fig. 14 is a perspective view of a typical expansion joint member utilized in conjunction with the sections of vertical mullions;

Fig. 15 is a typical expansion joint member utilized in conjunction with the sections of horizontally oriented rail members;

Fig. 16 is a side elevational view of the sinuous spring utilized in conjunction with the front and rear portions of the vertical mullions; and

Fig. 17 is a sectional view of the lock utilized to lock the movable sash against movement in the rail members of the curtain wall construction of my invention.

Referring to the drawings and particularly to Fig. 1 thereof, I show a curtain wall 10 constructed in accordance with the teachings of my invention and operatively connected to a building structure 12 which includes a side wall 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 to which the vertical mullions 22 are secured, as best shown in Figs. 2 and 6 of the drawings.

The mullions 22 are split into front and rear portions 24 and 26 and the front portion 24 and rear portion 26 of each vertical mullion 22 is multi-sectional in character and is constituted by a plurality of lengths of hollow aluminum extrusions, the lengths 30 constituting the rear portion of each mullion 22 being of greater cross-sectional area than the lengths 32 of extrusion incorporated in the front portion 24 of each mullion 22. Since the mullions 22 are split, a vertical space 28 is defined therebetween for a purpose which will be described in greater detail below.

The reason for the difference in cross section is obvious since, as will be apparent, the rear portion 26 of the mullions 22 support the entire load of the curtain wall assembly. The lengths 30 of extrusion constituting the rear portion 26 of each mullion 22 are provided in twelve foot sections and the abutting extremities thereof are maintained in operative relationship by means of an expansion fitting 34 which is, as best shown in Fig. 6 of the drawings, of substantially T-shape configuration in side elevation, the upper and lower extremities 36 and 38 of the head of the T being, respectively, received in the lower and upper extremities of abutting lengths 30 of extrusion.

It will be noted that, as best shown in Fig. 2 of the drawings, a slot 40 is formed in the rear wall of the upper extrusion to permit the mounting arms 42 of the expansion fitting 34 to engage a mounting bracket 44 secured to the adjacent face of a floor slab 20 and to be secured thereto by means of a bolt and nut combination 46. It will be noted that, as best shown in Fig. 6 of the drawings, the lower extremity of the upper length 30 of extrusion is disposed in spaced relationship with the upper extremity of the lower length of extrusion to define an expansion space 48 therebetween which thus permits expansion and contraction of the extremities of the lengths 30 of extrusion with reference to each other without imposing undesired strains upon the curtain wall construction 10. Thus, an expansion fitting 34 is mounted on each floor slab 20 and an expansion space 48 is provided thereat which will permit expansion of the extremities of the sections 30 of the rear portion 26 of each mullion 22.

The upper extremity of the uppermost length 30 of extrusion is engaged by a U-shaped mounting bracket 50 secured on the underside of the roof slab 16, said bracket projecting into the interior of the extrusion and, once again, permitting upward or downward movement of the engaged portion to accommodate expansion and contraction thereof. In a similar manner a sill anchor is constituted by an identical bracket 50 secured to the upper surface of the lowermost floor slab 18 and thus the entire rear portion 26 of each mullion 22 is firmly fastened to the face of the building 12 while the individual sections or lengths of extrusion constituting the rear portion 26 of the mullion 22 can expand and contract when subjected to extremes of temperature.

The front portions 24 of the vertical mullions 22 and, more particularly, the sections 32 of extrusion constituting the same are maintained in operative relationship with each other and with their respective rear portions 26 in the manner graphically illustrated in Figs. 4, 6, 11, and 13 of the drawings by means of expansion fittings 52 whose upper and lower extremities are receivable in adjacent extremities of the sections 32 of extrusion. In order to maintain the fitting 52 in operative relationship with the adjacent extremities of sections 32 of extrusion and in operative relationship with the rear portion 26 of a mullion 22, an access opening 54 is provided in the upper extremity of the lower section 32 of extrusion, said access opening being registerable with a similar opening 56 formed in the front wall of the fitting 52 to permit the passage of the head and shank of a bolt 58, said shank passing through an elongated slot 60 in the rear wall of the expansion fitting 52 and engaging

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a threaded opening 62 an adjacent section 30 of the rear portion 26 of the mullion 22. The shank of the bolt 58 also passes through a drain passage 61 on the rail 70, as best shown in Fig. 6 of the drawings.

Thus, the bolt 58 secures the expansion fitting 52 against movement on the rear portion 26 of the mullion 22, but the adjacent extremities of the lengths 32 of extrusion are permitted to expand or contract by virtue of an expansion space 64 therebetween which thus permits the front portion 24 of a mullion 22 to expand proportionally with the rear portion 26 thereof to avoid the imposition of undue stresses on the curtain wall 10 and the structure 12 with which it is associated. Thus, an expansion fitting 52 may be provided at each floor slab 20 as is an expansion space 64. In some instances, an expansion fitting 34 and an expansion fitting 52 may be used to connect sections of the front and rear portions 24 and 26 of the mullion 22 where no rail member of the character to be described hereinbelow is located.

It will be noted that the front wall of the expansion fitting 52 is also provided with a plurality of adjustment apertures 66 whose function will become apparent as the installation of the expansion fitting 52 with associated sections 32 of extrusion in the front portion 24 of a vertical mullion 22 is described.

For instance, if it is desired to release the upper of two sections 32 of extrusions from a lower section, the bolt 58 is partially released to permit the fitting 52 to slide downwardly in the lower section 32 of extrusion by virtue of the slot 60 and thus the lower extremity of the upper section 32 can be readily disengaged from operative relationship with the upper extremity of the lower section. When it is desired to relocate said extremities in operative relationship with each other, a tool is inserted in the adjustment apertures 66 to urge the upper extremity of the expansion fitting 52 within the lower extremity of the upper section 32 of extrusion and to cause the upward movement of the expansion fitting 52 until the lower extremity of the slot 60 engages the shank of the bolt 58 which is then, once again, caused to securely impinge upon the peripheral area of the back wall of the expansion fitting 52 adjacent the slot 60 to secure the respective sections 32 of extrusion in operative relationship with each other.

Operatively associated with the vertically oriented mullions 22 is a plurality of rail members generally indicated at 70, said rail members including, as best shown in Figs. 6, and 8-10 of the drawings, specific types of rail members such as the cap rail member 72 adapted to be located adjacent the underside of the roof slab 16 and being provided on the underside thereof with track means 74. A first intermediate rail 76 is disposed in spaced relationship with the cap rail 72 and has track means 78 provided on the upper surface thereof and track means 80 incorporated in the underside thereof.

A second type 82 of intermediate rail is disposed below and in spaced relationship with the first intermediate rail 76 and incorporates track means 84 on the upper side thereof and a panel receptacle 86 on the underside thereof. Disposed below and in spaced relationship with the second intermediate rail 82 is a third intermediate rail member 88 which incorporates a panel receptacle 90 on the upper side thereof and has track means 94 provided on the underside thereof.

Disposed below and in spaced relationship with the third type 88 of intermediate rail member is a second intermediate rail member 82 which, in turn, is disposed above and in spaced relationship with a sill rail member 96 which is located upon the lowermost floor slab 18.

In addition to the various types of rail members shown in the drawings, another intermediate type of rail member is provided which includes panel receptacles on both the upper and undersides thereof so that a plurality of banks of panels may be maintained in operative relationship with one another. The individual rail members are

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multi-sectional, that is, they are composed of sections or lengths of extrusions, the longest of which is approximately twenty feet in length. Furthermore, as graphically illustrated in Figs. 6 and 8-12 of the drawings, the front portion 24 and rear portion 26 of each mullion 22 is respectively notched at 98 and 100 to permit the passage therethrough of the associated section of rail member and to cause said section to be supported between the front portion 24 and the rear portion 26 of the associated mullion 22.

The abutting extremities of sections 102 of a multi-sectional rail member 82 are operatively connected with each other within the space or pocket 28 between the front and rear portions 24 and 26 of a mullion 22 in the manner shown in Figs. 11-12 and 15 of the drawings by the use of a cruciform expansion fitting 104 having opposed pairs of legs 106 and 108, the legs 106 being provided with a continuous bore 110 therethrough, as best shown in Fig. 15 of the drawings. The intermediate portions of the sections of the rail member 82 are merely supported in notches 98 and 100. In order to accommodate the opposed extremities of the sections 102 of rail member 82, the expansion fitting 104 is mounted between the opposed faces of the adjacent sections 30 and 32 of the rear and front portions 26 and 24 of a mullion 22, as best illustrated in Fig. 11 of the drawings, the extremities of the legs 106 of said expansion fitting being engaged upon said opposed faces and a bolt 58 extending through the bore 110 in said fitting to operatively secure the same in fixed relationship in the pocket or space 28 between the front and rear portions 24 and 26 of the mullion 22.

When the expansion fitting 104 is so located, the legs 108 thereof extend laterally in the space or pocket 28 to engage the interior of each of the adjoining extremities of the sections 102 of the multi-sectional rail member 82 and slots 112 formed in said extremities ride over the adjacent portions of the legs 106 to provide an operative connection between the extremities of the sections 102 and the expansion fitting 104.

Therefore, when temperature extremes are encountered, the expansion and contraction of the adjacent extremities of the sections 102 of the rail member 82 can be accommodated since they can move freely with respect to the expansion fitting 104 when subjected to such temperature variation, thus eliminating the imposition of stresses upon the curtain wall construction which would ordinarily result, if the sections 102 of the rail member 82 were positively secured to the front and rear portions 24 and 26 of the mullion 22. While the expansion joint between the extremities of sections 102 of a particular rail member 82 have been shown and described, it is, of course, obvious that the same expansion fitting 104 can be applied with equal effectiveness, and is so applied, in joining the adjacent extremities of sections of the rail members 72, 76, 88, and 96.

In the above described manner, the sections 102 of the rail members indicated generally at 70 are joined in operative relationship by an expansion joint within the space or pocket 28 defined between the front and rear portions 24 and 26 of the vertically oriented mullions 22 and thus the entire curtain wall 10, by virtue of the expansion fittings 52 engaging the abutting extremities of mullion sections and expansion fittings 104 engaging adjacent extremities of rail member sections, is characterized by its inherent adaptability to extremes in temperature without causing the generation of undue loads or stresses which might impair the structural relationship of the curtain wall 10 to the building 12 with which it is associated.

Another advantage of the utilization of the expansion fittings 52 in association with the sections of the vertically oriented mullions 22 and the expansion fitting 104 in association with the sections of the horizontally oriented rail

members, and the conjoint use of the brackets 50 on the roof and floor slabs 16 and 18 which also permit expansion of the extreme upper and lower extremities of the mullions 22, is the fact that the various sections of the mullions 22 and the rail members 70 can obviously be very quickly installed in operative relationship with one another without the use of positive fastening means such as bolts and the like. Thus, the erection time of a curtain wall 10 constructed in accordance with the teachings of my invention is remarkably short, and the fact that all of the extrusions utilized in the mullions and the rail members will fit their respective expansion fittings with equal ease is, of course, another factor enhancing the simplicity of erection of the curtain wall 10.

When the curtain wall 10 is erected upon the structure 12 with which it is associated, the interior sides of the rail members 70 are disposed in spaced relationship with the edges of the floor slabs 20 and filler channels 114 are provided between the floor slabs and the inner surfaces of the rails which serve to fill the spaces which exist between the edges of the floor slabs and the inner surfaces of the rails, as best illustrated in Fig. 6 of the drawings.

Supporting pads 116 are, as best shown in Figs. 6 and 7a of the drawings, secured to the sides of the inner portions 26 of the mullions 22 to engage the extremities of the filler channels or stools 114 to support the same in operative relationship with the mullions 22. Therefore, when the mullions 22 and rail members 70 are operatively associated with each other in the above described manner, a plurality of openings 118 and 120 are defined therebetween, said openings 118 being adapted particularly for the reception of aluminum frame sliding sash 122 and the openings 120 being adapted for the reception of fixed panels 124.

In addition, panels of structural glass 126 which are fixed may be utilized, as best shown in the lower portion of Fig. 6 of the drawings. In any event, it should be readily apparent that there is little, if any, limitation on the type of closure which is to be received in any of the openings defined in the curtain wall 10 and the primary consideration is that if panels are to be used the rail members for supporting said panels must have panel receptacles therein, and if sliding sash are to be used the rail members must have track means incorporated therein for supporting said sliding sash.

The sliding sash 126 each includes a pane of glass 130, the lower extremity of which is mounted in a bottom rail 132 formed from an aluminum extrusion, as best shown in Figs. 6, 8, and 10 of the drawings. The upper edge of the pane 130 is encompassed in a stainless steel channel 134 which serves as a mount for a woven pile weatherstrip 136 and the lateral or side edges of the pane 130 are encompassed in a stainless steel channel 138, as best shown in Fig. 5 of the drawings, said stainless steel channel mounting woven pile weatherstrips 140. Secured to the aluminum extrusion constituting the bottom rail 132 is a stainless steel channel 142 which mounts a woven pile weatherstrip 144.

The tracks provided on the undersides of the rail members 70 are of uniform character and are constituted by recesses 146 divided by a central depending wall 148. The upper edges of the sliding sash 122 and, more particularly, the woven pile weatherstrip 136 thereupon engage the sides of the recesses and the central wall 148 to create a seal against the ingress of air and moisture. The tracks provided on the upper surfaces of the rail members 70 are also of uniform character and include recesses 150 divided by an upstanding central wall member 152.

To facilitate the translation of the sliding sash 122 in the tracks on the upper surfaces of the rail members 70, a roll formed zinc strip 154 is located in the recesses 150 and in overlying relationship with the centrally located wall 152, as best shown in Figs. 8 and 10 of the drawings. The aluminum extrusion constituting the bottom rail 132

engages the adjacent areas of the zinc strip 154 and thus free movement of the sash 122 thereupon is facilitated.

It will be noted that, as best shown in Figs. 2 and 5 of the drawings, the lateral edges of the sashes 122 are disposed in overlying relationship with each other so that the weatherstripping 140 and the stainless steel mounting channels 138 therefor are disposed within the pocket or space 28 between the front and rear portions 24 and 26 of the mullions 22. In this manner, there can be no visual perception of the weatherstripping or the channels 138 which mount the same and the appearance of the curtain wall 10 is not detracted from by the presence of stiles which are perceptible to the eye of the casual observer.

Moreover, each of the sections 30 and 32 constituting, respectively, the rear and front portions 26 and 24 of a mullion 22 is provided on its opposing face with a continuous receptacle 158 having side flanges 159 for the reception of a sealing pad 160 constituted by an aluminum extrusion having a plurality of linear corrugations 162 incorporated in the face thereof which engages the adjacent section of weatherstrip 140 on the channel 138. A sinuous spring 162 is located in the recess 158 between the wall of the recess and the spring pad 160 to force said pad into operative relationship with the adjacent area of the weatherstrip 140.

It is, therefore, clear that when the lateral edges of the sash 122 are moved into overlapping relationship with each other the spring pads 160 are forcibly engaged with the adjacent areas of the weatherstripping 140 and also serve to force the lateral edges of the sash 122 toward each other to create a positive dynamic seal which prevents the infiltration of air, moisture, and other contaminants into the interior of the building structure 12 with which the curtain wall 10 is associated. Moreover, the sash 122 can be moved horizontally in either direction in associated tracks to facilitate the cleaning thereof. Since the sash have their lateral edges mounted in the spaces 28 between the front and rear portions 24 and 26 of the mullions 22, there is no need to provide frames or other means for mounting the same.

As best shown in Figs. 2, 5, 8, and 17, locking blocks 164 are secured to the sash 122 and located in the recesses 150 of the tracks. Mounted in the blocks are allenhead screws 166 which are biased upwardly by a compression spring 167 and have detent lugs 169 engageable with the bottom of the associated track by passing through elongated openings therein. Therefore, the sashes 122 cannot be opened except by authorized personnel so that air-conditioning and other building services will not be undesirably affected.

When only one sash 122 is located in the space or pocket 28 adjacent the side wall or coping 14 of the building 12, a large pad 168 constituted by an aluminum extrusion is inserted in the rear portion 26 of the mullion 22, as best illustrated in Fig. 3 of the drawings. It should also be noted that the rail members 70 are provided with weep holes and openings 170 and 172, respectively, to drain condensate from the track in the rail members 70 and to convey it to the exterior thereof, as best shown in Figs. 8-10 of the drawings. In addition, a drip flange 174 is provided adjacent to the weep openings 172 to drain the condensate therefrom. Furthermore, the same type of drainage is provided in the rail members 70 supporting the panels 124.

The panels 124, as best shown in Figs. 4, 6, and 8-9 of the drawings, are mounted in receptacles 86 and 90 in adjacent rail members and are constituted by sheet metal pans 176 secured together by spot welding, or the like. The pans 176 together define a chamber in which is located a mass 178 of insulating material. The exterior surfaces of the panels are customarily enameled or otherwise coated to provide a decorative finish thereupon.

The adjacent edges of contiguous panels 124 are located in the pockets or spaces 78 in the mullions 22 and,

as best shown in Fig. 4 of the drawings, are engaged by vinyl plastic sealing strips 180 mounted in the recesses 158 in the front and rear portions 24 and 26 of the mullions 22. The upper and lower edges of the panels 124 are engaged by vinyl strips 182 to seal said edges. If desired, a conventional mastic can be used in substitution therefor.

I thus provide by my invention a composite curtain wall which is characterized by its ease of erection and assembly and by the facility with which the standardized components thereof may be adapted to specific applications. Also of significance is the provision of expansion joints and fittings in the mullions and rail members which accommodate expansion due to temperature changes without materially altering the appearance or function of the curtain wall.

Moreover, the provision of composite mullions defining pockets for the reception of panels and sashes enhances the appearance of the curtain wall since the lateral edges of said sashes and panels are concealed from view. Of particular importance is the incorporation in the front and rear portions of the mullions of spring-biased pads which urge the overlapping lateral edges of the sash against each other to create an effective seal therebetween.

I claim as my invention:

1. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each constituted by a pair of multi-sectional inner and outer portions disposed in spaced relationship with each other; fasteners operatively connecting said inner and outer portions; and a plurality of horizontally oriented rail members engageable with said mullions to define a plurality of closure receiving openings, said rail members being multi-sectional and said mullions supporting expansion joint connectors for the reception of opposing ends of sections of said rail members, said connectors for said rail member sections being located in the space between said mullion portions and supported on said fasteners.

2. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each constituted by a pair of multi-sectional inner and outer portions disposed in spaced relationship with each other; fasteners operatively connecting said inner and outer portions; and a plurality of horizontally oriented rail members engageable with said mullions to define a plurality of closure receiving openings, said rail members being multi-sectional and said mullions supporting expansion joint connectors for the reception of opposing ends of sections of said rail members, said connectors for said rail member sections being cruciform and located in the space between said mullion portions and supported on said fasteners.

3. In a curtain wall construction for suspension on the face of a building having a plurality of horizontal supporting surfaces and a plurality of vertical supporting surfaces, the combination of: a plurality of vertically oriented mullions each consisting of an inner and outer section disposed in spaced relationship with each other to define a through space therebetween, said inner sections being supported upon selected horizontal surfaces and said outer sections being supported upon said inner sections; and a plurality of horizontally oriented rail members supported on said inner and outer sections of said mullions and extending through said spaces.

4. In a curtain wall construction for suspension on the face of a building having a plurality of horizontal supporting surfaces and a plurality of vertical supporting surfaces, the combination of: a plurality of vertically oriented mullions each consisting of an inner and outer tubular section disposed in spaced relationship with each other to define a through space therebetween, said inner sections being supported upon selected horizontal surfaces and said outer sections being supported upon said inner sections; a plurality of horizontally oriented rail members supported on said inner and outer sections of said mullions

and extending through said spaces; and sashes having stiles and being slidably mounted for movement in said rail members, said sashes having their stiles received in overlying relationship in said spaces between said inner and outer sections of said mullions.

5. In a curtain wall construction for suspension on the face of a building having a plurality of horizontal supporting surfaces and a plurality of vertical supporting surfaces, the combination of: a plurality of vertically oriented mullions each consisting of an inner and outer section disposed in spaced relationship with each other to define an opening therebetween which extends completely through said mullion and having said inner sections supported upon selected horizontal surfaces and said outer sections supported on said inner sections; a plurality of horizontally oriented rail members supported on said inner and outer sections of said mullions and extending through said openings; and movable sashes having stiles mounted in said rail members, said sashes having their stiles disposed in overlapping relationship in said openings between said inner and outer sections of said mullions.

6. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each of which includes an inner and outer section disposed in spaced relationship with the other to define a continuous space open at the sides thereof, one of said sections having a receptacle therein facing the other section; a plurality of horizontally oriented rail members supported by said inner and outer sections of said mullions, said mullions, in conjunction with said rail members defining a plurality of openings; a closure disposed in each of said openings with its upper and lower edges supported on said rails and its lateral edges located in the spaces between said inner and outer sections of said mullions in overlying relationship with the lateral edges of adjacent closures; and resilient means in said receptacle urging said edges into engagement with each other.

7. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each of which includes an inner and outer section disposed in spaced relationship with the other to define a space open at the sides of the mullion, each of said sections having a receptacle therein; a plurality of horizontally oriented rail members supported by said inner and outer sections of said mullions, said mullions, in conjunction with said rail members, defining a plurality of openings; movable sashes having upper and lower rails and side stiles and being mounted in certain of said openings having their rails supported on lower rail members and their stiles located in said spaces between said inner and outer sections of said mullions in overlying relationship, said stiles being completely concealed within said mullions and having weatherstrips thereupon; and resilient means in said receptacles for urging said stiles toward each other.

8. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each of which includes an inner and outer section disposed in spaced relationship with the other to define a space open at the sides of the mullion, each of said sections having resilient means mounted therein in opposed relationship, a plurality of horizontally oriented rail members supported by said inner and outer sections of said mullions, said mullions, in conjunction with said rail members defining a plurality of openings; and closures disposed in said openings with their lower edges supported on said rails and their lateral edges disposed in overlapping relationship in the spaces between said inner and outer sections of said mullions, said edges being biased toward each other by said resilient means.

9. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each of which includes an inner and outer section disposed in spaced relationship with the other to define a space open at the sides of said mullion, said sections incorporating con-

tinuous receptacles having resilient means mounted therein; a plurality of horizontally oriented rail members supported by said inner and outer sections of said mullions, said mullions, in conjunction with said rail members defining a plurality of openings; and sashes having upper and lower rails and side stiles and being mounted in certain of said openings each of which has its rails supported on the lower rail members and its stiles located in said spaces between said inner and outer sections of said mullions, said stiles having weatherstrips thereupon and being engaged by said resilient means in said inner and outer sections.

10. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each consisting of inner and outer sections disposed in spaced relationship to define spaces open at the sides of, and extending through, the mullion, said inner and outer sections consisting of superimposed parts; an expansion joint fitting connecting said parts; and a plurality of horizontally oriented rail members supported upon said mullions and extending through said spaces to define a plurality of openings in combination therewith.

11. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each consisting of inner and outer sections disposed in spaced relationship to define spaces open at the sides of, and extending through, the mullion, said inner and outer sections consisting of superimposed parts; a combined expansion and supporting joint fitting connecting each of said parts; and a plurality of horizontally oriented rail members supported upon said mullions to define a plurality of openings in combination therewith, each of said rail members being constituted by a plurality of parts connected by combined expansion and supporting joint fittings.

12. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions defining closure receiving spaces open at the opposite edges of, and extending through, the mullions, each mullion consisting of a plurality of superimposed parts connected by combined expansion and supporting joints; a plurality of rail members extending into said spaces and supported therein to define, in conjunction with said mullions, a plurality of openings; and closures mounted in said openings with their upper and lower edges in said rail members and their lateral edges in said spaces.

13. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions defining closure receiving spaces open at the opposite edges of the mullions and extending therethrough, each mullion consisting of a plurality of superimposed parts connected by combined expansion and supporting joints; a plurality of rail members extending into said spaces and supported therein to define, in conjunction with said mullions, a plurality of openings, said rails consisting of a plurality of parts and said parts being connected by combined expansion and supporting joints; and closures mounted in said openings with their upper and lower edges in said rail members and their lateral edges in overlapping relationship in said spaces.

14. In a curtain wall, the combination of: a plurality of vertically oriented, multi-sectional mullions, said sections being connected by combined expansion and supporting joints; and a plurality of horizontally oriented, multi-sectional rail members operatively connected to said mullions, said rail member sections being connected to said mullions and to each other by combined expansion and supporting joints.

15. In a curtain wall, the combination of: a plurality of vertical mullions having closure receiving pockets therein open at the edges of the mullions and extending therethrough, confronting portions of said mullions having resilient means therein; horizontally extending rail members operatively associated with said mullions to define closure receiving openings in conjunction therewith; and closure means located in said openings with their lateral edges in said pockets and their upper and lower edges in said rail members, said closure means having weatherstrip means on their lateral edges urgeable into engagement by said resilient means.

16. In a curtain wall, the combination of: a plurality of vertical mullions having laterally opening, closure receiving pockets therein open at the edges of the mullions and extending therethrough, confronting portions of said mullions having resilient means therein; horizontally extending rail members operatively associated with said mullions to define closure receiving openings in conjunction therewith; and closure means located in said openings with their lateral edges in said pockets and their upper and lower edges in said rail members, at least some of said closure means being constituted by sliding sashes whose lateral edges are constituted by stiles located in overlapping relationship in and concealed within said pockets.

17. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each constituted by a pair of multi-sectional inner and outer, tubular portions disposed in spaced relationship with each other to define closure receiving pockets open at the opposite edges of the mullions and extending therethrough; fasteners operatively connecting said inner and outer portions; and a plurality of horizontally oriented rail members extending through said pockets to define a plurality of closure receiving openings.

18. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each constituted by a pair of multi-sectional inner and outer portions disposed in spaced relationship with each other; fasteners operatively connecting said inner and outer portions; combined expansion and supporting joint connectors between the sections of said mullions; and a plurality of horizontally oriented rail members engageable with said mullions to define a plurality of closure receiving openings.

19. In a curtain wall construction, the combination of: a plurality of vertically oriented mullions each constituted by a pair of multi-sectional inner and outer portions disposed in spaced relationship with each other to define spaces open at the edges of and extending through said mullions; fasteners operatively connecting said inner and outer portions; and a plurality of horizontally oriented rail members engageable with said mullions to define a plurality of closure receiving openings, said rail members being multi-sectional and said mullions supporting expansion joint connectors for the reception of opposing ends of sections of said rail members.

References Cited in the file of this patent

UNITED STATES PATENTS

1,845,304	Lunken	Feb. 16, 1932
2,066,051	Petit	Dec. 29, 1936
2,280,142	Daniels	Apr. 12, 1942
2,331,389	Grund	Oct. 12, 1943