Aug. 22, 1967 W. J. HORGAN, JR 3,336,707

STRUCTURAL GASKET CURTAIN WALL

Filed Dec. 9, 1964 5 Sheets-Sheet 1

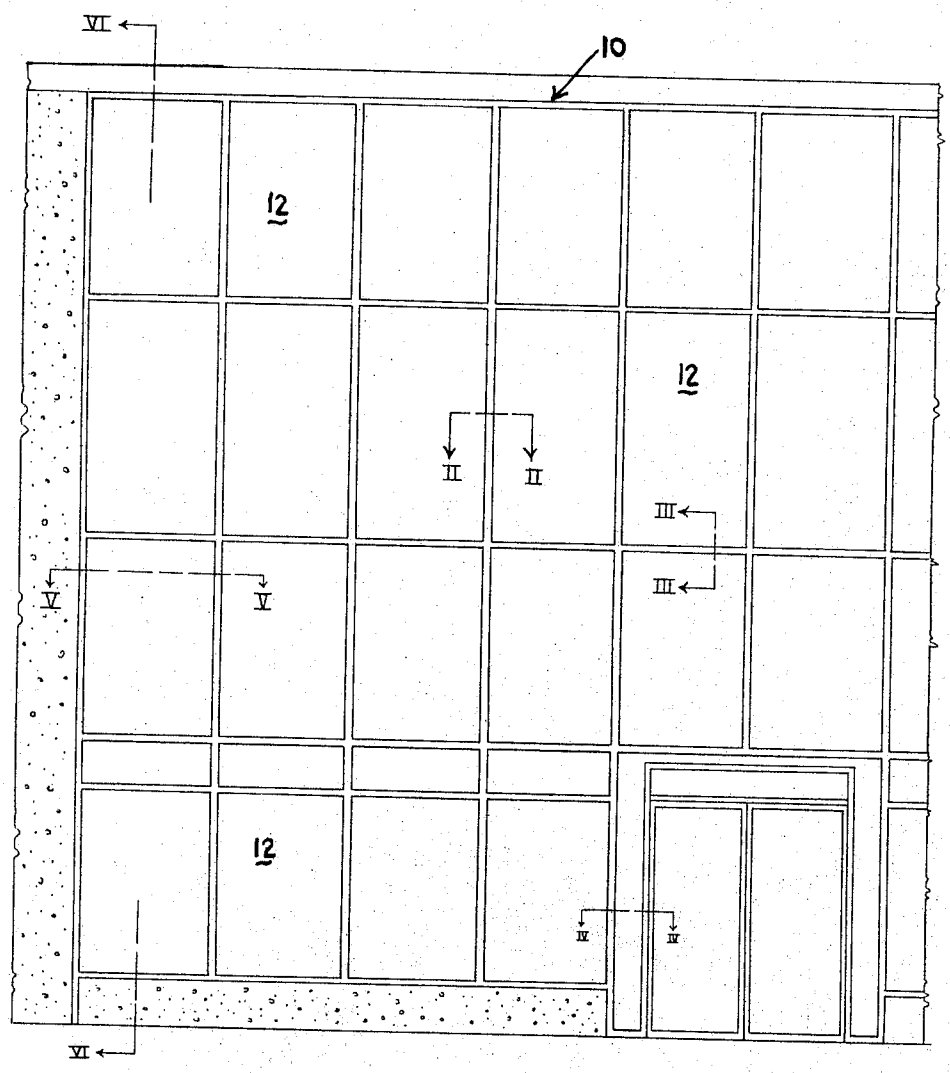


FIG. 1

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Aug. 22, 1967 W. J. HORGAN, JR 3,336,707

STRUCTURAL GASKET CURTAIN WALL

Filed Dec. 9, 1964 5 Sheets-Sheet 2

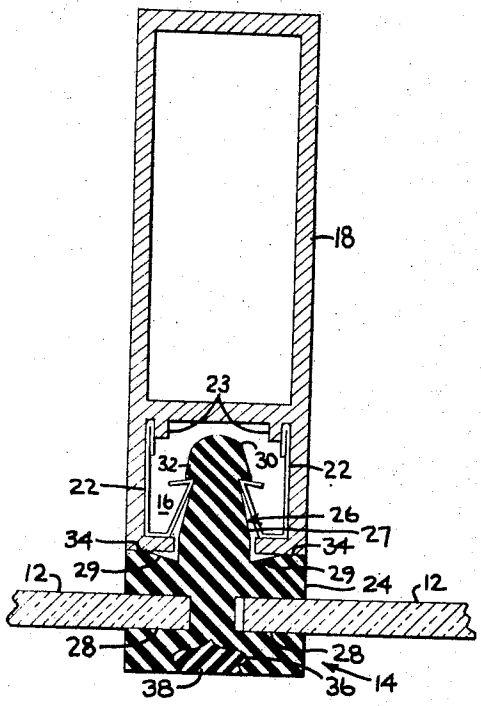


FIG. 2

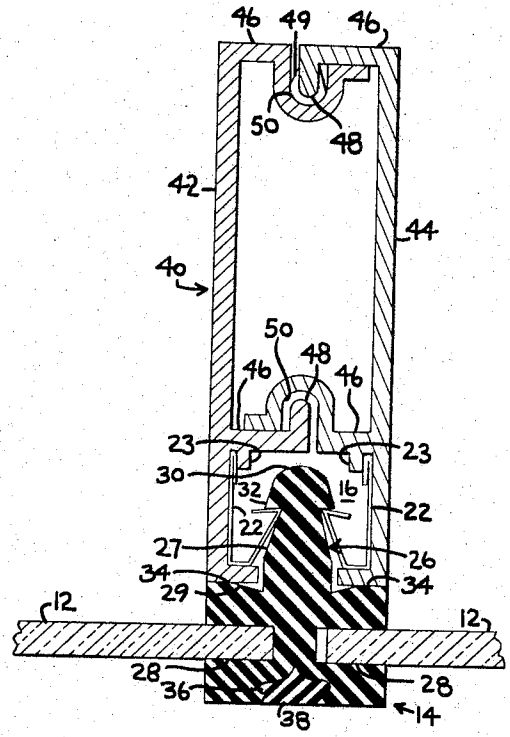


FIG. 3

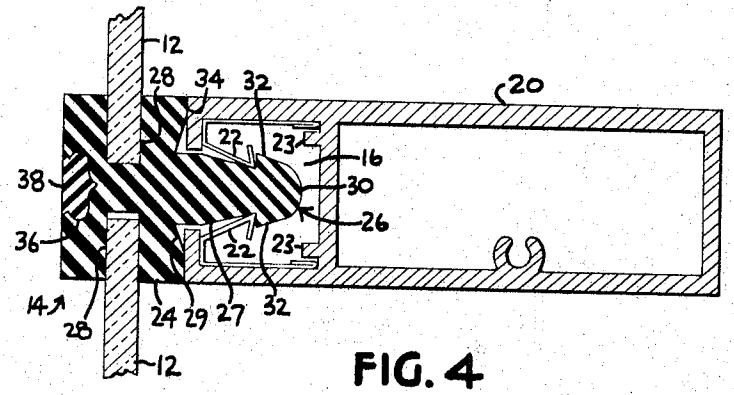


FIG. 4

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Aug. 22, 1967 W. J. HORGAN, JR 3,336,707

STRUCTURAL GASKET CURTAIN WALL

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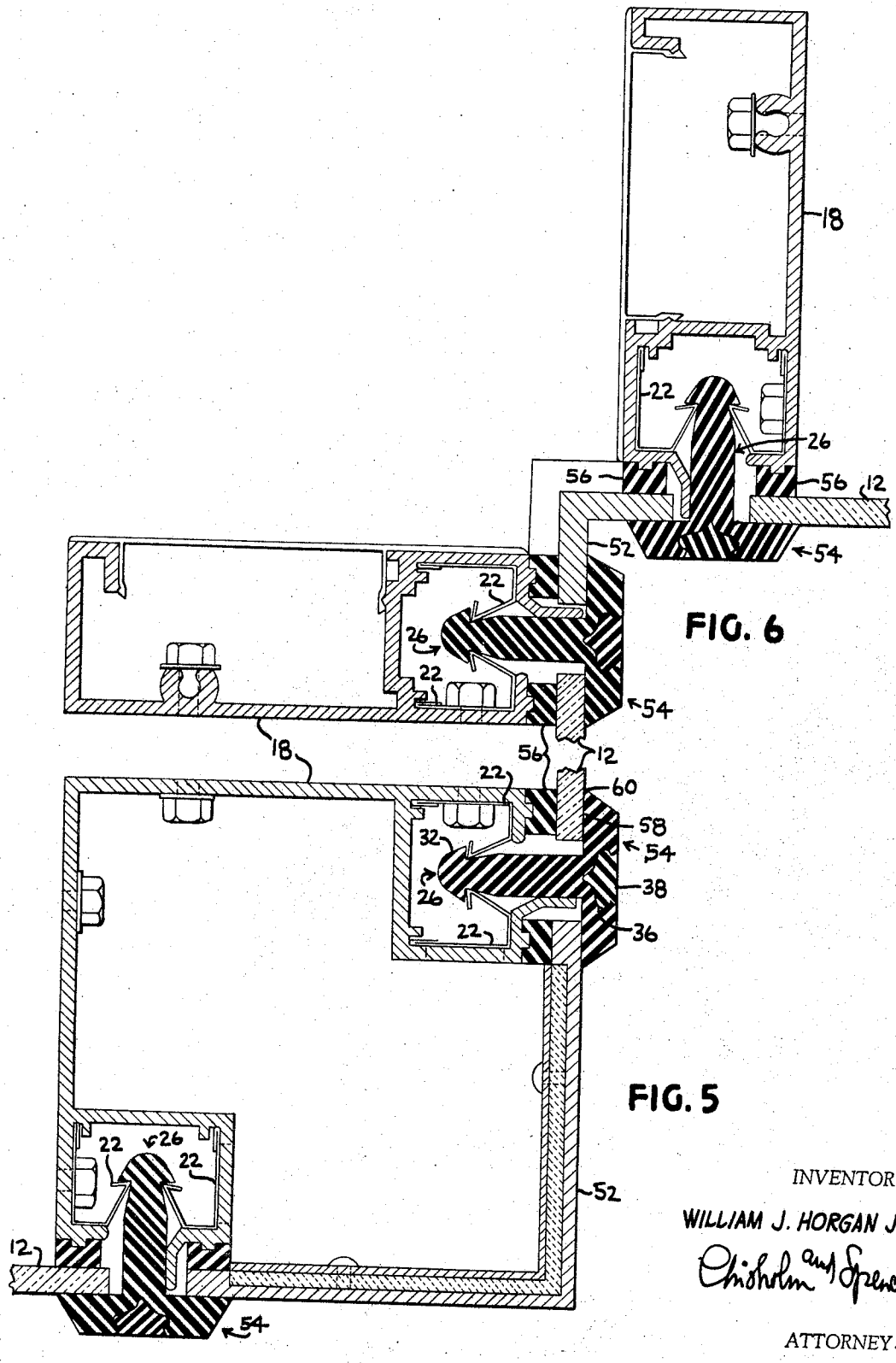


FIG. 6

FIG. 5

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STRUCTURAL GASKET CURTAIN WALL

Filed Dec. 9, 1964 5 Sheets-Sheet 4

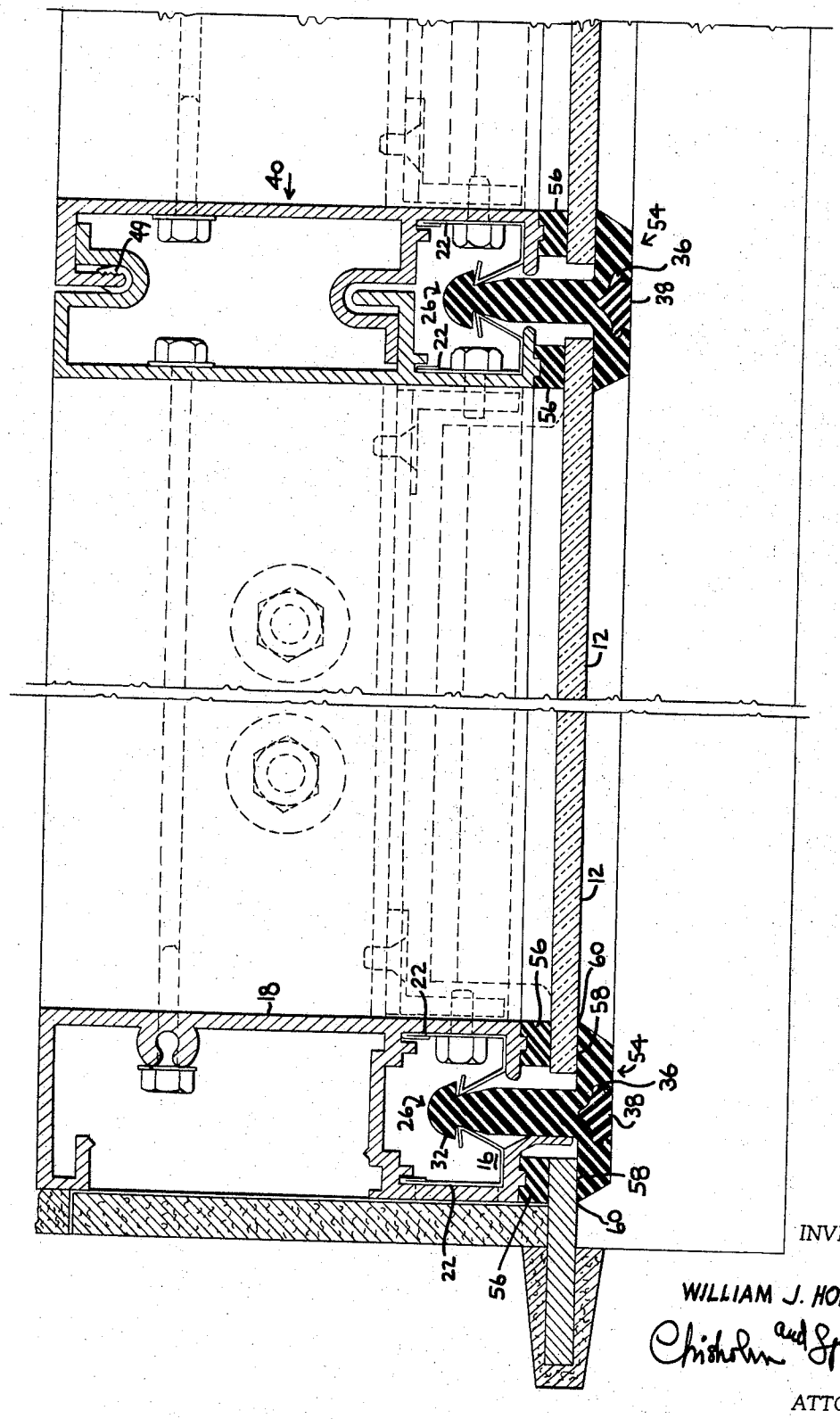


FIG. 7

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STRUCTURAL GASKET CURTAIN WALL

Filed Dec. 9, 1964 5 Sheets-Sheet 5

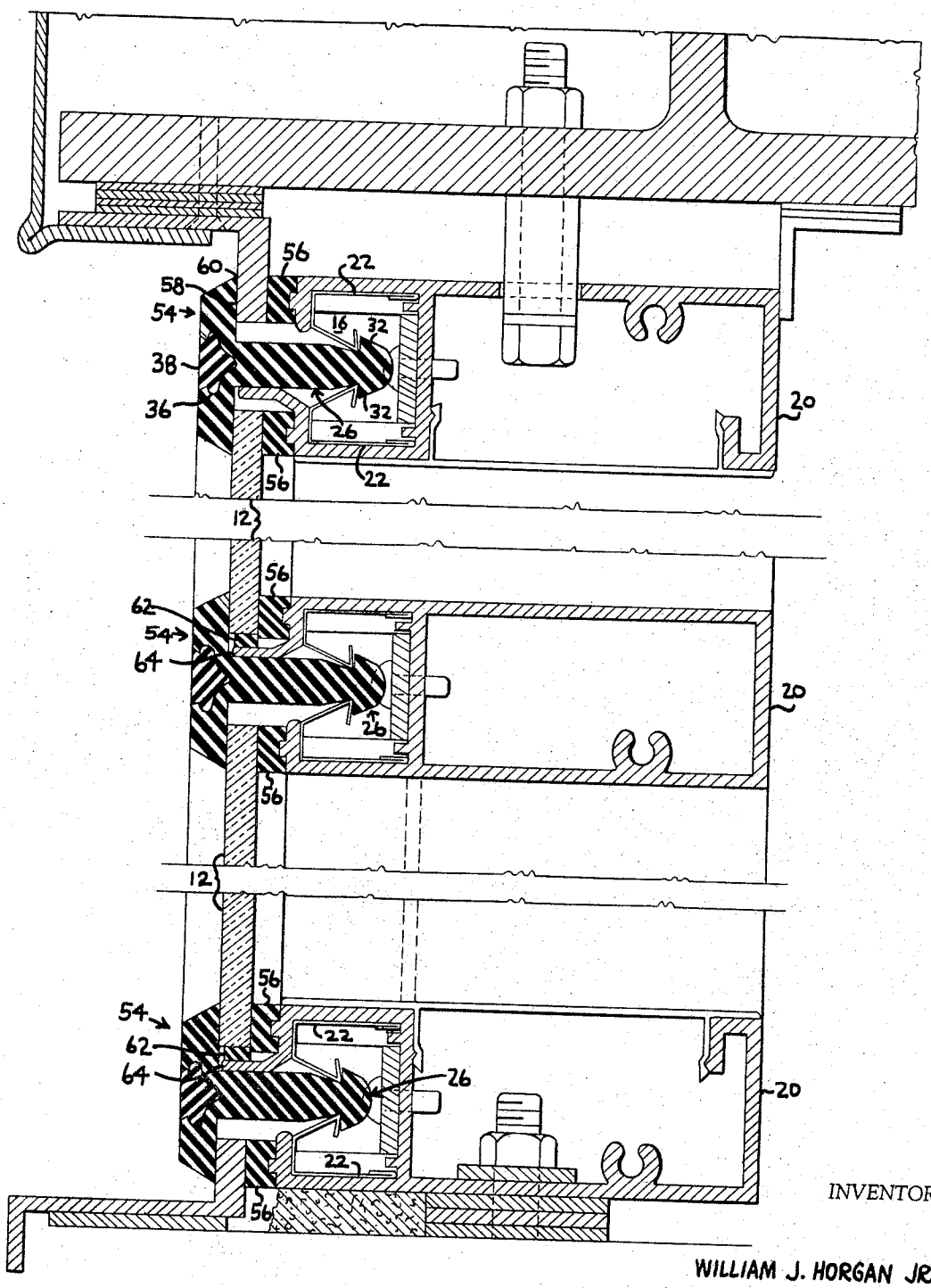


FIG. 8

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United States Patent Office 3,336,707 Patented Aug. 22, 1967

3,336,707

STRUCTURAL GASKET CURTAIN WALL

William J. Horgan, Jr., Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company, Pittsburgh, Pa., a corporation of Pennsylvania

Filed Dec. 9, 1964, Ser. No. 417,127
19 Claims. (Cl. 52—281)

This invention relates to curtain wall construction, and in particular to an improved curtain wall system employing a novel elastomeric structural glazing gasket. In addition, the present invention involves a novel curtain wall system that provides a complete thermal barrier between the interior and the exterior of a building.

A typical known form of curtain wall construction consists of replacing conventional masonry and like building walls with an open structural framework that either supports a panel within the open space defined by the structural framework or has separate panel framing elements attached to one face of the structural framework. The panels are usually made of glass, although other rigid materials may also be employed. The structural framework and panel framing elements are generally composed of a number of extruded metal members that may be joined to form a single module, but are more frequently joined into a multiple module grid structure. Generally, this form of construction has been found to be relatively expensive and difficult to install.

Furthermore, in previously known forms of curtain wall construction, problems have arisen with various attempts to provide a thermal grid barrier, i.e., a thermal break between the panel members and the grid members to prevent heat transfer from one member to the other, while providing a curtain wall system that is capable of fully meeting design specifications, both with respect to aesthetics and performance.

The present invention combines all of the best features of known types or forms of curtain wall construction, and provides a novel curtain wall system that is relatively easy and inexpensive to install, that has been fully tested to meet all performance specifications, that inherently possesses a complete thermal grid barrier and that is comparable or lower in cost to any known form of construction.

In addition, the curtain wall system of the present invention provides a clean sight line, particularly when viewing directly into the curtain wall. This is important, both aesthetically and functionally, where the system employs the use of transparent panels.

Furthermore, the curtain wall system of the present invention can be completely reversed, and thus can accommodate mounting of the panels, either from the interior or the exterior of the building, for maximum freedom in design and installation. Also, a novel vertical expansion member is provided to accommodate any horizontal expansion in the constituent structural members of the building.

A novel feature of the present invention, which makes the above advantages possible, involves the use of a T-shaped elastomeric structural glazing gasket constructed and arranged to be securely mounted on one face of a frame or grid structure in a manner that permits it to fully insulate, directly support, resiliently retain and weather seal the curtain wall panels in their installed position. A structural gasket, as the term is herein employed, means an elastomeric member which is so integrated with the structural members of the system and so associated with the curtain wall panels as to become literally an essential part of the panel supporting structure. In other words, an essential function of a structural gasket member is to provide structural support for the curtain wall panels.

However, the gasket may also have other functions, such as insulating, resiliently supporting and weather sealing the curtain wall panels in their installed position.

Elastomeric gasket strips have been used in the past to sealingly retain and cushion panels, such as plate glass or window glass, when mounted in the walls of a building or in automobile bodies. Such gasket strips generally comprise an elongated elastomeric body having grooves therein for receiving the edges of glass and/or other rigid sheets to be joined. The gasket strip may also include a wedge-shaped member insertable in a wedge-receiving recess in the body of the strip, whereby the elastomeric material is crowded to cause the groove to engage the glass and/or other rigid sheets more tightly. Other forms employ a cylindrical wedge insertable in a cylindrical groove for the same purpose.

Such known gasket strips provide a resilient weather seal around the periphery of the panels. When wedges are employed, the wedge helps to force the strip material into tight engagement with the panel, thereby positively preventing air or water from passing around the edge of the panel.

However, prior to the present invention, the use of such gasket strips in curtain wall construction has been severely limited by various design, installation and performance considerations. It was thus left for the present invention to provide a fully insulated curtain wall system that offers complete freedom of design and provides superior performance under all normal conditions of exposure, while employing elastomeric structural glazing gaskets in combination with metal stiffening members and gasket locking and retaining means.

Other features and advantages of the invention will be better understood when reference is had to the accompanying drawings wherein similar parts are usually designated by the same numeral and in which:

FIG. 1 represents an outside elevation of a typical curtain wall and recessed entranceway constructed in accordance with the present invention;

FIG. 2 is a typical cross-section along the line II—II of FIG. 1 showing the details of one preferred elastomeric structural glazing gasket in conjunction with one form of vertical stiffening member which may be employed;

FIG. 3 is a typical cross-section along the line II—II of FIG. 1 showing the novel elastomeric structural glazing gasket of FIG. 2 as employed in combination with a novel vertical expansion member;

FIG. 4 is a cross-section along the line III—III of FIG. 1 showing the novel elastomeric structural glazing gasket of FIG. 2 affixed to a typical horizontal stiffening member;

FIG. 5 is a typical cross-section along the line IV—IV of FIG. 1 showing a second preferred elastomeric structural glazing gasket and the preferred outside corner arrangement employed with the present invention;

FIG. 6 is a typical cross-section along the line IV—IV of FIG. 1 showing the novel elastomeric structural glazing gasket of FIG. 5 and the preferred inside corner arrangement employed with the present invention;

FIG. 7 is a cross-section along the line V—V of FIG. 1 showing the details of the second preferred elastomeric structural glazing gasket in combination with typical vertical stiffening members and gasket locking and retaining means; and

FIG. 8 is a cross-section along the line VI—VI of FIG. 1 showing the novel elastomeric structural glazing gasket of FIGS. 5 to 7 affixed to typical horizontal stiffening members.

The curtain wall **10**, depicted in FIG. 1, consists of a plurality of panels **12**, which are separated and supported along their peripheral edges by an elastomeric structural

glazing gasket securely mounted within horizontal and vertical stiffening members which form a suitable framework. Although FIG. 1 shows the structural glazing gaskets supporting a plurality of panels covering a complete wall section, it will be appreciated from the following description that the present invention is equally well adapted to single or multiple panel construction. The panels **12** may be of an insulating or non-insulating type and of any suitable material or construction.

As shown in FIGS. 2, 3 and 4, the structural glazing gasket **14** is received in an inwardly directed mounting groove **16** formed within the vertical metal stiffening members **18** and horizontal metal stiffening members **20**. Vertical stiffening members **18** and horizontal stiffening members **20** are joined to form a rigid structural frame or framework. Two continuous flat springs or spring clips **22** are held in place within groove **16** by protrusions **23** formed on the stiffening members. The springs **22** provide gasket engagement means for locking and retaining the structural glazing gasket within mounting groove **16**.

The structural glazing gasket **14** is an elongated strip made of natural or synthetic rubber or other elastomeric material which extends completely around the periphery of each of the panels **12** and is secured within the mounting groove **16** provided in each of the vertical stiffening members **18** and each of the horizontal stiffening members **20**.

The T-shaped structural glazing gasket **14** has an elongated body portion **24** and a longitudinally extending leg or tongue **26** protruding from one side of said body portion. A longitudinally extending groove **28** is formed in each of two opposed arms or sides of body portion **24**. The body portion **24** is provided with a frame engaging face **29** on the tongue side, which extends laterally outwardly at an acute angle relative to the tongue **26**. Tongue **26** is formed with inwardly directed reentrant surface portions or grooves **27**, which terminate in a bulbous end portion **30**, providing two protruding longitudinal lips **32**. The protruding lips **32** snap into and lock with the flat springs **22** when the structural gasket **14** is inserted into groove **16** in the rigid frame formed by the metal stiffening members **18, 20**. It will be appreciated that the thickness of tongue **26** and bulbous end portion **30** is slightly less than the width of the groove **16**. This permits the structural glazing gasket **14** to be readily inserted within the frame provided by stiffening members **18, 20**.

The frame engaging face **29** on body portion **24** extends laterally outwardly and at an acute angle to the tongue **26** for a substantial distance on either side of said tongue. The face terminates in a sealing lip **34**, which is deformable upon insertion of tongue **26** into mounting groove **16**. Sealing lip **34** is maintained deformed by protruding lips **32** on tongue **26**, snapping into and locking with flat springs **22**, thereby providing a sealing engagement with the rigid frame at the edge of said frame engaging face.

Body porton **24** has a longitudinally extending wedge recess **36** formed on its face opposite that from which tongue **26** extends, which is adapted to receive a wedge **38**. Wedge **38** forces one side wall of each panel receiving groove **28** into sealing engagement with one side of panel **12**, while the other side wall of each groove **28** is similarly being held in sealing engagement with the other side of panel **12**.

It will be apparent that the structure of this invention is assembled by inserting the tongue **26** of the structural glazing gasket **14** into groove **16** in the rigid frame members **18, 20** far enough so that the sealing lip **34** is deformed and protruding lips **32** on tongue **26** snap into and lock with flat springs **22**. Grooves **28** are then spread wide to receive panels **12** or, at corners and junctions, to receive a filler element **52** of suitable thickness. The wedge **38** is then inserted into wedge recess **36** to retain the side walls of grooves **28** in positive sealing engagement with panels **12**.

The embodiment of the vertical expansion member **40** shown in FIG. 3 is of substantially the same configuration as its vertical stiffening member counterpart **18**, shown in FIG. 2, except that it is longitudinally split into two halves, **42, 44**. Each half **42, 44** is provided with a pair of oppositely directed, longitudinal flanges **46**, which interlock with the corresponding flanges of the other half by means of tongues **48** received in relatively wider grooves **50**, formed thereon. A guide member **49**, comprising short U-shaped lengths of nylon or like material, may be inserted between tongues **48** and grooves **50** at spaced intervals along the length of the expansion member to assure that the two halves **42, 44** remain in parallel alignment after the structural glazing gasket and panels are completely installed. It will be appreciated that when structural glazing gasket **14** is properly installed within groove **16**, the structural gasket and spring retaining clips **22** interact with the halves **42, 44** of expansion member **40** to inhibit sliding or twisting disengagement of tongues **48** from grooves **50**. It should also be apparent that one or more vertical expansion members may be incorporated into the curtain wall system to accommodate any horizontal expansion in the constituent structural members of the building.

FIGS. 5 and 6 show the preferred outside corner and inside corner arrangements, respectively, which are employed with the present invention. Longitudinal angle flanges or filler strips **52**, preferably of a readily bent material such as metal, are employed to accomplish the transition from one of the panelled faces of the building to another. The filler strips **52** may be suitably backed with insulating material, as required, to provide or maintain a complete thermal barrier.

It will be evident that the structure of this invention provides simple means for installing and directly supporting glass or other building panels without the use of additional supporting structure, weather sealing and/or insulating material. Furthermore, the structural glazing gasket disclosed permits a single structural gasket to provide support for two panels while maintaining a clean sight line between the gasket, glass and metal members. Gasketed corners may be accomplished by the use of crosses, L's and T's having the same basic tongue configurations as mentioned above. The crosses, L's and T's will then adjoin the straight runs of the basic gasket configuration to form completely gasketed openings.

As shown in FIGS. 5 to 8, another preferred embodiment of the present invention involves the use of an elastomeric structural glazing gasket **54**, of a slightly modified design, in combination with resilient backing strips **56**. The function, basic construction and operation of the glazing gasket of this embodiment is substantially the same as that of the embodiment set out above. However, there is an important difference between the two embodiments and this will be best understood with reference being had to the method of assembly of the curtain wall structure depicted in FIGS. 5 to 8.

As distinguished from the previously disclosed embodiment, the curtain wall structure shown in FIGS. 5 to 8 is assembled by fastening the resilient backing strips **56** to frame members **18, 20**, then positioning panels **12** on the thus formed framework of resilient backing strips, inserting the leg or tongue **26** of the T-shaped structural glazing gasket **54** into grooves **16** far enough so that the backing strips **56** and the panel engaging face **58** and sealing lip **60** on the arms or body portion of the gasket are slightly compressed or deformed and the protruding lips **32** on tongue **26** snap into and lock with flat springs **22** and then inserting the wedge **38** into wedge recess **36** to force the panel engaging face **58** and sealing lip **60** into positive sealing engagement with panels **12**. Also, in this embodiment, conventional setting blocks **62** may be employed between the lower edge of

the panel 12 and a flange member 64 on the horizontal stiffening members 20.

It should be obvious from the foregoing that the use of this modified, elastomeric structural glazing gasket greatly simplifies the installation of the curtain wall panels by avoiding the manipulative step employed in connection with structural gasket 14 of spreading the grooves 28 of gasket 14 in preparation for receiving panels 12. Nevertheless, in all other respects, the two embodiments perform equally well.

It should also be apparent that a novel feature of the present invention involves the use of gasket engagement means that continuously and positively resist disengagement of the gasket members from assembled relation with the frame members. Although this invention is not limited thereto, the preferred gasket engagement means disclosed herein involves the use of stainless steel spring clips so constructed and arranged as to provide increased resistance to disengagement of the respective members as the force tending to separate said members is progressively increased.

While the preferred embodiments of the invention have been illustrated and described, it will be understood that various changes and modifications may be made within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. An elastomeric structural glazing gasket comprising an elongated member of T-shaped cross-section having a body portion and a leg portion, said body portion being of greater lateral dimension than said leg portion, a reentrant surface portion along the length of each side of the leg of the T forming a pair of grooves therein and a longitudinal wedge receiving recess and wedge member in said body portion opposite the leg of the T.

2. An elastomeric structural glazing gasket for mounting a panel on a vertical face of a frame having an inwardly directed mounting groove with gasket engagement means therein, comprising an elongated body portion, a longitudinally extending tongue protruding from one side of said body portion and having longitudinally extending reentrant grooves formed in opposite sides thereof to be engaged in said mounting groove by said gasket engagement means, a panel engaging face on said body portion extending laterally outwardly for a substantial distance on either side of said tongue and terminating in a sealing lip and wedge means in the side of said body portion opposite said one side for urging the panel engaging face into sealing engagement with said panel.

3. An elastomeric structural glazing gasket comprising an elongated member of T-shaped cross-section having longitudinal grooves formed in the sides of each of the arms of the T, a reentrant surface portion forming longitudinal grooves along the length of each side of the leg of the T and a longitudinal wedge receiving recess and wedge member in said gasket opposite the leg of the T, said arms of the T extending laterally outwardly for a substantial distance on either side of said leg of the T.

4. An elastomeric structural glazing gasket for mounting a panel on a vertical face of a frame having a inwardly directed mounting groove with gasket engagement means therein, comprising an elongated body portion, a longitudinal groove formed in each of two opposed sides of said body portion and adapted to engage a panel, a longitudinally extending tongue protruding from said body portion in a direction perpendicular to said panel engaging grooves, said tongue having means formed thereon to engage and lock with said gasket engagement means in said mounting groove, a frame-engaging face on said body portion extending laterally outwardly at an acute angle relative to said tongue and towards the frame for a substantial distance on either side of said tongue and terminating in a sealing lip, said sealing lip being deformable upon insertion of said tongue into said mounting groove and thereafter maintained deformed by said gasket engagement means to provide sealing at the edge of said frame-engaging face and wedge means in the side of said body portion opposite said frame for urging the walls of the grooves in said body portion into sealing engagement with said panel.

5. The elastomeric structural glazing gasket as defined in claim 4 wherein the means for urging the walls of the grooves in said body portion into sealing engagement with said panel comprises a longitudinally extending wedge recess formed in the side of said body portion opposite said frame-engaging face and a wedge member adapted to be received in said recess.

6. An elastomeric structural glazing gasket for mounting a panel on a vertical face of a frame having an inwardly directed mounting groove with gasket engagement means therein, comprising an elongated body portion, a longitudinally extending tongue protruding from said body portion and being laterally insertable into said groove, said tongue having means formed thereon to engage and lock with said gasket engagement means in said mounting groove, a panel-engaging face on said body portion extending laterally outwardly from said tongue for a substantial distance on either side thereof and terminating in a sealing lip and wedge means in the side of said gasket opposite said tongue for urging the panel-engaging face into sealing engagement with said panel.

7. The elastomeric structural glazing gasket as defined in claim 6 wherein the means for urging the panel-engaging face into sealing engagement with said panel comprises a longitudinally extending wedge recess formed in the side of said body portion opposite said tongue and a wedge member adapted to be received in said recess.

8. An elastomeric structural glazing gasket as defined in claim 7 wherein said tongue terminates with a bulbous end portion.

9. A structural panel support comprising horizontal and vertical members interconnected to form a frame and each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof, an elastomeric structural glazing gasket having a body portion and a tongue portion, said tongue portion being mounted in said grooves and said body portion being in supporting engagement with a panel, wedge means in the side of said body portion opposite said tongue portion for urging said body portion into sealing engagement with said panel and gasket engagement means supported within said grooves in locking engagement with said tongue portion of said gasket.

10. A method of assembling a structural gasket, curtain wall module comprising erecting horizontal and vertical stiffening members to form a rigid open frame, said stiffening members being provided with an inwardly directed mounting groove in one common vertical face thereof and having gasket engagement means therein, fastening a resilient panel backing strip to the face of said members blanking said grooves, erecting and positioning a panel into peripheral engagement with the thus formed framework of resilient backing strips, inserting the leg portion of a T-shaped elastomeric glazing gasket laterally into said grooves far enough so that said leg portion snaps into and locks with said gasket engagement means and then inserting a wedge into a wedge, recess provided in the side of said gasket opposite said leg portion to force a panel-engaging portion on a laterally directed arm of the gasket into positive sealing engagement with said panel.

11. A structural support for a curtain wall panel comprising horizontal and vertical members interconnected to form a frame with each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof, gasket engagement means supported within said grooves in locking engagement with an elastomeric structural glazing gasket comprising an elongated body portion, a longitudinally extending tongue protruding from one side of said body portion and having longi-

tudinally extending reentrant grooves formed in opposite sides thereof and engaged in said mounting groove by said gasket engagement means, a panel engaging face on said body portion extending laterally outwardly for a substantial distance on either side of said tongue and terminating in a sealing lip, and wedge means in the side of said body portion opposite said one side for urging the panel engaging face into sealing engagement with said panel.

12. A structural support for a curtain wall panel comprising horizontal and vertical members interconnected to form a frame with each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof, gasket engagement means supported within said grooves in locking engagement with an elastomeric structural glazing gasket comprising an elongated body portion, a longitudinal groove formed in each of two opposite sides of said body portion and adapted to engage a panel, a longitudinally extending tongue protruding from said body portion in a direction perpendicular to said panel engaging grooves, said tongue having means formed thereon that engage and lock with said gasket engagement means in said mounting groove, a frame engaging face on said body portion extending laterally outwardly at an acute angle relative to said tongue and towards the frame for a substantial distance on either side of said tongue and terminating in a sealing lip, said sealing lip being deformable upon insertion of said tongue into said mounting groove and thereafter maintained deformed by said gasket engagement means to provide sealing at the edge of said frame engaging face, and wedge means in the side of said body portion opposite said frame engaging face for urging the walls of the grooves in said body portion into sealing engagement with said panel.

13. A structural support for a curtain wall panel comprising horizontal and vertical members interconnected to form a frame with each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof and resilient panel backing strips flanking said groove, gasket engagement means supported within said grooves in locking engagement with an elastomeric structural glazing gasket comprising an elongated body portion, a longitudinally extending tongue protruding from said body portion and being laterally insertable into said grooves, said tongue having means formed thereon that engage and lock with said gasket engagement means in said mounting groove, a panel engaging face on said body portion extending laterally outwardly from said tongue for a substantial distance on either side thereof and terminating in a sealing lip, and wedge means in the side of said body portion opposite said panel engaging face for urging the panel engaging face into sealing engagement with said panel.

14. The structural panel support of claim **13** wherein the gasket engagement means comprises a longitudinally extending spring clip.

15. A structural panel support for curtain wall construction comprising a grid of horizontal and vertical members interconnected to form a rigid framework and each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof, gasket engagement means supported within said grooves in locking engagement with an elastomeric structural glazing gasket comprising an elongated body portion, a longitudinal groove formed in each of two opposed sides of said body portion and adapted to engage a panel, a longitudinally extending tongue protruding from said body portion in a direction perpendicular to said panel engaging grooves, said tongue having means formed thereon that engage and lock with said gasket engagement means in said mounting groove, a frame engaging face on said body portion extending laterally outwardly at an acute angle relative to said tongue and towards the frame for a substantial distance on either side of said tongue and terminating in a sealing lip, said sealing lip being deformable upon insertion of said tongue into said mounting groove and thereafter maintained deformed by said gasket engagement means to provide sealing at the edge of said frame engaging face, and wedge means in the side of said body portion opposite said frame engaging face for urging the walls of the grooves in said body portion into sealing engagement with said panel.

16. The structural panel support of claim **15** wherein the grooves are interconnected.

17. The structural panel support of claim **15** wherein at least one of the vertical members is an expansion member comprising a pair of oppositely directed, longitudinal channel members, said channel members having a web and a pair of flanges, a mating tongue and groove formed on opposed flanges and a longitudinal flange extending from the web of each channel member to form an inwardly directed longitudinal groove.

18. The structural panel support of claim **15** wherein at least one of the vertical members is a vertical mullion for an outside corner comprising a longitudinally extending angle flange having longitudinally extending U-shaped channel members extending from each of its distal ends with the open end of each of the U-shaped members facing outwardly.

19. A structural panel support for curtain wall construction comprising a grid of horizontal and vertical members interconnected to form a rigid framework and each member having an inwardly directed longitudinal mounting groove in one common vertical face thereof, gasket engagement means supported within said grooves in locking engagement with an elastomeric structural glazing gasket comprising an elongated body portion, a longitudinally extending tongue protruding from said body portion and being laterally insertable into said grooves, said tongue having means formed thereon that engage and lock with said gasket engagement means in said mounting groove, a panel engaging face on said body portion extending laterally outwardly from said tongue for a substantial distance on either side thereof and terminating in a sealing lip, and wedge means in the side of said body portions opposite said panel engaging face for urging the panel engaging face into sealing engagement with said panel.

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A. C. PERHAM, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,336,707 August 22, 1967

William J. Horgan, Jr.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 3, after "frame" insert --engaging face --; line 56, for "blanking" read -- flanking --; line 62, for "wedge," read -- wedge --; column 8, line 48, for "portions" read -- portion --.

Signed and sealed this 8th day of October 1968.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents