# United States Patent [19]

**Thom**

[11] **3,774,342**

[45] **Nov. 27, 1973**


[54] **SLIDING SCREEN DOOR**


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[73] Assignee: **Kaufman Window & Door Corporation,** Detroit, Mich.



[22] Filed: **May 28, 1971**

[21] Appl. No.: **147,962**

[52] **U.S. Cl.** ..... **49/420,** 16/99, 49/370, 49/449

[51] **Int. Cl.** ..... **E05d 13/02**

[58] **Field of Search** ..... 49/420, 425, 417, 49/370, 366–369, 449; 16/99, 105



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*Primary Examiner*—Kenneth Downey
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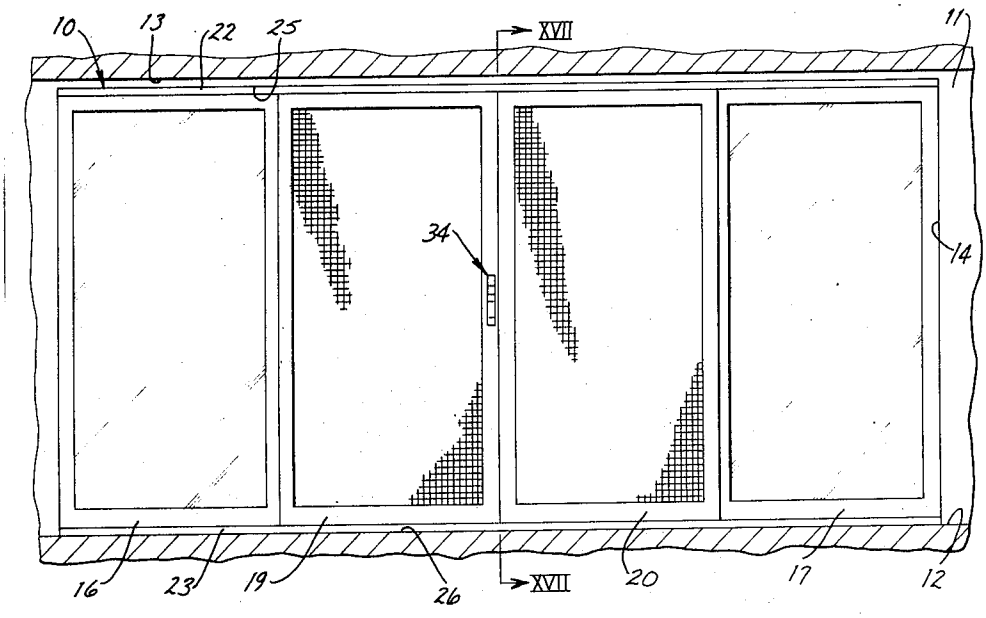
[57] **ABSTRACT**

A sliding door construction having top and bottom roller units comprising a pivoted, roller carrying bar for coaction with fixed door supporting and guiding rails. A block is slidably mounted within the framework of the door below for limiting inward pivotal movement of the roller carrying bar and is adjustable by movement along a frame member of the door by a single screw for defining the inward pivotal limit of the bar. A spring outwardly biases the bar associated with each of the top roller units to urge same into firm contact with the upper rail. Sealing means on the door coact with corresponding means on adjacent doors or fixed windows and include an astrogal providing guiding, sealing and locking functions between said door and an adjacent door.


**19 Claims, 25 Drawing Figures**



Patented Nov. 27, 1973 3,774,342



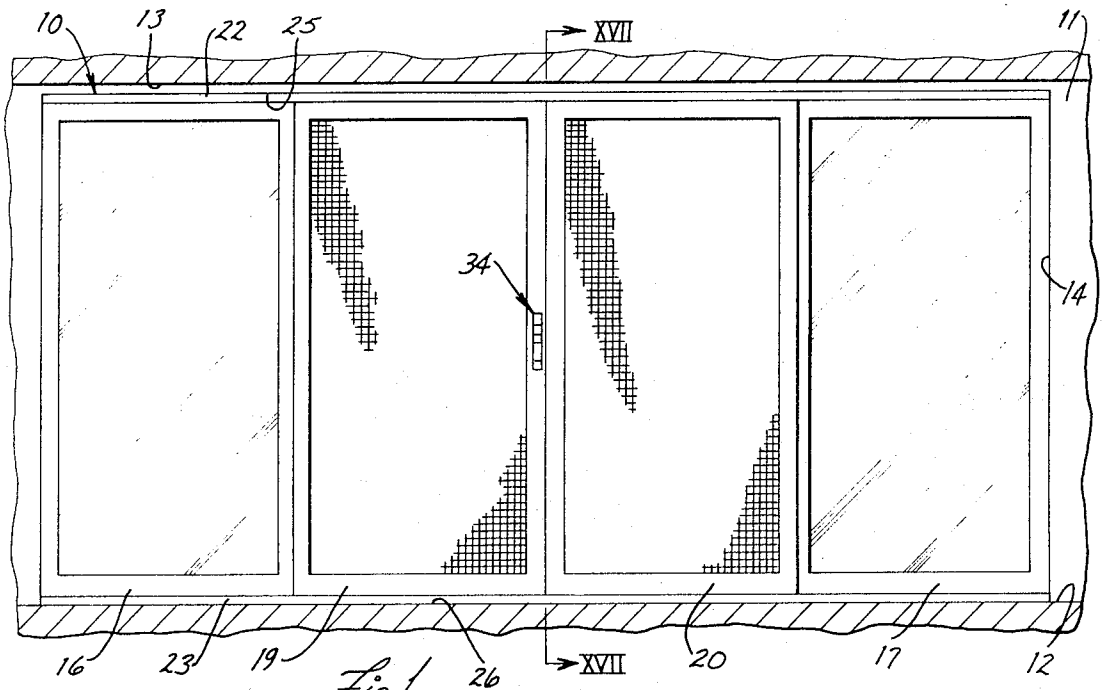



Fig. 1

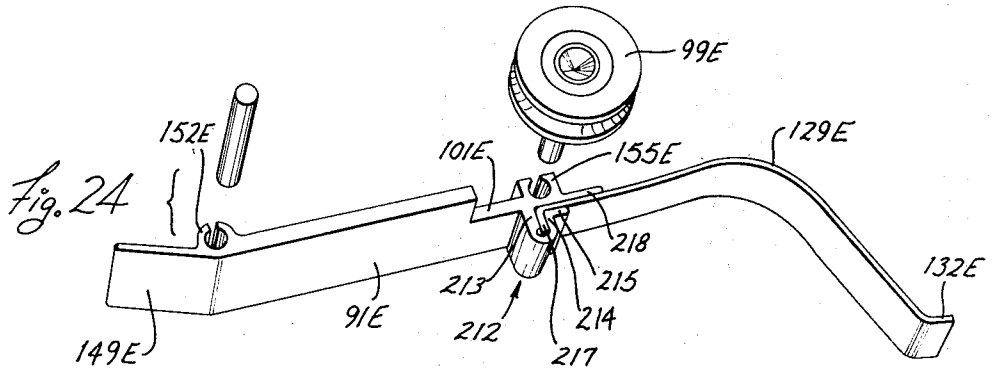



Fig. 24

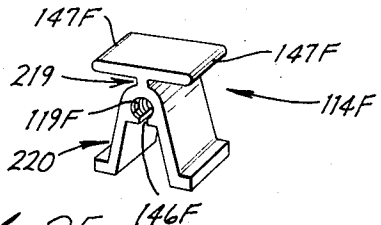



Fig. 25

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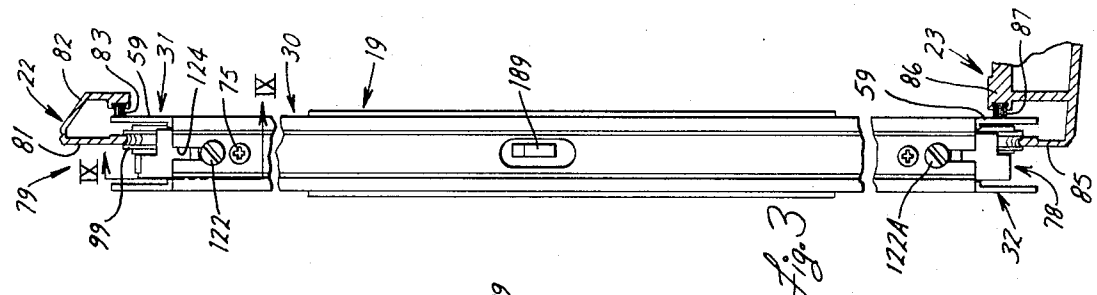


Fig. 3

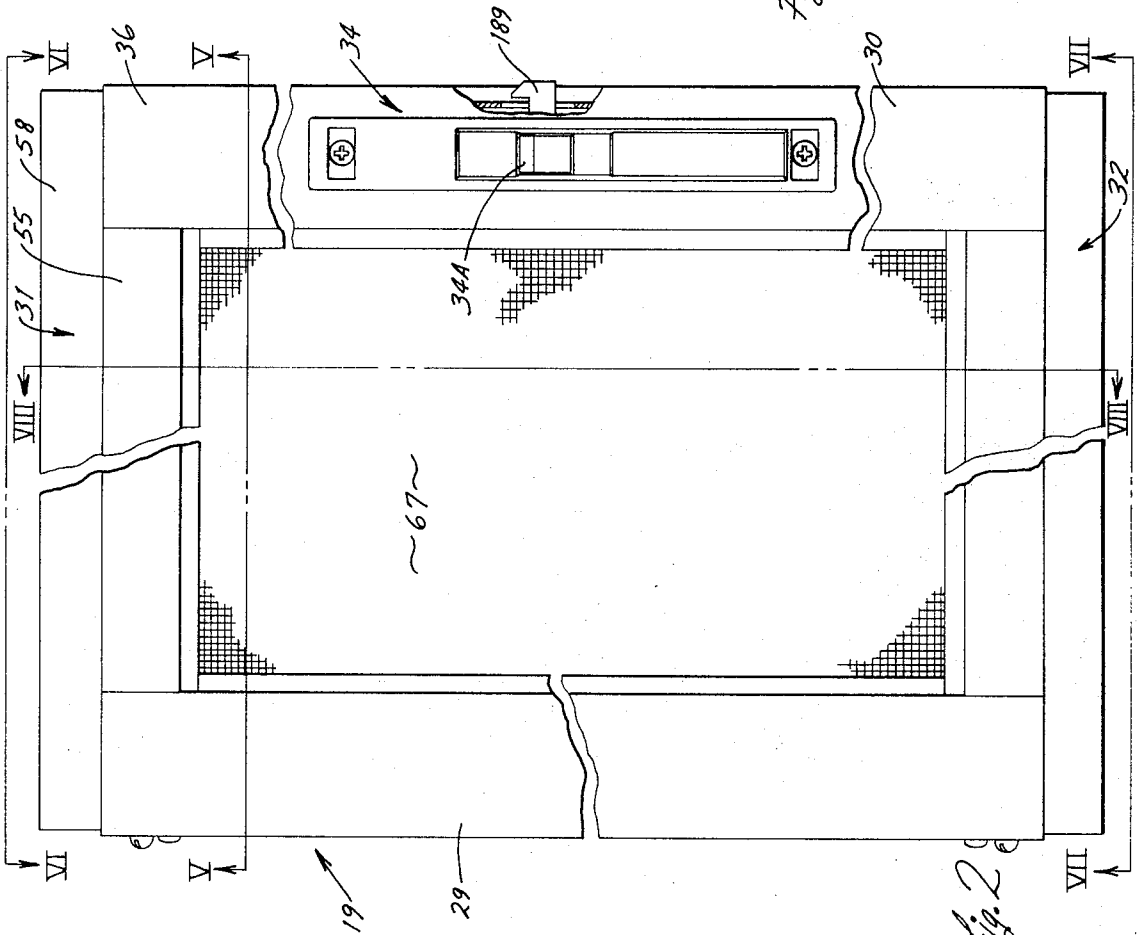


Fig. 2

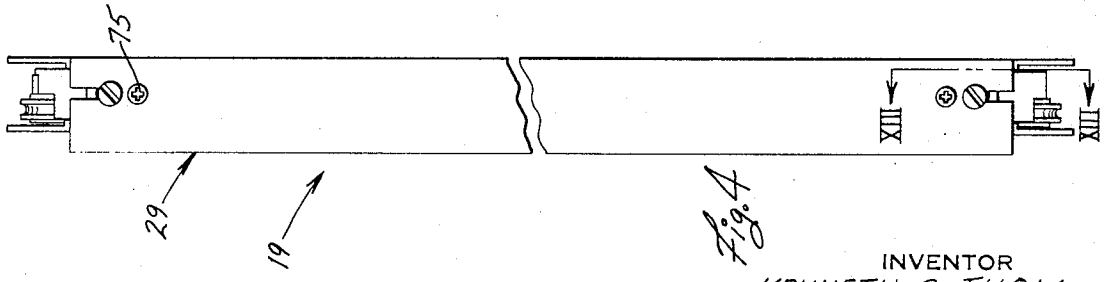


Fig. 4

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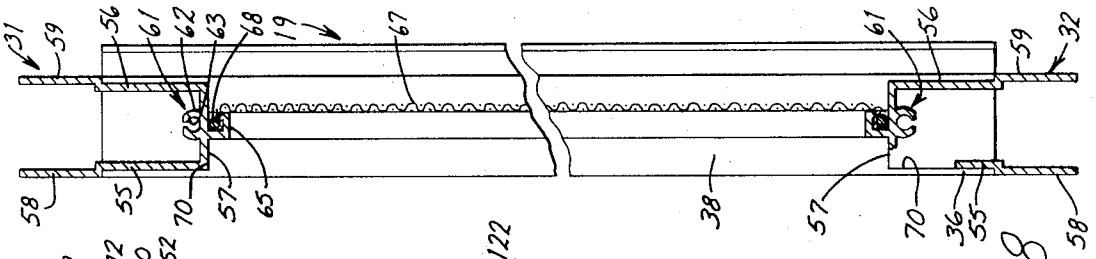


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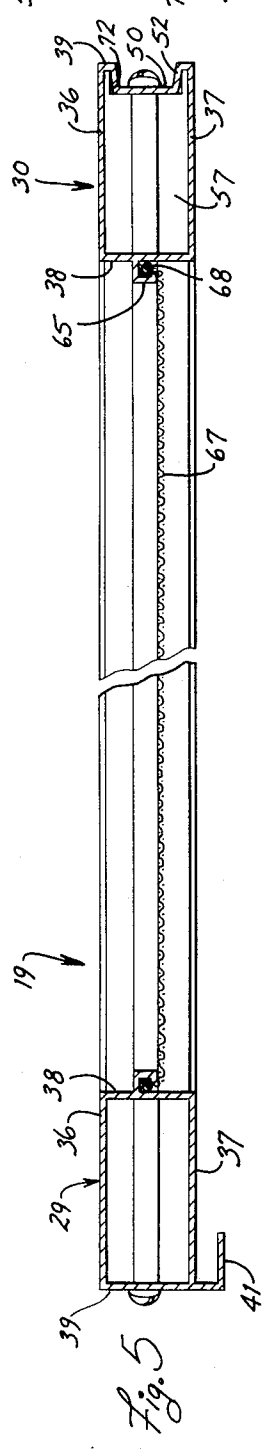


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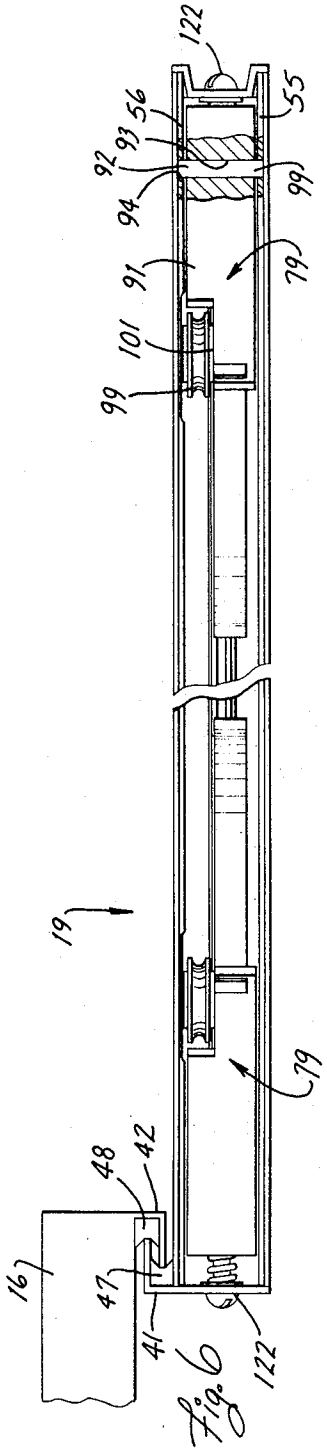


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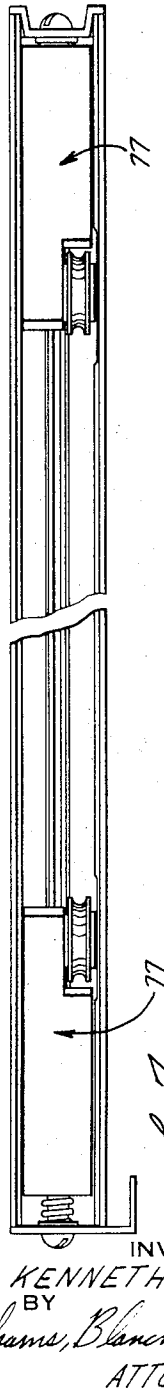


Fig. 7

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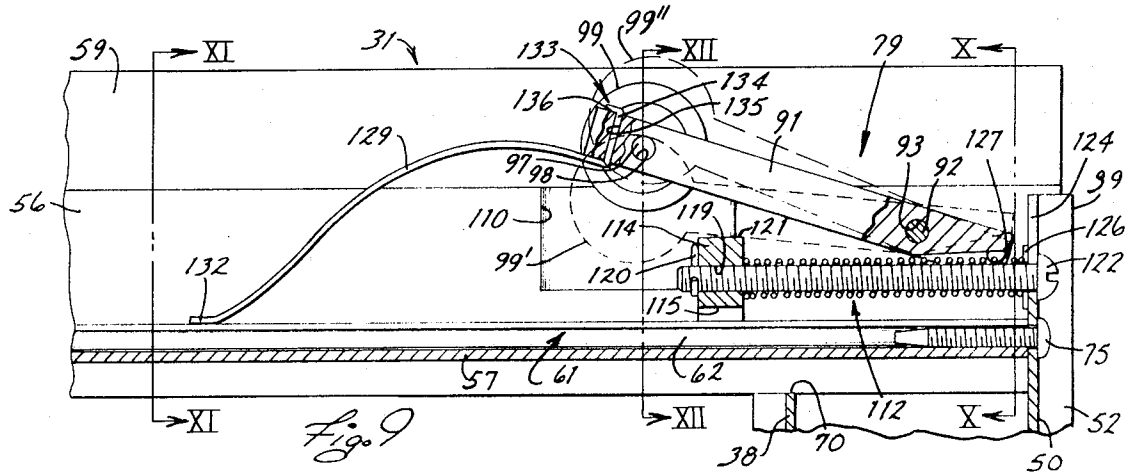


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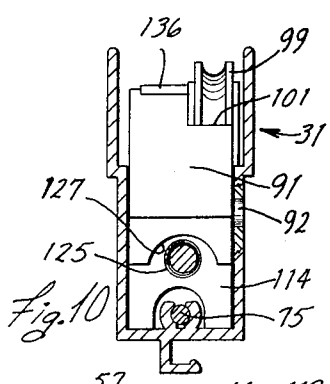


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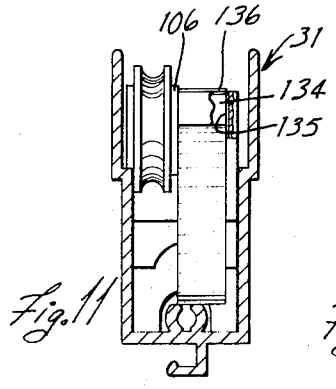


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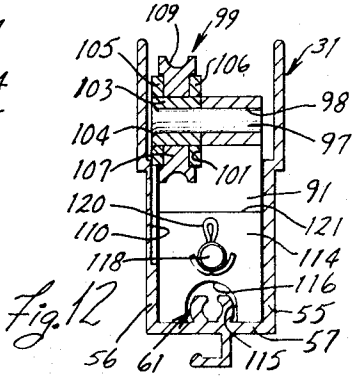


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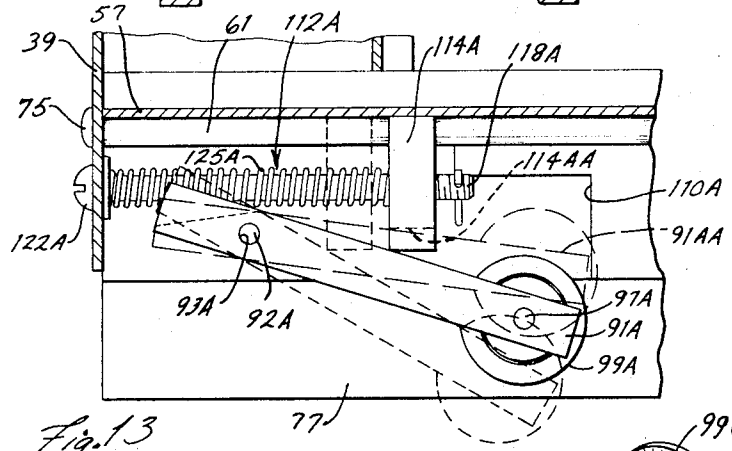


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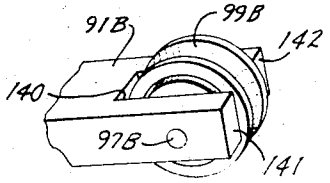


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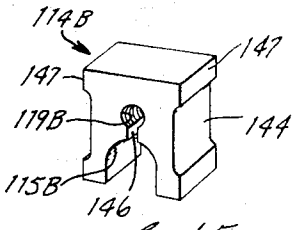


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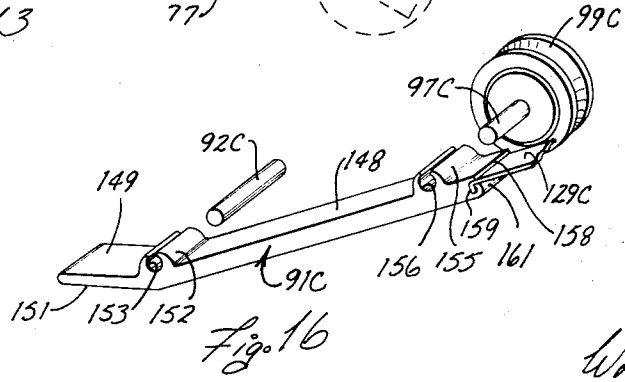


Fig. 16

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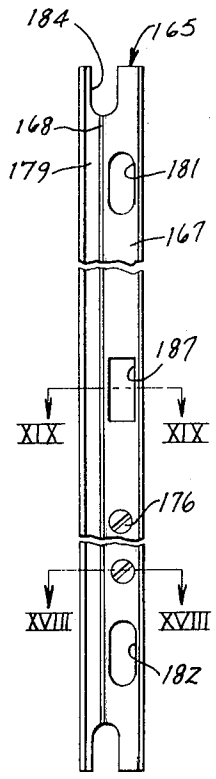


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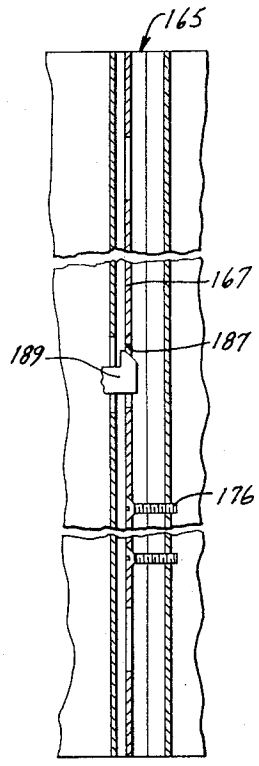


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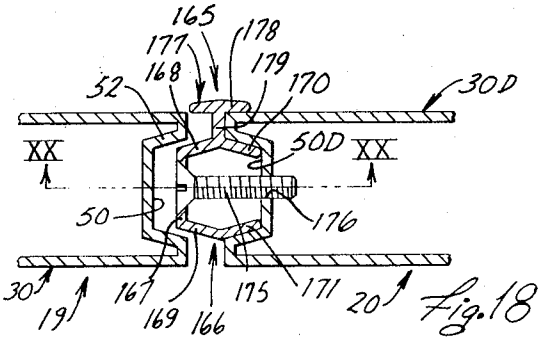


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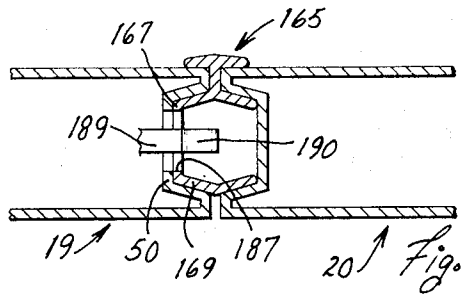


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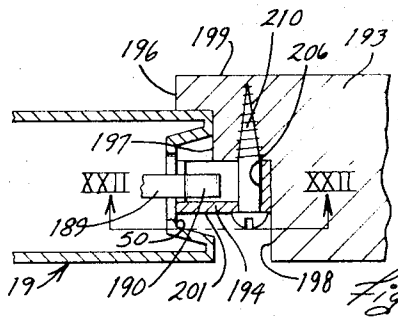


Fig. 21

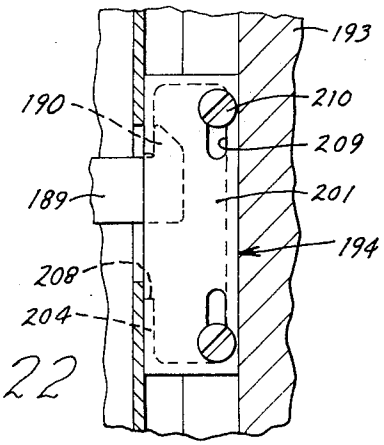


Fig. 22

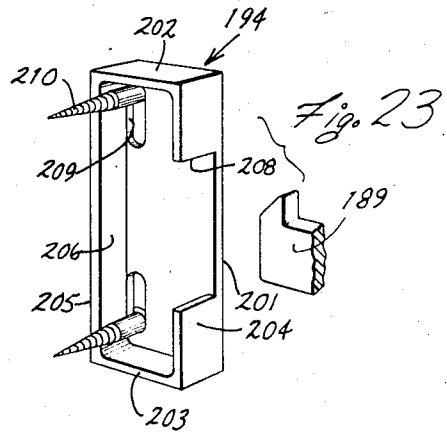


Fig. 23

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# SLIDING SCREEN DOOR

## FIELD OF THE INVENTION

This invention relates to a sliding door construction and more particularly to a screen door construction adaptable to use in multiple door and window units and to guiding, sealing and locking means therefor.

## BACKGROUND OF THE INVENTION

In recent years, sliding doors and, more particularly, substantially floor-to-ceiling window and sliding door assemblies including sliding glass and screen doors, have become very popular and have come into substantial use particularly in houses, apartments and other dwellings. Such units provide substantial advantages in providing for increased admittance of sunlight, an unobstructed view and a convenient means for entrance to and egress from the building.

However, problems have arisen in connection with use of prior units of this type, particularly with respect to sliding screen doors used in such units. Such screen doors are conventionally supported and guided by means of rollers carried thereby which engage rails fixed to the building structure above and below the door for rolling therealong. Such rails are fixed to the building structure but may often be not precisely parallel and evenly spaced and moreover may be subject to gradual relative movement due to settling of the building or portions of the adjacent structure thereof. Moreover, the precise separation between such rails may differ from installation to installation. Thus, prior doors which have not provided for adjustment or resilient mounting of the rollers have been generally unsatisfactory in meeting the above mentioned variations in rail spacing and alignment. Moreover, even where such adjustment is provided, the means for carrying out such adjustment are often inconvenient to use, for example, by reason of their particular location on the door or a requirement for special adjusting tools.

Further, inasmuch as such sliding screen doors are typically substantially taller than they are wide, there is a natural tendency in use for same to tilt with respect to the rails or, in other words, pivot in their central plane from an upright position, which tends to make such doors jam and thus be rendered unusable or interfere with their opening and closing movements.

Further, prior sliding doors have often been subject to unlocking or removal from the building opening by unauthorized persons seeking entrance to the building. Such removal is normally carried out by moving the door upwardly until the bottom rollers thereof clear the lower rail upon which they are normally supported, moving the bottom of the door outwardly and then moving the door as a whole downwardly to disengage the upper rollers thereof from the upper rail, whereby the door is completely removed from the building, allowing entrance thereinto. This unauthorized removal can be accomplished in known prior art sliding door constructions, particularly screen door constructions, by reason of the resilient mounting of the rollers thereof which allows substantial upward travel of the door with respect to the upper guiding rail.

It is often desired to provide a window, door unit in which more than one sliding screen (or glazed) door is provided, more particularly by providing a construction in which the building opening is closed by edgewise abutment of two slidable screen (or glazed) doors.



In such an arrangement problems arise in guiding the opposed, upstanding edges of the two slidable doors into an alignment with each other as they are closed, providing an insect or weather seal therebetween and providing for locking thereof with respect to each other. Moreover, it may be desired to utilize in such constructions doors which are also usable in sliding door units where only a single door is provided. The prior art does not fully resolve these problems in a simple and economical manner.

Accordingly, the objects of this invention includes provision of:

1. A sliding door construction having features particularly adapted to sliding screen doors as well as to glazed sliding doors.

2. A sliding door construction, as aforesaid, adapted to use in substantially floor-to-ceiling door units having either a single sliding glazed door and a single sliding screen door or multiple sliding screen and glazed doors wherein a pair of doors can slide together in an edge-to-edge abuting relationship to close the opening into the buidling.

3. A door construction, as aforesaid, wherein the tendency of relatively tall and narrow sliding doors to cock or tilt with respect to the rails upon which they are slidably supported is substantially eliminated and in which the vertical positioning of the door with respect to the top and bottom rails upon which same is mounted may be readily adjusted.

4. A door construction, as aforesaid, wherein means are provided to readily adjust the rollers by which the sliding door is supported and guided to compensate for misalignment or a non-horizontal condition of the rails contacted by such rollers so as to allow squaring of the door to the door jamb which it engages to close the opening into the building.

5. A door construction, as aforesaid, which prevents unauthorized lifting of the door with respect to the rails for unlatching same and for disengaging the rollers thereof from the supporting and guiding rails of the building and thereby eliminates the thread of unauthorized entry into the building by removal of the door or disengagement of the latch.

6. A door construction, as aforesaid, in which means are provided for limiting the travel inwardly and outwardly, with respect to the door, of the supporting rollers thereof which means are durable, capable of a long service life under adverse conditions, including conditions of relatively high heat as may be encountered during hot summer weather when the door construction is directly exposed to the sun.

7. A door construction, as aforesaid, in which the travel or orbit of the roller inwardly and outwardly of the portion of the door upon which same is mounted, and more particularly the extend to which same can travel inwardly with respect to the door, may be preselected, prior to use and during assembly or thereafter, in an extremely simple way and with inconsequential or no incrased cost, without use of means provided for adjustment of the inward limiting position of the roller with respect to the door.

8. A door construction, as aforesaid, in which the location of the rollers with respect to the central plane of the door can be readily changed during manufacture to allow use of the door with any of a wide variety of track constructions.

9. A door construction, as aforesaid, in which a large proportion of the parts comprising the door and roller mounting may be made economically and with little labor through wide use of extrusions.

10. A door construction, as aforesaid, including a removable astrogal unit particularly adapted to use in units wherein a pair of substantially coplanar doors are movable into and out of edge abutting relationship to close and open the portal and which simply and economically provides for guiding of the doors into a precisely aligned abutting relationship, provides for wind and weather sealing therebetween and provides means for locking same together.

Other objects and purposes of this invention will be apparent to persons acquainted with apparatus of this general type upon reading the following specification and inspecting the accompanying drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of a window and door unit embodying the invention as seen from the interior of a building structure into which same is incorporated.

FIG. **2** is a partially broken, enlarged elevational view of the leftward screen door of FIG. **1.**

FIG. **3** is a reduced, partially broken, rightward elevational view of the door of FIG. **2,** additionally showing rails for guiding and supporting such door.

FIG. **4** is a partially broken, leftward end elevational view of the door of FIG. **2.**

FIG. **5** is a partially broken, sectional view substantially taken along the line V—V of FIG. **2.**

FIG. **6** is a partially broken, sectional view substantially taken along the line VI—VI of FIG. **2** and additionally showing coaction of the door with an adjacent window unit. FIG. **7** is a partially broken, sectional view taken along the line VII—VII of FIG. **2.**

FIG. **8** is a partially broken, sectional view taken along the line VIII—VIII of FIG. **2.**

FIG. **9** is an enlarged, partially broken sectional view substantially as taken along the line IX—IX of FIG. **3.**

FIG. **10** is a partially broken, sectional view taken along the line X—X of FIG. **9.**

FIG. **11** is a partially broken, sectional view taken along the line XI—XI of FIG. **9.**

FIG. **12** is a sectional view taken along the line XII—XII of FIG. **9.**

FIG. **13** is an enlarged sectional view taken along the line XIII—XIII of FIG. **4.**

FIG. **14** is a fragmentary, pictorial view disclosing a modified roller mounting.

FIG. **15** is a pictorial view disclosing a modified adjustment block construction.

FIG. **16** is an exploded, pictorial and fragmentary view disclosing a modified roller mounting bar.

FIG. **17** is a partially broken, elevation view of an astrogal adapted for use with a door construction of FIG. **1.**

FIG. **18** is an enlarged fragmentary sectional view substantially taken along the line XVIII—XVIII and disclosing the use of an astrogal with a pair of relatively movable doors.

FIG. **19** is an enlarged sectional view substantially taken along the line XIX—XIX of FIG. **17** and disclosing the use of the astrogal in connection with a pair of relatively slidable and abutable doors and showing a lock feature thereof.

FIG. **20** is a reduced sectional view taken on the line XX—XX of FIG. **18.**

FIG. **21** is a cross-sectional view of a lock arrangement for the door construction of FIG. **2.**

FIG. **22** is a sectional view substantially taken along the line XXI—XXI of FIG. **20.**

FIG. **23** is an exploded pictorial view of portions of the apparatus of FIG. **20.**

FIG. **24** is an exploded, pictorial view disclosing a further modified roller mounting bar.

FIG. **25** is a pictorial view disclosing a further modified adjustment block construction.

Certain terminology will be used in the following description for convenience in reference only and will not be limiting. The words "up", "down", "right" and "left" will designate directions in the drawing to which reference is made. The words "in" and "out" will refer to directions toward and away from, respectively, the geometric center of the device and designated parts thereof. Such terminology will include derivatives of the above terms and words of similar import.

## SUMMARY OF THE INVENTION

The objects and purposes of the invention are met by providing a sliding door construction having top and bottom roller units comprising a pivoted roller carrying bar arranged for coaction with fixed door supporting and guiding rails. A block is slidably mounted within the framework of the door for limiting inward pivotal movement of the roller carrying bar and is adjustable by movement along a frame member of the door by a single screw for defining the inward limit position of the bar. A spring outwardly biases the bar associated with each of the top roller assemblies to urge same into firm contact with the upper rail. Sealing means on the door coact with corresponding means on adjacent doors or fixed windows and include an astrogal providing guiding, sealing and locking functions between said door and an adjacent door.

## DETAILED DESCRIPTION

FIG. **1** discloses a door assembly **10** embodying the invention, as seen from the interior of a building, the door assembly being located in an opening **14** in a wall **11** of the building. The bottom of the door assembly is substantially at the level of the floor **12** and the top of the assembly **10** is disclosed as being located adjacent the ceiling of a room in such building. The door assembly **10** includes a pair of fixed glas panels **16** and **17** which may be of conventional nature and a pair of horizontally slidable doors **19** and **20.**

The doors **19** and **20** are in the preferred embodiment shown slidable screen doors but it is contemplated that slidable glass doors may be provided in addition thereto in any conventional manner for providing additional coverage of the space between the fixed windows **16** and **17,** such additional glass doors not being shown. In addition, it is contemplated that the doors **19** and **20** themselves may be glazed, rather than screened, doors. Conventional upper and lower tracks **22** and **23** are provided in the door assembly **10** for supporting and guiding the screen doors **19** and **20** for sliding movement parallel to the plane of the wall **11** and fixed windows **16** and **17.** The upper track **22** is preferably fixed within the opening **14** in the wall **11** and to the upper edge **25** of such opening in a conventional manner and the lower track **23** is preferably fixed in a

conventional manner to the lower edge **26** of the building opening **14** preferably substantially at the level of the floor **12** and in vertically spaced opposition to the upper track **22**, the tracks being at least substantially horizontal and parallel. However, it is often the case with known sliding door assemblies that the upper and lower rails thereof when actually installed in an opening in a building structure may deviate from true parallelism with each other and/or from a strictly horizontal condition. Thus, as mentioned above, the door construction embodying the present invention hereinafter discussed is, as one of its aspects, intended to operate satisfactorily despite such deviations in the arrangment of the tracks with which it is associated and indeed to overcome such shortcomings of the tracks and track-mounting. The door **19** may be used in other door assemblies than the door assembly **10** shown, for example, door assemblies wherein a second door **20** is not provided and wherein the rightward edge of the door **26** engages a fixed portion of the door assembly when closed. The doors **19** and **20** are preferably of similar construction and more particularly preferably are substantially mirror images of each other as viewed from the top thereof. Thus, a description of the door **19** will also suffice for the door **20** except as hereinafter noted with respect to particular features such as the provision for latching and the arrangement of the astrogal, hereinafter described, between the doors **19** and **20.**

The door **19** (FIG. **2**) comprises a parallel, spaced pair of normally vertically oriented side members **29** and **30** joined at their upper and lower ends, respectively, by a top member **31** and a bottom member **32**, which are normally horizontally disposed and which are parallel to each other, the members **29** through **32** defining a rectangular door framework. The members **29** through **32** are preferably extrusions of anodized aluminum. The side member **30** carries a latch assembly **34** hereinafter discussed.

As seen in FIG. **5**, the side members **29** and **30** are of hollow, substantially rectangular cross-section, each having spaced interior and exterior walls **36** and **37**, which are parallel to the central plane of the door **19**, and spaced inner and outer walls **38** and **39**, which are normal to the central plane of the door **19.** The side member **39** is provided with a generally L-shaped flange **41** which extends interiorly from the wall to the juncture of the walls **37** and **39** and then inwardly in parallelism with the wall **37.** The L-shaped flange **41** coacts, as seen in FIG. **6**, with a similar flange **42** on the framework of the fixed window **16**, the flanges **41** and **42** being engageable in close spaced interfigured relationship as seen in FIG. **6** when the door **19** is in its closed position of FIGS. **1** and **6.** Weather seals at **47** and **48** are disposed in the pockets defined by the flanges **41** and **42** to provide weather and/or insect sealing between the window **16** and door **19** when the latter is in its closed position shown and further providing a stop for limiting rightward motion as seen in FIGS. **1** and **6** of the door **19** with respect to the window **16.**

Whereas the walls **36** through **38** of the side members **29** and **30** and the outer wall **39** of the side member **29** are preferably planar, the outer wall **39** of the side member **30** has a depressed central portion **50** (FIG. **5**) connected to the outer portions of the outer wall **39** of side member **30** by outwardly diverging portions **52.**

The top and bottom members **31** and **32** (FIG. **8**) are substantially similar in cross-section and preferably have cross-sections which are mirror images of each other. The members **31** and **32** are substantially channel-shaped in section, the upper member **31** opening upwardly and the lower member **32** opening downwardly. Thus, the top and bottom members each comprise interior and exterior sidewalls **55** and **56**, respectively. The sidewalls **55** and **56** are joined at their inner edges by an inner wall **57.** A pair of spaced, parallel sidewall extensions **58** and **59** extend outwardly beyond the free edges of the sidewalls **55** and **56**, respectively, are preferably parallel to the central plane of the door **19** and are preferably offset outwardly from said plane, by approximately the thickness of the sidewalls **55** and **56.** The sidewalls **55** and **56** and sidewall extensions **58** and **59** are preferably planar and parallel to the central plane of the door **19.** The inner wall **57** is preferably planar and perpendicular to the central plane of the door **19** and hence to the sidewalls **55** and **56.**

A hollow, split rib **61** is preferably centered on and extends outwardly from the inner wall **57** as well as extending lengthwise therealong. The rib is defined by a pair of spaced, outwardly convex flange elements defining, with the inner wall **57**, a semi-circular shell extending through more than 180°, for example through approximately 270°, for substantially enclosing a circular, longitudinally extending opening **63.**

The inner walls **38** and **57** (FIGS. **5** and **8**) of the side, top and bottom members **29** through **32** of the door **19** each have preferably centrally located thereon an L-shaped screen edge retaining flange **65** for defining a groove for receiving the edge of a sheet of screening **67** held in place therein by a conventional plastic strand **68** wedged with the screen edge thereinto.

The end portions of the inner walls **38** of side members **29** and **30** are recessed as indicated at **70** (FIGS. **8** and **9**), the recess **70** extending fully between the interior and exterior sidewalls **36** and **37** of the side members **29** and **30.** The depth and width of the recess **70** corresponds to the width dimensions of the sidewalls **55, 56** and inner wall **57**, respectively, of the top and bottom members **31** and **32.**

Thus, the ends of the top and bottom members **31** and **32** are inserted through the recesses **70** into the interior of the side members **29** and **30** and extend across the interior of such side members into abutting relationship with the outer walls **39** of the side members **29** and **30.** Because of the depressed central portion **50** of the outer wall **39** of side member **30**, the free end of the inner wall **57** of the top and bottom members **31** and **32** disposed within side member **30** is relieved as indicated at **72** (FIG. **5**) to a depth sufficient to receive therein the depressed portion **50** while allowing the adjacent free ends of the sidewalls **55** and **56** of such top and bottom members **31** and **32** to extend along the outwardly divergent portions **52** into contact with the outer parts of the outer wall **39** of side member **30.** The sidewall extensions **58** and **59** extending outwardly beyond the side members **29** and **30.** Because of the outward offset of the sidewall extensions **58** and **59**, the outer surfaces there of are substantially coplanar with the outer surfaces of the interior and exterior walls **36** and **37** of the side members **29** and **30.** Thus, the ends of the hollow spilt ribs **61** and bottom wall **57** extend into close adjacency with and preferably contact the

adjacent portion of the outer wall of the corresponding one of the side members **29** and **30.**

As illustrated in FIGS. **9** and **13,** the end walls **39** of side members **29** and **30** are provided with holes **74** coaxially aligned with the opposed split ribs **61** for receiving screws **75,** preferably of the self-tapping type, which threadedly engage the end portions of the opposed hollow split rib **61** for reception therewithin and between the flange element **62** thereof.

Thus, the framework of the door **19** is formed by nesting the top and bottom members **31** and **32** in the recesses **70** of the side members **29** and **30** and held together at each corner by a single screw **75,** for providing a rigid and yet very rapidly assembled, or if need by disassembled, door framework.

The door **19** is mounted for sliding movement along the upper and lower tracks **22** and **23** by upper and lower roller assemblies **79** and **77,** respectively (FIGS. **3, 6** and **7**). One lower roller assembly **77** is preferably located in the lower member **32** adjacent each end thereof. Similarly, one upper roller assembly **79** is preferably disposed substantially within the upper member **31** adjacent each end thereof.

The upper and lower tracks **22** and **23** may take any of a number of conventional forms. In the particular embodiment shown, the upper track **22** includes a depending rail **81** (FIG. **3**) having a lower edge surface disposed between the interior and exterior walls of the top frame member **31** and engageable with the upper roller assemblies **79.** The upper track **22** includes a leg **82** which extends exteriorly of the rail **81** and downwardly and in spaced opposition with the exterior wall **59** of top frame member **31,** the leg **82** carrying conventional weather stripping **83** which bears slidably against the outer surface of the wall **59.** Similarly, the bottom track **23** includes an upstanding rail **85** disposed between the interior and exterior walls of the bottom member **32** for engagement with the roller support assemblies **77.** The lower track **23** further includes a portion **86** spaced in opposition to the exterior wall **59** of bottom member **32** and carrying suitable weatherstripping **87** slidably engageable with the wall **59.**

The upper roller assemblies **79,** as seen in FIG. **6,** are preferably mirror images of each other. The lower roller assemblies **77** are also, as seen in FIG. **7,** preferably mirror images of each other. Thus, a description of one of the upper roller assemblies **79** will suffice for both and a description of one of the lower roller assemblies **77** will suffice for both. Further, the lower roller assemblies **77** are also generally similar in construction to the upper roller assemblies **79** except as hereinafter discussed in detail. Thus, a detailed description of the rightward one of the upper roller assemblies **79** will also suffice for the lower roller assemblies **77,** parts of the lower roller assemblies **77** corresponding to parts of the upper roller assemblies **79** carrying the same reference numerals thereas with the suffix A added.

The roller assembly **79** includes a pivot bar or lever **91** (FIGS. **9—11**) which in the particular embodiment shown is of substantially rectalinear form. The bar **91** is pivotally supported at a point intermediate its longitudinal mid-point and rightward end, by a pivot pin **92** extending through a transverse opening **93** in the bar **91.** The pin **92** extends beyond the sides of the bar **91** and is received, preferably fixedly, in openings **94** (FIG. **6**) in the sidewalls **55** and **56** of the top frame member **31** of the door **19.** The ends **95** of the pin **92** are preferably flush with the outer faces of the sidewalls **55** and **56** and when the door **19** is in its assembled condition are covered by the opposed end portions of the sidewalls **36** and **37** of the corresponding side member **36.**

A stub shaft **97** (FIGS. **9** and **12**) is snugly received in a transverse opening **98** in the bar **91** adjacent its leftward end for supporting a roller or wheel **99.** The bar **91** has a notch **101** adjacent its leftward end (FIGS. **6, 10** and **12**) for receiving the roller **99** loosely therewithin. In the particular embodiment shown, the rail **81** with which the roller **99** coacts is spaced, as seen in FIG. **3,** somewhat exteriorly from the central plane of the door **19** rather than being in the central plane of the door. Thus, the roller **99** and the cutout portion of the bar **91** are located exteriorly of the central plane of the door **19** and of the bar **91.** However, it is contemplated that upon different location of the rail **81** with respect to the central plane of the door that both the roller and the cutout portion for receiving same may be correspondingly relocated on the bar **91.**

The stub shaft **97** extends into the notch **101.** In the preferred embodiment shown, a sleeve **103** (FIG. **12**) is supported on the free end of the stub shaft **97** and secured thereto by flaring of the free end of the stub shaft as indicated at **104,** as by upsetting the end of the stub shaft after the sleeve is installed. The sleeve **103** carries spaced annular retainers **105** and **106** fixed thereto by any convenient means such as pressed fitting. The roller **99** is rotatably supported on the sleeve **103** between the retainers **105** and **106.**

The roller **99** has a narrowed radially inner portion **107** disposed between the retainers **105** and **106** and an outwardly facing, preferably hemicircular, circumferential groove **109** which is preferably complimental in shape to the rail **81** at the zone of contact therebetween. Thus, the roller **99** rolls on the rail **81.** By reason of the sidewalls of the groove **109,** the roller **99** resists transverse, that is, exterior or interior movement, with respect to the rail, thereby tending to prevent interior or exterior movement of the door **19** with respect to the track **22.**

In the particular embodiment shown, the portion of the sidewall **56** adjacent the roller **99** is relieved to form a shallow pocket **110** (FIGS. **9** and **12**) to allow free pivotal movement of the lever or bar **91** upwardly and downwardly about the pin **92** without interference of the roller **99** or retainer **105** with the exterior wall **56.**

Each roller assembly **79** includes a pivot limiting mechanism generally indicated at **112** comprising a limit block or nut **114** (FIGS. **9** and **12**) which in the particular embodiment shown is substantially rectalinear in shape. The nut **114** is snugly but slidably disposed between the sidewalls **55** and **56** of the frame member **31** and slidably rests atop the inner wall **57** of the member **31.** The lower end of the nut **114** is provided with a recess **115** which is preferably hemicircular in shape at its closed end as indicated at **116.** The recess **115** loosely accommodates the split rib **61** upstanding from the bottom wall **57.**

The end of an elongated adjustment screw **118** is threadedly received in a preferably centrally located threaded opening **119** located in the nut **114** above the recess **115.** A stop element **120,** here a conventional cotter pin, is fixed to the screw **119** at the leftward end thereof as seen in FIG. **9** for preventing unintended removal of the nut **114** from the free end of the screw **118**

and also thereby providing a limit to leftward movement of the nut **114** with respect to the screw **118** and the remainder of the roller assembly **79.** The upper end **121** of the nut **114** is spaced above the screw **118** for contacting and thereby limiting downward or inward movement of the pivot bar **91** and roller **99** carried thereby. The rightward end of the screw **118** is provided with a conventional slotted head **122.** The rightward end of the screw is received in and rests adjacent the bottom of a slot **124** (FIGS. **3** and **9**) in the outer wall **39** of the frame side member **30,** the head **122** being disposed against the outer face of the wall **39** for preventing leftward (as seen in FIG. **9**) movement of the screw therebeyond.

An axially elongate, coiled spring **125** and washer **126** coaxially surround the screw **118.** The spring **125** is located between the nut **114** and the washer **126.** The washer **126** is adapted to bear against the inner face of the outer wall **39,** the spring **125** continuously urging the nut **114** against its threaded engagement with the screw **118** in a direction away from the wall **39** and tending to prevent unintended rotation of the screw **118** and, hence, shifting of the nut **114** axially with respect thereto.

The screw **118** is rotatable for positively adjusting the location of the nut **114** longitudinally of the member **31** and, hence, substantially longitudinally of the pivot bar **91.** Thus, by adjustment of the screw the nut can be moved rightwardly therealong toward the pivot pin **92.** The upper end **121** of the nut **114** is preferably located a sufficient height above the wall **57** of member **31** that the pivot bar **91** during inward movement thereof contacts same before having assumed a horizontal position. Thus, rightward adjustment of the position of the nut **114** increasingly prevents counterclockwise pivotal movement of the pivot bar **91** or in other words increases the height of the lowermost position that can be assumed by the roller **99.** Thus, the innermost position of the roller **99** and pivot bar **91** is dictated by the position of adjustment of the nut **114.** The innermost position of the roller **99,** with the nut in its position shown in FIG. **9,** is indicated in broken lines at **99'**.

In the particular embodiment shown, the pivot pin **92** is sufficiently close to the screw **118** that the rightward end of the bar **91** would contact the spring **118** upon being rotated in a clockwise direction only a small distance from its innermost limiting position **99'**. Thus, the lower surface of the rightward end of the pivot bar **91** is provided with a centrally located groove **127** (FIGS. **9** and **10**) preferably of semicircular cross-section, of radius exceeding that of the spring **118** and of rightwardly (as seen in FIG. **9**) increasing depth. Thus, clockwise pivotal movement of the pivot bar **91** in FIG. **9** is ultimately limited by contact of the spring **118** with the bottom of the groove **127** to define the outward limiting position of the roller **99,** indicated in broken lines at **99''**, which position in the present embodiment is one in which at least the upper edge of the roller extends upwardly beyond the upper edge of the member **31.**

As above indicated, the construction of the lower roller assemblies **77** are preferably identical to that of the upper roller assemblies **79** to the extent that the latter have been described above. However, it will be noted that in view of the different functions of the upper and lower roller assemblies, it may be desired to provide nuts **114A** in the lower roller assemblies **77** (FIG. **13**) which differ in height from the nuts **114** used in the upper roller assemblies **79,** as discussed hereinafter.

The upper roller assemblies **79** differ further from the lower roller assemblies **77** in that a bias spring preferably in the form of a sinously curved leaf spring **129** is provided in each of the upper roller assemblies **79** for urging the pivot bar upwardly and outwardly with respect to the door **19** and thereby for resiliently urging the roller **99** into contact with the coacting rail **81** of the upper track **22.** Thus, the spring **124** causes the roller to remain in door guiding contact with the rail **81** despite misalignment of the tracks **22** and **23,** for example, nonparallelism of the tracks, nonlinearity of a track, etc.

In the preferred embodiment shown, the leaf spring **129** comprises a single, resilient and substantially rectangular sheet of spring material which for the major portion of its length and in the central portion thereof is convexly curved outwardly and leftwardly as seen in FIG. **9.** The spring **129** has a short, reversed curve portion **132** at the leftward end thereof forming a foot for slidably bearing against the upper end of the split rib **61.** The rightward end **133** of the spring **129** is substantially channel-shaped, extending substantially upwardly to define a bight portion **134** and then substantially leftwardly to define a tip **136.** The bight portion **134** is snugly received and retained in a narrow slot **135** in the pivot bar **91** adjacent the leftward upper end of said bar. The slot **135** opens in the exterior face of the pivot bar **91** in the cutaway portion **101** thereof. In the particular embodiment shown, the spring **129** is retained endwise of the slot **135** by the roller retainer **106.** The adjacent tip **136** of the spring overlies the leftward end of the pivot bar **91.** Thus, the rightward end **133** of the spring **129** grips the bar **191** by reason of the portions of said spring immediately adjacent the bight portion **134.**

FIG. **14** discloses a modified pivot bar construction **91B** wherein the roller **99B** is disposed at or near the center of the bar rather than adjacent one edge thereof. More particularly, the bar **91B** is provided with a substantially centrally located notch **140** of preferably rectilinear shape which receives the roller **99B.** A stub shaft **97B** is fixed to and extends between the legs **141** and **142** bounding the notch **140** for carrying the roller **99B.** The construction of FIG. **14** may be used, for example, wherein the rails **81** and **85** (FIG. **3**) are located in or adjacent the central plane of the door rather than to one side thereof.

FIG. **15** discloses a modified limit block or nut construction **114B.** the nut **114B** is preferably a metal, such as aluminum, extrusion, individual ones of the nut **114B** being manufactured by severing short lengths from a continuous or elongate extrusion of corresponding cross-section. The nut **114B** differs from the nut **114** above discussed with respect to FIGS. **9–13** in having relieved portions **144** in each of the side faces **146** and **147,** intermediate the top and bottom edges thereof, to reduce surface contact and, hence, friction between the nut **114B** and the sidewalls **55** and **56** (FIG. **12**) of the top or bottom member **31** or **32** in which same is disposed. The relieved portions **144** also save material.

The nut **114B** is also provided with a slot **146** communicating between the recess **115B** and the threaded opening **119B,** the slot **146** being provided to facilitate the extrusion process. The slot **146** is relatively narrow

and in no way interferes with the coaction of the threaded opening **119B** with the adjustment screw **118** or with other functions of the nut **114B**.

FIG. **16** discloses a modified form of the pivot bar as indicated at **91C**. The pivot bar **91C** is particularly adapted to construction in the form of an elongate extrusion, individual ones of the pivot bars **91C** being obtained from such an elongate extrusion by severing short lengths therefrom. Moreover, the configuration of the pivot bar **91C** provides adequate strength and all the functional capabilities of the pivot bar **91** of FIGS. **9–13** while effecting a considerable saving in the amount of material required. Bar **91C** comprises a substantially rectilinear body portion **148** provided at the leftward end thereof, as seen in FIG. **16**, with a substantially rectilinear extension **149** which is of reduced thickness and is slightly angled with respect to the length dimension of the body portion **148**. The underface **151** of the extension **149** is adapted to serve the purpose of the central groove **127** (FIG. **9**) of the bar **91**, namely in normally allowing the pivot bar **91C** to clear the adjustment screw **118** and its surrounding spring **125** but to bear against the periphery of the spring **125** to limit outward pivotal movement of the pivot bar.

At or adjacent the joint of the extension **149** to the body portion **148** there is provided, at the top the body member **148**, a transversely extending, hollow, slotted boss **152** defining therein a passage **153** corresponding to the pivot pin opening **93** of FIG. **9** and for reception thereinto and therethrough of a pivot pin **92C**. A further and similar hollow, slotted boss **155** is provided on the upper face of the body portion **148** in spaced relation to the boss **152** and adjacent the rightward end of the body member **148**. The passage **156** defined by the boss **155** serves the function of the opening **98** in the pivot bar **91** of FIG. **9**, the passage **156** thus receiving therewithin a stub shaft **97C** for supporting roller **99C** on and beside the pivot bar **91C**. The width of the body portion **148** and extension **149** preferably corresponds to the width of the pivot bar **91** of FIG. **10** at the notch **101**.

At the rightward tip of the pivot bar **91C** there is provided a generally L-shaped slot **158** extending transversely of the body portion **148** and having an upwardly extending portion and a rightwardly opening portion. A spring **129C** is provided with a narrow, transversely extending flange **159** receivable in the slot **158**. The flange **159** is held in fixed relation to the body member **148** by the edge portion **161** of the body member **148**, which defines the L-shaped slot **158**. After insertion of the leftward end of the spring **129C** into the slot **158**, the edge portion **161** is deformed to narrow the bottom of the slot **158** and, hence, tightly grip the flange **159** of the spring **129C**.

Where the door **19** is to be aligned with a further door **20**, as in the embodiment illustrated in FIG. **1**, the preferred embodiment of the invention provides an elongate alignment, sealing and locking strip or astrogal **165** (FIGS. **17–20**). The astrogal **165** is preferably formed as an extrusion, preferably of metal such as aluminum. As seen in FIG. **18**, the astrogal **165** has an interior portion **166** which is generally of C-shaped cross-section, comprising a bight wall **167** connecting a pair of divergent walls **168** and **169**. The divergent walls **168** and **169** terminate in a pair of convergent walls **170** and **171**, the free edges of which are spaced from each other by a distance corresponding substantially to the width of the bight wall **167**. The width of the bight wall **167** and the acute angle between the divergent walls **168** and **169** are such as to allow same to be snugly but readily received into the depressed central portion **50** of the side member **30** of door **19**, the divergent walls **168** and **169** paralleling the outwardly divergent portions **52** associated with the depressed portion **50**. The convergent walls **170** and **171** are arranged for similar snug but ready reception into the opposed depressed portion **50D** of the corresponding opposed side member **30D** of door **20**, the convergent wall **170** and **171** preferably paralleling the divergent walls **169** and **168**, respectively, and being of width similar thereto.

Bight wall **167** is provided with a plurality of spaced openings distributed longitudinally thereof for reception of screws **175** which threadedly engage suitable threaded openings **176** in the depressed portion **50D** of the door **20** for securing the astrogal **165** to the door **20** in nesting relation within the depressed portion **50D**.

The astrogal **165** further includes an exterior portion **177** of generally T-shaped cross-section having a cross arm **178** and central leg **179** connecting the midpoint of the cross arm **178** to the juncture of the exteriorily facing divergent and convergent walls **168** and **170**. The leg **179** is of sufficient length to dispose the crossarm **178** so that its interior face snugly abuts the exterior face of side member **30D** of the door **20** and will snugly but slidably receive the exterior face of the side member **30** of door **19** therepast. Thus, the groove-like space between the crossarm **178** and the convergent sidewall **170** normally snugly receives the exterior edge of the door **20** while the exterior edge of the door **19** is slidably but snugly receivable into the corresponding groove-like space between the crossarm **178** and the divergent wall **168**. The crossarm **178** and divergent wall **168** guide the edge of the door **19** into a closed coplanar relationship with door **20**. The labyrinthian character of the opposed faces of the astrogal **165** and door **19** tends to act as a weather or insect seal.

As seen in FIGS. **17** and **20**, the astrogal **165** is provided with longitudinally extending, rounded end openings **181** and **182** adjacent the ends thereof which allow access to adjustment screws on the door **20** corresponding to adjustment screws **122** and **122A** of the door **19** (FIG. **3**). The openings **181** and **182** also allow access to screws which hold the frame of the door **20** together corresponding to the screws **75** of FIG. **3**. The openings are aligned, longitudinally of the astrogal, with the screws **176** above mentioned, and hence are substantially centered on the bight wall **167** of the astrogal.

The ends of the astrogal **165** are provided with longitudinally extending, rounded-end notches **184** and **185** which are laterally offset from the openings **181** and **182**, being provided through adjacent portions of the bight wall **167**, divergent wall **168** and leg **179**. The notches **184** and **185** provide clearance for the rails **81** and **85** upon which the doors **19** and **20** are supported and guided.

A preferably rectangular, longitudinally extending latch opening **187** is provided in the bight wall **167** for reception thereinto of a generally L-shaped and vertically movable latch element **189** (FIGS. **2, 3, 19** and **20**) which comprises the operative portion of the latch assembly **34** on door **19**. The opening **187** is located

longitudinally of the astrogal **165** and door **20** in a manner that the upstanding leg **190** of latch element **29** may be located within the interior of the C-shaped astrogal portion **166** above the upper edge of latch opening **187**, whereby coaction between the portion of bight wall **167** immediately above the latch opening **187** with the leg **190** of latch element **189** will prevent lateral relative separating movement between the doors **19** and **20** so that the doors **19** and **20** will be latched together.

It is contemplated that the latch mechanism **34** may be of any conventional nature which provides a vertically reciprocable latch element generally of the type shown **189.** The leg **190** of the latch element may be downwardly extending rather than upwardly extending as shown, in which case the bottom edge of the astrogal opening **187** is located for coacting with the latch element leg **190** to enable latching and unlatching thereof.

Where it is desired that only one sliding screw or glazed door be utilized, such as the door **19,** instead of both doors **19** and **20,** the astrogal **165** and door **20** may be replaced as seen in FIGS. **21–23** by a fixed stile **193** and a hollowed latch block **194.** The stile **193** may be of any convenient material such as wood and may be part of the framing for the building opening in which the door assembly is disposed. The inward face **196** of the stile **193** is stepped as indicated at **197** and **198** so that the exterior face **199** of the stile extends furthest into the building opening in which the door **19** is disposed. The latch block **194** is preferably formed as a rectilinear, hollow element having an interior face **201,** end walls **202** and **203** and sidewalls **204** and **205** defining a recess or hollow interior **206.** A preferably rectangular notch is provided in the sidewall **204,** preferably by removal of the central portion of the sidewall, for receiption of the latch element **189.** Longitudinally elongated slots are provided through the interior face **201** along the edge thereof opposite the opening **208.**

The block **194** is snugly received within the step portion **198** of the stile **193** with the recess **206** thereof facing exteriorily and the free edges of the walls **202, 203** and **206** bearing on the interiorly facing portion of the step portion **198.** The block **194** is held in such position by screws **210** extending through the slots **209** and into threaded engagement with the material of the stile **193.** The block **194** extends beyond the step **197** and the face **204** is arranged to be disposed in close adjacency to the depressed portion **50** in the opposed edge of the closed door **19** in the region of the latch element **189.** Thus, the leg **190** may be received through the opening **208** in the block **194** and when moved into latching position, as shown in FIG. **22,** the leg **190** snugly but slidably bears against the interior face of the sidewall **204,** here at the upper edge of the notch **208,** for holding the door **19** closed. The slots **209** allow, upon loosening of the screws **210,** upward or downward adjustment of the latch block **194** for providing maximal overlap of the latch element leg **190** and the wall **204** in the latching position shown in FIG. **22** but allowing the leg **190** to be removed through the opening **208** when in the unlatched position to allow opening of the door **19.**

## OPERATION

Although the operation of the embodiment of the invention above described will be understood from the foregoing description by skilled persons, a summary of such description is given below for purposes of convenience.

The door **19** is quickly and readily assembled from the side members **29** and **30** and top and bottom members **31** and **32** (FIGS. **2–8**) by insertion of the ends of the top and bottom members **31** and **32** in the recesses **70** in the tops of the side members **29** and **30,** wherein the side member ends are snugly received throughout substantially the entire width of the side members **29** and **30.** The side members are fixed to the top and bottom members by the screws **75,** there being one such screw for each corner of the door, each screw **75** passing through the wall **39** of the corresponding side member at the hole **74** (FIG. **9**) and being held in self-tapping, threaded engagement between the flange element **62** of the hollow split rib **61.**

The upper and lower roller assemblies **79** and **77** are preferably secured within the top and bottom frame members **31** and **32** prior to assembly of the latter to the side members **29** and **30** by placement of the adjustment screw **118** and **118A,** nuts **114** and **114A,** springs **125,** rollers **99** and **99A** and pivot bars **91** and **91A** therein, each pivot bar being secured within the respective one of the top and bottom members by its respective pivot pin **92** or **92A.** The portion of each adjustment screw **118** adjacent the head **122** is received in the slot **124** in the adjacent side member as the top or bottom members are received in the side members, the head **122** and washer **126** being disposed on opposite sides of the slot **124.**

Installation of the door **19** into guided and supported relationship with respect to the rails **81** and **85** of tracks **22** and **23** is readily accomplished by adjustment, if required, of the adjustment screws **118** and **118A** of the upper and lower roller assemblies **79** and **77,** respectively, to allow each of the pivot bars **91** to assume a position at or adjacent its inwardmost limiting position **99'** (FIG. **9**) and further to allow each of the pivot bars **91A** to assume an inward limiting position such that the roller **99A** associated therewith is spaced above the lower edge of the bottom frame member **32.** With the roller assemblies so arranged, the upper edge of the door **19** is raised upwardly so that the rollers **99** thereof contact the upper rail **81.** The door thereafter is raised further to depress the springs **129** and move the pivot bars **91** into limiting contact with the opposed adjustment nuts **114** so that the door is raised to the fullest extent possible with respect to the rail **81.** Thereafter, the lower edge of the door may be swung interiorily, the bottom edge of the door clearing the lower rail **85** and the pivot bars **99A** being swung upwardly to their innermost limiting position, defined by the nuts **114A,** to also clear the rail **85.** Thereafter, with the rollers **99A** positioned directly over the lower rail **85,** the door is allowed to drop so that the rollers **99A** rest is guided, supported relation upon the lower rail **85.** The springs **129** urge the pivot bars **91** of the upper roller assemblies **79** upwardly to maintain guided contact between the rollers **99** and the upper rail **81** associated therewith.

Thereafter, the adjustment screws **122A** of the lower roller assembly **77** are rotated by engagement of the heads **122A** thereof by a screwdriver to move the adjustment nuts **114A** outwardly. Since the weight of the door **19** causes the pivot bars **91A** to bear against the nuts **114A,** such adjustment causes the pivot bars **91A** and rollers **99A** to move downwardly to raise the door on the track **23.** This, of course, will cause a corresponding depression of the rollers **99,** which is allowed

by the bias spring **129** of each of the upper roller assemblies. Such adjustment is continued until the opposed edges of the rails **81** and **85** contact by the rollers **99** and **99A** are both overlapped by the corresponding upper and lower edges of the door **19.** Thus, the door **19** is properly located vertically with respect to the rails **81** and **85.**

The adjustment of the adjustment screws **122A** is preferable also carried out in a manner to position the door **19** vertically so that the latch element **189** is properly located with respect to the latch opening in the astrogal **165** or lock block **194.** With the door **19** so properly positioned, the astrogal opening **187** will receive the latch element **189** upon sliding of the door **19** to its closed position against the edge of the door **20** and raising of the latch element **189** will latch the two doors together by reason of overlapping of the leg **190** of the latch element **189** and the portion of the astrogal wall **167** of the opening **187.** Such vertical adjustment of the door **19** is less critical when the second door **20** is omitted and the door **19** closes against a fixed stop **193** since the lock block **194** can be vertically adjusted by reason of slots **209** receiving the screws **210.**

Should the rail **85** be other than perfectly level, so that the door **19** tends to rest thereon in a tilted rather than vertical position, the adjustment screws **122A** of the lower roller assemblies may be further adjusted differentially to raise one of the lower corners of the door more than the other so that the door assumes an accurately vertical position to enable the side edges thereof to engage continuously, for example, the weatherstripping **48** on the fixed window **16** (FIG. **6**) and the astrogal **165** on the opposed door **20** (FIGS. **17–20**) or, if no such opposed door is provided, the stile **193** (FIG. **21**), when in its closed position to provide for complete weather or insect sealing and correct operation of the latching mechanism **34.**

The door **19** is readily adapted to use with tracks **22** and **23** of different spacings without varying the position of the adjustment screw **125A** and nut **114A** (FIG. **13**), by substitution of nuts **114A** of a different height. More particularly then, a nut of different height communicated in broken lines in FIG. **13** at **114AA** may be provided as a substitute for the nut **114A** shown in solid lines to allow the pivot bar **91A** to assume a higher of further inward limiting position as indicated in broken lines at **91AA**, for a given lateral adjustment of the nut. Alternatively, or in addition, nuts of different height can also be provided in the upper roller assemblies **79.**

Following adjustment of the adjustment screws **122A** of the lower roller assemblies **77** as above described, the adjustment screws **122** of the upper roller assembly **79** are adjusted, if required, to move the adjustment nuts **114** laterally therealong to predetermine the lower or inward limiting position of the pivot bars **91** and attached rollers **99.** Normally, this adjustment is made to move the inward limiting position of the pivot bars **91** upwardly so that the rollers **99** can thereafter move downwardly only to a relatively minor extent away from the upper rail **81,** normally to an extent little more than sufficient to allow sliding of the door to a fully open position and despite any nonparallelism of the rails **81** and **85.** In this manner, it becomes impossible for the door to be lifted, as by an intruder located on the outside of the door and seeking to gain unauthorized admittance to the building, to the extent required to disengage the lower edge of the door **19** from the rail **85** and swing same exteriorily for removal of the door.

The above mentioned adjustment of the inner limiting position of the upper roller assembly **79** also precludes unauthorized opening of the door from the outside in another manner. More particularly, the latch element **189** is normally held in its upwardmost or locking position with respect to the astrogal **165** or lock block **194** by a moderate amount of internal friction in the latch assembly **34** and by friction between the latch element **189** and the opposed face of the astrogal or lock block. An upward movement of the door **19** thus would not result in an upward movement of the latch element **189** therewith, upward movement of the latch element **189** being prevented by bearing thereof on the upper edge of the opening **187** (FIG. **17**) or **208** (FIGS. **22** and **23**). Thus, were the door was raised a distance greater than the height of the leg **190** on the latch **189** and thereafter allowed to fall to its normal operating position wherein the pivot bars **91A** engage the opposed adjustment blocks **114A** of the lower roller assemblies **77,** the latch element **189** will have been lowered with respect to the door to an extent sufficient that the latch element **189** as a whole can be removed from the opening **187** or **208** simply by sliding the door **19** away from the astrogal **165** or stile **193** in a normal opening movement. However, by the above mentioned adjustment of the adjustment screws **122** of the upper roller assemblies, whereby the adjustment nuts **114** are moved laterally outwardly to raise the innermost or downward limiting position of the pivot bars **91** and rollers **99,** the distance that the door **19** can be raised before the pivot bars **91** strike the nuts **114** can be limited to a distance substantially less than the height of the leg **190** on the latch element **189.** Thus, the door **19** cannot be raised sufficiently from the exterior thereof to move the latch element **189** to its lower or nonlocking position.

Still further, the unauthorized person seeking to gain admittance to the building has no access to the adjustment screws **122** and **122A** since the adjustment screws are either located in the interior of the building and shielded from tampering from the outside by the fixed window **16** or, on the other hand, are shielded from tampering from the exterior of the building by the astrogal **165** or stile **193.** Thus, appropriate adjustment of the adjustment screws **122,** resulting in a rigid or fixed inward limiting position for the pivot bars **91** positively precludes unauthorized entrance to the building by vertical manipulation of the latched door **19.**

Thus, with the door so properly vertically positioned and aligned, sliding of the door rightwardly or leftwardly will effect closing or opening of the building portal to allow entrance or exit therefrom.

To latch the door in its closed position, the door **19** is moved rightwardly to contact with the astrogal **165** and/or stile **193** whereby the latch element **189** is received in the corresponding opening **187** (FIGS. **17** through **20**) or **208** (FIGS. **21** and **22**). Upward movement of the latch element **189** results in overlapping of the leg **190** thereof with the portion of the wall **167** of the stile or wall **204** of the lock block **194** above the respective openings **187** and **208** to effect a latching of the door. Unlatching is carried out by lowering of the latch element. Normally, manually engagable means **34A** (FIG. **2**) for raising and lowering the latch element **189** are provided only on the interior side of the door

precluding unlatching and opening of the door from the exterior.

Where two doors **19** and **20** are provided, latching same together as above described prevents sliding movement of either door, by reason of interfingered engagement of the doors **19** and **20** with the corresponding windows **16** and **17**, such interfingered engagement being shown for example at **41** and **42** (FIG. **6**).

In addition to its latching function above discussed, the astrogal **165** by reason of its fixed attachement to the door **20** provides for weather or insect sealing and guiding of the door **19** upon closure thereof. More particularly, it will be seen from FIGS. **18** and **19** that upon rightward or closing movement of the door **19**, the rightward edge thereof will be brought into nesting relationship with the leftward face of the astrogal **165**, the rightward edge of the door **19** being guided into proper closing coplanar relationship with the door **20** by reception of its exterior edge portion between the divergent wall **168** and crossarm **178** of the astrogal **165**. Further, when the door **19** is closed as seen in FIG. **19**, the configuration of the several abutting faces of the astrogal **165** and rightward edge of the door **19** provide a labyrinthian interface which provides an excellent weather or insect seal. Moreover, the labyrinthian and close abutting character of the fit between astrogal and rightward door edge precludes entry thereinto of strip material for unauthorized manipulation and unlatching of the latch member **189**, again precluding unauthorized entry.

The closing, latching, door guiding, weather or insect sealing and strip insertion prevention features of the embodiment of FIGS. **21–23** are generally similar to those described above with respect to the astrogal equipped door **20** discussed above with respect to FIGS. **17–19**. In addition, the latch block **194** may be adjusted upwardly and downwardly, by loosening of the screws **210** followed by a retightening thereof, to compensate for vertical misadjustment of the door **19** whereby proper latching and unlatching can be carried out despite such vertical misadjustment of the door **19**.

FIG. **24** discloses a further modified form of the pivot bar as indicated at **91E** which is similar to the bar **91C** (FIG. **16**) but differs therefrom in several particulars indicated below. The pivot bar **91E** shown is intended for use on the upper edge of the door panel construction. The pivot bar **91E** is wider than the pivot bar **91C**, corresponding in width to the pivot bar **91** of FIG. **9**, and is thus capable of substantially filling the space between the side walls of the top frame member **31**. The pivot bar **91E** is provided with a notch **101E** for reception of the wheel **99E**, as in the case of the pivot bar **91** of FIG. **9**.

The pivot bar **91E** provides for a strengthened and more secure mounting for the end of the spring **129E** in including a substantially U-shaped boss **212** on the underside thereof and beneath and somewhat longitudinally inwardly of the boss **155E** utilized for mounting of the wheel **99E**. The U-shaped boss **212** is at one end **213** thereof integral with the underside of the pivot bar **91E** and at the other end **214** thereof spaced from the underside of the pivot bar **91E**, the end **214** having a longitudinally and rightwardly extending flange **250**. Thus, the U-shaped boss **212** with its flange **215** defines a substantially L-shaped slot into which the corresponding, substantially L-shaped end **217** of the spring **129E** is receivable. The end **217** of the spring **129E** is fixed within the U-shaped boss **212** and between the flange **215** thereof and the underface of the bar **91E** by distorting the U-shaped flange **212** to move the end **214** thereof rightwardly and upwardly toward the end **212** thereof. An extension **218** of the pivot bar **91E** extends rightwardly from the wheel mounting boss **155E** along the upper surface of the spring **129E** to provide an elongated backing surface for the leftward end of the spring which prevents any tendency of the leftward end of the spring to rock within the U-shaped boss **212** and thus enhances the rigid mounting of the spring when upwardly directed forces are applied to the rightward end **132E** of the spring during use.

The thickness of the extension **218** is preverably less than that of the central portion of the bar **91E** and further is preferably substantially that of the leftward extension **149E** thereof.

As is the case of the pivot bar **91C** of FIG. **16**, the pivot bar **91E** is adapted to manufacture by extrusion along the axes of the bosses **155E** and **152E** wherein individual pivot bars **91E** may be transversely severed from such an elongated extrusion.

Pivot bars for the lower portion of the door (usable in the place of the pivot bar **91A** in FIG. **13**) may be constructed in a manner similar to the pivot bars of FIGS. **16** and **24** by omission of the corresponding spring **129C** or **129E**. In addition, for example in the case of FIG. **24**, the extension **218** and U-shaped boss **212** with its flange **215** may also be omitted when the pivot bar is intended for use in the bottom frame **32** of the door.

FIG. **25** discloses a further modified limit block or nut construction **114F** which like the nut construction **114B** of FIG. **5** is adapted for manufacture from an elongate extrusion by a transverse severing operation. The nut **114F** has the above discussed advantages of the nut **114B** of FIG. **15** and in addition requires even less material to manufacture while retaining the requisite amount of strength. More particularly, the side faces **147F** are substantially more extensively hollowed out than in the case of the nut **114B**. Thus, the nut **114F** comprises a generally T-shaped and upstanding top portion **219** from which integrally depends a substantially A-shaped bottom portion **220**. The upper end of the A-shaped portion includes a threaded opening **119F** which opens, through a slot **146F**, downwardly into the zone between the downwardly diverging legs of the A-shaped bottom portion **220**.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modifications of the disclosed apparatus, including the rearrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

**1.** A sliding door construction guided for sliding movement by a rail, comprising:

a door adjacent said rail, said door comprising a frame-work including spaced side members and spaced transverse channel members of outwardly opening channel cross section connecting said side members adjacent the ends thereof;

a guidable element engageable with said rail;

movable support means carrying said guidable element and securing same to said door for movement through a selected path;

an abutment element capable of interfering contact with said movable support means to limit movement of said support means on said first mentioned path, said abutment element being movable along a second path to change the position on said first mentioned path at which said limitation of movement of said support means occurs;

adjustment means accessible from the outside of the door and manipulatable for adjusting the position of said abutment element on said second path;

at least one pair each of guidable elements, movable support means, abutment elements and adjustment means being received in each channel member, said side members having opposed notched portions snugly receiving the adjacent ends of said transverse members having spaced opposed sidewalls connected by a bight wall, said sidewalls having outward extensions of increased spacing lying beyond and abutting the ends of said side members, a hollow rib on one said wall extending longitudinally of said transverse member, elongate fastening means receivable in said rib and engaging the adjacent side member for fastening the transverse members to the side members, said abutment element comprising a block supported for sliding movement on the walls of said channel member and having a recessed portion receiving said rib.

**2.** The device defined in claim **1** in which said adjustment means comprises a screw substantially parallel to said rib and threadedly engaging said block, said screw being axially fixed with respect to the adjacent side member whereby rotation of said screw will cause the block to move longitudinally of said channel adjacent said rib, said movable support means comprising a bar pivotally supported between the sidewalls of said channel adjacent said screw, said block lying in the pivotal path of said bar for limiting inward movement of said guidable element with respect to said door.

**3.** A sliding door construction guided for sliding movement by a rail, comprising:

a door adjacent said rail;

a guidable element engageable with said rail;

movable support means carrying said guidable element and securing same to said door for movement through a selected path;

an abutment element capable of interfering contact with said movable support means to limit movement of said support means on said first mentioned path, said abutment element being movable along a second path to change the position on said first mentioned path at which said limitation of movement of said support means occurs;

adjustment means accessible from the outside of the door and manipulatable for adjusting the position of said abutment element on said second path;

a second door substantially coplanar to said first mentioned door;

an elongate astragal secured to the edge of one of said doors, said astragal comprising a first portion of generally C-shaped cross section and a second portion of generally T-shaped cross section having a crossarm and a leg, said leg being integrally connected to said portion of C-shaped cross section adjacent to but spaced from one edge thereof, said doors having opposed concave end faces, said crossarm being disposed exteriorly of said doors, said leg extending between said doors and one portion of said C-shaped portion being snugly receivable in the concave end face of one door and the remaining portion of said C-shaped portion being snugly receivable in the concave end face of the other door for effecting a labyrinthian interface therebetween.

**4.** The device defined in claim **3** in which said second door carries further guidable elements, movable support means, abutment elements and adjustments means, said astragal including openings in said C-shaped portion for providing access to said adjustment means of said one door, a latch element in the concave end face of the other door extending towards said one door, said astragal having an opposed opening for coacting with said latch element for latching said doors together in relatively immovable relationship.

**5.** The device defined in claim **4** in which said astragal is notched at an end thereof for reception of said rail in clearance relation therein.

**6.** A sliding door construction guided for sliding movement by a rail, comprising:

a door adjacent said rail;

a guidable element engageable with said rail;

movable support means carrying said guidable element and securing same to said door for movement through a selected path;

an abutment element capable of interfering contact with said movable support means to limit movement of said support means on said first mentioned path, said abutment element being movable along a second path to change the position on said first mentioned path at which said limitation of movement of said support means occurs;

adjustment means accessible from the outside of the door and manipulatable for adjusting the position of said abutment element on said second path;

latch means on one edge of said door;

a fixed stile in the path of said door, said stile having a stepped face opposed to said door; and

a latch block fixed to one of the steps of said stile and having an opening therein for reception of said latch means on said door for latching said door to said stile, said latch block having a recess facing transversely of the plane of said door and closed by the opposed surface of said one step, said opening communicating with said recess.

**7.** The device defined in claim **6** in which the latch block recess is defined by an interior face from which transversely extend an opposed pair of end walls and an opposed pair of sidewalls connecting said end walls, one of said sidewalls having said opening therein for reception into the interior of said latch block of said latch means of said door, elongate slots in the interior face of said latch blocks for reception thereinto of screws engagable with said stile for holding said latch block thereto, said latch block being adjustable along the length of said stile to an extent dependent on the length dimension of said slots for properly positioning the opening in said latch block with respect to the latch on said door.

**8.** In a door construction slidable between a vertically spaced pair of rails, a combination comprising:

a door framework comprising a spaced opposed pair of upstanding side members and a spaced opposed

pair of substantially horizontal top and bottom members fixedly connecting said side members and being of substantially channel-like and upwardly and downwardly opening cross-section, respectively;

a pivot bar located in one of said top and bottom members, said pivot bar being disposed between the sidewalls of said channel and pivotally supported by a pin extending between said walls, said pin being located adjacent the end of said pivot bar nearest the adjacent side member of said frame for pivotally mounting said pivot bar for pivotal movement in a plane substantially parallel to and between said sidewalls;

a roller adjacent the opposite end of said pivot bar and guidedly engageable with said rail;

a nut disposed between said sidewalls in said channel and supported upon the bight wall of said channel connecting said sidewalls for sliding movement longitudinally of the channel, said nut being disposed inwardly of said pivot bar with respect to said door, said nut having an abutment surface capable of contact by said pivot bar for precluding further inward movement of said pivot bar with respect to said door and towards said bight wall of said channel, the length axis of said pivot bar being inclined with respect to said bight wall when said pivot bar is in contact with said abutment surface in a manner that the portion of the length axis of said pivot bar adjacent said abutment nut is further from said bight wall than the portion of said axis adjacent said pivot mounting of said bar, whereby movement of said abutment nut along the bight wall towards the pivot axis pivotally moves said pivot bar in a direction for moving said roller away from said bight wall;

an elongate adjustment screw extending along said pivot bar and threadedly engaging said nut, said adjustment screw being substantially parallel said bight wall, whereupon rotation of said adjustment screw causes said nut to move along said bight wall to adjust the inwardmost limiting position of said pivot bar;

resilient means disposed between said nut and a fixed wall defining the end of said channel and means defining a head on said screw disposed on the opposite side of said fixed wall from said resilient means, said resilient means and head cooperating to maintain said adjustment screw in substantially fixed relationship with respect to said door while not precluding rotation thereof.

**9.** The device defined in claim **8** in which said resilient means comprises a coil spring coaxially receiving said adjustment screw therewithin and including means preventing unintentional threaded movement of said nut off said screw.

**10.** The device defined in claim **8** including an elongate sinuously curved leaf spring releasably secured at one end thereof to the end of said pivot bar carrying said roller and normally bearing at its other end upon means fixed with respect to said bottom wall for urging said pivot bar outwardly of said door construction, there being at least two pivot bars equipped with such sinuously curved springs, one at each end of said upper frame member, there being two further such pivot bars disposed adjacent the ends of the bottom frame member and having no such spring.

**11.** The device defined in claim **8** in which said nut comprises a severed length of an extrusion having generally rectilinear form, having recessed portions in opposed sidewalls thereof normally disposed opposite to the sidewalls of the channel of the corresponding top or bottom frame member, a threaded opening therethrough for reception of said adjustment screw therein and a slot communicating between said threaded opening and exterior face of said block.

**12.** The device defined in claim **8** in which said pivot bar comprises a plate-like element having an extension which is angled at a shallow angle with respect to the central plane of said plate-like portion, said extension being angled to allow clearance of said pivot bar and said adjustment screw, spaced slotted bosses extending transversely of said pivot bar on one face thereof for reception of the pivot pin and means for supporting said roller and further slot adjacent the roller carrying end of said pivot bar, said spring having an L-shaped end thereon engageable within said slot, the end portion of said bar defining said slot being deformable into close pressed relationship with said end of said spring for holding said spring in fixed relationship to said bar.

**13.** The device defined in claim **8** in which the pivot bar comprises a plate-like element having a first extension at one end thereof angled at a shallow angle with respect to the central plane of said plane-like portion, said first extension being angled to allow clearance of said pivot bar and said adjustment screw, spaced slotted bosses extending transversely of said pivot bar on one face thereof for reception of said pivot pin and means for supporting said roller, a substantially U-shaped boss on the side of said pivot bar opposite said slotted bosses and located substantially opposite the one of said bosses receiving said means for supporting said roller, one leg of said U-shaped boss being spaced from the opposed side of said pivot bar for defining therewith an L-shaped slot, said spring having L-shaped end engageable within said slot, said U-shaped boss being deformable into close spaced relationship with the end of said spring for holding same in fixed relation to said bar, said bar having a second extension extending beyond said last mentioned slotted boss for backing the portion of said spring adjacent the L-shaped end thereof.

**14.** A sliding door construction including a door guided for sliding movement by a rail, comprising:

a guidable element engageable with said rail;

an elongate bar and pivot means adjacent one end of said bar for pivotally mounting said bar on said door, said guidable element being mounted adjacent the other end of said bar, said other end of said bar extending at a shallow angle to said rail so that movement of said guidable element is predominantly toward and away from said rail;

means defining a limit block movable on said door along a path adjacent a portion of said bar intermediate said pivot means and guidable element and engageable with said intermediate portion of said bar for limiting movement of said guidable element inwardly of said door, said limit block comprising a nut supported for sliding motion on said door along a path substantially parallel to said rail and intersected by said other end of said bar, said nut being contractable by said bar for limiting inward pivotal movement of said bar, movement of said nut in one direction along said path of travel progressively moving the inward limiting position of said bar outwardly of the door;

adjustment means accessible from the outside of the door for adjusting the position of said limit block on said path and lying adjacent said one end of said bar for limiting movement of said guidable element outwardly of said door, said adjustment means comprising an adjustment screw threadedly engaging said nut and rotatable for moving said nut along its path and further including means at least resiliently urging said screw to remain in a longitudinally fixed position with respect to said door.

**15.** The device defined in claim **14,** including spring means mounted on said other end of said bar and spaced from said pivot means at least substantially as far as in said guidable means for urging said bar outwardly of said door.

**16.** A sliding door construction including a door guided for sliding movement by a rail, comprising:

a guidable element engageable with said rail;

an elongate bar and pivot means adjacent one end of said bar for pivotally mounting said bar on said door, said guidable element being mounted adjacent the other end of said bar;

means defining a limit block movable on said door along a path adjacent a portion of said bar intermediate said pivot means and guidable element and engageable with said intermediate portion of said bar for limiting movement of said guidable element inwardly of said door;

said bar comprising an extrusion segment including spaced parallel bosses on one side of said bar, said bosses extending and being slotted transversely of said bar and located at opposite ends of said intermediate portion, said guidable element and pivot means including pins receivable in said bosses, said one bar end extending from the adjacent boss and being angled toward said one bar side, said bar including a further boss adjacent the other bar end and facing oppositely of the adjacent first mentioned boss and defining a substantially L-shaped slot opening toward said other bar end, said bar being relieved adjacent said other bar end for receiving said guidable element;

a leaf spring adapted to bear against the door and having an L-shaped end received in said L-shaped slot and gripped by said further boss; and

adjustment means accessible from the outside of the door for adjusting the position of said limit block on said path and lying adjacent said one end of said bar for limiting movement of said guidable element outwardly of said door.

**17.** The device defined in claim **16** in which said adjustment means comprises a screw and said limit block comprises a nut threadedly engageable with said screw and movable with respedt to said door inboard of said bar upon rotation of said screw.

**18.** A sliding door construction including a door guided for sliding movement by a rail, comprising:

a guidable element engageable with said rail;

an elongate bar and pivot means adjacent one end of said bar for pivotally mounting said bar on said door, said guidable element being mounted adjacent the other end of said bar;

means defining a limit block movable on said door along a path adjacent a portion of said bar intermediate said pivot means and guidable element and engageable with said intermediate portion of said bar for limiting movement of said guidable element inwardly of said door;

adjustment means accessible from the outside of the door for adjusting the position of said limit block on said path and lying adjacent said one end of said bar for limiting movement of said guidable element outwardly of said door; and

first and second substantially coplanar doors and an elongate astragal secured to the edge of one of said doors, said astragal comprising a first portion of generally C-shaped cross section and a second portion of generally T-shaped cross section having a crossarm and a leg, said leg being integrally connected to said portion of C-shaped cross section adjacent to but spaced from one edge thereof, said doors having opposed concave end faces, said crossarm being disposed exteriorly of said doors, said leg extending between said doors and one portion of said C-shaped portion being snugly receivable in the concave end face of one door and the remaining portion of said C-shaped portion being snugly receivable in the concave end face of the other door for effecting a labyrinthian interface therebetween.

**19.** A sliding door construction including a door guided for sliding movement by a rail, comprising:

a guidable element engageable with said rail;

an elongate bar and pivot means adjacent one end of said bar for pivotally mounting said bar on said door, said guidable element being mounted adjacent the other end of said bar;

means defining a limit block movable on said door along a path adjacent a portion of said bar intermediate said pivot means and guidable element and engageable with said intermediate portion of said bar for limiting movement of said guidable element inwardly of said door;

adjustment means accessible from the outside of the door for adjusting the position of said limit block on said path and lying adjacent said one end of said bar for limiting movement of said guidable element outwardly of said door; and

latch means on one edge of said door, a fixed stile in the path of said door, said stile having a stepped face opposed to said door, a latch block fixed to one of the steps of said stile and having an opening therein for reception of said latch means on said door for latching said door to said stile, said latch block having a recess facing transversely of the plane of said door and closed by the opposed surface of said one step, said opening communicating with said recess.

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