May 9, 1967 L. F. CARSON 3,318,047

COMBINATION SLIDING AND PIVOTED DOOR

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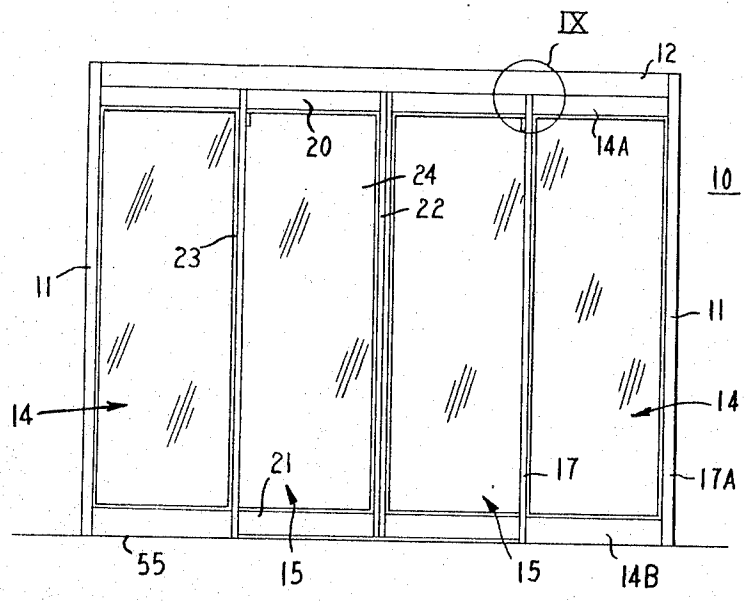


FIG. 1

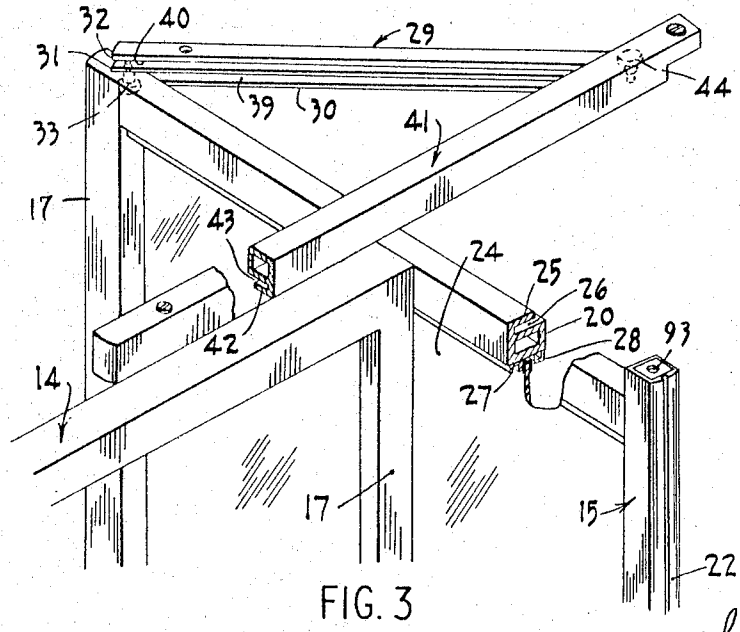


FIG. 3

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COMBINATION SLIDING AND PIVOTED DOOR

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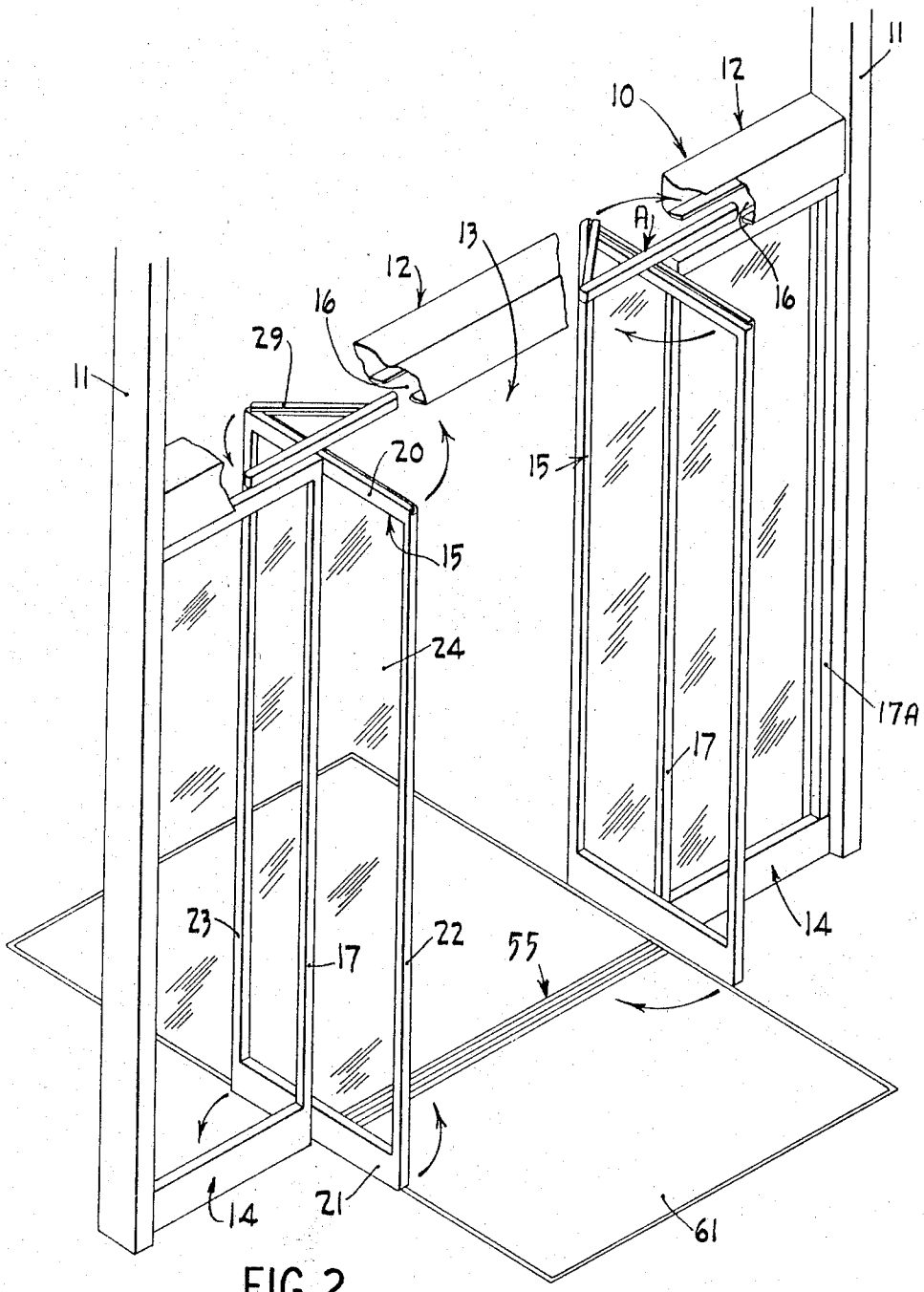


FIG. 2

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COMBINATION SLIDING AND PIVOTED DOOR

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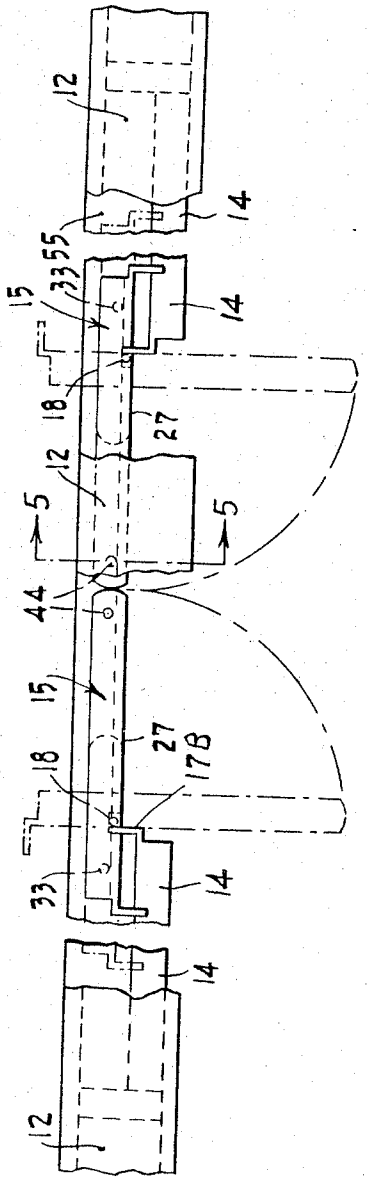


FIG. 4

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COMBINATION SLIDING AND PIVOTED DOOR

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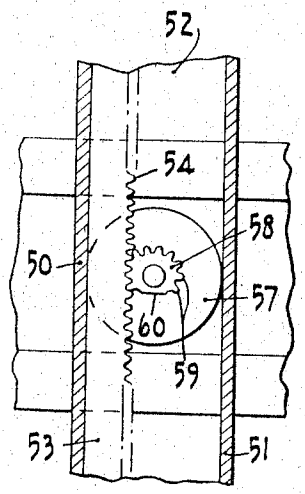


FIG.6

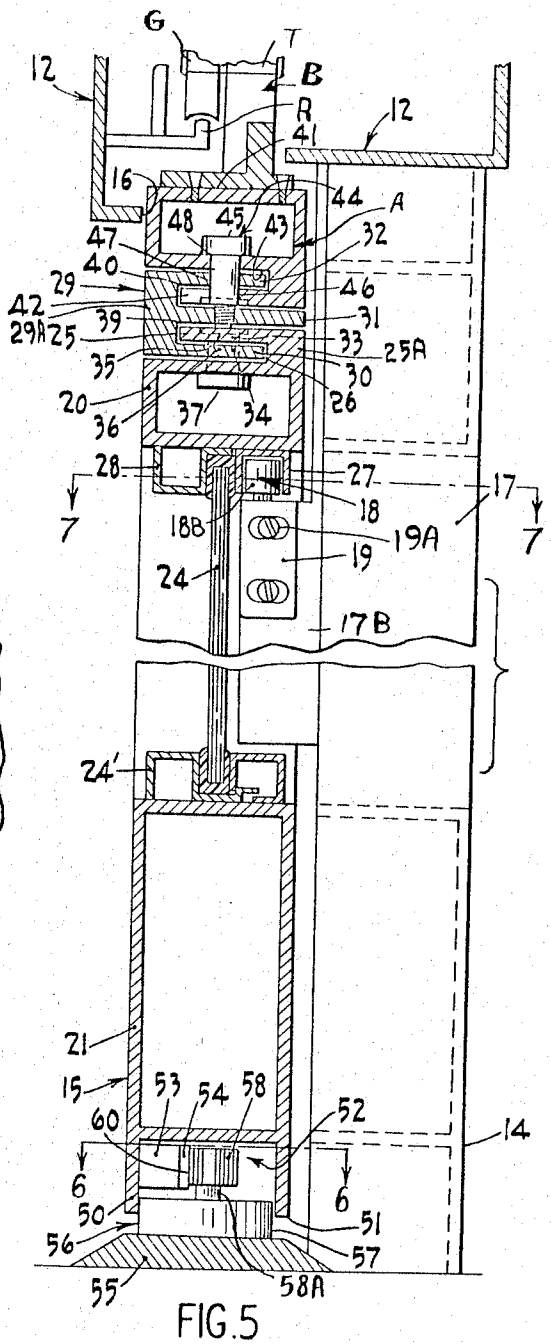


FIG.5

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COMBINATION SLIDING AND PIVOTED DOOR

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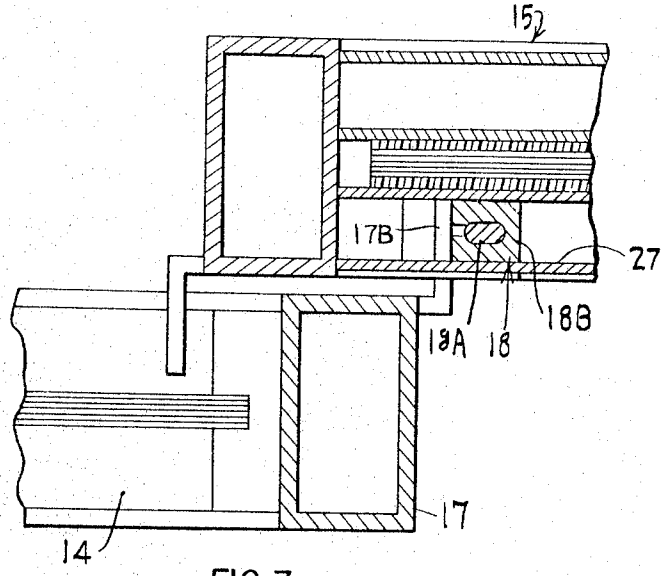


FIG. 7

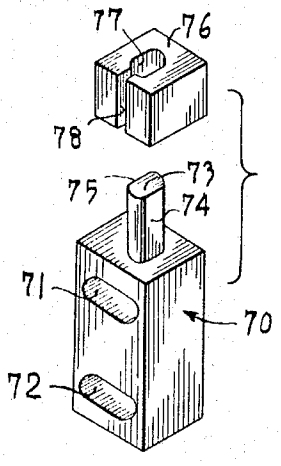


FIG. 8

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COMBINATION SLIDING AND PIVOTED DOOR

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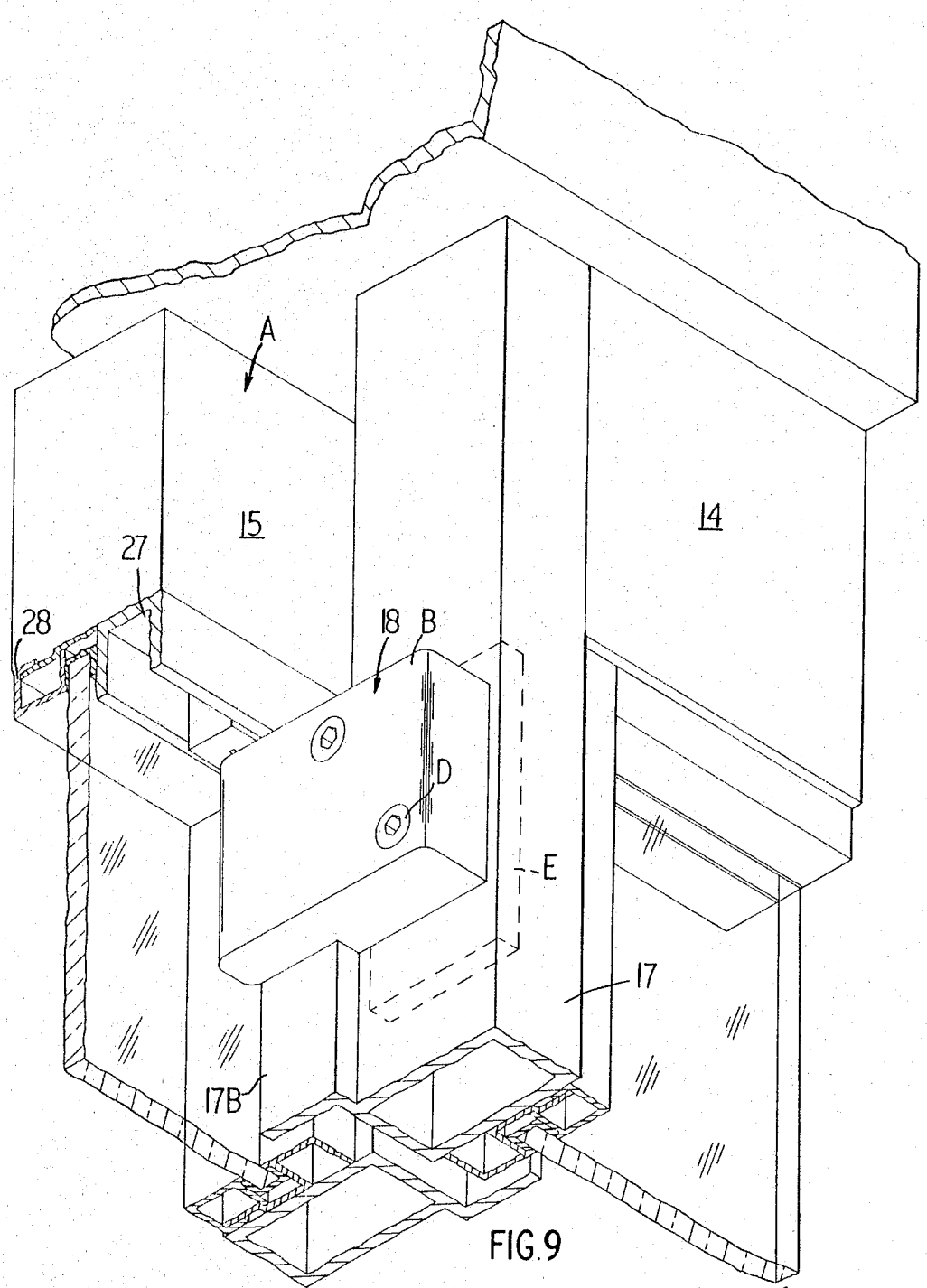


FIG. 9

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COMBINATION SLIDING AND PIVOTED DOOR

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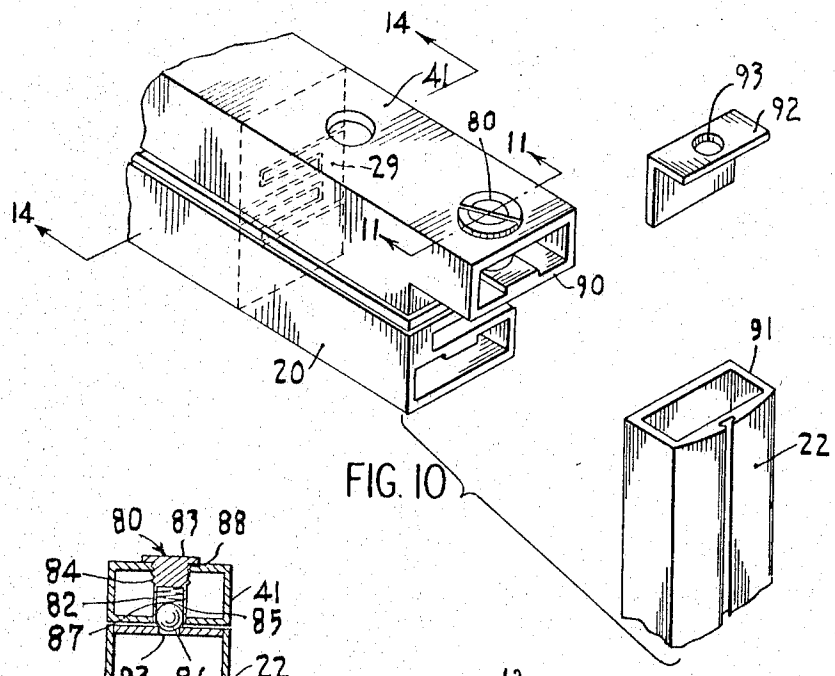


FIG. 10

FIG. 11

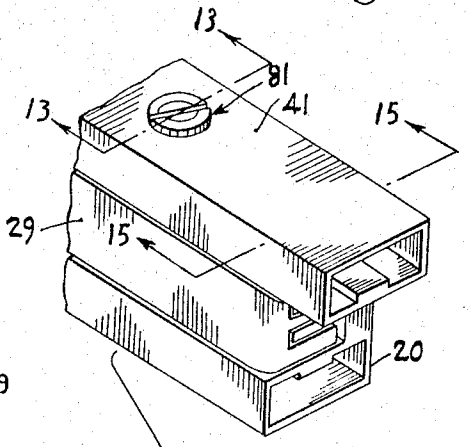


FIG. 12

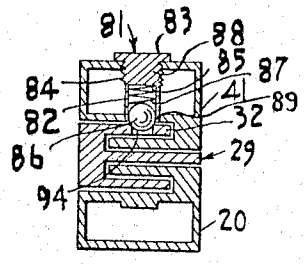
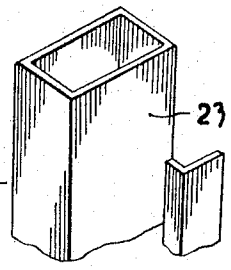


FIG. 13



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COMBINATION SLIDING AND PIVOTED DOOR

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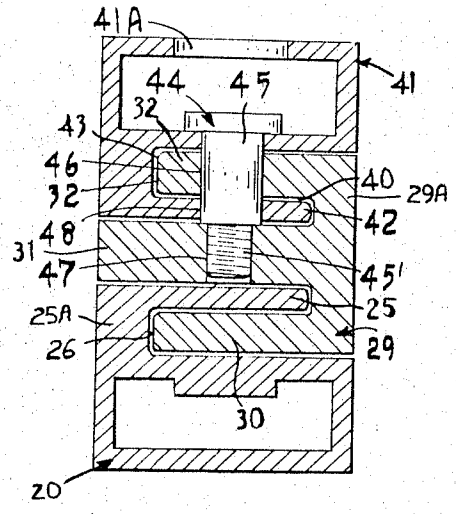


FIG. 14

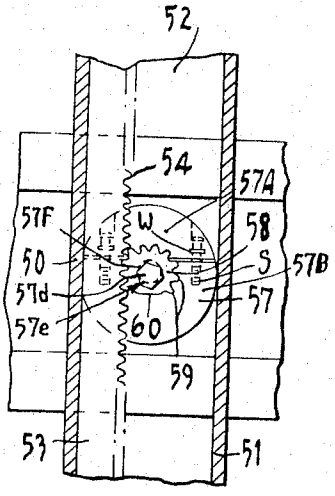


FIG. 16

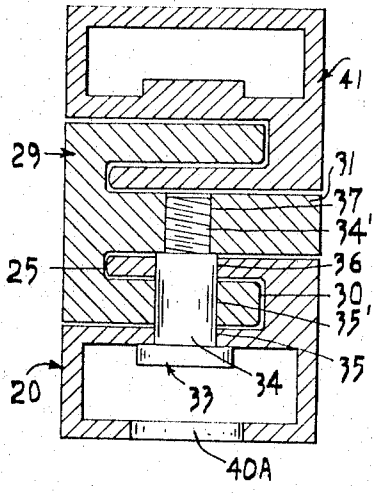


FIG. 15

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COMBINATION SLIDING AND PIVOTED DOOR

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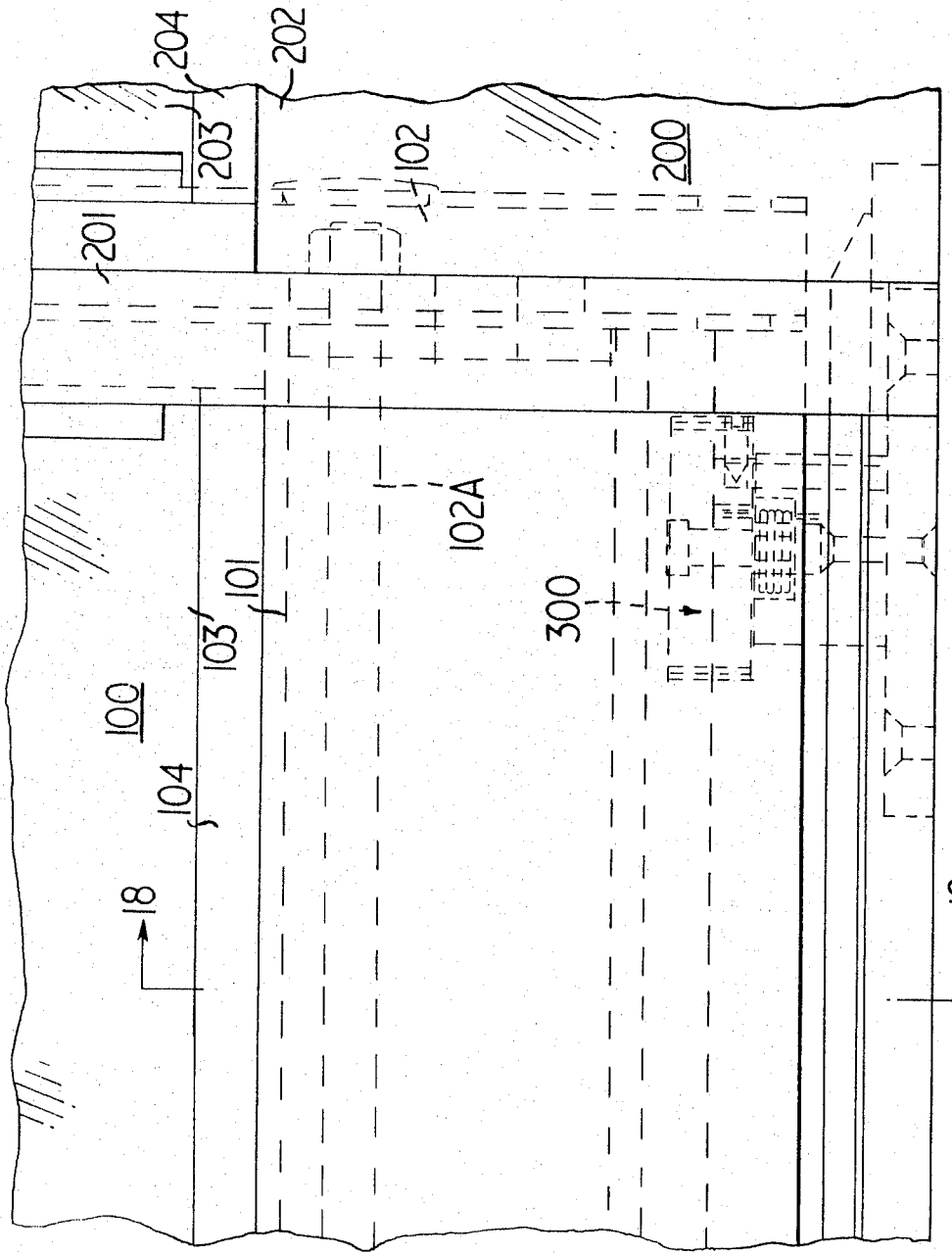


FIG. 17

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COMBINATION SLIDING AND PIVOTED DOOR

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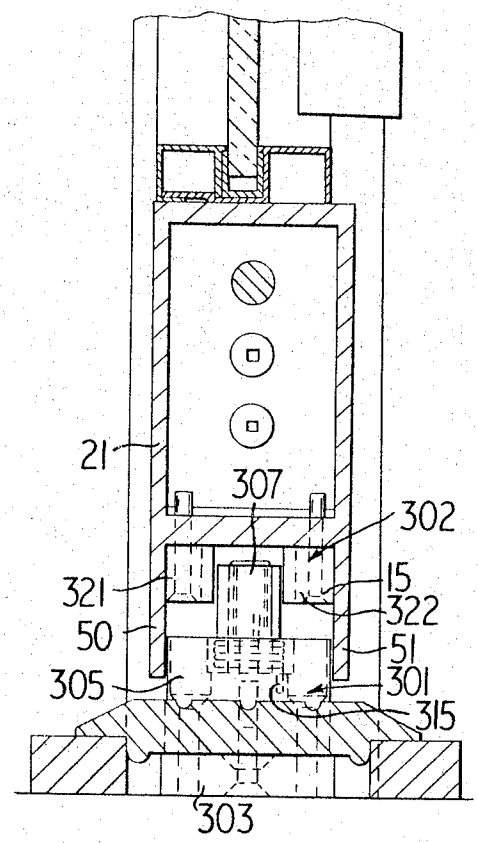


FIG. 18

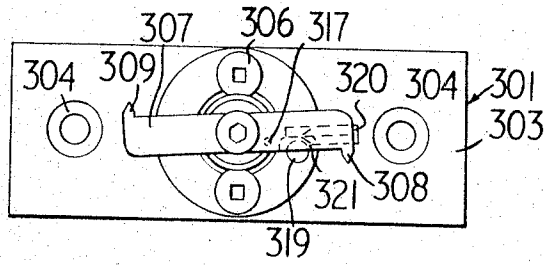


FIG. 19

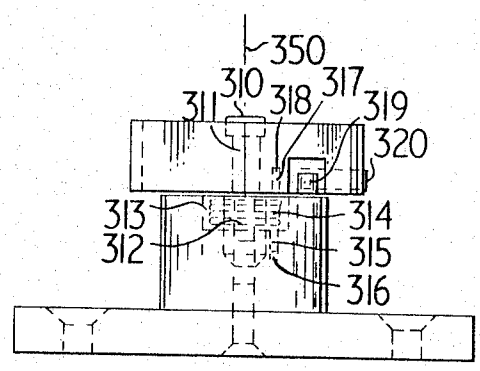


FIG. 20

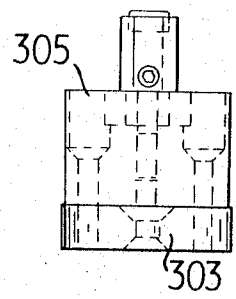


FIG. 21

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United States Patent Office 3,318,047
Patented May 9, 1967

3,318,047

COMBINATION SLIDING AND PIVOTED DOOR

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Filed Dec. 17, 1965, Ser. No. 514,570
Claims priority, application Canada, Jan. 16, 1964, 893,366; June 14, 1965, 933,190
24 Claims. (Cl. 49—149)

This application is a continuation-in-part of application S.N. 366,024 filed May 8, 1964, now abandoned.

This invention relates to improvements in sliding door structures of the power operated type and more particularly to a sliding door mounted such that the door is selectively pivotable about a vertical axis.

The present invention also concerns various types of sliding pivots for mounting doors, panels, or the like to slide along a selected path generally parallel to the flat planar surface of the door or panel and, alternatively, selectively pivotable about an axis generally perpendicular to the path of sliding.

When power operated sliding doors are in use in public buildings, power failure presents a serious problem. Various attempts to provide panic devices to permit manual opening of the sliding doors have not been entirely satisfactory as they tended to be expensive and inconvenient in use.

Sliding pivots provide means whereby a panel mounted thereby selectively for opening or closing an opening combines the advantages and characteristics peculiar to each of sliding closures and pivoted closures. A bath tub enclosure utilizing sliding doors is an example of a sliding closure and a normal pivoted door is an example of the other. There are obvious disadvantages, however, to each and in the case of a bath tub enclosure, the sliding door prevents access to the tub. Desirably, the panels which are slidable should be pivotable to provide complete access. Sliding doors in store fronts, which are often power operated in certain instances require pivotal mounting whereby they may be opened in the event of a power failure. Canadian Patent 692,399, issued Aug. 11, 1964, discloses a sliding door having one type of panic device.

Doors which are selectively pivotable and, alternatively, selectively slidable find many useful applications. These include bath tub enclosures, panic type doors of the general type referred to in the aforementioned patent and even patio doors in residential construction. Gates, or cabinet doors also may be mounted with sliding pivots. One difficulty of sliding pivots is preventing a panel mounted thereby from sliding during rotation of the panel about the pivot axis. This sliding may occur at one or both of a pair of opposed guided edges of the panel and the sliding is most pronounced during transition from sliding to pivoting. Sliding during transition causes the pivot axis to tilt with respect to its normal operative relative orientation and this tilting results in the panel binding during pivotal movement. A door, for example, which is vertically mounted and slidable horizontally and selectively pivotable about a vertical axis may be rendered inoperative by even slight sliding movement of the pivots during the initial stage of pivotal movement. The slight angle of tilt of the axis results in the leading edge of the door engaging the ground or floor surface.

It is an object of this invention to provide a slidable door structure which enables the slidable door to be swung open when in the closed position or partially closed position.

A further object is to provide a pivot for a sliding door operable effectively to prevent the door from sliding upon selected rotation of such door about the axis of such pivot.

A further object is to provide means for guiding the upper edge of a sliding door comprising overlapping coextensive bars alternately pivotally connected at opposed ends and having the uppermost bar guided for sliding movement and the lowermost bar secured to the door adjacent the upper edge.

A further object is to provide a bar arrangement of the aforementioned type whereby the door may be suspended by such bars from an overhead rail.

A further object of the present invention is to minimize sliding during transition to pivotal movement of a slide pivot.

A further object is to provide a sliding pivot with means of adjustment to vary the amount of pivotal movement required to restrain further sliding movement of the pivot during the pivotal movement.

A further object of the present invention is to provide means for adjustment to vary the amount of pivotal movement required to restrain or prevent sliding movement of the pivot during further pivotal movement and thereby compensate for wear during use of the sliding pivot.

In one aspect of the present invention there is provided a horizontal sliding door pivotable about a vertical axis to an open position irrespective of the door's horizontal sliding position.

In a further aspect of the present invention there is provided articulated bars for use in mounting horizontal sliding doors to facilitate pivotal movement thereof about a vertical axis comprising three substantially co-extensive bars pivotally connected, the center one of said bars being pivotally connected at opposed ends respectively to respective ones of the two outer bars.

In a further aspect the invention consists of a horizontally slidable door including mounting means therefor whereby the door is selectively pivoted about a vertical axis irrespective of the door's horizontal sliding position, said mounting means comprising a sliding pivot adjacent the lower and upper edge of the door, at least the lowermost one thereof including means to prevent sliding of the door upon selected rotation thereof about a vertical axis and an articulated assembly secured to said door and overlying the upper edge thereof, said assembly including a first bar pivotally secured at one end to said door adjacent a vertical edge thereof and pivotally secured at the other end to a second bar, said second bar being disposed at least partially within a channel to provide a guide for horizontal movement only of said second bar.

In a further aspect of the present invention, there is provided a sliding pivot which includes first means comprising a pair of members securable respectively to a pair of relatively movable further members, guide means for at least one of said members to guide such member along a selected path during sliding movement, means selectively interconnecting said members permitting relative pivotal movement thereof about an axis substantially normal to said path and means to adjust said interconnecting means and thereby vary the amount of initial pivotal movement required to restrain relative sliding movement of said members during further relative pivotal movement thereof.

In a further aspect the invention provides a panel and means for mounting said panel whereby the latter is alternately slidable and pivotable respectively along a path and a pivot axis substantially normal thereto, said mounting means comprising a sliding pivot adjacent a pair of opposed edges of said panel, at least one of said mounting means including an adjustment to vary the amount of initial pivotal movement of said panel required to prevent or restrain further sliding of said pivot during further pivotal movement of said panel.

The invention is illustrated by way of example in the accompanying drawings wherein:

FIGURE 1 is a front elevational view of a pair of doors horizontally slidable with respect to a pair of fixed panels;

FIGURE 2 is a perspective view in partial section of a sliding door structure in accordance with the present invention;

FIGURE 3 is a perspective view partly in section of one movable door panel and fixed panel of the door structure of FIGURE 2;

FIGURE 4 is a top plan view of the door structure of FIGURES 1 and 2 illustrating the various open and closed positions of the door panels;

FIGURE 5 is a vertical section taken along line **5—5** of FIGURE 4;

FIGURE 6 is a horizontal section taken along the line **6—6** of FIGURE 5, the door panel being swung to the open position;

FIGURE 7 is a broken sectional view of the sliding pivot taken along the line **7—7** of FIGURE 5;

FIGURE 8 is a perspective view of one form of a sliding pivot;

FIGURE 9 is a partial sectional, enlarged perspective view of a pair of relatively movable panels illustrating the mounting of the upper sliding pivot and is a detail of the encircled portion IX in FIGURE 1;

FIGURE 10 is an exploded, perspective view of the leading edge of a door frame and mounting of a slidable panel;

FIGURE 11 is a section taken along the line **11—11** of FIGURE 10;

FIGURE 12 is an exploded perspective view of a portion of the trailing edge of the movable door panel;

FIGURE 13 is a section taken along the line **13—13** of FIGURE 12;

FIGURE 14 is a cross sectional view along section **14—14** of FIGURE 10;

FIGURE 15 is a cross sectional view along section **15—15** of FIGURE 12;

FIGURE 16 is a horizontal section similar to FIGURE 6 but illustrating a modification whereby adjustment is provided for movement of the pinion relative to the rack;

FIGURE 17 is an exterior elevation view of the right-hand bottom corner of a sliding door employing a slide pivot having an alternative means to adjust the door engaging portion of the pivot relative to the door;

FIGURE 18 is a vertical section along section **18—18** of FIGURE 17;

FIGURE 19 is a top plan view of a portion of the sliding pivot illustrated in FIGURES 17 and 18;

FIGURE 20 is a front elevational view of the slide pivot shown in FIGURE 19; and,

FIGURE 21 is a side elevational view of the slide pivot shown in FIGURE 19.

Referring now in detail to the drawings, a sliding door structure is shown generally at **10** in FIGURES 1 and 2. The sliding door structure **10** selectively opens and closes a portion of a door opening **13**, defined by a pair of vertical jamb members **11**, horizontally spaced from one another, a horizontal header **12** secured to the jamb members and interconnecting them and a sill **55**.

The door opening **13** is partially closed by a pair of fixed panels **14** which may or may not be transparent. The remaining portion of the door opening **13** is selectively opened and closed by a pair of movable panels or doors **15** (see FIGURE 3). The movable panels **15** are mounted to slide in a plane parallel to the plane of the fixed panels **14** and thus overlap the fixed panels when in the open position, as illustrated in phantom in FIGURE 4. Each door is also mounted to pivot about a vertical axis irrespective of its sliding portion.

The header **12** is a metal channel of substantially rectangular cross-section to which the fixed panels **14** are secured in any well known manner. A longitudinally extending slot or opening **16** in the lower face of the header **12** is adapted to receive a portion of a guide assembly A, to be described in detail hereinafter. The assembly A, as will be seen hereinafter, consists of a plurality of articulate bars and provides a guide for horizontally sliding the movable panels while at the same time permits pivotal movement of such panel. If desired, the movable panel may be suspended from an overhead rail through the intermediary of such assembly.

Since the two movable panels **15** illustrated are identical except for one being a mirror image of the other, and the two fixed panels **14** are also identical in construction, only one of each will be described in detail.

The panels **14** and **15** each include a pair of vertical stiles, a top rail and a bottom rail. The top rail of the movable panel **15**, in the form illustrated, is modified to define part of the assembly A. It is obvious, as will appear hereinafter, that the portion shown integrally with the top rail which forms a portion of the assembly A may be a separate part detachably secured to the rail.

The sliding panel **15** comprises a top rail **20**, a bottom rail **21**, vertical stiles **22** and **23** respectively disposed at the leading and trailing edge and a glass sheet **24**. The glass sheet **24** is held in place by conventional two-piece metal moulding strips **24'** (see FIG. 5) except for under the lower surface of the top rail **20**, where a portion of the moulding strip is replaced by an inverted channel member **27** (see FIGS. 3, 5 and 9). The channel **27** has the legs thereof directed downwardly and effectively provides a substantially horizontal slot forming the guide for a portion of a sliding pivot to be described in more detail hereinafter.

Co-operating with the channel **27**, to retain the glass sheet at the upper edge, is a moulding strip **28** disposed on the opposite side of the glass sheet.

The top rail **20** consists of a hollow metal body, substantially rectangular in cross-section, having a flange **25** in a plane parallel to the upper surface of the metal body and spaced vertically therefrom to define a groove **26**. Interconnecting the flange and the body is a web **25A**. It will be noted from the various figures, particularly FIGS. 2 and 5, that the groove **26** is directed in a direction away from the fixed panel **14**.

The fixed panel **14** consists of respectively top and bottom rails **14A** and **14B**, and a pair of vertical stiles **17** and **17A**. The stile **17** adjacent the door opening, selectively openable and closeable by the movable panels, is modified to include throughout a portion of the length thereof a flange **17B**. The flange **17B** is directed outwardly from the plane of the panel **14** towards the plane of the panel **15** and the length and the depth is such as to avoid interference in the sliding movement of the panel **15**.

Secured to the flange **17B** is a pivot **18** having a portion thereof disposed within the channel **27**. The pivot **18** consists of a body member **19** secured as by screws **19A** to the flange **17B** and includes a guide follower **18B** slidable within the channel **27**. The pivot **17** may be one of two different types. It may be of the type illustrated in FIGURE 5 wherein the guide follower **18B** is a roller, slidable within the channel without effecting any gripping action. In other words, it merely forms a guide. As will be apparent hereinafter, it is preferable that the pivot be of the type illustrated in FIGURES 8 and 9 wherein the guide follower disposed within the channel, is expandable upon selected pivotal movement of the slidable panel effectively to prevent relative sliding movement between the guide follower **18B** and the channel **27** during further pivoted movement of the panel.

The aforementioned assembly A (see FIGS. 5, 14 and 15) consists of the flange **25** and web **25A** of the top rail **20**, a first or center bar **29** pivotally secured at one end to the flange **25** and a second or top bar **41** pivotally secured to the first bar. The bar **29** is substantially E-shape in cross-section and includes a web **29A** having spaced parallel flanges **30**, **31**, and **32** projecting outwardly therefrom. The flanges **30**, **31** and **32** define a pair of spaced

parallel grooves 39 and 40. The flange 30 is adapted to fit into the groove 26 in the top rail 20 and one of the members 29 is pivotably secured to the top rail 20 by a pivot pin 33 disposed adjacent the trailing edge of the panel 15 (see FIGURES 3 and 15).

The pivot pin 33 is adapted to be inserted through an aperture 40A in the lowermost wall of the rail 20 and includes a cylindrical portion 34 projecting through apertures 35, 35' and 36 disposed respectively in the upper wall of rail 20 and the flanges 30 and 25. The pivot pin terminates in a threaded end portion 34' threadedly received in an aperture 37 in flange 31.

The second bar member 41 is slidingly guided in the header slot 16 by having a portion thereof disposed within the slot. If desired, the bar 41 may be suspended from an over-head rail R (see FIG. 5) by a bracket or hanger B and roller G journalled thereto by a shaft T. The rail R is secured to the header 12 as shown or alternately it may be secured to other suitable framework. The bar 41 is substantially a mirror image in cross section of frame member 20 and includes a flange 42 extending along the lower surface thereof and spaced therefrom to define a groove 43. The flange 32 of bar 29 fits into the groove 43 and the bar 29 is pivotally secured to bar 41 by pivot pin 44. The pivot pin 44 is adapted to be inserted through an aperture 41A in the upper wall of bar 41 and includes a cylindrical portion 45 inserted through an aperture in the lower wall of bar 41 into apertures 46 and 48 respectively in the flanges 32 and 42 and further includes a threaded terminal end portion 45' threadedly received in an aperture 47 in the flange 31 of bar 29. The flange 31 is adapted to be received between the upper surface of the flange 25 and the lower surface of the flange 42.

The bar 41 which is thus secured to the movable panel 15 slides therewith and a portion thereof is received in the longitudinal slot 16 in the header 12.

At the lower edge of the door is a sliding pivot assembly 56 (see FIG. 5) which normally permits sliding movement of the panel but upon selected rotation of the latter, further sliding movement is prevented. The sliding pivot includes an inverted channel in the lower edge of sliding panel and a rack and pinion disposed thereon and secured respectively to the door and door sill. The bottom rail 21 of the sliding panel 15 includes a spaced pair of flanges 50 and 51 depending downwardly and defining therebetween a channel 52. A rack 53 is secured to the flange 51 and disposed within the channel with the teeth thereof directed toward the flange 51. A pinion or gear segment 58 is secured to the door sill 55 with the teeth thereof engageable with the teeth of the rack upon selected rotation of the door about a vertical axis.

The sill 55 is secured to the floor or base and extends along and is adjacent the lower rail of the fixed panel 14. The pivot has the pinion portion thereof fixedly secured to the sill 55 and is ideally positioned so as to have the axis thereof coincide with the vertical axis of the upper pivot 18. In actual practice and, as shown, the pivots have their respective axis offset a minute amount without materially affecting pivoting of the door. The pinion is secured by a pin 58A to a cylindrical member 57. The cylindrical member is disposed within the channel 52, and has a diameter substantially equal to the width of the channel.

The gear segment or pinion 58 has teeth 59 which extend throughout approximately ¾ of its circumference and are adapted to mesh with the teeth 54 on the rack 53 upon selected rotation of the sliding panel about a vertical axis. The gear segment 58 includes a removed chordal section or a flattened peripheral portion 60 normally in face-to-face relationship with the rack when the movable panel 15 is in a horizontal sliding position i.e. a plane parallel to the plane of the fixed panel 14.

As shown in FIGS, 3, 10, 11, 12 and 13, the bar 41 is provided with locking assemblies 80 and 81 respectively at the leading and trailing end of the door. The locking assemblies 80 and 81 (see FIGS. 11 and 13) each comprise a cylindrical body 82 having an enlarged head 83 at one end thereof and a threaded portion 84 between the body and head. An axial bore 85 extends into the body from the end thereof opposite to that of the enlarged head and inserted in such bore is a compression spring 87 abutting against and urging a ball 86 outwardly of the bore. The ball 86 is retained in the bore 85 by suitable means such as crimping the outer end of the body to reduce the diameter of the bore 85.

The locking assemblies 80 and 81 are each threaded into an aperture 88 in the upper wall or flange of the bar 41 and the opposite end projects into an aperture 89 in the flange of bar 41 which forms one wall of the groove 43. As shown in FIG. 10 of the drawings, the bar 41 is undercut at 90 to receive a portion 91 of the movable door stile 22 which projects upwardly from the top rail 20. A right-angle bracket 92 fits into the open end of the projecting portion 91 and is secured thereto. The bracket 92 has an aperture 93 and is located substantially centrally with respect to the end of the stile. The locking assembly 80 described above is so positioned that the ball 86 projects into the aperture 93 when the door is in a sliding position.

With reference to FIGS. 12 and 13, the locking assembly 81 is positioned such that the ball 86 projects into an aperture 94 in the flange 32 of the bar 29 when the bars 29 and 41 are in alignment in an internested or folded position.

The sliding panel is also provided with conventional power operating means (not shown) and includes pressure pads 61 (see FIG. 2) which control the power operating means.

In operation the sliding panels 15 slide selectively to an open and a closed position as illustrated in FIG. 4 in the usual manner. In this sliding movement the panel 15 is guided by the channel 27 co-operating with the pivot assembly 18, by the bar 41 disposed partially in the slot 16 of the header 12, and by the lower sliding pivot assembly 56.

The bars 41 and 29 and the panel 15 are retained in alignment by the balls 86 of locking assemblies 80 and 81 which seat respectively in the apertures 93 and 94. The balls 86 are urged into the apertures 93 and 94 by the springs 87 and the pressure of engagement may be varied by suitable rotation of the threaded body portion 84.

The lower portion of the panel 15 is prevented from transverse movement by the cylindrical member 57. It will be noted that the teeth 54 of the rack 53 do not engage the gear segment during sliding movement of the panel 15 as the rack 53 is adjacent the flat side 60 of the gear segment 58.

In the event of power failure the so-called panic feature may be brought into operation by pivoting the panel 15 outwardly, as illustrated in FIGURE 2. Pivoting may be effected by pushing on the panel and the outward pressure on the panel 15 forces the balls 86 into the body of the associated locking assemblies 80 and 81 thus permitting relative movement of the panel 15 and the associated bars 41 and 29 about the pivots at the leading and trailing end of the panel. The pivot 18 allows the panel 15 to pivot about its axis. At the same time, the lower portion of the panel 15 pivots about the axis of the cylindrical member 57 and the teeth 54 of the rack 53 engage the teeth 59 of the gear segment 58 thereby preventing further slidable movement of the panel 15.

The pivotal movement of the panel 15 also causes the bar 29 to pivot away from the bar 41 about the axis of pivot means 44. The pivot means 33 allows similar pivotal movement between the bar 29 and the stile 20 of the panel. With regard to this pivotal movement, it will be noted the pivots 33 and 44 are disposed a short distance inwardly from the ends of the bars. In view of this positioning it is necessary to have certain end portions of selected flanges removed from the bars of the assembly A so as to prevent jambing.

It will be apparent from the foregoing description that the slidable panel **15** is capable of being swung open when in either a closed or any partially closed position. Furthermore, irrespective of the sliding position of the panel, the pivot axis is disposed adjacent the fixed panel and thus the panel always swings open to give a maximum clear opening.

FIGURE 8 illustrates a pivot assembly **70** which may be used in place of the pivot **18**. The pivot assembly **70** is actually the preferred embodiment and is adapted to be secured to the flange **17A** of stile **17** by screws or bolts **19A** inserted through apertures **71** and **72**. The shaft of pivot **18** is cylindrical while the pivot assembly **70** has a noncircular in cross-section shaft **73** having opposed flat sides **74** and **75**.

In place of the roller **18B** of pivot **18**, the pivot assembly **70** is provided with a substantially rectangular block **76** adapted to be disposed in the channel **27**. The block **76** is preferably formed of a tough resilient plastic material having a low co-efficient of friction such as that known under the tradename nylon. The block **76** has an aperture **77** therethrough conforming in shape to the shaft **73** and adapted to receive the same. A slot **78** in a vertical side face of the block **76** extends into the aperture **77** thus enabling the block **76** to be expanded.

The pivot assembly **70** allows the panel **15** to pivot about its axis in the same manner as pivot **18**. However, as the shaft **73** rotates with respect to the block **76**, the latter expands due to the shape of the shaft **73** and the aperture **77**. This expansion of the block **76** causes the block to bind in the channel **27** thereby preventing further sliding movement of the panel **15** during further rotation of the same.

The pivot **18** is described and shown as being secured to a flange **17B** extending laterally from the stile **17**. FIG. 9 illustrates an alternative pivot **18'** consisting of a block B secured to the stile **17** by a pair of Allen headed screws D. The screws may be threaded into the stile and/or a flat strap E disposed inside the tubular stile.

In a modified form, the suspension rail R may be disposed of and the panel **15** may be suspended by the pivot **18** (or **70**) in cooperation with the inverted channel **27**.

The sliding panel may also be provided with conventional locking means of the throw type secured to the bottom rail **21** to prevent swinging or sliding movement of the panel when this is desirable. Various other modifications will undoubtedly occur to those skilled in the art. For example, although the panel **15** described and illustrated herein is constructed of metal and glass, it will be appreciated that this invention is applicable to a panel of any material.

Furthermore, it will be appreciated that although the door assembly shown has a pair of fixed side panels **14**, it is possible to eliminate one or both of the fixed side panels. The sliding panels **15** in such case could be adapted to overlap a portion of the wall at each side of the door opening or could be adapted to slide into cavities within the wall; in the latter case the wall would be so constituted as to allow the slidable panels **15** to open out in a panic situation irrespective of their sliding position, as by using a collapsible or hinged wall.

In the foregoing described embodiment of the lower sliding pivot, no provision is made for adjusting the relative portions of engageable portions of the pivot respectively secured to the sliding panel and the sill. Ideally, sliding movement should be eliminated in the transition from sliding to pivotal movement so that the door remains in an upright position. Adjustment of the relative position of the engaging portions of the pivot affects the amount of pivotal movement required to restrain sliding of the door.

FIG. 16 is one embodiment wherein means is provided to vary the amount of clearance between a portion of the pivot and a portion of the door which engage during pivotal movement. FIG. 16 is substantially the same as FIG. 6 wherein a channel **52** is formed in the lower rail of the door by spaced downwardly parallel flanges **50** and **51** and a rack **53** is secured to the flange **50**. The cylindrical block which engages the spaced flanges **50** and **51**, however, is split so that its effective diameter in one dimension may be varied. A block **57'** is shown in FIG. 16 and consists of portions **57*a*** and **57*b*** interconnected by a pair of studs S rotatably secured in the portion **57*a*** and threaded into apertures in the body portion **57*b***. The studs may be prevented from movement with respect to the portion **57*a*** by having a washer W secured to the stem thereof and received in a suitable recess in the body. It is obvious that rotation of the stud effects relative movement of the body portions **57*a*** and **57*b*** and thereby provides means for expanding or contracting the block. This adjustment effectively compensates for variation in the width between spaced flanges **50** and **51** and takes care of manufacturing tolerances. The adjustment is substantially in the direction as illustrated in FIGURE 16 since the least amount of play is required with the door in a sliding position. The door, as in FIG. 6, is illustrated in a position substantially transverse to its normal sliding position.

The pinion **58** may also be made adjustable so that the distance of the cordal removed portion **60** from the teeth **54** of the rack may be varied when the door is in its normal sliding position. To effect this adjustment, the pinion **58** is secured to the body portion **57*b*** by an eccentric **57*e***. The eccentric includes a head **57*d***, noncircular for engagement by a wrench and extending downwardly from the head is a stem which passes through the pinion. Offset from this portion of the stem and extending downwardly therefrom is a further stem portion **57*f*** which is rotatably mounted in the body portion **57*b***. It is obvious that rotation of the eccentric effects lateral reciprocation of the pinion. This reciprocation provides means whereby the distance between the removed cordal portion and the teeth **54** may be varied at the site. Access to the head of the eccentric may be gained through an aperture in one of the flanges **50** or **51**.

A further modified adjustable pivot is illustrated in FIGS. 17 to 21 inclusive. Shown in FIG. 17 is a panel **100** slidable along a horizontal path relative to a fixed panel **200**. The panel **100** includes a lower rail **101** and a vertical stile **102** interconnected by a tie rod **102A**. The movable panel **100** further includes a glazing panel **103** retained in position by a glazing stop **104**. FIG. 17 illustrates only the lower right-hand portion of the movable panel and the part not shown includes a similar vertical stile at the opposite side of stile **102** and an upper top rail generally parallel to the lower rail **101**.

The fixed panel **200** includes a vertical stile **201** connected to a horizontal lower rail **202**. Glazing **203** is secured to the rail and stile by glazing stops **204**. The movable panel **100** and the fixed panel **200** may be identical to the respective panels **15** and **14** illustrated in FIGS. 1 and 2. The movable panel **100** also may be suspended from an overhead rail by an assembly as described with reference to FIGS. 1 to 16. In FIG. 17 the sliding panel **100** is provided at the lower right-hand corner with a slide pivot assembly **300** which is adjustable. The slide pivot assembly **300** includes a guide as in the previous cases for guiding the panel during horizontal sliding movement along the path generally parallel to the plane of the fixed panel. The slide pivot assembly **300** further includes means selectively to engage the movable panel to restrain sliding movement of the panel during pivotal movement thereof about a vertical axis.

The slide pivot assembly **300** (see FIGS. 18–21) consists of a first portion **301** securable to the door sill **55** or rigid floor structure and a second portion **302** securable to the movable panel. The first portion **301** consists of a base plate **303** having a pair of apertures **304** providing means whereby the base may be secured to the rigid immovable structure by a pair of screws. The first por-

tion **301** further includes a cylindrical body portion **305** secured to the base plate by a pair of screws **306** projecting through apertures in the body into apertures aligned therewith in the base. The first body portion **301** further includes a movable dog assembly **307** mounted upon the upper edge of the cylindrical body so as to oscillate about an axis generally perpendicular to the flat planar surface of the base plate. The movable dog **307** includes a bar portion having oppositely directed lugs **308** and **309** directed outwardly from opposed ends thereof in a direction perpendicular to a plane passing through the pivotal axis. The movable dog **307** is secured to the cylindrical body by a pin **310** having a stem **311** passing through an aperture in the arm of the dog and a further threaded portion **312** of reduced diameter. The threaded portion **312** is received in a threaded aperture in the cylindrical body. The pin **310** includes an enlarged head portion and thereby retains the dog in position. The ledge formed at the junction of the portions **311** and **312** provides an abutment limiting the depth of penetration of the threaded portion **312** into the cylindrical body.

The upper portion of the cylindrical body includes an annular recess **313** adapted to receive a torsion spring **314**. Th actual spring includes a first terminal end portion **315** turned downwardly to be received in a recess **316** in the cylindrical body. The opposite end of the spring includes an upwardly turned terminal end portion **317** projecting into a recess **318** in the movable dog. The spring thus being secured at opposed ends in the body and movable dog provides means of urging the dog to a first operative position.

The movable dog and the body portion include respective portions of an abutment means and the spring normally retains such portions in engagement. In the embodiment illustrated, there is a pin **319** projecting upwardly from the cylindrical body to engage a member **320** secured to the movable dog. The member **320** consists of a stud threaded into an aperture in the movable dog and terminates in a tapered end portion **321** which engages a side edge surface of the pin **319**. The stud **320** is movable and the tapered end portion provides means whereby movement of the stud adjusts the dog by slight movement thereof about the pin **310**.

It is obvious that other relatively movable types of engagement surfaces on respective portions of the body and movable dog may be utilized to accomplish the same results. The pin, for example, may project downwardly from the movable dog to engage selectively movable member mounted on the body. It is obvious also that the adjustment may be accomplished in an alternative embodiment by providing a pin which may be bent and remain in such bent position.

The portion **302** of the sliding pivot consists of a pair of racks **321** and **322** secured respectively to flanges **50** and **51** of the door lower rail **21**. The racks **321** and **322** are positioned so as to respectively engage the teeth or lugs **308** and **309** of the movable dog. During sliding movement of the door along its normal path, the teeth or lugs of the dog are out of engagement but in near proximity to the teeth of the racks. This close proximity may be adjusted by rotation of the previously described stud **320**. The tension in the spring is such as to urge the teeth in a direction towards respective ones of the adjacent racks. At any sliding position of the door, it may be pivoted about a vertical axis **350** passing through the pin **310**. During the initial pivotal movement the teeth **308** and **309** engage between adjacent teeth of respective racks **321** and **322** thereby to prevent sliding movement of the door during further pivotal movement. It is obvious that by providing means for adjusting the dog, the amount of initial pivotal movement required to engage the rack and dog may be varied. This, desirably, is kept to a minimum so that the vertical axis remains substantially in its intended vertical position. The adjustable sliding pivot provides means to compensate for wear which occurs during use and also provides adjustment individually for each installation. Manufacturing tolerances and the tolerances of installation are such as to require or make it desirable to have such an adjustment.

The sliding pivot as described with reference to FIGS. 17 to 21 may be utilized to replace the slide pivot assembly **52** illustrated in FIG. 5. It is obvious, however, that the pivot illustrated in FIGS. 17 to 19 may be used at opposed upper and lower edges in a vertically mounted panel such as a bath tub enclosure, patio sliding door, or the like. A pair of pivots located one at each of the upper and lower edges provides a guide for the door during sliding and also provides a path for pivotal movement, sliding, of course, being prevented during the pivotal movement.

Pivotal movement of the door to an open position acts against the tension of the spring. The strength of the spring, however, is selected so as not to close the door and may thus remain in any pivotal position. There may, however, be certain instances where it may be desirable to select the tension so as to return the door to its normal sliding position from the pivoted position.

I claim:

1. A mounting for a sliding panel adapted to slide horizontally and pivot about a vertical axis comprising a first bar having first and second pivots at opposed ends thereof, the axis of said pivots being parallel, and said first pivot being pivotally securable to said panel adjacent a vertical edge thereof, a second bar pivotally secured at one end thereof to the second pivot, guide means for said second bar permitting reciprocation thereof along a horizontal axis, and a further pivot having the axis normal to the reciprocation of said second bar and slidably engaging said panel intermediate the vertical edges thereof, said further pivot providing a vertical axis of rotation for said panel irrespective of its sliding position and having means to prevent sliding of said panel during selected rotation thereof about said vertical axis.

2. In a slidably mounted panel having a top rail and a pair of spaced stiles disposed substantially normal to said rail, a guide and pivot assembly comprising a first bar pivotally secured at one end thereof to said top rail adjacent one of said stiles, a second bar pivotally secured to said first bar at the other end thereof, said second bar being mounted to reciprocate along the longitudinal axis thereof and further pivot slidably engaging said door intermediate the vertical edges thereof, said panel rail and first and second bars being substantially coplanar in a panel sliding position and said panel being selectively pivotable about said further pivot irrespective of the sliding position thereof and means associated wtih said further pivot restraining said panel from sliding movement during pivotal movement thereof.

3. A slidably mounted panel as defined in claim **2** wherein said first bar is substantially E-shaped in cross-section, the outer flanges thereof respectively interfitting channels formed respectively in the top rail and second bar in a panel sliding position.

4. A slidably mounted panel as defined in claim **2**, including means releasably retaining said first and second bars and top rail in a coplanar door sliding position.

5. A slidably mounted panel as defined in claim **2** wherein said bars are substantially co-extensive with and overlie the top rail of said panel.

6. A slidably mounted panel as defined in claim **2**, wherein said second bar is suspended by roller means from an overhead rail.

7. A slidable panel structure adapted for pivotal movement about a vertical axis to provide an emergency exit irrespective of the sliding position of said panel comprising an opening defined by a horizontally disposed header having a longitudinal groove in the lower surface thereof and a pair of horizontally spaced, vertical jamb

members, a panel, having a top rail, horizontally slidable to open and close said opening, a slide and pivot assembly secured to said top rail, said slide and pivot assembly including a longitudinal groove in a side face of said rail substantially co-extensive therewith, a first bar substantially E-shape in cross section, pivotally secured at one end to said panel adjacent a first vertical edge thereof and disposed to overlie said top rail having a flange thereof defined by the lower leg of the E disposed in nesting relationship within the groove in the side face of said top rail, and a second bar having a longitudinal groove in a side face thereof pivotally secured to the other end of said first bar, a flange of said first bar defined by the upper leg of the E fitting in nested relationship in said last mentioned groove, said second bar having a portion thereof, vertically above the groove in the side face thereof, projecting into the longitudinal groove in the header and thereby being guided to permit sliding movement only and a further pair of pivots disposed respectively at the upper and lower edges of said panel on a vertical axis adjacent a vertical edge thereof when said panel is in a closed position, said further pair of pivots each slidably engaging said door and means associated with each of said pivots preventing relative sliding movement between respective ones of said pair of pivots and said panel upon selected rotation of said panel about said vertical axis.

8. A panel structure as defined in claim **7** wherein said second bar is suspended from an overhead rail by roller means.

9. A panel structure as defined in claim **7** wherein one of said pair of pivots includes a segmental gear fixed relative to said jamb members and adapted to mesh with a rack secured to said panel upon selected rotation of the latter about said vertical axis thereby providing said means preventing said sliding movement of said panel during pivotal movement thereof.

10. A panel structure as defined in claim **9** wherein the relative position of asid segmental gear and rack in a door sliding position is adjustable.

11. A panel structure as defined in claim **7** including adjustable releasable retaining means maintaining said panel top rail and bars in nested relationship in a panel sliding position.

12. A panel structure as defined in claim **7** including a spherical member secured to one of said bars and resilient biased into seating engagement with an aperture in the other bar thereby releasably retaining said bars in nested panel sliding position.

13. A slidable pivot for a pair of relatively movable members comprising:

(a) an elongated member secured to one of said relatively movable members and having a plurality of aligned projections projecting from one side in spaced relation along a selected length thereof, said elongated member having the longitudinal axis thereof disposed in a direction parallel to a selected path defined by the sliding of one of the relative movable members with respect to the other;

(b) a first member pivotally secured to other of said members for selected oscillation about an axis normal to said path and in the plane thereof, said pivotally mounted first member having a projecting end portion directed toward the projection of said elongated member;

(c) means resiliently urging the said projecting end portion of said first member toward said elongated member;

(d) abutment means providing a stop retaining said pivotally mounted first member in a first operative position wherein the projecting end portion thereof is adjacent but in spaced relation with respect to said elongated member to provide a clearance therebetween during sliding of the member along said selected path; and

(e) abutment adjusting means selectively to vary said clearance consisting of a stud threaded into the elongated member or the first member and having an end portion engageable with a stop on the other of said members, relative pivotal movement of said first member and elongated member about said axis effecting contact of the projecting end portion of the first member intermediate a pair of adjacent projections on said elongated member thereby preventing relative sliding movement of said members during further pivotal movement in the same direction, said further pivotal movement acting against said resilient means.

14. A slidable pivot as defined in claim **13** wherein said pivotally mounted member is mounted on a cylindrical hub adapted to cooperate with a channel in the slidable member to provide a guide therefor during sliding thereof.

15. A mounting means for a panel permitting sliding movement thereof relative to a fixed structure along a selected path in the plane of said panel and providing pivotal movement of said panel about an axis in said plane irrespective of the relative sliding position of said panel and fixed structure, said mounting means comprising:

(a) a rack secured to said panel and being substantially co-extensive therewith and disposed in a direction parallel to said path, and

(b) a pinion secured to said fixed structure, said pinion having a portion of the teeth thereof removed to provide a selected removed cordal section thereby permitting relative sliding movement of said rack with respect to said pinion along said path and the teeth of said rack and pinion being engageable upon selected rotational movement of said panel about said axis, said pinion being secured to the fixed structure provides a pivot axis for said panel fixed in position relative to the fixed structure.

16. A mounting as defined in claim **15** wherein said panel includes an inverted channel in the lower edge thereof extending in a direction of said selected path and said pinion includes a cylindrical portion with the axis thereof coincident with said axis of pivotal movement, said cylindrical body having a portion thereof projecting into said channel to provide a guide for horizontal movement of said panel.

17. A slidably mounted panel adapted for pivotal movement about a vertical axis to provide an emergency exit through an opening defined by a header and a pair of vertically disposed, horizontally spaced jamb members comprising:

(a) a horizontally moveable panel;

(b) guide means, associated with said panel, for guiding said panel along a selected path during horizontal sliding movement thereof;

(c) panel suspension means, associated with said panel and said guide means, to permit selectively pivoting said panel about said vertical axis;

(d) at least one pivot means slidably engaging said panel intermediate the vertical edges thereof during horizontal sliding thereof and having a vertical pivot axis fixed with respect to said vertical jamb members, said pivot means being engageable with said panel upon selected initial pivotal movement thereof about said vertical axis irrespective of the panel's horizontal sliding position and thereby provide a pivot for said panel about an axis fixed with respect to the vertical jamb members during further pivotal movement thereof; and,

(e) means, associated with said pivot, to restrain sliding movement of said panel during said further pivotal movement.

18. A slidably mounted panel as defined in claim 17, wherein said pivot means comprises a non-circular in cross-section shaft fitting into a correspondingly shaped aperture in a resilient block, and a channel fixed to said panel and receiving said block, rotation of the shaft effecting expansion of the block frictionally to engage the channel and thereby prevent sliding movement of said panel during said further pivotal movement.

19. A slidably mounted panel structure as defined in claim 17 wherein said pivot means comprises a segmental gear fixed with respect to said jamb members and a rack secured to said panel, said pinion engaging said rack upon selected initial pivotal movement of said panel.

20. A slidably mounted panel selectively pivotable about a vertical axis as defined in claim 17 including adjusting means for said pivot means to vary the amount of initial pivotable movement of the panel required to effect engagement of the pivot means and the panel and thereby restrain sliding of said panel during said further pivotal movement.

21. A slidably and pivotally mounted closure comprising a panel member slidable along a selected path, guide means for said panel guiding the same along said selected path, a rack secured to said panel and disposed in a direction parallel to the path of sliding movement thereof and a pinion fixed in position irrespective of the sliding position of the panel, said pinion having teeth thereof removed from a selected peripheral portion to provide a removed cordal section disposed adjacent said rack during sliding movement of said panel along said selected path, the teeth of said rack and pinion engaging upon selected initial pivotal movement of said panel irrespective of the panel's horizontal sliding position and meshing during further pivotal movement of the panel to provide a pivot for said panel and to restrain said panel from further sliding movement during such further pivotal movement thereof.

22. A mounting as defined in claim 21 including means selectively to adjust the relative position of said rack and pinion and thereby vary the required amount of initial

pivotal movement of said panel to effect engagement of the teeth of said rack and pinion.

23. A panel and means for mounting said panel whereby the latter is alternately slidable and pivotable respectively along a selected path and a pivot axis substantially normal thereto, said mounting means comprising a pivot disposed adjacent a pair of opposed edges of said panel in sliding relation with respect thereto during sliding of said panel along said selected path, means interconnecting said pivot and panel upon selected initial pivotal movement of said panel to provide a pivot for said panel during further pivotal movement thereof and to restrain said panel from sliding movement during said further pivoting and adjustment means selectively to vary the amount of initial pivotal movement of said panel required to prevent or restrain sliding of said panel during said further pivotal movement thereof.

24. A sliding pivot comprising a rack and dog selectively engageable with and securable to, respectively, a panel and a structure rigid with respect thereto, said dog being engageable with said rack upon selected initial pivotal movement of said panel and pivotally movable upon further pivotal movement of said panel, means to adjust the relative position of the dog and rack to vary the amount of initial pivotal movement required to effect engagement thereof comprising a stud threaded into the body portion of said dog and having a tapered end engageable with a stop on said rigid structure and means for guiding said panel for sliding movement along a selected path.

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