Sept. 3, 1963 J. RUDNICK 3,102,582

FOLDING DOOR STRUCTURE

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Fig. 1.

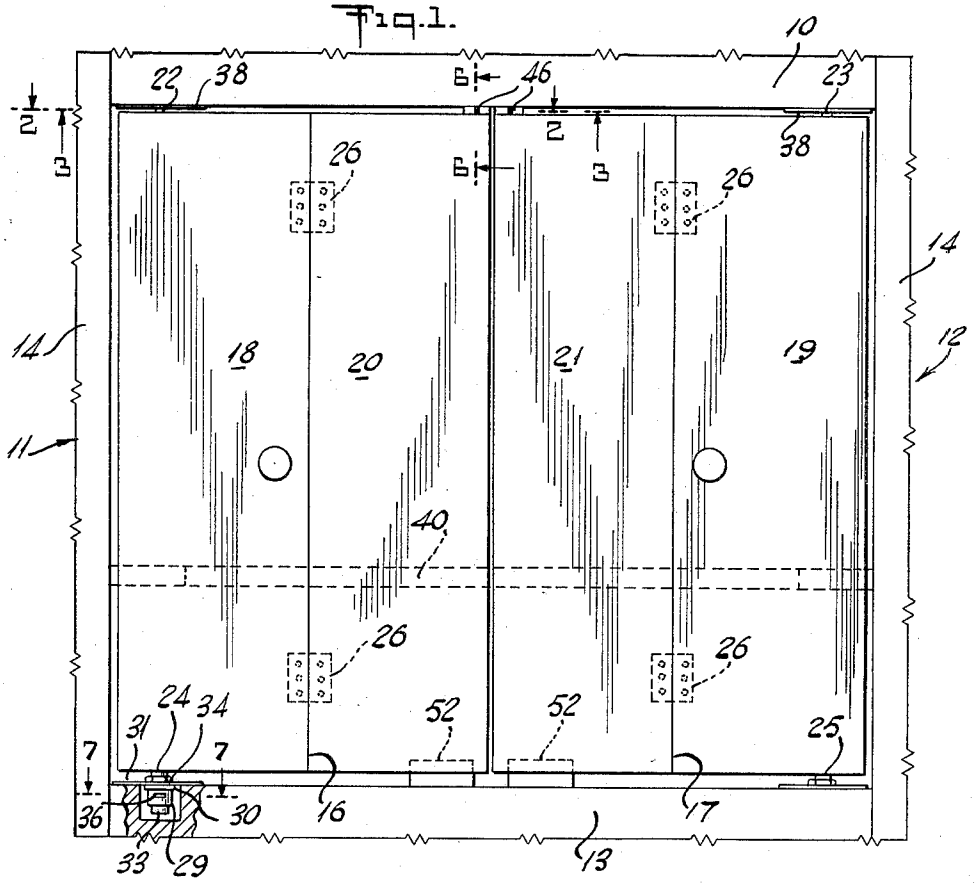


Fig. 2.

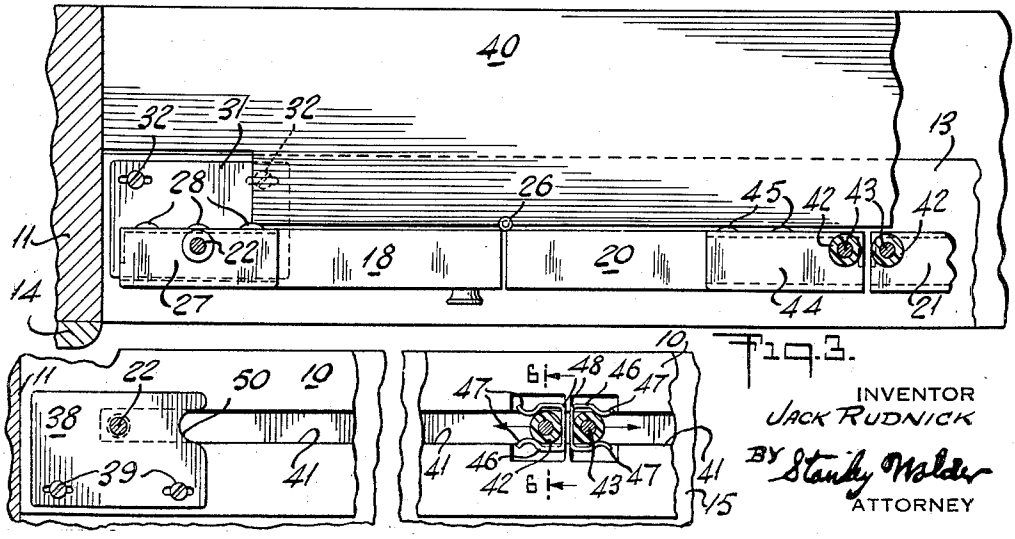


Fig. 3.

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Sept. 3, 1963 J. RUDNICK 3,102,582

FOLDING DOOR STRUCTURE

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Fig. 4.

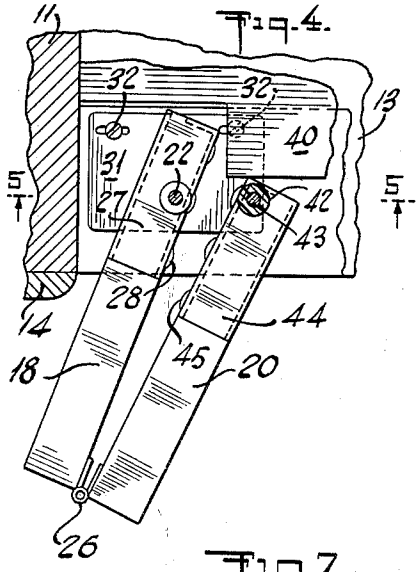


Fig. 5.

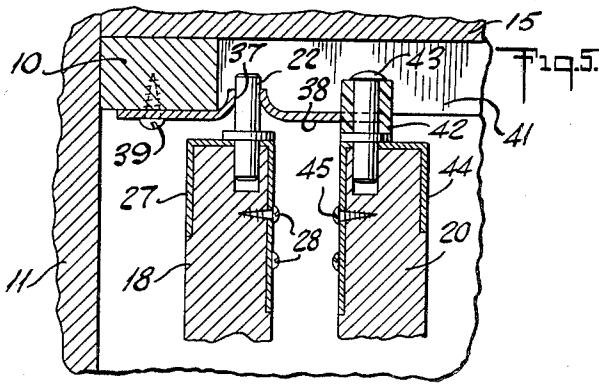


Fig. 6.

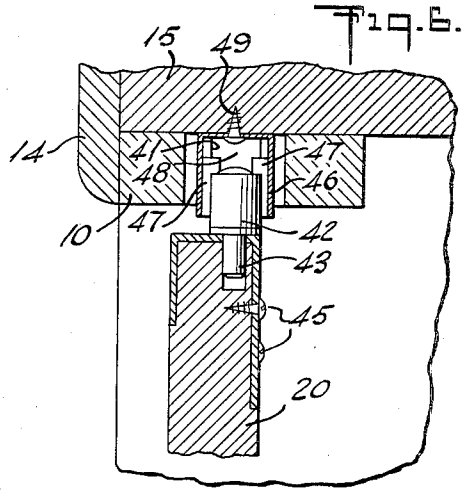


Fig. 7.

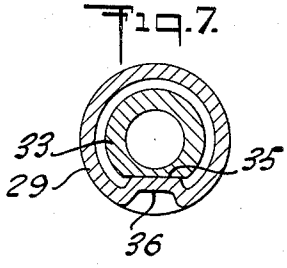


Fig. 8.

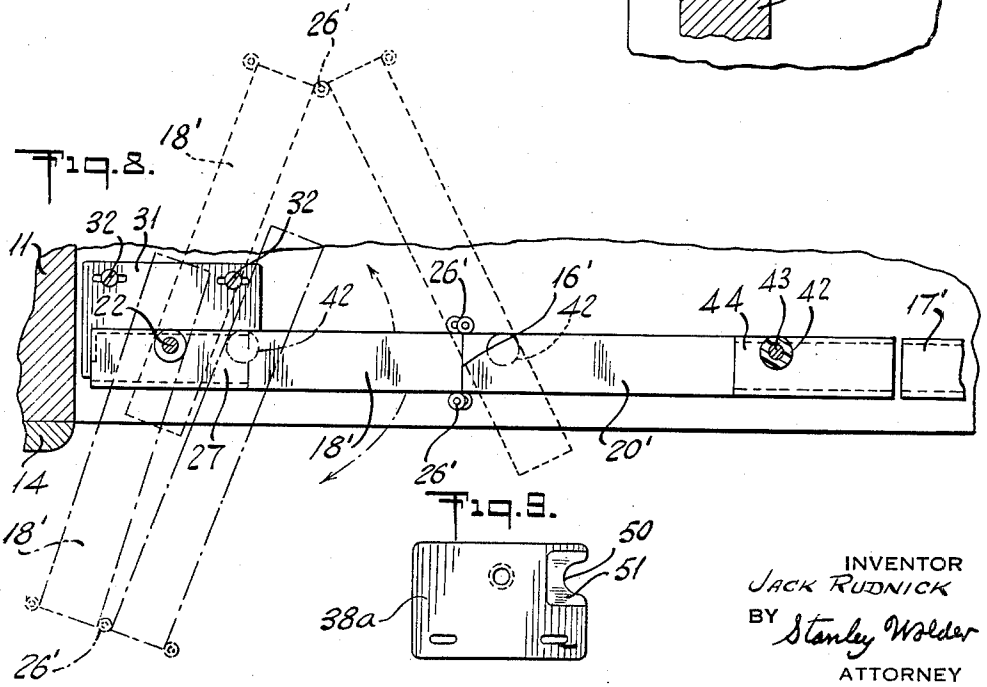


Fig. 9.

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Sept. 3, 1963 J. RUDNICK 3,102,582

FOLDING DOOR STRUCTURE

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Fig. 10.

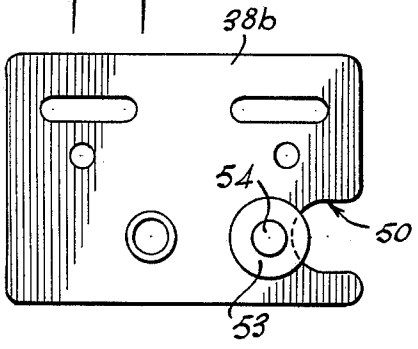


Fig. 12.

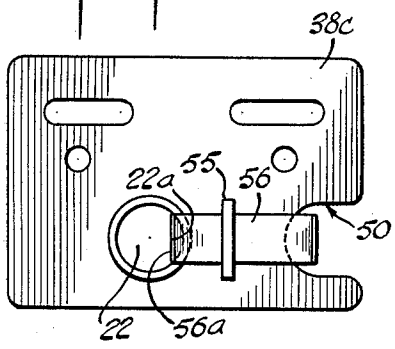


Fig. 11.

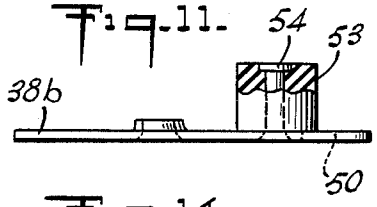


Fig. 13.

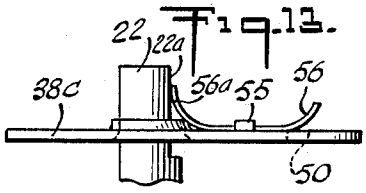


Fig. 14

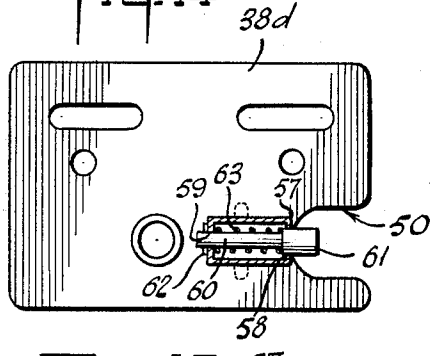


Fig. 16.

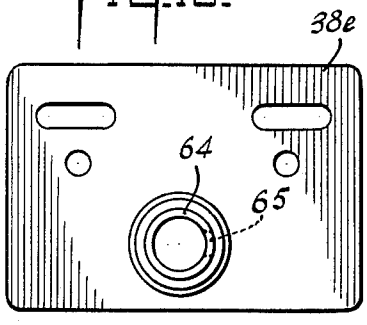


Fig. 15.

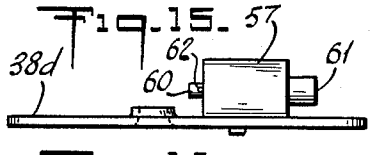


Fig. 17.

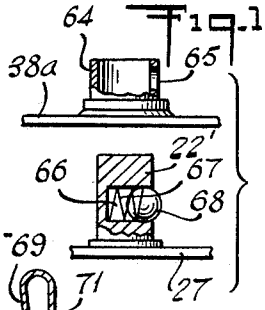


Fig. 18.

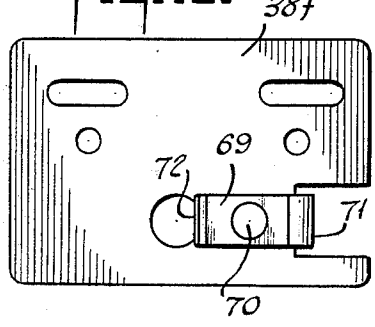
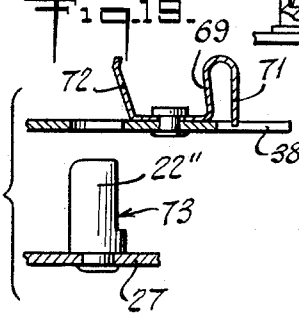


Fig. 19.



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FOLDING DOOR STRUCTURE

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Filed Nov. 25, 1957, Ser. No. 700,249

6 Claims. (Cl. 160—206)

The present invention relates to a folding door structure and more particularly those which are especially adaptable for closets, cabinets, doorways, room dividers and the like.

One of the principal difficulties with formerly known folding door structures was that shelves and horizontal stops and the like had to be recessed from the closed position of the door in order to permit the outer marginal portions of the doors to swing inwardly about the pivot pins on which the doors were hung when the doors were opened. This entailed a loss of shelf or other usable space and also meant that such doors could not use the forward edges of the shelves and similar structures for lateral support.

In addition, by reason of the fact that previously known folding door structures generally produced an outward thrust when they were opened and closed along their top guide pins it was necessary to employ aluminum or other metal tracks along the underside of the head jambs of doorways incorporating such structures. The upper guide pins which travel in such aluminum or metal tracks were frequently ripped out of engagement with the tracks in cases where children climbed thereon or the doors were otherwise roughly handled.

An object of the present invention is to provide folding doors which in the closed position will lie flush against shelves, horizontal stops and the like on the inside of the doorframe.

Another object thereof is the provision of folding doors which will not require aluminum or other metal track guides but will be usable with un-reenforced grooved headers.

Still another object thereof is the provision of folding doors which in the open position will lock against disengagement from a doorframe header or track therein.

A still further object of the present invention is the enablement of folding door structures which may employ for the panels particle boards and other sheets of material of less strength and screw holding power and more holding power than ordinary wood panels.

Yet another object thereof is the provision of a folding door structure which will permit folding doors of great height without sacrificing simplicity and ease of construction.

Still yet another object of the present invention is the provision of means to latch a folding door in the open position.

The above and other objects may be achieved in a preferred form by providing folding doors each comprising a door of hingedly connected panels, the outer margin of the outside panel of each being pivoted for vertical movement within the doorway, its outer edge lying in close confrontation to a side jamb thereof when in the closed position, the inner panel being shorter horizontally than the outer panel and bearing on its top side proximate its inner margin and displaced rearwardly from the center an upstanding horizontally rotatable guide roller which rides in a horizontal groove in the header forming the upper margin of the doorway, the pivot pins on which said outer panel is vertically suspended being offset from a medial position toward the rear side of the door.

The outer end of the groove in said header is reinforced by a recessed member or the like so that as said door is opened said guide roller will enter such recess and

be prevented from moving forwardly or rearwardly when said door is urged in such directions.

Other objects and a fuller understanding of the present invention may be had by referring to the following detailed description and claims, taken in conjunction with the accompanying drawings which illustrate preferred embodiments thereof, it being understood that the foregoing statement of the objects of the invention and the brief summary thereof is intended to generally explain the same without limiting it in any manner.

FIG. 1 is a side elevational view of a doorframe and a set of folding doors mounted therein embodying the present invention, a portion thereof being broken away to reveal the vertically adjustable lower pivot mount.

FIG. 2 is a sectional view thereof taken along the lines 2—2 of FIG. 1.

FIG. 3 is a sectional view thereof taken along the lines 3—3 of FIG. 1.

FIG. 4 is an enlarged plan view of the lefthand folding door of FIG. 1 shown in the open position, the adjacent jamb and casing being shown in section.

FIG. 5 is a sectional view taken along the lines 5—5 of FIG. 4.

FIG. 6 is a sectional view taken proximate the inner end of the inner panel of the lefthand folding door along lines 6—6 of FIG. 3.

FIG. 7 is a sectional view through the vertically adjustable pivot mount taken along lines 7—7 of FIG. 1.

FIG. 8 is a view corresponding to the view of FIG. 2 but with reference to another embodiment of the present invention in which two-way or reversible folding doors are shown in opposite open positions in dotted and dot-dashed outline.

FIG. 9 is a plan view of another form of the mounting plate.

FIG. 10 is a plan view of still another mounting plate incorporating a rubber bumper arrangement.

FIG. 11 is a side elevation of the mounting plate of bumper 10.

FIG. 12 is a plan view of yet another mounting plate incorporating a detent spring.

FIG. 13 is a side elevation thereof.

FIG. 14 is a plan view of another mounting plate incorporating a spring biased bumper.

FIG. 15 is a plan view of the mounting plate of FIG. 14.

FIG. 16 is a plan view of still another mounting plate incorporating a sleeve coaxial with the aperture therein.

FIG. 17 is a fragmentary view in elevation thereof and of the cooperating pivot pin, portions being broken away to better show the structure.

FIG. 18 is a plan view of another mounting plate incorporating a spring bumper and latch arrangement.

FIG. 19 is a fragmentary side elevational view thereof and a view of the cooperating pivot pin, portions being broken away to show the structure.

Referring to the drawing and in particular to the form shown in FIGS. 1 through 7, the present invention includes a doorframe or doorway consisting of a header 10, side jambs 11 and 12 and a sill 13, a casing or trim 14 being fixed over the side jambs and a lintel 15 being positioned over header 10, a pair of folding doors 16 and 17 each comprising outer panels 18 and 19 and inner panels 20 and 21 respectively which outer panels are mounted to swing horizontally about upper pivot pins 22 and 23 and lower pivot pins 24 and 25 extending from the upper and lower ends of said outer panels 18 and 19 respectively. The inner and outer panels of said doors are hingedly connected by hinges 26.

Both top and bottom pivot pins (see FIG. 5) are studs which are fixedly secured to channel-shaped panel supports 27, the inner portions of said studs extending into recesses in the panels. By reason of the fact that the

end portions of said supports are U-shaped instead of being merely L-shaped and are preferably dimensioned so as to grip and frictionally retain the marginal portions of the panel with which they are in contact, screws 28 which pass through apertures in such supports into the materials of said panels do not function as stress screws but operate substantially as positioning or holding members. Again, since such supports extend about the margins of the panels with which they are associated the panels may be made of particle boards (such as those marketed by U.S. Plywood Corp, under the trademark "Novoply") or other sheets which do not have the structural strength of wood. When the panels are subjected to torsional and other non-compressive forces there is no need to fear ripping out of the screws since the material of the panel is tightly held in place by the clamping action of the panel support. As shown in the drawing (FIGS. 5 and 6) panel supports 27 and 44 actually grip routed or recessed portions of panels 18 and 20, respectively, so that the outer side surfaces of said supports are flush with the side surfaces of said panel. This is a preferred construction. However, it is not necessary to so reduce the panels and panel supports having inside dimensions substantially equal to the outside dimensions of the panels may be employed with them.

Lower pivot pins 24 and 25 are journalled in vertically adjustable pivot mounts such as those described in the copending U.S. patent application Serial Number 683,354 filed September 11, 1957. As shown in the portion of FIG. 1 which is broken away, said pivot mount includes a sleeve 29 having an upper flanged portion 30 affixed to a lower mounting plate 31 which in turn is affixed by screws 32 to door sill 13, plate 31 having an aperture which is coaxial with a recess in sill 13 into which sleeve 29 extends, a hollow externally threaded bearing screw 33 being slideably mounted within sleeve 29 by means of adjustment nut 34, bearing screw 33 being flatted on one side to form a flatted portion 35, sleeve 29 having an inwardly extending dimple 36 therein which abuts against flatted surface 35 of said screw to prevent the same from rotating. Lower pivot pin 24 extending from a lower panel support 27 (not shown except by reference to FIG. 5) is journalled within the upper hollow portion of bearing screw 33. As nut 34 is rotated, bearing screw 33 and with it door 16 is carried upwards or downwards depending upon the direction of rotation thereof.

Upper pivot pins 22 and 23 pass through a slightly recessed aperture 37 in upper mounting plate 38 into a bore in header 10, said mounting plate being affixed to said header by means of screws 39. Said aperture is recessed in order to provide pin-finder means so that in the course of assembly the upper pivot pins may easily be positioned therein.

All of the pivot pins are displaced toward the rearward portion of the ends of the panels on which they are found. For example, as may be best observed from FIGS. 2 and 5, pin 22 does not extend from the center of the middle portion of panel support 27, but extends upward from a portion thereof rearward of such center. Lower pivot pin 24 is correspondingly so displaced rearwardly. Shelf 40 which extends completely across the inner margin of the doorframe and the forward end of which is substantially in contact with the rear confronting surface of doors 16 and 17 substantially across the width of the doorframe, is recessed at both of its front lateral margins to form clearance areas for the outside ends of panels 18 and 19 when the doors are opened. The placement of pivot pins 22, 23, 24 and 25 toward the rear margin of outer panels 18 and 19 was made so that a minimum clearance area would be required.

In header 10 there is formed a groove 41 which forms a guideway for horizontally rotatable rollers 42, preferably made of nylon or the like, and secured in position by head lugs 43, which are fixed to a panel support 44 one of each of which in turn are secured about the upper inner margins of inner panels 20 and 21 by screws 45 in such a fashion that said rollers extend from the tops of panels 20 and 21 as far toward the inner side and to the rear as the construction will permit. There is positioned at the inner end of the path of each of rollers 42 a spring latch 46 which consists of a U-shaped member seated within groove 41, the sides of said U being resilient fingers 47, the middle portion 48 thereof being shown as linear and from which portion there extends an apertured rectangular portion abutting the upper face of groove 41 and secured thereto by screws 49. Spring latches 46 are engaged by rollers 42 when the doors are in the closed position and act to maintain the doors in such condition.

Upper mounting plates 38 which may overlie a portion of the outer ends of groove 41 may be indented at the outer end of the paths of rollers 42 to provide latching grooves 50 (see FIGS. 3 and 4). Said latching grooves act to prevent the forward-rearward displacement of rollers 42 when the doors are open. Such displacement may be caused by children hanging on the doors or by rearward or forward tugging upon the doors when in the open position.

As may be observed most clearly in FIG. 4, inner panel 20 is shorter in width than outer panel 18 and the distance between pivot pin 22 and the axis of hinge 26 is less than the distance between said hinge axis and guide roller 42. It has been found that if the desired close clearance between the outer side of panel 18 and side jamb 11 is to be realized while maintaining the substantial contact between the inside of panels 18 and 20 and the forward edge of a structure such as shelf 40, inner panel 20 should be made shorter. It will be observed that when such end is achieved and the doors are in the closed position the doors may not be pushed inward and hence provide a degree of rigidity which is highly desirable and which has not been heretofore obtained. In the event that shelves are not employed, then a horizontal doorstop in the form of either short molding 52 or a molding which extends horizontally across the entire door frame, less a marginal clearance area, either at the top and/or at the bottom of the door, may be employed to impart rigidity to the closed door structure. Such rigidity has not heretofore been obtained since prior folding door structures did not enable the continuous contact between the inside of the door and the abutting shelf or door stop. When in the claims reference is made to the term "door stop" it shall include such an abutting shelf. An additional advantage which results is that the doors when closed will lie in the same plane. It is difficult to achieve this straight alignment in the ordinary door structure but with the present structure such alignment is assured.

If it is desired to cushion the impact of rollers 42, when the doors are opened, against the margins of latching grooves 50, then the form of mounting plate shown in FIG. 9 may be employed. In such case, mounting plate 38*a* is fitted with a rubber or other resilient insert 51 which covers said latching groove and which acts to more gradually de-accelerate a roller 42 as it enters the latching groove.

In FIG. 10 there is illustrated another means of more gradually de-accelerating a roller 42 associated with the groove in mounting plate 38*b*. In this case a rubber bumper 52 is mounted so as to extend over the inner margins of latching grooves 50, the same consisting of one or a plurality of centrally apertured rubber rings 53 held in place by a headed upright extending stud 54 affixed to plate 38*b*.

In FIGS. 12 and 13 still another form of bumper is shown. Here, there is secured by means of strap 55 to mounting plate 38*c* a leaf spring bumper 56 which curls upward at either end, one end extending over latching

groove 50 and the other end 56*a* contacting an upper pivot pin such as pivot pin 22 at a flatted portion thereof 22*a*.

By reason of the coaction of end 56*a* against flatted portion 22*a* of pin 22, a latching effect takes place which effectively maintains the door in the position in which it is located when the linear edge of end 56*a* contacts the corresponding flat surface at 22*a*. If the door at such time is in the closed position, then the door will be maintained in such position by reason of such coaction. On the other hand, another flatted portion (not shown) may be added to pivot pin 22 so that such coaction takes place when the door is in the open position, in which event it will be maintained in such open position by such latching action.

In FIGS. 14–15, there is illustrated a more elaborate form of bumper associated with a mounting plate 38*d* wherein a bumper housing 57 having apertures 58 and 59 in the side walls thereof slideably retains a bumper rod 60 within said housing and said apertures, one end of said rod terminating in a bumper button 61 fixedly secured thereto and the other end bearing a retainer clip 62, a spiral spring 63 being mounted about said rod and engaging the inside edge of button 61 on one side and the inside of said housing on the other, thereby biasing said button to a position over the edge of a latching groove 50.

In FIGS. 16 and 17 there is shown another means of maintaining the door in the open or closed position. In this instance, mounting plate 38*e* bears an upstanding sleeve 64 which has an aperture 65 in one wall thereof; the cooperating pivot pin 22′ in this instance bears a lateral bore 66 in which there is positioned a spring 67 which outwardly biases a captive ball 68. In self-evident fashion when pivot pin 22′ is positioned within sleeve 64 and the radial relative positions of the two members are such that ball 68 is pushed into aperture 65 by spring 67 the door will be held in position resisting, but of course, not preventing displacement from such predetermined position. Obviously the design may be such that such predetermined position may be either in the open position of the door or the closed position of the door, or there may be two apertures 65 radially distant so that both possibilities are comprehended.

A form similar to the form illustrated in FIGS. 12 and 13 is shown in FIGS. 18 and 19 wherein there is affixed to mounting plate 38*f* a bent spring 69 by means of rivet 70 in such position that the forward U-shaped portion 71 acts as a bumper and the rear finger portion 72 comes in contact with a top pivot pin 22″ which has a flatted portion 73 to provide an action similar to that provided by portion 56*a* of spring 55 and flatted portion 22*a* of pivot pin 22 as shown in FIG. 13.

The functioning of all of the above bumpers is self-evident. As a roller 42 enters the rear portion of a latching groove 50 it is contacted by one of the bumpers which acts to deaccelerate it relatively gradually and thus cushions the blow which otherwise would tend to deform the roller and its support means. Of course, other bumper structures may similarly be employed to achieve the purpose served by the described bumpers.

Another embodiment of the present invention is shown in FIG. 8 wherein folding doors 16′ and 17′ corresponding to doors 16 and 17 are shown, the differences residing in the fact that outer panel 18′ and inner panel 20 are hingedly connected by two-way or reversible hinges 25′ and that no shelves or doorstops are provided. This enables a folding door which is foldable in either direction, i.e. may be folded toward the front or the rear of the doorway. All panels may be the same in size or they may be as shown in FIG. 8 wherein inner panel 20′ is shown to be greater in width than outer panel 18′. This enables the positioning of a handle on either one or both sides of panel 20′ near the inner edge thereof so that when the door is in the open position the handle will lie to the rear or in front of the end of panel 18′. If it is not desired to use a handle, the user may grasp the inner margin of panel 18′ and in that manner manipulate the door to an open and closed position.

It may be similarly latched in either the closed or open position and has substantially all of the advantages of the first embodiment except, of course, that it does not have the resistance to rearward deformation in the closed position which, of course, would not be desirable in this second embodiment.

Although the present invention has been described with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous variations may be employed without transcending the scope of the invention as hereinafter claimed.

What is claimed is:

1. A folding door structure comprising top and bottom frame members, a pair of first and second panels hingedly connected along a first vertical axis, said first panel being mounted to pivot about a second vertical axis lying within said frame members, said second panel being shorter in width than said first panel, means associated with said top frame member defining a guideway, a vertically upstanding guide member rigidly connected to said second panel and extending into said guideway, whereby said guide member is confined to a predetermined path, the distance between said first and second axes being less than the distance between said first axis and said guide member, stop means preventing said panels from assuming parallel positions, and a reinforcing member having an inwardly open recess formed therein, affixed to said top frame member proximate the end of the path of said guide member in the open position of said panels, the recess in said reinforcing member registering with the confronting end portion of said guideway and having opposed side walls, the recess being in substantial alignment with said guideway and receiving said guide member between the side walls in said open position, whereby when said panels are in the open position rearward and forward travel of said guide member is restricted by the walls of said recess and said panels are prevented from assuming relatively parallel positions.

2. A folding door structure including top and bottom frame members, a first panel pivotally connected to said frame adjacent one lateral margin of said panel to rotate about a first vertical axis lying within said frame members, a second panel hingedly connected to said first panel along a second axis adjacent the other lateral margin of said first panel, said second panel being vertically coextensive with said first panel, but being shorter in width, said top frame member having a downwardly open horizontal groove formed therein, a guide member extending vertically upward from said second panel proximate its innermost lateral margin into said groove, said guide member being rigidly connected to said second panel and being in extension of the top of said second panel, whereby said groove provides a guideway for said guide member, confining the same to a predetermined path, the distance between said first and second axes being less than the distance between said second axis and said guide member and stop means preventing said panels from assuming relative parallel positions and defined by a reinforcing plate having an inwardly open recess formed therein, secured to said top frame member about said groove, said recess having opposite side walls registering with the side walls of said groove at and inwardly proximate the end of the path of and receiving said guide member when said panels are in the open position whereby portions of said guide member enter said recess when said panels are in the open position.

3. A structure as described in claim 2 and resilient means affixed to said reinforcing plate and extending into the path of said guide member to cushion the impact of

said guide member against said plate when said panels are opened.

4. A folding door structure comprising top and bottom frame members, a pair of first and second panels hingedly connected along a first vertical axis, said first panel being mounted to pivot about a second vertical axis lying within said frame members, said second panel being shorter in width than said first panel, means associated with said top frame member defining a guideway, a vertically upstanding guide member rigidly connected to said second panel and extending into said guideway, whereby said guide member is confined to a predetermined path, the distance between said first and second axes being less than the distance between said first axis and said guide member, stop means preventing said panels from assuming parallel positions, said pivotal connection of said first panel including top and bottom channel-shaped door supports secured to the top and bottom outside lateral margins thereof, respectively, top and bottom pivot pins extending vertically, respectively, upwardly and downwardly and offset from center rearwardly, from each of said door supports, said guide member being correspondingly offset rearwardly and latch means to retain said panels in a predetermined position including spring means connected to said top frame member and biased against said top pivot pin, said top pivot pin having a flatted portion positioned in confrontation to said spring means when said panels are in said predetermined position.

5. A folding door structure including top and bottom frame members, a first panel pivotally connected to said frame adjacent one lateral margin of said panel to rotate about a first vertical axis lying within said frame members, a second panel, a set of two-way hinges connecting said second panel to said first panel along a second vertical axis adjacent the other lateral margin of said first panel, said second panel being vertically coextensive with said first panel, but being longer in lateral dimension, said top frame member having a downwardly open horizontal groove formed therein, a guide member extending vertically upward from said second panel proximate its innermost lateral margin into said groove, whereby said groove provides a guideway for said guide member, confining the same to a predetermined path, the distance between said first and second axis being less than the distance between said second axis and said guide member, stop means preventing said panels from assuming relatively parallel positions, a reinforcing plate having an inwardly open recess formed therein, secured to said top frame member about said groove, said recess having opposed side walls registering with the side walls of said groove at and inwardly proximate the end of the path of and receiving said guide member when said panels are in the open position whereby portions of said guide member enter said recess when said panels are in the open position.

6. A structure as described in claim 5 and resilient means affixed to said reinforcing plate and extending into the path of said guide member to cushion the impact of said guide member against said plate when said panels are opened.

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