Feb. 6, 1962 R. L. LEIGH 3,019,836

FOLDING DOORS AND MOUNTING FIXTURES THEREFOR

Filed Feb. 20, 1959 3 Sheets-Sheet 1

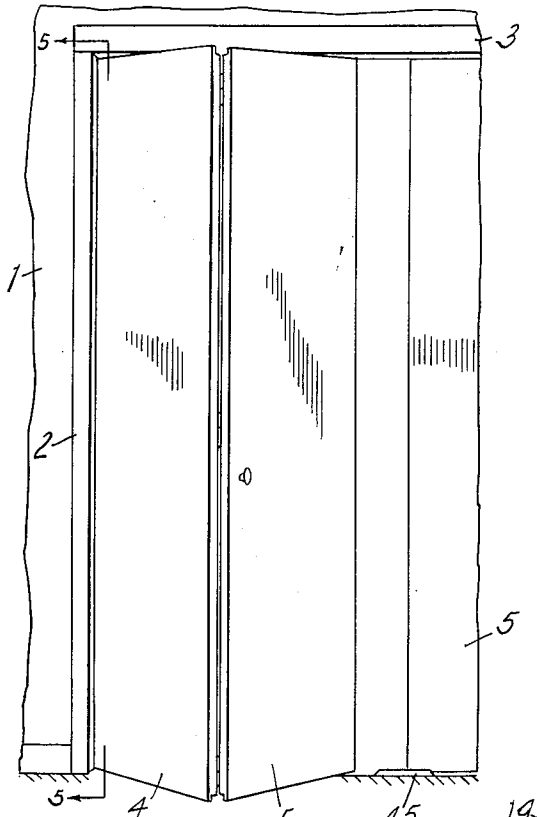


Fig. 1.

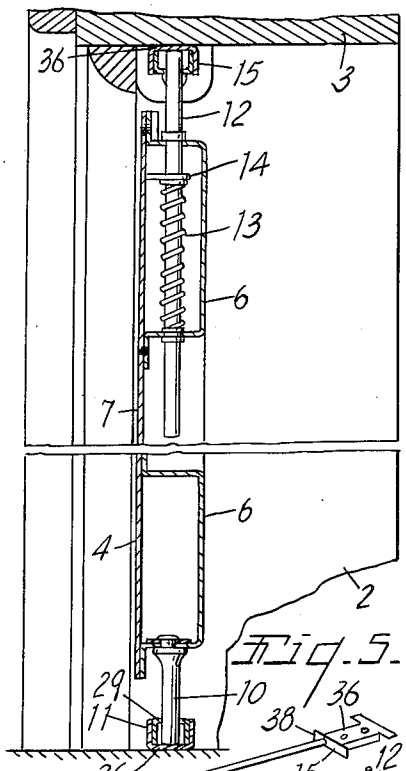


Fig. 5.

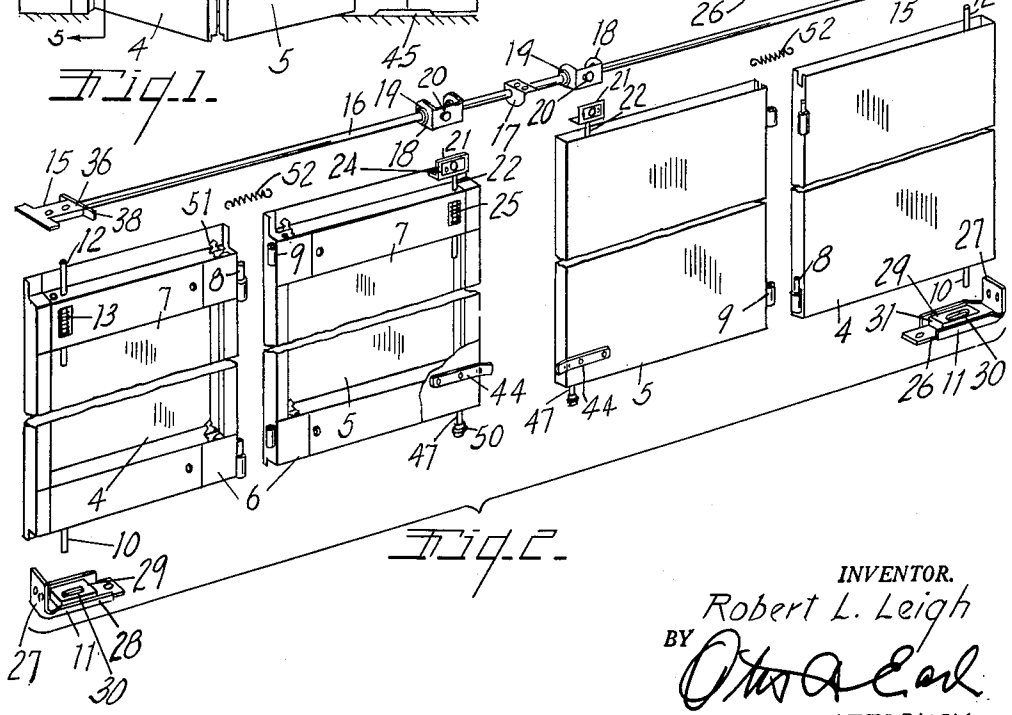


Fig. 2.

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FOLDING DOORS AND MOUNTING FIXTURES THEREFOR

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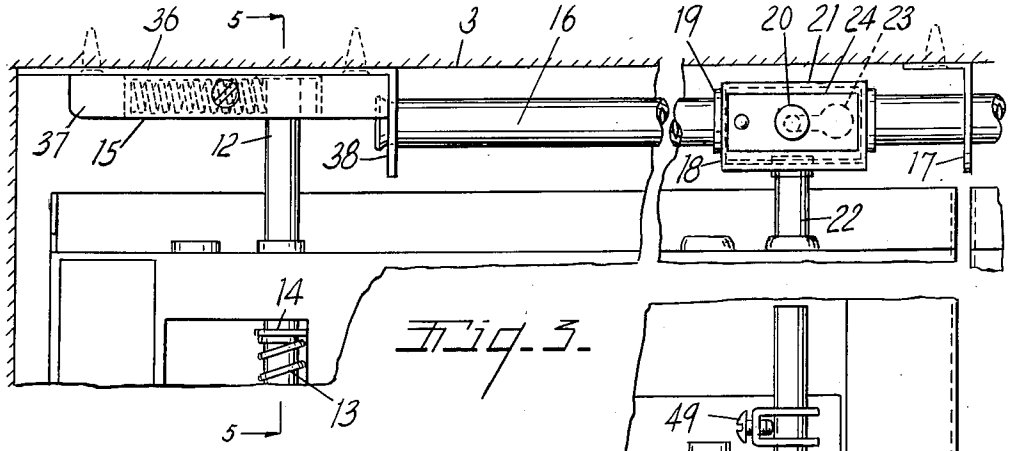


Fig. 3.

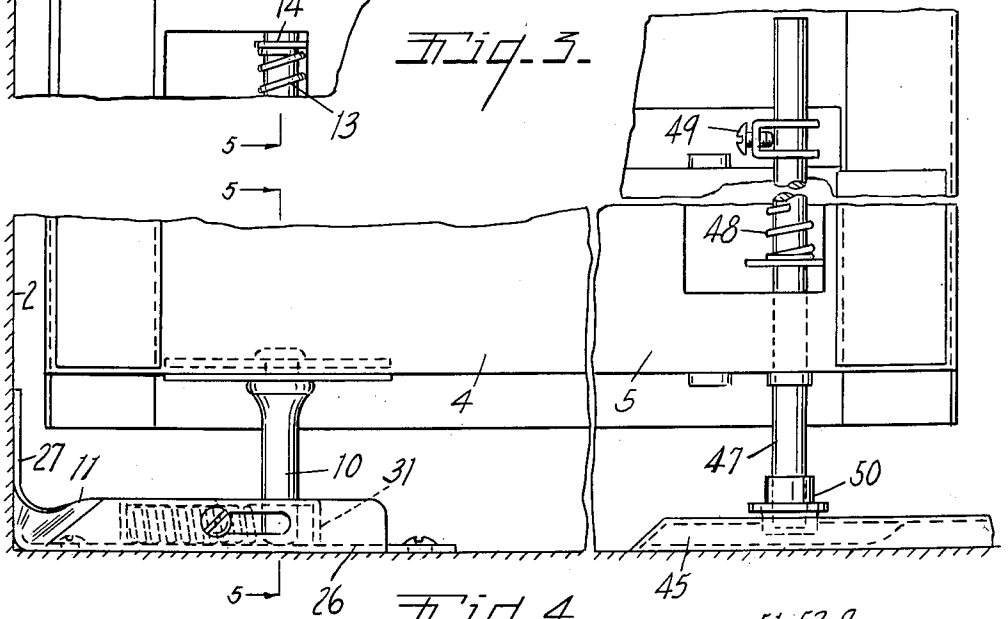


Fig. 4.

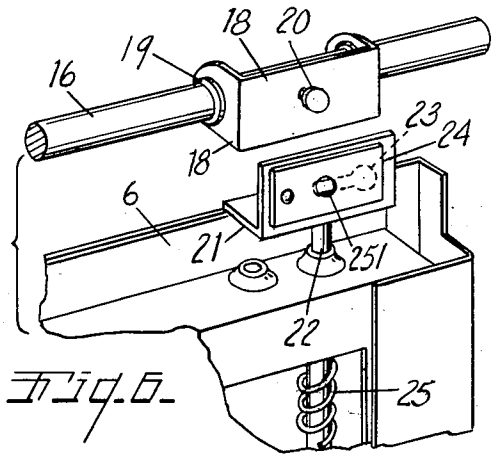


Fig. 6.

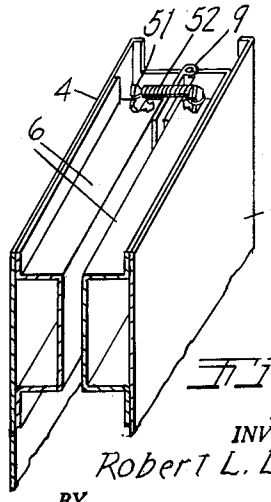


Fig. 7

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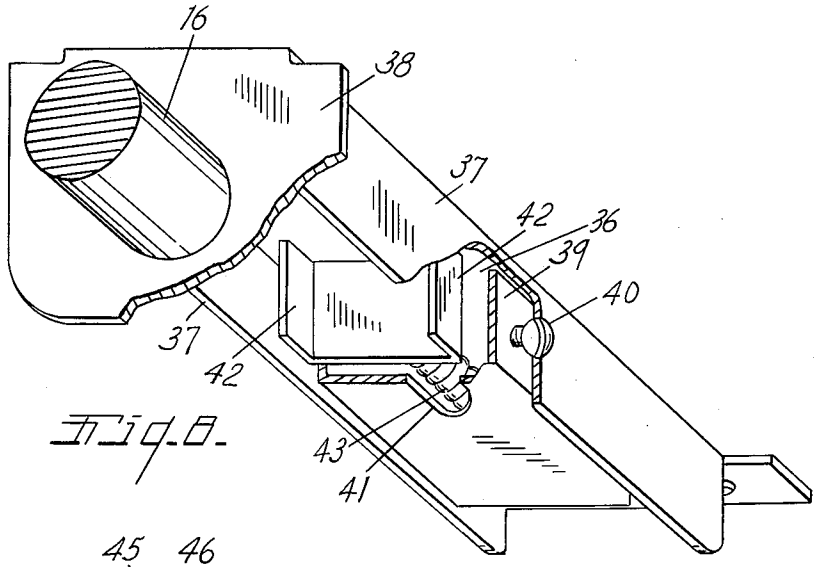


Fig. 8.

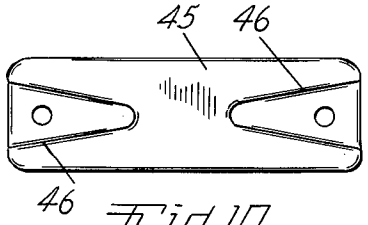


Fig. 10.

Fig. 9.

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3,019,836
Patented Feb. 6, 1962

3,019,836
FOLDING DOORS AND MOUNTING FIXTURES THEREFOR

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Filed Feb. 20, 1959, Ser. No. 794,573
8 Claims. (Cl. 160—199)

This invention relates to improvements in folding doors and mounting fixtures therefor. The principal objects of this invention are:

First, to provide a folding door with mounting and guiding brackets and pintles which will permit the easy assembly and smooth operation of a folding door in a doorway even though the outline of the doorway is not truly rectangular.

Second, to provide mounting brackets and pintles for a folding door installation in which the upper and lower pintles on which the door is supported are yieldably supported to compensate for irregularities in the shape of the door opening, and in which the guide pins for guiding the outer or folding panel of the door are yieldably biased into engagement with guide tracks so that the panel can swing in a truly rectangular path even though the guide tracks must be mounted at an incline due to out of square shape of the doorway opening.

Third, to provide mounting brackets and connections for a folding door which yieldably bias the door to planar closed position against a door stop or coacting door to hold the folding door in closed position without rattling, but which permit easy swinging of the panels of the folding door to open position.

Fourth, to provide a folding door assembly which is relatively inexpensive and easy to install but which supports the door for easy operation.

Other objects and advantages of the invention will be apparent from a consideration of the following description and claims. The drawings, of which there are three sheets, illustrate a highly practical form of the door and its mounting fasteners and two modified forms of retainers for holding the door closed.

FIG. 1 is a fragmentary front elevational view of a folding door installation with one side of the door partially open.

FIG. 2 is a fragmentary exploded perspective view of the door and its mounting brackets with one-half of the double folding door conventionally illustrated and showing a modified form of guide structure for the bottom edge of the door.

FIG. 3 is an enlarged fragmentary rear elevational view of the top of a folding door with parts broken away and in cross section.

FIG. 4 is an enlarged fragmentary rear elevational view of the bottom of a folding door with parts broken away and in cross section and illustrating a modified form of guide structure for locating the free edge of the door in closed position.

FIG. 5 is a fragmentary enlarged vertical cross sectional view taken along the plane of the line 5—5 in FIGS. 1, 3 and 4.

FIG. 6 is a fragmentary perspective exploded view of the upper guide pin connection for the free edge of the folding door.

FIG. 7 is a fragmentary perspective view of the connection between the two adjacent panels of a folding door with the door in open folded position.

FIG. 8 is an enlarged fragmentary perspective view of an upper mounting bracket and guide bar support with parts broken away and in cross section.

FIG. 9 is an enlarged fragmentary perspective view of a lower pintle bracket for the folding door with parts broken away and in cross section.

FIG. 10 is a plan view of the center guide and locating bracket shown in FIGS. 1 and 4.

FIG. 1 illustrates the general relationship of the parts of a folding door in which a wall **1** defines a doorway surrounded by a side frame member **2** and a lintel **3**. A folding door consisting of a first panel **4** and a second panel **5** and cooperating with a similar pair of panels is mounted to selectively open or close the doorway as is generally common in doors of this type. Since the pairs of panels **4** and **5** are identical or may be used as a single pair, the description will be limited to the structure and mounting of a single pair of folding panels. The panel **4** which is hingedly connected to the door frame will be referred to as the inner panel while the panel **5** which is disposed outwardly from the side frame member **2** will be referred to as the outer panel.

The door panels **4** and **5** are made up of any suitable frame construction **6** having closure panels **7** on their front faces and are, of course, sized to approximately fit the opening in which they are to be mounted. The height and combined width of the pair of panels **4** and **5** are somewhat less than the corresponding dimensions of the doorway to permit free movement of the door panels. The outer swinging edge of the inner panel **4** carries a plurality of upwardly projecting hinge pins **8** and the adjacent inner edge of the outer panel **5** carries coacting sockets **9** which fit over the pins **8** to hingedly support the outer panel on the swinging edge of the inner panel.

As appears most clearly from FIGS. 2, 4 and 5 the inner lower corner of the inner panel **4** carries a downwardly projecting fixed pintle or hinge pin **10** which is received in and supported by a lower mounting bracket generally identified by the reference numeral **11**. The pintle **10** rests upon the bottom of the bracket **11** and vertically supports the weight of both the inner and the outer panel. As will be more particularly described presently the mounting bracket **11** includes provision for shifting and adjusting the pintle **10** transversely of the doorway. The upper inner corner of the inner panel **4** carries an upwardly projecting pintle or hinge pin **12** and as appears most clearly in FIG. 3 this pin is yieldably biased upwardly by a spring **13** received in a hollow section of the door frame and bearing upwardly against a collar **14** on the pin. The upper end of the pintle pin **12** is received and supported in an upper mounting bracket generally indicated at **15** and as will be more particularly described the bracket **15** is arranged to yieldably support the pintle pin for movement transversely of the doorway.

The upper mounting bracket **15** also supports one end of a guide rod **16** which extends transversely across the doorway in spaced relation below the lintel **3** to a second top bracket at the opposite side of the doorway. When two pairs of folding doors are provided a center bracket **17** on the guide rod is attachable to the lintel above the

center of the door. For each pair of folding panels the guide rod 16 carries a slide 18 of U-shaped section having nylon or other antifriction bushings 19 mounted in its arms and engaged with the rod 16. The side web of the slide 18 carries a laterally projecting headed pin 20 (see FIG. 6). The slide 18 and the pin 20 thereon are designed to engage a bracket 21 on the upper end of a guide pin 22 yieldably supported at the upper outer corner of the outer panel 5. The pin 22 is welded to the bracket and has a keyhole slot 23 that receives the head of the pin 20. A flat leaf spring 24 riveted to the side of the bracket overlies the enlarged end of the keyhole slot and defines a hole 25 registering with the narrow portion of the slot and arranged to snap over the head of the pin 20 to hold the bracket 21 and guide pin 22 engaged with the slide 18.

Attention is now directed to the details of the lower mounting bracket 11 appearing most clearly in FIG. 9. The bracket has a bottom wall 26 attachable to the floor and an end flange 27 attachable to the side frame of the doorway. Side walls 28 on the bracket form a channel shaped way in which an inverted retainer member 29 is adjustable transversely of the doorway. The top wall of the retainer 29 defines an elongated slot 30 and is held in spaced relation above the bottom plate 26 by end walls 31—31. One side wall 28 of the mounting bracket defines a slot 32 through which a screw 33 is passed into threaded engagement with the side wall of the retainer to adjust the position of the retainer transversely of the doorway. Slidably mounted within the retainer 29 is a U-shaped abutment member 34 that is biased outwardly of the doorway by a spring 35. The slot 30 in the top of the retainer is sized to receive and laterally retain the fixed pintle pin 10 on the bottom of the outer door panel while the abutment 34 and spring 35 yieldably bias the pintle to the inner end of the slot 30.

The upper mounting bracket 15 is most clearly illustrated in FIG. 8 and includes a top wall 36 attachable to the lintel 3 and provided with depending side walls 37. An outer end wall 38 engages and supports the previously described guide rod 16. Secured within the channel formed by the side walls 37 is an upwardly opening U-shaped retainer 39 that is held in place by a screw 40 projected through a hole in one side wall 37. The retainer 39 is not adjustable transversely of the doorway but defines a transverse slot 41 in its lower wall which receives the upwardly projecting pintle pin 12 at the upper outer corner of the door and permits limited transverse adjustment of the upper pintle. A U-shaped abutment 42 slidably retained by the bracket 15 and the retainer 39 is biased outwardly toward the center of the door by a spring 43.

With the mounting and connecting structure thus far described, it should be apparent that it is possible to mount the upper brackets 15 and the guide bar 16 across the underside of the lintel 3. The slot 41 in the upper mounting bracket thus locates and defines an area of mounting of the upper pintle pin 12 and the lower mounting bracket 11 is secured to the floor below the upper mounting bracket and the adjustable retainer 29 in the lower bracket is positioned to locate the lower abutment 34 vertically underneath the upper abutment 42. The assembled door panels 4 and 5 are then moved into position by inserting the lower fixed pintle pin 10 through the slot 30 into the lower bracket 11. The upper pintle pin 12 is retracted against the compression of the spring 13 and the doors swung into vertical position to let the pintle pin 12 project upwardly into the slot 41 at the outer side of the abutment 42. Even though the side frame 2 of the doorway may not be truly vertical, the lower retainer 29 can be adjusted in the lower bracket 11 to locate the pintle pins 10 and 12 in alined vertical position. During mounting of the pintle pins 10 and 12 the guide pin 22 at the upper outer corner of the outer panel can be pushed downwardly and the pin 20 on the slide 18 snapped laterally into the slot 23 in the previously described bracket 21. The free moving edge of the outer panel is thus guided in a vertical plane passed through the guide rod 16. Should the lintel 3 and guide rod 16 be inclined somewhat to the horizontal the yieldable mounting of the guide pin 22 permits the pin to slide vertically while moving along the inclined guide rod and does not interfere with swinging of the door panels about the vertical axis of the pintle pins 10 and 12. Should the adjacent pair of doors or the fixed side frame with which the swinging edge of the outer panel 5 coacts, be at an angle to true vertical the yieldable backing of the springs 43 and 35 in the upper and lower mounting brackets permits the pintle pins 10 and 12 to move sufficiently for the door to close.

It is highly desirable to locate and guide the lower outer corner of the outer panel 5 in the closed position of the panels so that the door will close and remain straight. Two modified structures for accomplishing this function are disclosed. In FIG. 2 the lower outer corner of the outer panels 5 are provided with outwardly projecting angled straps 44 that overlap the adjacent panels when the door is closed and prevent one panel from moving relative to the other. A second form of guide is illustrated in FIGS. 4 and 10 in which a center retaining bracket 45 is secured to the floor in the center of the doorway. The bracket defines V-shaped notches 46 that open upwardly and transversely across the doorway to receive a guide pin 47 that is yieldably supported in the bottom cross member of the outer panel. A spring 48 yieldably biases the pin 47 downwardly and downward motion of the pin is adjustably limited by the screw clamp 49. The lower end of the pin 47 carries a nylon or other sound deadening bumper 50 that is received in the V-shaped notch 46 to locate the lower outer corner of the door. Should irregular contour of the floor require it, the bumper 50 can slidably engage the floor in moving across the doorway and yieldably press the guide pin 47 upwardly as the door opens and closes.

In order to retain the panels 4 and 5 against rattling in either open or closed positions the adjacent upper corners of the panels are provided with projecting anchors 51 (see FIGS. 2 and 7). In the example illustrated these anchors are formed by punching and bending pointed ears out of the metal of the frame members 6. These anchors 51 are located forwardly toward the front of the panels from the transverse plane through the hinge sockets 9 and a short tension spring 52 is stretched between the adjacent anchors along the upper edge of the door panels. When the doors are closed the springs 52 obviously tend to swing the panels 4 and 5 forwardly relative to the hinge connection 8—9 or to urge the hinge connection rearwardly and keep the two panels closed. As the swinging panels are opened with the necessary folding motion about the hinge connections 8—9, the spring 52 is stretched and moved across the axis of the hinge connection 8—9 so that the spring assists in holding the panels in the open folded position shown in FIG. 7.

What is claimed as new is:

1. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket of downwardly opening channel section secured to said lintel adjacent said side of said doorway and having a downturned transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels, an upwardly opening channel shaped spring retainer secured within said bracket inwardly of said transverse wall and defining a first slot disposed perpendicular to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged

outwardly from the side of said doorway by said spring, a top pintle slidably mounted at the upper inside corner of said side panel and spring urged through said first slot at the outer side of said abutment, a bottom bracket of upwardly opening channel section secured to said floor below said top bracket and extending outwardly from the side of said doorway, a second spring retainer of downwardly opening channel section longitudinally adjustably secured in said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, a top guide rod slidably mounted in the upper outer corner of said outer panel and spring biased upwardly therefrom, said top guide rod having an angled bracket on its upper end, a U-shaped guide bracket slidably mounted on said guide rail and having a laterally projecting head pin on its side, said bracket on said top guide rod defining a laterally opening slot receiving the end of said headed pin, a spring plate on said angled bracket overlying the slot therein and defining a hole retaining said headed pin in said bracket, a bottom guide rod slidably mounted in the lower outside corner of said outer panel and yieldably projected therebelow, and a retaining bracket secured to said floor below the closed position of the outer edge of said outer panel and defining an upwardly opening inwardly diverging V-shaped notch adapted to receive said bottom guide rod, the top edges of said panels having projections thereon spaced from the adjacent side edges of the panels and a tension spring connected between said projections.

2. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket secured to said lintel adjacent said side of said doorway and having a transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels, an upwardly opening channel shaped spring retainer secured to said bracket inwardly of said transverse wall and defining a first slot disposed perpendicular to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged outwardly from the side of said doorway by said spring, a top pintle slidably mounted at the upper inside corner of said side panel and spring urged through said first slot at the outer side of said abutment, a bottom bracket secured to said floor below said top bracket and extending outwardly from the side of said doorway, a second spring retainer of downwardly opening channel section longitudinally adjustably secured to said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, a top guide rod slidably mounted in the upper outer corner of said outer panel, said top guide rod having vertical plate on its upper end, a guide bracket slidably mounted on said guide rail and having a laterally projecting headed pin on its side, said plate defining a keyhole slot receiving the end of said headed pin, a spring on said bracket on said guide pin retaining said headed pin in the slot, a bottom guide rod slidably mounted in the lower outside corner of said outer panel and yieldably projected therebelow, and a retaining bracket secured to said floor below the closed position of the outer edge of said outer panel and defining an upwardly opening inwardly diverging V-shaped notch adapted to receive said bottom guide rod.

3. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket secured to said lintel adjacent said side of said doorway and having a transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels, an upwardly opening channel shaped spring retainer secured to said bracket inwardly of said transverse wall and defining a first slot disposed perpendicular to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged outwardly from the side of said doorway by said spring, a top pintle slidably mounted at the upper inside corner of said side panel and spring urged through said first slot at the outer side of said abutment, a bottom bracket secured to said floor below said top bracket and extending outwardly from the side of said doorway, a second spring retainer of downwardly opening channel section longitudinally adjustably secured to said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, a top guide rod slidably mounted in the upper outer corner of said outer panel, said top guide rod having a plate with a keyhole slot therein on its upper end, a guide bracket slidably mounted on said guide rail and having a laterally projecting pin detachably received in the slot on said top guide rod, and a spring retaining said laterally projecting pin in the slot.

4. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said panel, a top bracket of downwardly opening channel section secured to said lintel adjacent said side of said doorway and having a downturned transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels, an upwardly opening channel shaped spring retainer secured within said bracket inwardly of said transverse wall and defining a first slot disposed perpendicular to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged outwardly from the side of said doorway by said spring, a top pintle slidably mounted at the upper inside corner of said side panel and spring urged through said first slot at the outer side of said abutment, a bottom bracket of upwardly opening channel section secured to said floor below said top bracket and extending outwardly from the side of said doorway, a second spring retainer of downwardly opening channel section longitudinally adjustably secured in said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, a top guide rod slidably mounted in the upper outer corner of said outer panel and spring biased upwardly therefrom, said top guide rod having a plate with a slot therein on its upper end, a guide bracket slidably mounted on said guide rail and having a lateral pin on its side received in the slot on said top guide rod, and a spring on said plate retaining said lateral pin in the slot, the top edges of said panels having projections

thereon spaced from the adjacent side edges of the panels and a tension spring connected between said projections.

5. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket secured to said lintel adjacent said side of said doorway and having a downturned transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels, a spring retainer secured to said bracket inwardly of said transverse wall and defining a first slot disposed perpendicular to said side of said doorway, a spring retained between said bracket and said retainer, a top abutment slidable in said retainer and urged outwardly from the side of said doorway by said spring, a top pintle slidably mounted at the upper inside corner of said side panel and spring urged through said first slot at the outer side of said abutment, a bottom bracket secured to said floor below said top bracket and extending outwardly from the side of said doorway, a second spring retainer longitudinally adjustably secured to said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, a top guide rod slidably mounted in the upper outer corner of said outer panel and spring biased upwardly therefrom, said top guide rod having a vertical plate on its upper end, a guide bracket slidably mounted on said guide rail and having a plate on its side, one of said plates defining a laterally opening slot, the other of said plates having a headed pin received in said laterally opening slot, a spring on said one plate retaining said pin in the slot, a bottom guide rod slidably mounted in the lower outside corner of said outer panel and yieldably projected therebelow, and a retaining bracket secured to said floor below the closed position of the outer edge of said outer panel and defining an upwardly opening inwardly diverging V-shaped notch adapted to receive said bottom guide rod, the top edges of said panels having projections thereon spaced from the adjacent side edges of the panels and a tension spring connected between said projections.

6. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket secured to said lintel adjacent said side of said doorway and having a downturned transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels and spaced from said lintel over said panels, a spring retainer secured to said bracket inwardly of said transverse wall and defining a first slot extending perpendicularly inwardly and outwardly relative to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged outwardly from the side of said doorway by said spring, a top pintle projecting above the upper inside corner of said side panel and through said first slot at the outer side of said abutment, a bottom bracket secured to said floor below said top bracket and extending perpendicularly inwardly and outwardly to said side of said doorway, a second spring retainer secured to said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle fixedly projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, one of said pintles being spring biased vertically outwardly of said side panel and one of said spring retainers being adjustable in its bracket inwardly and outwardly from the side of said doorway, a top guide rod slidably mounted in the upper outer corner of said outer panel and spring biased upwardly therefrom, and a guide bracket slidably mounted on said guide rail, means on said guide bracket and said top guide rod defining a laterally opening slot and coacting pin detachably connecting the rod and bracket, the top edges of said panels having projections thereon between the opposite faces of the panels spaced from the adjacent side edges of the panels and a tension spring connected between said projections.

7. A folding door assembly in a doorway having a lintel, side and floor comprising a side panel positioned adjacent said side and an outer panel hingedly supported from the outer edge of said side panel, a top bracket secured to said lintel adjacent said side of said doorway and having a downturned transverse wall at its outer end, a guide rail secured to said transverse wall and extending outwardly from said side and across said doorway above said panels and spaced from said lintel over said panels, a spring retainer secured to said bracket inwardly of said transverse wall and defining a first slot extending perpendicularly inwardly and outwardly relative to said side of said doorway, a spring retained above said retainer, a top abutment slidable in said retainer and urged outward from the side of said doorway by said spring, a top pintle projecting above the upper inside corner of said side panel and through said first slot at the outer side of said abutment, a bottom bracket secured to said floor below said top bracket and extending perpendicularly inwardly and outwardly to said side of said doorway, a second spring retainer secured to said bottom bracket and defining an upwardly opening slot, a second spring positioned between said bottom bracket and said second retainer, a bottom abutment slidable in said second retainer at the outer end of said second spring, a bottom pintle projecting from the lower inside corner of said side panel and projecting through the upwardly opening slot in said second retainer outwardly of said second abutment, one of said pintles being spring biased vertically outwardly of said side panel and one of said spring retainers being adjustable in its bracket inwardly and outwardly from the side of said doorway, a top guide rod slidably mounted in the upper outer corner of said outer panel and spring biased upwardly therefrom, and a guide bracket slidably mounted on said guide rail and engaging the end of said top guide rod.

8. A folding door for a doorway comprising an inner panel having hinge pintles projecting from its upper and lower edges adjacent the inner edge thereof, the upper pintle being yieldably retractable into said panel, mounting brackets adapted to be secured to the frame of the doorway at the top and bottom thereof, means on said brackets defining slots arranged to extent inwardly and outwardly perpendicular to the side of the doorway and receiving the ends of said pintles, the slot defining means on the lower of said brackets being adjustable inwardly and outwardly relative to the side of the doorway, springs carried by said brackets and engaging said pintles to urge the pintles to the outer ends of said slots, an outer panel hingedly supported on the outer edge of said inner panel, spring anchor projections on a horizontal edge of said panels between the opposite faces of the panels spaced transversely from the adjacent edges of the panels and disposed toward the outwardly folding sides of the panels from the hinge connection therebetween, a tension spring connected between said projections to swing across the axis of said hinge connection as said panels fold, a guide rail connected at one end to said upper bracket and extending across the tops of said panels and spaced from the lintel over the panels, a slide slidably supported

on said guide rail, and a guide rod carried by the upper outer corner of said outer panel and projecting yieldably thereabove and laterally releasably connected to said slide.

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