July 9, 1963 L. R. DICKINSON ETAL 3,096,539

FOLDING DOOR HINGE ASSEMBLY

Filed April 11, 1962 2 Sheets-Sheet 1

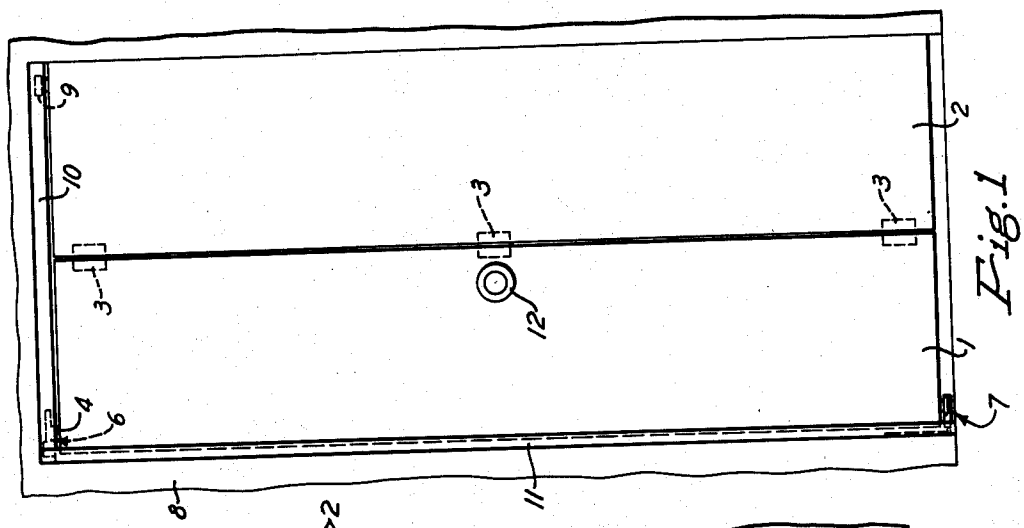


Fig. 1

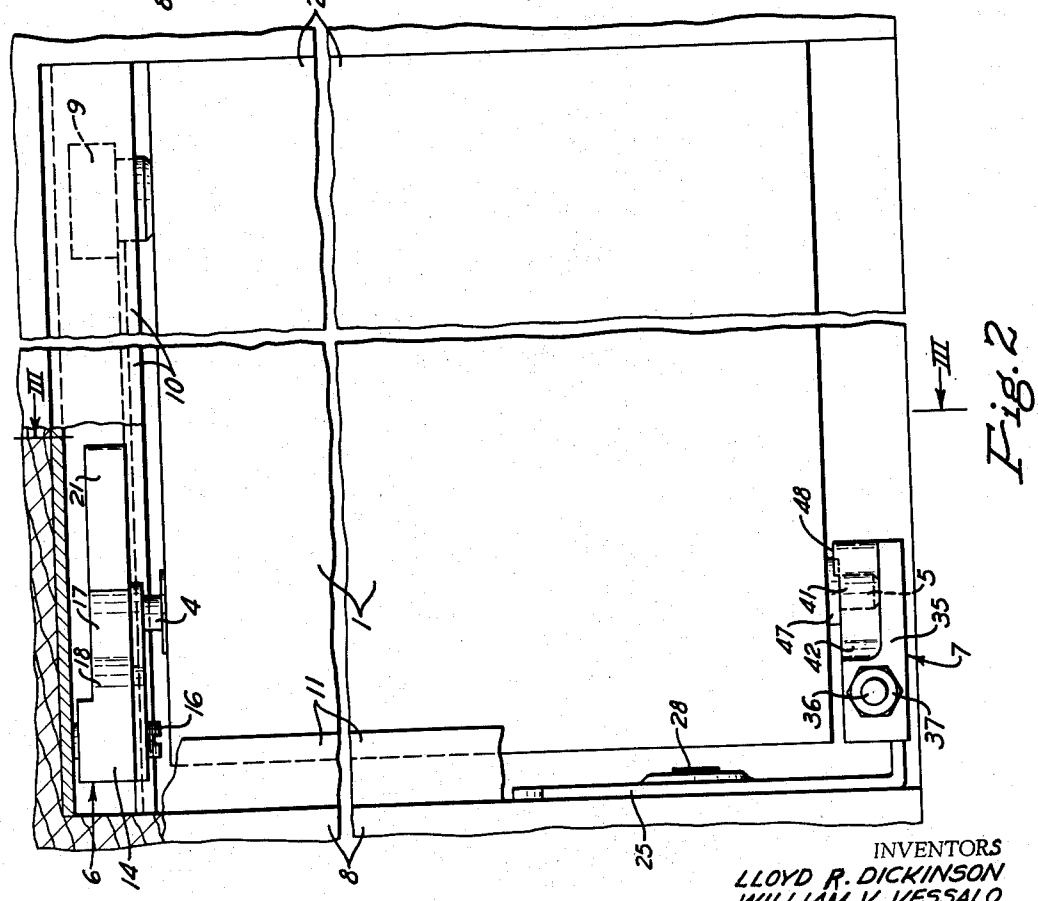


Fig. 2

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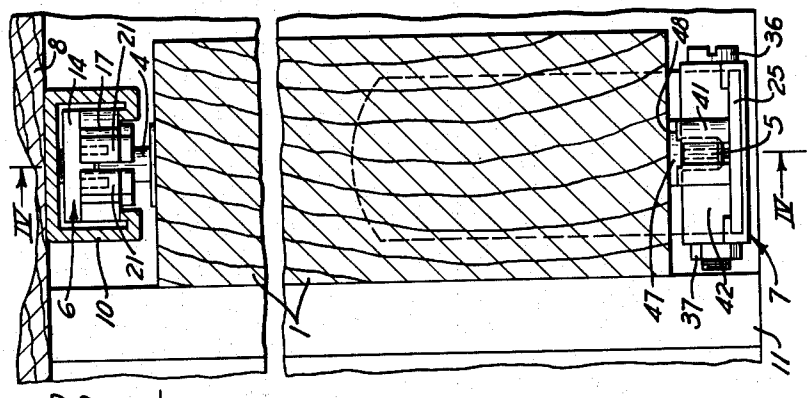


Fig. 3

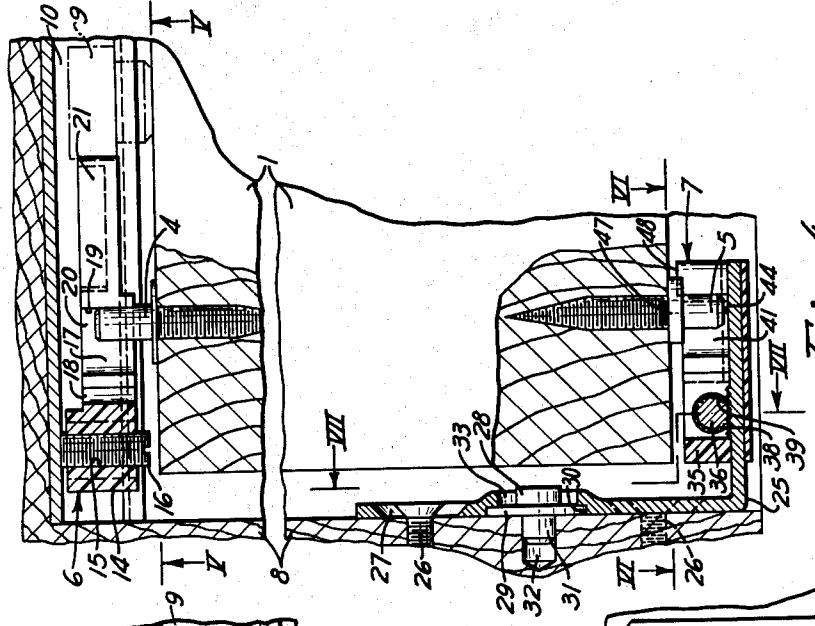


Fig. 4

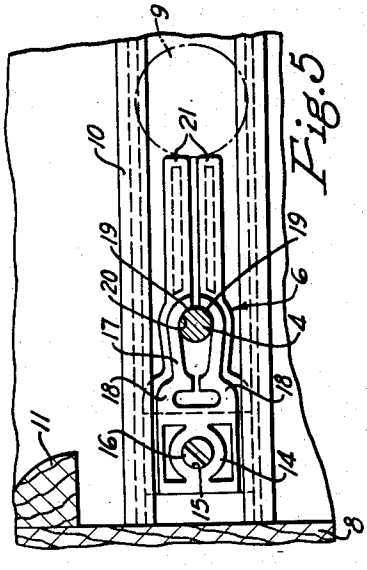


Fig. 5

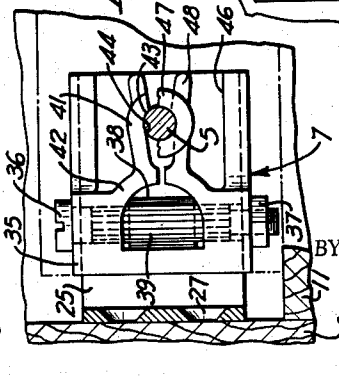


Fig. 6

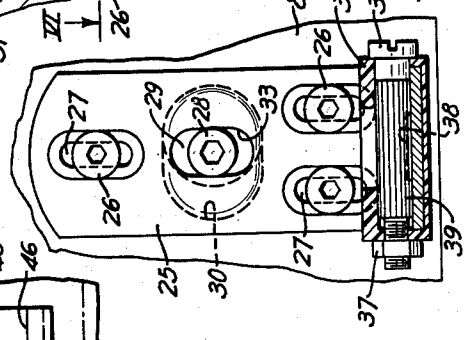


Fig. 7

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FOLDING DOOR HINGE ASSEMBLY

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This invention relates to hinge assemblies for pivotally supporting folding doors, and more particularly to those that permit the pivoted edge of a door to move laterally toward the adjacent side of the doorway when the door starts to open.

Door mountings of the type forming the subject matter of this invention are shown in Patent 3,002,218. By reference to that patent it will be seen that the outer edge portion of one of the panels of a folding door is pivotally mounted in a doorway by means of pivot pins that project from the top and bottom of the door into bearings mounted in the doorway above and below the door. As explained in that patent, the coil springs in the hinge brackets hold the free or unpivoted edge of the door against one side of the doorway while the door is closed, but they permit the pin bearings and therefor the door to move away from that side of the doorway sufficiently for the door to be opened. Such movement is necessary because during initial pivoting of the door its overall width will increase momentarily, due to alignment of the diagonal dimensions of the panels, and therefore something has to give because the free edge of the door was in engagement with the door jamb while the door was closed. As the door continues to open, its width decreases and the coil springs push the bearings and pivots back away from the adjacent side of the doorway. From then on, the door will merely pivot in the bearings as if they were rigidly mounted. The same general idea is shown in Patent 2,987,756, in which the lower pivot bearing can be adjusted to control the distance that it can be moved away from the side of the doorway.

It is among the objects of this invention to provide a folding door hinge assembly, in which the pivoted edge of the door is urged away from the adjacent side of the doorway by the bearing member itself without the use of an auxiliary spring, in which the bearing member does not slide back and forth with its pivot pin, in which the bearing member can be locked in various positions along its support, and in which the lower pivot pin can be moved laterally into and out of its bearing member.

In accordance with this invention, a door has pivot pins projecting from its top and bottom near one edge adjacent one side of the doorway. Beneath the lower pin there is a metal bracket that is formed for rigid mounting in the doorway with its outer end located at the adjacent side of the doorway. Mounted on this bracket there is a bearing member that is provided with a horizontal spring fork extending toward the inner end of the bracket and straddling the bottom pivot pin in engagement with it. The sides of the fork diverge toward the inner end of the bracket and have interior opposed shoulders facing the narrow end of the fork and defining with the interior surfaces of the fork a bearing opening rotatably receiving the pivot pin in a location spaced from the narrow end of the fork. The diverging sides of the fork will be moved away from each other by the pin when it is forced laterally from said opening toward the narrow end of the fork. Upon release of the lateral force against the pin, the tendency of the expanded fork to contract will force the pin back into the bearing opening. Preferably, the top of the bracket is provided with a series of transverse teeth engaged by a toothed cylindrical transverse member rotatably mounted in the bearing member above the

teeth. When this member is turned it will therefore adjust the bearing member along the bracket. A similar bearing member may be mounted in the track above the door for receiving the upper pivot pin. The invention is illustrated in the accompanying drawings, in which

FIG. 1 is a front view of a closed folding door;

FIG. 2 is an enlarged fragmentary front view of the door, but with a portion of the track broken away to show it in section;

FIG. 3 is a vertical cross section taken on the line III—III of FIG. 2;

FIG. 4 is a fragmentary vertical section taken on the line IV—IV of FIG. 3;

FIG. 5 is a horizontal section, taken on the line V—V of FIG. 4, showing the upper bearing;

FIG. 6 is a horizontal section, taken on the line VI—VI of FIG. 4, showing the lower bearing; and

FIG. 7 is a vertical cross section taken on the line VII—VII of FIG. 4.

Referring to FIGS. 1 and 2 of the drawings, a folding door is shown that is formed from two rigid panels **1** and **2** hinged together by any suitable form of hinges **3** secured to their backs. The panels may be rather thick, in the neighborhood of an inch, for example. Screwed into the top and bottom of panel **1** near its outer edge are upwardly and downwardly extending pivot pins **4** and **5** that project into bearing members **6** and **7**, respectively, mounted in the door frame **8**. The opposite or free edge of the door has an upwardly extending hanger or guide member **9** that is slidable back and forth in a horizontal channel-shape track **10** secured to the top of the doorway along the top of the closed door. While the door is closed, its free edge engages or nearly touches the adjoining side or jamb of the doorway. Its opposite or pivoted edge, however, is spaced a short distance from the adjacent door jamb. This space may be concealed by a molding strip **11** secured to the jamb. When the door is opened by pulling on a knob **12** or the like, or by pushing on its opposite side, the guide member **9** will move along the track and compel the door to fold in a well-known manner.

Just as the door starts to fold, it increases in width for a moment, but its pivoted edge can move towards the adjacent side of the doorway to allow this temporary increase in width to take place. For this purpose, the pivot pins **4** and **5** on which the door turns are movable in their bearings toward and away from the adjacent door jamb. The upper bearing member **6** preferably is molded from a synthetic plastic, such as nylon, and is mounted inside of track **10**. The body **14** of the bearing member is at its outer end portion near the end of the track and is provided with a threaded central vertical opening **15** through it, as shown in FIG. 4. A set screw **16** extends up through the opening and presses against the top of the track. By tightening the screw, the bearing member body is pressed down against the lower flanges of the track and thereby is locked in place.

Extending inward from the body **14** of the bearing member is a horizontal spring fork **17**, the outer end of which is joined to the body by means of integral curved arms **18** as shown in FIG. 5. The fork straddles the upper pivot pin and engages it. It also diverges toward the inner end of the bearing member, and the inner surfaces of its opposite sides are provided with opposed curved shoulders **19** that face the narrow end of the fork. These shoulders, along with the adjoining interior surfaces of the fork, form the side walls of a bearing opening **20**, in which the upper end of the pivot pin can rotate. Extending inwardly along the track from the wide end of the fork is a pair of substantially parallel fork extensions **21**, the inner ends of which serve as a stop for

guide member **9**, shown in dotted lines in FIGS. 4 and 5, to prevent the door panels from being folded flat against each other. This prevents binding of the door when it starts to close.

The bearing opening **20** is spaced some distance from the narrow end of the fork. Consequently, when lateral pressure against pivot pin **4** urges it toward the adjacent side of the doorway, due to the door starting to open, the pin can and will be pushed sideways from the bearing opening toward the narrow end of the fork. This action will move or spring the opposite sides of the fork away from each other, but upon release of the lateral pressure against the pin the tendency of the expanded fork to contract to its original size will cause its diverging pin-engaging surfaces to force the pin back toward the wide end of the fork until it reenters the bearing opening and engages shoulders **19** again. It will therefore be seen that the fork serves not only as a bearing, but also as a spring for returning the pivot pin to its bearing opening after lateral movement away from it. Nevertheless, the entire bearing member is made in one piece and does not slide back and forth in the track with the pivot pin after the bearing member has once been adjusted to correct position.

The bearing member **7** that receives lower pivot pin **5** is mounted on a supporting L-shape metal bracket **25**. As shown in FIGS. 4 and 7, the upright portion of the bracket is fastened to the door jamb by means of screws **26** extending through vertical slots **27** so that the bracket can be adjusted vertically. Adjustment is effected, while the screws are loose, by turning a boss **28** projecting eccentrically from a circular cam **29** rotatably mounted in an oval recess **30** in the outer side of the bracket. The cam has a pin **31** opposite the boss rotatably mounted in a hole **32** drilled in the door jamb. When the boss is turned by a screwdriver or wrench, the cam pushes the bracket up or down, the slot **33** for the boss permitting this.

Like the upper bearing member **6**, this one likewise may be molded from a synthetic plastic, such as nylon, and it has a body **35** surrounding the horizontal portion of the bracket and snugly engaging it. However, the bearing member can be moved lengthwise of its support support for adjustment purposes when desired. To lock the bearing member on the bracket, a cylindrical element, preferably in the form of a bolt **36**, extends transversely through the bearing body near its outer end and is rotatable therein. A nut **37** is screwed on one end of the bolt. The body of the bearing member adjacent the bottom of the bolt is cut away to permit the body of the bolt to engage the underlying area of the bracket. This area of the bracket is provided with a series of parallel teeth **38** extending across its central portion and engaged by circumferentially spaced teeth **39** on the body of the bolt. When the nut is loose, the bolt can be turned by a screwdriver to cause the registering teeth to adjust the bearing member in or out on the bracket. When the bearing member has been adjusted into the correct position in this manner, the nut is tightened against it to clamp it tightly against the opposite edges of the bracket in order to hold the bearing member in place.

As shown in FIG. 6, the bearing member **7** is provided with a horizontal spring fork **41** that extends from a point adjacent the inner side of the bolt toward the inner end of the bracket. The outer end of the fork is joined to the body of the bracket near opposite ends of the bolt by means of integral curved arms **42**. The fork straddles the lower pivot pin **5** and engages it. It also diverges toward the inner end of the bracket, preferably at a 10° angle, and the inner surfaces of its opposite sides are provided with opposed curved shoulders **43** that face the narrow end of the fork. These shoulders, along with the adjoining interior surfaces of the fork, form the side walls of a bearing opening **44** in which the lower end

of the pivot pin can rotate. This opening is spaced from the narrow end of the fork so that the pin can be pushed sideways out of the bearing opening toward the narrow end of the fork. Since this will move the opposite sides of the fork away from each other, the tendency of the expanded fork to contract to its original size will cause its diverging pin-engaging surfaces to force the pin back toward the wide end of the fork again when the side pressure on the pin is released. The fork therefore serves both as a bearing and as a spring. The pressure of the fork against the pin can be increased by tightening nut **37** still further, which will reduce the space between arms **42**.

Preferably, the top of bearing body **35** beneath the fork is provided with a recess **46** so that the fork can directly engage the underlying portion of the bracket. Also, since it is desirable that the fork support the door, the pivot pin **5** is encircled by an integral circular thrust collar **47** engaging the bottom of the door. This collar rests on top of the fork, normally around bearing opening **44**. The fork shoulders **43** normally will prevent the pin from being accidentally removed from the wide end of the fork, but as an additional precaution the wide end of the fork may be provided on top with a pair of vertical projections **48** that will be engaged by the side of the thrust collar to prevent it from being moved laterally out of the fork. In order to remove the pivot pin from the fork, when that is desired, all that it is necessary to do is to lift the door slightly so that thrust collar **47** will clear projections **48**, and then pull the lower pivot pin sideways out of the wide end of the fork, after which the tilted door can be lowered enough to withdraw the upper pivot pin from the upper bearing member.

Of course, this invention is not limited to use with two-panel folding doors, or to a single folding door in a given doorway.

We claim:

1. A folding door hinge assembly adapted to be mounted in a doorway, comprising a vertical pivot pin adapted to project from a door near one edge adjacent one side of the doorway, a bearing member provided with a horizontal spring fork straddling said pin in engagement therewith, means for rigidly mounting the bearing member in the doorway with its outer end located at said side of the doorway, said fork extending toward the inner end of the bearing member and having sides diverging toward said inner end, the fork sides having interior opposed shoulders facing the narrow end of the fork and defining with adjoining interior surfaces of the fork a bearing opening rotatably receiving the pivot pin in a location spaced from said narrow end, and said diverging fork sides being movable away from each other by said pin when it is forced laterally from said opening toward said narrow end, whereby upon release of said lateral force from the pin the tendency of the expanded fork to contract will force the pin back into said bearing opening.

2. A folding door hinge assembly according to claim 1, in which the wide end of the fork is provided with a pair of substantially parallel extensions forming a door stop.

3. A folding door hinge assembly adapted to be mounted in a track at the top of a doorway, comprising a vertical pivot pin adapted to project from the top of a door near one edge adjacent one side of the doorway and up into the track, a bearing member adapted to be disposed in the track with its outer end adjacent the end of the track, said member being provided with an inwardly extending horizontal spring fork straddling said pin in engagement therewith, the outer end portion of the bearing member being provided with a threaded vertical opening therethrough, a set screw in said opening adapted to be pressed against the top of the track to hold the bearing member in place, the sides of the fork diverging toward the inner end of the bearing member and having interior

opposed shoulders facing the narrow end of the fork and defining with adjoining interior surfaces of the fork a bearing opening rotatably receiving the pivot pin in a location spaced from said narrow end, and said diverging fork sides being movable away from each other by said pin when it is forced laterally from said opening toward said narrow end, whereby upon release of said lateral force from the pin the tendency of the expanded fork to contract will force the pin back into said bearing opening.

4. A folding door hinge ascsembly adapted to be mounted in a doorway, the assembly comprising a vertical pivot pin adapted to project from the bottom of a door near one edge adjacent one side of the doorway, a metal bracket beneath said pin formed for rigid mounting in the doorway with its outer end located at said side of the doorway, and a bearing member mounted on said bracket and provided with a horizontal spring fork extending toward the inner end of the bracket and straddling said pin in engagement therewith, the sides of the fork diverging toward said inner end of the bracket and having interior opposed shoulders facing the narrow end of the fork and defining with adjoining interior surfaces of the fork a bearing opening rotatably receiving the pivot pin in a location spaced from said narrow end, and said diverging fork sides being movable away from each other by said pin when it is forced laterally from said opening toward said narrow end, whereby upon release of said lateral force from the pin the tendency of the expanded fork to contract will force the pin back into said bearing opening.

5. A hinge assembly according to claim 1, in which the pivot pin is encircled by a circular thrust collar resting on top of the fork, and the top of the fork is provided with vertical projections between its wide end and said shoulders substantially engaging the side of said collar to prevent accidental removal of the pin laterally from the fork.

6. A hinge assembly according to claim 1, in which the top of said bracket is provided with a series of transverse teeth, said assembly including a cylindrical transverse member rotatably mounted in said bearing member above said teeth, said rotatable member having circumferentially spaced teeth registering with said bracket teeth, whereby when the rotatable member is turned it will adjust the bearing member along said bracket, and means for locking the rotatable member against rotation.

7. A hinge assembly according to claim 6, in which said rotatable member is in the form of a bolt, and said locking means is a nut screwed on one end of the bolt and tightly against said bearing member.

8. A folding door hinge assembly adapted to be mounted in a doorway, the assembly comprising a vertical pivot pin adapted to project from the bottom of a door near one edge adjacent one side of the doorway, a rectangular metal bracket beneath said pin formed for rigid mounting in the doorway with its outer end located at said side of the doorway, a bearing member provided with a body engaging the bottom and opposite side edges of said bracket and extending across the top of the bracket near said outer end, and means rigidly connecting the bearing member to said bracket, said bearing member including a horizontal spring fork engaging the top of said bracket and straddling said pin in engagement therewith, the fork being connected at one end to said body and extending toward the inner end of the support, the sides of the fork diverging toward said inner end of the bracket and having interior opposed shoulders facing the narrow end of the fork and defining with adjoining interior surfaces of the fork a bearing opening rotatably receiving the pivot pin in a location spaced from said narrow end, and said diverging fork sides being movable away from each other by said pin when it is forced laterally from said opening toward said narrow end, whereby upon release of said lateral force from the pin the tendency of the expanded fork to contract will force the pin back into said bearing opening.

9. A folding door hinge assembly adapted to be mounted in a doorway, the assembly comprising a vertical pivot pin adapted to project from the bottom of a door near one edge adjacent one side of the doorway, a rectangular metal bracket beneath said pin formed for rigid mounting in the doorway with its outer end located at said side of the doorway, a bearing member provided with a body surrounding said bracket and slidable lengthwise thereon, and a cylindrical transverse member rotatably mounted in said body above said bracket near its outer end, the top of the bracket beneath said rotatable member being provided with a series of transverse teeth, said rotatable member having circumferentially spaced teeth projecting therefrom and registering with said bracket teeth for adjusting said body along the bracket, said bearing member including a horizontal spring fork straddling said pin in engagement therewith and connected at one end by arms to said body near said rotatable member, the fork extending toward the inner end of the bracket and having sides diverging toward that end, said sides having interior opposed shoulders facing the narrow end of the fork and defining with adjoining interior surfaces of said sides a bearing opening rotatably receiving the pivot pin in a location spaced from said narrow end, and said diverging fork sides being movable away from each other by said pin when it is forced laterally from said opening toward said narrow end, whereby upon release of said lateral force from the pin the tendency of the expanded fork to contract will force the pin back into said bearing opening.

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