

Feb. 8, 1966

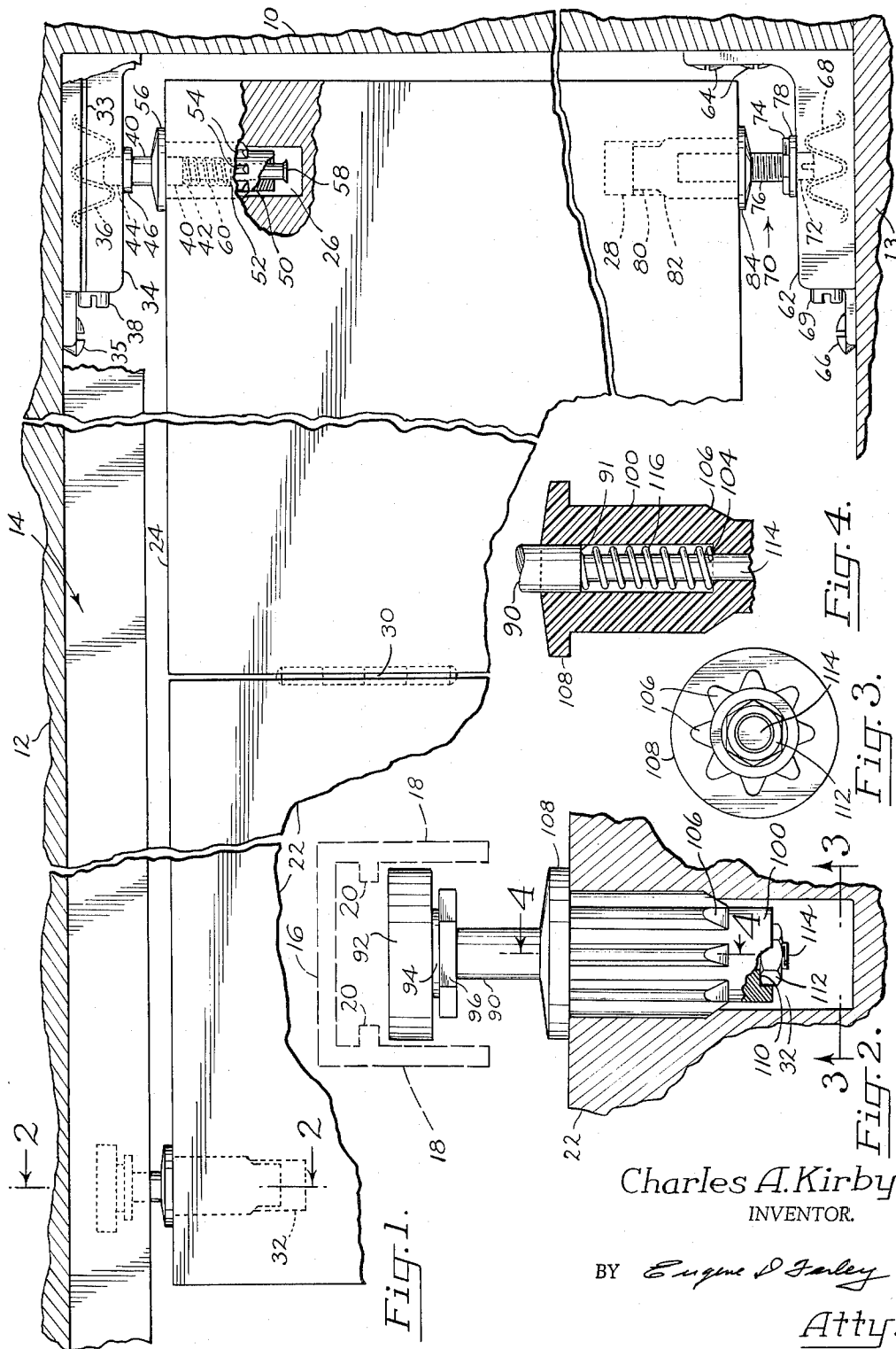
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FOLDING DOOR ASSEMBLY AND MOUNTING UNITS THEREFOR

Filed July 30, 1962

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

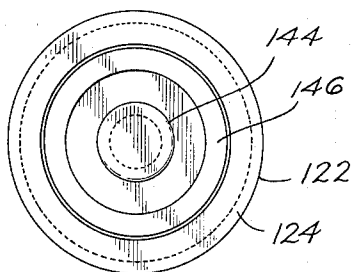


Fig. 6.

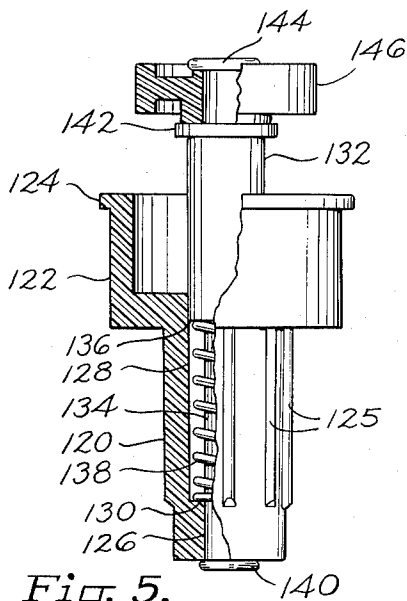


Fig. 5.

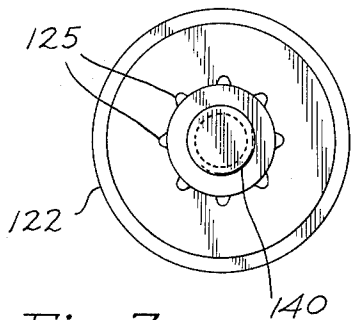


Fig. 7.

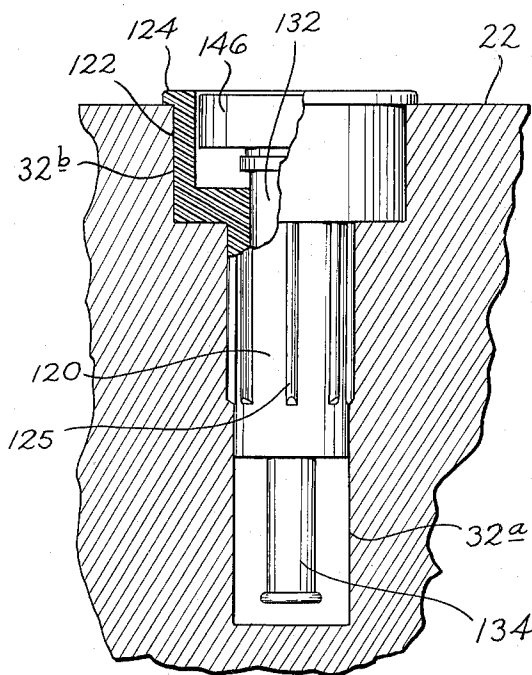


Fig. 8.

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FOLDING DOOR ASSEMBLY AND MOUNTING UNITS THEREFOR

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3 Claims. (Cl. 160-206)

This invention relates to folding door assemblies of the class comprising a plurality of vertically arranged panels hinged together and pivotally supported in a doorway, and to mounting units therefor.

It is the general object of this invention to provide a folding door assembly which is fast and easy to install; which is adjustable in both horizontal and vertical directions without demounting, initially and during use; which operates smoothly, easily and quietly; and which is removable at will, either partially or entirely, from the doorway at any time without disassembly.

It is a further object of the invention to provide mounting units for such a folding door assembly, which mounting units are easily installed, concealed and readily accessible for adjustment when required.

The manner in which the foregoing and other objects of the present invention are accomplished will be apparent from the accompanying specification and claims considered together with the drawings, wherein:

FIG. 1 is a fragmentary view, partly in section, illustrating the herein described folding door assembly and the manner of mounting it in a door opening;

FIG. 2 is a detail view in elevation, partly in section, taken along line 2-2 of FIG. 1, illustrating in detail a first embodiment of a traveling upper mounting unit of the herein described folding door assembly;

FIG. 3 is a bottom plan view of the mounting unit of FIG. 2, looking upwardly in the direction of the arrows of line 3-3;

FIG. 4 is a detail longitudinal sectional view taken along line 4-4 of FIG. 2;

FIG. 5 is a detail view in elevation, partly in section, illustrating a second embodiment of the traveling upper mounting unit;

FIG. 6 is a top plan view of the mounting unit of FIG. 5;

FIG. 7 is a bottom plan view thereof; and

FIG. 8 is an elevational view, partly in section, showing the embodiment of FIG. 5 mounted in a door.

The folding door assembly of my invention is adapted to be mounted in a doorway comprising a side jamb 10 and a headpiece 12 located over a floor 13. A track, indicated generally at 14, is fastened to the head piece longitudinally thereof.

Although the track may assume a diversity of configurations, depending upon the door guiding means employed, it is illustrated herein in the cross sectional form indicated in FIG. 2 and including a base 16, a pair of side walls 18 and a pair of track shoulders or ribs 20 projecting inwardly toward each other one from each of the side walls. These do not support the door, but shield the guiding assembly thereof from scraping against the heads of screws by which the track is fastened to the headpiece.

The door itself comprises a plurality of vertically arranged panels, there being two such panels indicated at 22, 24 in the presently described embodiment. The inner

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panel 24, i.e. the panel next to jamb 10, is provided with an upper recess 26 opening out into its inner top surface, and a substantially aligned lower recess 28 opening into its inner bottom surface. Outer panel 22, i.e. the panel farthest removed from jamb 10, is hinged edge to edge in folding relationship to inner panel 24 by suitable hinge means such as pin hinges 30. It is provided with a recess 32 opening out into its outer top surface.

Recesses 26, 28 and 32 afford means for securing to the door assembly a stationary upper mounting unit, a stationary lower mounting unit, and a traveling upper mounting unit respectively. These are described below in the indicated order.

The stationary upper mounting unit

The stationary upper mounting unit received in recess 26 operates in conjunction with suitable socket means which, in the illustrated form of the invention, comprise a conventional horizontally adjustable socket unit 34. This unit is wedged into the angle between jamb 10 and head piece 12, being retained there by screw 35. Socket unit 34 has side grooves 33 which receive the ribs 20 of the track 14 and is further securely anchored in place by such ribs.

Unit 34 houses a rotatably mounted worm 36 sized to accommodate a pivot pin in the space between its convolutions. An adjusting screw 38 is fixed to the outer end of the worm, with the result that horizontal adjustment of the socket is made possible by rotation of this screw, as will be more apparent hereinafter.

Cooperating with adjustable socket 34 is a stepped pivot pin 40, the stepped edge of which is indicated at 42. The outer end 44 of the pin is dimensioned, as explained above, to be received between the convolutions of worm 36, the lower surface of the socket being open or suitably slotted to receive such end 44 of the pin. An annular flange 46 is fixed to the pin or formed integrally therewith adjacent outer end 44. The outer surface of this flange serves as a thrust bearing, being in sliding engagement with the outer surface of the housing of socket element 34.

Pivot pin 40 is slidably received in a sleeve 50 having a longitudinal bore therethrough formed with an annular interior shoulder 52.

This sleeve is made of metal or a tough durable plastic such as "nylon," "Teflon" or other well known plastic. It is formed with longitudinal fluting 54 dimensioned for a press fit within recess 26. Also, it is formed with an annular flange 56 at its upper end, which overlies and seals off the opening of recess 26.

The inner end of pivot pin 40 is formed with a rivet head 58. This acts as a stop, limiting the outward travel of the pin.

Resilient means are provided for continuously urging the pivot pin to its extended position, thereby insuring retaining it in pivoting relation to socket unit 34. In the illustrated form of the invention, the resilient means employed comprises a compression spring 60 encircling the reduced portion of pivot pin 40 and interposed between shoulder 42 on the pin and shoulder 52 on the sleeve. The spring thus limits the inward travel of the pin.

The stationary lower mounting unit

This unit is mounted in recess 28 in the inner bottom surface of door panel 24. It cooperates with a socket assembly indicated generally at 62 and corresponding in

function and manner of operation to socket assembly 34 associated with the stationary upper mounting unit.

Thus it is wedged into the angle present between jamb 10 and floor 13, being secured by upper screws 64 and lower screws 66. It contains a rotatably mounted worm 68, the space between the whorls of which is adapted to receive the end of a pivot pin. A screw 69 is fixed to the worm, thus affording a means of horizontal adjustment of the socket.

The pivot pin cooperating with socket unit 62, indicated generally at 70, is provided with a slotted lower end 72, an integral adjustment nut 74, and a threaded shank segment 76. Thrust bearing means such as the self-lubricating plastic washer 73 preferably is interposed between nut 74 and the upper bearing surface of socket unit 62.

The threaded shank section 76 of the pivot pin is threaded into the longitudinal bore of a sleeve or insert 80. This member preferably also is formed integrally of one piece of plastic material and is provided with longitudinal fluting 82 dimensioned to provide a press fit against the side walls of recess 28. It is provided with an annular flange 84 which covers and seals off the opening of recess 28.

The traveling upper mounting unit

This unit is housed in recess 32 in the top surface of outer panel 22. It guides the leading edge of the panel, cooperating with track 14. A first embodiment of the upper mounting unit is illustrated in detail in FIGS. 2, 3 and 4.

As in the case of the stationary upper mounting unit, the traveling upper mounting unit of FIG. 2 includes a stepped pivot pin 90, the step of which is shown at 91 in FIG. 4. The upper end of the pivot pin carries a rotatably mounted horizontal guide wheel 92 made of self-lubricating plastic or other suitable material. This wheel tracks on the side walls 18 of track 14 and is prevented by shoulders 20 from contacting the heads of the screws mounting the track.

The wheel unit preferably includes a downwardly extending neck 94. Directly below neck 94 and fixed to, or formed integrally with, pin 90, is a nut 96 spaced from the underside of guide wheel 92.

Pivot pin 90 is slidably received in a sleeve 100 having a stepped longitudinal bore, the step of which is indicated at 104 in FIG. 4. Its exterior surface preferably is provided with spaced longitudinal flutings 106 dimensioned for a friction fit within recess 32, thereby locating the sleeve.

At the upper end of sleeve 100 there is an integral annular flange 108 which covers and seals off recess 32. At the lower end of the sleeve there is a recess 110 which opens out into recess 32 in which the unit is mounted.

Adjustable stop means are provided for adjusting the extent of outward upper extension of pin 90. Such means comprise a nut 112 threaded onto the terminal segment 114 of the pin. Nut 112 is received in recess 110 and preferably the recess corresponds in shape to the shape of the nut to lock it against rotation when thus received.

Resilient means preferably are present for maintaining pin 90 normally in its extended position, with nut 112 firmly seated in recess 110.

As shown in FIG. 4, the resilient means preferably comprises a compression spring 116, coiled about the reduced segment of pin 90 and bearing against shoulder 91 of the latter and shoulder 104 of sleeve 100. Inward travel of the pin thus is restricted by the presence of the spring itself.

Operation

The operation of the herein described folding door assembly, and the individual mounting units thereof thus far described, is as follows:

First, track 14 is located on head piece 12, upper socket 34 in the angle between head piece 12 and jamb 10, and

lower socket unit 62 in the angle between jamb 10 and floor 13.

The assembly including pivot pin 40 then is pressed into recess 26; that including pivot pin 70, into recess 28; and that including pivot pin 90, into recess 32; using in each case fluted sleeves 50, 80 and 100, respectively, to locate and secure the pivot pin assemblies within the recesses.

The door panels are elevated, guide wheel 92 placed in track 14 and pivot pin segment 44 placed in the selected convolution of the worm contained in socket unit 34. Upward pressure then will elevate the door against the resilient force of spring 60 in pivot pin unit 40 and of spring 116 in pivot pin unit 90, sufficiently that the pivoting end 72 of pivot pin 70 can be inserted in the selected convolution of worm 68 contained in socket unit 62. The door thus may be mounted quickly and, by reversing the above sequence, demounted easily whenever desired.

In the event that either horizontal or vertical adjustment is required to mount the door assembly in the first instance, or to compensate for developed irregularities in the doorway through structure settling, occurring during the service life of the door, various adjustments can be made.

Thus, vertical adjustment may be made in the first instance by screwing pivot pin 70 into threaded sleeve 80 using slotted head 72. During use of the door, the same vertical adjustment may be made by adjustment of nut 74 with a suitably sized wrench.

Similarly, vertical adjustment of the traveling end of the door may be accomplished by adjustment of nut 96 on pin 90. This is made possible by the fact that adjustment nut 112 is anchored in recess 110 by the resilient force of spring 116, locking the pin against rotation.

Suitable horizontal adjustment also may be made, either in the first instance or as a running adjustment during use of the door. This is accomplished merely by adjusting one or the other, or both, of screws 38, 69 associated with worms 36, 68, respectively, of the socket units in which the upper and lower stationary pivot pins are mounted.

FIGS. 5-8 illustrate a second embodiment of the traveling upper mounting unit. In this embodiment, there is employed a sleeve 120 having an enlarged upper socket portion 122. This unit is adapted to be mounted in a recess 32a in the top surface of panel 22 and such recess has a counterbored portion 32b for receiving the enlarged socket portion 122. The sleeve 120 has a top flange 124 adapted to seat on the top edge of the panel 22 and has longitudinal flutings 125 dimensioned for a friction fit within recess 32a.

As best apparent in FIG. 5, sleeve 120 has a bottom bore 126 and a counterbored portion 128, a shoulder 130 being formed between these bore portions. Slidably received in the sleeve 120 is a pin 132 having a lower shank portion 134 which is reduced in diameter to form an upper shoulder portion 136. Mounted on the pin 132 and confined between the upper shoulder 136 of the pin and the lower shoulder 130 in the sleeve is a compression spring 138 urging the pin 132 to an upper or outwardly extended limit position, FIG. 5. The bottom end of the pin has a rivet head 140 which limits outward movement of the pin.

Carried on the outer or upper end of the pin 132 between a lower flange 142 and a top rivet head or swaged portion 144 is a guide wheel 146 which, similar to the wheel 92 of the FIG. 2 embodiment, is adapted for engagement in track 14.

In this latter embodiment, the wheel 146 is adapted to be depressed into the socket portion 122 for moving this end of the door into and out of engagement with the track 14. Since the wheel is movable to a plane below the top edge of the door, it is apparent that only a small clearance between the top of the door and the track is necessary, i.e., a clearance only a little greater than the thickness of flange 124. Thus, in installing or removing

the door, or for disconnecting the traveling end of the door for cleaning or the like, the pin 132 and wheel 146 are depressed so that the latter will clear the bottom edge of the track.

Thus it is apparent that by the present invention, I have provided a folding door assembly, and mounting units therefor, which are easily mounted in doorways of diverse shapes and sizes, which are fast and easy to install, and which enable easy running adjustment, both horizontal and vertical, of the door without demounting the same.

Furthermore, the mounting units are almost completely concealed and operate to make possible removing and reinstalling of the door whenever desired, as when cleaning the area closed off by the door, laying carpet underneath the door, etc.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described by invention, I claim:

1. For use with track means in an upper mounting unit at a doorway header for the upper end of an outer door panel of a folding assembly, a traveling upper mounting unit comprising:

- (a) a stepped pivot pin having an outer end,
- (b) a sleeve adapted for frictional retention in a recess in the door panel extending downward from the upper end of the latter inward of the outer vertical edge thereof and freely receiving the pivot pin therethrough for axial rotation and longitudinal sliding movement,
- (c) the sleeve having an inner shoulder spaced from and facing the step of the pivot pin,
- (d) an adjustable stop nut threaded onto the inner end of the pin and seated against rotation in a recess in the inner end of the sleeve, and an adjusting nut fixed to the exposed outer end portion of the pin for rotating the latter relative to the stop nut for adjusting the pin vertically relative to the sleeve and door panel,
- (e) resilient means positioned between the sleeve shoulder and pivot pin step for urging the pivot pin to its limit of movement in the direction of its outer end, and
- (f) door guide means pivoted to the outer end of the pin and adapted for traveling engagement with the track means.

2. The traveling upper mounting unit of claim 1, wherein the door guide means comprises a wheel rotatable on a vertical axis, and the unit includes an enlarged upper socket portion on said sleeve adapted to be mounted in a door panel recess below the top surface of the door panel, the socket portion being dimensioned and arranged to receive the wheel therein at the limit of inward movement of the pivot pin against the resistance of the resilient means.

3. A folding door assembly adapted for mounting in a doorway defined by a head piece, a side jamb and a floor, said assembly comprising:

- (a) a track adapted to be fastened longitudinally to the head piece;
- (b) a plurality of vertically hinged together door panels arranged in folding relation to each other;
- (c) a stationary upper mounting unit including
 - (1) first pivot means mounted on the top surface of the innermost door panel and including
 - (a) a stepped pivot pin having an outer end,
 - (b) a sleeve adapted for frictional retention in a recess in the innermost door panel extending downward from the upper end of the latter inward of the inner vertical edge thereof and freely receiving the pivot pin

therethrough for longitudinal sliding movement,

- (c) the sleeve having an interior shoulder spaced from and facing the step of the pivot pin,
 - (d) stop means on the inner end of the pivot pin for engagement with the sleeve, thereby limiting movement of the pivot pin in the direction of its outer end, and
 - (e) resilient means positioned between the sleeve shoulder and pivot pin step for urging the pivot pin to its limit of movement in the direction of its outer end,
- (2) first socket means mounted on the head piece above the first pivot means and including
- (a) a base member having an elongated guide slot therein adapted to freely receive therein the outer end of the pivot pin of the first pivot means, the guide slot being arranged substantially parallel to the plane of the doorway, and
 - (b) a worm mounted for rotation in the base member on an axis parallel to the guide slot and communicating with the latter and receiving the outer end of the pivot pin pivotally between adjacent ones of its convolutions, whereby adjustable rotation of the worm effects movement of the pivot pin along the guide slot;
- (d) a stationary lower mounting unit including
- (1) second pivot means mounted on the bottom surface of the innermost panel, substantially aligned with the first pivot means,
 - (2) second socket means mounted on the floor below the second pivot means and including
 - (a) a base member having an elongated guide slot therein adapted to freely receive the second pivot means therein, the guide slot being arranged substantially parallel to the plane of the doorway, and
 - (b) a worm mounted for rotation in the base member on an axis parallel to the guide slot and communicating with the latter and receiving the second pivot means pivotally between adjacent ones of its convolutions, whereby adjustable rotation of the worm effects movement of the pivot means along the guide slot; and
- (e) a traveling upper mounting unit including
- (1) a stepped pivot pin having an outer end,
 - (2) a sleeve adapted for frictional retention in a recess in the outer door panel extending downward from the upper end of the latter inward of the outer vertical edge thereof and freely receiving the pivot pin therethrough for longitudinal sliding movement,
 - (3) the sleeve having an interior shoulder spaced from and facing the step of the pivot pin,
 - (4) an adjustable stop nut threaded onto the inner end of the pin and seated against rotation in a recess in the inner end of the sleeve, and an adjusting nut fixed to the exposed outer end portion of the pin for rotating the latter relative to the stop nut for adjusting the pin vertically relative to the sleeve and door panel,
 - (5) resilient means positioned between the sleeve shoulder and pivot pin step for urging the pivot pin to its limit of movement in the direction of its outer end, and
 - (6) door guide means pivoted to the outer end of the pivot pin for rolling engagement with the track.

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