Sept. 18, 1962 R. BRYDOLF 3,054,447

FOLDING DOOR HARDWARE

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FIG. 1.

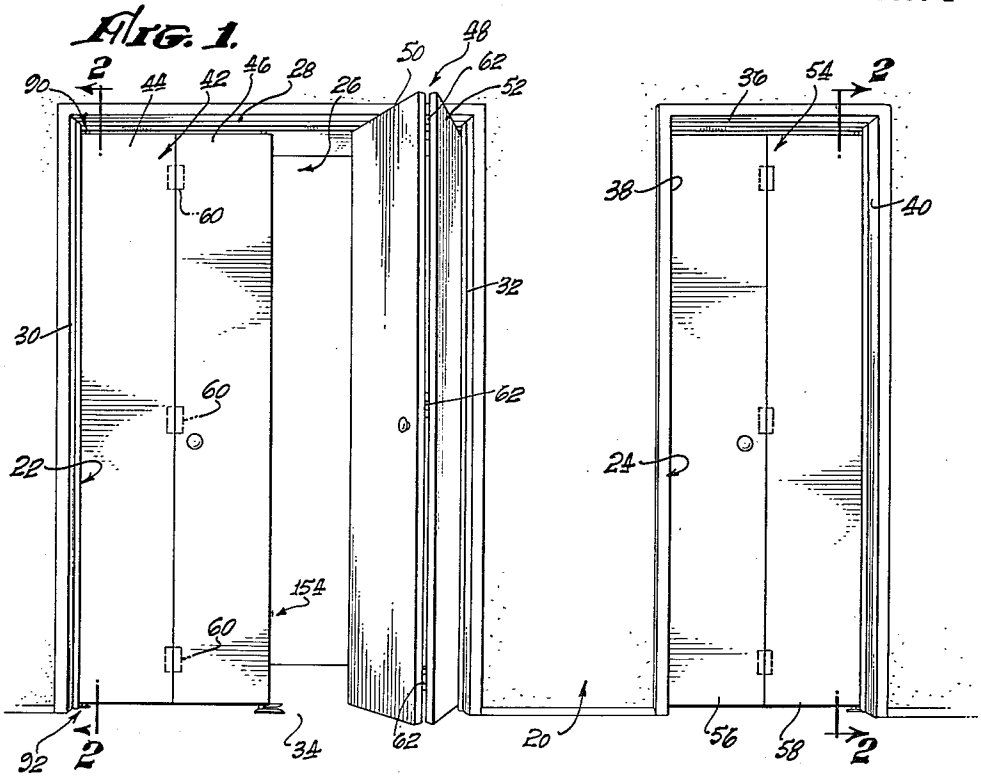


FIG. 11.

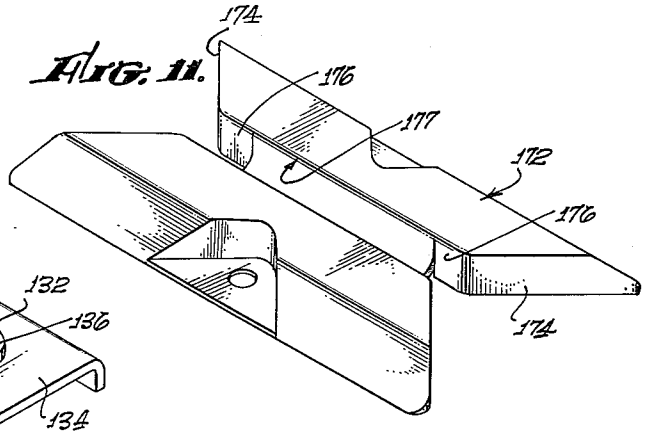
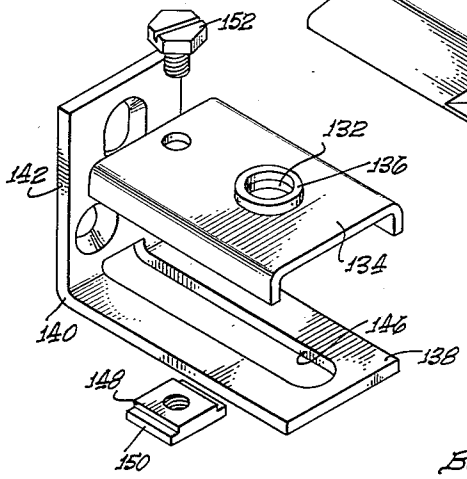


FIG. 6.



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FIG. 2.

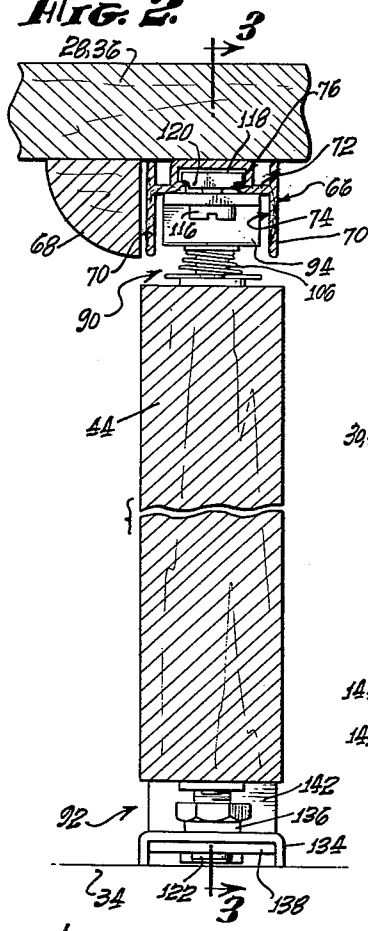


FIG. 3.

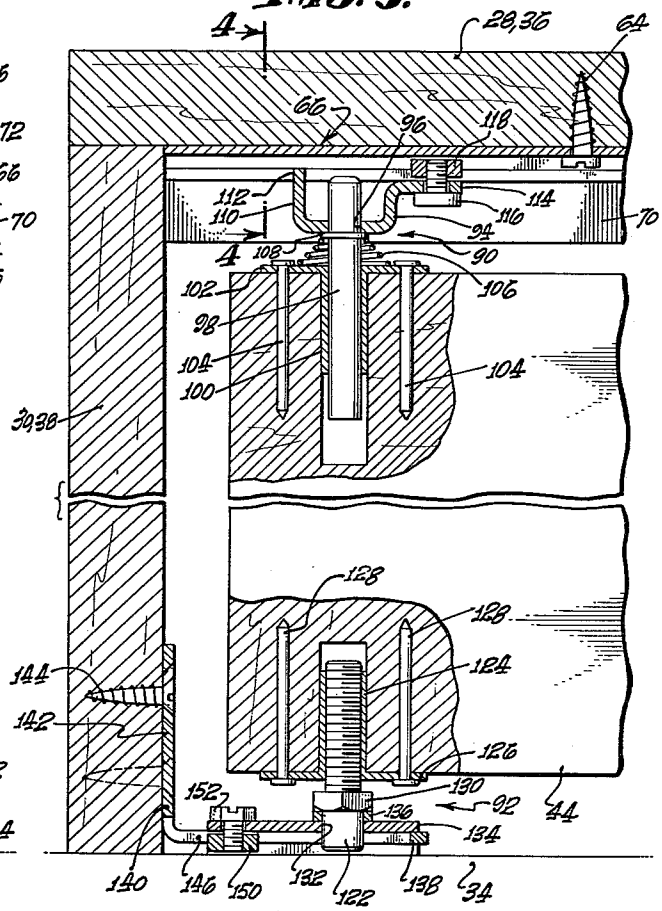


FIG. 4.

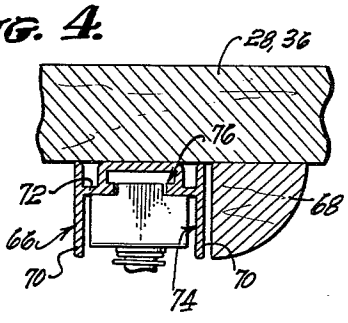
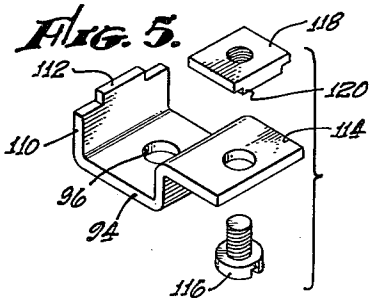


FIG. 5.



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FIG. 7.

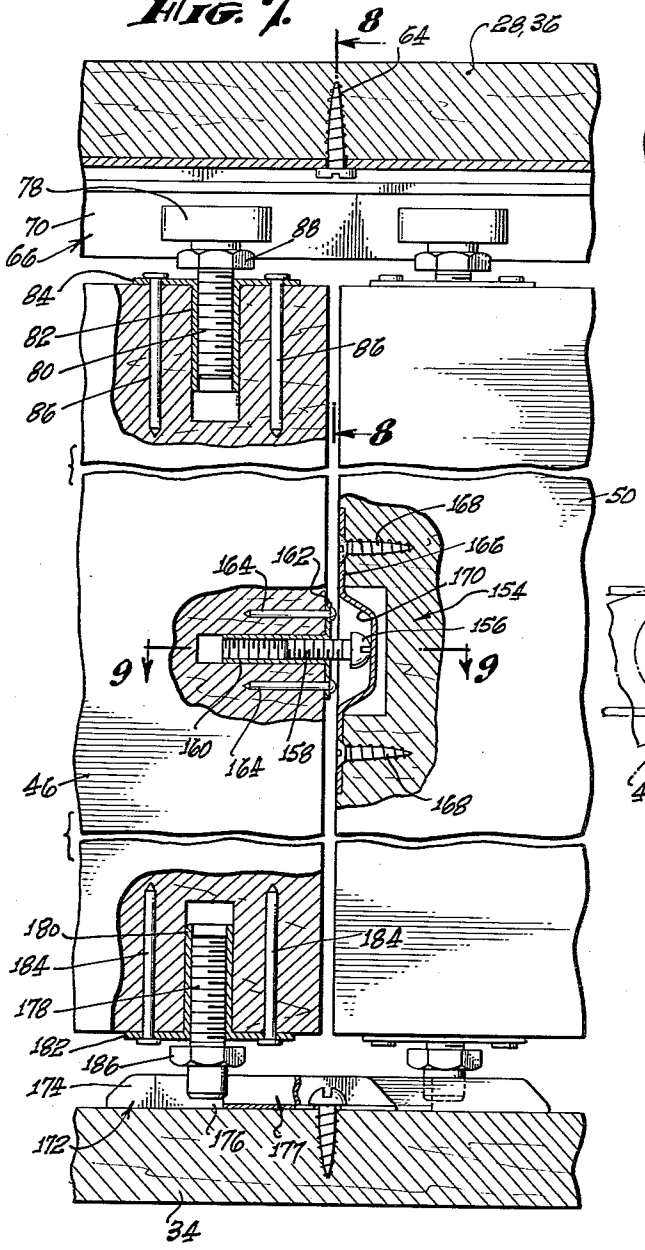


FIG. 8.

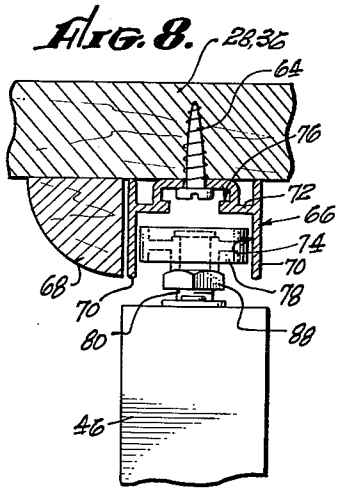


FIG. 9.

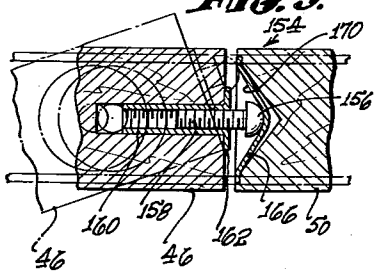
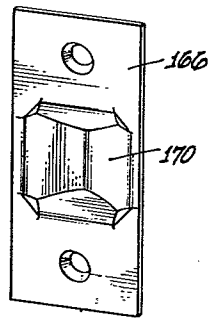


FIG. 10.



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3,054,447

FOLDING DOOR HARDWARE

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Filed Dec. 27, 1957, Ser. No. 705,707
8 Claims. (Cl. 160—206)

The present invention relates in general to folding doors and, more particularly, to hardware for a folding door assembly which includes a pair of doors foldable to one side of a doorway, or two pairs of doors respectively foldable to opposite sides of the doorway.

A general object of the invention is to provide hardware for mounting such a folding door assembly which is substantially completely concealed so that the hardware does not detract from the appearance of the doors themselves.

The invention contemplates, and an object thereof is to provide, hardware for a folding door assembly which includes: an overhead track member or track means spanning the doorway and carried by the supporting structure in which the doorway is formed, which supporting structure may be a wall of a house or other building; a pair of doors adapted to at least partially span the doorway and adapted to be folded to one side thereof; upper and lower pivot pins carried by the upper and lower ends of one of the doors adjacent one of its vertical edges; upper and lower pivot sockets respectively engaging the upper and lower pivot pins and carried by the supporting structure; a guide carried by the upper end of the other door adjacent one of its vertical edges and engaging the track member; and hinge means pivotally interconnecting the other vertical edges of the two doors. With this construction, when the doors are in a closed position, they are in alignment and the axis of the pivot pins, the axis of the hinge means and the axis of the guide are all at least substantially in alignment. When the doors are in an open position, they are folded against each other at one side of the doorway with the axis of the hinge means laterally offset from the axis of the pivot pins and the guide.

An important object of the invention is to provide means for adjusting the positions of either the pivot sockets or the pivot pins in a direction spanning the doorway so that the horizontal positions of the doors in the doorway can be adjusted readily. More particularly, an important object is to make the pivot sockets ajustable relative to the supporting structure in a direction spanning the doorway so that the positions of the doors relative to the doorway may be adjusted readily after hanging of the doors merely by adjusting the positions of the pivot sockets laterally of the doorway.

Another object is to provide hardware by means of which the doors may be adjusted vertically relative to the doorway after hanging.

Another object is to provide a track means or track member which includes primary and secondary tracks, the primary track receiving the guide hereinbefore mentioned, and the secondary track slidably receiving the upper pivot socket, which may be locked in any desired position along the secondary track for adjustment purposes by a locking means thereon. With this construction, there is no necessity for accurately locating a hole in the track member in a position to receive the upper pivot pin, which is necessary in accordance with many prior practices. With the present invention, it is merely necessary to insert the upper pivot pin in the pivot socket slidably carried by the secondary track, and then lock the upper pivot socket relative to the track member after sliding the upper pivot socket into the proper position, which is an important feature of the invention.

Another object is to provide hardware wherein the lower pivot socket is slidable in a direction spanning the doorway relative to a guide member attached to the supporting structure, means being provided for locking the lower pivot socket relative to such guide member. With this construction, the position of the lower pivot socket transversely of the doorway may also be adjusted readily after hanging of the doors in a manner similar to that in which the upper pivot socket is adjusted, thereby avoiding any necessity for accurately locating the position of the lower pivot socket in advance of installation of the doors.

Another object is to provide hardware wherein the upper and lower pivot pins and the guide, which engages the primary track, are vertically adjustable relative to the doors after hanging of the doors.

A further object is to provide hardware having spring means for biasing the upper pivot pin into engagement with the upper pivot socket, whereby the upper pivot pin may be disengaged from the upper pivot socket readily by merely compressing such spring means. With this construction, the doors may be removed readily without removing any of the mounting hardware, which is an important feature.

Another object of the invention is to provide a folding door assembly wherein the axis of the hinge means is offset laterally from the central vertical planes of the doors and wherein the axis of the pivot pins and the axis of the guide are located in the central vertical planes of the respective doors, the axis of the hinge means moving across a plane containing the axis of the pivot pins and the axis of the guide as the doors are closed. With this construction, the door assembly constitutes a toggle wherein the axis of the hinge means moves over center as the doors are closed, thereby holding the doors in the closed position.

Another important object of the invention is to provide a guide element mounted on the supporting structure at the bottom of the doorway, e.g., on the floor beneath the doorway, and having therein a generally triangular notch to receive an element at the lower end of the lead doors, i.e., the door which carries the guide at the upper end thereof, when such door is closed, thereby positively guiding the lead door into its closed position. Another object in this connection is to provide the guide element mentioned with a substantially parallel-sided channel communicating with the apex of the generally triangular notch and adapted to receive the element at the bottom of the lead door. With this construction, the generally triangular notch guides the element at the lower end of the door in question into the generally parallel-sided channel, the walls of the latter accurately aligning the door in its closed position.

Another object of importance is to provide a door aligner for the lead door which includes a convex aligning element projecting from the leading vertical edge of the lead door and engageable with the walls of a concave cavity in an aligning socket, this aligning socket either being carried by the supporting structure, or being carried by the leading vertical edge of the lead door of the other of the two pairs of doors utilized to close the doorway.

Another object is to provide such a door aligner which includes a mount for the aligning element into which the aligning element is threaded. With this construction, the position of the aligning element relative to the leading vertical edge of the lead door may be adjusted to obtain proper engagement of the aligning element with the walls of the concave cavity in the aligning socket.

The foregoing objects, advantages, features and results of the present invention, together with various other objects, advantages, features and results thereof which will be apparent to those skilled in the folding door art in the

light of this disclosure, may be attained with the exemplary embodiments of the invention described in detail hereinafter and illustrated in the accompanying drawings, in which:

FIG. 1 is a perspective view illustrating two folding door installations of the invention in a single wall for convenience, one comprising two pairs of folding doors and the other a single pair;

FIG. 2 is an enlarged, fragmentary sectional view taken along either of the arrowed lines 2—2 of FIG. 1;

FIG. 3 is a view, partially in section and partially in elevation, taken along the arrowed line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken along the arrowed line 4—4 of FIG. 3;

FIG. 5 is a perspective view of an upper adjustable pivot socket of the invention;

FIG. 6 is a perspective view of a lower adjustable pivot socket of the invention;

FIG. 7 is a view, partially in section and partially in elevation, showing the two pairs of folding doors of the left hand folding door installation of FIG. 1 in closed position;

FIGS. 8 and 9 are fragmentary sectional views taken along the arrowed lines 8—8 and 9—9, respectively of FIG. 7;

FIG. 10 is a perspective view of an aligning socket of the invention; and

FIG. 11 is a perspective view of a guide element of the invention.

Referring particularly to FIG. 1 of the drawings, illustrated therein is a wall structure 20 provided with doorways 22 and 24 therethrough, the doorway 22 being shown as the doorway into a closet 26, although the invention is not limited to such a doorway. The doorway is bounded by a header 28, jambs 30 and 32 and a floor 34. Similarly, the doorway 24 is defined by a header 36, jambs 38 and 40 and the floor 34.

The doorway 22 is adapted to be closed by a pair 42 of doors 44 and 46 and a pair 48 of doors 50 and 52. The doorway 24 is adapted to be closed by a pair 54 of doors 56 and 58. The door pairs 42 and 54 are identical, except that one is a mirror image of the other, and the door pair 48 is similar to the door pairs 42 and 54, all three door pairs 42, 48 and 54 being identically hung. Consequently, the description which follows will be restricted largely to the door pair 42 as a matter of convenience.

Considering the door pair 42, the doors 44 and 46 of this pair are hinged together along adjacent vertical edges thereof by a hinge means which includes aligned hinges 60. The hinge axis provided by the hinges 60 is offset laterally from the central vertical planes of the doors 44 and 46 and is located behind such doors, as suggested by the dotted-line showing of the hinges 60 in FIG. 1 of the drawings. The showing of hinges 62 in FIG. 1 between the doors 50 and 52 of the door pair 48 also illustrates this rearward offset of the hinge axis from the vertical central planes of the doors. The reason for this hinge-axis offset will be considered hereinafter.

As shown in FIGS. 2, 3, 4, 7 and 8 of the drawings, spanning the doorway 22 and secured to the header 28 thereof, as by screws 64, is a track means or track member 66 concealed by a quarter round 68. The track member 66 has the general cross-sectional configuration of an I-beam and includes flanges 70 interconnected by a web 72. The flanges 70 and the web 72 cooperate to provide a downwardly-facing, channel-shaped primary track 74, while the web 72 is formed to provide a downwardly-facing, C-shaped, secondary track 76 above the primary track.

The door 46 of the door pair 42, sometimes referred to herein as the lead door of this pair, is provided at its upper end, and adjacent the vertical edge thereof opposite the edge to which the hinges 60 are connected, with a guide 78, FIGS. 7 and 8, in the form of a roller which extends into the primary track 74 and which is engageable with the flanges 70 of the track member 66. The guide roller 78 is rotatably mounted on a stud 80 which is threaded into a tubular insert 82 set into the upper end of the door 46. The insert 82 is provided with a flange 84 through which nails 86, or other fasteners, extend into the door 46 to secure the insert to such door. The stud 80 is provided with a hexagonal collar 88 by means of which the stud may be rotated relative to the tubular insert 82 to adjust the position of the guide roller 78 vertically relative to the primary track 74 after the doors 44 and 46 are hung.

Referring to FIGS. 2 to 6 of the drawings, the door 44 of the pair 42 is pivotally connected to the wall structure 20 adjacent the vertical edge of the door 44 opposite the vertical edge thereof which is connected to the door 46 by the hinges 60. Upper and lower pivot assemblies 90 and 92 are provided to pivotally connect the door 44 to the wall structure 20.

Considering the upper pivot assembly 90 with reference to FIGS. 2 to 5 of the drawings, it includes a pivot socket or socket member 94 having therethrough an opening 96 which receives a pivot pin 98 carried by the door 44. The pivot pin 98 extends into and is slidable in a tubular insert 100 set into the upper end of the door 44, this insert having a flange 102 secured by nails 104, or other fasteners. A compression spring 106 seated against the flange 102 and against a collar 108 on the pivot pin 98 biases this pivot pin into the opening 96 in the pivot socket 94. As will be explained hereinafter, the spring 106 may be compressed, in response to upward movement of the door pair 42 to permit disengagement of parts of the lower pivot assembly 92, whereupon the pivot pin 98 may be withdrawn from the opening 96 and the guide roller 78 may be withdrawn from the primary track 74 to permit removal of the door pair 42.

The pivot socket 94 is provided with a flange 110 which slidably seats against the under side of the web 72 of the track member 66 and which has thereon a tab 112 slidably fitting into the mouth of the downwardly-facing, C-shaped secondary track 76. The pivot socket 94 is provided with another flange 114 through which a screw 116 extends into a rectangular nut 118 within the secondary track 76. The nut 118 has a rectangular projection 120 which fits into the mouth of the downwardly-facing, C-shaped secondary track 76. Thus, the nut 118 is prevented from rotating as the screw 116 is rotated.

With the foregoing construction, the pivot socket 94 may slide along the track member 66, the nut 118, which forms part of the pivot socket, sliding in the secondary track 76. In adjusting the doors 44 and 46 relative to the doorway 22 after hanging the doors, the pivot socket 94 is moved along the track member 66 until the pivot axis is the correct distance from the jamb 30, whereupon the screw 116 is tightened to lock the pivot socket 94 in the correct position, the screw 116 and the nut 118 serving as a locking means for locking the pivot socket 94 in such position.

Considering the lower pivot assembly 92, it includes a lower pivot pin 122 which is threaded into a tubular insert 124 set into the lower end of the door 44, the insert 124 having a flange 126 secured by nails 128, or other fasteners. The pivot pin 122 is provided with a hexagonal collar 130 thereon by means of which this pivot pin may be rotated relative to the threaded insert 124 to adjust the position of the door pair 44 vertically relative to the doorway 22.

The pivot pin 122 extends downwardly into a hole 132 in a lower pivot socket or socket member 134, the hole 132 being encircled by a thrust ring 136 on which the collar 130 on the pivot pin 122 is seated to carry the weight of the door pair 42. As best shown in FIGS. 3 and 6, the pivot socket 134 has the shape of an inverted channel which fits over a flange 138 of an angle-shaped bracket or guide member 140, this bracket having

a flange 142 secured to the jamb 30 of the doorway 32 by screws 144. The flange 138 of the bracket 140 is provided therein with a slot 146 which extends in a direction spanning the doorway, and this slot receives a rectangular projection 148 on a nut 150 underlying the flange 138. A screw 152 extends through the pivot socket 134 and is threaded into the nut 150.

With this construction of the lower pivot assembly 92, the screw 152 is initially loose, whereby the pivot socket 134 may slide back and forth along the flange 138 of the bracket 140 to space the pivot axis of the door 44 the correct distance from the jamb 30, this adjustment being made after the doors 44 and 46 are hung. With the correct pivot axis established, the screw 152 is tightened to lock the pivot socket 134 in the desired position, the nut 150 and the screw 152 serving as a locking means corresponding to that provided by the screw 116 and the nut 118 of the upper pivot assembly 90.

It will be noted that the pivot pin 122 extends into the pivot socket 134 a relatively short distance, this distance being less than the extent to which the spring 106 associated with the pivot pin 98 may be compressed. Consequently, if removal of the door pair 42 after hanging is desired for any reason, this may be accomplished readily by lifting upwardly thereon to withdraw the pivot pin 122 from the hole 132 in the pivot socket 134, this being permitted by the spring 106. Thereafter, the door pair 42 is moved downwardly, at the same time swinging the lower end thereof outwardly, to withdraw the pivot pin 98 from the opening 96 in the pivot socket 94 and to withdraw the guide roller 78 from the primary track 74. The door pair 42 may be reinstalled merely by reversing this process.

An important feature of the construction described is that all of the adjustments, both horizontal and vertical, necessary to properly align the door pair 42 with the doorway 22 may be made after the doors 44 and 46 are hung. In other words, after hanging, the pivot sockets 94 and 134 are adjusted in a direction spanning the doorway to locate the pivot axis for the door 44 in the proper position, and the stud 80 and the pivot pin 122 are adjusted vertically to properly locate the guide roller 78 relative to the primary track 74 and to properly locate the doors 44 and 46 vertically relative to the doorway 22.

The pivot pins 98 and 122 are located with their common axis substantially in the vertical central plane of the door 44 and the stud 80 for the guide roller 78 is located with its axis substantially in the vertical central plane of the door 46, while, as hereinbefore pointed out, the common axis of the hinges 60 is offset relative to the vertical central planes of the doors 44 and 46. Consequently, as the guide roller 78 moves along the primary track 74 in moving the doors 44 and 46 to a closed position, wherein they are aligned, the axis of the hinges 60 moves across a plane containing the axis of the pivot pins 98 and 122 and the axis of the guide-roller stud 80. Thus, this construction constitutes a toggle joint which moves over center as the doors 44 and 46 are closed, thereby holding the doors in their closed position.

Referring to FIGS. 7, 9 and 10 of the drawings, illustrated therein is an aligner or aligning means 154 for aligning the lead door 46 of the pair 42 with the lead door 50 of the pair 48. A similar aligner is utilized in conjunction with the door pair 54, except that it aligns the lead door 56 with the jamb 38 since only one pair of doors is utilized in the doorway 24.

Considering the aligner 154, it includes a convex aligning element 156 having, in the particular construction illustrated, the form of the head of a screw 158 threaded into a tubular insert 160 set in the leading vertical edge of the door 46. This insert is provided with a flange 162 which is secured by means of nails 164, or the like. The aligner 154 also includes an aligning socket 166 attached to the leading vertical edge of the lead door 50 by screws 168, or the like. The aligning socket 166 is provided with a concave, generally pyramidal cavity 170 therein.

As best shown in FIG. 9 of the drawings, as the doors 44 and 46 are closed after closing of the doors 50 and 52, the aligning element 156 enters the cavity 170, the convergent walls of the cavity 170 acting on the aligning element 156 as the latter approaches the deepest portion of the cavity to properly align all of the doors 44, 46, 50 and 52. A similar action occurs when the aligner 154 is utilized in conjunction with the door 56 and the jamb 38. As will be apparent, by rotating the aligning element 156, it may be moved inwardly or outwardly relative to the leading vertical edge of the lead door 46 to insure proper engagement with the convergent walls of the cavity 170 and proper entry into the apex of this cavity.

Referring to FIGS. 7 and 11, illustrated therein is an aligner 172 which may be utilized alternatively, or concurrently, with the aligner 154. The aligner 172 is adapted to be mounted on the floor 34 below the meeting point of the vertical leading edges of the lead doors 46 and 50, and is provided therein with oppositely facing, generally triangular notches 174. In the construction shown, the apices of the notches 174 terminate in substantially parallel-sided recesses 176 shown as connected by a channel or groove 177 which is a continuation of the recesses. The lower end of the lead door 46 is provided adjacent the leading vertical edge thereof with a stud 178 threaded into a tubular insert 180 set into the lower end of such door and provided with a flange 182 secured by nails 184, or the like. The stud 178 is provided with a hexagonal collar 186 for vertical adjustment purposes. The lower end of the lead door 50 of the pair 48 is similarly equipped with a stud like the stud 178.

Considering the operation of the aligner 172, as the doors 44 and 46 are moved to their closed position, the lower end of the stud 178 first enters one of the notches 174, the walls of such notch guiding the stud to the apex thereof and thence into the corresponding recess 176. Depending on the location of the stud 178 relative to the adjacent vertical edge of the door 46, the stud may or may not pass through the corresponding recess 176 into the channel 177. The widths of the recesses 176 and the channel 177 are only slightly greater than the diameter of the lower end of the stud 178 so that the aligner 172 accurately and rigidly positions the lower end of the door 46, the lower end of the door 50 being aligned in a similar manner.

For the purposes of the door pair 54, an aligner, not shown, constituting, in effect, one-half of the aligner 172 may be utilized. In other words, such aligner includes one of the notches 174 and a portion of the channel 176, or one of the notches 174 alone.

Although exemplary embodiments of the invention have been disclosed herein for purposes of illustration, it will be understood that various changes, modifications and substitutions may be incorporated in such embodiments without departing from the spirit of the invention as defined by the claims which follow:

I claim as my invention:

1. A folding door overhead track member to be secured in a door opening and including parallel primary and secondary tracks having portions which are common to each other, said primary track being generally channel-shaped in cross section and which includes a downwardly facing horizontal web surface with marginal depending flanges having oppositely facing vertical surfaces that cooperate with said downwardly facing horizontal web surface to form primary track guiding surfaces, said secondary track being generally C-shaped in cross section and which includes a top horizontal web with parallel depending sides terminating in oppositely disposed inturned horizontal flanges the marginal edges of which form a continuously extending mouth, said continuously extending mouth being of less width than the distance be-

tween said depending primary track flanges to provide said primary track downwardly facing horizontal web surface on the underside of said inturned horizontal flanges, said mouth interconnecting the interior of said primary and secondary tracks.

2. Hardware for a plurality of hingedly connected folding doors including: a track member as set forth in claim 1; a pivot socket having spaced sliding seats engaging said downwardly facing horizontal web surface of said primary track and a tab on one of said seats guided in said mouth of the secondary track, a nut supported by said inturned flanges of said secondary track and a screw having its stem pass through said second seat and into said nut to support and guide said pivot socket along said secondary track and to clamp and lock the same along said track at the correct position from the door jamb, an upper pivot pin mounted on one of said hinged doors to slidably move into said pivot socket, and a guide mountable on another of said hinged doors to extend between said marginal depending flanges of said primary track and engage said horizontal and vertical guide surfaces thereof.

3. Hardware for a plurality of hingedly connected folding doors including the structure as set forth in claim 2, a lower pivot pin mounted on said one of said hinged doors, a lower pivot assembly consisting of an angle bracket having a vertical leg with screw holes to attach the same to the door jamb and having a horizontal leg provided with a longitudinal slot extending toward and away from said vertical leg, a channel shaped pivot member having a web covering said horizontal leg and carrying a securing means opening and a pivot socket with an opening, said openings spaced from each other, marginal depending guide flanges on said pivot member to engage each longitudinal edge of said horizontal leg to slidably guide and center said securing means opening and said pivot socket opening over said slot in said horizontal leg when moving said pivot socket toward and away from said vertical leg, securing means including a nut below said horizontal leg and a screw having its stem passing through said securing means opening and said slot to engage said nut and clamp said pivot member to said horizontal leg and align said lower pivot pin with said upper pivot pin, said marginal guide flanges on said pivot member extending below said nut as a gauge to provide clearance between said nut and the door opening.

4. The structure of claim 3 characterized by means on said lower pivot pin to raise and lower said hingedly connected folding doors after assembly to trim the top of said doors relative to said primary track flanges.

5. The structure of claim 4 characterized by resilient means to extend said upper pivot pin upwardly into its pivot socket and to slidably support said upper pivot pin in its mounting in said one of said hinged doors to retain said upper pivot pin in said pivot socket regardless of the vertical position of said doors.

6. The structure of claim 3 characterized by said lower pivot pin has a collar to engage on said pivot socket and the depending portion of said lower pivot pin below said collar is stepped into said pivot socket opening to an extent less than the clearance between the top of the hinged doors and said overhead track to permit said hinged doors to be raised to unstep said lower pivot pin to remove said hinged doors from their adjusted pivot sockets.

7. Pivot assembly hardware for a plurality of hingedly connected folding doors, consisting of an angle bracket having a vertical leg with screw holes to attach the same to a door jamb and having a horizontal leg provided with a longitudinal slot extending toward and away from said vertical leg, a channel-shaped pivot member having a web covering said horizontal leg and carrying a securing means opening and a pivot socket with an opening, said openings spaced from each other, marginal depending guide flanges on said pivot member to engage each longitudinal edge of said horizontal leg to slidably guide and center said pivot socket opening and said securing means opening over said slot in said horizontal leg when moving said pivot socket toward and away from said vertical leg, and securing means including a nut below said horizontal leg and a screw having its stem passing through said securing means opening and said slot to engage said nut and clamp said pivot member to said horizontal leg at different positions therealong, said marginal guide flanges on said pivot member extending below said nut as a gauge to provide clearance between said nut and the door openings.

8. A hardware for a plurality of hingedly connected folding doors including an overhead track with spaced inturned flanges, a pivot socket having spaced seats for sliding engagement with a downwardly facing portion of said inturned flange, a tab on one of said seats to engage between said inturned flanges and guide said pivot socket therealong, a nut support by said inturned flanges, and a screw having its stem pass through said second seat and into said nut to support and guide said pivot socket along said inturned flanges, said nut and screw clamping said pivot socket along said track to properly position said pivot socket.

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