Dec. 8, 1964 R. O. JOHNSON 3,160,201

DOOR STRUCTURE

Filed Nov. 16, 1961 2 Sheets-Sheet 1

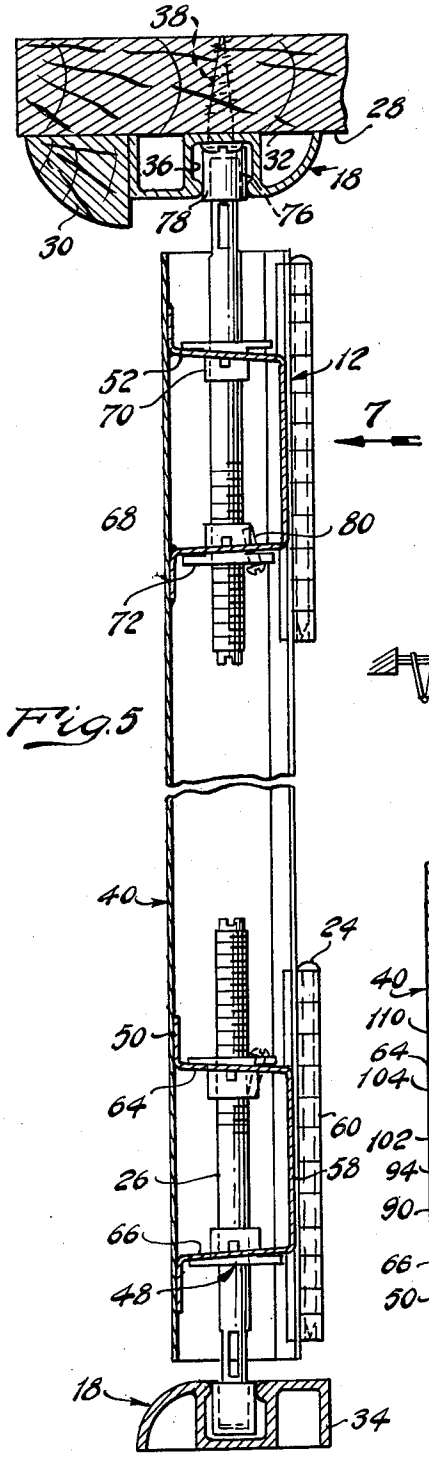

Fig. 5

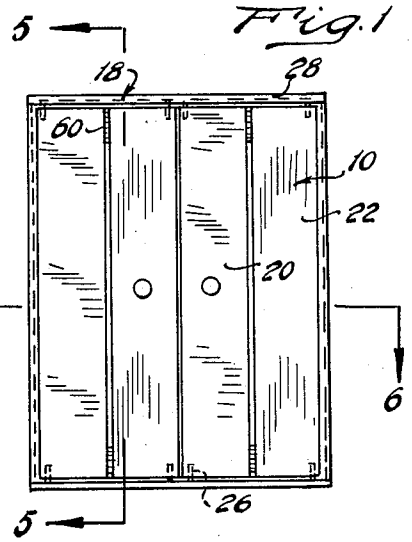

Fig. 1

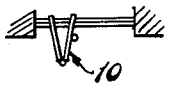

Fig. 2

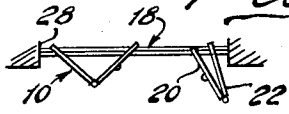

Fig. 3

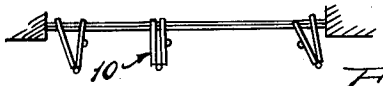

Fig. 4

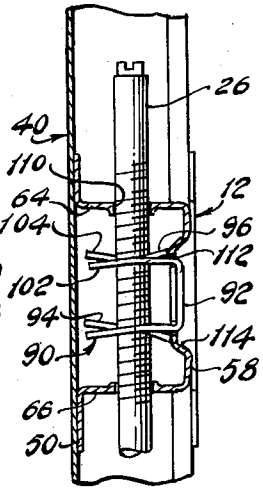

Fig. 9

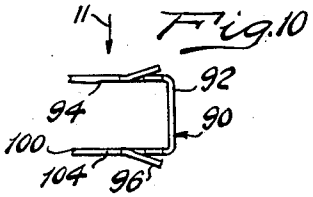

Fig. 10

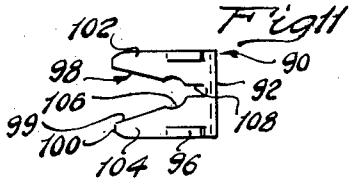

Fig. 11

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DOOR STRUCTURE

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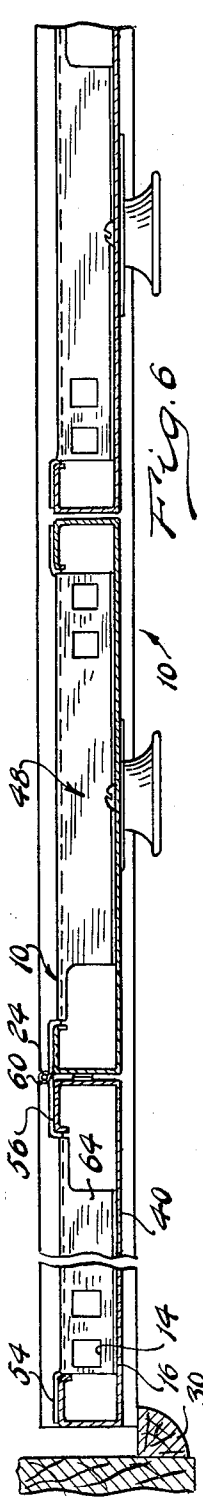

Fig. 6

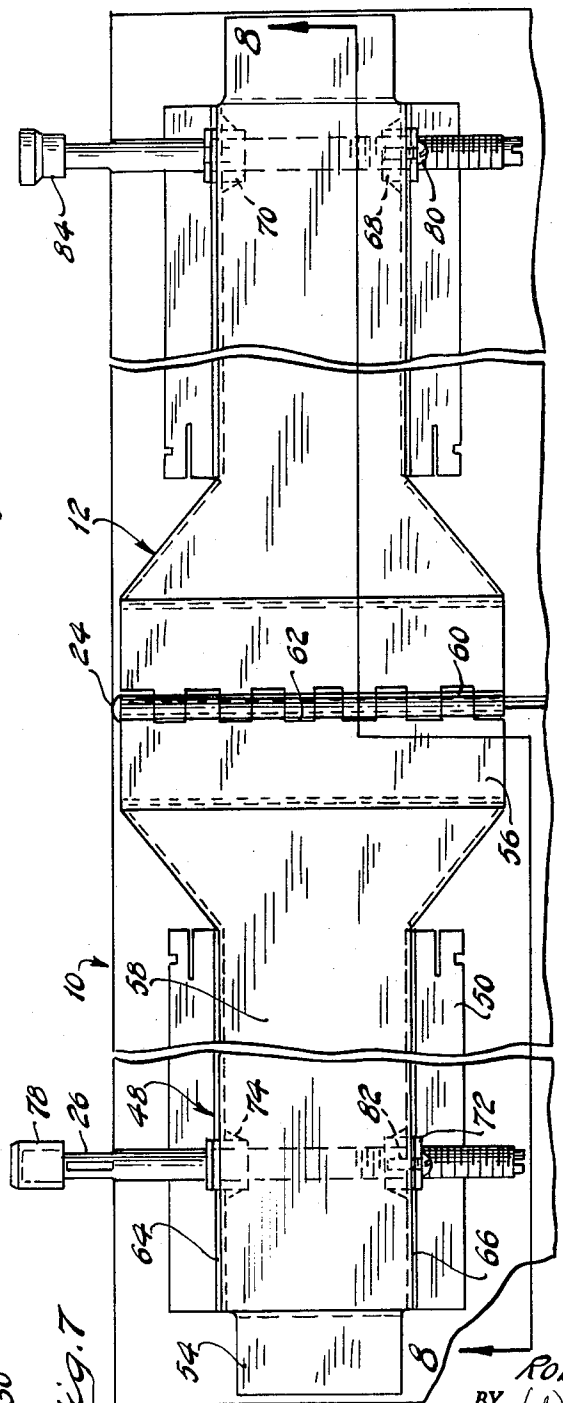

Fig. 7

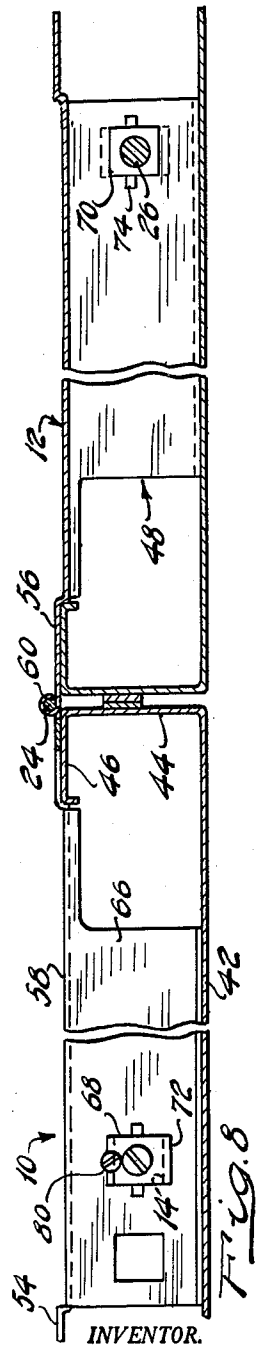

Fig. 8

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DOOR STRUCTURE

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8 Claims. (Cl. 160—206)

The present invention relates to doors and refers more specifically to folding closet doors or the like and a combination reinforcing member, leaf hinge and pivot mounting means therefor.

In the past, reinforcing frames or members, hinges and pivot mounting means for doors have usually been separate elements produced separately and later installed on doors to perform their indicated functions. The separate production and assembly of parts of doors such as hinges, reinforcing members and pivot mounting means is wasteful of time of skilled production and assembly personnel and in addition is wasteful of material. Doors produced by such methods are therefore more expensive than necessary and due to the many individual parts are more complicated and less reliable in use.

Further, in the past threaded collars and clamping means such as set screws or the like have been used to secure pivot means to the pivot mounting means of doors. These collars and clamping means require considerable time to manufacture and assemble whereby the cost of the installed doors is further increased.

It is therefore one of the objects of the present invention to provide an improved folding door or similar article.

Another object is to provide a door including a combination reinforcing and hinge member.

Another object is to provide a door including a combination reinforcing member and pivot mounting means.

Another object is to provide a door including a combination hinge and pivot mounting means.

Another object is to provide a door including a combination reinforcing frame member, hinge and pivot mounting means.

Another object is to provide a door as set forth above wherein the pivot mounting means are so positioned that bination reinforcing frame member, hinge and pivot mounting means.

Another object is to provide a pair of folding doors including a combination reinforcing member, hinge and pivot mounting means which pivot mounting means is so positioned that one leaf of a folding door is wider than the other between the hinge connection therebetween and the pivot mounting thereof to prevent both leaves of the folding door from assuming a position at ninety degrees to the track along which said pivot mounting means slides.

Another object is to provide a door including pivot means, pivot mounting means and a spring clip nut for securing the pivot means to the pivot mounting means in adjusted position.

Another object is to provide a spring clip nut comprising a U-shaped resilient member including a connecting portion and flat leg portions which leg portions have a recess therein extending from the free end thereof toward the connecting portion which recess includes inwardly converging sides terminating in a circular cut-out area and a slot on the connecting portion side of the circular cut-out area to permit bending of the parts of the leg portion formed by the recess in opposite directions transversely of the leg portions in alignment with the threads of a threaded member held within the circular cut-out area.

Another object is to provide a door which is simple in construction, economical to manufacture, and efficient in use.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is an elevational view of a pair of folding closet doors constructed in accordance with the invention.

FIGURES 2, 3 and 4 are plan views of one-half, one, and one and one-half unit folding closet doors respectively constructed in accordance with the invention and shown in various open positions.

FIGURE 5 is an enlarged, broken longitudinal section through the folding doors illustrated in FIGURE 1 taken substantially on the line 5—5 in FIGURE 1.

FIGURE 6 is an enlarged partial broken horizontal section through the doors illustrated in FIGURE 1 taken substantially on the line 6—6 in FIGURE 1.

FIGURE 7 is a broken view of the top portion of the doors illustrated in FIGURE 5 taken in the direction of arrow 7 in FIGURE 5.

FIGURE 8 is a broken longitudinal section through the doors illustrated in FIGURE 7 taken substantially on the line 8—8 in FIGURE 7.

FIGURE 9 is a partial longitudinal section through the folding doors illustrated in FIGURE 1 similar to a portion of that shown in FIGURE 5 and illustrating modified means for securing a pivot rod to the reinforcing frame member, hinge and pivot mounting means.

FIGURE 10 is a side view of a spring clip nut for use in securing the pivot rod to the reinforcing frame member, hinge and pivot mounting means as shown in FIGURE 9.

FIGURE 11 is a top view of the spring clip nut illustrated in FIGURE 10 taken in the direction of arrow 11 in FIGURE 10.

With particular reference to the figures of the drawings, one embodiment of the present invention will now be considered.

In accordance with the invention the folding doors 10 are provided with a combination reinforcing member, leaf hinge and pivot mounting means 12. Further, the combination reinforcing member, leaf hinge and pivot mounting means 12 is provided with spaced openings 14 in the end 16 thereof adapted to receive the pivot rods 26 for pivotal mounting of the doors 10 in the tracks 18, with one of the door leaves 20 and 22 of less width between the hinge pin 24 and the pivot rod 26 than the other door leaf whereby the wider door leaf is prevented from extending at ninety degrees to the track 18 and binding of the folding doors is prevented.

The folding doors of the invention are particularly simple in construction requiring only a single member to perform reinforcing, hinge and pivot mounting functions and are economical to produce inasmuch as separate manufacture and assembly of reinforcing members, hinges and pivot mounting means are not required. Additionally, the door structure as indicated is particularly efficient since the door leaves are completely interchangeable and either leaf may be installed to be of less width than the other between the pivot rod 26 and the hinge pin 24 to prevent binding of the doors in the open position.

More specifically, folding closet doors 10 are installed in an opening 28 in, for example, an interior building wall, not shown. If desired the opening 28 in which the folding doors 10 are installed may be provided with appropriate trim material such as the quarter round molding illustrated in FIGURES 5 and 6 at the top and both sides thereof.

Tracks 18, along which the pivot rods 26 of the folding doors 10 are guided in opening and closing the doors 10, are provided at the top 32 and bottom 34 of the opening 28 as best shown in FIGURE 5. The tracks

18 which extend horizontally are shaped as shown in cross section in FIGURE 5 to provide a recess 36 in which the pivot rod 26 of the door 10 is secured. The tracks 18 are secured in the opening 28 by convenient means such as the wood screws 38.

The individual door leaves 20 and 22 of the folding doors 10 each comprise a panel member 40 as shown best in FIGURES 6 and 8 having a substantially flat continuous planar portion 42, edge portions 44 extending at right angles thereto from both sides thereof, and flange members 46 depending from the edge portions 44 as shown best in FIGURE 8. The door leaves 20 and 22 also include a plurality of the combination reinforcing member, leaf hinge and pivot mounting means 12 spaced vertically therealong as shown best in FIGURE 5.

The combination reinforcing member, leaf hinge and pivot mounting means 12 comprises a U-shaped central portion 48 having flange portions 50 extending away from each other depending from the free ends 52 of the U-shaped central portion 48. The flanges 50 of the member 12 are secured to the planar portion of the panel 42 by convenient means such as spot welding along their length.

Additionally, the member 12 is provided with offset portions 54 and 56 extending from the connecting part 58 of the U-shaped portion 48 of the member 12. These offset portions 54 and 56 of the member 12 are secured to the flanges 46 of the panel by convenient means such as spot welding whereby the member 12 provides extremely rigid reinforcing to strengthen the panel members 42 and therefore prevent warping, bending or other deformation of the individual door leaves 20 and 22.

As best shown in FIGURE 7 the offset portion 56 of the member 12 is slotted and return folded to provide spaced cylindrical portions 60 along the outer edge 62 thereof adapted to interfit with mating cylindrical portions along the edge of a similar member 12 on an adjacent door leaf to provide door hinges in conjunction with the hinge pin 24 extending through the cylindrical portions 60. The member 12 thus serves to provide door hinges between the separate leaves 20 and 22 of a folding door 10.

Further, as will be noted from an inspection of FIGURE 6, the leg portions 64 and 66 of the U-shaped portion 48 of the member 12 are provided at the end 16 of the member 12 with the pair of longitudinally spaced openings 14 extending therethrough. The openings 14 provide mounting means for the pivot rods 26 whereby, if desired, the width of the individual leaves 20 and 22 of the doors 10 between the hinge pin 24 and the pivot rod 26 may be varied to prevent both leaves of a folding door 10 from assuming a ninety degree angle with respect to the track 18 on opening of the door whereby the door is prevented from binding in an open position.

The pivot rods 26 are secured in the openings 14 by means of the pivot nuts 68 and bushings 70. The pivot nuts 68 and bushings 70 are held in position by means of flanges 72 and struck out portions 74 thereof as shown best in FIGURE 7.

In assembly the pivot rods 26 are inserted through the bushings 70 and threaded through the nuts 68 and are adjusted so that the ends 76 thereof having bushings 78 thereon extend within the recesses 36. The pivot rods 26 are then fixed in the adjusted positions by the set screw 80 extending through the flange 72 of the nut 68, the side 66 of the U-shaped portion 48 of the member 12 and into engagement with the pivot rod 26 through the slot 82 in the nut 68.

As shown best in FIGURE 7, a special headed bushing 84 may be provided at the moving side of a folding door 10 while the bushing 78 is provided at the fixed side of the folding door.

Thus it will be seen that in accordance with the invention there is provided novel door structure which includes a combination reinforcing member, hinge and

pivot mounting means. The over-all structure of the door of the invention is simpler than prior door structures and less expensive to manufacture. In addition, as has previously been indicated, doors constructed in accordance with the invention are particularly efficient in operation since they include few parts which may require maintenance.

Further the doors are completely reversible both structurally and in their pivot mountings. Thus, any door leaf may be used as either the fixed or sliding leaf of sliding doors and either door leaf of a pair of sliding doors may be of less width than the other to prevent locking of the doors in open position.

The modification of the invention illustrated in FIGURE 9 provides a spring clip nut for securing the pivot rod 26 to the combination reinforcing member, hinge leaf and pivot mounting means 12 in place of the pivot nuts 68 and bushings 70 illustrated in FIGURE 5. The spring clip nut 90 is cheaper to manufacture than the many parts necessary for securing the pivot rod 26 in an adjusted position including the pivot nuts 68, bushings 70 and set screws 80 indicated. Further the spring clip nut 90 may be assembled much more quickly than the usual pivot nuts 68, bushings 70 and set screws 80.

As shown best in FIGURES 10 and 11 the spring clip nut 90 comprises a U-shaped member which may be stamped and bent from a single sheet of spring steel in the form illustrated. As shown the U-shaped member includes the connecting portion 92 and the leg portions 94 having the tab locks 96 formed therein. Each of the leg portions 94 includes a recess 98 extending from the free end 100 of the leg portions 94 toward the connecting portion 92 forming parts 102 and 104 on opposite sides thereof. The recesses 98 have sides converging toward the connecting portion 92 and terminating in a circular cut-out portion 106. Further a slot 108 is provided extending from the connecting portion side of the circular cut-out portion 106 toward the connecting portion 92 to permit bending of the parts 102 and 104 of the legs 94 in opposite directions transversely of the leg portions 94 to conform to the pitch of the threads of a threaded pivot rod 26 pisitioned within the circular cut-out portion 106 as best shown in FIGURE 9.

In assembly of the pivot rod 26 with the combination reinforcing member, hinge and pivot mounting means 12 as shown in FIGURE 9 the pivot rod 26 is inserted through the openings 110 in the leg portions 64 and 66 of the U-shaped portion 48 of the member 12 and adjusted to provide a desired door position. The leg portions 94 of the spring clip nut 90 are then inserted through a pair of parallel slots 112 provided in a recess 114 in the connecting part 58 of the U-shaped portion 48 of the member 12. As the leg portions 98 are inserted through the parallel slots 112 the pivot rod 26 is cammed along the converging sides 99 of the recess 98 and into the circular cut-out portion 106. During the camming operation the portions 102 and 104 of the spring clip nut are caused to bend slightly in opposite directions as shown in FIGURE 9 in accordance with the slope of the threads on the opposite sides of the pivot rod 26. The spring clip nut 90 is locked in position by the locking tabs 96.

The pivot rod 26 is thus held securely in an axial position and prevented from pivoting during normal operation of the door due to the friction between the threads of the pivot rod 26 and the sides of the circular cut-out portion 106 of the spring clip nut 90. The pivot rod 26 may however be adjusted axially by rotation of rod 26 due to the engagement of the periphery of the circular cut-out area 106 of the spring clip nut with the threads of the rod.

The drawings and foregoing specification constitute the description of the improved door structure in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. A folding door comprising a pair of door panels, threaded rod pivot means, combination reinforcing member, leaf hinge and pivot mounting means securing the panels together comprising an elongated U-shaped member including parallel leg portions having aligned openings therein through which the threaded rod pivot means extends and a connecting portion having parallel spaced apart slots therein extending transversely of the threaded rod pivot means, a guide secured adjacent one end of said panels in which the threaded rod pivot means is received and a spring clip nut securing the threaded rod pivot means to the reinforcing member, leaf hinge and pivot mounting means comprising a U-shaped member including substantially flat leg portions and a connecting portion, each of said leg portions of the spring clip nut having a recess therein extending from the free edge thereof toward the connecting portion, including a circular portion, converging sides terminating in the circular portion, and a slot extending from the circular portion toward the connecting portion, the leg portions of the spring clip nut extending through the slots in the reinforcing member, leaf hinge and pivot mounting means to engage the threaded rod pivot means within the circular portion of the recess.

2. A folding door for installation in a building opening comprising a pair of door panels having adjacent edges, each including an elongated flat connecting portion, longitudinally extending leg portions depending substantially perpendicularly from the opposite sides of the connecting portion in the same direction and longitudinally extending flanges depending from the leg portions toward each other in a plane parallel to the plane of the connecting portion and in spaced relation thereto, an elongated, integral, combination reinforcing member, leaf hinge and pivot mounting means secured to each of the door panels at the top and bottom thereof extending transversely of the panels and each including an elongated connecting portion, longitudinally extending leg portions depending from the edge of the connecting portion, longitudinally extending flanges depending from the leg portions in opposite directions in a plane parallel to the plane of the connecting portion and in spaced relation relative thereto, offset flanges depending from the connecting portions at the opposite ends thereof and extending in opposite directions in surface-to-surface engagement with and connected to the flanges of the panels and integral hinge means secured to the offset flange at the adjacent edges of the door panels for pivotally securing the panels together, a plurality of aligned openings in the leg portions of the combination reinforcing member, leaf hinge and pivot mounting means adjacent the other edges of the panels, guide means mounted in the building opening adjacent the top and bottom of the building panels, threaded pivot rods extending through the aligned openings in the combination reinforcing member, leaf hinge and pivot mounting means and into the guide means, a bushing inserted in the aligned openings in each of the combination reinforcing member, leaf hinge and pivot mounting means closest the end of the panel and a threaded nut secured in the other of the aligned openings in each of the combination reinforcing member, leaf hinge and pivot mounting means and a set screw extending through each nut and engaged with the associated pivot rod for securing the pivot rod in an adjusted position.

3. A folding door for installation in a building opening comprising a pair of door panels having adjacent edges, each including an elongated flat connecting portion, longitudinally extending leg portions depending substantially perpendicularly from the opposite sides of the connecting portion in the same direction and longitudinally extending flanges depending from the leg portions toward each other in a plane parallel to the plane of the connecting portion and in spaced relation thereto, an

elongated, integral, combination reinforcing member, leaf hinge and pivot mounting means secured to each of the door panels at the top and bottom thereof extending transversely of the panels and each including an elongated connecting portion, longitudinally extending leg portions depending from the edge of the connecting portion, longitudinally extending flanges depending from the leg portions in opposite directions in a plane parallel to the plane of the connecting portion and in spaced relation relative thereto, offset flanges depending from the connecting portions at the opposite ends thereof and extending in opposite directions in surface-to-surface engagement with and connected to the flanges of the panels and integral hinge means secured to the offset flange at the adjacent edges of the door panels for pivotally securing the panels together, a plurality of aligned openings in the leg portions of the combination reinforcing member, leaf hinge and pivot mounting means adjacent the other edges of the panels, guide means mounted in the building opening adjacent the top and bottom of the building panels, threaded pivot rods extending through the aligned openings in the combination reinforcing member, leaf hinge and pivot mounting means and into the guide means, and means for securing the pivot rods to the combination reinforcing member, leaf hinge and pivot mounting means including a pair of spaced apart parallel slots in the connecting portion of each of the combination reinforcing member, leaf hinge and pivot mounting means in vertical alignment with the aligned openings through the legs of the reinforcing member, leaf hinge and pivot mounting means and a spring clip nut comprising a U-shaped member having a connecting portion and leg portions extending through each pair of slots and engaging the respective pivot rods with recesses therein extending from the free end of the leg portions toward the connecting portion of the spring clip nut, the sides of which recesses converge toward the connecting portion of the clip, are provided with a circular portion gripping the pivot rods and terminate in a further portion extending toward the connecting portion, the two parts of each of the leg portions of the spring clip extending transversely in opposite directions.

4. Structure as set forth in claim 3 wherein the leg portions of the spring clip nut further include portions extending transversely thereof which diverge from the leg portions toward the connecting portion and terminate adjacent the connecting portion for securing the spring clip nut within the parallel slots.

5. A folding door having a fixed and a sliding side comprising a pair of door panels, a separate, integral combination reinforcing member, leaf hinge and pivot mounting means for securing the panels together at the top and bottom of the door each having a U-shaped cross section, a separate track secured adjacent the top and bottom of the door, a fixed pivot rod extending through the U-shaped cross section of the reinforcing member, leaf hinge and pivot mounting means at the top and bottom of the fixed side of the folding door, a sliding pivot rod extending through the U-shaped cross section of the reinforcing member, leaf hinge and pivot mounting means at the top and bottom of the sliding side of the folding door and means carried by and operable between each pivot rod and the respective combination reinforcing member, leaf hinge and pivot mounting means for securing the pivot rod in fixed axial positions with respect to the combination reinforcing member, leaf hinge and pivot mounting means associated therewith, comprising aligned openings in the combination reinforcing member, leaf hinge and pivot mounting means through which the rod extends, a bushing having an outwardly extending flange at one end thereof and a portion projecting from the sides thereof in spaced relation to the flange clamping the bushing in one of the openings and a set screw threaded into the bushing for engagement with the pivot rod extending therethrough.

6. A folding door having a fixed and a sliding side comprising a pair of door panels, a separate, integral combination reinforcing member, leaf hinge and pivot mounting means for securing the panels together at the top and bottom of the door each having a U-shaped cross section, a separate track secured adjacent the top and bottom of the door, a fixed pivot rod extending through the U-shaped cross section of the reinforcing member, leaf hinge and pivot mounting means at the top and bottom of the fixed side of the folding door, a sliding pivot rod extending through the U-shaped cross section of the reinforcing member, leaf hinge and pivot mounting means at the top and bottom of the sliding side of the folding door and means carried by and operable between each pivot rod and the respective combination reinforcing member, leaf hinge and pivot mounting means for securing the pivot rod in fixed axial positions with respect to the combination reinforcing member, leaf hinge and pivot mounting means associated therewith comprising aligned openings in the combination reinforcing member, leaf hinge and pivot mounting means through which the rod extends, spaced apart parallel slots in the reinforcing member, leaf hinge and pivot mounting means extending transversely of the rod extending through the aligned openings and a U-shaped spring clip nut including substantially flat leg portions and a connecting portion, each of said leg portions of the U-shaped member having a recess therein extending from the free edge thereof toward the connecting portion including a circular portion, converging sides terminating in the circular portion and a slot extending from the circular portion toward the connecting portion, the leg portions of the spring clip nut extending through the slots in the reinforcing member, leaf hinge and pivot mounting means to engage the rod within the circular portion of the recess therein.

7. A folding door comprising a pair of door panels, a pivot rod, reinforcing leaf hinge and pivot mounting means securing the panels together comprising an elongated U-shaped member including parallel leg portions having aligned openings therein through which the pivot rod extends and a connecting portion having parallel

spaced apart slots therein extending transversely of the pivot rod, a guide secured adjacent one end of said panels receiving the pivot rod and a spring clip nut securing said pivot rod to said reinforcing leaf hinge and pivot mounting means comprising a U-shaped member including substantially flat leg portions and a connecting portion, each of said leg portions of the spring clip nut having a recess therein extending from the free edge thereof toward the connecting portion, the leg portions of the spring clip nut extending through the slots in the reinforcing leaf hinge and pivot mounting means to engage the pivot rod within the recess in the leg portions.

8. A folding door comprising a pair of door panels, a threaded pivot rod, reinforcing leaf hinge and pivot mounting means securing the panels together comprising an elongated U-shaped structure including parallel leg portions having aligned openings therein through which the pivot rod extends and a connecting portion, a guide secured adjacent one end of said panels receiving said pivot rod, a bushing member inserted in one of the aligned openings in each of the reinforcing leaf hinge and pivot mounting means and a threaded nut member threadedly receiving the threaded pivot rod secured in the other of the aligned openings in each of the reinforcing leaf hinge and pivot mounting means and a set screw extending through one of the members and engaged with the associated pivot rod for securing the rod in an adjusted position.

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