

March 1, 1966

J. RUDNICK

3,237,239

HINGE STRUCTURE

Filed Aug. 30, 1963

2 Sheets-Sheet 1

FIG. 1

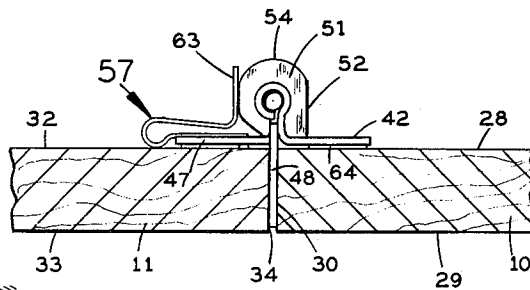
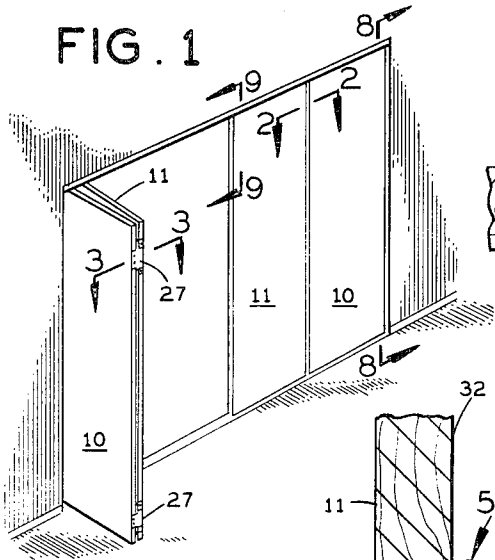


FIG. 2

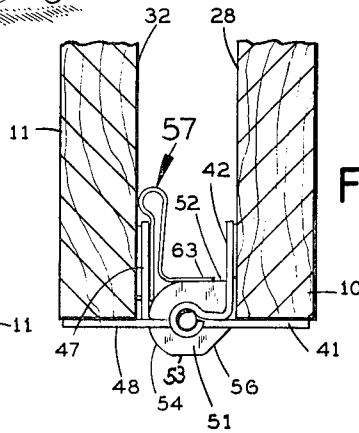


FIG. 3

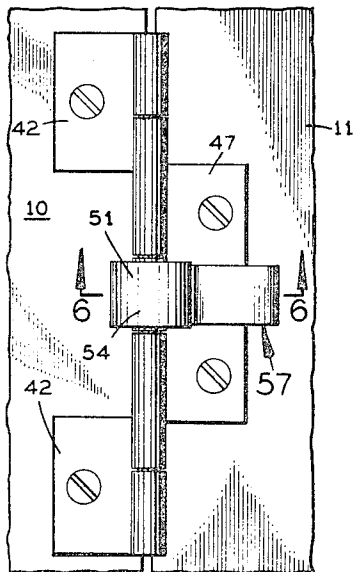


FIG. 4

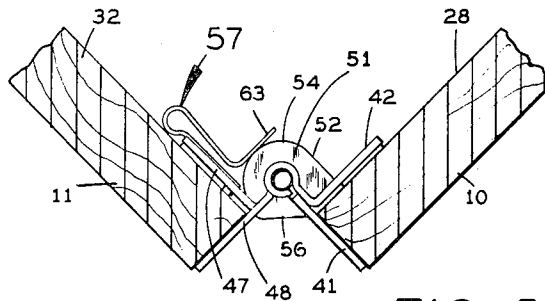


FIG. 5

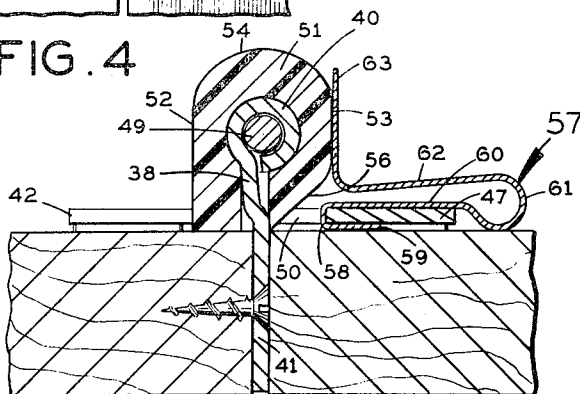


FIG. 6

INVENTOR.
JACK RUDNICK
BY *Stanley Wolder*
ATTORNEY

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J. RUDNICK
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2 Sheets-Sheet 2

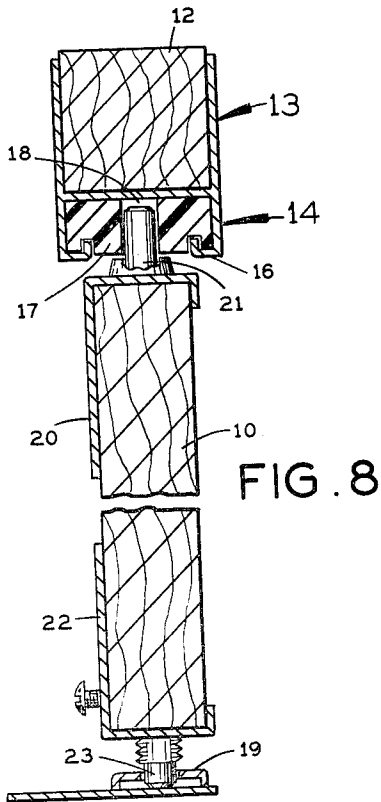


FIG. 8

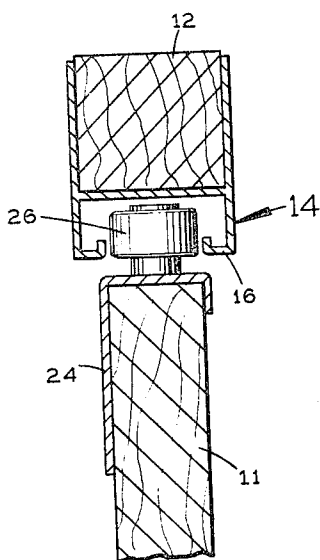


FIG. 9

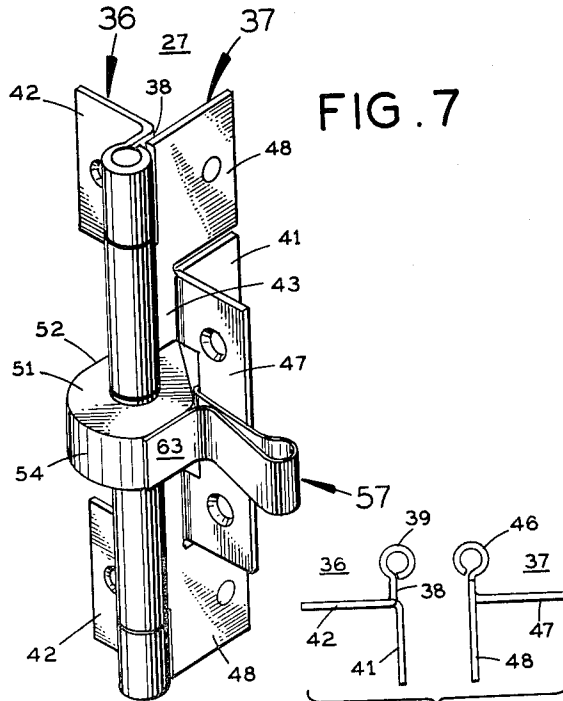


FIG. 7

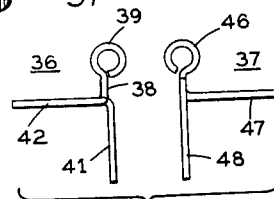


FIG. 11

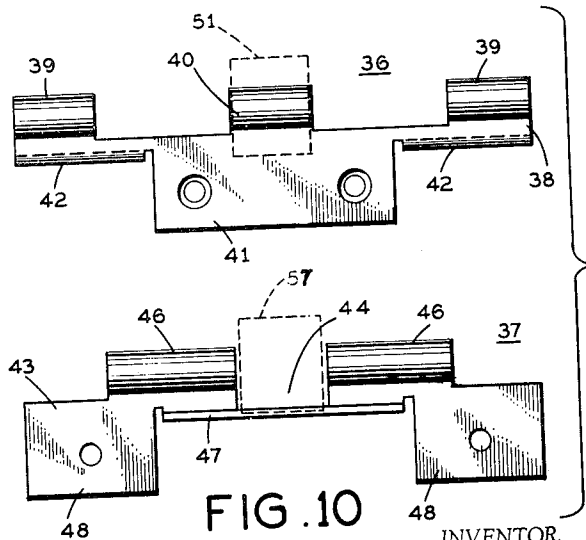


FIG. 10

INVENTOR.
JACK RUDNICK
BY Stanley Wolder

ATTORNEY

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3,237,239

HINGE STRUCTURE

Jack Rudnick, New York, N.Y., assignor to Jack Rudnick, New York, N.Y., and Benjamin Rudnick, Tarrytown, N.Y.

Filed Aug. 30, 1963, Ser. No. 305,793

4 Claims. (Cl. 16-145)

The present invention relates generally to improvements in hinge devices and it relates more particularly to improvements in folding door hinge structures and mechanisms.

Folding or accordeon type doors are highly preferred over conventional doors under many conditions. Thus where the opening is relatively wide or where the access space is relatively small as is frequently the case with the access openings to closets, the use of the hinged single panel door is accompanied by many drawbacks which are overcome by the use of a folding type door. The folding door is typified by one or more pairs of side by side rectangular panels which are hinged to each other along their adjacent or inner edges and the outer corners pivotally engage an overhead track registering with the door opening, at least one of the corners being slidable along the track thereby permitting the closing and the folding or opening of the door. The folding door structures heretofore proposed and available leave much to be desired in many of the features. It is the usual practice to connect adjacent panels of each pair by a longitudinally extending piano hinge, the leaves of which are screw connected to the confronting end faces of the adjacent panels. This arrangement is not only costly but results in a relatively weak structure which can not withstand rough handling. Inward pressure against the hinged areas of the panels results in a strong pulling force on the hinge connecting screws and often causes the withdrawal thereof from the panels. This is particularly true where the panels are formed of composition board as is commonly the practice.

It is generally desirable to spring urge the folded door alternatively to its open or closed position. This has heretofore been affected by connecting a tension spring between the adjacent panels to normally urge the panels to their open or closed position. Here again, this arrangement is expensive, requiring the recessing of door panels and also possesses the drawback that the door can not normally be maintained in any desired position between its fully open and fully closed position.

It is therefore a principal object of the present invention to provide an improved door structure.

Another object of the present invention is to provide an improved hinge mechanism.

Still another object of the present invention is to provide an improved hinge arrangement in folding door structures.

A further object of the present invention is to provide an improved hinge assembly for folding door structures which maintains the door in any selected position and alternatively releasably locks the door in its fully open or fully closed position.

Still a further object of the present invention is to provide a hinge assembly of the above nature characterized by its low cost, ease of application, ruggedness, and reliability.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawing wherein:

FIGURE 1 is a perspective view of a two unit folding door structure embodying the present invention, one of the folding door units being shown in its fully open posi-

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tion and the other of the folding door units being shown in its fully closed position.

FIGURE 2 is an enlarged sectional view taken along line 2-2 in FIGURE 1.

FIGURE 3 is an enlarged sectional view taken along line 3-3 in FIGURE 1.

FIGURE 4 is a rear fragmentary elevational view illustrating the hinge assembly in the door closed position.

FIGURE 5 is a view similar to FIGURES 2 and 3 with the door panels in the position intermediate the closed and open positions.

FIGURE 6 is a sectional view taken along line 6-6 in FIGURE 4.

FIGURE 7 is a rear perspective view of the assembled hinge structure in its closed position.

FIGURE 8 is an enlarged fragmentary sectional view taken along line 8-8 in FIGURE 1.

FIGURE 9 is an enlarged fragmentary sectional view taken along line 9-9 in FIGURE 1.

FIGURE 10 is an exploded plan view of the hinge sections, the associated cam and follower being diagrammatically illustrated by broken line.

FIGURE 11 is an exploded end view thereof.

As applied to a folding door the present invention contemplates a structure comprising a pair of side by side first and second panels, a hinge having first and second hinge sections connected to respective of said panels to swingably connected said panels, a cam mounted on and movable with one of said hinge sections and a cam follower mounted on and movable with the other of said hinge sections and spring urged into engagement with said cam.

Another feature of the present invention resides in the panel hinge assembly which includes a pair of complementary hinge sections provided with registering aligned knuckles along their adjacent edges and a pintle engaging said knuckles, said hinge sections having a first pair of longitudinally offset leaves affixed to said panel end faces and a second pair of longitudinally offset leaves substantially perpendicular to said first leaves and affixed to said panel rear faces, said first leaves being in substantially coplanar end to end relationship and sandwiched between said panel end faces when said panels are in their side by side positions.

According to a preferred form of the present folding door structure a first of said hinge sections includes a longitudinally extending strip provided with longitudinally spaced intermediate and opposite end knuckles and having an intermediate inwardly offset substantially parallel intermediate leaf and opposite perpendicular end leaves directed outwardly from the free edge of said strip. The second of the hinge sections likewise includes a longitudinally extending strip provided with knuckles interdigitating the first hinge section knuckles and having longitudinally spaced coplanar end leaves and an intermediate outwardly directed perpendicular leaf. The second hinge section strip is cut out at its medial area and along the corresponding inner edge of the intermediate leaf and the cam is provided with a radial slot and tightly embraces the first hinge section intermediate knuckle and the corresponding strip section and the cam follower is defined by a leaf spring mounted on the second hinge section intermediate leaf and bearing on the cam surface.

Referring now to the drawings which illustrate a preferred embodiment of the present invention as applied to a two section folding door structure associated with a closet opening, the reference numerals 10 and 11 generally designate inner and outer rectangular door panels of opposite pairs thereof, the adjacent edges of the panels 10 and 11 being hinged to each other in the manner hereinafter set forth. A longitudinal overhead guide bar 12 is affixed to the head of the closet opening and is friction-

ally engaged by the upper channel section 13 of a track member provided with a longitudinally extending downwardly directed channel shaped track 14 having side legs terminating in inwardly directed flanges 16. A first journal block 17 associated with each pair of door panels is positioned in and locked to the track 14 and has a vertical socket 18 formed therein. A second journal member 19 is mounted on the sill of the closet opening in alignment with each journal socket 18.

A first bracket 20 is affixed to the upper inner corner of each door panel 10 and is provided with an upwardly directed pin 21 rotatably registering with the socket 18. A second bracket 22 is affixed to the lower inner corner of each inner panel 10 and is provided with a vertical tapped bore engaging the threaded shank of a pivot pin 23 which rotatably engages the journal member 19. Mounted on the outer upper corner of the outer door panel is a bracket 24 provided with an upwardly directed pin carrying a track follower wheel 26 which slidably registers with the track 14. A detailed description of the door panel mounting structure is given in the copending application of Jack Rudnick, Serial No. 259,327 filed February 18, 1963.

The door panels 10 and 11 of each pair thereof are hinged to each other along their adjacent edges by a pair of vertically spaced hinges 27. The panel 10 includes a rear face 28, a front face 29 and an end face 30 and the panel 11 includes a rear face 32, a front face 33 and an end face 34. When the door panels are in their extended or closed position, the panel faces 28 and 32 are coplanar as are the faces 29 and 33 and the end faces 30 and 34 are in confronting and parallel relationship.

Each of the hinges 27 comprise a pair of complementary first and second hinge sections 36 and 37, each preferably formed of a unitary metal stamping of sheet steel or other suitable material. The first hinge section 36 includes a longitudinally extending strip 38 having formed along its inner edge longitudinally spaced aligned knuckles including opposite end knuckles 39 and a medially located knuckle 40. A medially located leaf 41 extends transversely from and substantially parallel to the strip 38, the leaf 41 being inwardly offset relative to the strip 38 approximately the thickness of the material forming the hinge section to a plane passing through the knuckle axis. Flanking the leaf 41 and perpendicular thereto are opposite end leaves 42 projecting from the longitudinal edge of the strip 38.

The second hinge section 37 includes a longitudinally extending strip 43 interrupted by a medially located recess 44. The strip 43 has located along its inner longitudinal edge and extending from opposite sides of the recess 44 to points short of the ends of the strip 43, a pair of symmetrical aligned knuckles 46. A medially located leaf 47 projects from the outer longitudinal edge of the strip 43 and is perpendicular thereto. A recess 50 is formed in the leaf 47 along its inner edge in registry with the recess 44. Flanking the leaf 47 and extending from the lower side edges of the strip 43 are opposite end leaves 48 coplanar with the strip 43. In the assembled hinge the knuckles 46 interdigitate the knuckles 39 and 40 and a pintle 49 registers with the aligned knuckles 39, 40 and 46. Each of the hinge leaves have screw receiving openings formed therein to permit their securement to the door panels.

A cam 51 formed of metal, nylon or other suitable material is mounted on and rotatable with the first hinge section 36 and has formed therein an axial bore tightly engaging the knuckle 40 and a radial slot communicating with the axial bore and tightly embracing the strip 43. The cam 51 has opposite flat depressed end cam sections 52 and 53 parallel to the strip 38 and leaf 41 and an intermediate raised arcuate section 54 coaxial with the pintle 49. Both sides of the cam 51 extend substantially to the lower edge of the strip 38, the underface 56 of the cam 51 extending from the flat section 53 is down-

wardly inclined to the strip 38 to permit the free unimpeded swinging of the leaf 47 relative thereto.

Mounted on and movable with the second hinge section 37 and resiliently engaging and bearing against the cam 51 is a cam follower member 57 formed of any suitable leaf spring material such as spring steel or beryllium copper band or the like. The follower member 57 includes a U-shaped anchoring section 58 embracing the leaf 47 and extending about the inner edge thereof in registry with the recess 50. The lower arm 59 of the anchoring section 58 underlies the leaf 57 and the upper arm 60 thereof extends rearwardly along and beyond the top face of the leaf 47. The arm 60 is joined by an arcuate section 61 to a forwardly extending arm 62 which terminates in an upwardly directed leg 63 resiliently bearing on the cam 51.

In the assembled condition of the hinges 27 with the associated panels 10 and 11, the hinge section 36 engages the inner rear corner of the panel 11 and the hinge section 37 engages the inner rear corner of the adjacent panel 10. The leaves 42 overlie the panel rear face 28 being spaced therefrom by shims or washers 64 the thickness of the follower leg 59, and the leaf 41 is superimposed on the panel end face 30. The leaf 47 overlies the panel rear face 32 and is spaced therefrom by shims corresponding to the shims 64 and the leaves 48 are superimposed on the panel end face 34. The hinge leaves are fastened to the respective panel faces by screws registering with screw openings formed in the hinge leaves and engaging the panels 10 and 11.

Considering now the operation of the door and hinge structure described above, in the closed condition of the folding door the panels 10 and 11 are in end to end relationship as seen in FIGURE 1 and the hinge leaves 41 and 48 are in coplanar end to end arrangement and tightly sandwiched between the panel end faces 30 and 34. The follower leg 63 bears on the cam depressed flat 53. In opening the folding door the mutually hinged sections of the door panels are pulled forward to swing the panels about their inner and outer edges and mutually about their adjacent edges, the outer edge of the panel 11 moving laterally along the door opening. The follower leg 63 travels out of engagement with the depressed flat 53 into engagement with the arcuate raised cam section 54, as seen in FIGURE 5, in which position the cam follower is highly stressed and firmly maintains the door panels in any selected position between its opened and closed position. As the door panels are opened further to a position closely approaching their fully opened position, the follower leg 63 passes the cam arcuate raised section 54 and by reason of the pressure thereon by the follower member 57 the panels are urged toward their fully opened position. In the fully opened position of the door panels, the follower leg 63 engages the cam depressed flat 52 to releasably lock the door panels on their fully open position. The folding door may be closed by moving the panels 10 and 11 toward their extended positions whereby the follower leg 63 travels by the cam depressed flat 52 along the cam arcuate section 54 and as it passes the cam section 54 it urges the panels to their fully closed end to end position with the follower leg engaging the cam flat 53 to releasably lock the door panels in their fully closed position.

It should be noted that by reason of each of the hinge sections 36 and 37 being secured to the end and rear faces of the respective panels 10 and 11, the assembly can withstand relatively high pressure against the outer faces of the panels 10 and 11 in the area of their confronting hinged edges without any pulling away or detachment of the hinge sections from the panels or the weakening of the assembly thereof. This feature provides for a more rugged structure and facilitates the use of various types of composition material for the door panels. Moreover, the hinge assembly directly carrying the resilient opening and closing mechanism including the cam

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and follower arrangement permits the simple, rapid and economic assembly of the panels.

Although the subject hinge mechanism has been described as applied to folding doors, where it may be employed to great advantage, it should be understood that the improved hinge, and particularly the cam and follower mechanism, is highly useful with other swinging door structures such as cabinet doors, kitchen doors, etc.

While there has been described and illustrated a preferred embodiment of the present invention, it is apparent that numerous alterations and omissions and additions may be made without departure from the spirit thereof.

What is claimed is:

1. A hinge comprising a pair of complementary first and second hinge sections adapted to be secured to adjacent panels of a folding door, said first hinge section having a first longitudinally extending strip provided along one longitudinal edge thereof with first spaced aligned knuckles and along the other edge thereof with longitudinally spaced leaves alternately perpendicular and parallel to said first strip, said parallel leaves being inwardly offset relative to said first strip, said second hinge section including a second longitudinally extending strip provided along one longitudinal edge thereof with second knuckles interdigitating said first knuckles and along the other edge thereof with longitudinally spaced leaves alternately parallel and perpendicular to said strip, the leaves parallel to the strips being in substantially coplanar end to end relationship and sandwiched between the end faces of said panels when the panels are in a common plane, a cam mounted on a knuckle of the first hinge section and engaging the first strip, and a cam follower mounted on a perpendicular leaf of said second

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hinge section and bearing on said cam to releasably retain the panels in desired angular relationships relative to each other.

2. The hinge structure of claim 1 wherein said cam follower comprises a leaf spring resiliently bearing on said cam.

3. The hinge structure of claim 1 wherein said cam includes a first depressed section and said cam follower registers with said cam depressed section when said panels are in end to end relationship.

4. The hinge structure of claim 3 wherein said cam includes a second depressed section opposite to said first depressed section and said cam follower registers with said second depressed section when said panels are in a substantially parallel relatively folded position.

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30 JOSEPH D. SEERS, *Primary Examiner.*

M. HENSON WOOD, JR., DONLEY, J. STOCKING,
Examiners.