

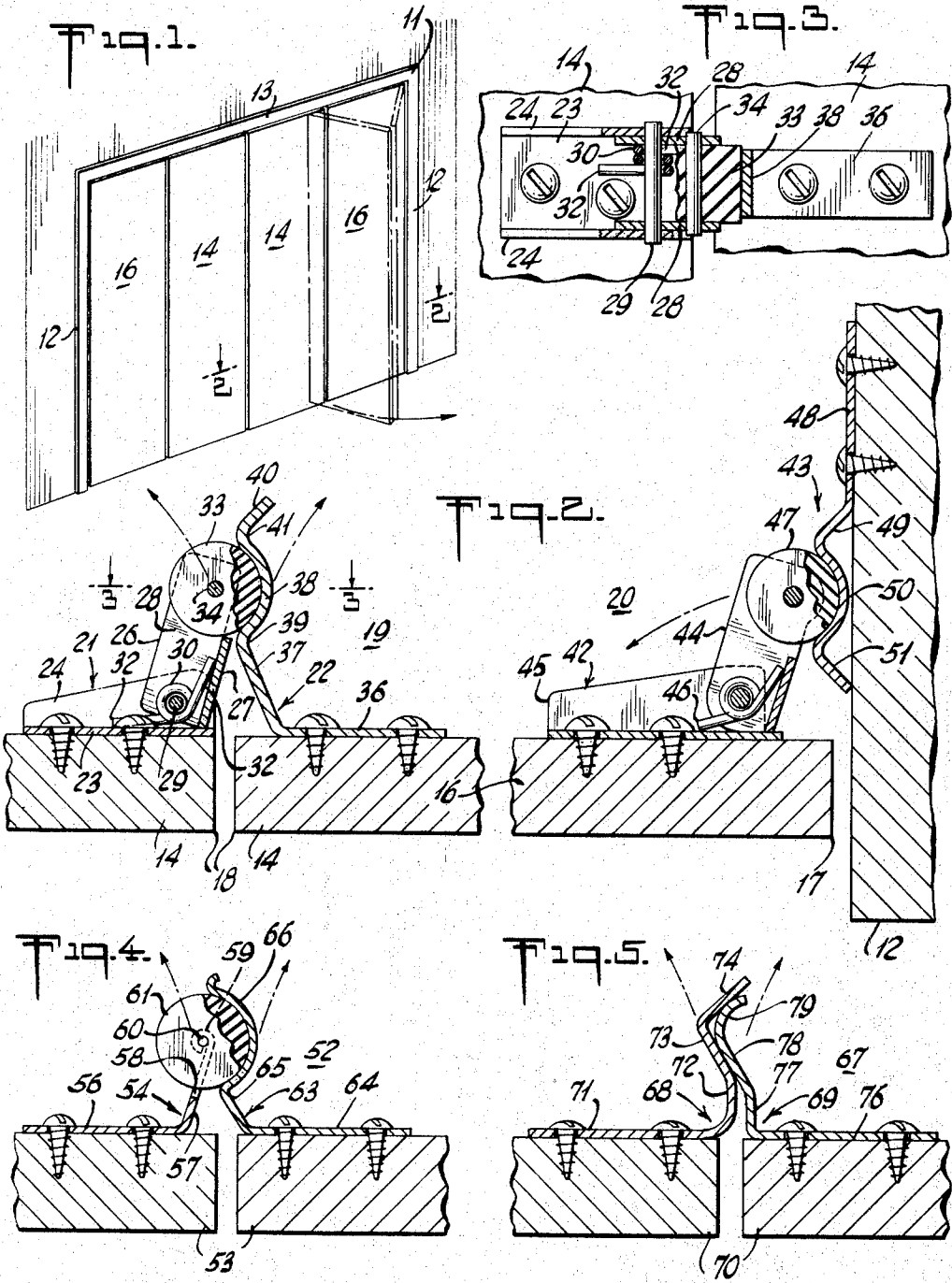
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J. RUDNICK

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DOOR STRUCTURE

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INVENTOR
JACK RUDNICK
BY Stanley Wolder
ATTORNEY

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DOOR STRUCTURE

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

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ABSTRACT OF THE DISCLOSURE

A folding door includes laterally opposite pairs of folding door panels, the adjacent edges of the panels of each pair being hinge connected, the outer panels of each pair being pivoted at their tops and bottoms to a door frame adjacent to the respective side edges thereof, and the upper inner corners of the inner panels being slidable along a vertical track the inner panels being swingable about their inner edges. In order to assure a parallel relationship of the inner panel inner edges of the closed doors they are provided at their rear, intermediate their top and bottom with interengageable alignment members, one being provided with a recess having a cammed face and the other being provided with a resiliently supported mating projection likewise having a cammed surface and which may be a roller. Corresponding pairs of alignment members are provided on proximate outer panel outer edges and the adjacent areas of the door frame.

The present invention relates generally to improvements in door structures and it relates more particularly to an improved door structure provided with means for effecting mutual alignment of the edges of relatively movable door members when said edges are in adjacent positions attendant to the closing of the door.

There are numerous forms of door structures in which there is provided a pair of relatively movable normally parallel edges which under certain conditions of the door are visually contiguous or closely spaced. Typical of such structures are folding doors which are commonly employed for closing and affording access through large openings such as to closets and the like. Folding doors frequently include laterally spaced pairs of inner and outer rectangular door panels, the panels of each pair being hinged to each other along adjacent edges to permit their relative forward folding attendant to the opening of the door. The outer panels are pivoted at their upper and lower corners to the upper and lower door frame members adjacent to the sides of the door frame. Follower members project upwardly from the inner upper corners of the door panels and slidably engage overhead tracks extending along the top of the door frame and restrict the movement of the inner edges of the inner panels along the direction of the tracks while permitting the rotation of the inner panels about vertical axes through the followers. When the folding door is in a closed condition the inner unhinged edges of the inner panels are juxtapositioned and the outer edges of the outer panels are juxtapositioned to the corresponding vertical sides of the door frame.

Since the door panels in the folding door structure are commonly formed of wood or other material which is subject to warping, the free vertical edges of the door panels, that is the edges which are not mutually hinged, are frequently curved and non-linear in various directions. Accordingly, when the folding doors are in their closed position the juxtapositioned free vertical door panel edges and vertical door frame sides are neither parallel nor evenly spaced. The result is not only a door of highly unattractive appearance but a condition which may lead to further warping and deterioration of the door structure which would eventually interfere with the satisfactory operation thereof.

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

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Another object of the present invention is to provide an improved door structure having means for effecting the mutual alignment of the edges of relatively movable door members when said edges are juxtapositioned attendant to the closing of the door.

Still another object of the present invention is to provide in a folding door structure having panels whose edges are movable relative to each other and are normally unsupported between the ends thereof, means for effecting the alignment of such edges when in juxtaposition.

A further object of the present invention is to provide in a door structure including a panel pivoted at its upper and lower corners, for swinging about a vertical axis adjacent a vertical door frame member, means for effecting the alignment of the hinged edge of the panel and the frame member when the door panel is in its closed position.

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

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 front perspective view of a folding door structure embodying the present invention;

FIGURE 2 is an enlarged fragmentary sectional view taken along line 2—2 in FIGURE 1;

FIGURE 3 is a sectional view taken along line 3—3 in FIGURE 2;

FIGURE 4 is a sectional view similar to FIGURE 2 of another embodiment of the present invention; and

FIGURE 5 is a sectional view similar to FIGURE 2 of still another embodiment of the present invention.

In a sense the present invention contemplates the provision of a self aligning door structure comprising a pair of first and second door structure members at least one of said members comprising a vertical panel including a vertical side edge and swingable about a vertical axis adjacent to said side edge between a closed position with said side edge disposed adjacent to said other member and an open position with said side edge being disposed relatively remote from said other member, and a pair of first and second separably engaging alignment members one of which is mounted on said vertical panel adjacent to said side edge and between the top and bottom thereof and the other alignment member being mounted on the other door structure member, one of said alignment members including a rearwardly directed first arm provided with a recess adjacent its free end and the other of said alignment members including a rearwardly directed second arm having a projection adjacent its free end in mating engagement with said recess, said recess and projection being transversely resiliently urged toward each other when said panel is in said closed position.

The present construction is applied to great advantage to folding doors and particularly folding doors in which folding panel pairs are pivotally supported along opposite sides of a door frame. Mating alignment members may be mounted not only on the inner vertical edges of adjacent panel pairs which are juxtapositioned when the doors are fully closed but may be likewise positioned to advantage on the sides of the door frame and the adjacent panel edges. In accordance with a preferred form of the alignment devices, the recess in the first alignment member is a vertically extending arcuate groove and the arm of the second alignment member is hinged to the door panel and spring urged toward the other alignment member and the projection is defined by a vertical roller mounted on the free end of the second arm.

Referring now to the drawings and more particularly FIGURES 1 to 3 thereof which illustrate a preferred embodiment of the present invention as applied to a folding door, the reference numeral 10 generally designates the folding door assembly associated with a closet or other opening delineated by a door frame 11. The door frame 11 includes opposite vertical side legs 12 joined at their top by a horizontal cross leg 13, the bottom of the frame 11 being defined by the floor.

The folding door 10, per se, may be of conventional construction and is supported and guided in the door frame 11 in a known manner. Specifically, a longitudinal channel shaped track is secured to and extends along the underface of the frame top leg 13 substantially to the side legs 12. The door 10 comprises two opposite pairs of adjacent inner and outer vertical rectangular panels 14 and 16 respectively which may be formed of solid wood or plywood, composition board or the like, the panels 14 and 16 of each pair being hinged to each other along their adjacent edges to permit their forward folding as indicated by broken line in FIGURE 1.

Projecting above and below the upper and lower edges respectively of each outer panel 16 shortly inwardly of the outer edges 17 thereof adjacent the corresponding frame vertical leg 12 are upper and lower axially aligned pivot pins which engage mating upper and lower socket members positioned on the overhead track and on the floor respectively. Mounted on the upper edge of each of the inner panels 14 adjacent to its inner edge 18 is an upwardly directed follower, which may be a vertical roller, which slidably engages the overhead track thereby restricting the lineal movement of the panel inner edges along the length of the overhead track and permitting the swinging of the panels 14 about axes shortly outwardly offset from their inner edges 18. The folding door 10 may be opened and closed in the usual fashion.

When the door 10 is in its closed condition, as illustrated, the inner panel inner edges 18 are substantially juxtapositioned and are conventionally unsupported along the lengths thereof and the outer panel outer edge 17 is likewise unsupported along its length and substantially juxtapositioned to the frame leg 12. Thus any warping or bending of the panels 14 results in the unsightly misalignment of their adjacent edges 18 and any warping of the panels 16 results in an unsightly misalignment of their outer edges 17 with the adjacent frame legs 12. In accordance with the present invention, an edge aligning device 19 is provided on the inner panel adjacent edges 18 intermediate the tops and bottoms thereof and an aligning device 20 is provided on the outer panel outer edges 17 and frame legs 12 intermediate their tops and bottoms.

The alignment device 19 comprises a pair of cooperating members 21 and 22 mounted on the rear faces of the panels 14 adjacent their edges 18. The alignment member 21 comprises a channel shaped mounting bracket including a cross web 23 abutting the rear face of panel 14 and secured thereto by screws, and vertically spaced horizontal parallel rearwardly directed flanges 24 extending substantially to the panel edge 18. A channel shaped arm has a trailing part sandwiched between the bracket flanges 24 and includes a cross web 27 and upper and lower flanges 28 extending along the full lengths of and rearwardly beyond the side edges of the cross web 27 to define a yoke. The arm 26 is hinged at its trailing section to the mounting bracket by a hinge pin 29 engaging vertically aligned holes formed in the flanges 24 and 28 and being preferably enlarged at its opposite ends. A hairpin spring 30 includes a loop engaging the pin 29, and radially projecting arms 32 which bear on the inner faces of the cross webs 23 and 27 to resiliently urge the arm 27 clockwise as viewed in FIGURE 2. The clockwise swinging movement of the arm 26 is limited to a rearwardly inwardly inclined position, as seen in FIGURE 2, by the rear edge of the cross web 27 bearing on the cross web 23 and the counterclockwise position of the arm 26 is limited to a rearwardly

outwardly inclined position by the front edges of the flanges 28 bearing on the cross web 23.

A roller 33 preferably formed of rubber or other elastomeric or resilient material is supported by and between the arm flanges 28 rearwardly of the cross web 27 by a pin 34 journaled between the free end of the flanges 28. The roller 33 is rotatable about its vertical axis and its peripheral surface projects beyond the cross web 27.

The alignment member 22 includes a rear arm 36 which abuts and is secured to the rear face of the other inner panel 14 adjacent to the edge 18 and an inclined arm 37 projects inwardly and rearwardly from the inner edge of the arm 36. Integrally formed along the rear border of the arm 37 is a vertical arcuate channel shaped section 38 whose concave face confronts and complements the roller 33. The arm 37 joins the channel section 38 by an oppositely curved elbow section 39 and the channel section 38 terminates along its rear edge in a rearwardly outwardly inclined leg 40 joined thereto by a curved elbow section 41. It should be noted that the alignment members 21 and 22 are so related and dimensioned that when the roller 33 is in mating engagement with the channel 38 the panel edges 18 are in proper parallel coplanar alignment, with the vertical axis of the roller 33 being disposed directly rearwardly of the edges 18.

The alignment device 20 includes a pair of cooperating alignment members 42 and 43. The alignment member 42 is substantially identical in construction to the alignment member 21 described above and includes a bracket 45 secured to the rear face of each outer panel 16 a short distance inside the outer edge 17 thereof. A swingable arm 44 is hinged to the bracket 45 and its free end is urged outwardly by a spring 46, the arm 44 carrying at its free end a vertical roller 47.

An alignment member 43 is mounted on each frame leg 12 and includes an arm 48 secured to the corresponding frame leg 12 rearwardly of the panel edge 17 and is provided at its forward edge with an inwardly forwardly inclined arm 49. A vertical arcuate channel section 50 complements the peripheral surface of the roller 47 and is joined to the arm 49 by a curved elbow and is provided along its front edge with an outwardly forwardly inclined arm 51 joined thereto by a curved elbow. The alignment members 42 and 43 are so dimensioned and related that in the door closed position with the roller 47 in mating engagement with the channel 50 the panel edges 17 are parallel to the frame legs 12.

In the operation of the folding door structure described above, when the door is in its fully closed position the roller 33 and channel 38 are in mating engagement to retain the panel edges 18 in a parallel relationship coplanar with the panel front faces and the rollers 47 are in mating engagement with corresponding channels 50 to retain the panel edges parallel to the frame legs 12. Upon the opening of the folding doors the rollers 33 and 43 are retracted from the respective channels 38 and 50 and are positioned out of sight behind the door panels.

When the doors are closed and the panels are in flat unwarped condition, the rollers 33 and 47 are brought into direct engagement with corresponding channels 38 and 50. However, when the inner panel edges 18 are normally out of parallel due to the warping of one or both panels 14, as the roller 33 approaches the channel 38 it is out of alignment therewith and before full closure of the doors will strike either the front or rear elbow defining edge of the channel 38. Upon urging the door to its fully closed position the roller 33 and the channel 38 are pulled into registry and then into mating engagement upon full door closure by reason of the longitudinally and transversely oblique cam defining engaging faces of the roller 33 and the channel 38 to thereby pull the panel edges 18 into parallel relationship coplanar with the front faces of panels 14. In a like manner, the panel edges 17 are pulled into parallel relationship with the frame legs 12 when the panels 16 are warped.

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In FIGURE 4 of the drawing there is illustrated another form of alignment device 52 illustrated as applied to the adjacent borders of a pair of adjacent inner panels 53 of a folding door of the structure described above, and differing from the alignment device 19 primarily in the simple construction of the alignment member 54. Specifically the alignment member 54 is formed from a band of resilient sheet metal, for example spring steel, and includes a first arm 56 fastened to the rear face of one of the panels 53 adjacent its inner free vertical edge and having projecting from its inner end an integrally formed rearwardly inwardly directed arm 57. The arm 57 has an elongated medial longitudinal slot formed therein and extending to its free end to delineate a pair of transversely spaced yoke defining resilient arms 58. The arms 58 terminate at their free ends in integrally formed axially aligned tubular sections 59 which engage a vertical pin 60. A vertical rubber roller 61 is rotatably mounted on the pin 60 and extends between the yoke legs 58.

The other alignment member 63 is likewise advantageously formed of a resilient metal band and includes an arm 64 secured to the rear face of the other panel 53 adjacent to its free vertical edge and provided at its inner end with an integrally formed inwardly rearwardly directed arm 65. Joined to the rear end of the arm 65 is a recess or socket defining arcuate leg 66, beaded at its free end and complementing and confronting the roller 66.

The alignment members 54 and 63 are so dimensioned and related that when the roller 61 and arcuate arm 65 are in full mating engagement the adjacent edges of the panels 53 are parallel and coplanar with the faces of the panels 53. A similar alignment arrangement may be provided on the folding door outer panels and the door frame vertical legs. The folding door structure employing the alignment devices 52 operates in the manner of the folding door structure 10 described above.

A still simpler form of alignment device 67 is illustrated in FIGURE 5 and includes a pair of cooperating alignment members 68 and 69, each formed of a resilient metal band, for example spring steel. The alignment members 68 and 69 are mounted on the rear faces of the inner folding door panels 70 adjacent to the inner edges thereof. The alignment member 68 comprises a transversely extending arm 71 secured to the rear face of one panel 70 and provided at its inner edge adjacent that of the panel 70 with a rearwardly directed arm 72. Projecting from the rear of the arm 72 and joined thereto by an inwardly convex slightly curved elbow is a rearwardly outwardly inclined arm 73 terminating in a rearwardly inwardly inclined leg 74, the arm 73 and leg 74 defining an alignment recess or socket.

The alignment member 69 comprises a transverse arm 76 secured to the rear face of the other panel 70 and provided at its inner end adjacent to the inner edge of the corresponding panel 70 with a rearwardly directed arm 77. Joined to the rear of the arm 77 is a rearwardly inwardly projecting integrally formed arm 78 terminating in a curved leg 79 having an inwardly facing convex face. The alignment members 68 and 69 are so dimensioned and related that when the curved leg 79 is in mating engagement with the socket or recess defined by the arm 73 and leg 74 the inner juxtapositioned edges of the panels 70, when the folding door is in closed condition, are parallel and coplanar with the corresponding faces of the panels 70. The operation of the folding door employing the alignment devices 67 is similar to that of the previously described folding door structures.

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

What is claimed is:

1. A self aligning door structure comprising a pair of first and second door structure members at least one of said members comprising a vertical panel including a

vertical side edge swingably mounted about a fixed vertical axis adjacent and parallel to said side edge between a closed position with said side edge disposed adjacent to said other member and an open position with said side edge being disposed relatively remote from said other member, and a pair of first and second separably engaging alignment members one of which is mounted on the rear face of said vertical panel adjacent to said side edge and spaced between the top and bottom thereof and includes a rearwardly directed arm swingable about said vertical axis and the other alignment member being mounted on the other door structure member, said alignment members including a projection and a recess positioned rearwardly of said fixed vertical axis and on said rearwardly directed arm adjacent its free end, said recess and projection being movable into separable mating engagement, at least one of said alignment members having a cam defining transversely and longitudinally oblique surface engageable by the other of said alignment members whereby said recess and projection are transversely urged toward each other when said panel is urged toward said closed position to urge adjacent sections of said door structure members toward a parallel relationship.

2. The door structure of claim 1 wherein said recess including alignment member comprises a resilient arm and said recess is provided with transversely converging walls.

3. The door structure of claim 1 wherein said arm is resilient and said projection is positioned on said arm and is of curved configuration with a convex face adapted to engage said recess.

4. The door structure of claim 1 wherein said arm is resilient and said projection is positioned on said arm and is defined by a vertical roller mounted on the free end of said second arm.

5. The door structure of claim 1 wherein said arm is hinged at its inner end for swinging about a vertical axis and including spring means urging the free end of said arm toward said other alignment member, said projection being defined by a vertical roller mounted on the free end of said arm.

6. The door structure of claim 1 in the form of a multi-section folding door including a pair of inner and outer door panels registering with a door frame, said inner and outer door panels being hinged to each other and said outer panel being pivoted adjacent to its upper and lower outer corners to the corresponding upper and lower outer corners of said door frame and the upper free corners of said inner panel being restricted to lineal movement along the upper edge of said door frame and said inner panel being swingable about vertical axes extending adjacent said inner panel free upper corners whereby said panels are movable between a closed substantially coplanar position and an open position with the inner and outer panels being forwardly directed, said alignment member including said rearwardly directed arm being mounted on the rear face of one of said outer panels defining said first door structure member adjacent to the free vertical edge thereof and the other of said alignment member being mounted on door frame.

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DAVID J. WILLIAMOWSKY, *Primary Examiner.*

REINALD P. MACHADO, DENNIS L. TAYLOR,
Examiners.