April 19, 1938. R. F. LOHRMAN 2,114,743

SLIDING DOOR

Filed June 15, 1936 3 Sheets-Sheet 1

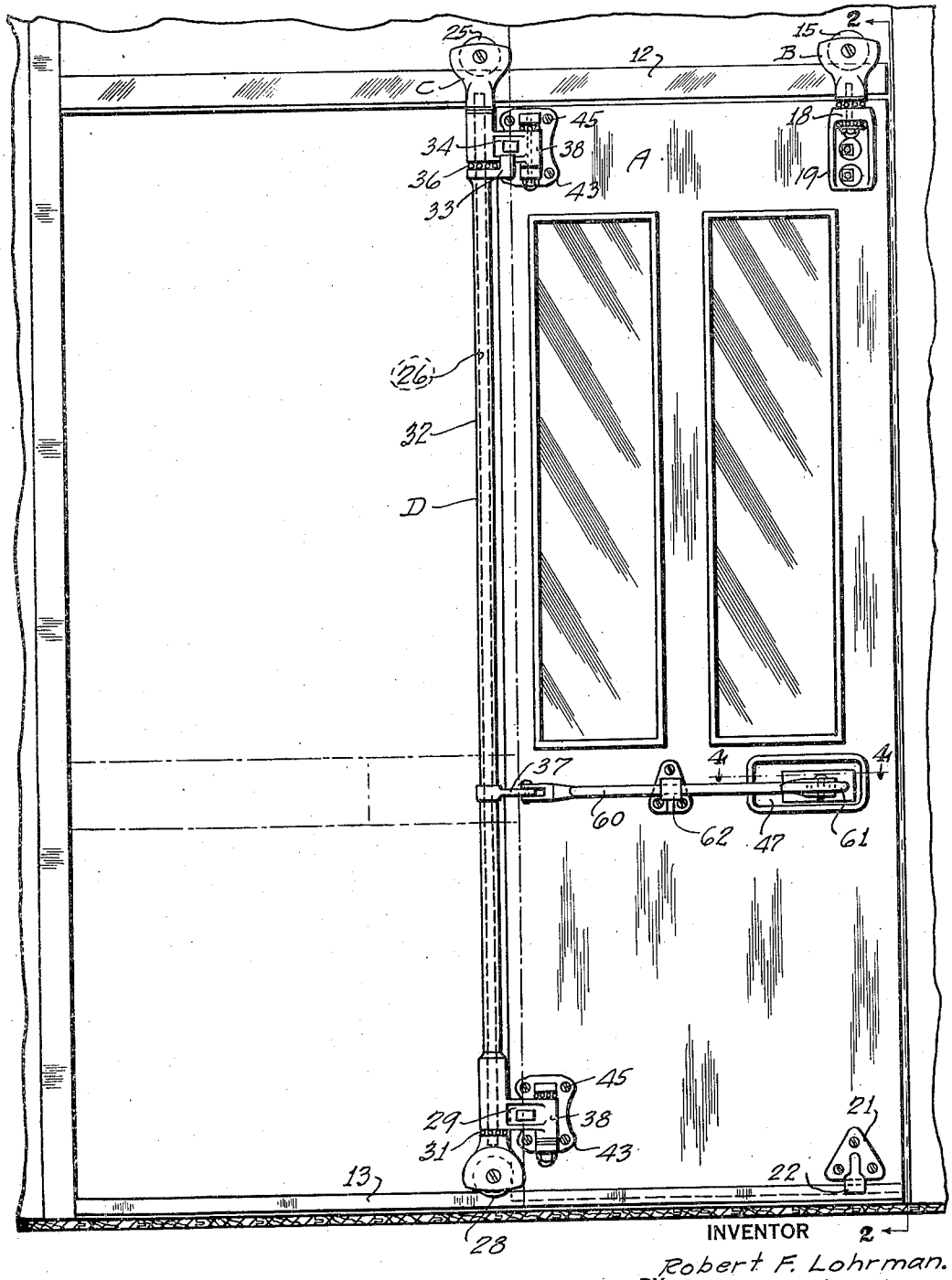


Fig. 1.

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SLIDING DOOR

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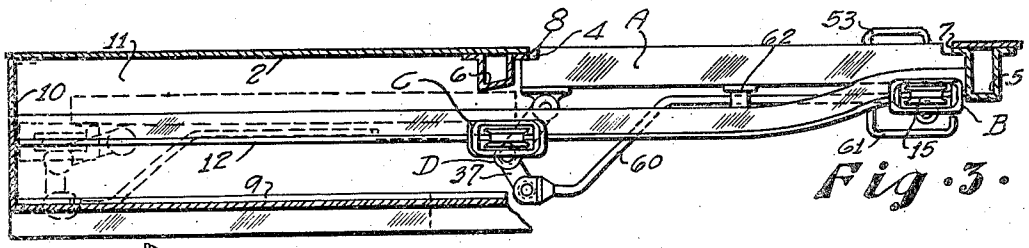


Fig. 3.

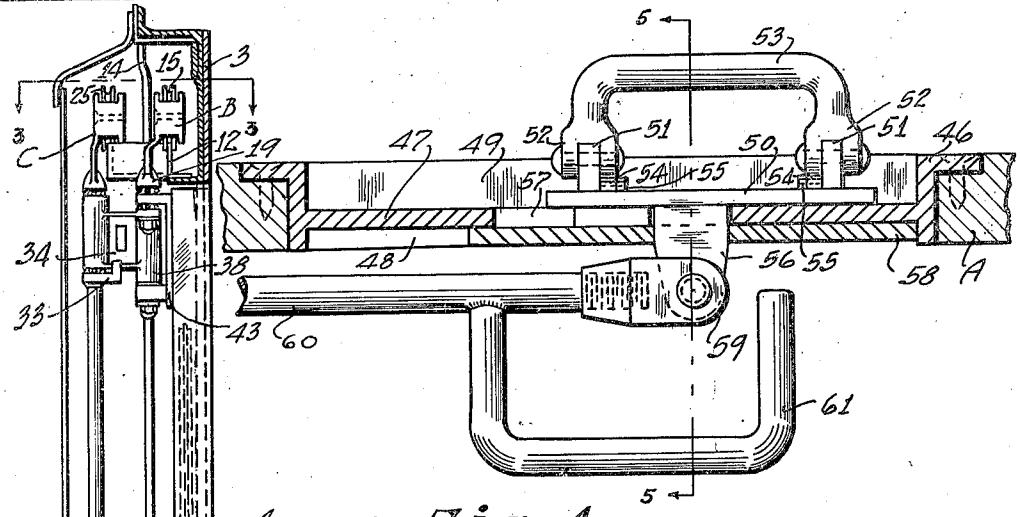


Fig. 4.

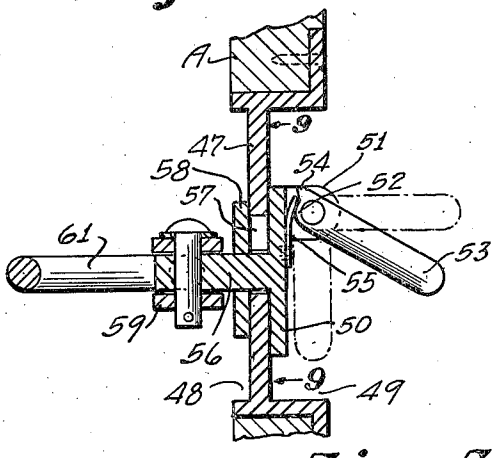


Fig. 5.

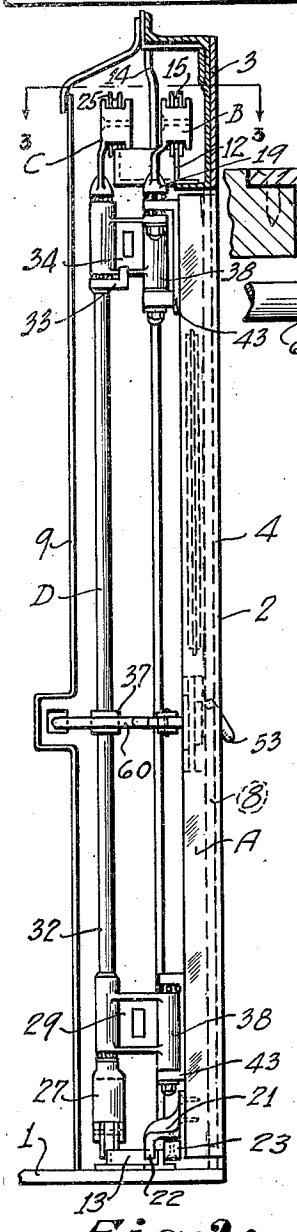


Fig. 2.

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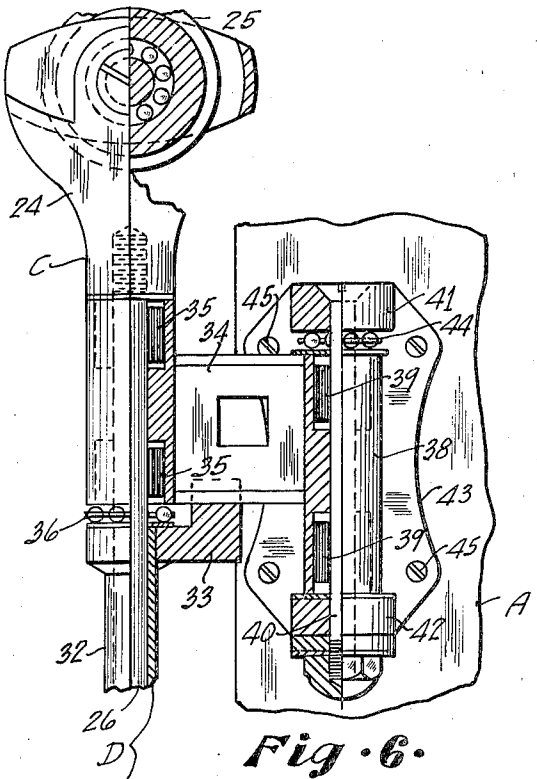


Fig. 6.

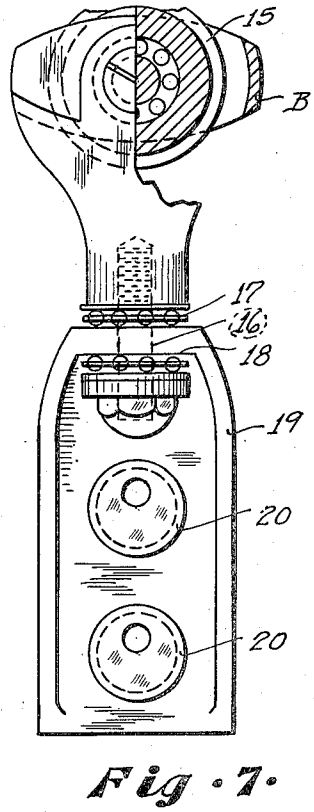


Fig. 7.

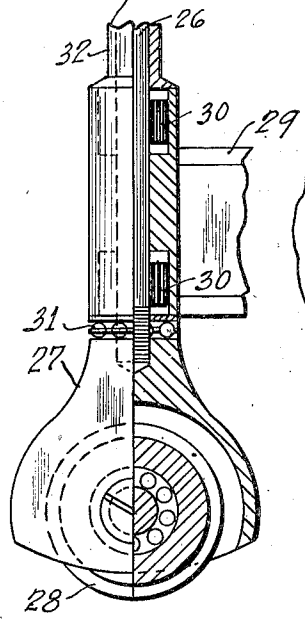


Fig. 8.

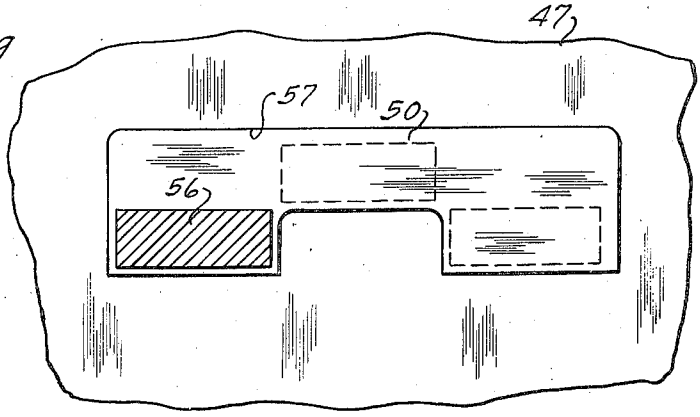


Fig. 9.

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2,114,743

SLIDING DOOR

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Application June 15, 1936, Serial No. 85,265

13 Claims. (Cl. 20—23)

This invention relates generally to closure-structures and, more particularly, to a certain new and unseful improvement in closure-structures of the sliding door type.

A sliding-door generally has its movement substantially parallel with the plane of the opening. Now, when the door-opening occurs or is located in a wall of a structure such, for example, as a railway vehicle or car, it is requisite for structural reasons to bound at least the sides of the opening with jambs or other wall re-enforcing members. Further, in modern so-called streamlined trains, it is a matter of vital importance that recesses or pockets in the sides of the vehicle be obviated, so as to eliminate undesirable air friction losses when the vehicle is in motion. Consequently all openings should be closed by doors or other closures which, when closed, reside substantially flush with the outer face of the vehicle body.

My invention has hence for its chief object the provision of a door of sliding type so constructed as, when closed, to snugly fit between the jambs and within the opening in substantially flushwise registration with the wall of the car or other structure and, when opened, in a combined sliding and swinging operation or movement, to clear the jambs for disposition at a side of the opening in laterally spaced relation to the jambs and opening.

My invention has for a further object the provision of a door of the type and for the purpose stated, which may be readily and economically constructed and installed, may with ease and facility be actuated to open or closed position, and is efficient in the performance of its intended functions.

And with the above and other objects in view, my invention resides in the novel features of form, construction, arrangement, and combination of parts presently described and pointed out in the claims.

In the accompanying drawings (three sheets),—

Figure 1 is an inside elevational view of a door-structure embodying my invention, fragmentary portions of a vehicle or car-body being also shown;

Figure 2 is a vertical sectional view of the door-structure taken approximately along the line 2—2, Figure 1;

Figure 3 is a broken top sectional view taken approximately along the line 3—3, Figure 2;

Figure 4 is an enlarged fragmentary sectional view of the latch mechanism of the structure taken approximately along the line 4—4, Figure 1;

Figure 5 is a fragmentary sectional view taken approximately along the line 5—5, Figure 4;

Figure 6 is an enlarged fragmental elevational view, partly broken away and in section, showing the upper rear trolley hanger and its associated door-supporting and shifting mechanism;

Figure 7 is an enlarged detail view, partly broken away and in section, of the upper front trolley hanger;

Figure 8 is an enlarged detail view of the lower rear truck and a portion of its door-supporting mechanism; and

Figure 9 is an enlarged fragmentary detail view of the latch plate and associated mechanism, taken approximately along the line 9—9, Figure 5.

Referring now more in detail and by reference characters to the drawings, which illustrate a preferred embodiment of my invention, the door is shown in connection with a wall structure, which may, as in the present instance, comprise the side wall of a so-called streamlined railway coach or the like, 1 designating the coach or car-floor, 2 the outer side plate, and 3 the eave construction.

Formed in the side-plate or wall 2, is a conventional access opening 4, the side-margins of which are re-enforced by front and rear vertical jamb-posts 5, 6, respectively, extending between the floor 1 and the eave 3, the jambs 5, 6, being spaced, however, from the respective margins of the opening 4 and formed, as best seen in Figure 3, for providing respective so-called sealing flanges or lips 7, 8, for a purpose soon appearing.

Disposed rearwardly of the opening 4 and spaced in parallel relation inwardly from the side wall 2, is a vertical door guard plate or partition 9, which, in conjunction with an also vertical rear end plate 10 connecting the guard 9 at its rear margin with the wall 2, forms a box-like structure providing a door-receptive pocket of housing 11 within the coach or other enclosure, best also seen in Figure 3.

Extending from the plate 10 longitudinally through the door-pocket 11 and then projecting in approximate parallelism to, and spaced inwardly from, the plane of the opening 4, are registering upper and lower trolley-supporting and guiding members or rails 12, 13, respectively, which at their front ends are curved outwardly toward, and substantially abut, the front jamb 5, as also seen in Figure 3, the upper rail 12 be-

ing preferably of angle-section, supported at its rear end by the end plate 10 and at an intermediate point by a suitable hanger 14, and fixed at its front end on the lower flange of the eave structure 3, although such arrangement may, of course, be varied as circumstances require. The lower rail 13 is preferably of T-section and is attached to the car-floor 1, as best seen in Figure 2.

The closure for the opening 4 comprises a traveling door A of substantially rectangular shape in the present instance and dimensioned to snugly, when in closed position, fit between the jambs 5, 6, with its outer side marginal faces engaging the respective seal flanges 7, 8.

The door A at its front end is pivotally supported on a first traveling support or swivel trolley B, whose path of movement is defined by, and which is equipped with a roller 15 for engaging, the rail 12. The trolley B includes a swivel pin 16 suitably carrying a pair of thrust bearings 17, between which is engaged an ear 18 of a hanger-bracket 19, which latter is attached to and upon the inner face, and adjacent the upper and front margins, of the door A. Preferably, such attachment is effected by means of eccentric washers 20, whereby the door A may be accurately leveled or aligned with the door opening 4, as best seen in Figure 7.

To and upon the inner face, and adjacent the lower and front margins, of the door A, is attached a guide bracket 21 having a depending lip or shoe 22, which engages the inside face of the lower rail 13. Preferably, the bracket 21 is equipped with a depending vertically revolving roller 23, which bears on the outside face of the rail 13, the co-operation of the shoe 22 and roller 23 with the rail 13 guiding and defining the path of movement of the door A at its lower front portion, while permitting pivotal movement of the door A, as best seen in Figure 2.

At its rear end, the door A is swingably supported on a second traveling support C having a path of movement defined by the rails 12, 13, and comprising an upper hanger-type trolley 24 equipped with a roller 25, which is engageable with the upper rail 12. The trolley 24 has rigidly attached thereto a suitably elongated pintle-rod 26, which, at its lower end, is, in turn, rigidly attached to a truck-type trolley 27 equipped with a roller 28 engageable with the lower rail 13.

Journaled on the pintle-rod 26, is what may be described as a swing-frame D, which includes a radial arm 29 having its hub equipped with suitable anti-friction or roller bearings 30 engaging the pintle-rod 26, and having endwise support on an anti-friction or ball-thrust bearing 31 which engages the truck-trolley 27, as best seen in Figure 8.

Extending upwardly from the hub of the arm 29, and forming part of the frame D, is a preferably integrally formed sleeve 32, which rotatably fits about the pintle 26, and at its upper end, which is suitably spaced from the hanger-trolley 24, carries a radially projecting lug 33 having a bifurcated upturned end disposed in vertical registration with the arm 29.

Journaled on the upper end of the pintle 26 intermediate the lug 33 and trolley 24, is another radial arm 34 whose hub is similarly equipped with roller-bearings 35 and has endwise support on a thrust bearing 36 engaging the upper end, that is to say, the lug portion 33, of the sleeve 32. As best seen in Figure 6, the arm 34 is engaged with the bifurcated end of the lug 33 for not only disposing the arm 34 in vertical registration with the arm 29, but also that the arms 29 and 34 may swing together or as a unit when the frame D and its sleeve 32 are rotatably actuated on the pintle 26, the sleeve 32 being equipped, at a suitable point intermediate its ends, with a crank-arm 37 for a purpose shortly more fully appearing, and as best seen in Figure 3.

At the free end of each of the respective arms 29, 34, is an elongated eye 38 having a vertically disposed bore equipped with a pair of radial bearings 39, and in which is journaled a hinge-pin 40, which, extending both above and below the eye 38, is engaged in a pair of vertically spaced upper and lower ears 41, 42, respectively, projecting from a door-hanger bracket-plate 43, the upper ear 41 resting on a thrust bearing 44, which, in turn, engages the upper end of the eye 38 for supporting the bracket 43 hingedly on the arm 29, or 34, as the case may be, and as best seen in Figures 2 and 6.

The brackets 43 on the respective arms 29, 34, are attached, as by suitable fastening elements 45, to the rear inside marginal face of the door A, whereby, on rotation of the frame D on the pintle C, the rear end of the door A may be swung about the front support B as a pivot toward and from the defined path of movement of the pintle C on the rails 12, 13.

Set into the door A adjacent its front margin, and at a suitable elevation above the level of the floor 1, is a box-frame 46, which includes a vertical partition or latch-plate 47 disposed intermediately the thickness of the door A, whereby there is provided in the frame 46 a relatively shallow recess 48 on the inner face, and a relatively deep recess 49 on the outer face, of the door A, as best seen in Figure 4.

Slidably engaging the outer face of the latch-plate 47, is a slide plate 50 having a pair of horizontally spaced outwardly projecting ears 51, on which is pivotally mounted the respective bifurcated hubs or ends 52 of a U-shaped hand-grip or handle 53, which normally resides in depending vertical position snugly within the recess 49. Each hub 52 is provided with a lug 54 adapted, when the handle 53 is lifted to horizontal position from the recess 49, to impinge the free upstanding end of a leaf-spring 55 attached to the slide plate 50, the spring 55 frictionally bearing also on the suitably rounded end of the hub 52, as will best be understood from Figure 5.

A tongue 56 projects inwardly from the slide-plate 50 and works in an inverted U-shaped slot 57 provided in the latch-plate 47. Normally, the tongue 56 resides in one leg or the other of the U-slot 57 and is, by the side walls of the leg of the slot, held against sidewise movement therein. On lifting the handle 53, however, the engagement of the lug 54 with the spring 55 enables the raising of the tongue 56 from the particular leg of the slot 57 for permitting the traverse of the tongue 56 through the bight or horizontal portion of the slot 57 and into the opposite leg thereof, as best seen in Figure 9.

A seal slide-plate 58 is mounted on the tongue 56 and slidably engages the inside face of the latch-plate 47 for covering the slot 57 and preventing infiltration of air therethrough.

On the inner free end of the tongue 56 is pivotally mounted a clevis 59 having engagement with the forward end of an operator in the form of a rod 60, which, adjacent the clevis 59, carries an inner handle or grip-bar 61. The rod 60

extends rearwardly of the car through a support or guide 62 attached to the door A and at its rear end is pivotally engaged with the free end of the crank 37 on the frame D, so that longitudinal movement of the rod 60 will effect rotation of the frame D and its carried door-supporting arms 29 and 34 for moving the door A toward and from the path of movement of the pintle C, as has been described, and as best understood from Figure 3.

In use and operation, the door A, when in its closed position, is disposed between the jambs 5, 6, and the forward traveling door-support B resides at the front end portion of the track-rail 12, which disposes the front end of the door A abuttingly against the front seal flange 7 of the door opening 4. The latch-tongue 56 resides in the front leg of the slot 57, the rod 60 being then in forwardly shifted position for rotating the frame D on the pintle C, for, in turn, swinging the arms 29, 34, outwardly, thereby shifting the rear end of the door A also outwardly and away from the track-rails 12, 13, which disposes the rear end of the door A likewise abuttingly against the rear seal flange 8 of the opening 4.

A person desiring to open the door A, if on the inside, grasps the handle 61, and, if on the outside, grasps and lifts the handle 53, and in either case raises the tongue 56 out of the front leg of the slot 57 and moves it rearwardly into the rear leg of the slot 57, thereby shifting the rod 60 rearwardly on, and relatively to, the door A.

Such movement of the rod 60 rotates the frame D on the pintle C and swings the arms 29, 34, inwardly, thus also swinging the rear end of the door A inwardly toward the rails 12, 13, and about the support B as a pivot, until the rear end of the door A clears the rear jamb 6 of the opening 4.

The rear end of the door A having been thus shifted into laterally spaced relation with the opening 4, and the tongue 56 now residing in the rear leg of the slot 57, it is a simple matter to push on the handle 53, or 61, as the case may be, for moving the door A and support C rearwardly along the defined path thereof until the door A resides in the door-pocket 11, and as the front support or trolley B rides on the rail 12, the front end of the door A is likewise shifted inwardly from the opening 4 to clear the jamb 6, the final open position of the door A in the pocket 11 being indicated by the dash lines of Figure 3.

The reverse procedure is followed for closing the door A. The tongue 56 is allowed to remain in the rear leg of the slot 57 until the door A is brought into registration with and is opposite the opening 4 with the rear end of the door A in laterally spaced relation with the opening 4, although, by reason of the curvature of the rails 12, 13, the front end of the door A is in more or less front abutting relation with the front jamb 5. The tongue 56 is then shifted into the front leg of the slot 57, which actuates the frame D for moving the now registered door A laterally into the opening 4 between the jambs 5, 6, and restores the door A to its closed and sealed position, as hereinbefore described.

The door-structure is facile in operation and manipulation, efficiently meets the sliding door requirements of streamlined modern railway car construction, and fulfills in every respect the objects stated, it being noted that the door A is preferably centrally of such thickness, so that, when in closed position, as best seen in Figures 2 and 3, its outer face intermediate the jambs 5, 6, is substantially flush with the plane of the outer face of the car or vehicle side wall.

It will be understood that changes and modifications in the form, construction, arrangement, and combination of the several parts of the door structure may be made and substituted for those herein shown and described without departing from the nature and principle of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is,—

1. In a sliding door structure, in combination, first and second supports movable in spaced relation in a defined path, a door pivoted adjacent a margin on the first support, and means including members having pivoted connection with both the door at its opposite margin and the second support and being swingable in a horizontal plane for swingable actuation of the door relatively to the first support for producing bodily transverse movement of the door.

2. In a sliding door structure, in combination, first and second supports movable in spaced relation in a defined path, a door pivoted adjacent a margin on the first support, means swingable in a horizontal plane on the second support for supporting the door at its opposite margin for swingable movement relatively to the first support, and means on the door co-operable with the second support for disposing the door in selectively swung position for producing bodily transverse movement of the door.

3. In a sliding door structure, a support movable in a defined path, a pintle on the support at right angles to the plane of the defined path, a frame swingable on the pintle in a plane parallel to the plane of the defined path, a door carried by said frame for bodily shiftable movement of the door toward and from the defined path responsive to swingable actuation of the frame on the pintle, an operator shiftable on the door for actuation of the frame.

4. In a sliding door structure, a support movable in a defined path, a pintle on the support at right angles to the plane of the defined path, a frame swingable on the pintle in a plane parallel to the plane of the defined path, a door carried by said frame for bodily shiftable movement of the door toward and from the defined path responsive to swingable actuation of the frame on the pintle, an operator shiftable on the door for actuation of the frame, said door having a U-shaped slot, a member selectively engageable with the respective legs of the slot for latching the operator in shifted position, and handle means co-operable with said member for both moving the door and the support in its defined path when said member is in a particular leg of the slot and for shifting said member from one leg to the other of the slot for actuation of the operator.

5. In a sliding-door structure, in combination, a trackway including vertically spaced upper and lower members, a support including a vertically disposed pintle having traveling engagement with the track-members, arms having pivoted connection with the pintle intermediate the track-members for swingable movement in a horizontal plane, and a door carried by the arms for movement both edgewise in the path defined by the trackway and marginally arcwise relatively to the trackway and the support.

6. In a sliding-door structure, in combination, a trackway including vertically spaced upper and lower members, a support including a vertically disposed pintle having traveling engagement with

the track-members for swingable movement in a horizontal plane, a door, and means for suspending the door for movement both edgewise in the path defined by the trackway and marginally arcwise relatively to the trackway and support, said means including a frame sleeved on the pintle, a first arm on the frame having engagement with the door, a second arm having engagement with the door and pivoted connection with the pintle, and a bracket on the frame having engagement with the second arm.

7. In a sliding-door structure, in combination, a trackway including vertically spaced upper and lower members, a support including a vertically disposed pintle having traveling engagement with the track-members, arms having pivoted connection with the pintle intermediate the track-members for swingable movement in a horizontal plane, a door, means including a frame having engagement with the door and pivoted connection with the pintle intermediate the track-members for supporting the door for movement edgewise in the path defined by the trackway, and an actuator for pivotally actuating the frame for marginally arcwise swinging the door relatively to the trackway and support.

8. A sliding-door structure comprising, in combination, a trackway comprising upper and lower members, a support having traveling engagement at its respective ends with both of said track-members, a door, means including a frame mounted pivotally on the support and connected with a side margin of the door intermediate the track-members for edgewise movement of the door with the support in said path, and an actuator shiftable on the door for pivotal actuation of the frame for shifting the door marginally arcwise relatively to said path and support.

9. A sliding-door structure comprising, in combination, a trackway comprising upper and lower members, a support having traveling engagement at its respective ends with both of said track-members, a door, means including a frame mounted pivotally on the support and connected with a side margin of the door intermediate the track-members for edgewise movement of the door with the support in said path, an actuator shiftable on the door for pivotal actuation of the frame for shifting the door marginally arcwise relatively to said path and support, and means for latching said support in shifted position.

10. In combination with a structure having a door opening, upper and lower registering tracks, vertically aligned upper and lower front track-engaging members, a door pivotally mounted at one end between said members for revolvable movement about a vertical axis, a support-member mounted at its respective ends upon, and extending vertically between, the upper and lower tracks for traveling movement longitudinally therealong, radial bracket means pivotally mounted for horizontally swingable movement at one extremity upon and extending outwardly from the support-member, said bracket means being also pivotally attached at the other extremity to an adjacent margin of the door, and actuator means for rotating the bracket means about the support-member for swinging said door transversely away from the door opening.

11. In combination, a structure having a door opening, upper and lower registering tracks, vertically aligned upper and lower front track-engaging members, a door pivotally mounted at one margin between said members for revolvable movement about a vertical axis, a support member mounted at its respective ends upon, and extending vertically between, the upper and lower tracks for traveling movement longitudinally therealong, radial bracket means pivotally mounted for horizontally swingable movement at one extremity upon and extending outwardly from the support member, said bracket means being pivotally attached at their other extremity to the opposite margin of the door, and actuator means for rotating the bracket means about the support-member for swinging said door transversely away from the door opening, said actuator means including a longitudinally shiftable bar mounted on the door.

12. In combination, an enclosure having an opening in a wall thereof, a door adapted to fit within the opening, means for supporting the door for transverse shifting movement toward and away from the opening, and means for bodily moving the door into and out of closure-engagement with the door opening while maintaining the door substantially parallel to the plane of the opening.

13. In combination with an enclosure having an opening in the wall thereof, jambs at opposite margins of said opening, each jamb having a sealing-flange approximately in the plane of the outer face of said wall, a door for fitting said opening, supporting means for shifting the door in a defined path within the enclosure for registering the door in laterally spaced relation to said opening, said means being adapted to permit bodily shifting movement of the door when the latter is in registry with the opening, and means on said supporting means for moving the registered door transversely into marginal engagement with the flanges while maintaining the door constantly parallel to the plane of the opening.

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