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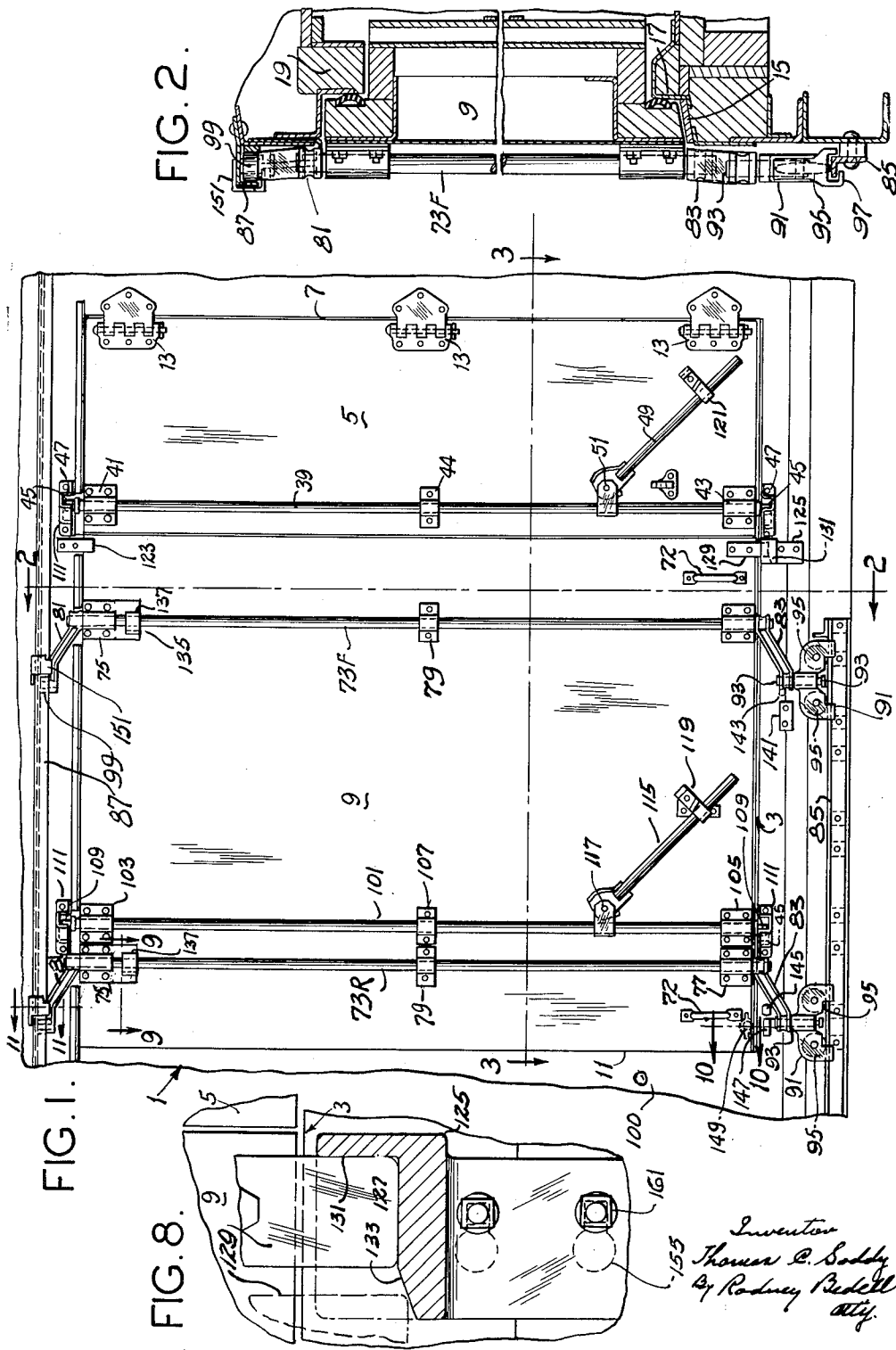
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HOUSE CAR SIDE DOOR STRUCTURE

Filed March 3, 1958

3 Sheets-Sheet 1



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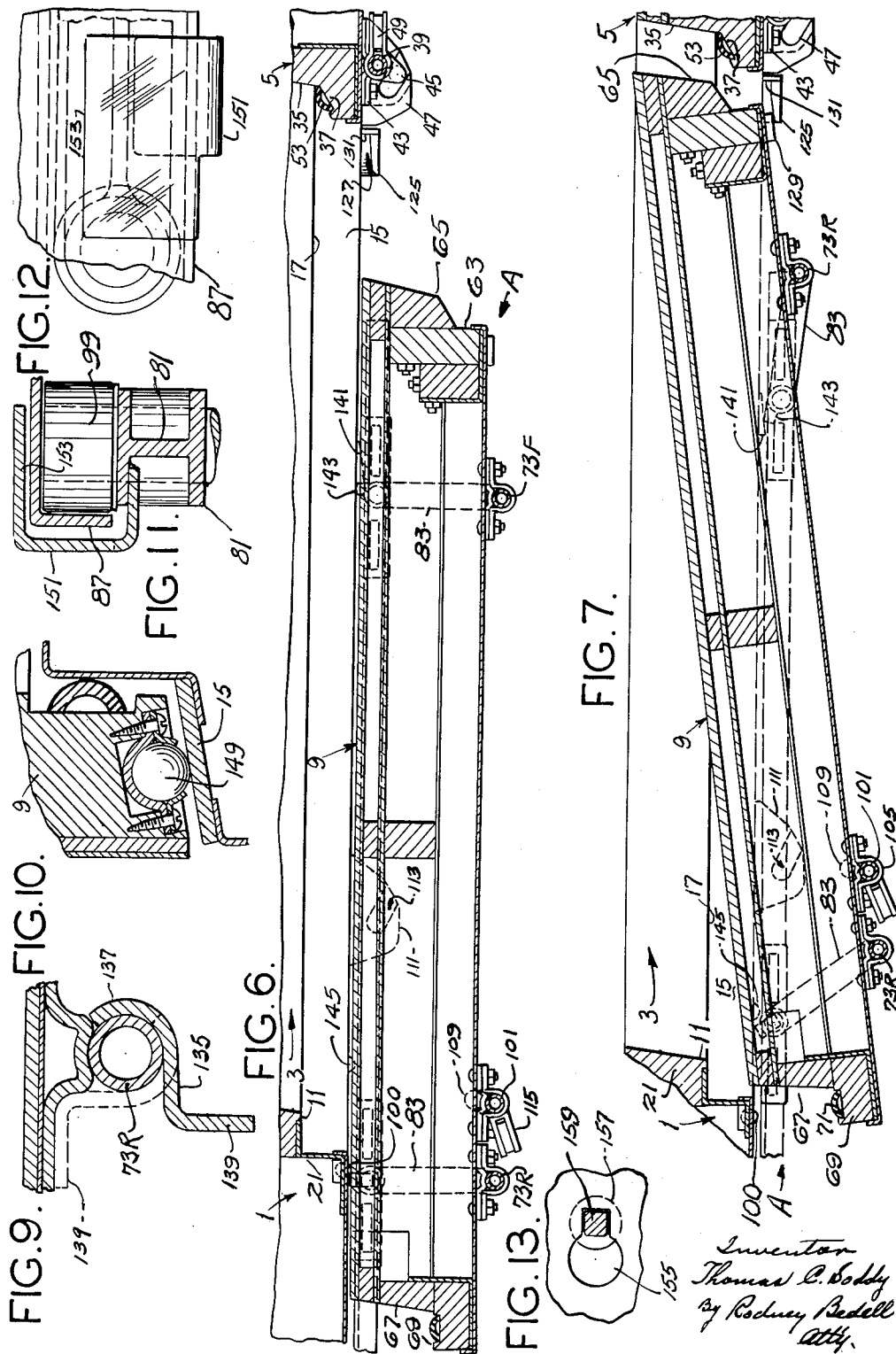
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HOUSE CAR SIDE DOOR STRUCTURE

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13 Claims. (Cl. 20-23)

This invention relates to railway car doors, such as refrigerator car doors, and more particularly to supporting, operating and holding means for sliding car doors of the type which close into a door opening in a side wall of a car, the door when fully closed being substantially flush with the side wall.

When a railway car equipped with a sliding door of the class described is subjected to endwise impacts, such as occur in switching operations, if the door should be open (and not latched in fully open position), it will slide endwise repeatedly with considerable momentum. With prior supporting and operating means, this has resulted in the front or rear end of the door bouncing against the front or rear stops for the door, depending upon the direction of impact, resulting in such dynamic shocks that the door stops may be knocked off the car or the door may be badly damaged, or the door track or guide damaged. One of the objects of this invention is the provision of improved door supporting and operating means which acts automatically, upon sliding of the door in closing direction, to swing both the front and rear ends of the door into the door opening. Thus, should the door be open when the car is subjected to an impact which makes the door slide in closing direction, the door will automatically move into such a position within the door opening that subsequent end impacts cannot cause it to move.

A sliding door of the class described when closed may be subjected to relatively high internal loads tending to push it outwardly. For example, in a car loaded with barrels of merchandise, barrels may break loose and wedge against the inside surface of the door. Another object of the invention is the provision of means for locking the door in closed position to resist such internal loads.

A sliding door of the class described may be particularly useful in combination with a hinged door, the latter having a rabbet at its free end which overlaps a rabbet on the swinging end of the sliding door when the doors are closed. Another object of this invention is the provision of supporting and operating means for the sliding door in such a combination which allows for opening and closing it without opening the hinged door, acting automatically to enter the rabbet on the sliding door behind the rabbet on the hinged door on movement of the sliding door in closing direction, and acting in reverse manner on opening of the sliding door.

In prior sliding door constructions, the weight of the door when closed is borne by the door supporting and operating means, and vibration of the car while in service is apt to cause wear of parts and sagging of the door. A further object of this invention is the provision of means for automatically taking the load due to the weight of the door off the supporting and operating means whenever the door is closed to avoid such wear and sagging.

Sliding doors of the class described usually are supported by a lower track and retained at the top by a top retainer or guide. When a car is subjected to severe endwise impact, the stress is such that the portion of the car side plate above the door opening tends to buckle upward and the portion of the car side sill below the door opening tends to buckle downward, with resultant tendency to spread apart the track and top retainer. With prior constructions, this spreading could result in the disengage-

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ment of the door supporting and operating means from the top retainer. A further object of this invention is the provision of safety means as a part of the door supporting and operating mechanism which acts to prevent such disengagement. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated:

FIGURE 1 is a view in elevation of a side wall of a refrigerator car equipped with sliding and hinged door structure, the doors being shown in closed position.

FIGURE 2 is an enlarged vertical section on line 2-2 of FIGURE 1, the middle portion of the door being broken away.

FIGURE 3 is an enlarged horizontal section on line 3-3 of FIGURE 1.

FIGURES 4-7 are views similar to FIGURE 3 but illustrating various moved positions of the door.

FIGURE 8 is an enlarged detail section on line 8-8 of FIGURE 3.

FIGURES 9-11 are enlarged detail sections on lines 9-9 to 11-11, respectively, of FIGURE 1.

FIGURE 12 is a plan view of parts shown in FIGURE 11.

FIGURE 13 is a detail section of a typical fastening for parts of the supporting and operating means.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

A railway refrigerator car side wall 1 has a door opening 3. A relatively narrow door 5 is hinged at 13 to the car side at the right hand end of opening 3 and is adapted to swing into and out of a closed position substantially flush with side wall 1. A relatively wide sliding door 9 is adapted to occupy a closed position between the left hand end 11 of the door opening and the narrow door and substantially flush with side wall 1. At the bottom of door opening 3 is a threshold plate 15 (FIGURE 2) which is inclined upward from outside to inside. This plate lies outside of a bottom stop 17. At the top of the door opening is a header 19. At the left hand end of the opening 3 is a door post 21.

Narrow hinged door 5 comprises a rectangular wood frame 27, a sheet metal outside panel 29, and spaced inside plywood panels 31 and 33 (see FIGURES 3 and 4). Frame 27 is made so that the edges of door 5 have a rearwardly and inwardly facing rabbet 35, 37. On the outside of door 5 is a vertical rotary locking shaft 39 journaled in upper and lower bearings 41 and 43 and an intermediate bearing 44. Shaft 39 has eccentric lugs 45 at its ends engageable in keepers 47, mounted on the car side wall above and below the door opening, for forcing the door open and closed and for locking it closed. A handle 49 is pivoted to the shaft at 51. The thickness of door 5, as shown, is the same as the thickness of the car wall and, when the door is closed, its outside face is flush with the outside of the car wall and its inside face is flush with the inside of the car wall. The door is provided with rubber sealing strips 53.

Wide sliding door 9 comprises a rectangular wood frame 55, a sheet metal outside wall 57, and spaced inside plywood panels 59 and 61. Door 9 is the same thickness as door 5. The outer edge 65 of frame 55 has a forwardly and outwardly facing rabbet 63 adapted to enter rabbet 35 on the opposing edge 37 of the hinged door. The rear end of door 9 and the door post has a similar rabbet structure 67, 69. Door 9 has sealing strips 71 at the rear, top and bottom edges for engagement with the door rear post 21, header 19 and threshold abutment 17. Door 9 has front and rear hand holds 72.

Door 9 is part of a door assembly A including front and rear rotary mounting shafts designated 73F and 73R extending vertically on the outside of the door and journaled in upper and lower bearings 75, 77 and an intermediate bearing 79. Shaft 73F is located near the front end of the door and shaft 73R is located near the rear end of the door. Fixed on the upper and lower ends of each of shafts 73F, 73R are crank arms 81, 83. Extending longitudinally on the outside of the car side wall below the door opening is a track 85. Extending longitudinally on the outside of the car side wall above the door opening is a top retainer or guide 87. Each of the lower crank arms 83 has a roller carriage 91 vertically pin-connected at its free end as indicated at 93, whereby the crank arms may swing horizontally on the vertical axes of the pin-connections. Each carriage 91 carries rollers 95 riding on track 85 and has hook portions 97 (FIGURE 2) which extend under the track. Each of upper crank arms 81 has a roller 99 on a vertical pin at its free end which rides on the guide 87. When door 9 is in closed position (FIGURES 1, 3), upper and lower crank arms 81 and 83 of both mounting shafts 73F and 73R extend from the shafts longitudinally of the car to the left in the direction of opening movement of door 9 (FIGURES 1 and 3-7).

To open door 9 when door 5 is closed, shaft 101 is rotated by crank 115 to release the rear end of door 9 from keepers 11 (FIGURE 4), then handle 72 is grasped to move the door to the position shown in FIGURE 5, then the door is pushed to the left. The inner face of the door will engage rivet 100 and as the door moves rearwardly its forward edge automatically is swung outwardly to the position shown in FIGURE 6, from whence the carriages and crankshafts move along track 85 with the door spaced from the car wall.

Door assembly A includes a rotary locking shaft 101 located inward of and adjacent rear mounting shaft 73R, extending vertically on the outside of the door, and journaled in upper and lower bearings 103, 105 and an intermediate bearing 107. Locking shaft 101 is rotatable independently of mounting shafts 73F and 73R. It has an eccentric lug 109 at each end. Keepers 111 provided on the car side wall, one above and the other below the door opening, are engageable by lugs 109 of the shaft 101. Each keeper has an angled slot 113 for receiving respective lug 109 whereby upon rotation of locking shaft 101 in counterclockwise direction, as viewed from above, the door is forced closed and locked, and on rotation of shaft 101 in the opposite direction the door is unlocked and forced in the direction out of the door opening. Shaft 101 has a handle 115 pivoted at 117 thereon. A catch 119 on the outside of sliding door 9 holds handle 115 in a door-locking position flat against the outside of the door and inclined downward from pivotal connection 117. A similar catch 121 is provided for handle 49 on hinged door 5.

Lugs 109 and keepers 111 lock door 9 against moving out under internal loads at two points, adjacent the rear corners of the door. Other means locks door 9 against moving out under internal loads at its front corners. This means comprises an upper keeper 123 and a lower keeper 125. Upper keeper 123 (FIGURE 1) comprises a flat bar fastened to the car side wall above the door opening immediately rearward of the left hand edge of hinged door 5 and extending down below the top of the door opening to overlap the upper front corner of sliding door 9 when the latter is in closed position. Lower keeper 125 (FIGURE 8) is fastened to the car side wall below the door opening and directly below upper keeper 123. It provides a recess 127 (FIGURE 6) for receiving a lug 129 which projects down from the front lower corner of door 9 when the latter is closed to lock the front lower corner of the door in closed position. Keeper 125 has a wall portion 131 at its front end engageable by lug 129 to act as a stop for door 9. The bottom of recess 127 in keeper 125 has a rearward inclined portion 133 for lifting up the front end of door 9 slightly, when the latter

moves into its closed position, to take the weight of the door off front lower crank arm 83 and front carriage 91.

For each mounting shaft 73F and 73R there is a stop 135 (FIGURE 9) for restricting the rotation of the shaft in door-opening direction to approximately 90°, and thereby limiting the rotation of the crank arms 83 to approximately 90°. This stop is a special feature of this invention, for the purpose of preventing continued rotation of cranks 83 until the inside surface of the door could rub against the car side wall. As shown in FIGURES 1 and 9 it comprises an arm having an arcuate end portion 137 welded on shaft 73F or 73R, as the case may be, immediately below the upper bearing for the shaft. The arm extends tangentially from the shaft and has an angled end portion 139 engageable flatwise with the face of bearing 75 when the shaft is rotated from its door-closed to its door-open position. FIGURE 9 shows rear shaft 73R and stop or arm 135 thereon in the door-closed position in solid lines, and in the door-open position in dotted lines.

Accordingly, the operator, when opening the door, may apply rearward thrust on handle 72 without giving thought to the left hand edge of the door which automatically will be held by stop 135 against transverse movement toward the side wall when the crankshafts 73R and 73F have rotated 90°.

Near the end of movement of door 9 to the right to closed position, the front end of the door is automatically swung toward the side wall to enter keepers 123, 125 and to insert rabbet 65 behind rabbet 37 of hinged door 5, whereupon the rear end of the door swings into the door opening. This feature is particularly desirable in conjunction with the provision of well-known means (not shown) for latching door 9 in fully open position to avoid sliding forwardly and rearwardly, if the car is bumped or decelerated, as could happen if the door is left partially open.

Means for effecting the transverse movements of door 9 comprises a stop 141 on the outside of the car wall below the door opening somewhat to the left of the rear end of hinged door 5. This stop 141 (FIGURE 3) consists of a metal plate, having an inclined outer face, welded on the side wall of the car. The inner end of front lower crank arm has an extension 143 (FIGURES 1, 3, 4, 5) engageable with the left hand edge of stop 141 as door 9 slides toward closed position so that continued movement of the door swings its front end into the door opening (FIGURE 7) just before the door reaches keepers 123, 125.

A rear stop 145 (FIGURES 1, 7) on the car wall adjacent the lower left hand corner of the door opening engages an extension 147 on the inner end of lower left crank arm 83 after extension 143 engages front stop 141, and continued forward movement of the door swings its rear end into the door opening (FIGURE 3). During this movement lugs 109 enter keepers 111, whereupon handle 115 may be swung to lock the rear end of the door. As door 9 completes its closing movement, its upper front corner moves in behind upper keeper 123, and lug 129 moves in behind lower keeper 125 to hold the front end of the door against outward movement. Stop 145 is above the level of extension 143 so that the latter clears stop 145 as it moves by the same. After the stops have swung the cranks inwardly, extensions 143, 147 slide over their co-operating stops 141, 145 to accommodate further movement of the door to the right.

The lower rear corner of the door mounts a ball roller 149 (FIGURES 1, 10) and, during the final inward movement, rides up the inclined threshold plate 15 and lifts the rear end of the door slightly to take the weight of the door off rear lower crank arm 83 and rear carriage 91. This acts, in conjunction, with inclined portion 133 of keeper 125 to take the weight of the door, when closed, off the door supporting and operating means, thereby avoiding wear of these parts and sagging of the door such

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as may otherwise occur due to vibration of the car while in service.

Safety means for preventing rollers 99 from coming out of top retainer or guide 87 upon endwise impact on the car comprises C-shaped retainers or hooks 151 (FIGURES 1, 11, 12) on upper crank arms 81 having upper portions 153 which overlie guide 87 when the crank arms are either in or out and prevent rollers 99 from coming out of guides 87. These retainers are described and claimed in my copending application Serial No. 730,624 filed April 24, 1958.

The various elements of the door supporting and operating mechanism described above secured to the doors or the car side wall may be fastened by bolts entered in keyhole slots in the outside of the door or car side wall. For example, FIGURE 8 shows keeper 125 so attached to the side wall, and FIGURE 13 is a detail of the attachment. For each bolt there is a keyhole slot 155 the large end of which is large enough to receive bolt 157. The bolt has a square shank 159 fitting in the narrow part of the keyhole slot to prevent the bolt from turning when a nut 161 is threaded on the outer end of the bolt. By using this type of fastening, replacement of parts may be easily accomplished without disturbing the inside lining or insulation of the side wall or door.

Operation is as follows:

To open sliding door 9, locking shaft 101 is manually rotated by means of handle 115 in clockwise direction as viewed from above away from the FIGURE 3 position to force the rear left end of the door outward to a position as illustrated in FIGURE 4 and to disengage lugs 109 from keepers 111. Then the rear end of door 9 is manually pulled completely out of the door opening 3, by grasping rear handle 72, and the door is given some sliding movement in opening direction (to the left) reaching a position as illustrated in FIGURE 5, wherein the rear end of the door is completely outside the car side wall and the front end has moved far enough in opening direction that extension 143 of the front lower crank arm is past the front stop 141. The front end of the door is now clear of keepers 123, 125 and its rabbet 65 is now clear of rabbet 37, so that the front end of the door can now swing out for the door to assume its sliding position outside of and parallel to the car side wall (FIGURE 6) as explained above. In this position of the door, crank arms 81, 83 extend laterally out from the car side wall generally at right angles to the car side wall. With the door in sliding position, it may be rolled manually to the left to a completely open position and latched therein by suitable latching means (not shown).

To close door 9, it is rolled back to the right. It remains parallel to the car side wall until it reaches the position shown in FIGURE 6, at which extension 143 on front lower crank arm 83 engages stop 141 on the car side wall. This occurs before extension 147 on rear lower crank arm 83 engages rear stop 145. As a result of the engagement of extension 143 with stop 141, the front end of the door swings into door opening 3 before it reaches keepers 123, 125 (FIGURE 5). The door momentum, or continued operating thrust to the right, results in extension 147 on rear lower crank arm 83 engaging rear stop 145 which causes a further lengthwise movement of the door, while it is at an angle to the side of the car, to the FIGURE 7 position in which the front end of the door slides in behind keepers 123, 125 (hinged door 5 being closed), and rabbet 65 slides in behind rabbet 37. At the same time the left hand crank arms swing on their carriages and the rear end of the door swings partly into the door opening (FIGURE 4). Then the rear end of the door may be pushed in farther by the operator, lugs 109 entering keepers 111. Then the operator swings handle 115 counterclockwise to force the door inwardly against the gaskets and to lock the door in its closed position (FIGURE 3).

Keepers 123, 125 hold the front edge of door 9 against

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movement outwardly of the opening. Shaft 39 and elements 45, 47 hold the swinging edge of door 5 against movement outwardly of the opening. These holding means are independent of each other and do not interfere with the swinging of door 5 on its hinges. The opposed rabbet edges of doors 5 and 9 provide a tight joint between them which is sealed by the compression of strip 53 when shaft 39 is rotated to position to thrust the swinging end of door 5 inwardly.

Sliding door 9 can be opened without opening hinged door 5. Hinged door 5 may be opened independently of the sliding door, and the sliding door opened when the hinged door is open. There is no required sequence of operation of the doors to open either or both doors. The sliding door may be opened and then the hinged door; or the hinged door may be opened and then the sliding door. The sliding door may be opened without opening the hinged door because the action of the operating mechanism allows rabbet 65 to slide rearward from behind rabbet 37.

The supporting and operating means for the sliding door shown is useful for closing the door opening on a car side wall where there is only the sliding door (no hinged door). Under such circumstances, the front door post would be of tongue and groove construction like the free edge of the hinged door shown herein.

The details of the structure may be varied substantially without departing from the spirit of the invention and the exclusive use of those modifications coming within the scope of the claims is contemplated.

What is claimed is:

1. Supporting and operating means for a railway car exterior sliding door of the type which closes into a door opening in a side wall of the car and substantially flush with the side wall, comprising a track on the outside of the side wall below the door opening, horizontal crank arms spaced apart lengthwise of the door having freely journaled upright pivots on the lower portion of the door near the front and rear thereof, carriages riding on the track and having upright pivots journaled on the swinging ends of the crank arms, said crank arms being freely swingable about said carriages as the door moves into and out of closed position, said door when swung out of closed position being movable with said carriages along said track longitudinally of the car in rearward direction to a retracted position clear of the opening and being movable in forward direction abreast of the opening, the lower crank arms having projections on their pivoted ends in opposite directions to their door supporting swinging ends, and stops fixed relative to the side wall and projecting therefrom and between the side wall and the track and engageable by said projections as the door moves abreast of the opening to automatically swing the crank arms at front and rear of the door about their pivots and move both the front and the rear of the door into the door opening.

2. Supporting and operating means according to claim 1 which includes free swinging crank arms having upright pivots on the upper portion of the door, a guide outboard of the side wall above the door opening, said guide being of inverted U section and engaging the swinging ends of the upper crank arms and cooperating with the crank arm-engaging stops abreast of the lower portions of the door to automatically swing the door into said opening.

3. Supporting and operating means as set forth in claim 1 further comprising means fixed on the car wall above and below the door and adjacent the four corners of the door for engaging the door and locking the closed door to the car side wall.

4. Supporting and operating means as set forth in claim 1 further comprising antifriction means on the car side wall engaging the bottom of the door adjacent the rear end of the door for supporting the door rear end as it moves into closed position.

5. Supporting and operating means as set forth in claim

1 wherein the crank arm-engaging stops are on the side wall below and near the front and rear of the door opening, there being an extension on the lower front crank arm engageable with the front stop, and an extension on the lower rear crank arm engageable with the rear stop, the extension on the front lower crank arm being located at a lower level to clear the rear stop as it moves past the same.

6. Structure as set forth in claim 3 in which the locking means at the rear end of the door comprises an upright shaft journaled on the door and having offset lugs, and fixed keepers on the wall receiving said lugs, and the locking means at the front end of the door comprises fixed keepers mounted on the car side wall above and below the door and projecting in front of the door opening and receiving the front of the door behind them as it is moved into closed position.

7. Supporting and operating means for a sliding railway car door of the type which is mounted exteriorly of the car and closes into a door opening in a side wall of the car and substantially flush with said side wall, comprising a straight track on the outside of said side wall below the door opening, a guide on the outside of the side wall above the door opening, a pair of rotary mounting shafts carrying the door extending vertically on the outside of the door adjacent the ends of the door, upper and lower horizontal crank arms fixed on the ends of the mounting shafts, carriages riding on the track and journaling the ends of the lower crank arms, means on the ends of the upper crank arms guided by the guide, said crank arms being swingable freely in and out for movement of the door into and out of closed position flush with the car side wall, said door when swung out of closed position being movable longitudinally along the side of the car in rearward direction to a retracted position clear of the opening and being movable freely back in forward direction for closing thereof, a rotary locking shaft extending vertically on the outside of the door and carried by the door, said locking shaft being rotatable independently of said mounting shafts, eccentric lugs on the ends of the locking shaft, and keepers on the side wall for receiving said lugs adapted upon rotation of the locking shaft in one direction to force the door inward and lock it closed, and adapted upon rotation of the locking shaft in the opposite direction to force the door outward, each of the mounting shafts having an arm thereon engageable with the outside of the door when the shaft rotates in door-opening direction to limit the rotation of the shaft and the swing of the door.

8. Structure as set forth in claim 7 in which the mounting shaft arm extends tangentially from the periphery of the shaft and has an angled end portion engageable flatwise with the outside of the door to limit the shaft rotation.

9. Structure according to claim 1 in which the crank arm projection near the rear of the door engages the coacting fixed element subsequent the engagement by the crank arm projection near the front of the door with its coacting element whereby the action of the rear crank arm thrusts the front of the door forwardly after it has been moved into the door opening, and keepers on the car side wall projecting beyond the door opening and near the front thereof and receiving the front of the door during said forward thrust of the latter by the rear crank arm.

10. Structure according to claim 1 in which the crank arm projection near the rear of the door engages the coacting fixed element subsequent to the engagement by the crank arm projection near the front of the door with its coacting element whereby the action of the rear crank arm thrusts the front of the door forwardly after it has

been moved into the door opening, and the front edge of the door forming a projecting tongue adjacent the inner face of the door and with the front edge of the door opening for the sliding door forming a rabbet with a tongue adjacent the outer face of the car side wall and projecting into said sliding door opening and receiving the door front edge tongue during said forward thrust of the latter by the rear crank arm.

11. Supporting and operating means for a railway car sliding door of the type which closes into a door opening in a side wall of the car and substantially flush with the side wall, comprising a straight track on the outside of the side wall below the door opening, crank arms having upright pivots freely journaled on the lower portion of the door near the front and rear thereof, carriages having upright pivots freely journaled on the swinging ends of the crank arms and riding on the track, said crank arms being freely swingable about said carriages for movement of the door into and out of closed position, said door when swung out of closed position being movable with said carriages along said track longitudinally of the car in rearward direction to a retracted position clear of the opening and being movable in forward direction abreast of the opening, securing elements fixed on the side wall adjacent to the four corners of the door opening, and cooperating devices adjacent to the four corners of the door and projecting therefrom beyond the edges of the door into engagement with said elements when the door is in closed position to hold the door against movement outwardly of the door opening independently of said crank arms.

12. Supporting and operating means for a railway car sliding door of the type which closes into a door opening in a side wall of the car and substantially flush with the side wall, comprising a straight track on the outside of the side wall below the door opening, horizontal crank arms having upright pivots on the lower portion of the door near the front and rear thereof and swinging freely on the door, carriages having upright pivots on the swinging ends of the crank arms and riding on the track, said crank arms being freely swingable about said carriages for movement of the door into and out of closed position, said door when swung out of closed position being movable with said carriages along said track longitudinally of the car in rearward direction to a retracted position clear of the opening and being movable in forward direction abreast of the opening, and means on the bottom of the door disposed to engage an upwardly facing surface of the car wall below the door opening as the door moves into closed position independently of said crank arms to take the load of the door off the carriages.

13. Supporting and operating means for a railway car sliding door according to claim 1 in which the stops on the car side wall are spaced farther apart than the crank arm pivots so that the crank arm projections engage the stops successively as the door is moved abreast of the opening, the stop engaging the front crank arm projection effecting inward movement of the front end of the door before the stop engaging the rear crank arm projection effects inward movement of the rear end of the door.

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