July 23, 1957 R. I. GARDNER ET AL 2,799,900

CAR DOOR

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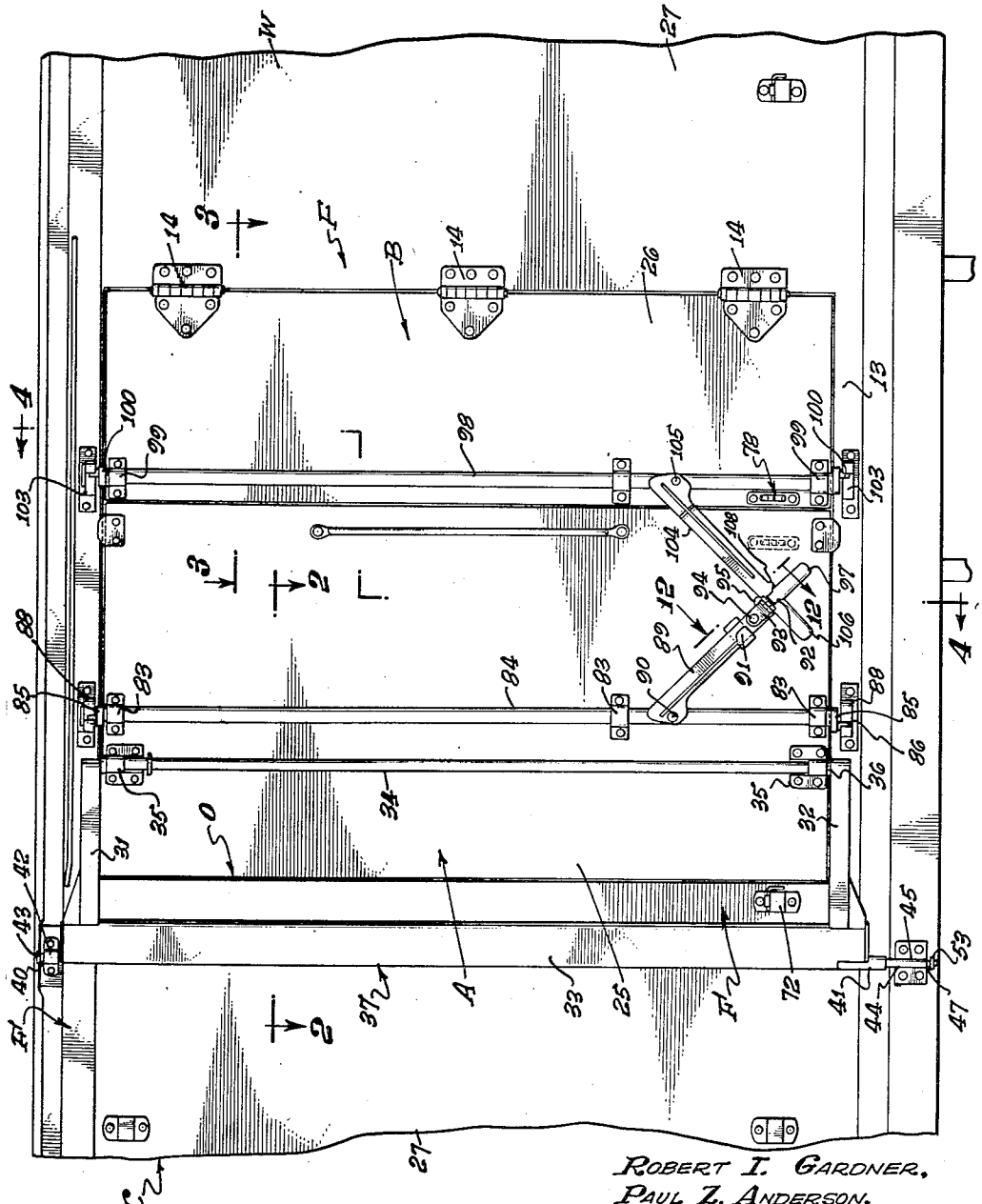


FIG. 1.

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HENRY O. FUCHS,
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CAR DOOR

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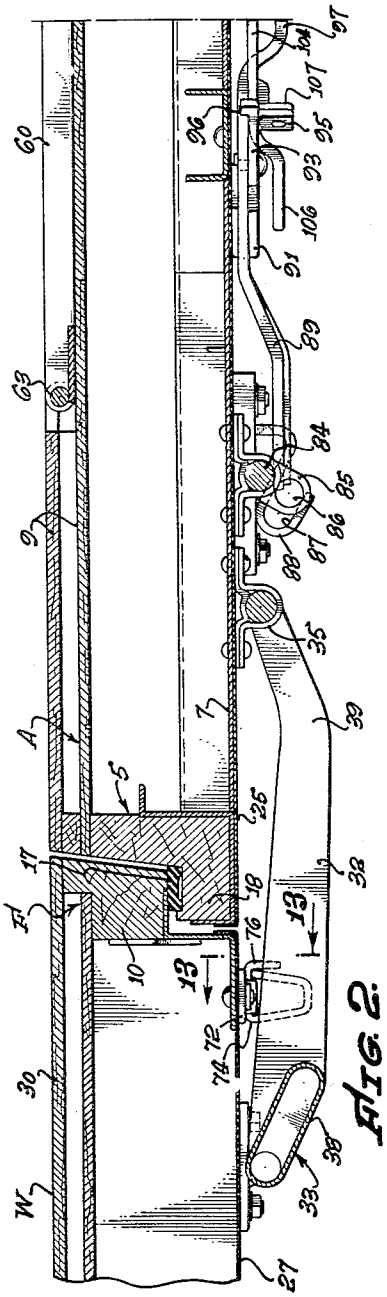


FIG. 2.

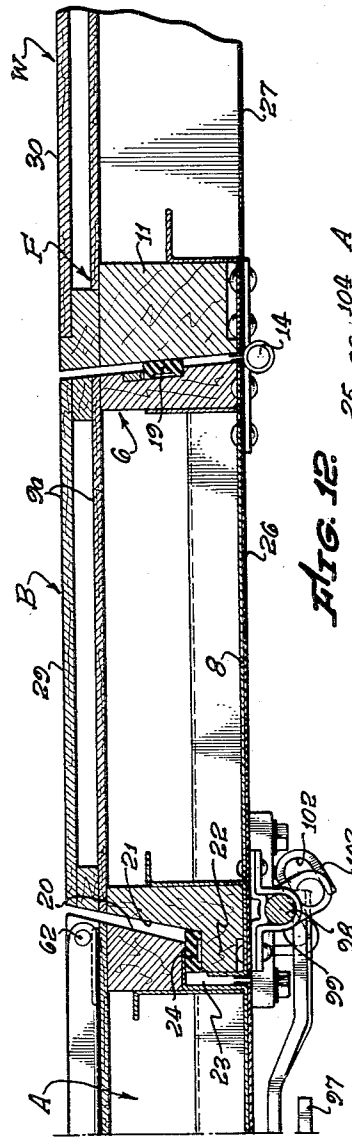


FIG. 3.

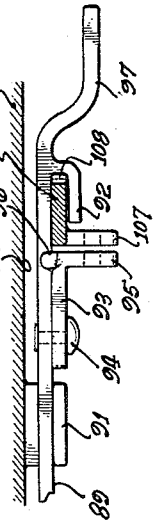


FIG. 12.

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CAR DOOR

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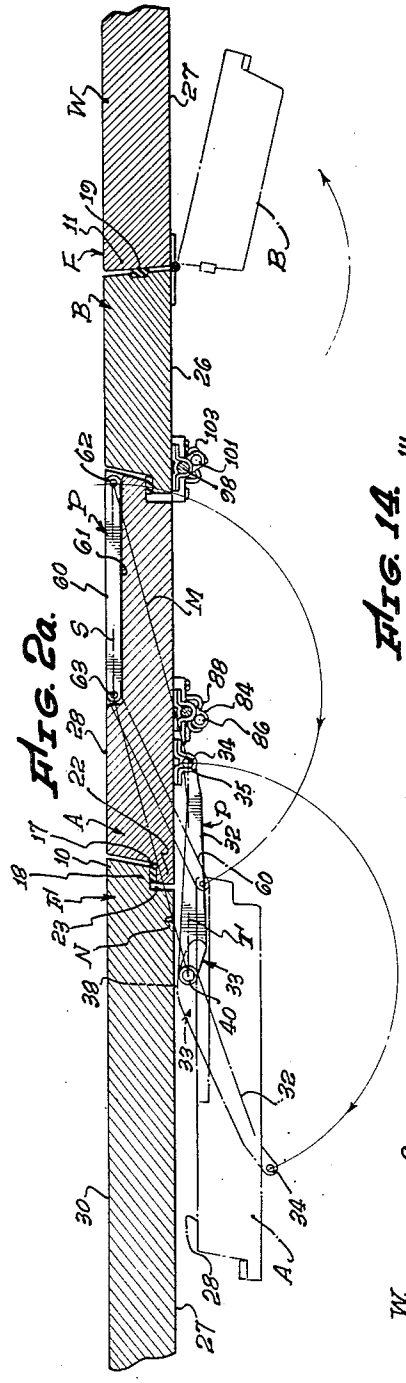


FIG. 2a.

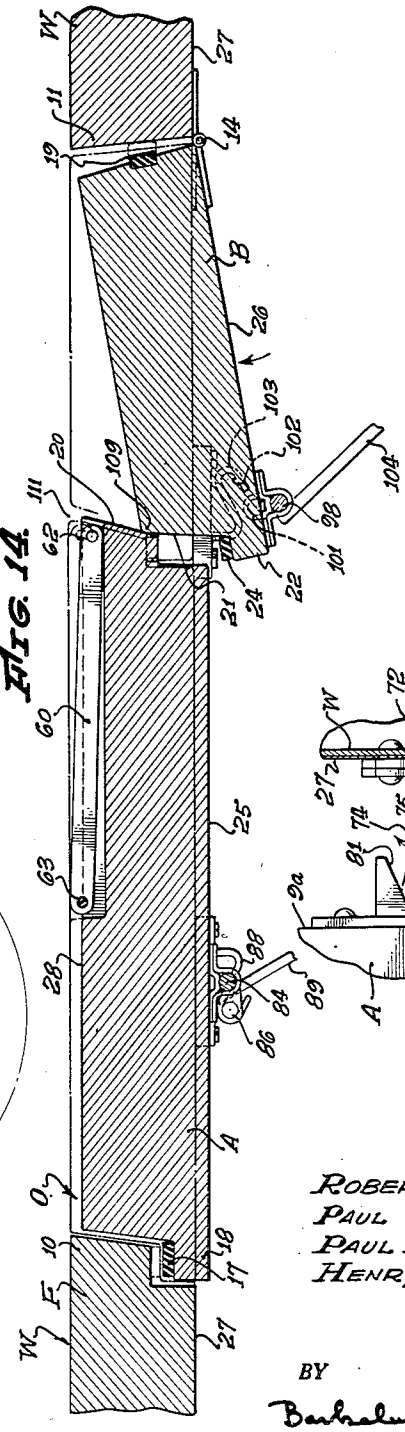


FIG. 14.

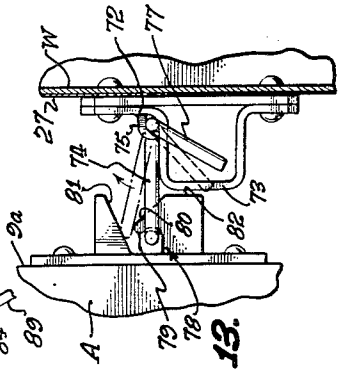


FIG. 13.

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CAR DOOR

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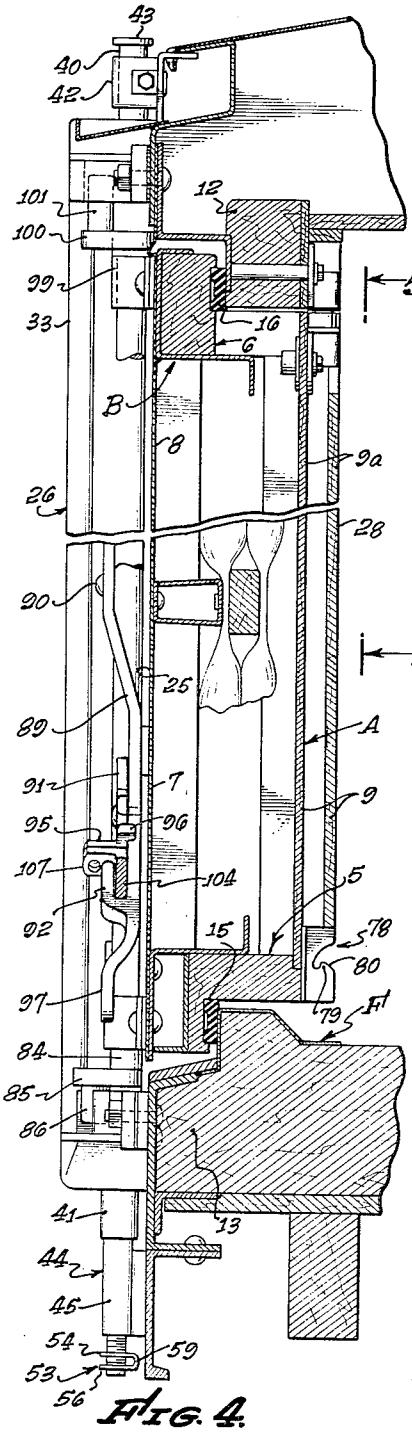


FIG. 4.

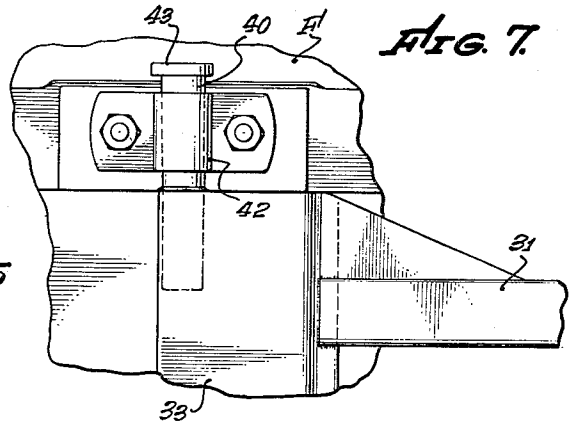


FIG. 7.

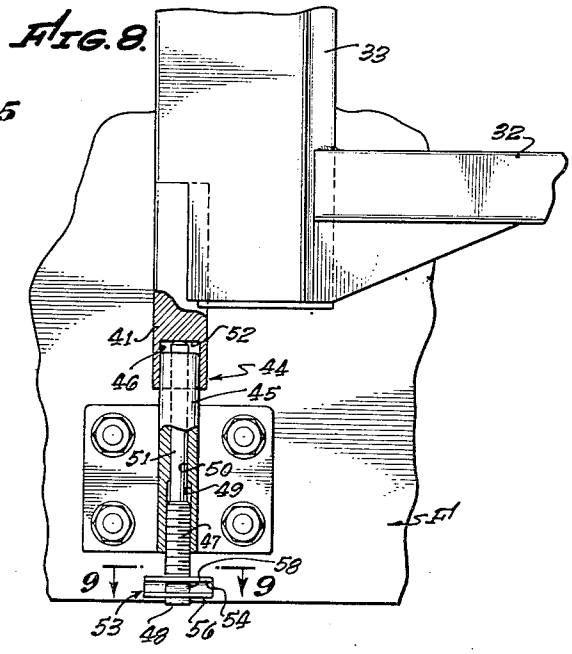


FIG. 8.

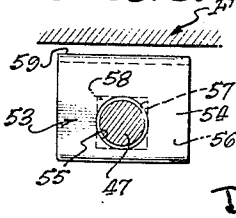


FIG. 9.

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CAR DOOR

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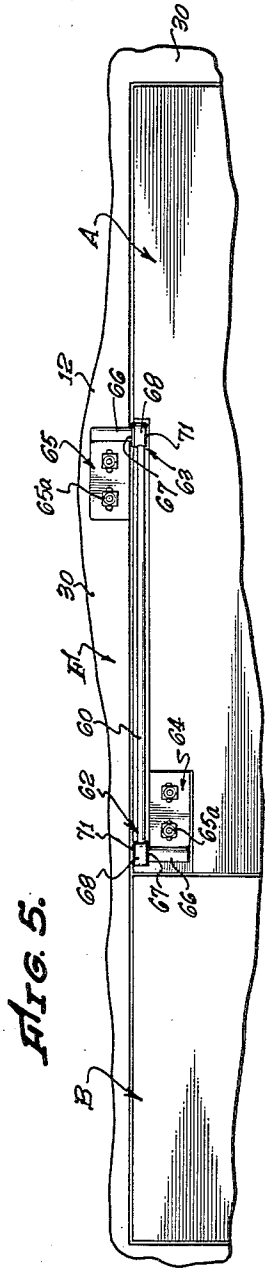


FIG. 5.

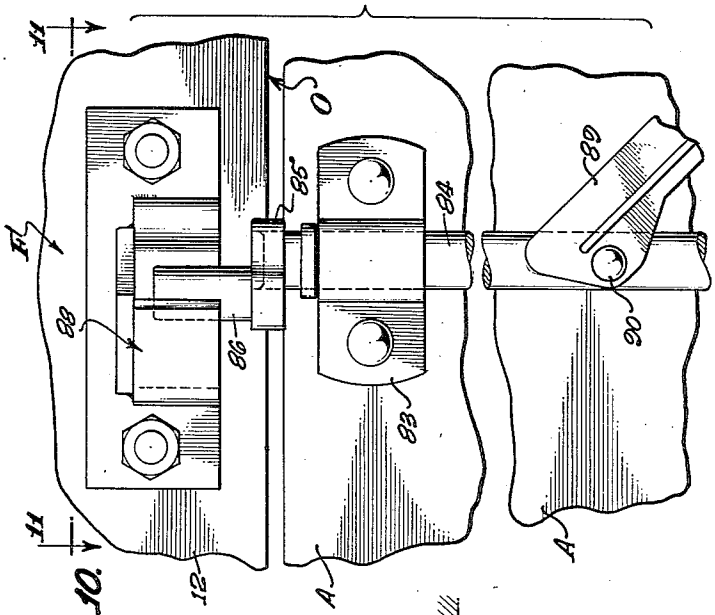


FIG. 10.

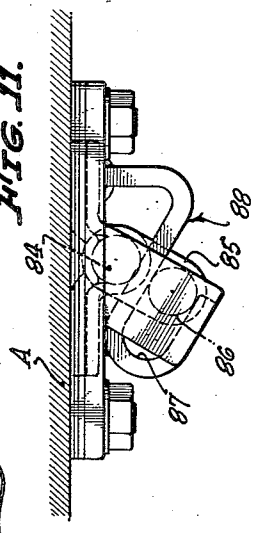


FIG. 11.

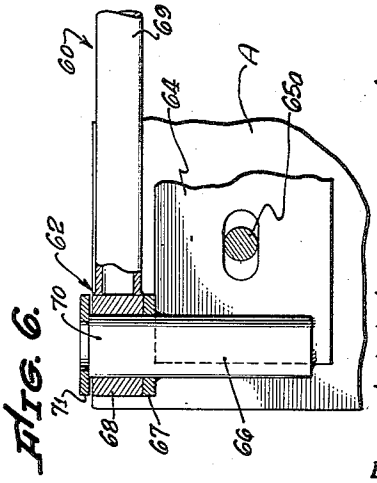


FIG. 6.

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CAR DOOR

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FIG. 15.

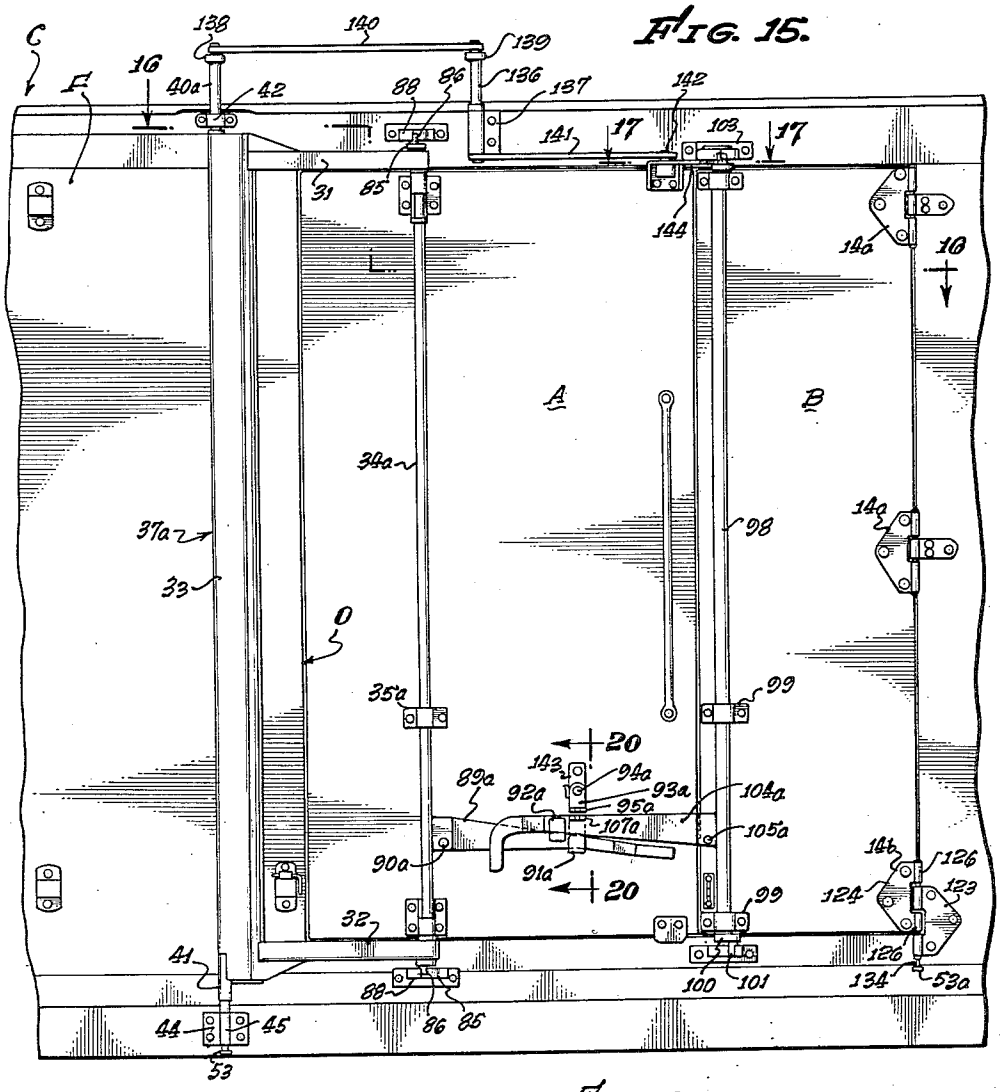
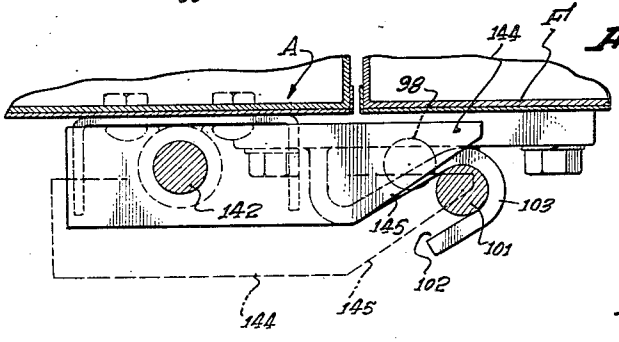


FIG. 17.



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FIG. 20.

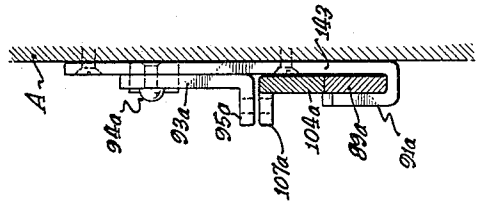


FIG. 16.

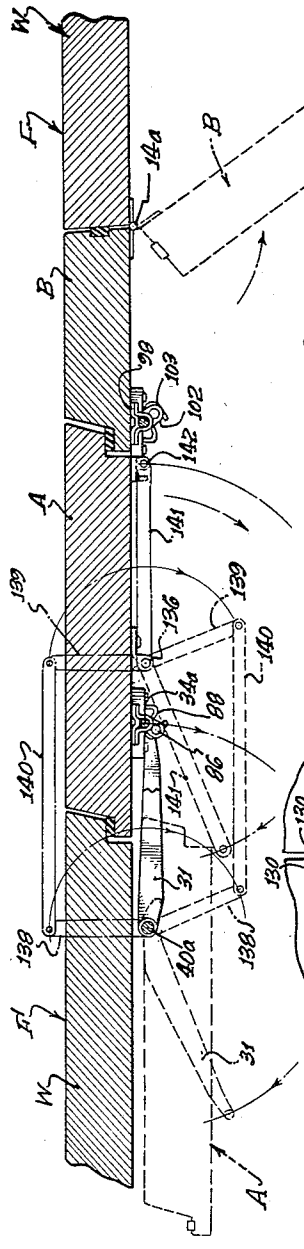


FIG. 19.

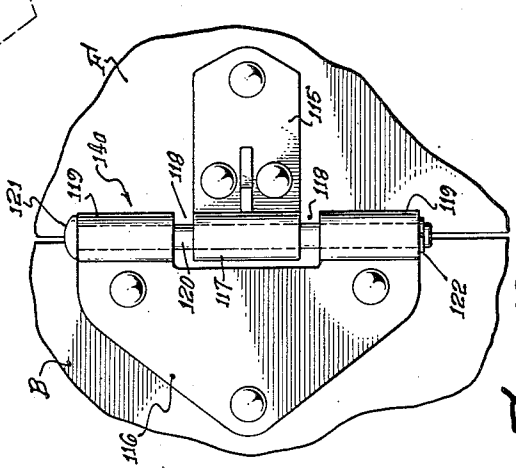
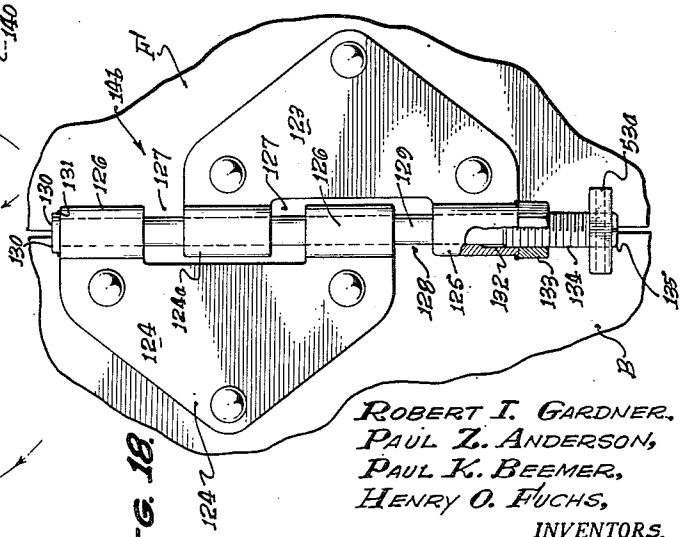


FIG. 18.



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United States Patent Office 2,799,900 Patented July 23, 1957

2,799,900

CAR DOOR

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Application March 15, 1954, Serial No. 416,170

27 Claims. (Cl. 20—24)

This invention has to do generally with railway house car doors and is more particularly concerned with doors of a type adapted especially well to installation in refrigerator cars.

Therefore, though the invention is not at all to be considered as limited thereto, the drawings and description are directed to the invention as embodied in refrigerator cars and the beginning discussion is based on such an embodiment.

For many years dual, hinged doors, filling doorways about four feet wide, were standard refrigerator car equipment, but in later years such doors proved inadequate for certain purposes. For instance, it became necessary to increase the doorway width to about six feet in order to handle palletized loading with lift trucks. This, of course, created new door problems, for loading platform clearances, etc., had to be preserved in spite of the fact that the doorway closure had to be of increased width. The clearance would not permit the use of hinged doors any wider than the old standard.

An attempt to solve this problem was by way of providing six-foot sliding doors, but this created new problems. For instance, such doors were necessarily so heavy as to be decidedly cumbersome, and in many situations (particularly under bad weather conditions) it was impossible for an inspector, working alone, to open the door even to the relatively slight extent necessary to permit his entry. On the other hand, such doors were frequently opened, for inspection purposes, to much greater extents than were necessary to permit the entrance of an inspector, leading to the loss of the temperature conditions previously prevailing in the car.

It is therefor among the general objects of the invention to provide a closure for a wide doorway which allows the maintenance of standard platform clearance and yet is easily and readily operated under all conditions, and permits inspection-entry with minimum effort on the part of the inspector and without unduly affecting the temperature condition within the car.

Generally, this is accomplished by the provision of a two-part closure for the doorway. One of the panels or doors making up this closure is relatively narrow and is hinged to the doorway frame in the usual manner. Its width is well within the limit of a swinging door from the standpoint of clearing loading platforms. It is this narrow and easily opened door which is to be opened for the use of in-transit inspectors, to obvious advantage.

The other, and wider, door is mounted for such movement that it does not exceed the clearance limits as it is being opened and closed. In handling certain commodities, after the car has been loaded up to the edge of the doorway, this wide door is closed and the loading may be continued against it up to that part of the doorway which is still unclosed by the narrow door. The loaders may later leave through the narrow doorway.

The mounting of the wider door is in the general nature of a parallelogram type of linkage, whereby, during the opening and closing movement, the door continues to lie

in planes parallel to the plane of the car wall. When fully open, the inner face of the door may, in effect, be in facial engagement with the outer face of the car wall and the door completely clears the doorway. The door swings bodily in such manner that it never extends beyond the standard horizontal clearance limits.

We have devised a door mounting and linkage which is novel, per se, and, while it is particularly well adapted for use in combination with a narrow, swinging door, the invention, considered in certain aspects, is not limited to such use. For example, both doors could be wider than the usual hinged door and mounted according to the mounting of the single wide door illustrated.

As a preferred, though not limitative, feature, the parallel linkage includes the employment of a vertically elongated, rigid, rectangular frame. One of the vertical frame members is pivotally connected to the outside of the car wall adjacent the doorway, while the opposite vertical frame member is pivotally connected to the outer face of the wide door at points spaced horizontally inward from its vertical edge. The horizontal members or "arms" connecting the two vertical members are spaced one above and the other below the door, these arms being of the same effective length as the link which, in the preferred form of the invention, is pivotally connected at its opposite ends to the door and frame near their inner faces. The frame transfers the weight of the door to the car structure. The linkage is such as to resist effectively all the stresses and strains incident to this type of door hanging. Preferably, the frame, as a whole, is vertically adjustable.

It is also a feature of the invention to provide special means whereby the clamping and unclamping of the two doors is forced to be in predetermined sequence, this being accomplished by the way of certain interferences between the doors and/or interlocks between their individual operating members. For instance, there may be an interlock between the operating handles of the individual clamping-cam shafts, and there may be means by which the entrance channel of the clamping-cam keeper associated with one of the doors is blocked by a member on the other door when said other door stands slightly ajar. Or the doors may "interfere" in such a manner that, until one door has been closed a certain extent, the clamping cams of the other door cannot be effectively entered in their keepers.

It is a general object of the invention to provide, throughout, a structure which, though readily and easily operable and relatively light, will long withstand the exceptionally severe service conditions to which apparatus of this type are constantly exposed.

Other objects and features of novelty will be made apparent from the following detailed description.

Fig. 1 is an elevation showing a preferred embodiment of the invention;

Fig. 2 is an enlarged, fragmentary section on line 2—2 of Fig. 1;

Fig. 2*a* is a schematic view illustrating the doors in open and closed position, and may be considered as connected sections taken on lines 2—2 and 3—3 of Fig. 1;

Fig. 3 is an enlarged, fragmentary section on line 3—3 of Fig. 1;

Fig. 4 is an enlarged, fragmentary section on line 4—4 of Fig. 1;

Fig. 5 is a reduced-scale, fragmentary view of the inner faces of the doors as viewed from the position of line 5—5 in Fig. 4;

Fig. 6 is an enlarged, fragmentary view, partly in section, of the pin and bracket connection shown in Fig. 5;

Fig. 7 is an enlarged fragmentary elevation of the upper mounting of the D-frame;

Fig. 8 is an enlarged fragmentary elevation, partly in section, of the lower mounting of the D-frame;

Fig. 9 is a section on line 9—9 of Fig. 8;

Fig. 10 is an enlarged, fragmentary view of the cam and keeper for the large door;

Fig. 11 is a section on line 11—11 of Fig. 10;

Fig. 12 is an enlarged, fragmentary section on line 12—12 of Fig. 1;

Fig. 13 is an enlarged fragmentary section on line 13—13 of Fig. 2, but showing the door latched open;

Fig. 14 is a schematic section illustrating means for forcing certain sequential operations;

Fig. 15 is a side elevation of a variational embodiment of the invention;

Fig. 16 is a schematic section on line 16—16 of Fig. 15;

Fig. 17 is an enlarged fragmentary section on line 17—17 of Fig. 15;

Fig. 18 is an enlarged view of one of the door hinges shown in Fig. 15;

Fig. 19 is an enlarged view of another of the door hinges shown in Fig. 15;

Fig. 20 is an enlarged section on line 20—20 of Fig. 15.

The wall of the "house car" C is indicated generally at W, the detailed structure of which is not a part of the present invention, which wall frames an opening or doorway O. While the jambs 10 and 11, header 12 and sill 13 make up the door frame, proper, we will use the term "framing" to include both these individual members and also all adjacent parts of the wall structure, and will refer generally to the same as framing F.

The closure for opening O is made up of a relatively wide door A and a relatively narrow door B, the latter being hinged at 14 for normal swinging movement, as indicated in Fig. 2*a*. In contra-distinction, the wide door A is mounted for such movement that it remains substantially parallel to wall W at all times. As made apparent in this view, the extent of outward swing of door A may be even less than the radius of the swing-arc of door B, in spite of the fact that door A is almost twice as wide as door B. The very real advantage of this feature has been pointed out in the fore part of the specification.

The particularities of the doors, per se and the sealing or gasketting thereof, when the doors are in closed positions, makes up no part of the present invention, but we have conventionally indicated that doors A and B respectively include rectangular wooden frames 5 and 6, frontal, metal "skins" 7 and 8, and backing sheets 9 and 9*a*. We have also conventionally indicated seal strips 15 and 16 between the doors, on the one hand, and the sill 13 and header 12 on the other hand (Fig. 4); seal strip 17 between jamb 10 and lip 18 of door A, and seal strip 19 between jamb 12 and the hinged end of door B. The "meeting" edges 20 and 21 are beveled as clearly indicated in Fig. 3, the nature of the preferred bevelling being later discussed; door B having a vertically extending lip 22 adapted to be received in groove 23 in door A when the doors are closed (Fig. 3). Carried on the lip 22 and adapted to engage the bottom of groove 23 when the doors are closed, is a sealing strip 24. The outer face 25 of door A and the outer face 26 of door B are preferably flush with the outer face 27 of wall W when the doors are closed. Preferably, also, the inner faces 28 and 29 of doors A and B, respectively, are substantially flush with the inner face 30 of wall W.

We will now describe the preferred mounting of door A. This mounting includes a pair of horizontal arms 31 and 32, the first above the top of door A and the other below the bottom of that door, connected by a vertical post or strut 33 which is mounted on framing F for rotation about a vertical axis, as will be described. The distal ends of the arms are connected by rod or tension member 34, and door A has rotational bearing on this rod at 35. A load-bearing spacing washer 36 provided on rod 34 between the lower, door-carried bearing 35 and lower arm 32, holds the door in proper vertical relation to the opening O, though, as will appear, the entire vertically elongated, rectangular or D-shaped frame 37, made up of arms 31, 32, post 33 and rod 34, may be vertically adjusted to shift door A vertically to provide proper vertical clearance with respect to the horizontal framing of the opening. It will be apparent that, in the broadest sense, arms 31 and 32 do not require interconnection by post 33 and rod 34, it is only necessary that the arms be pivotally connected at one end to framing F and at the other end to door A. However, the illustrated and described interconnection of arms make for superior rigidity of structure and sureness of proper continued operation.

While post 33 may be of any suitable formation, preferably it is tubular and has a horizontally elongated, box-like transverse cross section, as clearly shown in Fig. 2, the post lying at an acute angle with respect to wall face 27 when door A is fully closed. The angle is such that, when the door is fully open, face 38 lies parallel and close to wall-face 27, thus allowing the inner face 28 of the door also to lie close to said face 27, in spite of the ample effective widths and of the horizontal offsetting of the arms at 39. The post and arms thus have great structural strength and yet do not interfere with the full opening of the door.

Welded within the upper and lower ends of post 33 are coaxial, vertical studs 40 and 41, the upper stud being rotationally supported in bearing 42 secured to framing F. Preferably, upper stud 40 is headed at 43, the head being spaced above bearing 42 to allow for limited vertical adjustment of frame 37 but serving to take the weight of the door should the lower bearing 44 fail. Lower, adjustable bearing 44 consists of a tubular vertical stud 45 entered and having rotational bearing in socket 46 which opens downwardly to the end of stud 41. For the vertical adjustment of frame 37 and hence of door A, a bolt 47, having a square head 48, is threaded into the counter-bore 49 which opens to bore 50 of stud 45, a load rod 51 extending from the bolt to the horizontal shoulder 52 represented by the bottom of socket 46.

To releasably hold bolt 47 in adjusted position, there is provided a lock member 53 made up of a metal strip bent into U formation, the upper leaf 54 having a circular hole 55 adapted to take the threaded shank of bolt 47 with annular clearance but not large enough to pass square head 48, and the lower leaf 56 having a square hole 57 adapted to take head 48. The lock is shown in operative position in Figs. 8 and 9, the square head 48 fitting in hole 57 and the shoulder 58 at the junction of the bolt head and threads engaging the under side of leaf 54 to prevent the member 53 from dropping further. In this condition, the bent over edge 59 of member 53 is sufficiently close to framing F to prevent bodily rotation of that member, and hence, because head 48 is in square hole 57, to prevent rotation of bolt 47. However, after manually lifting member 53 until head 48 is cleared from hole 57, bolt 47 may be threaded further into or further out of counter bore 49 to vertically adjust rod 50 and hence the entire frame 37 and door A. Member 53 is then dropped back to the position of Fig. 8, thus locking the bolt in its new position of adjustment.

Referring now to Figs. 2*a*, 5, 6, and 14, there is shown a link connection, which, with arms 31, 32 and their mountings makes up the parallel linkage P which controls the movement of the door in the manner described. Thus, link 60 is set in door-recess 61, being pivoted at one end 62 to door A near the junction of inner face 28 and "meeting" edge 20, and at the other end 63 to framing F near inner face 30. When door A is fully closed, link 60 is parallel with the plane of door A. The line S, from center 62 to center 63 (Fig. 2*a*) is parallel and equal in length to the line T from the center of stud 40 to the center of rod 34; and the line N, from center 63 to the center of stud 40, is parallel and equal in length to the line M from center 62 to the center of rod 34.

Thus, during all periods of movement and rest of door A, link 60 remains parallel with arms 31, 32, and therefore door A remains parallel with wall W. It will be seen that the system represented by lines S, T, N and M comprises a parallelogram wherein the points 40 and 63 are pivotally connected to framing F, and the points 62 and 34 are pivotally connected to door A.

In Figs. 5 and 6 are shown the preferred means connecting the link 60 to the door A and framing F. Brackets 64 and 65 are identical but are relatively turned top for bottom. Brackets 64 is adjustably bolted at 65a to the upper corner of door A whereas bracket 65 is similarly secured to framing F just above the doorway. Welded to each bracket is a stud 66 and a washer 67. The eyes 68, welded to the pipe 69 which forms the reach of the link, are applied over the projecting ends 70 of studs 66, retainer washers 71 being secured to the studs to hold the link and brackets in assembly.

Before describing the means for clamping door A in closed position, we will discuss the novel latch employed for holding said door in open position, reference being made particularly to Figs. 1, 2, 4 and 13. Secured to the outer face 27 of wall W at a point adjacent doorway O, is a bracket 72 having an outwardly projecting U-portion 73 on top of which rests a horizontal staple 74 which is adapted to swing upwardly from its point 75 of pivotal connection with the bracket. The staple stock is extended beyond the side of the bracket as at 76 (Fig. 2) and then turned town to provide a handle 77 whereby it may be manually lifted to the dotted line position in Fig. 13.

Secured to the inner backing wall 9a of door A and adapted to line up with bracket 72 when the door is fully open, is a keeper 78 comprising an upwardly opening hook 79 having a forward camming face 80 and an overhanging cam face 81. As the door is swung to a fully open position, cam face 80 will elevate staple 74 so the latter rides over the nose of the hook and finally drops behind the hook, thus latching the door in open position, bracket projection 73 being engaged by the forward edge 82 of the hook to positively limit the extent of swinging movement of the door. Should staple 74 fail to drop by gravity to a position behind the hook, cam face 81 will force it down. Handle 77 provides means whereby the stample may be manually rotated to unlatch the door.

We will now describe the means for clamping door A in closed position. Mounted in bearings 83 secured to door A, is a usual operating rod or shaft 84, the shaft being capable of limited rotational oscillation. The opposite ends of the shaft carry usual crank-type cams 85 (Figs. 1, 4, 10 and 11) whose offset crank pins or cam ends 86 are adapted to be entered in the ways 87 of usual keepers 88 on framing F, and then operated in the usual manner by shaft rotation to cam the door tightly shut and releasably clamp it in that position. Upon initial reverse rotation of the shaft, the door is forced open by the cams to an extent which finally allows the cams to be cleared from the keepers and thus permit free door opening movement. The shaft 84 is oscillated by swinging handle 89, secured at 90 to that shaft, away from or towards the door, the connection 90 being a pivotal one which permits the handle to swing through a vertical plane. The handle is ordinarily swung through a vertical plane to more nearly a horizontal position before it is moved through a horizontal plane to oscillate the rock shaft 84. When the door is clamped fully shut, the body of handle 89 is closely adjacent face 25 of the door and it is then lowered to drop it into keeper 91 which is fixed to that door-face. The keeper prevents the shaft 84 from being rotated to release the cam locks except after wilfully lifting the handle clear of keeper 91. For a purpose to be described later, handle 89 is provided with an integral keeper 92 (Fig. 12) and an opposing and

spaced-away, pivotally mounted keeper 93. The pivotal connection between handle 89 and keeper 93 is indicated at 94. The free end of keeper 93 carries an angularly turned, pierced lug 95, and an oppositely turned ear 96, the latter engaging the upper edge of the handle to prevent keeper 93 from swinging, with respect to the handle, downwardly beyond the position of Fig. 1. The hand grip 97 of handle 89 is horizontally and outwardly offset so it may be easily grasped even when the body of the handle lies relatively snugly against the door.

A vertical rod or operating shaft 98 is rotatably mounted in bearings 99 on door B, this shaft carrying crank-type cams 100 whose crank pins 101 are adapted to be entered in the ways 102 of usual keepers 103 on framing F, and then operated in the usual manner by shaft rotation to cam door B tightly shut and releasably clamp it in that position. Upon initial reverse rotation of the shaft, door B is forced open by the cams to an extent which finally allows the cams to be cleared from the keepers and then permit free door-opening movement. Shaft 98 is oscillated by swinging handle 104, secured at 105 to that shaft, away from or towards the door, the connection 105 being a pivotal one which permits the handle to swing through a vertical plane. Handle 104 is ordinarily swung through a vertical plane to a more nearly horizontal position before it is moved through a horizontal plane to oscillate shaft 98. When door B is clamped fully shut, the body of handle 104 lies close to the door and, assuming door A is also fully closed and clamped shut, directly overlies handle 89, the arms thus crossing each other to form an X. Hand grip 106 is horizontally offset from handle 104.

There is an interlock, parts of which have been described, between handles 89 and 104, which forces predetermined sequential operation of the cam locks of the two doors and predetermined sequential opening and closing movements of the doors. With both doors clamped shut and with handle 89 in keeper 91, handle 104 lies behind keeper 92 on handle 89, the handle 104 thus being held from swinging horizontally in a manner to unclamp door B. Handle 104 has an integral, pierced lug 107 which is directly opposed by lug 95 on swinging keeper 93, the piercings of these two lugs being adapted to take a usual seal (not shown) to prevent the unauthorized opening of the doors, for it will be seen that with keeper 93 in this position, handle 104 cannot be swung upwardly to clear it from keeper 92 and shaft 98 cannot be rotated. A lug 108 on handle 104 engages the upper edge of handle 89 to prevent handle 89 from being swung upwardly, even though keeper 93 be not wired or sealed to lug 107, until said handle 104 has been lifted from keeper 92. And, of course, with handles 104 and 89 interlocked as described, handle 89 cannot be lifted clear of keeper 91 and therefore cannot be swung outwardly in a manner to rotate shaft 84 in an attempt to unclamp door A.

If, now, it be desired to open the doors, it will be seen that small door B must be the first to be unclamped and forced open, for handle 104 must be out of the way before handle 89 is in a condition to be operated. And it is desirable that the small door be opened first, for many times it is undesirable that the entire doorway be opened up (as, for instance, when an inspector desires entrance) and the opening of the small door will do much less to alter the temperature conditions within the car than would the opening of the large door. To effect the opening of the small door, the seal, if any, between lugs 95 and 107 is broken and keeper 93 is swung upwardly to clear the path for handle 104. Said handle is then swung upwardly until it clears lug 92 and then swung outwardly between the end of that lug and keeper 93. The outward swinging of arm 104 unclamps door B and forces it ajar, as has been described, and the door may then be freely and fully opened. The path of handle 89 now being cleared, said handle may be lifted free of keeper 91 and swung in a direction to unclamp and force door A

ajar, whereupon said door may be freely and fully opened, as has been described.

When both doors are to be reclosed and clamped shut, door A must be the first to be moved into a position ready for clamping, since if door B were first to be shut, lip 22 would interfere with the closing of door A. Further, of course, handle 104 cannot be interlocked with handle 89 until handle 89 has been operated to clamp door A shut, and then dropped into keeper 91.

Without the provision of preventative means there is a possibility that the following malfunction might occur. Assume that door A were closed to the extent that its cams 86 rested on their respective keepers 88 but were not yet actuated to cam the door shut, and that door B were then closed to an extent allowing the operative entry of its cams 101 to their respective keepers 103. Then, were the door B to be cammed shut, the adjacent edge 20 of door A would be forced inwardly and the opposite edge forced outwardly, thus causing door A to be "cocked" open in a manner putting said door and its linkage under very severe deformation stresses.

Such malfunction is prevented by means forcing a predetermined operational sequence which insures that door B cannot be cammed shut until door A has reached such a position that its cams 86 are engaged with their keepers 88 in such fashion that pressure exerted on door A by door B will overcome the resistance of those cams with relation to their keepers, and cause door A to move through its normal path towards closed position, rather than causing door A to "cock."

In Fig. 14 is shown one means for forcing the described sequence of operations, while in Figs. 15 and 17 is shown a variational means which will be described later.

In Fig. 14, the "forcing" means includes certain relative fashioning of the "meeting" edges 20, 21 of the doors so there will be interference between them which will prevent clamping pressure to be applied to door B until the door A is in a "non-cockable" position. The dotted lines indicate the positions of doors A and B when fully closed, while the solid lines indicate their positions wherein certain interference exists between them when they are in positions of near-closure.

For purposes of discussion, dimensions will be ascribed to certain of the parts, but it will be understood these ascriptions are not at all to be considered as limitative. The center of hinge 14 is about 9" from the plane of the inner face 29 of door B, and the door corner or edge 109, diagonally opposite the hinge, is about 24" to the left of said hinge when door B is closed. Consequently edge 109, when door B is being opened from its position of full closure, moves outwardly and to the left, as viewed in Fig. 14 in the ratio of about 2.6 to 1. End face 20 of door A slants to the left so, when said door is fully closed, said face lies approximately parallel to a chord of the arc through which edge 109 moves as door B is being opened. End face 20 of door A preferably is substantially parallel to face 21 when both doors are closed, at which time a horizontal clearance 111 of about ¼" exists between faces 20 and 21. The effective length of link 60 is 26" and door A moves almost straight out and in during its initial opening and final closing movements respectively, because of the parallel linkage previously described. With all these conditions prevailing, suppose now both doors have been wide open and that door A has been reclosed to the extent indicated in solid lines. On the scale given, this means door A is open about ¾", in which position cams 86 may be engaged with keepers 88, as illustrated in Fig. 14. At this time cams 88 stand at about 60 degrees from their dead center positions. Of course the operator may now rotate the cam in a manner to swing and clamp door A fully shut and proceed to close and clamp door B. But suppose, before giving door A its final closing movement, the operator swings door B into the full line position of Fig. 14 and attempts to force door B fully home. Then, because of the relationships just described, edge 109 will strike face 20 of door A near the outermost edge of that face. This holds door B ajar by about 3" and when in that position cams 101 cannot possibly be entered in their keepers 103, as clearly indicated in Fig. 14. Thus, final closing and clamping pressure cannot be put on door B and such pressure, since it does not exist, cannot be imparted through edge 109 to door A in a manner to "cock" the latter. Thus, the interference between face 20 and edge 109 forces the operator more fully to close door A before he can engage cams 101 on door B with their keepers 103.

If the operator proceeds to more nearly close door A, without fully closing it, that door will soon reach a position which will allow the cams 101 of door B to enter their keepers 103. By this time the cams 86 of door A will be almost in clamping position, and their resistance to movement into full clamping position can be overcome by the force applied through edge 109 of door B to door A, as door B is cammed towards its final position of closure. If, by any chance, door A is not completely closed in response to such closing movement of door B, handles 89 and 104 will not be in positions to be interlocked as described, so, to complete the final clamping of both doors, the operator must swing handle 89 through its final movement and drop it into keeper 91 and then swing handle 104 fully home so it may be dropped behind keeper 92. Thus, once door A has been swung inwardly beyond the limiting position (dotted lines of Fig. 14) the interlocking feature of the two handles comes into play to force final closure in the proper sequence.

In Figs. 15 through 20, we have shown a variational embodiment of the invention. Many of the parts, and their operation, are the same as those of the preferred embodiment and will therefore be given the same reference numerals, with the understanding that the previous description applies thereto.

In place of the plain hinges shown in the preferred embodiment, the hinges 14*a* and 14*b* are fashioned in a manner to provide for vertical adjustment of door B. Each hinge 14*a* (Fig. 19) has a strap 115 secured to framing F and a strap 116 secured to door B. Strap 115 and its pintle bearing 117 are narrower than is the space 118 between the pintle bearings 119 on strap 116. Pintle 120 is associated with bearings 117 and 119 in the usual manner, being headed at 121 and carrying a lock collar 122. Because of the vertical clearance between bearings 117 and 119 it will be seen that hinge 14*a* permits limited vertical adjustment of door B.

Hinge 14*b* (Fig. 18) has a strap 123 secured to framing F and a strap 124 secured to door B. Strap 123 carries vertically spaced pintle bearings 124*a* and 125, while strap 124 carries two vertically spaced pintle-taking bosses 126. Vertical clearances 127 exist between bearing 124*a* and bosses 126; while vertical clearance 128 exists between bearing 125 and the lower boss 126.

Pintle 129 extends through the several bosses and bearings, its head 130 being welded at 131 to upper boss 126. Bearing 125 has a counterbore 132 opening to the bore of nut 133 which is welded to the lower end of the boss. Threaded into this nut is an adjustment bolt 134 having a square head 135. The lower end of pintle 129 bears on the upper end of bolt 134, and it will be seen that by screwing the bolt up or down, the pintle 129, hinge strap 124 and door B are raised or lowered, respectively, thus providing for vertical adjustment of the door with respect to doorway O. A locking member 53*a* cooperates with bolt 134 in the same manner as that described in connection with lock 53 and bolt 47.

The operating shaft 98, cams 100, keepers 103 and their associated parts are the same in form and operation as the corresponding parts of the preferred embodiment. The frame 37*a* is generally the same as frame 37, except that stud 40*a* is extended to a point above the car, and rod 34*a* is rotatably mounted in bearings 35*a*, thus

serving the dual purpose of rods 34 and 84 in the preferred form. Thus, cranks 85 are applied to the ends of rod 34 for operative cooperation with keepers 88 upon rotation of that rod, and the rod also provides the connection between arms 31, 32 and between those arms and the door.

In Fig. 16 the full and dot-dash lines indicate the positions of door A and the parallel linkage when the door is fully closed, while the dotted lines indicate the positions of those elements when the door is fully open. Vertical shaft 136 reaches to the same height as stud 40*a*, being journaled in a framing-carried bearing 137, the line of common centers of the shaft and stud being parallel to the plane of wall W. Fixed to stud 40*a* and shaft 136, respectively, are parallel, equi-length crank arms 138 and 139. These crank arms are normal to the plane of wall W when door A is fully closed. A link 140 connects the distal ends of the crank arms.

Secured to the lower end of shaft 136 is a crank arm 141, the distal end of this crank being pivotally connected to the outer face of door A at 142, the effective length of the crank being equal to the horizontal spacing between stud 40*a* and rod 34*a*. Centers 40*a*, 34*a* and 142 lie in a plane parallel to the plane of wall W when door A is fully closed. It will be seen that as door A is thrust outwardly from the doorway and finally inward against the outside of wall W, the described linkage acts to maintain the door parallel to wall W at all times, to the advantageous ends previously spoken of.

The generalities of handles 89*a* and 104*a*, their operation and their interlock, are the same as those of corresponding elements of the preferred form, and therefore only the changes need be noted. In the form of Figs. 17 and 20, keeper 91*a* is secured to door A, as was keeper 91, but the base plate 143 of keeper 91*a* is extended upwardly and provides the support for pivoted keeper 93*a*, whereas, in the preferred form, corresponding keeper 93 was pivoted to handle 89. However, keeper 93*a* functions just as does keeper 93.

In Figs. 15 and 17 is shown variational means for preventing the clamping cams 101 on door B from operatively engaging keepers 103 until door A has been closed—the reason for such prevention having been previously set forth. Attached to the upper right hand corner of door A is a stop plate 144 whose free, beveled end 145 clears keeper way 102 when door A is fully closed. However, when door A is ajar to an extent that the operation of camming door B shut would bring about the "cocking" of door A, as has been described, stop 144 will be in the dotted position of Fig. 17, in which position the end 145 of the stop plate closes the way 102 to an extent which prevents the entry of cam 101 to said way. Accordingly, cam 101 cannot operatively engage keeper 103 until door A has been more completely shut.

While we have shown and described preferred embodiments of our invention, it is to be understood that various changes in design, structure and arrangement may be made without departing from the spirit and scope of the appended claims.

We claim:

1. In a railway house car, or the like, having a framing defining a doorway in one wall thereof, a pair of doors for said doorway, a parallel-linkage connecting one of the doors to one side of the framing and maintaining said one door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of said one door, and the other door being hinged to the other side of the framing for simple arcuate movement about a vertical axis, the opposed edges of the two doors being substantially in mutual engagement when said doors are closed.

2. The structure of claim 1, including also a pair of releasable door-clamping means, one for each door and cooperating individually between said doors and framing, said means being individually operable, and means forcing predetermined sequential applying operation of said clamping means.

3. The structure of claim 1; including also a pair of releasable door-clamping means, one for each door and cooperating individually between said doors and framing, said means being individually operable, said opposed edges interfering with one another when said doors stand ajar by a certain extent whereby the clamping means for one of the doors is held out of position to effectively cooperate with the framing.

4. The structure of claim 1, wherein said other door is narrower than said one door, and including means preventing opening movement of the wider door until the narrower door is moved out of fully closed position.

5. The structure of claim 2, wherein said forcing means is mounted on one door and cooperates with the clamping means on the other door.

6. The structure of claim 1, including also a pair of releasable door-clamping means, one for each door and cooperating with said doors and the framing, means on each door for independently operating the associated clamping means, and a releasable interlock between the operating means on the two doors and adapted releasably to hold both said clamping means in clamping condition.

7. The structure of claim 6, wherein said interlock also forces predetermined sequential clamp-releasing operation of said operating means.

8. In a railway house car or the like having a framing defining a doorway in one wall thereof, a pair of doors pivotally connected to the framing to swing to opposite sides of the doorway, a pair of releasable door-clamping means, one for each door and cooperating between said doors and framing, said means being individually operable, and means forcing predetermined sequential applying operation of said clamping means.

9. The structure of claim 8, wherein said forcing means is mounted on one door and cooperates with the clamping means on the other door.

10. The structure of claim 8, wherein one of said clamping means includes a keeper on the frame and provided with an entrance channel, and a cam rotatably carried by one door and adapted to tranverse the channel during clamping and unclamping operation, and said forcing means comprises a member carried by the other door and blocking said channel at times when said other door is not fully closed.

11. In a railway house car or the like having a framing defining a doorway in one wall thereof, a pair of doors pivotally connected to the framing to swing to opposite sides of the doorway, a pair of releasable door-clamping means, one for each door and cooperating between said doors and framing, said means being individually operable, the clamping means for each of said doors including a keeper on the framing, a cam rotatably carried by the associated door and engageable with and disengageable from the keeper, a rotatable operating shaft carried on the door and connected to the cam, and an operating lever on the shaft for rotating it, said lever being connected to the shaft for movement pivotally about an axis transverse of the shaft axis; a lever-keeper on one door for releasably holding the lever on the associated door from shaft-rotating operation, the lever being movable into the lever-keeper by virtue of its pivotal movement with respect to the shaft, a second lever-keeper mounted on the last named lever, the lever on the other door being releasably engageable with the second lever-keeper and being thereby releasably held against shaft-rotating operation.

12. A structure as in claim 11, including also a releasable holding member mounted on said one door and engageable with the last named lever to hold it releasably against movement out of the second lever-keeper.

13. A structure as in claim 11, including also a releasable holding member mounted on the first named

lever and engageable with the lever on the other door to hold it releasably against movement out of the second lever-keeper.

14. In a railway house car or the like having a framing defining a doorway in one wall thereof, a door for said doorway, and a parallel-linkage connecting the door to the framing and maintaining said door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of the door, said linkage including a pair of upper and lower horizontal arms, each pivotally connected at one end to one side of the framing at the outside of the wall and pivotally connected at its distal end to the outside of the door, one arm being above the door and the other arm being below the door, and a link pivotally connected at one end to the frame near its inner face and at the other end to the door near its inner face, the line common to the pivot centers of the link being parallel to the plane common to the pivot centers of said arms, the link and said arms being of substantially equal effective length.

15. In a railway house car or the like having a framing defining a doorway in one wall thereof, a door for said doorway, and a parallel-linkage connecting the door to the framing and maintaining said door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of the door, said linkage including a vertical member mounted on the framing at one side of the doorway for rotation about a vertical pivotal axis, a pair of horizontal arms rigidly connected, one each, to the member near its opposite ends, one arm being above the door and the other arm being below the door, a pivotal connection between the distal end of each arm and the door near the outer face thereof, and a link pivotally connected to one end to the framing near its inner face and at the other end to the door near its inner face, the line common to the pivot centers of the link being parallel to the plane common to the pivotal axis of the vertical member and the pivotal connections between the arms and the door, the link and said arms being of substantially equal effective length.

16. A structure as in claim 15, including also means for vertically adjusting the vertical member with respect to said framing and doorway.

17. In a railway house car or the like having a framing defining a doorway in one wall thereof, a door for said doorway, and a parallel-linkage connecting the door to the framing and maintaining said door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of the door, said linkage including a pair of upper and lower horizontal arms, each pivotally connected at one end to one side of the framing at the outside of the wall, one arm being above the door and the other arm being below the door, a vertical member connecting the arms at points adjacent their pivotal connections with the wall, a rotatable vertical rod connecting the distal ends of said arms and pivotally connected to said door, said rod projecting vertically above the upper arm and below the lower arm, cams on the axial projections of the rod, said cams being adapted to cooperate with keepers on the framing when the door is closed, and means for rotating the rod.

18. In a railway house car or the like having a framing defining a doorway in one wall thereof, a door for said doorway, and a parallel-linkage connecting the door to the framing and maintaining said door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of the door, said linkage including a pair of upper and lower horizontal arms, each pivotally connected at one end to one side of the framing at the outside of the wall and pivotally connected at its distal end to the outside of the door, one arm being above the door and the other arm being below the door, a vertical shaft connected to said upper arm and coaxial with its pivotal axis, a second vertical shaft parallel to the first shaft and rotatably mounted on the framing near the distal ends of the arms, when the door is closed, a pair of parallel, equi-length crank arms, one on each shaft and extending at substantially right angles with respect to the plane of the door when the door is closed, a link connecting the distal ends of the crank arms, and a crank carried by said second shaft and pivotally connected to said door, said last named crank being parallel to and of the same effective length as said arms.

19. A railway house car side wall and door assembly including a rigid frame of greater height than the door and comprising an upright having pivotal connections to fixed points on the outer side of the car wall and with horizontals extending from said upright over the top and below the bottom of the door, respectively, and pivotally mounting the door intermediate its front and rear edges.

20. In a railway house car and door assembly comprising an upright wall having an opening, a door therefor, door support structure comprising horizontals swinging about a fixed axis on the wall and positioned above the level of the top of said opening and below the level of the bottom of said opening, respectively, with their outer portions swinging outwardly and away from said wall and then lengthwise thereof and then towards the same, the outer portions of the horizontals being pivotally connected to said door intermediate its front and rear edges.

21. A railway house car and door assembly as described in claim 20, in which the horizontals are pivoted to the wall at points spaced longitudinally of the wall from the opening.

22. A railway house car side wall and door assembly including a rigid, open, rectangular frame of greater height than the door and positioned outwardly of the car side wall and door and with an upright having pivotal connections to the outer side of the car side wall and an upright spaced therefrom having pivotal connections to the outer face of the door, and with horizontals extending between said uprights over the level of the top and below the level of the bottom of the door, respectively, to pass a portion of the door parallel to the wall and through the rectangular frame as the frame and door swing on their respective pivotal connections.

23. In a car having side framing forming a doorway, a door, parallel linkage connecting said door to the framing and providing for movement of the door from a position to close part of the doorway to a position clearing the doorway and maintaining said door in vertical plane substantially parallel to the plane of the framing, and another door mounted on the framing to close the remainder of the doorway and to clear the doorway.

24. A structure according to claim 23 including also individual devices for locking each door, when closed, to the framing, said devices being operable individually, and said devices having associated therewith means providing predetermined sequential operation of said devices.

25. In a railway house car or the like having a framing defining a doorway in one wall thereof, a door for said doorway, and a parallel-linkage connecting the door to the framing and maintaining said door in vertical planes substantially parallel to the plane of said wall throughout opening and closing movement of the door, said linkage including a pair of upper and lower horizontal arms, each pivotally connected at one end to one side of the framing at the outside of the wall and pivotally connected at its distal end to the outside of the door, one arm being above the door and the other arm being below the door, and a link pivotally connected at one end to the framing and at the other end to the door, the points of connection of said link to the framing and to the door being spaced lengthwise of the framing equal distances in the same direction from the points of connection of said linkage to the frame and door respectively.

26. In a railway house car having a side wall with a door opening, a pair of doors for said opening having interengaging meeting edges, said doors moving transversely of said wall away from the same during initial

opening movement, individual manually-operable means on each door, associated with the wall for holding the door to the wall, and means forcing predetermined sequential operation of said holding means during initial opening movement of the doors.

27. In a railway house car having an opening in its side wall, a pair of doors for said opening having interengaging meeting edges, individual members mounting said doors for movement transversely of said wall away from the same during at least a portion of their opening movement, and means for individually adjusting said door mounting members vertically to vary the height of the doors relative to the car side wall and to each other.

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