April 22, 1941. J. NICOL 2,239,467

FOLDING DOOR

Original Filed April 16, 1938 2 Sheets-Sheet 1

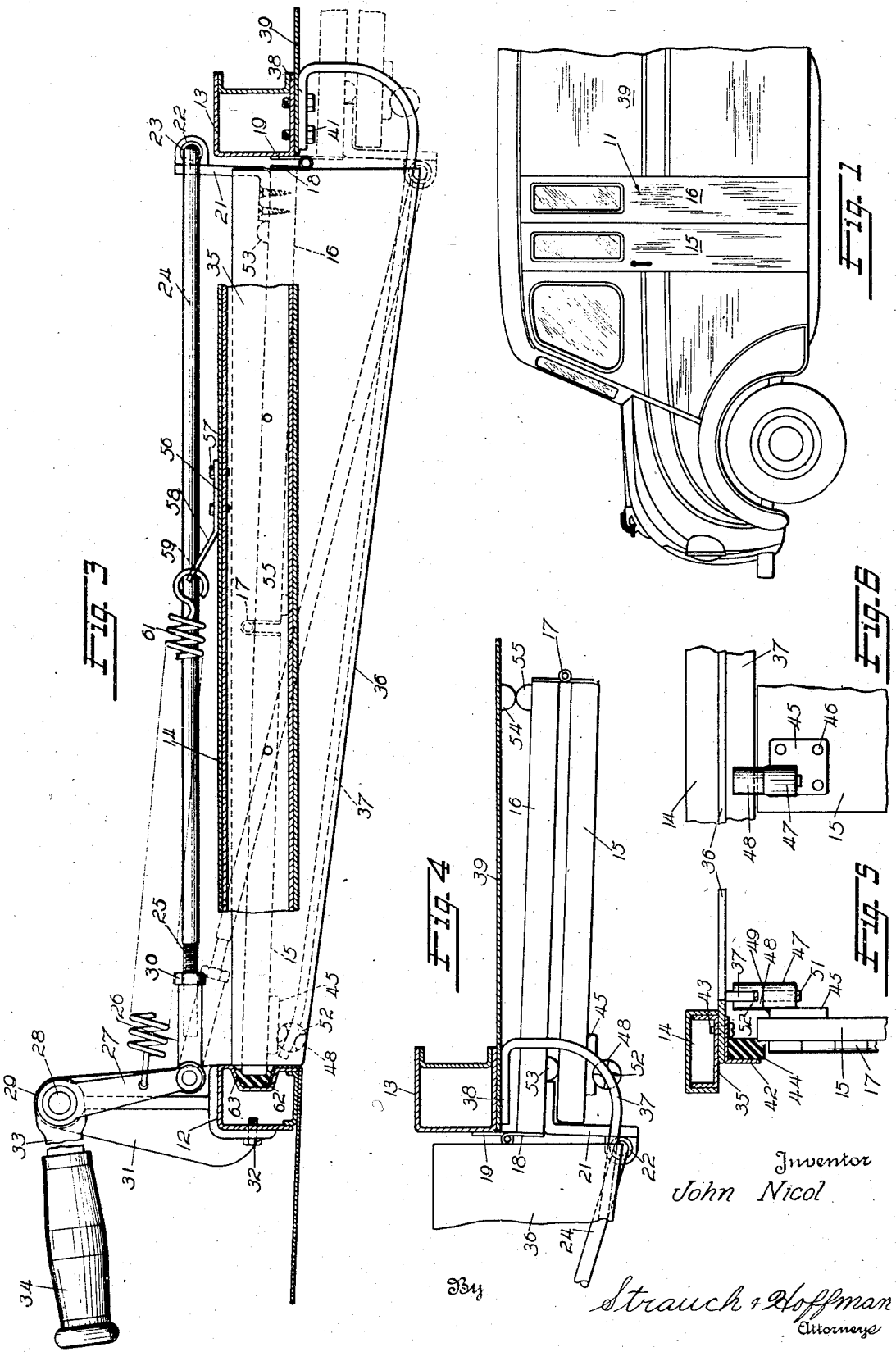


Fig. 1

Fig. 3

Fig. 4

Fig. 5

Fig. 6

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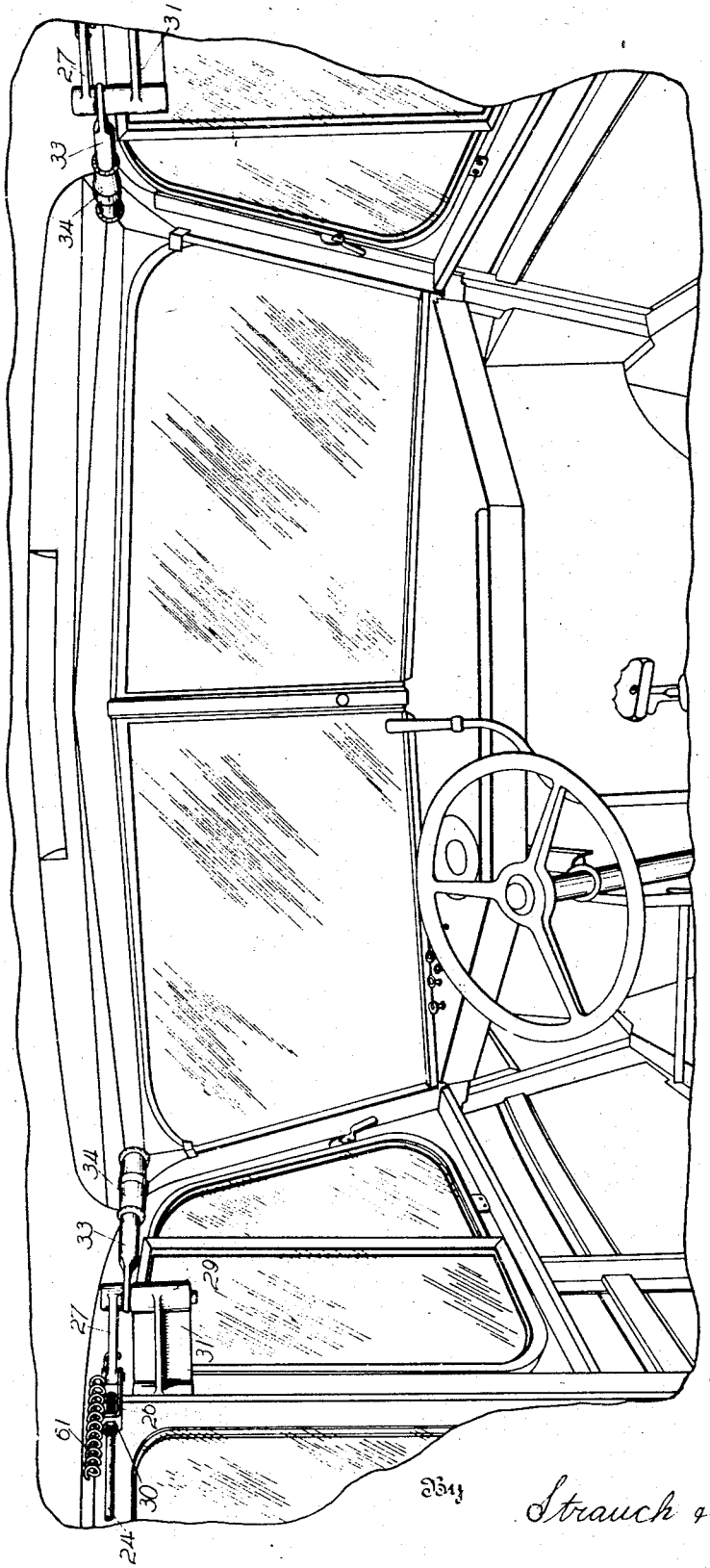


Fig 2

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UNITED STATES PATENT OFFICE

2,239,467

FOLDING DOOR

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Original application April 16, 1938, Serial No. 202,536. Divided and this application June 19, 1939, Serial No. 279,970

13 Claims. (Cl. 296—49)

This invention relates to folding doors for automotive vehicles and the like and is more particularly concerned with mechanisms and arrangements for opening and closing operation of such doors.

In its preferred embodiment, the invention will be described as employed at opposite side door openings of a stand drive delivery truck, but it will be understood that the door operating mechanism and other arrangements herein disclosed are applicable to any foldable closure member.

The present application is a division of my copending application Serial Number 202,536 filed April 16, 1938.

While folding side doors for vehicles are generally known and used, the mechanisms employed for operating such doors are usually relatively complicated and quick to get out of order; and no especial precautions are taken for cushioning opening and closing shocks, or protecting the door operating mechanism from the weather.

With the above in mind, it is a major object of the present invention to provide novel folding vehicle door arrangements wherein the door actuating mechanisms are simple and sturdy in construction and easy and reliable in operation; and wherein the doors may be opened or closed quickly with substantially no noise or shock and with a minimum of effort on the part of the operator.

A further object of the invention is to provide a novel vehicle door operating mechanism wherein initial actuation of the door toward either closed or open position is effected manually by the operator through special lever and spring mechanism, and wherein the final closing or opening movements of the door are effected by momentum gained by it during initial actuation. Specifically a door operating handle is provided at the upper front end of the body of the vehicle adjacent the door, which handle need be moved only slightly to operate the door in either direction and is adapted to assume a position where it will not interfere with the operator in the vehicle regardless of whether the door is open or closed.

It is a further object of the invention to provide a novel door guide mechanism for insuring proper opening and closing movements of the folding door. In its preferred embodiment, part of this guide mechanism is supported by a water shed member which extends along the door opening and affords appreciable protection to the guide mechanism from weather conditions.

It is a further object of the invention to provide novel arrangements for cushioning shocks and noise due to opening and closing movements of a folding vehicle side door.

Further objects of the invention will presently appear as the description of the invention proceeds in connection with appended claims and the annexed drawings in which:

Figure 1 is a side elevation of a stand drive delivery vehicle illustrating the location of a door of the invention as employed on the side of such a vehicle.

Figure 2 is an enlarged view of the interior of the front end of the vehicle of Figure 1 illustrating the vehicle controls and the location of the opposite door control handles.

Figure 3 is an enlarged top plan view, partly in section, of the door operating mechanism of the invention and the combination door guide and watershed, with the door in closed position.

Figure 4 is a fragmentary top plan view of the door operating mechanism partly in section, illustrating the door in open position.

Figure 5 is a fragmentary view representing a section through the door frame illustrating the guide arrangements and the cushion member for absorbing door closing shocks.

Figure 6 is a fragmentary view in side elevation further illustrating the door guide.

Referring to Figure 1, the vehicle therein disclosed is a stand drive delivery truck having a low level through aisle which is disposed only a short step above ground level and extends between opposite side door openings provided with double folding doors 11, here illustrated in closed position.

This vehicle is the same as that disclosed in detail in my above identified application.

Each door 11 is designated to close a side door opening, whose side edges are defined by front and rear door posts 12 and 13 respectively (Figure 3) and whose top edge is defined by the top frame or roof side rail 14, when in unfolded or closed position as shown in Figure 3. Door 11 is illustrated in folded or open position in Figure 4.

Each side door 11 comprises a front section 15 and a rear section 16 interconnected by a suitable hinge 17 which extends the entire distance from top to bottom at the adjoining edge portions of each section. Rear section 16 is provided at its rear edge with a suitable hinge portion 18 which cooperates with a hinge portion

19 secured to the front side of rear door post 13. Hinge portions 18 and 19 also extend the entire length of the door from top to bottom. In this manner rear door section 16 is hinged to the body frame door post while front section 15 is hinged to and supported by its hinged mounting on the rear section.

Adjacent hinge portion 18, and just below its top edge rear door section 16 is provided with a rigid arm 21 which projects substantially normal to the door section into the interior of the body. Arm 21 may be integral with a portion of door section 16, or may be welded or bolted thereto as desired. At its free end, arm 21 is provided with an upstanding hollow boss 22 in which is rotatably secured the downwardly extending end portion 23 of rod 24. Rod 24 extends forwardly along the inner side of the door opening and, adjecent the front door post, is provided with a threaded end 25 upon which is fitted a threaded collar 26. Lock nut 30 maintains collar 26 in any desired position along the threaded portion 25 so that rod 24 is adjustable in length.

Collar 26 is bifurcated at its front end to pivotally receive one end of a short lever 27. (See Figure 2.) The other end of lever 27 is non-rotatably secured to a vertical post 28. Post 28 is rotatably supported in a hollow boss 29 at the inner end of a rigid ribbed bracket 31 which is firmly secured, as by bolts 32, to front door post 12. As shown in Figures 2 and 3, an operating lever 33 is non-rotatably secured to post 28 immediately below lever 27 and is provided with a suitable handle grip 34. With this arrangement, left door handle 34 is in a convenient position above and forwardly of the driver's head and to the left of the steering wheel so that it is easily available to a driver whether he is in the through aisle or in the forwardly disposed driving compartment described in my above mentioned application. Door handle 34 at the right side of the body is similarly disposed with respect to the through aisle.

With reference to Figures 5 and 6, top frame rail 14 has secured thereto, as by welding, a channel-shaped strip 35 which extends along the top of the door opening between posts 12 and 13. A generally wedge shaped flat plate 36 is supported along the bottom surface of channel 35. Plate 36 is narrow at its forward end but increases in width toward the rear so that it projects a substantial distance outwardly from the body. A downwardly extending guide rail 37 is secured, preferably by welding, upon plate 36. Guide rail 37 extends in substantially a straight line along the bottom surface of plate 36 adjacent its outer edge and, after passing the rear edge of plate 36, curves inwardly and forwardly to provide a flat end portion 38 which is secured to the rear body side panel 39 and post 13 by bolts 41.

Angle strip 42 is supported along the bottom surface of plate 36 just above the door. Preferably sheet metal screws 43 are provided for securing both plate 36 and angle strip 42 upon channel 35. Angle 42 is provided with an outwardly facing sealing strip 44 of rubber or the like, preferably vulcanized thereto, for a purpose later to be described.

A plate 45 is secured, preferably by bolts 46, flush upon the forward outer surface of door section 15 adjacent the forward end of the guide rail and is provided with an outwardly projecting hollow boss 47. A cylindrical guide block 48 is provided with a shoulder portion 49 in bearing engagement with the top surface of boss 47 and a downwardly extending reduced end portion 51 fitting rotatably within boss 47. Block 48 projects above the top of door 11 and is slotted at 52 to receive guide rail 37. The walls of slot 52 are curved and flared at opposite ends to prevent binding as the block slides along its guide rail as shown in Figure 4.

Door section 16 is provided with a projecting bumper 53 of rubber or some suitable material at its inner surface, and panel 39 is provided with a similar bumper 54 adapted to be engaged by a rubber bumper 55 on the outer side of door section 16 when the door is in folded position as shown in Figure 4.

A spring anchor plate 56 is secured by bolts 57 at the inner side of rail 14. Plate 56 is provided with an inwardly extending lug 58 which is apertured at 59 to receive one end of a tension spring 61. The other end of spring 61 is secured to lever 27 adjacent its pivotal connection to collar 26 as shown in Figures 2 and 3. When the door is in closed position as shown in Figure 3, the forward end of front section 15 fits snugly against a resilient striker strip 62 of sponge rubber or the like seated in a longitudinal depression or channel 63 having inclined side walls in post 12.

Starting with the door in closed position as shown in full lines in Figure 3, operation of the door opening mechanism will now be described. The driver standing in the driver's compartment reaches up and pulls door handle 34 toward himself thus rotating operating lever 33, post 28 and lever 27 in a clockwise direction. Rotation of lever 27 pulls rod 24 forward and, through the toggle joint at 22, 23 and arm 21, causes rotation of rear door section 16 outwardly about the hinge at 18, 19 as a pivot. After the operating handle has been pulled through about a quarter of a turn, the door is about half open and rod 24 and the toggle joint will have reached the limit of forward motion, but momentum gained by the door during its initial movement described above will carry it over the toggle center toward the position shown in dotted lines in Figure 3. During the last half of the opening movement the door rod 24 is traveling rearwardly assisted by the pull of spring 61; and handle 34, released by the driver, will return approximately to its initial position so that it will not interfere with the driver's exit from the vehicle.

Rear door section 16 simply pivots about the hinge at 18, 19 but the front door section 15 pivots about hinge 17 and is caused by guide block 48 to follow guide 37 as the door swings open. This causes door section 15 to swing clockwise about hinge 17 as the door opens with the result that the door sections are folded with their inner surfaces facing each other when in fully open position, shown in dotted lines in Figure 3 and in full lines in Figure 4, has been reached. Bumper 53 absorbs the impact when door sections 15 and 16 come together in folded relation, while bumpers 54 and 55 absorb the impact caused by the whole door swinging back against the outer surface of the body.

When it is desired to close the door, handle 34 is again pulled toward the interior of the vehicle in a clockwise direction for about a quarter of a turn and the door swings forward about hinge 18, 19 with an unfolding motion exactly opposite to its folding motion while opening. Impact of the front edge of door section 15 against door post 12 when full closed position is reached is absorbed by sponge rubber striker strip 62.

During the operations above described, proper folding and unfolding movements of the door sections is insured by the door guide mechanism illustrated in Figures 5 and 6.

The folding side door mechanism described above is preferably used at each door opening at opposite sides of the through aisle. The operating handles are located near the forward upper corners of the vehicle body as illustrated in Figure 2 so that there is no danger of the operator striking his head thereagainst during his movements in the driver's compartment and along the through aisle.

The door guide arrangement is simple and sturdy. Plate **36** performs the double function of being a guide rail support and a water shed member for protecting the door opening. The size of plate **36** is generally determined by the size of the door sections since its outer edge is designed to extend over and protect the guide rail mechanism at all times.

The door operating mechanisms above described require very little manual effort on the part of the driver for operation, and are efficient and quickly actuated. The various bumper and shock absorbing members at **44, 53, 54, 55** and **62** insure that opening and closing shocks are eliminated, thereby increasing the life of the door and reducing danger of breakage of its window panels, and that door slamming and such noises are prevented. The details of the linkages employed between the door operating handle and the door have been carefully determined to provide a novel structural assemblage utilizing a minimum of simple parts all of which are conveniently available for repair or replacement.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In an automotive vehicle; a body having a side door opening and a door comprising a plurality of foldable sections mounted upon a substantially vertical hinge at a side edge of said door opening; bracket means within said body adjacent the front edge of said door opening and a handle member pivoted upon said bracket means; mechanism comprising a lever rigid with said member, an arm rigid with the rear section of said door and a rod extending along the top edge of said door opening pivotally connected at opposite ends to said lever and said arm for actuating the door upon movement of said member and a spring secured at one end to said mechanism adjacent the pivotal connection of the lever with said rod, the other end of said spring being rigidly anchored upon said body.

2. In an automotive vehicle having a side door opening provided with generally vertical front and rear door posts; a folding door hingedly mounted on said rear door post; a roof rail member rigid with the body of said vehicle bridging said posts above the level of said opening; a bracket projecting from said front post inwardly of said body; and mechanism for opening and closing said door comprising a manually operable door actuating lever pivoted upon said bracket, a rod pivotally connected to said lever and adapted to operate said door upon movement of said lever and a spring attached at one end to said mechanism between said bracket pivot and said door and anchored at its other end to said roof rail.

3. In an automotive vehicle body having a side door opening supported upon a substantially vertical hinge at the rear side edge thereof; a sectional door in said opening; a roof frame rail extending along said body above said opening; bracket means inside said body adjacent the forward edge of said opening and a manual door operating member pivotally mounted on said bracket means; a generally L-shaped bracket having one leg secured upon a section of said door and with its other leg extending generally normal to the plane of the door in closed position; a rod having its opposite ends pivotally connected to said member and said other leg; a spring secured at one end to said member and means for anchoring the other end of said spring upon said rail.

4. In a vehicle, a body having a side door opening, a double folding door pivotally mounted at one side of said opening, a laterally extending water shed member projecting outwardly from said body at the top of said opening, a depending guide rail extending along the bottom of said member and a follower interfitting with said guide rail rotatably mounted upon said door and adapted to travel along said guide rail when the door is moved.

5. In a vehicle body of the type defined in claim 9, said door controlling means comprising a toggle connection operative to positively cause only initial movement of said door from open or closed position, the remainder of said movement following through momentum of the door attained during such initial movement.

6. In an automobile vehicle body having a side doorway provided for passage to and from the interior of said body and located in the front side wall of the body adjacent the vehicle controls; a sectional foldable door hinged for movement about a substantially vertical axis along the rear side edge of said doorway; and mechanism for actuating said door comprising an operating handle pivotally mounted within the body adjacent the upper front corner of said doorway forwardly of said doorway and close to said wall, a lever rigid with said handle, a rod extending along the top edge of the doorway pivotally connected at opposite ends to said lever and the rear section of said door, said rod being disposed within the body when the door is closed, a spring secured at one end to said lever and means for anchoring the other end of said spring upon said body at the interior thereof.

7. In an automotive vehicle; a body having a side door opening and a longitudinal top frame rail above said opening; a foldable door hingedly mounted at the rear side edge of said opening; a plate secured to said rail projecting laterally outwardly of said body at said door opening and a depending door guide track on said plate extending along the body adjacent the top of said door opening; and a track following element rotatable about a generally vertical axis mounted upon and projecting above the upper, outer front corner of said door, said element cooperatively interfitting with said guide track.

8. In a vehicle, a body having a side doorway, a folding door movably mounted in said doorway, a plate secured at its inner edge along the upper

edge of said doorway and projecting a substantial distance laterally outwardly of said body and cooperating means on said plate and door guiding opening and closing movements of said door, said plate being of sufficient size to extend over and serve as a water shed for said doorway.

9. In a stand drive vehicle body having a side doorway and a low level floor upon which the driver stands during operation of the vehicle; a foldable sectional door hinged along one edge of said doorway and adapted to fold snugly against the outer side wall of said body when fully open; and a door operating lever equipped with a projecting handle pivotally mounted within the upper inner front end of the body forwardly of said door opening and mechanism operatively connecting said lever and door, said mechanism being so constructed and arranged that said handle is normally disposed projecting toward the front end of the vehicle and generally parallel to the body side wall during fully open and closed positions of said door so as to avoid accidental contact of said handle with the head of the driver standing or moving on said floor.

10. In an automobile vehicle body having a side doorway, a double section folding door having one section hinged along one edge of said doorway, a water shed member secured along the top of said doorway and projecting laterally outwardly from said body, said member being provided with a guide track, and a follower carried by the other section of said door interfitting with said track and adapted to travel along said track during opening and closing movements of said door.

11. In the body defined in claim 10, said guide track comprising a narrow rigid guide rail extending along the bottom of said member and said follower comprising an upstanding block rotatably carried by said other door section and having a slotted head embracing said guide rail.

12. In a vehicle body having a side doorway defined by spaced vertical door posts disposed inwardly of the plane of the vehicle side wall, a rigid water shed plate bridging the top of the doorway and substantially extending between the upper ends of said door posts, said plate having a portion of substantial area projecting laterally outwardly of the plane of said side wall, a multisection folding door hinged along the rear door post, a guideway on said plate extending angularly outwardly of said vehicle side wall and rearwardly and substantially coextensively longitudinally with said doorway, and a follower projecting upwardly from the front door section connected to have continuous operative engagement with said guideway during all opening and closing movements of said door.

13. In the body defined in claim 10, the major portion of said guide track being located on that portion of said water shed member which is laterally outwardly of the body.

JOHN NICOL.

CERTIFICATE OF CORRECTION.

Patent No. 2,239,467. April 22, 1941.

JOHN NICOL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, lines 8, 9 and 10, claim 3, for the words "opening supported upon a substantially vertical hinge at the rear side edge thereof; a sectional door in said opening; a roof" read --opening; a sectional door in said opening supported upon a substantially vertical hinge at the rear side edge thereof; a roof--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of May, A. D. 1941.

Henry Van Arsdale,

(Seal) Acting Commissioner of Patents.