

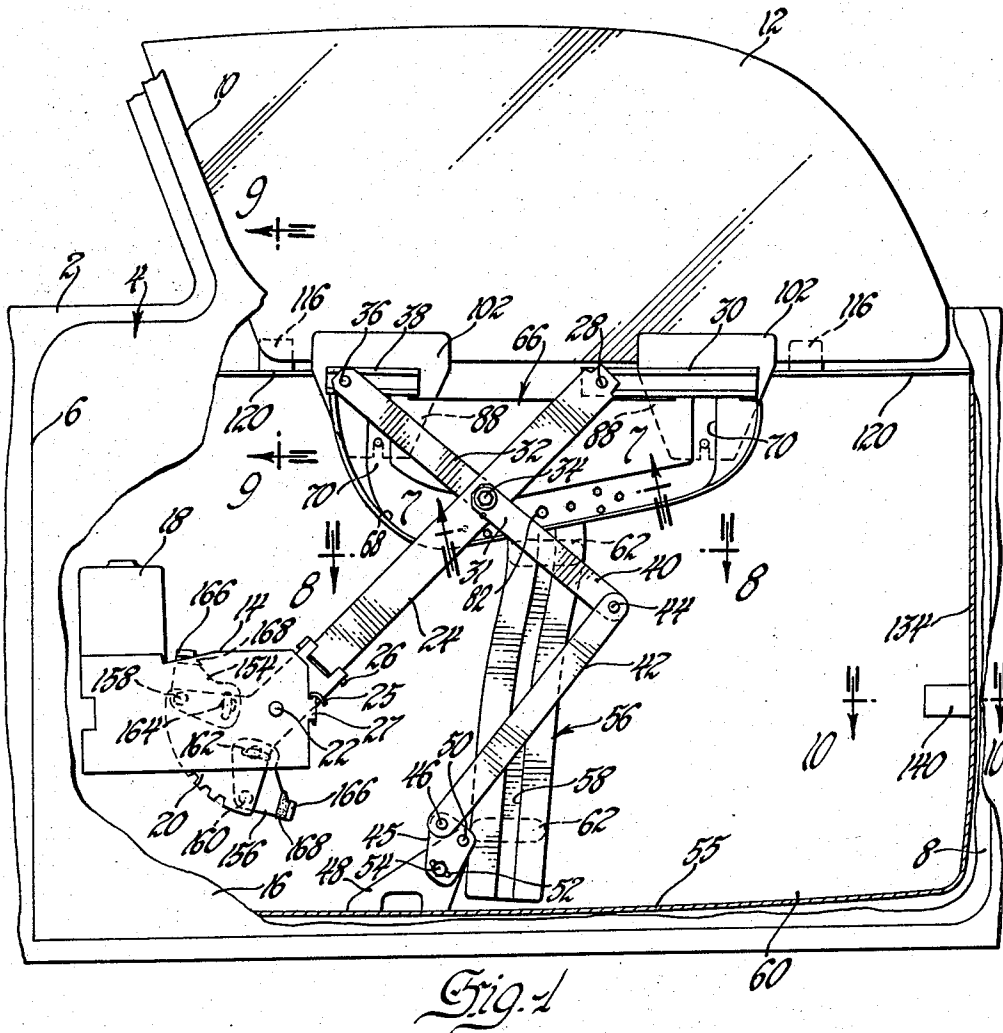
March 3, 1959

D. C. PROBST
WINDOW REGULATOR

2,876,003

Filed March 11, 1955

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

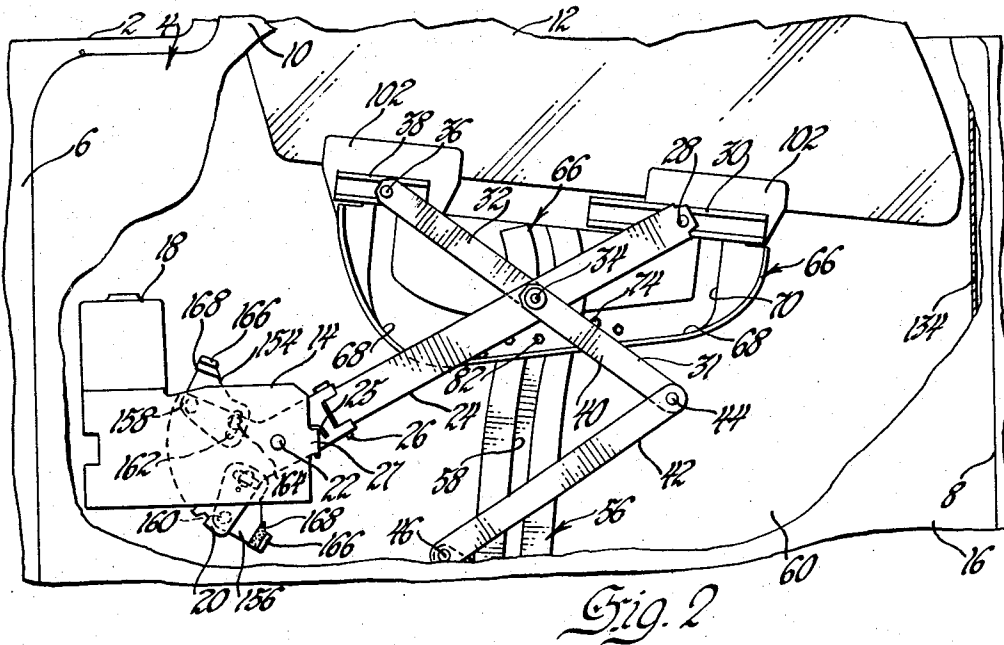


Fig. 2

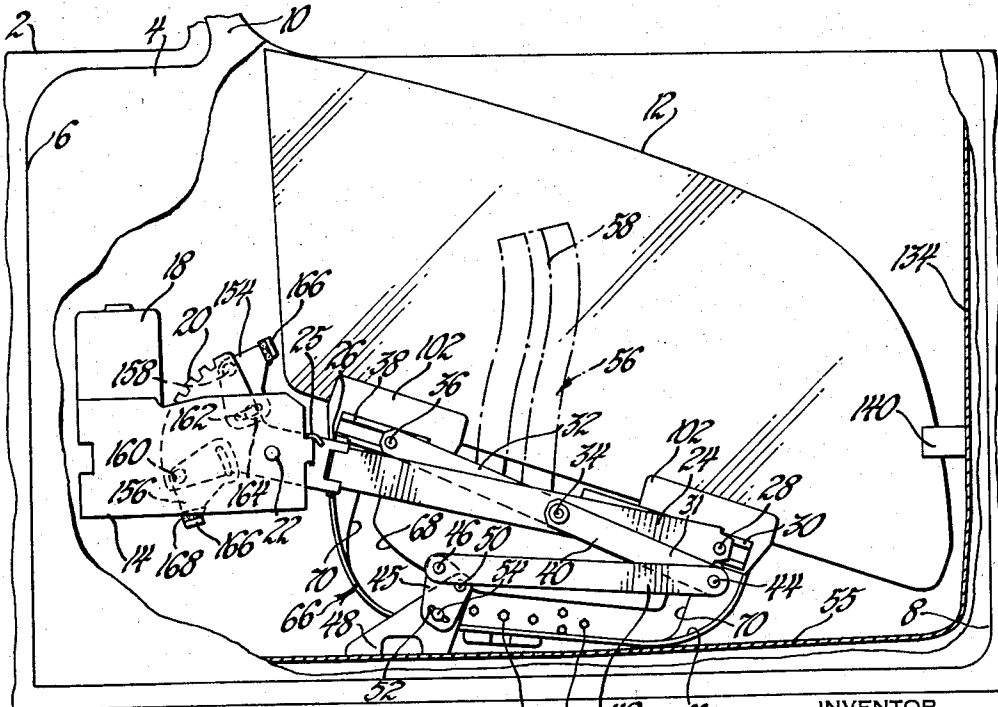


Fig. 3

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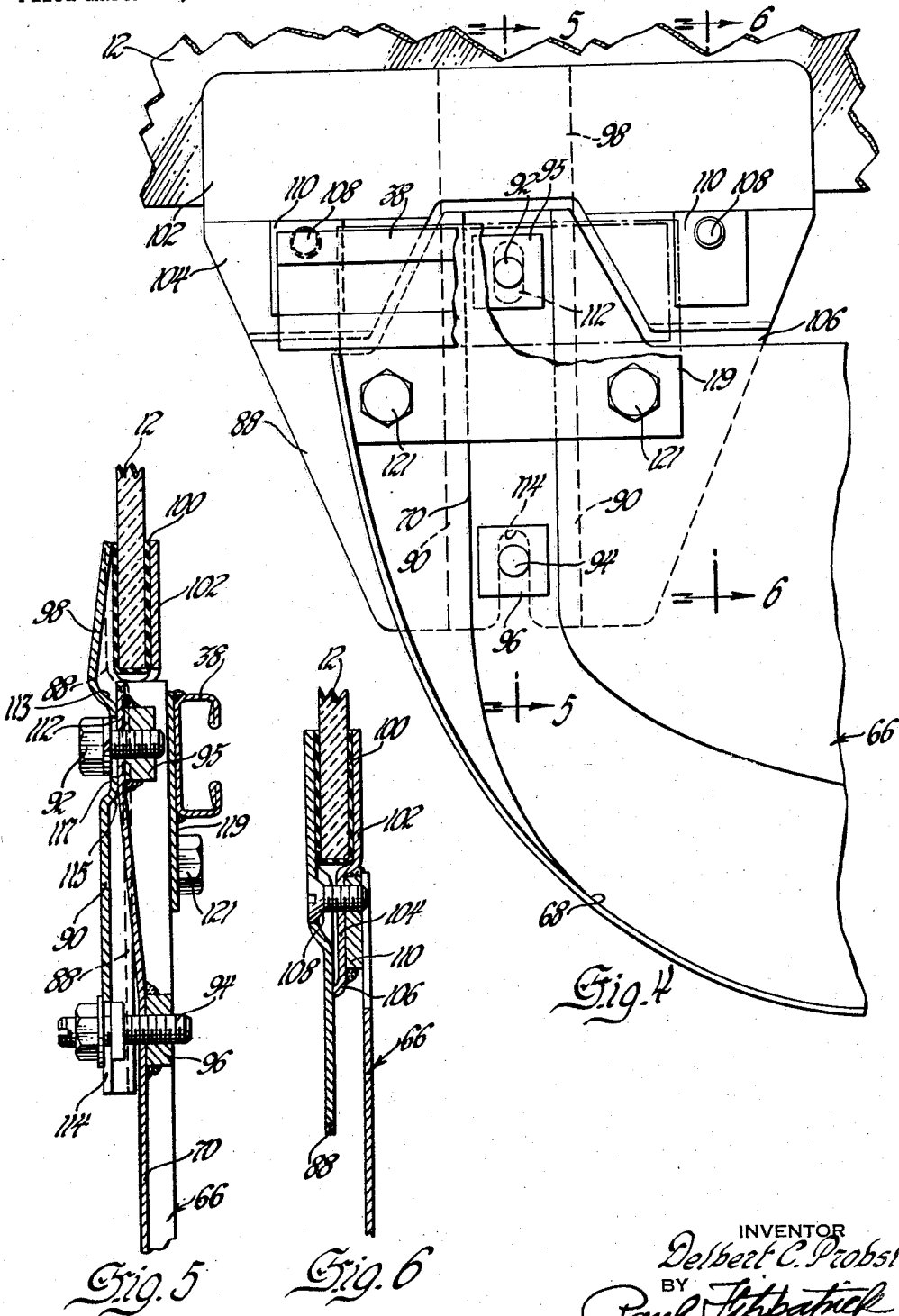
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4 Sheets-Sheet 3



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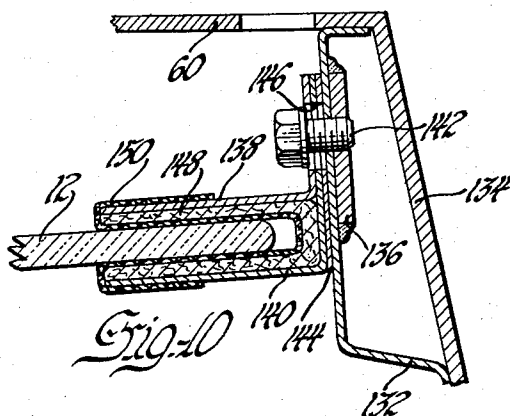
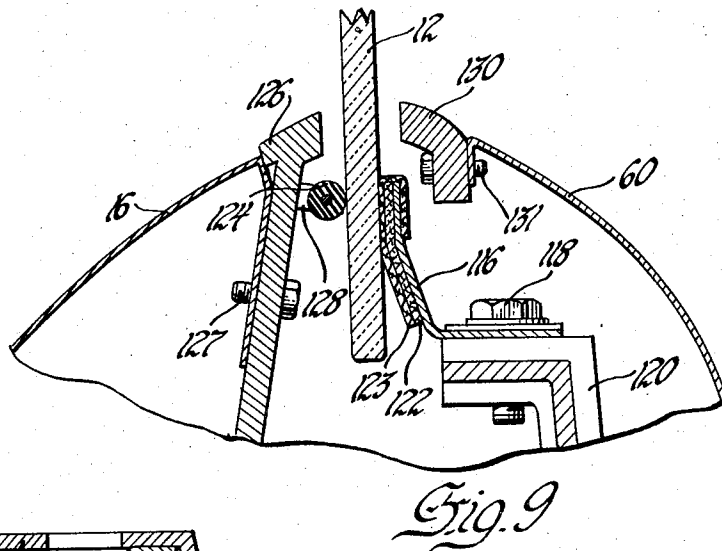
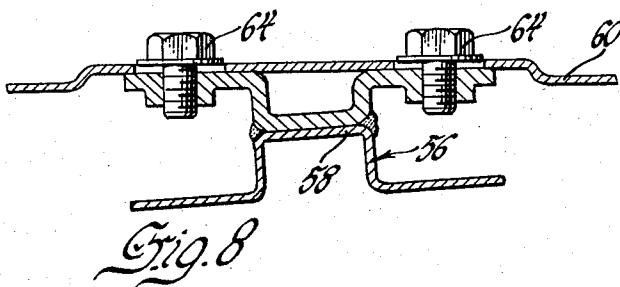
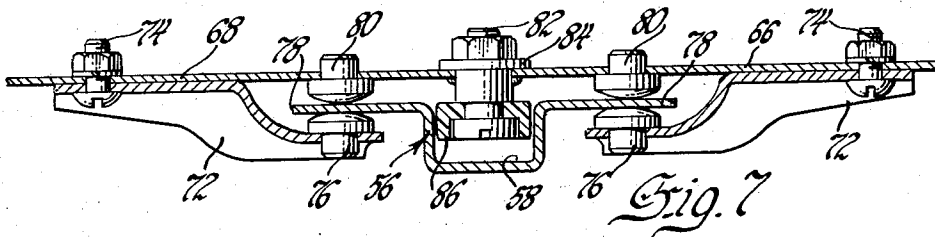
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WINDOW REGULATOR

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4 Sheets-Sheet 4



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2,876,003

WINDOW REGULATOR

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7 Claims. (Cl. 268—126)

This invention relates to a window regulator and more particularly to a window regulator for moving a vehicle window into and out of a window well along a curvilinear path to open and close a window opening.

The window regulator of this invention has many outstanding and noteworthy features in its preferred embodiment. One of the principal features lies in the window regulator linkage which controls the entire movement of the window along its curvilinear path. A lift arm, having one end slidably and pivotally mounted in a retainer channel on the window, is pivotally mounted on a back plate supported by the outer door panel and provides the power for the movement of the window. A lever is pivotally supported intermediate its ends on the lift arm, with one end of the lever slidably and pivotally mounted in a retainer channel on the window, and the other end of the lever pivotally connected to one end of a link pivotally supported at its other end on the lower wall of the window well. This link may be called the pivoting restricting link or controlling link, for the position of this link is critical with respect to any given geometry of the window movement, and by changing the pivoting point of the link on the lower wall of the window well, the curvilinear path of the window can be varied.

Another feature of this invention lies in the window glass support plate located below the lower edge of the window. Spaced pairs of inner and outer clamping plates adjustably supported by the window glass support plate are clamped to the lower portion of the window to mount the window on the glass support plate. The clamping plates are adjustable to vary the vertical spacing between the lower edge of the window and the upper edge of the support plate and to tilt the window with respect to the support plate. The support plate also mounts the retainer channels connected with the lift arm and the lever which supports the window glass support plate and the window.

A further principal feature of this invention lies in the guide channel which is fixedly mounted on the inner door panel and pivotally and slidably connected to the window by means of a stud mounted on the window glass support plate and fitting within the guide channel. As hereinbefore stated, both the lift arm and the lever are slidably and pivotally mounted in the retainer channels mounted on the glass support plate and, therefore, cannot control the fore and aft shifting movement of the window. The guide channel controls the fore and aft shifting movement of the window and maintains the correct relationship of the window with the inner door hardware and the inner and outer door panels to prevent interference.

These and other features of this invention will be readily apparent from the following specification and drawings, in which:

Figure 1 is a side elevational view of the preferred embodiment of the window regulator of this invention mounted within a door of an automobile with the window in up position;

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Figure 2 is a view similar to Figure 1 showing the window in partially open position;

Figure 3 is a view similar to Figure 1 showing the window in down position;

Figure 4 is an enlarged view of a portion of the window supporting plate and its connection with the window;

Figure 5 is a sectional view on the plane indicated by line 5—5 of Figure 4;

Figure 6 is a sectional view on the plane indicated by line 6—6 of Figure 4;

Figure 7 is a sectional view on the plane indicated by line 7—7 of Figure 1;

Figure 8 is a sectional view on the plane indicated by line 8—8 of Figure 1;

Figure 9 is a sectional view on the plane indicated by line 9—9 of Figure 1; and

Figure 10 is a sectional view on the plane indicated by line 10—10 of Figure 1.

Referring now to Figure 1 of the drawings, a vehicle body 2 includes a door 4 hinged at its forward edge 6 to the body and latched at its rearward edge 8 to the body. The door header 10 extends obliquely forwardly and upwardly at the forward portion of the door to the roof rail and mounts the usual glass run channel slidably receiving the forward edge of window 12 in the up position of the window, as shown in Figure 1. Since the door header 10 extends obliquely upwardly, vertical straight line movement of window 12 between open and closed positions is impossible. Therefore, in order to stow window 12 within the window well provided by the lower portion of door 4, the window must have curvilinear movement so that the rear portion of the window can be moved rearwardly and downwardly within the window well to allow the forward portion of the window to also move downwardly within the window well and clear the door header 10.

A back plate 14 supported by the outer door panel 16 mounts an electric motor 18 driving the usual worm and pinion gear assembly which drives the window regulator. Sector gear 20 pivotally mounted inboard of back plate 14 at 22 is driven by the pinion gear and drives a window lift arm 24 pivotally connected to the sector gear by a hinge arrangement 26. A coiled torsion spring 25 having one end fixed to pivot 22 and the other end held by clinched-over tab 27 of back plate 14 counterbalances the lift arm. The upper end of lift arm 24 mounts stud 28 slidably mounted in retainer channel 30. An arm 32 of lever 31, pivotally supported on the lift arm at 34, mounts a stud 36 slidably mounted in retainer channel 38. The other arm 40 of lever 31 is held in fixed alignment with arm 32 by the pivotal connection at 34 and is pivoted to the pivoting restricting link or controlling link 42 at 44. The free end of link 42 is pivotally connected to plate 45 at 46. Plate 45 is pivotally supported on bracket 48 at 50 and is adjustable with respect to the bracket by means of slot 52 in the plate and bolt 54 supported by bracket 48. Bracket 48 is bolted to the lower wall 55 of door 6 and may be adjustable with respect to the lower wall by the use of shims or washers between the bracket and the wall.

A guide 56 having an outwardly facing central channel 58 defining an irregular curvilinear path is supported on the door panel 60 by means of U-shaped brackets 62, Figure 8, welded to the base of channel 58 and secured to the inner door panel by machine screws 64. Referring now to Figures 1, 4, and 7, a window support plate 66 includes an integral lower outwardly opening channel 68 terminating in upwardly extending channel portions 70. A pair of offset brackets 72 fixed to the base of channel 68 by bolts 74 mount nylon buttons 76 bearing against the inner surface of flanges 78 of guide 56. A similar pair of nylon buttons 80 mounted on the base of channel

68 bear against the outer surfaces of flanges 78 opposite buttons 76. The clamping action of buttons 76 and 80 on the flanges of guide 56 provides a lateral stabilizer for the window to reduce lateral tilting movement of the window about vertical and horizontal axes in conjunction with lift arm 24 and arm 32. In the up position of the window, the door header 10 cooperates with the buttons and the arms to prevent lateral tilting movement of the window.

A stud 82 slidably mounted within bushing 84 welded to the base of channel 68 mounts a cup-shaped roller 86 which is held in position by the bushing and the head of the stud. As the window moves between open and closed positions, the stud and roller slide in channel 58 to control the fore and aft shifting movement of window 12.

Referring now to Figures 4, 5, and 6, an inner clamping plate 88 having a central inwardly extending rib 90 fitting over channel portion 70 of the window support plate 66 is secured to the support plate by studs 92 and 94 threaded in nuts 95 and 96 welded to channel portion 70. The upper portion 98 of rib 90 is offset outwardly to engage the inner side of window 12 together with the remainder of the upper portion of the plate. A rubber channel 100 is provided around the lower edge of the window to prevent rattling between plate 88 and the window. An outer clamping plate 102 having offset leg portions 104 provided with terminal flanges 106 is secured to plate 88 by bolts 108 threaded in nuts 110 welded to the leg portions 104. Plate 102 engages rubber channel 100 on the outer side of the window, and when plates 88 and 102 are bolted together the window is securely clamped and mounted on the window support plate 66.

In order to provide for adjustment of the vertical spacing between the window and the window support plate, slots 112 and 114 are provided in clamping plate 88. Since clamping plate 102 is supported by plate 88, adjustment of plate 88 relative to the window support plate 66 will adjust either the forward or rearward portion of the window relative to the window support plate 66. The window may also be tilted relative to the window support plate by varying the spacing between the base of rib 90 and the base of channel portion 70 by means of stud 94. To accomplish this, bolts 108 and stud 92 are loosened, and plate 88 is adjusted by stud 94 relative to the window support arm so that either shoulder 113 or 115 of offset 117 bears against the base of channel portion 70. Thus, when bolts 108 and stud 92 are thereafter tightened, the window will be tilted either inboard or outboard relative to the window support plate 66. The retainer channel 38 is welded to bracket 119 bolted to the window support plate at 121 to mount the retainer channel on the support plate, and retainer channel 30 is similarly supported on the window support plate 66.

Referring now to Figures 1, 9, and 10, a pair of L-shaped spring steel brackets 116 are bolted at 118 to support 120 which spans the door well and is secured to the front and rear walls of the door. The free legs of the brackets are covered with felt 122 and cloth 123 and bear against the window to hold the window against a cylindrical rubber bumper 124 supported on the outer window garnish molding 126 at 128. The garnish molding is bolted to the outer door panel 16 at 127. The brackets 116 prevent rattling of the window within the window opening formed by the outer window garnish molding 126 and the inner window garnish molding 130 which is bolted to the inner door panel 60 at 131. A support 132, Figure 10, welded to the inner door panel 60 and the rear wall 134 of the door mounts a nut 136 which is welded to the bracket. A pair of L-shaped spring steel clamping members 138 and 140 are bolted to bracket 132 at 142. A shim 144 is used to adjust the position of the brackets 138 and 140 toward and away from the bracket, and slots 146 are provided in the brackets and in the shim to adjust the position of brackets 138 and 140 along

the outer face of bracket 132. Brackets 138 and 140 form a channel, and a felt channel 148 having a cloth covering 150 is mounted in this channel.

Referring now to Figures 1 and 3, in the closed position of the window the spring steel brackets 116 bear against the window to prevent rattling. As the window moves downwardly to open position within the door well, the window is first released from engagement with the rear bracket 116 and then later released from the front bracket 116. When the window is released from engagement with the front bracket 116, the rear edge of the window enters the channel formed by brackets 138 and 140 to prevent rattling in the open or substantially open position of the window. At no time is the window free of all of the spring steel brackets and, therefore, rattling is prevented in all positions of the window.

In order to limit the swinging movement of the lift arm 24 about pivot 22, stops are provided between the sector gear 20 and the back plate 14. Referring now to Figure 1 of the drawings, an upper and a lower limiting stop 154 and 156, respectively, are pivotally mounted on the sector gear at 158 and 160, respectively, and are adjustable with respect to the sector gear by means of slots 162 in the stops and bolts 164 mounted on the sector gear. Each stop has an outwardly extending flanged edge 166 covered with a rubber bumper 168, with the flanged edge of stop 154 engaging the upper edge of the back plate 14 to limit the upward movement of the lift arm, as can be seen in Figure 1, and the flanged edge of stop 156 engaging the lower edge of back plate 14 to limit the downward movement of the lift arm, as can be seen in Figure 3.

Referring now to Figures 1, 2, and 3, the operation of the window regulator will be described. As hereinbefore stated, the guide 56 controls the fore and aft shifting movement of the window as it moves between open and closed positions, and the opposed nylon studs 76 and 80 together with the spring steel brackets 116 and 138 and 140 prevent lateral tilting movement of the window about horizontal and vertical axes. As the lift arm 24 swings downwardly within the door well about pivot 22 from its position of Figure 1 to its position of Figure 2, the window moves rearwardly and the rear portion of the window moves downwardly within the door well at a faster rate than the forward portion of the window in order that the forward portion of the window can be released from engagement within the door header 10. The downward movement of the forward portion of the window is controlled by lever 31 and link 42, which controls the rotational movement of lever 31 about pivot 34 on the lift arm. It should also be noted that lever 31 rotates in an opposite direction to the direction of rotation of the lift arm 24 about pivot 22. If the forward portion of the window did not initially move downwardly at a slower rate than the rear portion of the window, the window could not be released from sealing engagement with the door header 10. As the window moves from its position of Figure 2 to its position of Figure 3, the rear portion of the window continues to move downwardly within the window well at a faster rate than the forward portion of the window, so that the forward portion of the window is finally positioned higher than the rear portion of the window, as can be seen in Figure 3.

When the window moves upwardly within the door well from its position of Figure 3 to its position of Figure 1, the forward portion of the window moves at a slower rate than the rear portion of the window. As the window passes through its position of Figure 2, the window is tilted forwardly into sealing engagement with the door header 10 as the rear portion of the window continues to move upwardly at a faster rate than the forward portion of the window. The lower forward portion of the window enters into sealing engagement with the door header 10 before the upper forward portion of the window, since the rear portion of the window must

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be moved upwardly before the upper forward portion of the window enters into sealing engagement with the door header 10. Throughout the entire movement of the window, the lift arm 24 controls the rate of travel of the rear portion of the window, and lever 31 rotating in an opposite direction to the lift arm and controlled by link 42 controls the rate of travel of the forward portion of the window.

The window illustrated is a curved glass window, but the window regulator of this invention may be used with equal success on flat glass windows. Since a curved glass window requires a larger window opening in the door than a flat glass window, the relative spacing of the garnish moldings will vary with the window.

While a specific embodiment of this invention has been shown and described, various changes and modifications may be made within the scope and spirit of the invention.

I claim:

1. A window regulator mechanism for a vehicle window movable into and out of a window well comprising in combination, guiding means within said well defining a curvilinear path, guide means on said window movable within said guiding means during movement of said window to move said window along said curvilinear path, a lift arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said lift arm and having one end thereof pivotally secured to the other portion of said window to one side of said lift arm, and a controlling link pivotally supported within said well below the pivotal support of said lift arm and being pivotally connected to said balance arm to the other side of said lift arm for swinging said balance arm about its fulcrum on the lift arm during swinging movement of the lift arm to restrict movement of the other portion of the window to a lesser rate than movement of the one portion of the window as said window moves along said curvilinear path.

2. A window regulator mechanism for a vehicle window movable into and out of a window well comprising in combination, guiding means within said well defining a curvilinear path, guide means on said window movable within said guiding means during movement of said window to move said window along said curvilinear path, a lift arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said lift arm and having one end thereof pivotally secured to another portion of said window to one side of said lift arm, and a controlling link pivotally supported within said well below the pivotal support of said lift arm and being pivotally connected to said balance arm to the other side of said lift arm to dispose said controlling link and balance arm in unfolded position, said controlling link swinging said balance arm about its fulcrum on the lift arm during swinging movement of the lift arm to fold said controlling link and balance arm about their common pivotal connection and restrict movement of the other portion of the window to a lesser rate than movement of the one portion of the window as said window moves along said curvilinear path.

3. A window regulator mechanism for a vehicle window movable into and out of a window well comprising in combination, a lift arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one lower edge portion of said window, a balance arm fulcrumed intermediate its ends on said lift arm and having one end thereof pivotally secured to the lower edge portion of said window to one side of said lift arm, and a controlling link pivotally supported within said well on a fixed pivotal connection below the pivotal support of said

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lift arm and being pivotally connected to said balance arm to the other side of said lift arm for swinging said balance arm about its fulcrum on the lift arm during swinging movement of the lift arm to restrict movement of said other edge portion of the window to a lesser rate than movement of said one edge portion of the window and dispose said lower edge portion of said window in general alignment with said lift arm.

4. A window regulator mechanism for a vehicle window movable into and out of a window well comprising in combination, guiding means within said well defining a curvilinear path, guide means on said window movable within said guiding means during movement of said window to move said window along said curvilinear path, a lift arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said lift arm and having one end thereof pivotally secured to another portion of said window to one side of said lift arm, and a controlling link pivotally supported within said well below and to the other side of said lift arm in all positions thereof and being pivotally connected to said balance arm to said other side of said lift arm to dispose said controlling link and balance arm in unfolded position, said controlling link swinging said balance arm about its fulcrum on the lift arm during swinging movement of the lift arm to fold said controlling link and balance arm about their common pivotal connection into general alignment with said lift arm and thereby restrict movement of the other portion of the window to a lesser rate than movement of the one portion of the window as said window moves along said curvilinear path.

5. In a vehicle body having a window well, a window opening thereabove having a sloping side edge, and a window having a complementary sloping side edge for sealing engagement therewith; a window regulator mechanism for said window to move said window into said well out of sealing engagement with said edge of said opening comprising, a lift arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said lift arm and having one end thereof pivotally secured to the other portion of said window adjacent said one side edge thereof and to one side of said lift arm, and a controlling link pivotally supported within said well below the pivotal support of said lift arm and being pivotally connected to said balance arm to the other side of said lift arm for swinging said balance arm about its fulcrum on the lift arm during swinging movement of the lift arm to restrict movement of the other portion of the window to a lesser rate than movement of the one portion of the window whereby said window moves outwardly and downwardly away from said side edge of said opening and into said well along a curvilinear path.

6. A window regulator mechanism for a vehicle window movable into and out of a window well comprising, a guideway within said well, a guide member mounted on said window and being pivotally and slidably secured to said guideway for controlling bodily shifting movement of said window during movement thereof and allowing said window to pivot during the bodily shifting movement thereof, a drive arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said drive arm and having one end thereof pivotally secured to another portion of said window, and a control link pivotally supported within said well and pivotally connected to said balance arm for swinging said balance arm about its fulcrum on the drive

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arm during swinging movement of the drive arm to restrict movement of said another portion of the window to a differential rate than movement of the one portion of the window whereby said window pivots relative to said guideway about said guide member during bodily shifting movement thereof.

7. A window regulator mechanism for a vehicle window movable into and out of a window well comprising, a guideway within said well, a guide member mounted on said window and being pivotally and slidably secured to said guideway for controlling bodily shifting movement of said window during movement thereof and allowing said window to pivot during the bodily shifting movement thereof, a drive arm pivotally supported adjacent one end thereof within said well and having the other end thereof pivotally secured to one portion of said window, a balance arm fulcrumed intermediate its ends on said drive arm and having one end thereof pivotally secured to another portion of said window, and a control link pivotally supported within said

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well and pivotally connected to said balance arm for swinging said balance arm about its fulcrum on the drive arm during swinging movement of the drive arm to restrict movement of said another portion of the window to a lesser rate than movement of the one portion of the window whereby said window pivots relative to said guideway about said guide member during bodily shifting movement thereof to an angular position within said window well.

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