

Dec. 2, 1958

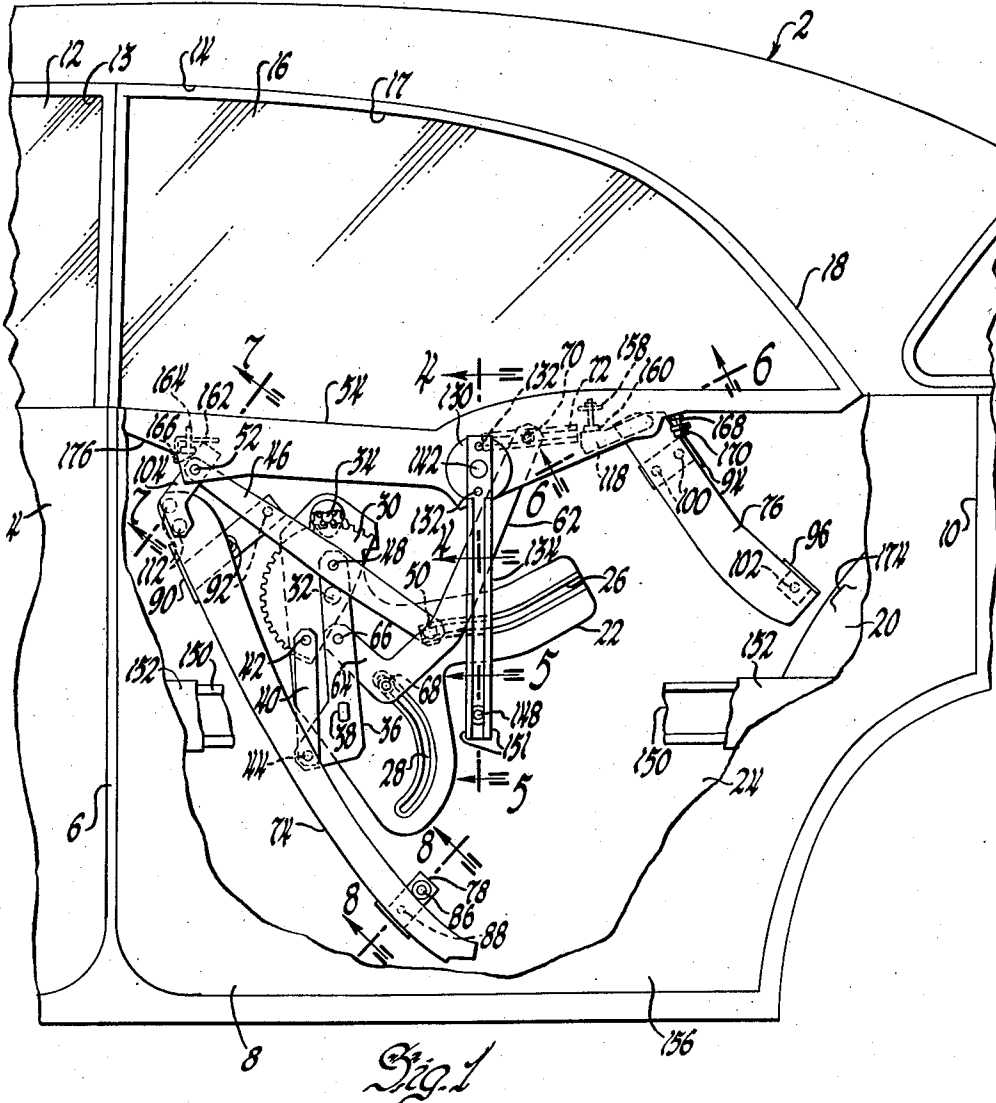
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2,862,703

WINDOW REGULATOR

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3 Sheets-Sheet 1



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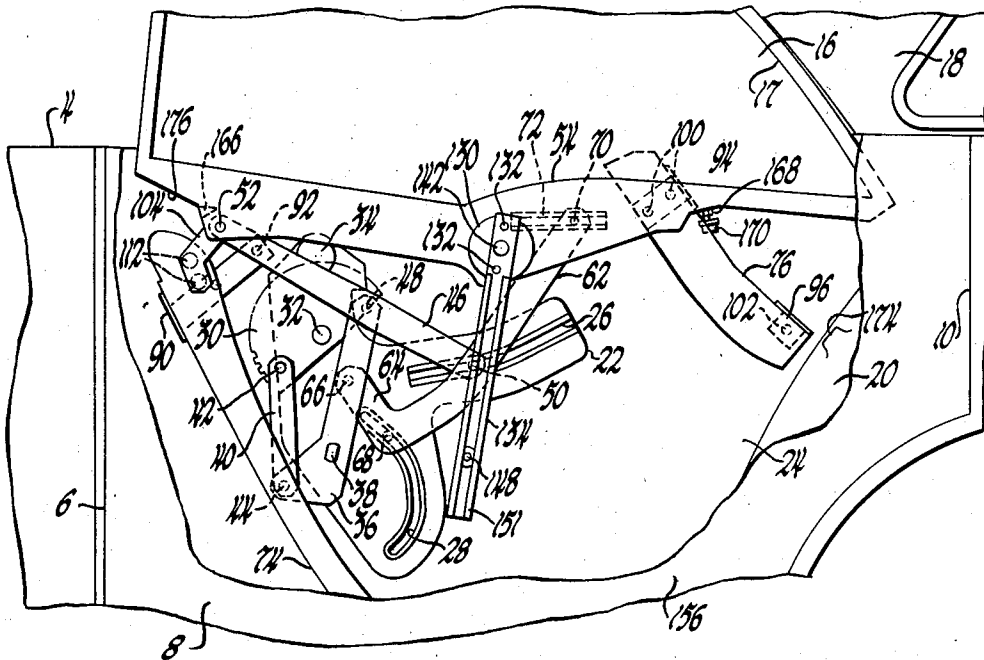


Fig. 2

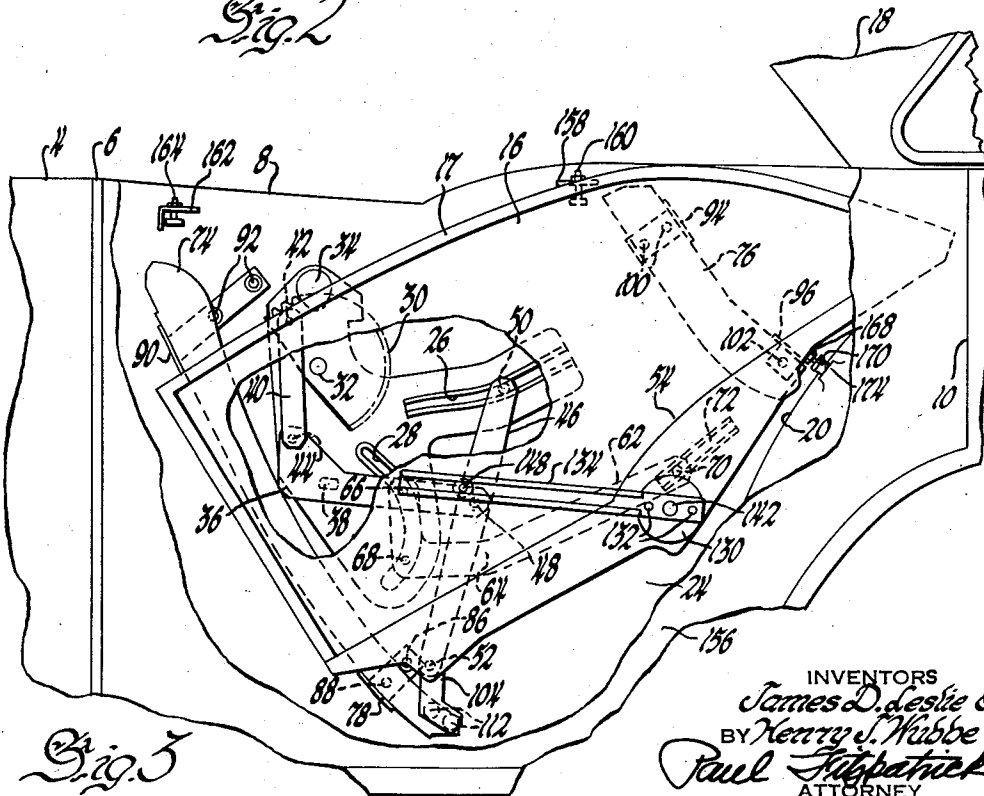


Fig. 3

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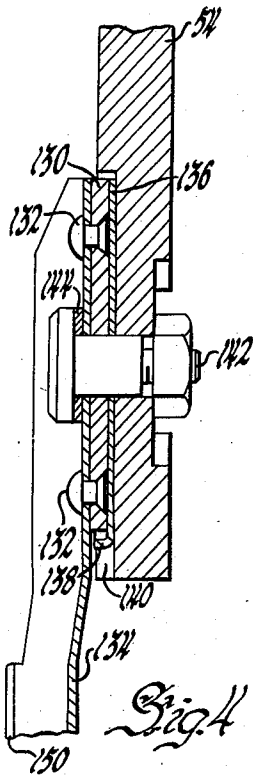
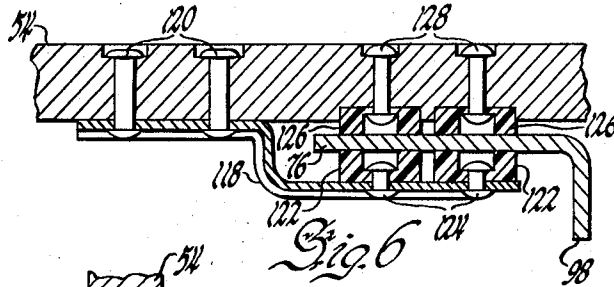
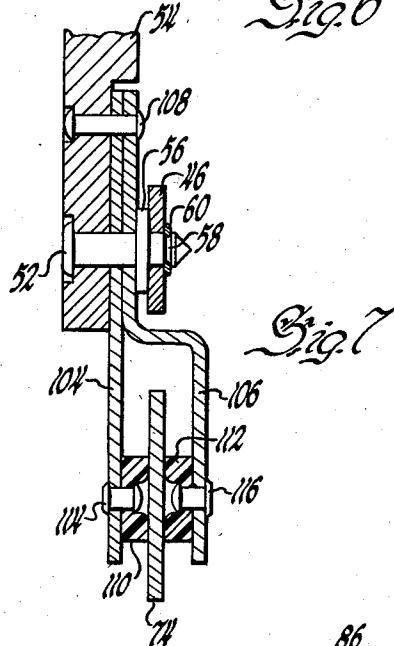
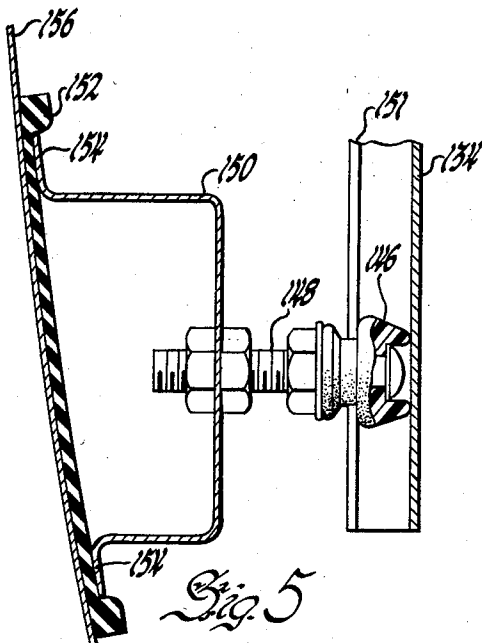
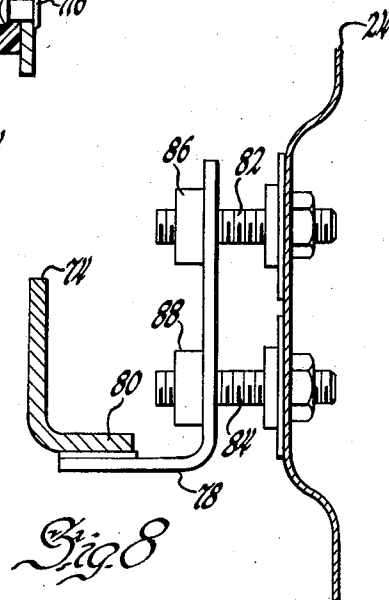
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WINDOW REGULATOR

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3 Sheets-Sheet 3



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2,862,703

WINDOW REGULATOR

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8 Claims. (Cl. 268—104)

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 recently introduced four-door hard top sedan has no center pillar above the body belt line and no door window frames above the body belt line except for the ventipane window frame at the forward portion of the front door. This results in a continuous window opening from the ventipane window to the rear quarter area of the body when the front and rear door windows are in down position. The front and rear door windows seal against each other and the roof rail to close the window opening. The front door window also seals against the ventipane window frame.

There are many problems presented by the rear window installation in this type of automobile. The rear window overlaps the center pillar in up position in order to seal against the front window which requires that the window have forward and rearward movement as well as vertical movement in order to be moved into and out of the door well. The front window may have conventional vertical movement between open and closed positions. The rear window must also be irregularly shaped because of the styling of the body belt line portion of the door and the styling of the roof rail. The rear wheel housing projects into the lower rear portion of the rear door to reduce stowage space to a minimum and to prevent vertical straight line movement of the window into and out of the door well.

This invention solves the many problems presented by this type of rear window installation by providing a window regulator moving the rear window along a curvilinear path between open and closed positions. The window regulator also securely holds the window in any position without rattling or lateral tilting movement of the window inboard and outboard of the window opening, for the absence of door window frames above the body belt line tends to increase both of these problems.

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 back plate mounted on the inner door panel has a pair of cam channels defining irregular curvilinear paths. A manually driven sector gear and a radius arm or main driving arm pivoted on the back plate are interconnected by a shiftable link so that rotation of the sector gear by the operator rotates the radius arm about its pivot on the back plate. A front window controlling link is pivotally connected to the radius arm intermediate the ends of the link, with one end of the link being pivotally connected to the window and the other end of the link being pivotally and slidably mounted in one of the back plate cam channels. A rear window controlling link has one end pivotally and slidably connected to the window, an integral elbow extension at the other end of the arm pivot-

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ally connected to the radius arm and is pivotally and slidably mounted within the other back plate cam channel at approximately the junction point between the link and the integral elbow extension. As the radius arm rotates, it bodily shifts the front and rear window controlling links in concentric arcuate paths about the pivot of the radius arm and the back plate, and at the same time the links are also guided in irregular arcuate paths by the back plate cam channels. Thus, each link is bodily shifted in an irregular curvilinear path which is the resultant of the arcuate concentric path of the link about the pivot of the radius arm and the irregular curvilinear path defined by the cam channels. The resultant of the irregular curvilinear paths in which the links are shifted defines the curvilinear path of the window as it moves between open and closed positions.

Another principal feature of this invention in its preferred embodiment lies in the front and rear guides mounted on the inner door panel and slidably connected to the window frame. As hereinbefore stated, there are no door window frames above the body belt line and, therefore, the windows are subject to lateral tilting movement inboard and outboard of the window opening and are also subject to lateral shifting movement fore and aft of the body due to the fact that the window regulator linkage includes the bodily shiftable front and rear window controlling links. The front and rear guide channels control the lateral tilting movement of the window inboard and outboard of the window opening in any position of the window and also control the fore and aft shifting movement of the window to maintain the correct relationship of the window with the inner door hardware and the inner and outer door panels to prevent interference. These channels have no function whatsoever of controlling the movement of the window as it moves along its curvilinear path.

Another feature of this invention in its preferred embodiment lies in the fact that both the front and rear guide channels and the window regulator linkage are mounted on the inner door panel to one side of the window. As hereinbefore stated, the window stowage space is decreased to a minimum by the rear wheel housing and by the styling of the body belt line and, therefore, only a minimum amount of stowage space for the window and the window regulator mechanism is available. By mounting the guide channels and the window regulator linkage on the inner door panel, space is provided for the window, the window guides, and the window regulator linkage within the door well.

A further feature of this invention lies in the use of a lateral stabilizer to prevent tilting movement of the window in conjunction with the front and rear guides as the window moves along its curvilinear path or in any fixed position of the window. This lateral stabilizer includes a depending channel pivotally mounted on the lower window frame with the lower portion of the channel pivotally and slidably mounted on the outer door panel by means of a supporting bracket and a stud engaging within the channel. As the window moves along its curvilinear path, the lower portion of the channel slides on the stud and follows a curvilinear path different from that of the window.

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 window regulator of this invention mounted within the rear door of a four-door hard top sedan with the window in up position;

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;

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Figure 4 is a sectional view on the plane indicated by line 4—4 of Figure 1;

Figure 5 is a sectional view on the plane indicated by line 5—5 of Figure 1;

Figure 6 is a partial sectional view on the plane indicated by line 6—6 of Figure 1;

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

Figure 8 is a sectional view on the line 8—8 of Figure 1.

Referring now to Figure 1 of the drawings, a vehicle body 2 includes a front door 4 hinged at its forward edge to the body and latched at its rearward edge to the center pillar 6, and a rear door 8 hinged at its forward edge to the center pillar 6 and latched at its rearward edge 10 to the vehicle body. The center pillar 6 extends only from the floor of the vehicle to the body belt line, which is the top edge of the front and rear doors. A front window 12 mounted within a window frame 13 is supported within door 4 by a suitable window regulator for vertical movement between open and closed positions. The front window seals against the roof rail 14 and also against the ventipane window frame (not shown) extending upwardly to the roof rail at the forward portion of door 4 and pivotally supporting a ventipane window. A rear window 16 mounted within a window frame 17 is supported within door 8 by the window regulator of this invention and seals against the roof rail 14 and the front window 12 in closed position. Thus, it can be seen that when both the front and rear windows are in open position, a continuous window opening extends from the ventipane window frame to the rear quarter area 18 of the body and accounts for the name of this type of automobile, a four-door hard top sedan.

Inasmuch as there is no support for either the front or rear windows above the body belt line, each window must be supported entirely within the door wells of the front and rear doors. The front window 12 moves vertically between open and closed positions, and a suitable window regulator of known type may be used. However, the rear window 16 cannot move vertically between open and closed positions since it must overlap the center pillar 6 in closed position in order to seal against the front window. The rear door 8 also extends rearwardly beyond the rear quarter area 18 of the body, and the rear wheel housing (not shown) projects into the lower rear portion of the rear door. This requires that a portion 20 of the rear wall of door 8 be offset forwardly of the body and this will further prevent vertical movement of the rear window. Thus, in order to stow window 16 within the rear door, the window must move along a curvilinear path between open and closed positions. This curvilinear path is an irregular curvilinear path, for the window pivots about a number of instantaneous centers as it moves between open and closed positions.

The window regulator of this invention will now be described. A back plate 22 mounted on the inner door panel 24 has a pair of cam slots 26 and 28 which define irregular curvilinear paths. A sector gear 30 pivoted on the back plate 22 at 32 is driven by a pinion gear 34 which is rotated by the window regulator handle (not shown) provided for the operator. A radius arm or main driving arm 36 pivoted on the back plate 22 at 38 is pivotally interconnected with sector gear 30 by a shiftable link 40 pivoted to sector gear 30 at 42 and to the radius arm 36 at 44. Thus, as the sector gear 30 is rotated in a clockwise direction about its pivot 32 by pinion gear 34, the shiftable link 40 rotates radius arm 36 in a clockwise direction about pivot 38.

A front window controlling link 46 pivotally connected to radius arm 36 at 48 supports a stud 50 at one end which is slidably and pivotally mounted in cam slot 26. Referring now to Figure 7 of the drawings, a stud 52 fixed to the lower window frame portion 54 of window frame

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16 has a shoulder 56 and the other end of the front window controlling link 46 is pivotally mounted on stud 52 and bears against shoulder 56. The end of stud 52 has a groove 58 and a split ring 60 mounted in this groove retains the link on stud 52. Referring now to Figure 1 of the drawings, a rear window controlling link 62 has an integral elbow extension 64 pivotally connected to radius arm 36 at 66. Stud 68 supported on link 62 at approximately the junction point between the link and the elbow extension 64 is pivotally and slidably mounted in cam slot 28 of back plate 22. The other end of arm 62 mounts a stud 70 which is pivotally and slidably mounted in retainer channel 72 mounted on the lower window frame portion 54 and facing inwardly of the body.

Since the front and rear window controlling links are the only support for the window and are ineffective to control lateral tilting movement of the window inboard and outboard of the window opening, front and rear guides 74 and 76, respectively, are necessary to control this lateral tilting movement of the window and also to control the fore and aft shifting movement of the window which results from the fact that both the front and rear window controlling links 46 and 62, respectively, are bodily shiftable and thus subject to slight movement. The front and rear guides 74 and 76, respectively, thus maintain the correct relationship of the window with the inner and outer door panels and the inner door hardware to prevent interference as the window moves between open and closed positions.

Referring now to Figures 1 and 8 of the drawings, an L-shaped bracket 78 welded to the inwardly extending flange 80 of guide 74 adjacent the lower end of the guide is supported on the inner door panel 24 by a pair of studs 82 and 84 adjustably mounted on the inner door panel and threaded in nuts 86 and 88 welded to bracket 78. A similar bracket 90 bolted to the inner door panel at 92 is welded to flange 80 adjacent the upper end of guide 74 to further mount the guide on the inner door panel. A pair of L-shaped brackets 94 and 96 welded to the inwardly extending flange 98, Figure 6, of the rear guide 76 adjacent the ends of the guide are bolted to the inner door panel at 100 and 102, respectively, to mount the guide on the inner door panel. The lower bracket 96 may be adjustably mounted on the inner door panel by use of adjustable studs such as studs 82 and 84 shown in Figure 8. The upper ends of both guides 74 and 76 may also be adjusted by the use of shims or spacers between brackets 90 and 94 and the inner door panel.

Referring now to Figures 1 and 7 of the drawings, bracket 104 and offset bracket 106 are secured to the lower window frame member 54 by rivet 108 and by stud 52 hereinbefore described. Pairs of spaced opposed felt or nylon pads 110 and 112 riveted to brackets 104 and 106 at 114 and 116, respectively, bear against opposite sides of the front guide 74 to slidably connect the forward portion of the window to the guide and control the lateral tilting movement of the window inboard and outboard of the body. The fore shifting movement of the window is limited by abutment of bracket 106 against flange 80. Referring now to Figure 6 of the drawings, an offset bracket 118 is riveted to the lower window frame member 54 at 120 and a pair of spaced felt or nylon pads 122 are riveted to bracket 118 at 124. A similar pair of felt or nylon pads 126 riveted to the lower window frame member 54 at 128 are located in spaced opposed relationship to pads 122, and each pair of pads bears against one side of the rear guide 76 to further control the lateral tilting movement of window 16 inboard and outboard of the window opening. The aft shifting movement of the window is limited by abutment of bracket 118 against flange 98.

Referring now to Figures 1, 4, and 5, a lateral stabilizer is used to further prevent lateral tilting movement of the window inboard and outboard of the window opening in conjunction with the front and rear guides 74 and 76.

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A washer 130 riveted at 132 to the upper end of the stabilizer channel 134 is interlocked with a bearing plate 136 by means of a tongue 138 on the bearing plate fitting within groove 140 in the washer. This assembly is pivotally mounted on the lower window frame member 54 by means of stud 142, with washer 144 being provided between the head of the stud and the base of the channel to further reduce friction. The channel 134 extends downwardly within the window well, as shown in Figure 1, and a felt or rubber washer 146 supported by adjustable stud 148 extends inwardly with respect to the vehicle body into engagement with the channel. The sides of the channel are flanged at 151 in order to retain the washer 146 within the channel in all positions of the window. The adjustable stud 148 is supported by a channel 150 spanning the lower portion of door 4 and secured to the front and rear walls of the door, with a rubber lining 152 being provided between flanged edges 154 of channel 150 and the outer door panel 156 to prevent rattling between the channel and the door.

Thus, in any position of the window, tilting movement of the window inboard and outboard of the body is minimized by the leverage action of the stabilizer channel 134 on studs 142 and 148 and the large bearing area between bearing plate 136 and the lower window frame member 54, as can be seen in Figure 4. As the window moves downwardly within the window well from its position of Figure 1 to its position of Figure 3, the stabilizer arm pivots about stud 142 and slides on stud 146 to continue its effectiveness in all positions of the window. It should be noted that the stabilizer arm follows a curvilinear path different than the curvilinear path of the window.

Referring now to Figures 1, 2, and 3, various stop arrangements are provided to adjust the position of the window in both open and closed positions. A bracket 158 welded to the inner door panel threadedly supports stud 160 which contacts the upper edge of bracket 118, as can be seen in Figure 1, to limit the upward movement of the rear portion of the window as the window moves to closed position. An L-shaped bracket 162 adjustably mounted on the inner door panel threadedly supports a stud 164, and a triangularly shaped lug 166 extending inwardly from the inner surface of the lower window frame member 54 contacts both the stud and the forward depending leg of the bracket to limit the upward and forward movement of the forward portion of the window as the window is moved to closed position. A stud 168 threaded in an aperture in the lower window frame member 54 supports a rubber bumper 170. When the window is in down position, as shown in Figure 3, the rubber bumper 170 engages an offset shoulder 174 formed in the rear wall 20 of the door to limit the downward movement of the rear portion of the window.

Referring now to Figures 1, 2, and 3 of the drawings, the operation of the window will be described as it moves from its closed position of Figure 1 to its open position of Figure 3. As the sector gear 50 is rotated clockwise about pivot 32 from its position of Figure 1 to its position of Figure 2, link 40 rotates the radius arm 36 about pivot 38 in clockwise direction from its position of Figure 1 to its position of Figure 2. Rotation of the radius arm in this direction imparts a downward movement to the front and rear window controlling links 46 and 62, respectively. Since the front window controlling link 46 has one end slidably mounted in cam slot 26 which extends upwardly and rearwardly with respect to pivot 38, there is very little downward force imparted to the forward portion of the window as the link is bodily shifted from its position of Figure 1 to its position of Figure 2. However, cam slot 28 extends rearwardly and downwardly with respect to pivot 38, and thus as the rear window controlling link 62 is moved downwardly by the radius arm 36, link 62 is bodily shifted rearwardly and downwardly causing the rear portion of the window to

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move rearwardly and downwardly at a greater rate of travel than the forward portion of the window. This withdraws the portion 176 of the lower window frame member 54 from overlapping relationship with the center pillar and moves the forward portion of the window away from the roof rail 14, as the window assumes its position of Figure 2. If the rear portion of the window did not move rearwardly and downwardly at a greater rate than the forward portion of the window, then the window could not be withdrawn from overlapping relationship with the center pillar or moved away from the roof rail.

As the sector gear continues to rotate radius arm 36 in a clockwise direction the window moves from its position of Figure 2 to its position of Figure 3. During this movement of the window, stud 50 of link 46 slides from its position shown in Figure 2 to the end of cam slot 26 and then returns to its position shown in Figure 3, as link 46 is bodily shifted from its position of Figure 2 to its position of Figure 3. Stud 68 of link 62, meanwhile, travels at a slower rate in cam slot 28 than stud 50 travels in cam slot 26 and moves to its position shown in Figure 3, as link 62 is bodily shifted from its position of Figure 2 to its position of Figure 3. Since the forward window controlling link 46 is bodily shifted downwardly at a greater rate than the rear window controlling link 62, the forward portion of the window moves downwardly at a greater rate than the rear portion of the window and the window moves to its position of Figure 3.

The pivotal connection 48 between the radius arm 36 and the front window controlling link 46 is at a greater distance from pivot 38 than the pivotal connection 60 between the rear window controlling link 62 and the radius arm. Thus, pivotal connection 48 must move at a faster rate than the pivotal connection 66 and stud 50 will move at a greater rate in cam slot 26 than stud 68 moves in cam slot 28. Stud 50 reaches the end of cam slot 26 at approximately the position wherein stud 50, pivotal connection 48, and pivotal connection 38 are substantially in alignment. As the window continues to move beyond this position, the pivotal connection 48 continues to move downwardly as the radius arm pivots about pivot 38, thus withdrawing stud 50 from its position at the end of cam slot 26 and returning it to its position somewhat nearer the middle of the slot, as shown in Figure 3.

As the window move from its position of Figure 3 to its position of Figure 1, the forward portion of the window moves upwardly at a greater rate than the rear portion of the window as stud 50 moves from its position of Figure 3 to the end of cam slot 26 and then returns to its position of Figure 2. The pivotal connection 48 between the radius arm 36 and the front window controlling link 46 passes through the position wherein it is substantially in alignment with pivotal connection 38 and stud 50 and assumes its position above pivot 38 and stud 50, as shown in Figure 2. As the window moves from its position of Figure 2 to its position of Figure 1, the rearward portion of the window moves upwardly at a greater rate than the forward portion of the window as the window moves forwardly into overlapping relationship with the center pillar 6 and seals against the roof rail 14.

The front and rear guides 74 and 76 must be spaced apart at certain distances to allow rearward and downward and forward and upward movement of both the front and rear portions of the window without any binding of the felt or rubber pads against the flanged edges of the channels. Thus, the spacing of the channels will vary with the various curvilinear paths of movement which may be imparted to various windows to stow them within the door well.

The window illustrated moves in a vertical plane of travel, but it is obvious that the window may follow a curved path when moving between open and closed positions by appropriately curving the front and rear guide

channels in an outward direction with respect to the inner door panel, and allowing a certain amount of play between link 46 and a stud 52, and stud 70 and retainer channel 72 so that these studs can move toward and away from the inner surface of the lower window frame member 52. The window may also be curved so that it will follow the outer contour of the rear door when in closed position and the window regulator of this invention may be used with equal success with the slight modifications just previously noted. Since both the window regulator linkage and the guide channels are mounted on the inner door panel inboard of the window in all positions of the window, curvature of the guide channels and the window may be had without materially reducing the stowage space within the door well to a point where it will not receive the window in closed position.

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.

We claim:

1. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, a pair of spaced links operatively connected to said window for moving said window along a curvilinear path between open and closed positions, and support means within said window well guiding each of said links along a curvilinear path independent of the curvilinear path of said window, the curvilinear path of said window being the resultant of the curvilinear paths of said links.

2. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, a pair of spaced links operatively connected to said window for moving said window along a curvilinear path between open and closed positions, support means within said window well bodily shifting each of said links along a curvilinear path independent of the curvilinear path of said window, the curvilinear path of said window being the resultant of the curvilinear paths of said links, and means controlling the lateral shifting movement of said window as said window moves along said curvilinear path.

3. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, linkage means including a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, support means bodily shifting said links along curvilinear paths independent of the curvilinear path of said window, said support means including a lever pivotally connected to said links and rotatable about a fixed pivot, the curvilinear path of said window being the resultant of the curvilinear paths of said links, and means controlling the lateral shifting movement of said window as said window moves along said curvilinear path.

4. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, linkage means including a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, support means bodily shifting said links along curvilinear paths independent of the curvilinear path of said window, said support means including means guiding said links in concentric arcuate paths about a fixed pivotal center within said window well and means guiding said links in irregular curvilinear paths, the curvilinear path of said window being the resultant of the curvilinear paths of said links, and means controlling the lateral shifting movement of said window as said window moves along said curvilinear path.

5. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, linkage means including a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, support means bodily shifting said links along curvilinear paths independent of the curvilinear path of said window, said support means including a rotatable lever pivotally interconnecting said links for shifting said links in concentric arcuate paths about a fixed pivotal center within said window well and means guiding said links in irregular curvilinear paths, the curvilinear path of said window being the resultant of the curvilinear paths of said links, and means controlling the lateral shifting movement of said window as said window moves along said curvilinear path.

6. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising in combination, linkage means including a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, rotatable lever means pivotally interconnecting said links for shifting said links in concentric arcuate paths about a fixed pivotal center within said window well, means including cam channels guiding said links in irregular arcuate paths as said links are shifted in said concentric arcuate paths, the curvilinear path of said window being the resultant of the concentric arcuate paths and the irregular curvilinear paths of said links, and means controlling the lateral shifting movement of said window as said window moves along said curvilinear path.

7. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising, a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, a lever pivotally supported within said well and pivotally connected to each of said links for shifting said links in concentric arcuate paths about the pivotal center of said lever, and means including cam channels pivotally and slidably connected to said links for guiding each of said links in an irregular arcuate path as said links are shifted in said concentric arcuate paths, the curvilinear path of said window being the resultant of the concentric arcuate paths and the irregular curvilinear paths of said links.

8. A window regulator mechanism for a vehicle window bodily movable into and out of a window well to open and close a window opening comprising, a pair of links pivotally connected to said window for moving said window along a curvilinear path between open and closed positions, a lever pivotally supported intermediate the ends thereof within said well, means pivotally connecting each of said links to said lever to one side of the pivotal center thereof whereby said lever shifts said links in concentric arcuate paths about the pivotal center thereof, means operatively connected to said lever to the other side of the pivotal center thereof for swinging said lever to thereby shift said links, and means including cam channels pivotally and slidably connected to said links for guiding each of said links in an irregular arcuate path as said links are shifted in said concentric arcuate paths, the curvilinear path of said window being the resultant of the concentric arcuate paths and the irregular curvilinear paths of said links.

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