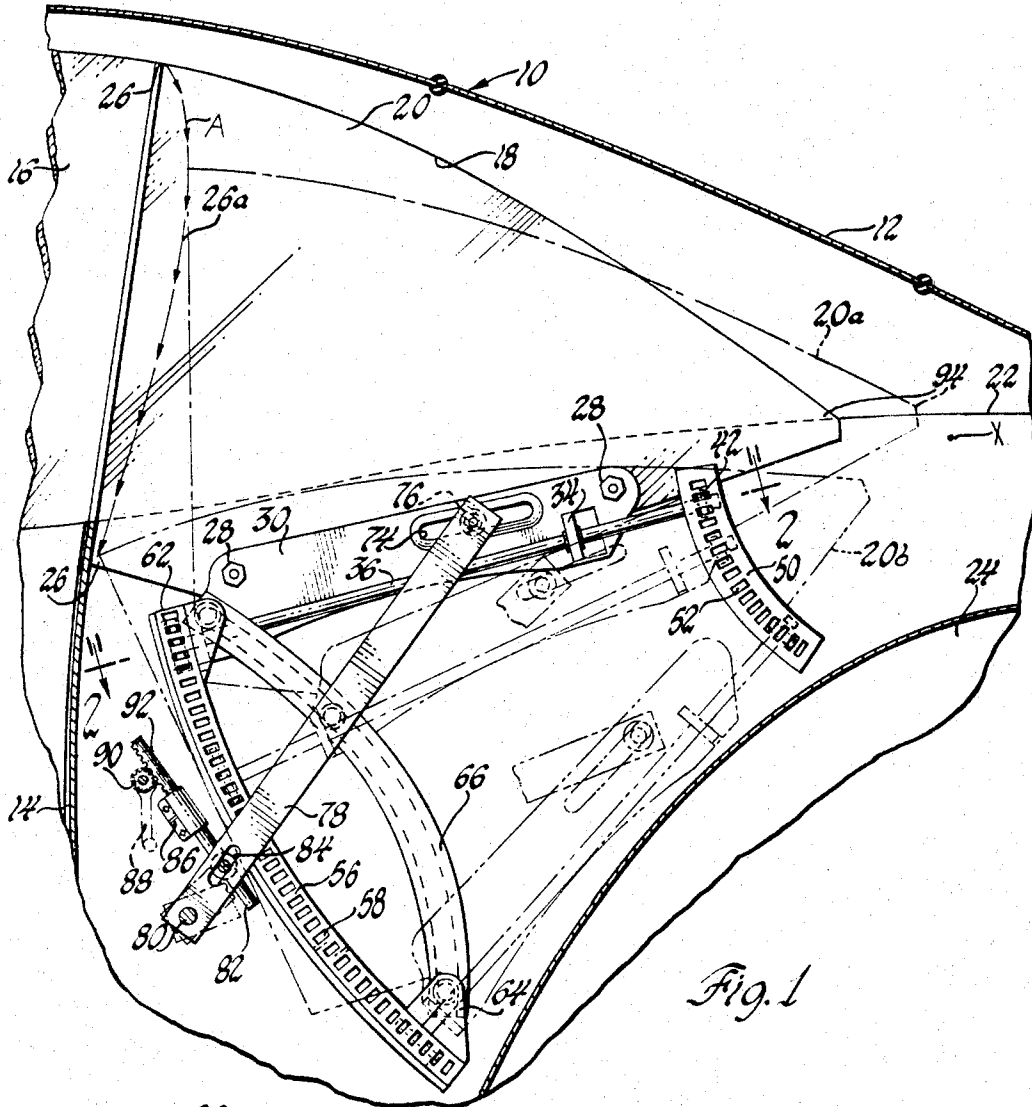
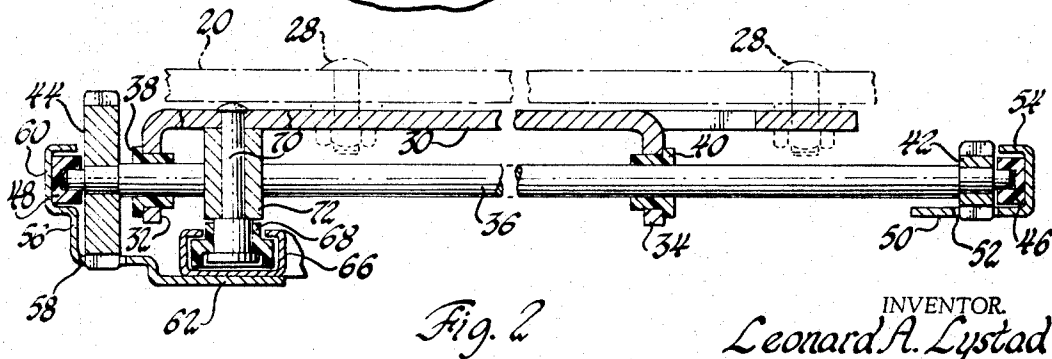


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CLOSURE OPERATOR

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ABSTRACT OF THE DISCLOSURE

A vehicle body closure is moved between a position closing a body opening and an open position stored within the body by an operating mechanism that includes a pair of spaced concentric arcuate racks that are engaged by spaced pinions of different size mounted on the end of a support rod that slidably supports the closure. The closure includes a guide member which is received within a curved guide channel mounted on the body so that movement of the closure by a driving device slides the closure relative to the support rod as the rod moves along the racks, thus moving spaced portions of the closure through a compound curvilinear path at different rates of travel between the closed and stored positions.

This invention relates generally to a closure operator and more specifically to an operator for moving a closure in a linear path between open and closed positions relative to a support.

Vehicle bodies having moveable rear quarter windows utilize a variety of mechanisms for moving the windows between closed and open positions. A conventional cross-arm window regulator is generally not used because of the limited storage space for the rear quarter windows between the body belt line and the rear wheel housings.

This invention provides an operating mechanism for moving a rear quarter window or other closure through a compound curvilinear path between open and closed positions and which comprises means for moving spaced portions of the window through a compound curvilinear path at different rates of travel between these positions.

One feature of this invention is that it provides a separate gearing means for moving spaced portions of the closure between open and closed positions. Another feature is that the gearing means comprise a pair of spaced pinions which are engageable with spaced racks mounted on the support. Yet another feature is that the racks are arcuate and move the spaced closure portions at different rates of travel. Still another feature is that guide means are provided for moving the closure relative to the arcuate racks to effect a compound curvilinear movement of the closure between open and closed positions.

A further feature is that coordinating means interconnecting the gearing means are provided for maintaining a constant ratio between the different rates of travel. A yet further feature is that the coordinating means comprise a rod interconnecting the pinions and rotatably and slidably connected to the closure.

Yet further features of this invention will become readily apparent upon reference to the following detailed description of the attached drawings in which:

FIGURE 1 is a sectional view of a vehicle body having a closure operator according to this invention.

FIGURE 2 is a sectional view taken generally on the plane indicated by line 2—2 of FIGURE 1.

Referring now to FIGURE 1 of the drawings, a vehicle body, generally indicated at 10, includes a backlight 12 and a side door 14 having a conventional vertically sliding side window 16. Rearwardly of window 16 body 10 includes a rear quarter panel opening 18 that is adapted to be closed by a wedge-shaped rear quarter window 20.

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An operating mechanism, to be later described, is operable to move the window in a compound curvilinear path between open and closed positions. The window moves from the fully raised solid line position 20 through an intermediate partially open position, indicated by dashed lines 20a, to a fully lowered position, indicated by dashed lines 20b, in which the window is stored between the vehicle belt line 22 and the rear wheel well 24. Movement of the upper front corner 26 of the window is traced by arrows A.

Window 20 is mounted by bolts 28 on a supporting sash member 30. As shown in FIGURE 2, sash 30 includes a pair of integral flanges 32 and 34 which rotatably and slidably mount a rod 36 through a pair of anti-friction bushings 38 and 40. Rod 36 rigidly mounts a rear pinion 42 and a larger forward pinion 44. Rod 36 has its ends journaled in anti-friction slide members 46 and adjacent pinions 42 and 44, respectively.

An elongated member 50 is attached to the vehicle body structure and includes an arcuate stamped rack portion 52 that is drivingly engaged by pinion 42. Member 50 further includes an arcuate guide channel 54 for slide member 46. Forwardly of member 50, a second member 56 is attached to the body structure and includes an arcuate stamped rack portion 58 that is drivingly engaged by pinion 44. Member 56 further includes a guide channel 60 for slide member 48.

The racks and pinions provide means for moving the front and rear portions of the window 20 between raised and lowered positions at constant controlled rates of travel. The shapes and relative lengths of the racks and the relative sizes of the pinions are dependent upon the shape of the window and upon the desired positioning and movement thereof. As shown in FIGURE 1, racks 52 and 58 are concentric with respect to a point X to enable movement of rod 36 in a desired arcuate path. Rack 58 is approximately three times as long as rack 52 to permit the indicated positioning and movement of wedge-shaped window 20. To coordinate movement of the front and rear portions of the window, pinion 44 has approximately three times as many teeth as pinion 42. Thus there is a constant ratio of about 3:1 between the rates of travel of the front and rear edge portions of the window. During window movement slides 46 and 48 coact with guide channels 54 and 60 to maintain engagement between the pinions and their associated racks and to limit the fore and aft displacement of rod 36.

As window 20 moves between raised and lowered positions it is necessary to effect some rearward movement thereof so that the upper front corner 26 clears window 16. Member 56 includes respective upper and lower flanges 62 and 64 which receive the ends of a curved guide channel 66. Channel 66 receives a roller 68 that is journaled about the enlarged head of a bolt 70 which is connected to sash 30 through a spacer block 72. As rod 36 lowers window 20, roller 68 and channel 66 force the sash 30 to slide longitudinally of rod 36 on bushings 38 and 40. Thus the window follows a compound curvilinear path during movement between raised and lowered positions, as indicated by the arrows A.

As shown in FIGURE 1, sash 30 includes an elongated slot 74 which receives a drive roller 76 connected to one end of a power lift arm 78 that is pivoted to the body at 80. An operating rod 82 is connected at 84 to lift arm 78 and is reciprocable within a body mounted bracket 86. A conventional window regulator handle 88 includes a pinion 90 that drivingly engages the threaded end portion 92 of rod 82. Thus rotation of handle 88 reciprocates rod 82 which pivots lift arm 78 to raise and lower window 20, as previously described. The lift arm 78 may also be directly connected to rod 36 and

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any conventional manual or power mechanism may be used to power the lift arm 78.

The use of the pinions and racks to control the window movement permits the use of a single lift arm or equivalent mechanism, rather than the more complex cross arm mechanism. However the closure operator of this invention does not impart any rocking or jerking movement to the window, as have previous single lift arm mechanisms. Regardless of the placement of drive roller 76 on sash 30, rod 36 distributes the lifting force proportionately and the racks and pinions assure a smooth, coordinated movement of the window.

Lateral stability for the bottom edge of window 20 relative to opening 18 is provided by slides 46 and 48. During the initial lowering of the window, the rear portion 94 thereof is moved into a conventional Bailey channel (not shown) to provide a spaced lateral support. As the window is further lowered, the belt line window channel (not shown) grips the window sufficiently to assist the slides in preventing lateral movement.

Thus this invention provides gearing means for raising and lowering spaced portions of a vehicle window in an arcuate path at constant different rates of travel and guide means for moving the window relative to the arcuate path to effect a compound curvilinear movement of the window between open and closed positions.

While only a preferred embodiment of this invention is shown and described, further modifications are contemplated within the scope of the invention.

I claim:

1. In a closure operator having drive means for moving a closure in a compound curvilinear path between open and closed positions relative to an opening in a vehicle body, means for regulating movement of the closure comprising: a support member, spaced means mounting the closure on the support member for sliding movement relative thereto, a first arcuate rack mounted on the body, a first pinion mounted on one end of the support member and engaging the first rack to enable movement of the one end of the support member at a first rate of travel along the rack, first means for maintaining engagement of the first pinion with the first rack, a second arcuate rack mounted on the body in spaced concentric relation to the first rack, a second pinion mounted on the other end of the support member and engaging the second rack to enable movement of the other end of the support member along the rack at a second rate of travel proportionate to the first, means for maintaining engagement of the second pinion with the second rack, and cooperating curved guide means on the closure and on the body for sliding the closure relative to the

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support member upon movement of the closure by the drive means, whereby spaced portions of the closure are moved at different rates of travel through the compound curvilinear path upon movement of the closure by the drive means between open and closed positions and the closure follows a path between the open and closed positions defined by the particular shape of the cooperating curved guide means.

2. In a closure operator having drive means for moving a closure in a compound curvilinear path between open and closed positions relative to an opening in a vehicle body, means for regulating the movement of the closure comprising: a sash member, spaced flanges on said sash member, a rod, means to slidably mount said rod on said sash member flanges, a first arcuate rack mounted on the body, a first pinion mounted on one end of the rod and engaging the first rack to enable movement of one end of the rod and sash member at a first rate of travel along the rack, means for maintaining engagement of the first pinion with the first rack, a second arcuate rack mounted on the body in a spaced concentric relationship with the first rack, a second pinion mounted on the other end of said rod and engaging the second rack to enable movement of the other rod end and sash member along the rack at a second rate of travel proportioned to the first, means for maintaining engagement of the second pinion with the second rack, a cooperating curved guide means mounted on the closure and the vehicle body, and means attached to the sash member and slidably received in the cooperating curved guide means upon movement of the closure by the driven means between the open and closed position.

3. In a closure operator having drive means for moving a closure in a compound curvilinear path between open and closed positions relative to a vehicle body as described in claim 2, wherein said means for maintaining engagement of the first and second pinions with the first and second racks comprise: antifriction slide members attached to the rod ends and channels attached to the racks which retain the slide members so that the pinions are maintained in engagement with the racks.

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