Dec. 18, 1962 A. ARLAUSKAS ETAL 3,069,152

WINDOW REGULATOR MECHANISM

Filed April 18, 1960 2 Sheets-Sheet 1

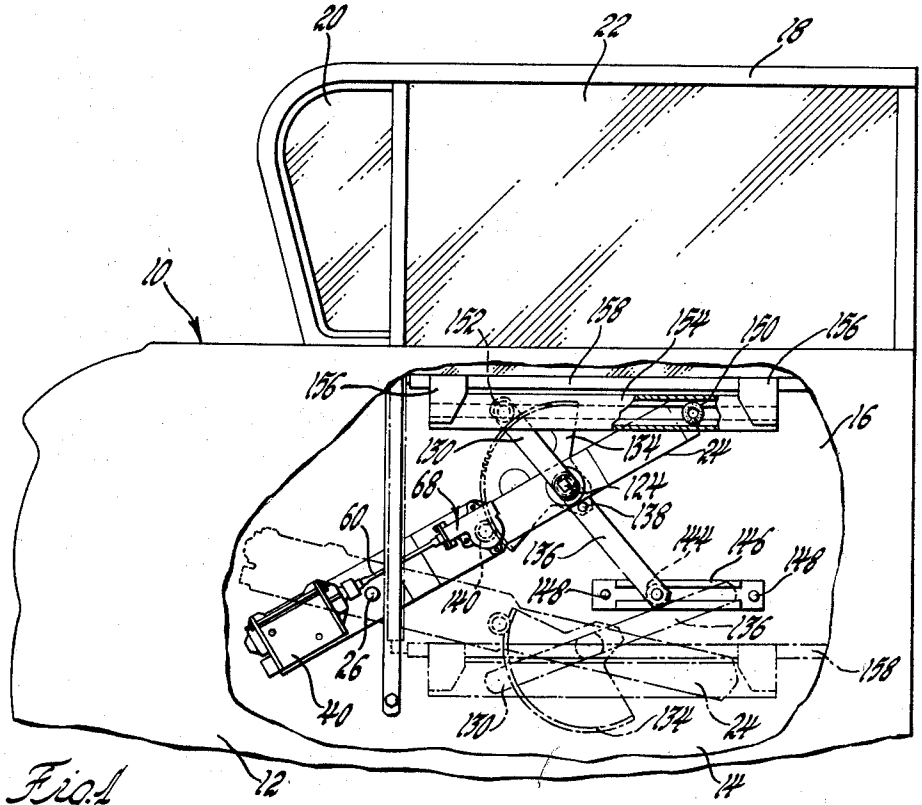

Fig. 1

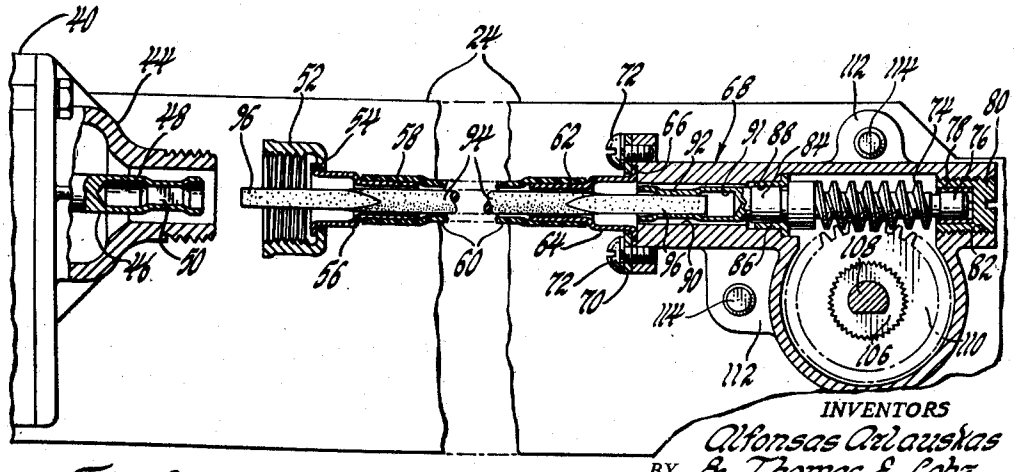

Fig. 2

INVENTORS
Alfonsas Arlauskas
BY & Thomas E. Lahr
Herbert Furman
ATTORNEY

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2 Sheets-Sheet 2

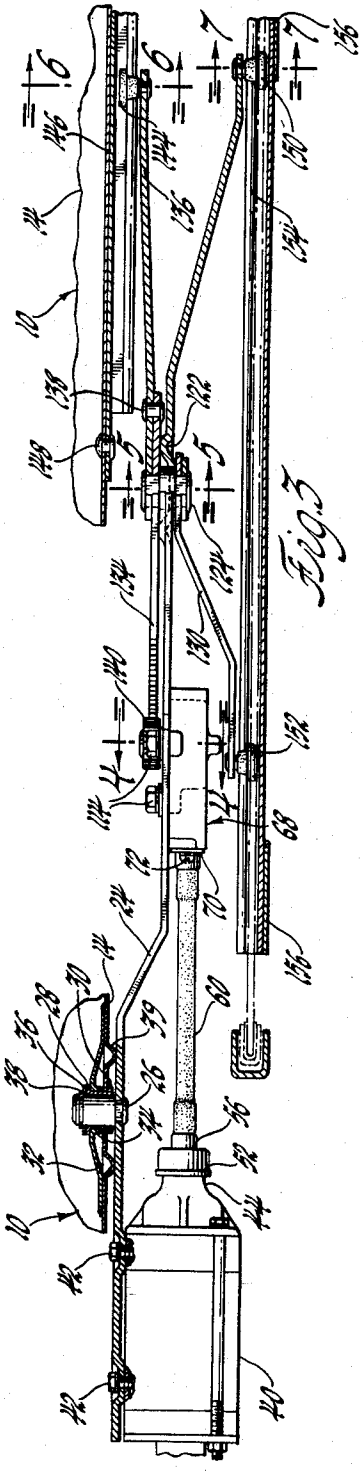

Fig. 3

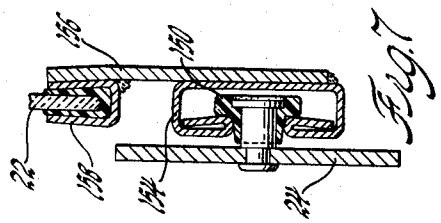

Fig. 7

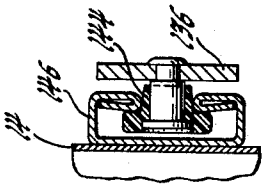

Fig. 6

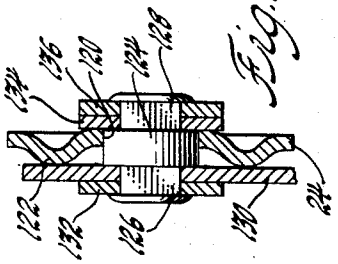

Fig. 5

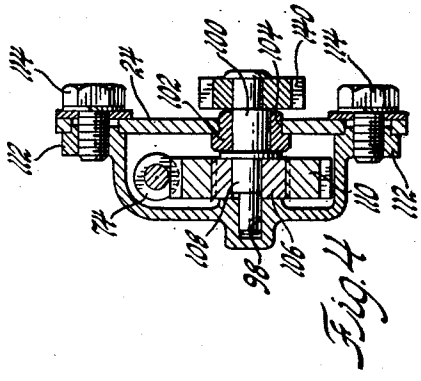

Fig. 4

INVENTORS
Alfonsas Arlauskas
BY & Thomas E. Lohr
Herbert Furman
ATTORNEY

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WINDOW REGULATOR MECHANISM

Alfonsas Arlauskas, Livonia, and Thomas E. Lohr, Redford, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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5 Claims. (Cl. 268—124)

This invention relates to window regulator mechanisms and more particularly to a new and improved power operated vehicle window regulator mechanism.

At the present time most power operated vehicle window regulator mechanisms of the cross arm type include a back plate mounted on a panel of the door or body and pivotally supporting one end of the lift or driving arm. The back plate also supports the drive means which includes an electric motor and reduction gear unit, the output pinion of which meshes with a sector gear fixed to the pivoted end of the lift arm. A counterbalance spring having one end anchored on the back plate and the other end anchored to the pivot of the lift arm counterbalances the window as it moves between open and closed positions.

Although such window regulator mechanisms have been successfully used for many years, they have the disadvantage of requiring different back plates when used on various types of doors and body styles. Further, the back plate must be adjustable on the door or body panel and the electric motor and reduction gear unit must be adjustable on the back plate so that the proper relationship between the regulator mechanism and window can be established.

The window regulator mechanism of this invention is universal in the sense that it can be used on all types of doors and on all body styles without restriction. The mechnism does not include any back plate whatsoever since the entire mechanism is supported directly on the door or body panel by a single pivot at whatever location desired. Although the mechanism of this invention is of the cross arm type, including a balance arm and a lift or driving arm, the balance arm is pivotally supported adjacent one end thereof on the door or body panel rather than the lift arm being pivotally supported as in prior art mechanisms of this type. The electric motor is secured to the pivoted end of the balance arm below the pivot of the arm on the support panel so as to counterbalance the window and obviate any need for a counterbalance spring. A flexible drive arrangement interconnects the motor and the reduction gear unit which is also mounted on the balance arm to the other side of the pivot thereof. The output pinion of the gear unit meshes with a sector fixed to the lift or driving arm. The flexible drive arrangement acts to take up the shock loads caused by the window reaching its limit positions so that no flexible drive coupling is required within the reduction gear unit.

In asmuch as there is only one pivotal connection between the entire window regulator mechanism and the door or body panel, this pivotal connection can be varied at will for various body styles and for various doors. Further, since the back plate and the counterbalance spring are eliminated, considerable economies are effected both in material cost and in installation cost.

The primary object of this invention is to provide a new and improved power operated vehicle window regulator mechanism which can be universally used on all types of doors and body styles.

This and other objects of the invention will be readily apparent from the following specification and drawings wherein:

FIGURE 1 is a partially broken away partial side elevational view of a vehicle door embodying a window regulator mechanism according to this invention;

FIGURE 2 is an enlarged partially broken away view of a portion of FIGURE 1;

FIGURE 3 is a partially broken away top plane view of a window regulator mechanism according to this invention;

FIGURE 4 is an enlarged sectional view taken generally along the plane indicated by line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged sectional view taken generally along the plane indicated by line 5—5 of FIGURE 3;

FIGURE 6 is an enlarged sectional view taken generally along the plane indicated by line 6—6 of FIGURE 3; and

FIGURE 7 is an enlarged sectional view generally along the plane indicated by line 7—7 of FIGURE 3.

Referring now particularly to FIGURE 1 of the drawings, a vehicle door **10** includes a door outer panel **12** and a door inner panel **14** spaced therefrom so as to define a window receiving well **16**. Door **10** further includes a door window frame portion **18** which mounts a swingable ventilation window **20** to open and close the forward portion of the window opening defined thereby. The rearward portion of the window opening is opened and closed by a vertically movable window **22** which is moved between a closed position, as shown, and an open position within well **16**, not shown, by a power operated window regulator mechanism according to this invention.

The window regulator mechanism generally includes a balance arm **24** which is fixed adjacent one end thereof to a bearing stud **26**. The bearing stud **26** is rotatably received within a flanged bushing **28**, FIGURE 3, supported on the inner panel **14**. The inner panel is provided with an outwardly flanged opening **30** receiving bushing **28** adjacent one end thereof, with a reinforcing plate **32** being secured to the inner panel and being provided with an outwardly flanged opening **34** receiving the bushing **28** adjacent the other end thereof. A washer **36** rotatively mounted on stud **26** and bearing against the flanged end of bushing **28** and a split ring **38** received within an angular groove of the stud locate the stud against outward movement relative to bushing **28** and frictionally hold arm **24** in engagement with a circular rib **39** of panel **14**.

An electric motor **40** is bolted at **42** to arm **24** to one side of the pivotal connection **26** of the arm to the inner panel so as to counterbalance window **22** as will be described. Motor **40** has a differential winding so as to provide more torque output when window **22** is moved from an open to a closed position to partially compensate for the elimination of the usual counterbalance spring. As best shown in FIGURE 2, the motor includes an externally threaded end cap **44** which houses one end of the armature shaft **46**. Shaft **46** is provided with an internal annular bore **48**, a portion **50** of which is shaped so as to be of square cross section. An internally threaded cap **52** is threaded on the cap **44** so as to clamp a flange **54** of a tubular member **56** against the end of the cap **44**. Member **56** includes a portion **58** of reduced diameter which is received within one end of a tube **60** of vinyl or other similar resilient plastic material. The other end of the tube **60** receives a portion **62** of reduced diameter of a tubular member **64** which is the same as member **56**. The flange **66** of member **64** is secured to one side of a housing **68** by an annular ring **70** bolted at **72** to the housing.

A worm **74** has one end **76** thereof of reduced diameter rotatably mounted in a bushing **78**. Bushing **78** is received within a bore of an externally threaded plug

80 which is threaded within an internally threaded bore 82 of housing 68. The other end of worm 74 includes a shouldered portion 84 rotatably mounted within a flanged bushing 86 received within a shouldered portion 88 of a bore 90 which opens to the tubular member 64. The other end of worm 74 further includes an annular bore 91 opening which includes an intermediate portion 92 of generally square shaped cross section. A nylon rod 94 includes square shaped end portions 96 which are respectively received within the square shaped portion 50 of bore 48 and the square shaped portion 92 of bore 91 to couple the motor 40 to worm 74.

Referring now particularly to FIGURE 4 of the drawings, the housing 68 further includes a bore 98 which rotatably mounts one shouldered end of a shaft 100. The other shouldered end of the shaft is rotatably mounted in a flanged bushing 102 received within an opening 104 in arm 24. An externally splined member 106 includes a D-shaped bore which is slidably and non-rotatably received on a D-shaped portion 108 of shaft 100 to locate member 106 between a shoulder of shaft 100 and housing 68, as shown. A worm wheel 110 is provided with an internal splined bore receiving member 106, with the worm wheel meshing with the worm 74. The housing 68 includes apertured ears 112 which are bolted at 114 to arm 24 to mount the housing and reduction gear unit thereon.

Referring now particularly to FIGURES 3 and 5 of the drawings, the arm 24 includes an aperture 120 surrounded by a circular rib 122. A stud 124 is rotatably mounted within the aperture 120 and provided with opposite square shaped end portions 126 and 128. An arm 130 is provided with square shaped aperture adjacent one end thereof which receives the portion 126 of stud 124. Arm 130 is secured in place against rib 122 and stud 124 by heading the end of portion 126 over a washer 132. A sector 134 includes a square shaped aperture which receives the other portion 128 of stud 124. Also received on portion 128 is one end of an arm 136 provided with a square shaped aperture. The end of portion 128 is headed over so as to secure the sector 134 and arm 136 in place against stud 124. Further, as shown in FIGURE 5, the sector is riveted at 138 to the arm 136. From the foregoing description, it can be seen that the arm 130, sector 134, and arm 136 will rotate as a unit with stud 124 relative to the arm 24 with arms 130 and 136 providing the lift or balance arm of the mechanism. The sector 134 meshes with an output pinion 140 secured to shaft 100 by providing a D shaped bore in the pinion which receives a D shaped portion of the shaft, with the end of the shaft being headed over the pinion.

The free end of arm 136 mounts a nylon roller 144, FIGURE 6, which is pivotally and slidably received within an outwardly opening cam channel 146 secured at 148 to the inner panel 14. The free ends of the arms 24 and 130 each mount similar rollers 150 and 152, respectively, which are pivotally and slidably received within an inwardly opening cam channel 154. Channel 154 is secured to a pair of brackets 156 which depend from the lower frame member 158 of window 22.

When it is desired to move the window 22 from its closed position, as shown in FIGURE 1, to an open position within well 16, motor 40 is operated so as to rotate rod 94 in the appropriate direction. This will rotate the worm 74 and the worm wheel 110 to in turn rotate pinion 140 clockwise as viewed in FIGURE 1. The meshing engagement of the sector 134 with pinion 140 will cause the sector and arms 130 and 136 to swing counterclockwise as a unit about the axis of the stud 124. As the arms 130 and 136 swing in this direction, roller 144 will move to the right, as viewed in FIGURE 1, within channel 146 while roller 152 will move to the left, as viewed in FIGURE 1, within channel 154 to thereby move the window 22 toward its open position. As the arms 130 and 136 rotate relative to the arm 24 and also shift as the rollers 144 and 152 move within their respective channels 146 and 154, the arm 24 will swing about its pivot 26 on the inner panel 14 as the roller 150 moves to the right within channel 154 to thereby balance the window 22 so it will move in a vertical path toward its open position. The weight of the motor 40 to the lower side of the pivot 26 will counterbalance the weight of the window so that the motor will drive the window rather than the window driving the motor. As the arms 130 and 136 continue to swing counterclockwise relative to the arm 24, these arms will come into alignment with the arm 24 adjacent the fully open position of the window 22 and will thereafter cross over arm 24 when the window reaches its fully open position. The position of arms 130, 136, and 24 and the sector 134 in the fully open position of the window are indicated by dot-dash lines in FIGURE 1.

Suitable fixed stops are provided to locate the window 22 in its open and closed positions. When the window engages these fixed stops, the shock load will be taken up by the rod 94 so as to prevent damage to the sector 134, pinion 140, worm 74, and worm wheel 110 as the motor 40 stalls.

It is believed that movement of the window 22 from its open position to its closed position is apparent without any further description.

Thus, the window regulator mechanism of this invention has several unique and distinct advantages over presently known cross arm type window regulators. By mounting the arm 24 directly on the support panel by means of a single pivot connection, considerable savings in cost and material are obtained since no back plate is required and the mechanism can be used universally for all doors and all body styles. By locating the motor 40 to the lower side of the pivot 26 of the arm 24 on the panel, the motor performs the function of a counterbalance spring so that no such spring is needed. Additionally, the functions of the lift arm and balance arm are reversed when compared to the usual cross arm type window regulator wherein the arm 24 usually functions as the lift or driving arm, while the arms 130 and 136 function as the balance arm. The force output of the window regulator mechanism is also increased by locating the sector 134 at the pivot 124 rather than at the pivot 26 as in the usual cross arm type of window regulator. Further, the use of the rod 94 to take up shock loads when the window reaches its limit positions results in a greatly simplified reduction gear arrangement since no flexible coupling is required between the worm 110 and the pinion 140.

Thus, this invention provides a new and improved power operated window regulator mechanism which can be universally used on all types of doors and body styles.

We claim:

1. A window regulator mechanism comprising, in combination, a movable window, a support, a pair of regulator arms swingable relative to each other, means operatively connecting one end of each of said arms to said window, means pivotally mounting one of said arms on said support adjacent the other end thereof, operating means supported on said other end of said one arm to one side of the pivot thereof on said support and on the opposite side of the pivot than the connection of said one arm to said window, means operatively connecting said operating means to said other arm to swing said other arm relative to said one arm upon operation of said operating means, and means connecting the other end of said other arm to said support.

2. A window regulator mechanism comprising, in combination, a movable window, a support, a driving and a driven regulator arm pivoted together intermediate the ends thereof, means operatively connecting one end of each of said arms to said window, means pivotally mounting said driven arm on said support adjacent the other end thereof, operating means secured to said other end

of said driven arm on the opposite side of said pivot than the connection of said driven arm to said window to counterbalance the weight of said window, means operatively connecting said operating means to said driving arm to the other side of said pivot to swing said driving arm relative to said driven arm upon operation of said operating means, and means mounted on said support and operatively connected to the other end of said driving arm to shift said driving arm relative to said support upon swinging movement thereof and cause said driven arm to swing about said pivot.

3. A window regulator mechanism comprising, in combination, a movable window, a support, a pair of regulator arms pivoted together intermediate the ends thereof, means operatively connecting one end of each of said arms to said window, means pivotally mounting one of said arms on said support adjacent the other end thereof, power operating means secured to said other end of said one arm to one side of the pivot thereof on said support and on the opposite side of said pivot than the connection of said one arm to said window, means operatively connecting said power operating means to said other arm adjacent the pivot of said arms to swing said other arm relative to said one arm upon operation of said power means, and means connecting the other end of said other arm to said support.

4. A window regulator mechanism comprising, in combination, a movable window, a support, a pair of regulator arms pivoted together intermediate the ends thereof, means operatively connecting one end of each of said arms to said window, means pivotally mounting

one of said arms on said support adjacent the other end thereof, power operating means mounted on said other end of said one arm to one side of the pivot thereof on said support and on the opposite side of the pivot than the connection of said one arm to said window, reduction gear means mounted on said one arm to the other side of the pivot thereof on said support, flexible drive means operatively interconnecting said power operating means and said reduction gear means, means operatively connecting said reduction gear means to said other arm to swing said other arm relative to said one arm upon operation of said power means, and means connecting the other end of said other arm to said support.

5. A window regulator mechainism comprising, in combination, a movable window, a support, an arm pivotally mounted on said support adjacent one end thereof, means pivotally connecting the other end of said arm to said window, operating means mounted solely on said one end of said arm on the opposite side of said pivot on said support than the connection of said one arm to said window for movement with said arm as a unit upon swinging movement thereof, and means mounted on said arm to the other side of said pivot on said support and operatively connected to said window to move said window upon operation of said operating means.

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