Sept. 22, 1959 B. F. MEYER ET AL 2,905,003

WINDOW REGULATOR DRIVE MECHANISM

Filed June 11, 1956 2 Sheets-Sheet 1

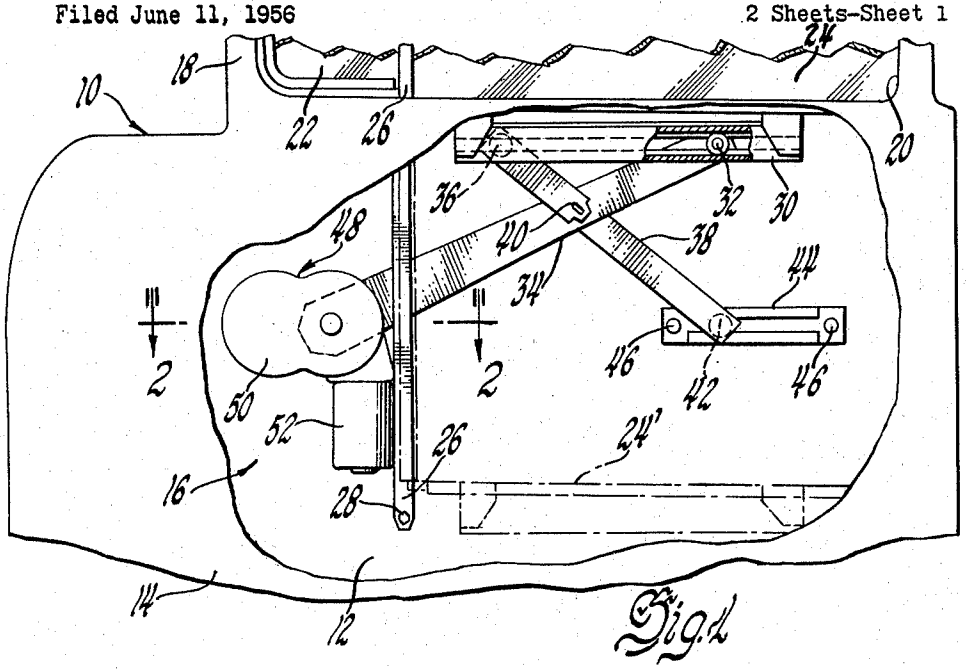


Fig. 1

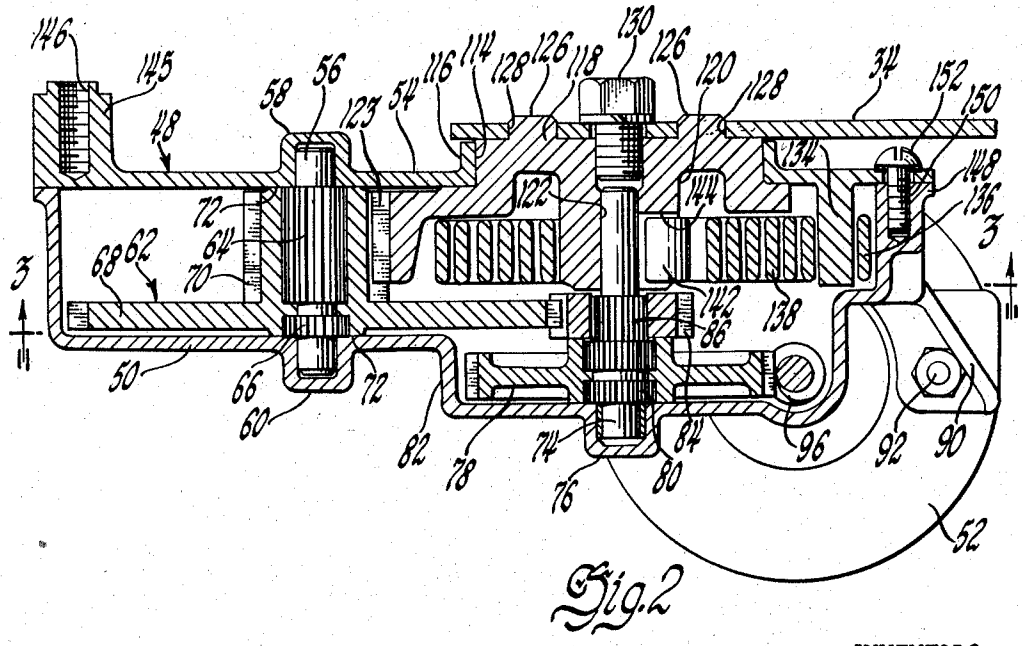


Fig. 2

INVENTORS.
Barthold F. Meyer &
LaVerne B. Ragsdale
BY Paul Fitzpatrick
ATTORNEY.

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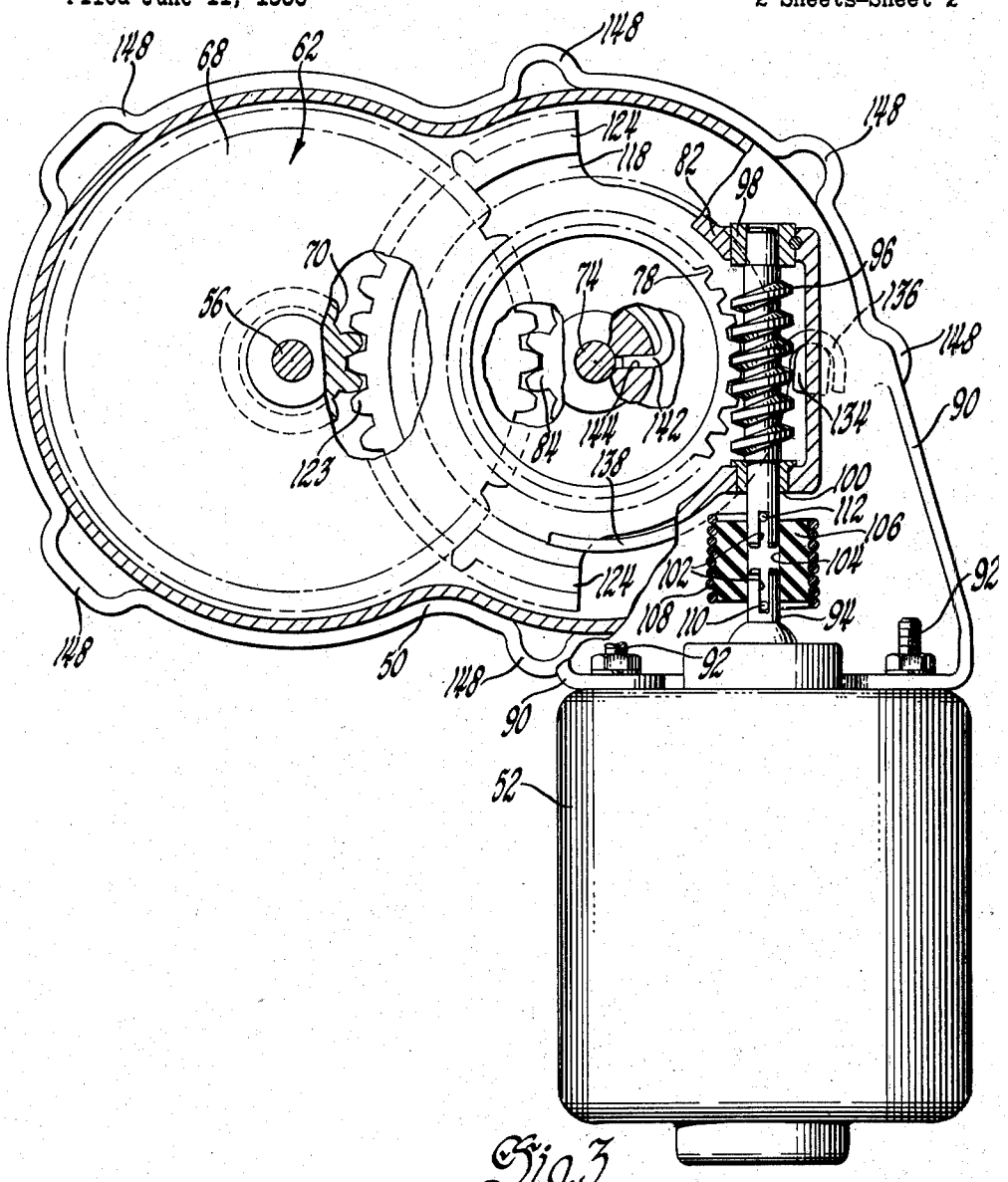


Fig. 3

INVENTORS.
Barthold F. Meyer &
LaVerne B. Ragsdale
BY Paul Fitzpatrick
ATTORNEY.

United States Patent Office 2,905,003 Patented Sept. 22, 1959

2,905,003

WINDOW REGULATOR DRIVE MECHANISM

Barthold F. Meyer, St. Clair Beach, Ontario, Canada, and La Verne B. Ragsdale, Dearborn, Mich., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application June 11, 1956, Serial No. 590,614

5 Claims. (Cl. 74—89)

This invention relates to a window regulator drive mechanism and more particularly to a window regulator drive mechanism for power operated vehicle windows.

The window regulator drive mechanism of this invention includes both power operating means and an improved reduction gear arrangement between the power operating means and the window regulator linkage. The improved reduction gear arrangement is of compact size and is mounted within a substantially sealed housing. This reduces the problem of lubrication of the reduction gear arrangement to a minimum and also protects the arrangement against dust, dirt, and rust to provide long service without repair or replacement. The power operating means is also supported by the housing so that the reduction gear arrangement and the power operating means are combined in a package unit. By providing such a package unit which includes both the reduction gear arrangement and the power operating means, replacement of the unit can be had with a minimum expenditure of time and effort. No back plate or other supporting plate is necessary in order to mount the unit on the supporting body panel since the housing is secured directly to the body panel.

The primary object of this invention is to provide a new and improved window regulator drive mechanism for power operated vehicle windows. Another object of this invention is to provide a new and improved package unit window regulator drive mechanism which includes power operating means and a reduction gear arrangement.

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

Figure 1 is a side elevational view of a vehicle door embodying a window regulator drive mechanism according to this invention, with parts broken away for clarity of illustration;

Figure 2 is a sectional view on the plane indicated by line 2—2 of Figure 1; and

Figure 3 is a sectional view taken on the plane indicated by line 3—3 of Figure 2, with parts broken away for clarity of illustration.

Referring now to Figure 1 of the drawings, a vehicle door 10 includes a door inner panel 12 and a door outer panel 14 joined along their front, rear, and bottom edges to define a window well 16. The door upper portion 18 defines a door window opening 20. A ventilation window 22 mounted on the door for swinging movement about a vertical axis opens and closes the forward portion of window opening 20, and a vertically movable window 24 opens and closes the rear portion of the window opening. A guide channel 26 secured to the door inner panel 12 at 28 provides a seal for the rear edge of the ventilation window in closed position and also guides vertical movement of the forward edge portion of window 24.

An inwardly opening channel member 30 secured to the lower edge portion of window 24 slidably and rotatably receives stud 32 secured to the upper end of lift arm 34 and stud 36 secured to the upper end of balance arm 38. The balance arm is pivoted at 40 intermediate its ends on lift arm 34 and the lower end of the balance arm mounts a stud 42 slidably and rotatably received within an outwardly opening channel 44 secured to the door inner panel 12 at 46.

Lift arm 34 is pivotally supported by the window regulator drive mechanism 48 and is power operated, as will be described. Upon downward or clockwise swinging movement of lift arm 34, window 24 moves between a closed position, as shown, and an open position indicated schematically at 24'. During this movement of the lift arm, balance arm 38 swings about pivot 40 in a direction opposite the direction of swinging movement of the lift arm and crosses over the lift arm prior to movement of window 24 to an open position. The window regulator linkage, which includes lift arm 34 and balance arm 38, is of conventional structure.

The window regulator drive mechanism 48 includes both a substantially sealed housing 50 for the reduction gear arrangement and an electric motor 52 which drives lift arm 34 through the reduction gear arrangement, as will be described. Referring now particularly to Figures 2 and 3, housing 50 is provided with a cover plate 54, with both the housing and cover plate being of figure eight shape as can be seen in Figures 1 and 3. A shaft 56 has one end thereof journalled in an annular boss 58 in cover plate 54 and the other end thereof journalled in a similar annular boss 60 in the base wall of housing 50. A gear 62 splined to shaft 56 at 64 and 66 so that the shaft and gear rotate as a unit includes a gear 68 of large diameter and a pinion 70 of small diameter. Gear 62 engages both the cover plate 54 and housing 50 at 72 at either side of the gear to locate the gear and prevent axial shifting movement thereof. A shaft 74 has one end thereof journalled within an annular boss 76 of housing 50. A worm wheel 78 splined at 80 to shaft 74 rotates within an annular boss 82 of the base wall of housing 50 and a pinion 84 splined to shaft 74 at 86 meshes with gear 68 of gear 62.

Referring now particularly to Figure 3, the electric motor 52 is supported on housing 50 by brackets 90 which are formed as an integral part of the housing and are bolted at 92 to the motor. The shaft 94 of the motor drives a worm 96 which meshes with worm wheel 78 so as to drive the worm wheel and shaft 74 upon operation of the motor. Worm 96 is journalled in bearings 98 and 100 which are fixed within opposite planar side wall portions of the annular boss 82 of housing 50. Both the motor shaft 94 and worm 96 are provided with slotted ends 102 which are received within a bore 104 of an annular rubber member 106. A coil spring 108 encircles member 106, with one end 110 of the spring being received within slot 102 of shaft 94 and the other end 112 of the spring being received within slot 102 of worm 96. The annular rubber member 106 and spring 108 provide a resilient torsional drive connection between the motor and worm 96 to prevent damage to the reduction gear arrangement and window regulator linkage upon overtravel of the motor and also to prevent bending or breaking of the window regulator linkage should the window 24 strike an obstruction in moving between open and closed positions.

Referring now particularly to Figure 2, cover plate 54 is provided with a circular opening 114 having an outwardly extending annular wall 116. The inner surface of wall 116 and the adjacent inner surface of cover plate 54 provide a bearing seat for an output sector gear 118 which is rotatably mounted within wall 116 and meshes with pinion 70 of gear 62. Gear 118 includes an annular sleeve portion 120 provided with a central bore 122 which slidably and rotatably receives the other end of shaft 74. As can be seen particularly in Figure 3, the partial tooth

portion 123 of the sector gear terminates at 124 at either end thereof and extends over an arc of approximately 172 degrees. A pair of lugs 126 on gear 118 are received within openings 128 of the window regulator lift arm 34 and a bolt 130 threaded within bore 132 of the gear secures the lift arm to the gear for rotation as a unit.

A laterally inwardly extending lug 134 on cover plate 54 is engaged by the outer hook-shaped end 136 of a counterbalance coil spring 138. Spring 138 encircles shaft 74 and the annular sleeve portion 120 of gear 118 and fits within the annular space defined by sleeve portion 120 and the tooth portion 123 of the sector gear. The inner terminal end 142 of the spring fits within a slot 144 in sleeve portion 120. The counterbalance spring balances the weight of window 24 and the window regulator linkage and is wound up as the window moves from closed to open position and unwound as the window moves from open to closed position. Since lug 134 extends laterally inwardly from cover 54, gear 118 cannot rotate 360 degrees but can only rotate approximately 90 degrees in either direction from its position shown in Figure 2 and 3. However, the arc of travel of the sector gear is sufficient for many different types of window regulator linkages, whether of the cross arm or X type, as shown, or of other types, since the arc of travel of the lift arm 34 is usually less than 90 degrees.

A number of laterally outwardly extending lugs 145 on cover plate 54 are provided with threaded bores 146. Lugs 145 engage the door inner panel 12 when the drive mechanism is mounted within the window well and bolts (not shown) extending through the inner panel are received within bores 146 to secure the drive mechanism to the door inner panel. Since lift arm 34 swings between the drive mechanism and the door inner panel 12 the drive mechanism must be spaced from the inner panel to provide room for this swinging movement. The side wall of housing 50 is provided with a number of bosses 148 provided with threaded bores 150. Bolts 152 extend through apertures in cover plate 54 and are threadedly received within bores 150 to secure the cover plate to housing 50. When the cover plate is secured in place on housing 50, the housing is substantially sealed. Since the reduction gear arrangement is supported within the housing, it is protected against dust, dirt, and rust and the problem of lubrication is reduced to a minimum.

Upon operation of the electric motor 52 to drive the motor shaft 94 in either direction, worm 96 will drive worm wheel 78 and in turn rotate shaft 74. Since pinion 84 is fixed to shaft 74, the pinion will rotate with the shaft and will drive pinion 68 of gear 62 and shaft 56. As gear 62 and shaft 56 rotate, pinion 70 of the gear will drive the output sector gear 118 to swing the window regulator lift arm 34 about an axis defined by shaft 74. Swinging movement of the lift arm moves the window between open and closed positions as previously mentioned.

It will be noted that sector gear 118 is both slidably and rotatably mounted on shaft 74 so that shaft 74 defines the axis of rotation of the gear and in turn the gear supports and locates one end of the shaft to insure that the shaft will remain substantially parallel with shaft 56. By providing such an arrangement of gear 118 and shaft 74, the overall size of the reduction gear arrangement is materially reduced. The arrangement of lug 134 and the counterbalance coil spring also aids in reducing the size of the reduction gear arrangement. Since gear 118 need not rotate through an arc of 360 degrees, lug 134 may be positioned within the arc of travel and gear 118 may be a sector gear without limiting the usefulness of the window regulator drive mechanism for all types of window regulators. Further, by providing the annular space between the tooth portion 123 and the sleeve portion 120 of the sector gear, the counterbalance spring may be located within the housing and in a space where it can effectively perform its function without interfering with the operation of the drive mechanism.

Thus, it can be seen that the window regulator drive mechanism is of a compact size through the improved reduction gear arrangement and is also a package unit since the mechanism also includes the electric motor 52.

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 drive mechanism comprising, a substantially sealed housing having an opening therein providing a bearing seat, a driven shaft rotatably mounted at each end thereof within said housing, a drive shaft rotatably mounted at one end thereof within said housing, said driven and drive shafts defining spaced axes of rotation, driven gear means secured to said driven shaft for rotation therewith, drive gear means secured to said drive shaft and meshing with said driven gear means, power operated means for driving said drive gear means, output gear means meshing with said driven gear means, said output gear means including a central hub portion rotatably mounted within said opening to close said housing and having a bore therein slidably and rotatably receiving the other end of said drive shaft to locate and provide a bearing seat therefor, a counterbalance spring within said housing operatively connected therebetween and said output gear means, and a window drive arm secured to the hub of said output gear means for rotation therewith whereby said drive shaft defines the axis of rotation of said output gear means and said drive arm.

2. A window regulator drive mechanism comprising, a substantially sealed housing having an opening therein providing a bearing seat, a driven shaft rotatably mounted at each end thereof within said housing, a drive shaft rotatably mounted at one end thereof within said housing, said driven and drive shafts defining spaced axes of rotation, driven gear means fixed to said driven shaft for rotation therewith, drive gear means fixed to said drive shaft and meshing with said driven gear means, power operated means for driving said drive gear means, output gear means meshing with said driven gear means, said output gear means including a central hub portion rotatably mounted within said opening to close said housing and having a bore therein slidably and rotatably receiving the other end of said driven shaft to locate and provide a bearing seat therefor, a counterbalance spring within said housing encircling said hub portion and operatively connected therebetween and said housing, and a window drive arm secured to the hub of said output gear means for rotation therewith whereby said drive shaft defines the axis of rotation of said output gear means and said drive arm.

3. A window regulator drive mechanism comprising, a substantially sealed housing having an opening therein providing a bearing seat, a driven shaft rotatably mounted at each end thereof within said housing, a drive shaft rotatably mounted at one end thereof within said housing and extending to adjacent said opening, said driven and drive shafts defining spaced axes of rotation, a driven gear fixed to said driven shaft for rotation therewith, a drive gear fixed to said drive shaft and meshing with said driven gear, power operated means for driving said drive gear, an output gear having an outer toothed sector flange portion meshing with said driven gear and an inner central hub portion rotatably mounted within said opening to close said housing and having a bore therein slidably and rotatably receiving the other end of said drive shaft to locate and provide a bearing seat therefor, a counterbalance spring within said housing disposed between said outer and inner portions of said output gear and operatively connected between said inner portion and said housing, and a window drive arm secured to the hub of said output gear for rotation therewith whereby said drive

shaft defines the axis of rotation of said output driven gear and said drive arm.

4. A window regulator drive mechanism comprising, a substantially sealed housing having an opening therein providing a bearing seat, a driven shaft rotatably mounted at each end thereof within said housing, a drive shaft rotatably mounted at one end thereof within said housing and extending to adjacent said opening, said drive and driven shafts defining spaced axes of rotation, a driven gear fixed to said driven shaft for rotation therewith, a drive gear fixed to said drive shaft and meshing with said driven gear, power operated means for driving said drive gear, an output gear having an outer toothed sector flange portion meshing with said driven gear and a spaced inner central hub portion rotatably mounted within said opening to close said housing and having a bore therein slidably and rotatably receiving the other end of said drive shaft to locate and provide a bearing seat therefor, a counterbalance spring within said housing disposed in the annular space between said inner and outer portions of said sector gear and having one end thereof operatively connected to said output gear, anchoring means on said housing secured to the other end of said spring and disposed in the path of travel of said sector flange portion, stop means limiting the rotational arc of travel of said sector flange portion, and a window drive arm secured to the hub of said output gear for rotation therewith whereby said drive shaft defines the axis of rotation of said output gear and said drive arm.

5. In a vehicle body including a window and a window well adapted to receive said window, a window regulator drive mechanism comprising, a substantially sealed housing having an opening therein providing a bearing seat, a driven shaft rotatably mounted at each end thereof within said housing, a drive shaft rotatably mounted at one end thereof within said housing and extending to adjacent said opening, said driven and drive shafts defining spaced axes of rotation, driven gear means secured to said driven shaft for rotation therewith, drive gear means secured to said drive shaft and meshing with said driven gear means; power operated means for driving said drive gear means, output gear means meshing with said driven gear means, said output gear means including a central hub portion rotatably mounted within said opening to close said housing and having a bore therein slidably and rotatably receiving the other end of said drive shaft to locate and provide a bearing seat therefor, a counterbalance spring within said housing operatively connected therebetween and said output gear means, a window drive arm secured to the hub of said output gear means for rotation therewith whereby said drive shaft defines the axis of rotation of said output gear means and said drive arm, and a plurality of mounting means on said housing adapted to be secured to a wall of said well to locate said housing in spaced relationship thereto whereby said drive arm may swing between said housing and said wall.

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