

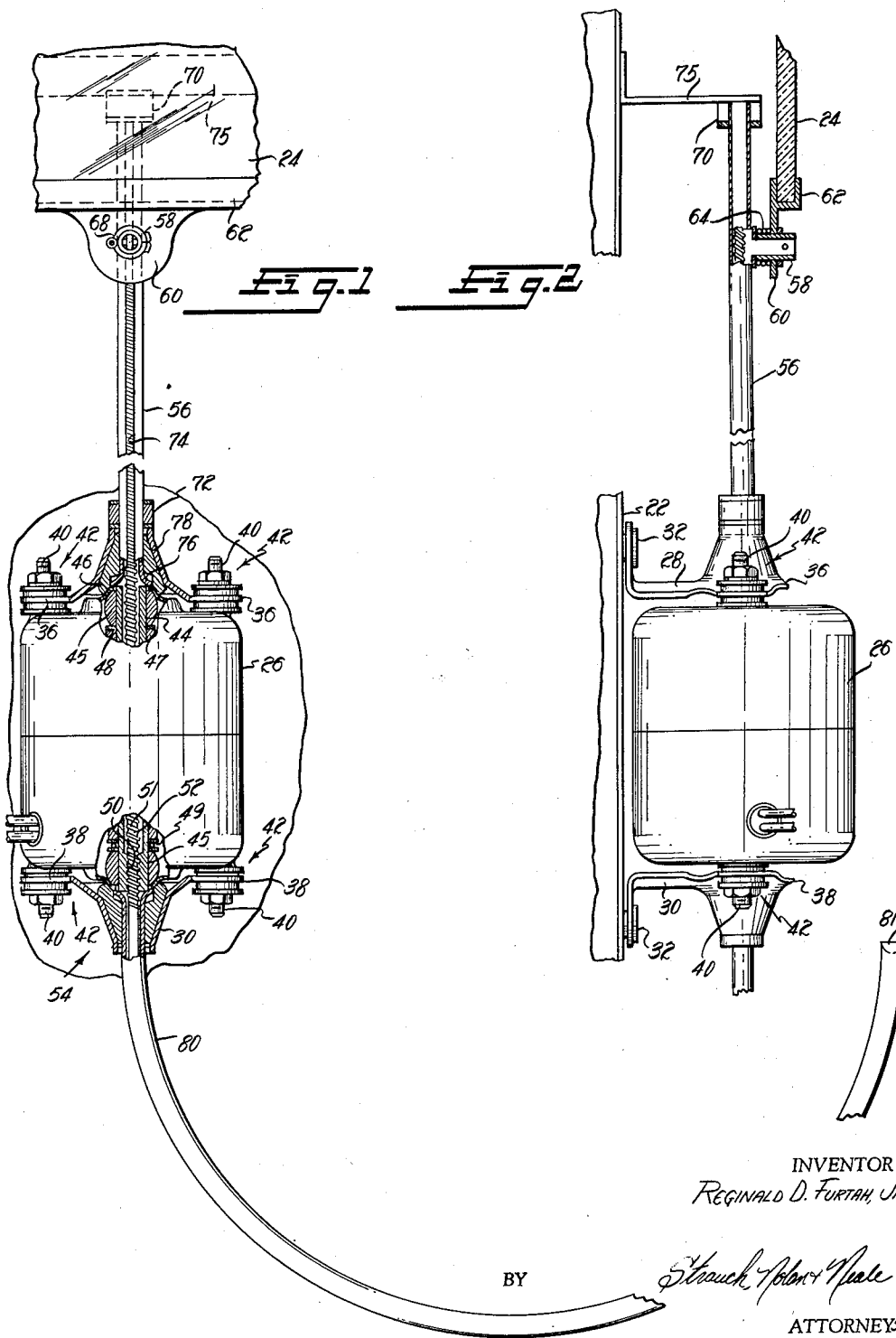
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POWER OPERATED WINDOW REGULATORS

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POWER OPERATED WINDOW REGULATORS

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This invention relates to window regulators and more particularly to electrically operated window regulators which are especially adapted for automotive use.

Conventional electrically operated window regulators now in widespread use include a reversible electric motor connected through a gear reduction unit to a sector which operates a scissors mechanism connected to the window. While window regulators of this general construction have proved to be quite satisfactory in operation, nevertheless the components of units of this type are relatively expensive and, because of the bulk of the components and their necessary relationship, it has become increasingly difficult to accommodate them in the doors or other fixed body structures of automobiles. In accordance with the present invention an electrically operated window regulator assembly is provided which has all the advantages of the prior constructions and yet is considerably less costly and less complex than prior systems.

The window regulators of the present invention comprise generally a reversible drive motor having a hollow shaft which is drivingly connected by threads to a cable which is provided with a mating externally threaded configuration and which may be directly connected to the window to be operated.

It is, accordingly, the principal purpose and object of the present invention to provide novel power operated window regulators which may be manufactured and sold at a cost well below the cost of prior units having comparable performance.

It is a further object of the present invention to provide improved power operated window regulators having a minimum number of moving parts subject to wear and which thus have an extended maintenance-free service life.

It is an additional object of the present invention to provide improved power operated vehicle window regulators which can be installed and adjusted in vehicles with a speed and ease not heretofore possible.

It is also an object of the present invention to provide improved power operated window regulators which fit virtually all existing and contemplated automotive bodies and doors and which thus obviate the necessity for maintaining a high inventory of operator assemblies adapted only for particular body construction or a particular portion such as the left or right hand side of a particular vehicle.

Additional objects and advantages will become apparent as the description proceeds in connection with the accompanying drawings in which:

Figure 1 is a front view with parts in section of a typical embodiment of a window regulator constructed in accordance with the present invention; and

Figure 2 is a side view of the regulator assembly of Figure 1.

The upper and lower portions of the vehicle structure which support the window regulator of the present invention are indicated generally at 20 and 22. Ordinarily the panels 20 and 22 form a part of the interior structure of the vehicle door. However, the panels may also form a

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part of the fixed body structure, for example, the rear quarter panel section of the vehicle on which the window regulators are mounted for operating the rear quarter windows in certain types of automobiles. The words "body" or "body panel" as used herein include door structure as well as fixed body structure.

For the present purposes the invention will be disclosed as applied to the operation of a window 24 mounted for vertical movement in the usual guide ways (not shown) in an automobile door. The drive motor 26 which is preferably a fractional horse power reversible D.C. motor is preferably mounted by upper and lower mounting brackets 28 and 30 to the lower body panel section 22. Brackets 28 and 30 may be secured to the body panel 22 for example by clinch nuts 32.

The brackets 28 and 30 include laterally projecting ears 36 and 38 to which the motor mounting studs 40 are secured by conventional resilient shock mount assemblies 42. The shock mounts protect the motor and also insulate the motor and drive assembly from the body panel 22 to minimize the noise and vibration of the unit when it is in operation. The motor shaft 44 which is of hollow tubular construction is journaled at its opposite ends in self-aligning bearings 45 received in sockets 46 formed in the motor housing. The upper end of a collar 47 rigid with the motor shaft bears against a plain steel thrust washer 48. The lower end of the collar bears against a ball thrust bearing assembly 49.

At least the lower end of the inner motor shaft is provided with threads 50 which drivingly engage a strand 51 helically wound on the body 52 of the flexible cable assembly indicated in its entirety at 54. It will be understood that a nut or other suitable threaded device may be mounted in the motor shaft or on the end of the motor shaft in lieu of threading the shaft itself. While a variety of types of cables 54 may be used, cables of the type shown in U.S. Patents 2,211,790 and 2,401,100 have proved to be satisfactory.

The cable 54 extends upwardly from the motor 26 through a rigid metal track and guide member 56 and at its upper end carries a driving stud 58 which projects through the fitting 60 mounted on the lower window frame member 62. Preferably the fitting 60 is biased outwardly by a spring 64 against a washer 66 held in place on the stud 58 by a cotter pin 68. The stud assembly 58 travels vertically in a slot 74 provided in the track 56 between limit positions defined by stop members 70 and 72. The upper stop 70 is secured by a bracket 75 to the upper body panel section 20 and thus forms a rigid support for the upper end of the track 56. The lower stop assembly 72 is mounted on the bracket assembly 28 and encircles the lower end of the guide 56 which extends downwardly through the stop assembly through an opening in the bracket 28 and terminates in a flared section 76 which is clamped against the outer surface of the socket 46 on the motor housing by a resilient packing member 78 received within the bracket assembly 28.

A bottom guide assembly 80 in the form of a closed tube having a sealed free end 81 is mounted by a similar construction in the lower bracket assembly 30. The cable is of sufficient length that when the window 24 is fully raised the lower end of the cable projects slightly below the lower end of the motor shaft 44. The lower guide 80 is of sufficient length so as to receive the bottom end of the cable when the window 24 is fully lowered. Thus the lower guide 80 protects the cable from possible damage and helps to keep it clean. It also guides the cable around and away from any obstructions in the vehicle structure which might entangle the cable. Finally, the tube provides a convenient sealed chamber for lubricant to insure

automatic lubrication of the cable each time the window is actuated.

Generally it is desired that the time for closing the window be the same as the time for opening the window, both of these times being in the neighborhood of 1½ to 3 seconds. Accordingly, it is necessary to compensate for the weight of the window which would otherwise substantially relatively increase the time for raising the window as compared to the time for lowering it. In the present invention this is accomplished simply and inexpensively by employing the plain steel thrust washer 48 at the upper end of the motor shaft 44 and a ball thrust bearing assembly 49 at the lower end of the motor shaft. Thus when the actuator is lifting the weight of the window, the thrust load is absorbed by the ball thrust assembly 49 with negligible friction loss and when the actuator is lowering the window the thrust is taken by the plain washer 48 with a friction loss which is sufficiently higher so the resulting loss of efficiency of the motor when operating to lower the window will substantially exactly compensate for the effect of the weight of the window. Alternately, a suitable counter-balance or spring arrangement may be employed to equalize the times for raising and lowering the window.

While the upper track 56 which guides the cable in its passage from the drive motor to the window has been shown as straight, it will be appreciated that this track may also be curved to facilitate the operation of a rear quarter window or other type of window which does not follow a straight path between open and closed positions.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. For example the operating cable may be connected to a conventional scissors mechanism rather than directly to the window, if desired. Also the cable and the motor shaft may be non-rotatably connected and the cable passed through a travelling nut rigid with the window. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A power operated window regulator for raising and lowering vehicle windows comprising a reversible drive motor mounted on said vehicle and having a hollow drive shaft, a flexible cable operatively connected at one end to said window and passing through said motor drive shaft, tubular guide means for guiding the length of the cable between the window and the motor, means rigidly supporting the upper and lower ends of said tubular cable guide including stop means for limiting the axial travel of

said cable within said tubular guide, means for preventing rotation of said cable within said tubular guide, and means providing a threaded connection between said cable and said drive shaft whereby upon rotation of said drive shaft said cable will be moved axially through said motor to raise or lower said window.

2. A power operated regulator for raising and lowering vehicle windows comprising a reversible drive motor mounted on said vehicle and having a hollow drive shaft, a flexible cable operatively connected at one end to said window and passing through said motor drive shaft, means for guiding the length of said cable between the window and the motor, means preventing rotation of said cable within said guide means, means providing a threaded connection between said cable and said drive shaft, whereby rotation of said motor in one direction or the other will cause said window to be raised or lowered, a thrust washer at the upper end of said motor drive shaft, and a ball thrust bearing assembly at the lower end of said drive shaft whereby the driving torque exerted on said cable when raising said window is greater than the torque exerted by said motor on said cable when the cable is moved in the opposite direction.

3. A power operated regulator for raising and lowering vehicle windows comprising a reversible drive motor mounted on said vehicle having a hollow drive shaft, a flexible cable operatively connected at one end to said window and passing through said motor drive shaft, a tubular guard means enclosing the length of the cable between the window and the motor, means rigidly supporting the upper and lower ends of said tubular guard, stop means for limiting the axial travel of said cable within said tubular guard, means preventing rotation of said cable within said tubular guard, means providing a threaded connection between said cable and said drive shaft whereby said rotation of said motor in one direction or the other will cause said window to be raised or lowered, a thrust washer at the upper end of said motor drive shaft, a ball thrust bearing assembly at the lower end of said drive shaft whereby the driving torque exerted on said cable when raising said window is greater than the torque exerted by said motor on said cable when the cable is moved in the opposite direction, and a sealed lower cable guard assembly for protectively housing the portion of the cable projecting below said motor, said lower cable guard assembly being of tubular construction closely surrounding said cable and containing a lubricant for said cable.

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