United States Patent

Littmann

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[54] MOTOR DRIVE ASSEMBLY FOR WINDOW REGULATORS

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[51] **Int. Cl.**.....**F16h 57/00,** F16h 1/18

[58] **Field of Search**.....74/411, 427, 425

[56] **References Cited**

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[57] **ABSTRACT**

A window regulator for vehicles having a reversible motor provided with a sectional drive shaft, one section having a worm meshing with a worm gear which forms a part of a spring clutch. The clutch has a regulator pinion for connection to the usual gear sector of a window regulator. One section of the drive shaft is connected to the armature of the electric motor and the sections are connected by a torsion bar, rectangular in cross section and which extends freely through the shaft sections but extends into sockets at the outer ends of these sections, the sockets being rectangular in cross section.

6 Claims, 5 Drawing Figures

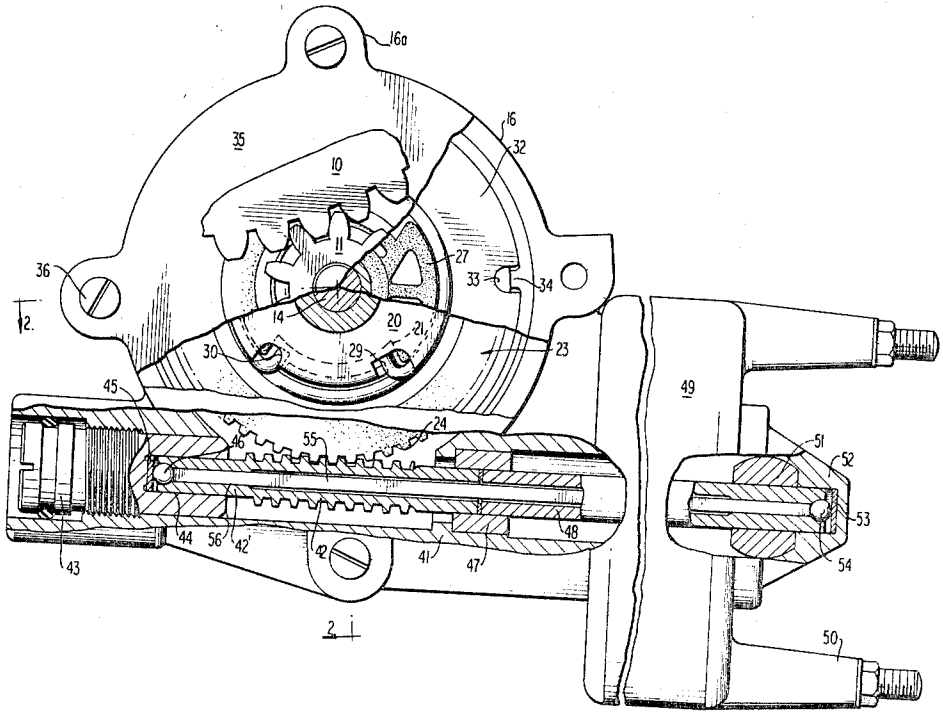

Fig. 1

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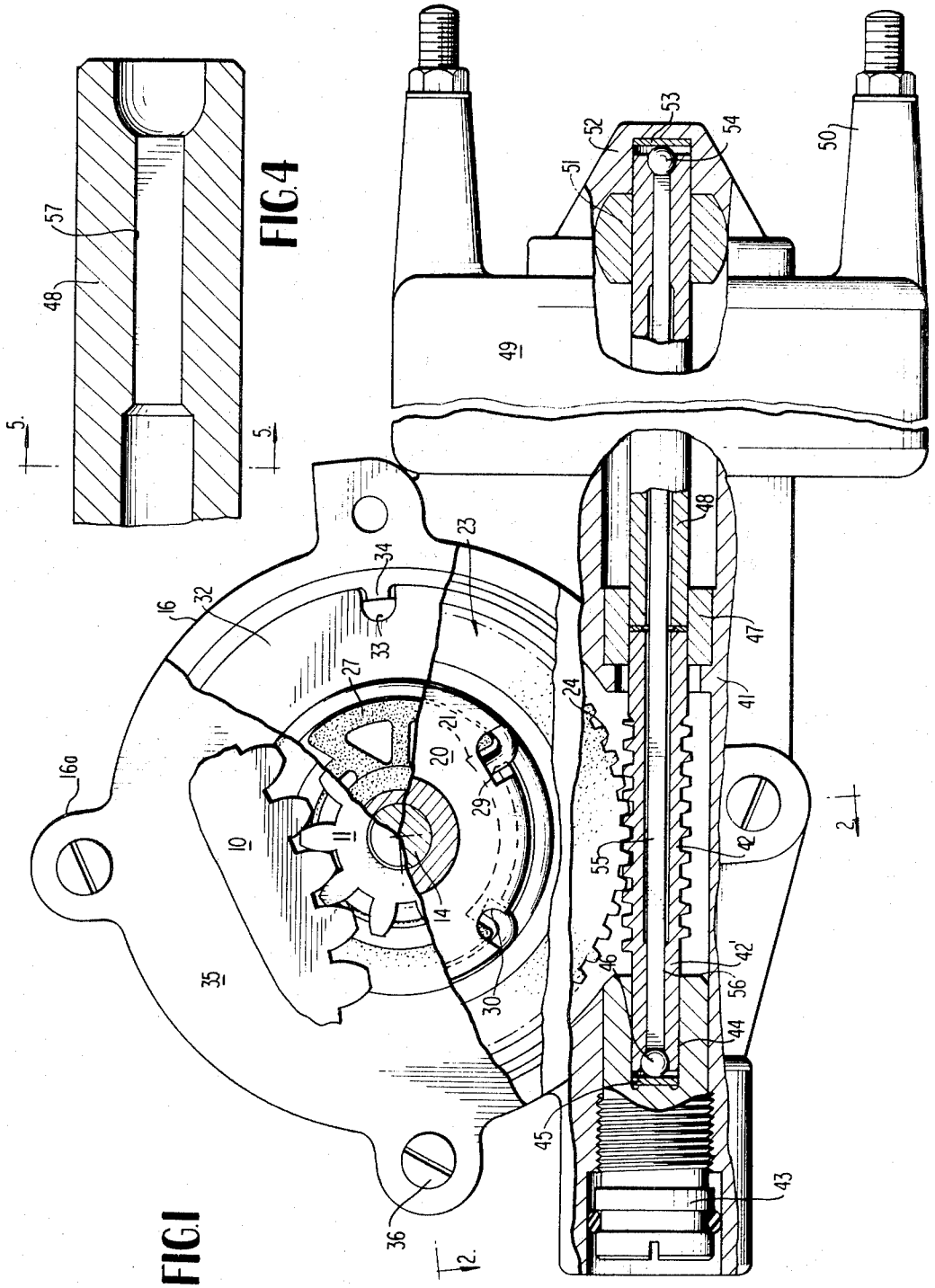
SHEET 1 OF 2



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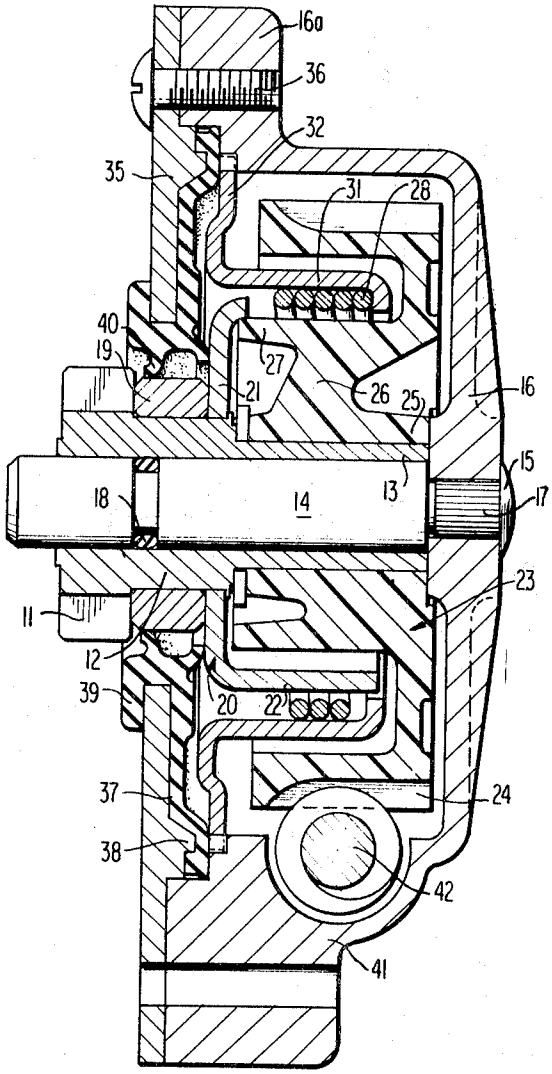

FIG.2

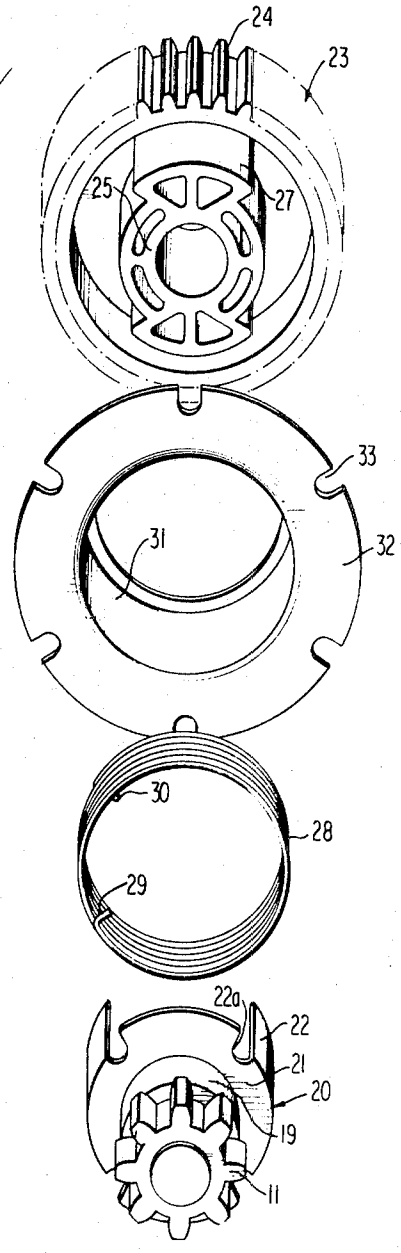

FIG.3

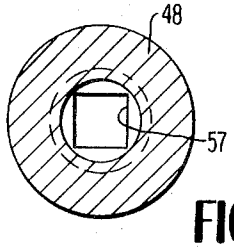

FIG.5

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MOTOR DRIVE ASSEMBLY FOR WINDOW REGULATORS

BACKGROUND OF THE INVENTION

A direct drive between the motor and the window is unsatisfactory because excessive torque obtains in the window closing which not infrequently causes damage to the motor structure. In the event a motor driven worm is employed for actuating the gear sector of the window regulator, the irreversibility of the worm causes excessive friction which must be coped with when the motor is reversed. Thus, a yieldable device has been incorporated in the power transmission to afford the desired fluidity of operation.

SUMMARY OF THE INVENTION

A reversible electric motor is connected to a window regulator through operative connections including a worm, and a worm gear which form part of a spring clutch device. A torsion bar affords the drive from the motor to the worm. An output pinion forms part of the spring clutch device and this meshes with the gear sector of the window regulator. Thus, when the motor is deenergized, the torsion bar unwinds to apply the spring brake and when the mechanism is at rest there is not load on the driving member. This facilitates the start of the window opening movement inasmuch as load conditions are reduced. The angularity of the teeth of the worm is of the order of 9°, which is only slightly above the angle of friction. A direct short extending across the motor armature serves as a dynamic brake to resist reverse rotation of the motor shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view with parts broken away showing a vehicle window power regulator embodying a torsion bar drive and spring clutch or brake unit for retaining the vehicle window in its position of adjustment;

FIG. 2 is a sectional view substantially on the line 2—2 of FIG. 1;

FIG. 3 is an exploded view of the parts of the spring clutch assembly;

FIG. 4 is a fragmentary sectional view of the outer end portion of the armature shaft section; and

FIG. 5 is a transverse sectional view substantially on the line 5—5 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The illustrated embodiment of the invention comprises a power operated vehicle window regulator mechanism having a gear sector 10 with which is associated suitable lever and linkage for raising and lowering the window. Meshing with the gear sector 10 is a driving pinion 11 having an integral elongate hub 12 from which extends an integral sleeve 13 in axial alignment with bores of the hub and pinion. The pinion 11, its hub 12, and sleeve 13 are rotatable about a bearing post 14 having a reduced axial extension 15 which is knurled and fits snugly into a hole in a cup-shaped housing part 16. The end of the extension 15 projects through the housing aperture and is upset or riveted over as indicated at 17. A reduced neck on the bearing post 14 receives and O-ring seal 18.

Fitting the hub 12 and abutting against the pinion 11 in a spacer ring 19 which is fixed thereto by brazing. Also fitting the hub 12 and brazed to the spacer ring 19 is a driven member 20 of a spring clutch. The driven member 20 has a flat sheet metal ringlike body 21 which projects radially beyond the spacer ring 19 and has a pair of diametrically opposed arms 22, there being notches 22*a* formed in the body part 21 on each side of each of said arms. The arms 22 extend at approximately right angles to the body 21 and are arcuate in cross section.

For actuating the driven member 20 and forming part of the spring clutch is an annular drive member 23 which may be of nylon or other suitable material, and, as shown in FIG. 3, is of

annular form, a worm gear 24 being formed in the periphery thereof. The drive member 23 has a hub portion 25 which has an axial bore to fit the sleeve 13 and rotate thereon. Webs 26 connect the hub portion 25 with arcuate sectors 27 and encircling the sectors 27 is a helical wire spring 28 which has hooked or inturned ends 29 and 30 adapted to extend into the space between an arm 22 of the driven member and an edge of the sector 27 of the drive member. The lock spring 28 is housed within a cup 31 in which it can expand against for tight frictional engagement or contract to enable rotational movement. The housing cup 31 has a flange 32, and formed in the edge portion of the flange 32 are notches 33 into which extend ribs 34 on the housing part 16 for holding the cup against rotary movement relative to the associated parts.

Closing the open end of the housing part 16 is a plate 35 of ring shape which is secured in place by screws 36 engaging lugs 16*a* projecting laterally from the housing part. To prevent moisture, grit and the like from entering the moving parts, an elastomeric sealing ring 37 is disposed principally on the inner side of the end plate 35, and is clamped into position between the plate 35 and the mouth of the housing part 16. The inside face of the end plate 35 has a stepped circular flange 38, which the rim portion of the gasket 37 is shaped to fit. As shown, the inner edge of the closure plate 35 is embraced by a gasket portion 39, and projecting from the outer side of the portion 39 is an annular blade 40 which has wiping contact with the rotating spacer ring 19.

A lower housing part 41 is integral with the housing part 16 and disposed therein is a hollow shaft section 42', on the outside of which is a worm meshing with the worm gear 24. The angularity of the teeth on the worm 42 is of the order of 9°, or only slightly above the angle of friction. The outer end portion of the shaft section 42' is rotatable in an adjustable bearing plug 43 which has screw threaded engagement with the housing part 41. The bearing plug 43 has a socket 44 in the inner end in which the end portion of the shaft section 42' rotates. In the inner end of the socket is a thrust plate 45 against which bears a thrust ball bearing 46 which fits a cup-shaped cavity in the end portion of the shaft section. The opposite end of the shaft section 42' extends into a bearing sleeve 47 which also receives the adjacent end portion of a hollow shaft section 48 constituting the shaft of the armature for a reversible electric motor indicated at 49. The housing for the motor 49 has mounting posts 50 to enable the assembly to be suitably mounted in a vehicle door, for example.

The opposite end portion of the shaft section 48 is mounted in a bearing 51 carried by a block 52 suitably secured to the motor housing. The block 52 is socketed to receive a thrust plate 53 against which a ball 54 bears, the latter being disposed in a cup-shaped cavity in the end of the shaft section 48. The drive from the shaft section 48 to the shaft 42' is through a torsion bar 55 which is square in cross section, and extends freely through hollow bores in the shaft sections. The shaft sections are cylindrical in cross section, except for the end portion 56 of the shaft section 42' which is square in cross section so as appropriately to fit the torsion bar. Similarly, the opposite end of the torsion bar fits the end portion 57 of the shaft section 48, which is also square in cross section. Manifestly, the torsion bar is nonrotatable with respect to the shaft sections 42' and 48, but has limited axial movement.

When the electric motor 49 is energized, the torque is transmitted from the armature shaft section 48 to the shaft section 42', so that the worm drives the worm wheel of the drive member 23. Such movement acts against one or the other of the in turned ends 29 and 30 tending to wind up or contract the spring 28 away from the wall of the housing cup 39, and permit the inturned ends to drive the pinion carrying driven member 20 so that the pinion 11 will actuate the gear sector 10 of the regulator. Operation will continue until the electric motor 49 is deenergized.

A direct short is established across the armature of the motor and, as a result, when the regulator movement is stopped, the motor armature acts as a dynamic brake to resist

reverse movement of the armature shaft as will be well understood by those skilled in this art. As a result the window, to which the regulator is connected, stops its movement when the motor is deenergized and does not drift substantially beyond that point.

When the mechanism is at rest, there is no load on the driving member **23** because at that time the coil spring **28** expands and engages the walls of the cup housing **31**, and securely holds the parts in position. When the motor **49** is deenergized, the unwinding of the torsion bar **55** serves to cause the spring **28** frictionally to engage the walls of the cup housing **31** and retain the parts in position of adjustment.

What I claim is:

1. A vehicle window regulator comprising a rotary electric motor, output shaft from said motor, a worm on said shaft, thrust bearings for opposite ends of said shaft, adjustable means for effecting relative axial adjustment for said thrust bearings, a spring clutch having a driving member provided with a worm gear meshing with said worm, said spring clutch having a contractable and expansible coil spring, a driven member constituting part of the spring clutch, and a regulator pinion connected rigidly to said driven member.

2. A vehicle window regulator as claimed in claim **1**, in which a cup-shaped housing part encloses said spring clutch and worm and worm gear, a flat ring shaped cover for the open side of said housing part, said regulator pinion being disposed on the outer side of said cover, a gasket of elastomeric material sealing the space between the inner side of said pinion and the cover, and and annular blade on said gasket having wiping contact in rear of said pinion.

3. A vehicle window regulator as claimed in claim **1**, characterized in that the angularity of the teeth of said worm is above the angle of friction.

4. A vehicle window regulator as claimed in claim **1**, characterized by means to cause the armature of said electric motor to act as a dynamic brake for resisting reverse movement of said shaft upon stopping of the regulator movement.

5. A vehicle window regulator comprising a rotary electric motor, a pair of aligned independent hollow shaft sections one of which is connected to said motor, a torsion bar extending freely through said shaft sections and having its ends secured against rotation relative to the outer ends of said shaft sections, a worm on one shaft section, a spring clutch having a driving member provided with a worm gear meshing with said worm, said spring clutch having a contractable and expansible coil spring, a driven member constituting part of the spring clutch, and a regulator pinion connected rigidly to said driven member.

6. A vehicle window regulator as claimed in claim **5**, in which said torsion bar is rectangular in cross section, and the outer end portions of said shaft sections having bores of rectangular cross section for fitting the torsion bar affording axial movement therein but not relative rotational movement.

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