Dec. 16, 1952 K. RATH 2,621,541

MULTIPLE DRIVE WINDOW REGULATOR

Filed Sept. 22, 1949

Fig. 1.

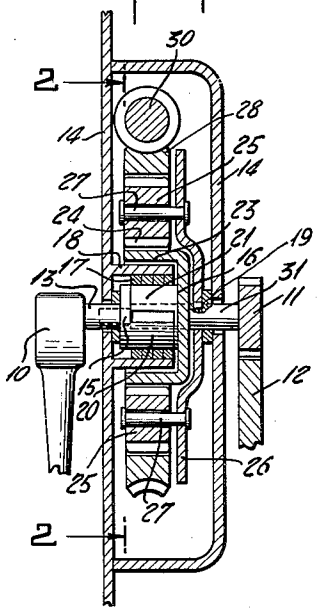


Fig. 2.

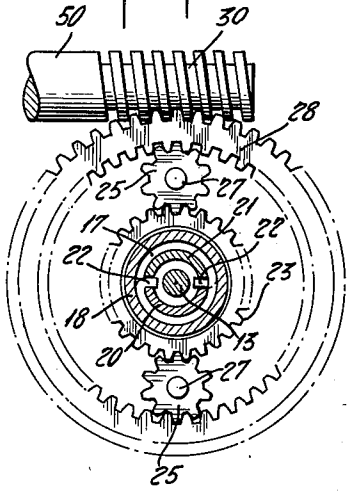


Fig. 3.

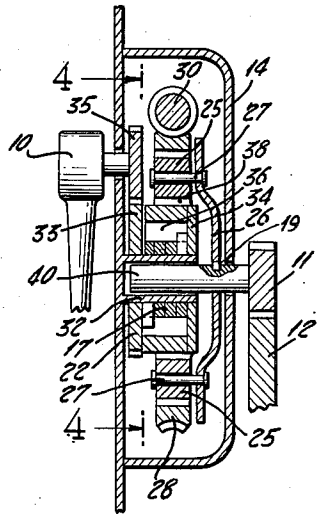


Fig. 4.

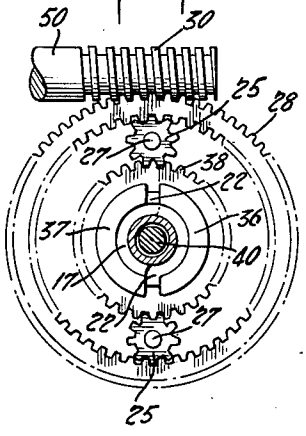
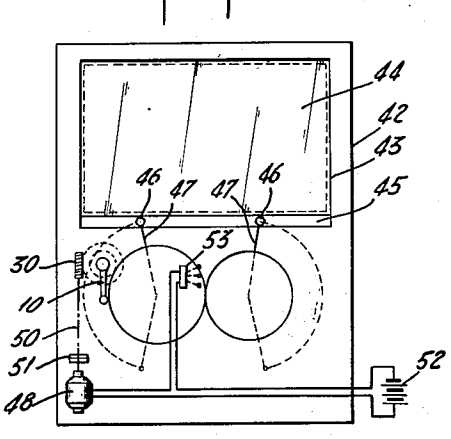


Fig. 5.



INVENTOR.

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MULTIPLE DRIVE WINDOW REGULATOR

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5 Claims. (Cl. 74—626)

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The present invention relates to window regulators, more particularly, though not exclusively, for use in motor vehicles and being of the general type as disclosed in U. S. Patent application Ser. No. 790,783, filed December 10, 1947 by Peter F. Rossmann and assigned in part to the present applicant.

There is shown and described in the above application a combined manual and/or automatic window regulator comprising a planetary gear assembly having a pair of side gears and a rotatable carrier cooperating with said side gears through at least one planet gear. According to the embodiment shown in said application, the carrier is in driving connection with the window operating mechanism, while the side gears are in driving connection with the manual and automatic driving means in the form of a hand crank or operating handle and an electric motor, respectively. The connection between the hand crank and its associated side gear includes a one-way friction or spring clutch which serves for the double purpose of locking the window during the manual operation and preventing it from reacting upon the handle by reason of its own weight or gravity, on the one hand, and of acting as a locking means for the planetary gear drive during the motor driven operation to enable power transmission from the motor to the window. Similarly, an additional one-way coupling device, preferably in the form of a worm gear transmission, is connected between the motor and its associated side gear, to prevent power transmission between the handle to the motor shaft and to prevent reaction of or to act as a locking means for the window.

In other words, both one-way coupling means, i. e. the spring clutch, on the one hand, and the worm gear drive, on the other hand, will be alternately effective during the manual and automatic operations of the window in preventing the latter from reacting upon the driving members (handle, motor) due to its own weight or gravity, and in acting as a locking means for the inactive or stationary element of the planetary gear assembly, to allow of power transmission from the operative input element to the window, as will be further understood as the following disclosure proceeds. As a result, the window may be operated optionally, either automatically and/or manually, both in the same or in opposite directions, without any interaction between the driving or operating members and without requiring any adjustment or switch-over operation when changing from one to the other mode of

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operation. This in turn results in complete safety and reliability of the window control, including cases of accident, exhaustion of the car battery and other emergencies when the automatic control has become defective or inoperative.

Among the objects of the present invention is the provision of a manual and/or automatic window regulator of the above character which is both simple and compact in design; which comprises a one-way window clutch structurally combined with a multiple planetary device or coupling; which may be used in connection with standard window operating devices and will enable operation of a window both manually and/or automatically; which can be easily installed or built in existing motor cars, without requiring special operations or changes in the car structure; and which may be manufactured in compact or unit form at low cost and suitable for quantity production.

Further objects and novel aspects of the invention will be better understood from the following detailed description taken in connection with the accompanying drawing forming part of this specification and in which:

Fig. 1 is a vertical cross-sectional view of a window regulator constructed in accordance with the principles of the invention;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1;

Fig. 3 is a vertical cross-section of a modified regulator construction according to the invention;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3; and

Fig. 5 is a schematic assembly view showing, by way of example, an automobile door equipped with a window regulator according to the invention.

Like reference numerals identify like parts in the different views of the drawing.

Referring to Fig. 1, the numeral 10 represents a hand crank for manually driving a gear 11 of a standard window operating mechanism including a window operating gear 12 in meshing relation with gear 11, as more clearly indicated in Fig. 5. The handle 10 has a shaft 13 passing through a support or housing 14 and being secured to or integral with one of the cooperating elements 15 of a one-way spring clutch or drive release brake of generally known construction and having a cooperating clutch element 16, a coil spring 17 and cylindrical housing 18, the

latter being secured to or integral with the support 14, as shown in the drawing. Clutch elements 15 and 16 are provided with inter-engaging sector-shaped axial projections 20 and 21 (see Fig. 2) designed to provide a pair of radial gaps for receiving the hooked ends 22 of the clutch spring 17 encircling the elements 20 and 21 and having its outside surface frictionally engaging the inside of the housing 18.

In the example shown, the sector 20 is connected to the clutch element 15 and the sector 21 is connected to the clutch element 16, whereby with element 15 being rotated in either direction by the operation of the hand crank 10, pressure will be exerted upon the inner faces of the hooked ends 22 of the clutch spring 17, thus contracting the spring and releasing it from its frictional engagement with the housing 18, in such a manner as to allow of rotary motion to be transmitted freely to the clutch element 16 by way of the sector 21. On the other hand, rotation of clutch element 16 and in turn of sector 21 will result in the latter pressing against the outer faces of the hooked ends 22 of the clutch spring 17, thus unwinding and tightening the spring firmly or locking it against the inside of housing 18. As a consequence, the drive release brake acts as a resilient one-way coupling means in allowing rotary motion to be transmitted freely from the handle 10 to the window operating mechanism but blocking transmission or acting as a locking means in the opposite direction.

Clutch element 16 is connected to a re-entrant or cup-shaped member 23 concentrically surrounding or bearing upon clutch housing 18 and being formed with external gear teeth 24 to act as the first side or sun gear of the planetary gear assembly. Sun gear 24 meshes with one or more planet gears 25 rotatably supported by a planetary carrier 26 in the form of a disc or spider by means of shafts 27, said planet gears being in turn in meshing relation with an outer internally toothed ring or second side gear 28. The latter is driven by an electric motor through a worm 30 meshing with worm teeth upon its periphery during the automatic or motor driven operation of the window. The planetary carrier 26 is secured to the driven or output shaft 31 carrying the window driving pinion 11 by a key 19. Shaft 31 is advantageously extended and supported within a central bore of shaft 13 of the operating handle to insure concentric mounting and guidance of the various elements.

During operation, rotation of the handle 10 will result in transmission of rotary motion to the window driving gear 11 through the action of the drive release brake, sun gear teeth 24, planet gears 25 and carrier 26. During this operation, the planet gears will revolve upon the ring gear 28 held stationary by the worm 30. During the motor driven operation, rotary motion will be transmitted from the motor through the worm 30 rotating the ring gear 28 and carrier 26 by way of the planet gears 25, in which case the inner or sun gear is locked or held stationary by the action of the drive release brake, whereby the planet gears 25 revolve upon the sun gear 24, in a manner understood from the foregoing.

It is seen, therefore, from the foregoing that both the one-way drive release brake 15—21 and the worm gear drive 28—29 serve to perform the double and alternate functions of preventing the window from reacting upon the driving sources or members during both the manual and automatic operations, on the one hand, and as locking means for the sun gear 24 and ring gear 28 of the differential gear assembly to enable power transmission from either of the input or driving means to the window.

The structure described herein above, wherein the drive release brake serves as a support or mounting of the planetary gear assembly which is radially aligned therewith results in a compact unit of reduced dimension especially in the axial direction, thus enabling its easy mounting in existing car door where space is limited.

Referring to Figures 3 and 4, there is shown a modified construction of a combined drive release brake and planet gear assembly of the type according to the invention. For this purpose, the drive release brake is constructed with its clutch spring 17 frictionally engaging a central housing or cylindrical support 32 integral with or secured to the housing 14. Input clutch member 33 has the form of a gear meshing with a gear 35 driven by the hand crank 10. Clutch member 33 has a sector-shaped axial extension 36 interlocking with a similar internal sector-shaped element 37 which is integral with the cup-shaped cooperating clutch output member 34. The latter is provided with external gear teeth 38 forming the inner or sun gear of the planetary gear assembly and cooperating with the planet gears 25 and remaining elements in substantially the same manner as in the case of Figures 1 and 2. The ends of the spring 17 in this case are bent radially outwardly and inserted in the gaps between the sectors 36 and 37 as shown in Fig. 4. As a consequence, rotation of sector 36 by the member 33 as a result of operation of the handle 10 will loosen the spring 17 from its friction with the cylinder 32, in such a manner as to allow ready transmission of rotary motion for manually raising and lowering the window. On the other hand, rotation of sector 34 will result in a tightening of the spring 17 upon the cylinder 32 or locking of the clutch to prevent transmission of motion in the opposite direction. Support 32 is preferably in the form of a hollow cylinder to serve as a guide for the extended shaft 40 of the window driving pinion 11. Other details of this construction are substantially similar to those described in connection with and understood from Figures 1 and 2.

Fig. 5 shows schematically a window operating mechanism mounted within an automobile door and comprising a regulator according to the invention. Numeral 42 indicates the door, 43 represents the window frame and 44 a window pane mounted upon a support or channel member 45. The latter serves as a guide for a pair of rollers 46 which are attached to the ends of links 47 each of which is connected to one of a pair of operating gears or sectors 12 arranged in mutual meshing relation. One of said gears corresponds to the gear 12 shown in Fig. 1 and in turn meshes with gear 11 of the regulator. Item 48 represents an electrical motor driving worm 30 by means of a shaft 50 and through an overload friction or slip clutch 51 of the type described in more detail in the above-mentioned co-pending application. The motor may be started to rotate in either direction by connecting it to a suitable current source such as a battery 52 through a reversible and preferably self-centering control switch 53, in the

manner shown and readily understood from the drawings. If desired, slip clutch 51 may be omitted when using a self-centering central switch 53, in that the operator will automatically release the switch and allow its return to the central or open position as soon as the window has reached one of its end positions.

As is understood, the manual and automatic drives may be inter-changed in the construction of both Fig. 3 and Fig. 5, i. e. the motor may be replaced by the handle and vice versa without substantially interfering with the operation of the regulator.

While there have been shown and described a few desirable embodiments of the invention, it is understood that this disclosure is for the purpose of illustration and that various changes in the size, shape and arrangement of parts, as well as the substitution of equivalent elements for those herein shown and described, may be made without departing from the spirit and scope of the invention as defined in the appended claims. The specification and drawing are accordingly to be regarded in an illustrative rather than in a limiting sense.

I claim:

1. In a window regulator including operating mechanism for controlling a window, multiple differential coupling means for optionally operating said mechanism by manual and/or automatic driving means, comprising a drive release brake having a cylindrical housing, an input clutch element connected to one of said driving means and a re-entrant cup-shaped output clutch element encircling said housing, said output element being provided with a clutch portion and with gear teeth to form a sun gear, said clutch portion and gear teeth being radially aligned, an internally toothed ring gear of greater diameter than said sun gear and provided with worm teeth upon its periphery, a rotatable differential carrier having driving connection with said mechanism, at least one planet gear rotatably supported by said carrier and meshing with both said sun and ring gears, and a worm gear connectable to the other driving means and meshing with said worm teeth, said worm gear, ring gear and planet gear all being radially aligned with said clutch element.

2. In a window regulator including operating mechanism for controlling a window, multiple differential coupling means for optionally operating said mechanism by manual and/or automatic driving means, comprising a drive release brake havng a cylindrical support, an input clutch element connected to one of said driving means, a cylindrical output element provided with gear teeth to form a sun gear, interlocking axial extensions of said elements, said sun gear being radially aligned with said axial extensions, a coil spring frictionally engaging said support and having hooked ends engaging radial gaps between said extensions, whereby to allow of rotary motion to be transmitted from said input element to said output element by release of said spring from said support and to block transmission in a reverse direction by clamping said spring against said support, an internally toothed ring gear of greater diameter than said sun gear and being provided with worm teeth upon its periphery, a rotatable differential carrier having driving connection with said mechanism, at least one planet gear rotatably supported by said carrier and meshing with both said sun and ring gears, and a worm gear connectable to the other driving means and meshing with said worm teeth.

3. In a window regulator including operating mechanism for controlling a window, multiple differential coupling means for optionally operating said mechanism by manual and/or automatic driving means, comprising a drive release brake having a cylindrical housing, an input clutch element connected to one of said driving means, a cylindrical output clutch element rotatable upon said housing and provided with gear teeth to form a sun gear, interlocking axial extensions of said elements, said sun gear being radially aligned with said axial extensions, a coil spring frictionally engaging the inside of said housing and having hooked ends engaging radial gaps between said extensions, whereby to allow of rotary motion to be transmitted from said input element to said output element by release of said spring from said housing and to block transmission in the reverse direction by clamping said spring against that housing, an internally toothed ring gear of greater diameter than said sun gear and being provided with worm teeth upon its periphery, a rotatable differential carrier having driving connection with said mechanism, at least one planet gear rotatably supported by said carrier and meshing with both sun and ring gears, and a worm gear connectable to the other driving means and meshing with said worm teeth.

4. In a window regulator including operating mechanism for controlling a window, multiple differential coupling means for optionally operating said mechanism by manual and/or automatic driving means, comprising a drive release brake having an inner cylindrical support, an input clutch element connected to one of said driving members, a cylindrical output clutch element concentric to said support and provided with gear teeth to form a sun gear, interlocking axial extensions of said elements, said sun gear being radially aligned with said axial extensions, a coil spring frictionally engaging the outside of said support and having ends bent from said coil and engaging radial gaps between said extensions, whereby to allow of rotary motion to be transmitted from said input element to said output element by expansion and release of said spring from said support and to block transmission in the reverse direction by contraction and clamping of said spring upon said support, an internally toothed ring gear of greater diameter than said sun gear and provided with worm teeth upon its periphery, a rotatable differential carrier having driving connection with said mechanism, at least one planet gear rotatably supported by said carrier and meshing with both said sun and ring gears, and a worm gear connectable to the other driving means and meshing with said worm teeth.

5. In a window regulator including operating mechanism for controlling a window, multiple coupling means for optionally operating said mechanism by manual and/or automatic driving means, comprising a drive release brake having an input element connected to one of said driving means and a cylindrical output element provided with gear teeth to form a sun gear, rotatable differential ring gear and carrier members, said ring gear being of greater diameter and coaxial with said sun gear, at least one planet gear rotatably supported by said carrier and meshing with both

said sun and ring gears, and further one-way coupling means connected to and uni-directionally driving one of said members by the other said driving means, said drive release brake and said further one-way coupling means being radially aligned.

KARL RATH.

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