June 25, 1929. A. T. NELSON 1,718,484

WINDOW REGULATOR

Filed Jan. 16, 1924 2 Sheets-Sheet 1

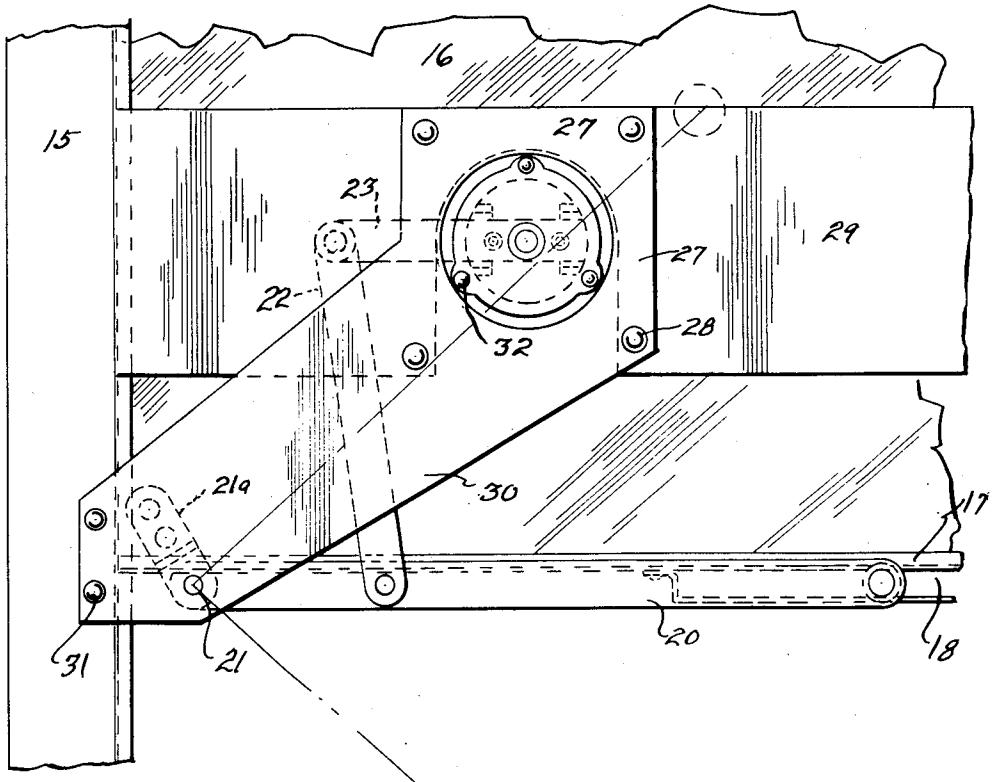



Fig. 1

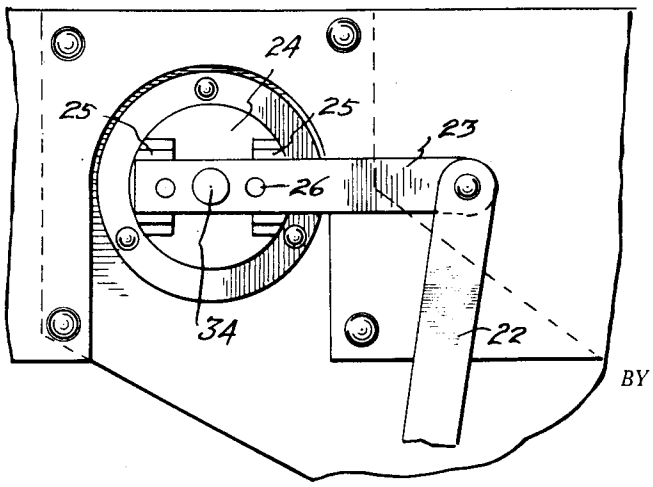



Fig. 3

INVENTOR.
Arne T. Nelson
BY
Parker & Burton
ATTORNEY.

June 25, 1929. A. T. NELSON 1,718,484

WINDOW REGULATOR

Filed Jan. 16, 1924 2 Sheets-Sheet 2

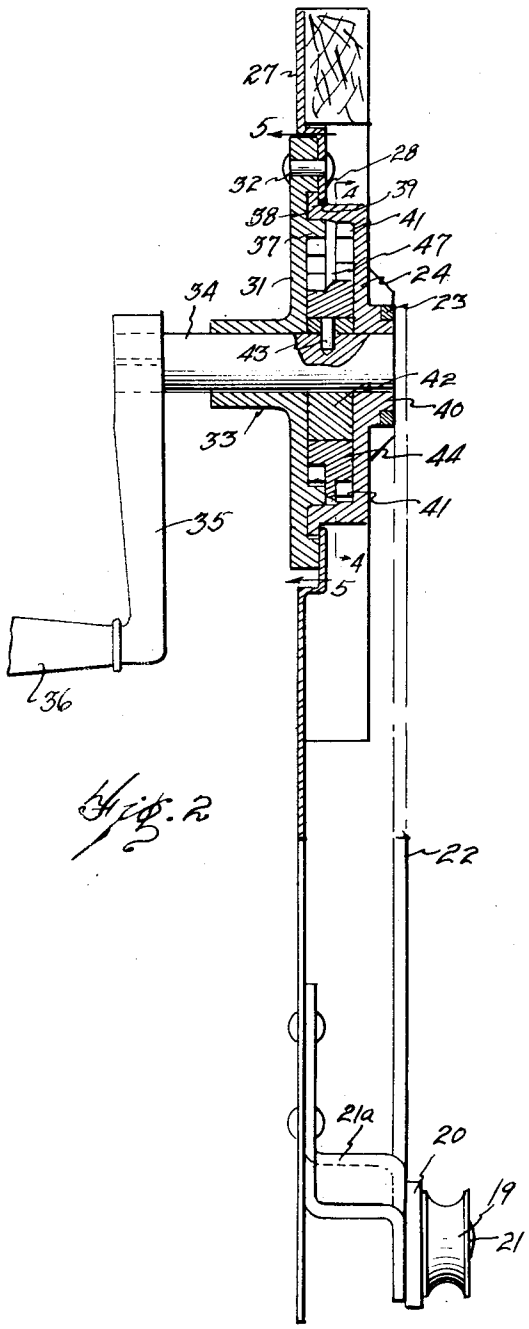



Fig. 2

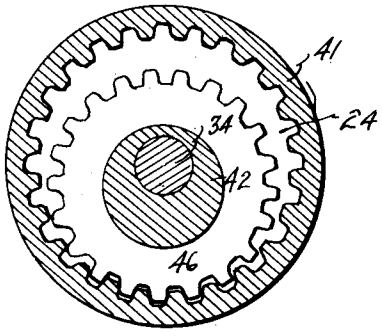



Fig. 4

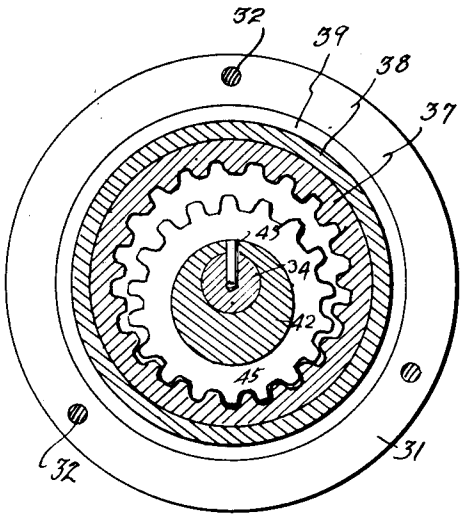



Fig. 5

INVENTOR.

Arne T. Nelson

BY

Parker & Burton

ATTORNEY.

Patented June 25, 1929. 1,718,484

# UNITED STATES PATENT OFFICE.

ARNE T. NELSON, OF HIGHLAND PARK, MICHIGAN.

## WINDOW REGULATOR.

Application filed January 16, 1924. Serial No. 686,503.

My invention relates to improvements in window regulators.

A window regulator should be inexpensive to meet the present day demand for quantity production; durable to withstand hard and continued usage; and composed of a minimum number of sturdy parts easily assembled in compact form.

It should be self-contained to facilitate installation on the car body; it should be positive in action; it must automatically retain the window at any point to which it has been elevated.

A regulator of the manually rotatable crank type should completely raise or lower the window with approximately ten or twelve revolutions of the handle. The construction of the regulator should be such that application of the slightest operative force thereto serves to raise or lower the window, yet the regulator must be irreversible under the most severe shock or jar transmitted from the window to the operating mechanism.

My improved window regulator possesses all these characteristics. It has a minimum number of strong, sturdy parts assembled in compact and unitary form; it positively operates to open and close a window on the application of the slightest force to the rotating crank; it is irreversible upon the application of great force directly to the window; it retains the window at any elevation to which it has been moved; it is durable, simple and inexpensive; it contains no springs or other similar exhaustible parts.

In the drawings,—

Figure 1 is a broken away side elevation of a vehicle door showing my regulator in place therein.

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

Fig. 3 is a fragmentary elevation of a portion of the vehicle door taken from the opposite side to that shown in Fig. 1.

Fig. 4 is a vertical sectional view taken on line 4—4, Fig. 2.

Fig. 5 is a vertical sectional view taken on line 5—5, Fig. 2.

My improved window regulator is adapted for use principally with the slidable frameless glass windows used in automobile body construction. Such windows comprise as a rule frameless glass panes disposed between suitable runways for slidable vertical movement. The lower edge of the window is generally framed to provide a means for connecting with the operating mechanism of a window lift.

In Fig. 1, I have shown a side frame member 15 and a slidable broken-away window pane 16. This window pane is provided on its lower edge with a suitable frame member 17. This frame member is slotted at 18 to receive the bearing of the window operating mechanism. I have shown this bearing in the form of a roller 19 adapted to travel in the slot 18. This roller is carried at the end of a lever 20, which lever is pivoted at its opposite end, as at 21, to a suitable stationary angular support $21^a$. A link 22 pivotally connects this lever to an arm 23. This arm is carried by the actuated gear 24 of the window operating mechanism.

In the drawing gear 24 is shown as having an outer surface provided with spaced-apart lugs 25. The arm is secured to the gear between the lugs in a suitable manner or by means of rivets 26. If the gear is rotated through a limited arc the end of the lever 20 is moved over a very considerable arc. In the construction here shown rotation of the actuated gear 24 through an arc considerably less than 90 degrees serves to move the lever 20 a sufficient distance to completely raise or lower the window.

The operating mechanism comprises an epicyclic train of gears in which the gear 24 is the slow-moving member. This train of gears and casing therefor is carried by a plate 27 which plate is secured by screws or other suitable means 28 to a stationary portion of the body structure such as a door cross-piece 29. The plate 27 has an angularly-extending portion 30 secured as at 31 to the side frame member of the door. This angularly-extending portion serves as a support for the pivoted end 21 of the lever 20. This provides a unitary regulator construction which may be installed easily in the space provided between the door panel and the interior covering for the door.

The driving mechanism consists of an epicyclic train of gears in which there is a stationary member 31 which is secured by rivets 32 or other suitable means to plate 27. This stationary member has a bearing 33 to support a high-speed shaft 34 which shaft is provided with a crank 35 having a handle 36. On the interior face of the stationary member and concentric with the bearing is an internally toothed gear ring

37. Encircling the gear ring 37, and spaced between the ring and the periphery of member 31, is an annular recess 38. This annular recess is adapted to receive flange 39 of the gear 24 so that the gear 24 may be supported therein for rotation. The edge 28 of plate 27 extends over the flange 39 to hold the gear 24 in place. Sufficient clearance is provided between the flange 39 and the plate to permit free rotation of the gear 24.

The driven gear 24 is shown as provided with a bearing 40 to co-operate with bearing 33 of the stationary gear to support the high-speed shaft 34 and the shaft is here shown as extending freely rotatably through lever 26. Gear 24 has an internally toothed gear ring 41. This gear ring is concentric with the bearing and the gear ring 37.

The high-speed shaft 34 carries for rotation therewith an eccentric 42. This eccentric is shown secured to the shaft by means of a pin 43. Rotatably mounted on the eccentric is a double differential pinion 44. Opposite sides of the pinion are shown in Figs. 4 and 5. This pinion is concentric with the eccentric 42 and therefore eccentric with the shaft 34. Opposite sides of the pinion constitutes differential pinions 45 and 46, here shown as separated by a shroud 47.

For purpose of illustration I prefer to show the face of the pinion identified as 45 having 18 teeth. The opposite face of the pinion is provided with 21 teeth. Stationary member 31 I show as provided with a gear ring of 21 teeth. Movable gear member 24 I show as a gear ring of 24 teeth. The teeth of the face 45 of the pinion are in mesh with the teeth of the stationary internal gear ring. The teeth of the face 46 of the pinion are in mesh with the teeth of the rotatable gear ring.

If the high-speed shaft is rotated in a clockwise direction a complete rotation of the pinion 44, by virtue of its face 45 having 18 teeth and being in engagement with a stationary gear ring having 21 teeth, will lose the distance measured by an arc of three teeth. Six rotations of the high-speed shaft will, therefore, be required to cause the pinion to rotate in a counterclockwise direction a complete revolution about the eccentric 42. As the pinion is a unitary structure the face 46 will travel in a counterclockwise direction at the same rate as the face 45 and forty-eight revolutions of the high-speed shaft will be required to rotate the ring gear 24 one complete revolution.

The slowly-movable member of the epicyclic train (ring gear 24) will be moved for each ten or twelve rotations of the high-speed shaft a sufficient distance to actuate the lever mechanism to such an extent as to open or close an ordinary vehicle body window. The mechanism is irreversible in that it is impossible to reverse its operation by pressure applied to the window within the limits of breakage of the mechanism itself.

What I claim is:

1. A window regulator for use with a window having a frame and a sash, and comprising, in combination, a plate arranged to bridge across and be secured at its ends to two of the window frame parts, a lever fulcrumed at one end on the plate near one of the ends of the plate and arranged at its free end for operative engagement with the sash, a reduction gearing mounted on the plate near its other end, an arm swung in an arc by the reduction gearing, and a link connecting the end of the arm to the lever between the ends of the lever.

2. In combination with a window slidably mounted within a frame, window operating mechanism including a lever pivoted at one end to the side of the frame and at its opposite end to the window, reduction gearing carried by the frame and provided with an arm adapted to be swung in an arc through the operation of said gearing, said arm arranged normally parallel to said lever and a link pivotally connected at one end to the outer end of the arm and at the opposite end to an intermediate point on the lever.

In testimony whereof, I sign this specification.

ARNE T. NELSON.