

April 10, 1934.

S. W. NICHOLSON

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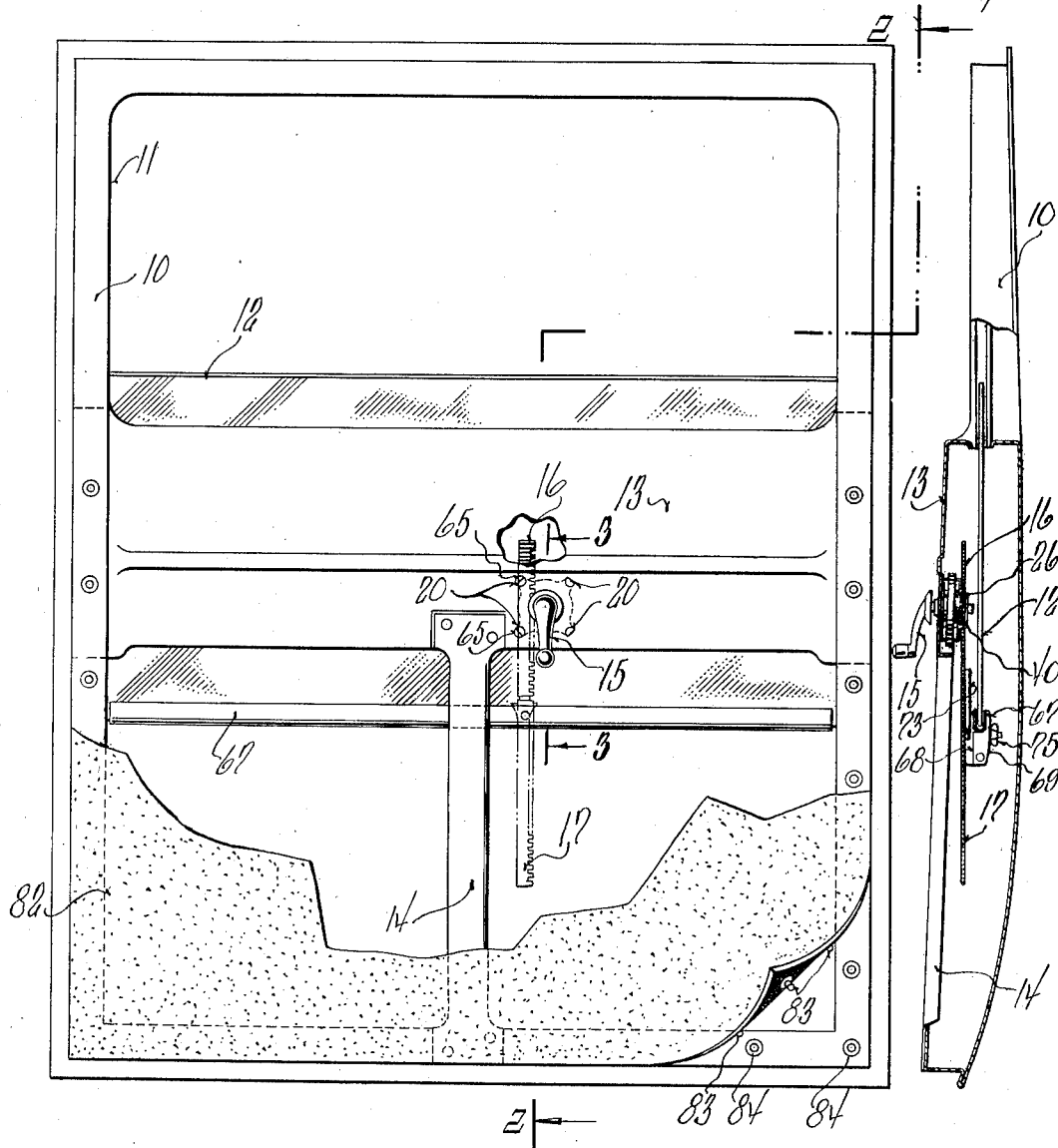
WINDOW REGULATOR

Filed March 22, 1929

4 Sheets-Sheet 1

Fig. 1

Fig. 2



Stanley W. Nicholson

By Sandra Miller Jones
Attorney

April 10, 1934.

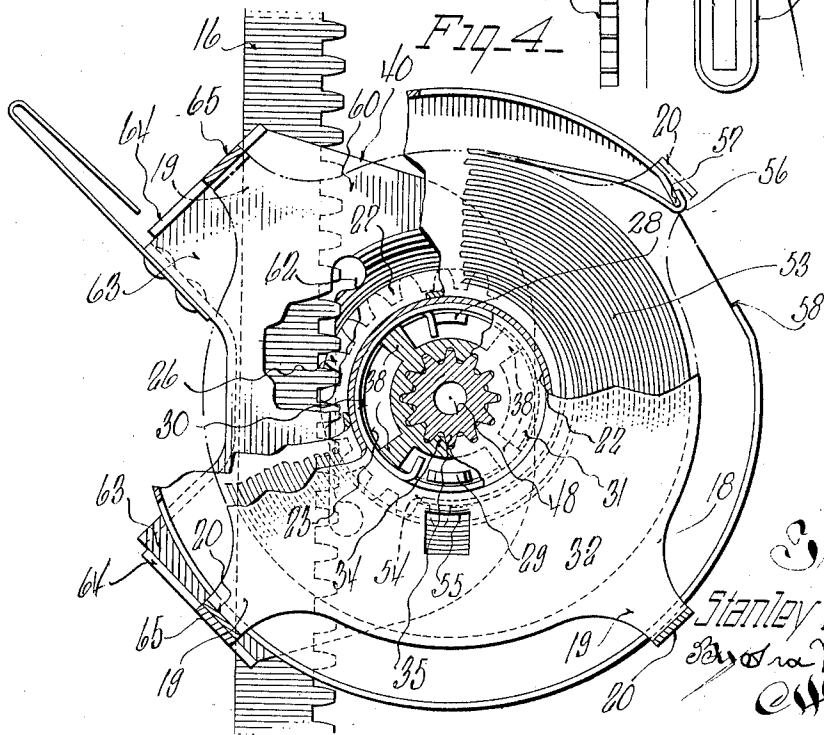
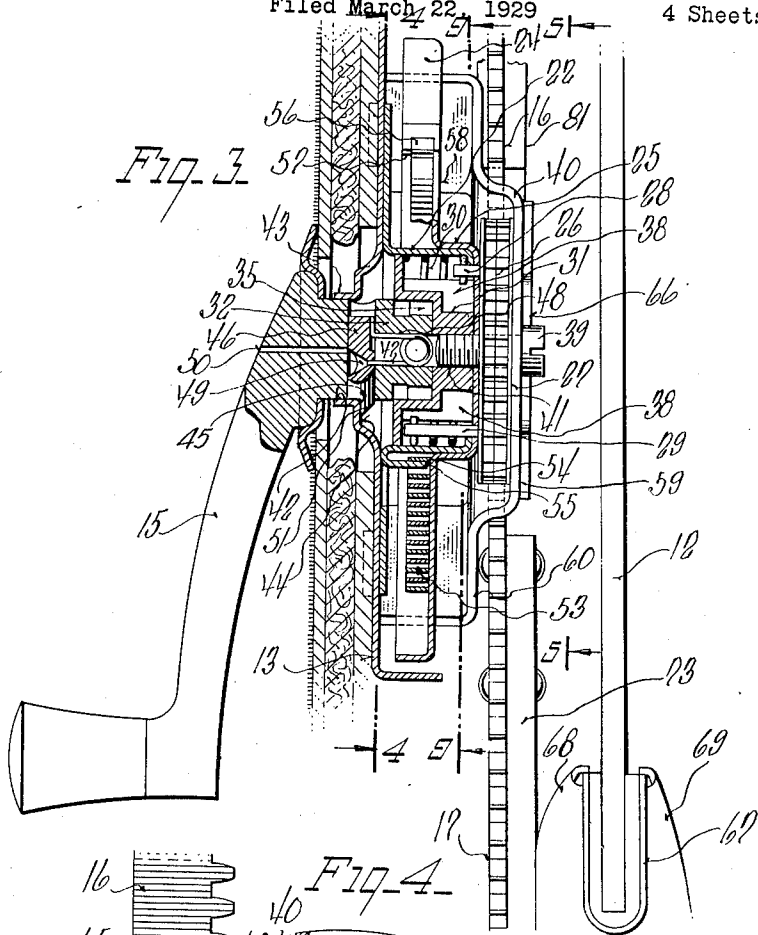
S. W. NICHOLSON

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WINDOW REGULATOR

Filed March 22, 1929

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Endorse
Stanley W. Nicholson
By Ira Miller Jones
Attorney

April 10, 1934.

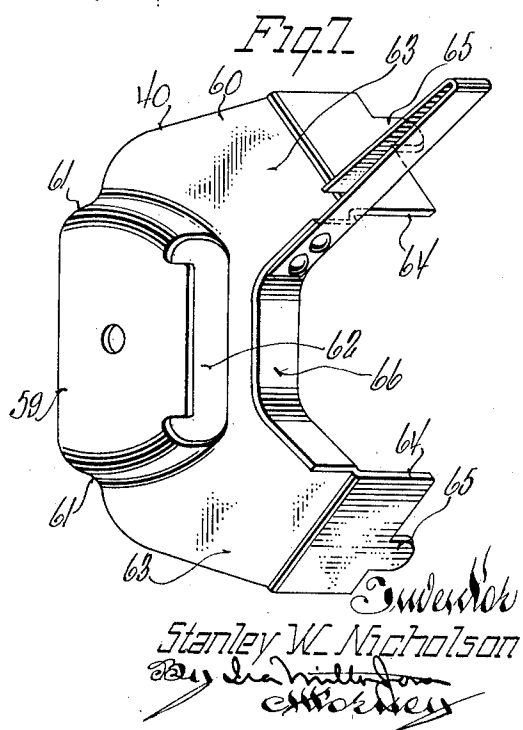
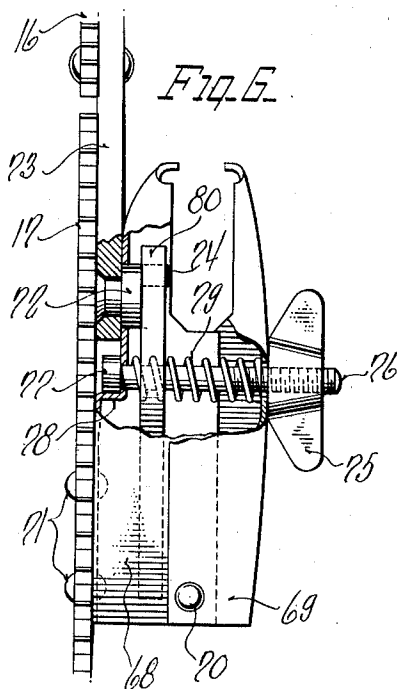
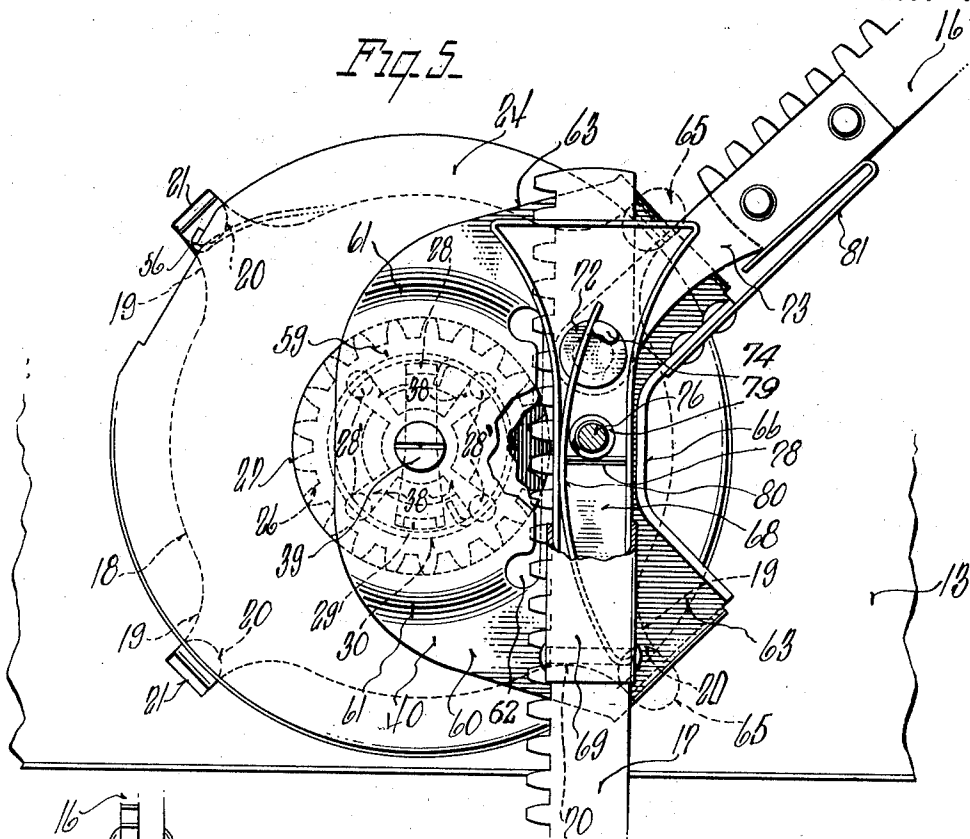
S. W. NICHOLSON

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WINDOW REGULATOR

Filed March 22, 1929

4 Sheets-Sheet 3



Endorsed
Stanley W. Nicholson
by the undersigned
attorneys

April 10, 1934.

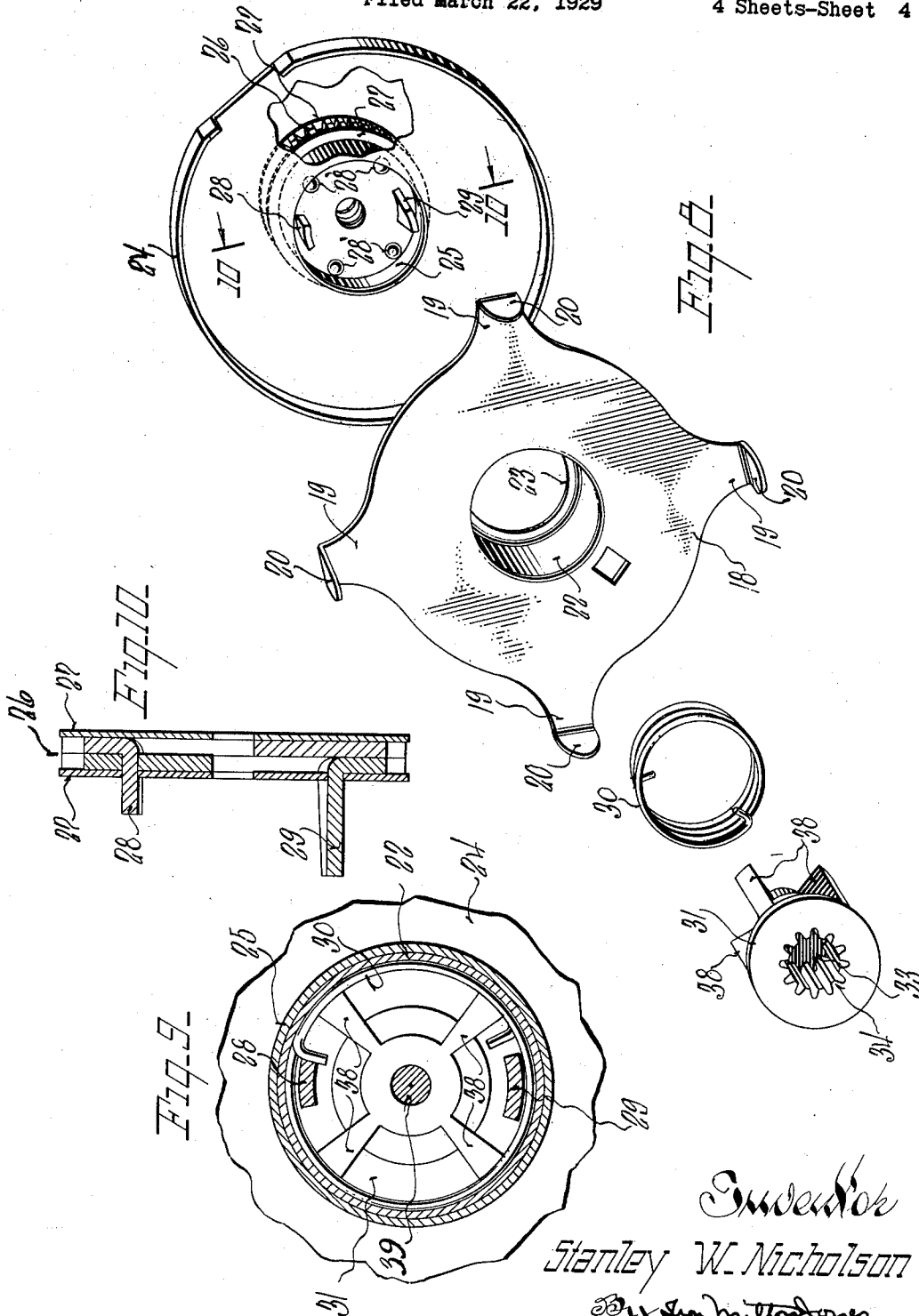
S. W. NICHOLSON

1,954,221

WINDOW REGULATOR

Filed March 22, 1929

4 Sheets-Sheet 4



Stanley W. Nicholson
By *Stanley W. Nicholson*
Attorney

UNITED STATES PATENT OFFICE

1,954,221

WINDOW REGULATOR

Stanley W. Nicholson, Toledo, Ohio, assignor, by
mesne assignments, to Briggs & Stratton Cor-
poration, Milwaukee, Wis., a corporation of
Delaware

Application March 22, 1929, Serial No. 349,197

20 Claims. (Cl. 268—132)

This invention relates to certain new and useful improvements in window regulators of the type used with automotive vehicles.

Heretofore, the usual construction for such window regulators has consisted of a pivotally mounted arm whose outer end was slidably connected with the lower edge of the window. A drive pinion meshed with a segment carried by the arm provided means for rocking the arm to raise and lower the window. This construction, however, had several objectional features, principal of which was the fact that the raising and lowering force was not applied in a direct line with the direction of movement of the window. It is, therefore, an object of this invention to provide an improved window regulator which applies opening and closing force in a direct line with the direction of movement.

Another objection to regulators heretofore in common use, has been the fact that their design necessitated positioning of the control handle or crank with its axis at right angles to the plane of the window, and as very often the panel upon which the regulator is mounted is normally at an angle to the plane of the glass, this disadvantage was costly.

It is, therefore, another object of this invention to provide a window regulator of the character described in which means are provided to accommodate angular misalignment between the planes of the mounting panel and the glass, and whereby the axis of the actuating handle may be at right angles to the mounting panel.

Another object of this invention resides in the provision of an improved window regulator wherein the mounting panel forms part of the regulator assembly, thus reducing its cost and simplifying its design.

Another object of this invention is to cut the cost of window regulators, by reducing the required amount of material.

Another object of this invention resides in the provision of a window regulator of the character described, which is so constructed as to permit an exceptionally simple method of limiting the downward movement of the glass.

Another object of this invention resides in the provision of a novel window regulator in which the window itself is utilized to provide a rigid guide and aligning means for the movable element of the regulator.

A further object of this invention resides in the provision of a window regulator of the character described which is adapted to be connected with

the window by merely tightening a single clamping screw.

A further object of this invention resides in the provision of novel means for detachably securing the actuating handle in operative position, which means can be moved to permit detachment of the handle by the mere insertion of a wire into an opening formed in the handle.

And a still further object of this invention resides in the provision of a window regulator which incorporates a rack formed in two parts hingedly connected and rigidly fixed to the window to be raised and lowered upon the actuation of a handle, and in which means are provided for moving the upper section of the rack to a position permitting further upward movement of the lower section to permit full closing of the window.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

In the accompanying drawings, I have illustrated one complete example of the physical embodiment of my invention constructed according to the best mode I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 is an elevational view of a typical automotive vehicle door construction illustrating my invention applied thereto;

Figure 2 is a sectional view taken through Figure 1 on the plane of the line 2—2;

Figure 3 is an enlarged sectional view taken through the regulator on the plane of the line 3—3 of Figure 1;

Figure 4 is a cross sectional view with parts broken away, and said view being taken through Figure 3 on the plane of the line 4—4;

Figure 5 is a back view of the regulator with parts broken away and in section to more clearly illustrate structural details, and said view being taken on the plane of the line 5—5 of Figure 3;

Figure 6 is a detail view illustrating the pivotal connection between the rack sections, and the clamp for securing the sections to the window channel;

Figure 7 is a perspective view of the rack guard shown detached from the structure;

Figure 8 is a perspective view illustrating the drive member assembly, the brake cup and the

brake spring actuating member shown separated from each other;

Figure 9 is an enlarged sectional view taken through Figure 3 on the plane of the line 9—9 and illustrating the relation of the brake to its associated elements; and

Figure 10 is a transverse sectional view through the drive gear.

Referring now more particularly to the accompanying drawings, in which like numerals designate like parts throughout the several views, the numeral 10 designates the frame of a conventional vehicle door, the upper portion of which is provided with a window opening 11 adapted to be closed by a glass window 12 slidably mounted in the frame 11 in the usual manner. The sides of the frame 10 are connected at their medial portions by a transverse panel or stiffening member 13, which has its rigidity increased by a vertical brace 14, connected at its lower end with the bottom of the frame 10.

As is customary in vehicle window regulators, the window 12 is adapted to be raised and lowered by the actuation of a crank handle 15, and is held at any point of adjustment by suitable brake mechanism, to be later described. Heretofore, the actuation of the crank handle raised and lowered the window through a pivoted arm, the outer end of which was slidably connected with the window, but this construction had several disadvantages as hereinbefore noted. The present invention overcomes these objectionable features by applying the raising and lowering force in a direct vertical line through an actuating member consisting of two pivotally connected rack sections 16 and 17.

The regulator proper is carried by the supporting panel 13, which in fact forms part of its assembly, and includes a stationary member 18 having four radial arms 19 whose outer ends are provided with tangs 20, which extend through apertures 21 in the mounting panel 13 to be struck over the outer face thereof and connect the member 18 to the inner side of the panel. The central portion of the member 18 is struck outwardly to provide a brake cup 22 whose bottom is apertured, as at 23, to substantially its entire inside diameter.

The outermost end of the cup 22 forms a bearing for a rotatable drive member 24, by being telescopically received within a central outstruck portion 25 thereof. The depth of the portion 25 of the drive member is less than the depth of the cup 22 and its outermost diameter is slightly less than the diameter at which the tangs 20 of the stationary member 18 enter the mounting panel 13. The bottom of the portion 25 closes the open bottom of the stationary cup 22 and carries a drive gear 26 which is meshed with the rack sections 16 and 17.

The drive gear 26 is preferably formed of two similar sections stamped from bendable metal, and is provided with side flanges 27, the gear sections and the flanges being secured together by rivets 28' or the like, which also pass through the bottom of the portion 25 to fix the gear to the drive member.

A pair of lugs 28 and 29 extend from the gear 26 and project into the cup 22 through its aperture 23 to provide means with which the ends of a brake spring 30, received within the cup 22, are engageable. The lugs 28 and 29 are of different lengths and are formed by being pressed inwardly from the gear sections. The short lug 28 is struck from the outermost gear section and

extends through aligned apertures in the innermost section, the adjacent flange 27, and the bottom of the cup 25, as clearly illustrated in Figures 8 and 10; and the lug 29 which is the longer of the two, is pressed from the innermost gear section and extends through similar apertures in the inner flange 27 and the bottom of the cup 25.

The brake spring 30, when free, is expanded to frictional engagement with the wall of the cup portion 22 to resist movement, and as the lugs of the drive gear engage its inturned ends, the drive member, and consequently the rack and window are held against movement, except when the spring is contracted, and this is only possible by the actuation of the crank handle 15.

Rotation of the handle 15 contracts the spring and imparts movement to the drive gear 26 through a brake spring engaging member 31, which is received within the cup 22 of the stationary member 18, and is confined between the bottom of the drive member cup portion 25 and the hub 32 of the handle. The outer face of the member 31 is provided with a recess 33 whose annular wall is serrated to form teeth 34, with which similar teeth 35, formed on the outer end of the handle hub 32, are engaged to non-rotatably connect the member 31 and the handle.

The inner side of the member 31 is cut away to provide a plurality of radial arms 38, two of which are received between the inturned ends of the spring 30, as best illustrated in Figures 4 and 9, so that rotation of the member 31 with the handle moves one of the radial arms into engagement with one inturned end of the spring, depending upon the direction of rotation of the handle. Further turning of the handle contracts the spring and engages the said radial arm with the adjacent lug, through the spring end, forming a direct drive connection between the handle and the drive member, to raise or lower the window. The radial arms 38 likewise provide guides which support the member 31 in its proper position within the coils of the spring 30.

The drive member, the stationary member 18, the spring 30, and the member 31, are maintained in proper assembled relation by a screw 39 which passes through aligned apertures in the gear sections, the bottom of the cup 25, and a rigidly mounted rack guide 40, to be later described, to have its inner end threaded in an aperture 41 formed in the member 31. The rack guide 40 is rigidly fixed to the panel 13, in a manner to be later described, so that the screw 39 passing through its aperture provides a bearing for the above assembly, and especially the drive gear 26.

The assembled elements are secured to the panel 13, by securing the stationary member 18 thereto as hereinbefore described, in axial alignment with an aperture 42, the surrounding portion of which is pressed outwardly to provide a bearing 43 in which the hub 32 of the handle is rotatably supported. In this manner, the projection of the handle from the panel is reduced to a minimum, and as the spline joint between the handle hub and the member 31 rigidly connects these elements, the bearing 43 cooperates with the rack guard 40 to support all of the rotatable parts. It will be noted also that the handle hub extends well into the interior of the brake mechanism.

The handle is removably secured in position by the engagement of a latch 45 carried thereby, behind an annular shoulder 44 formed at the inner end of the bearing 43. The latch 45 is

formed on one end of a pin 46 slidable in a transverse bore in the handle hub and normally yieldably urged to engagement behind the shoulder 44, by a spring 47 positioned in an axial aperture 5 48 in the handle hub, as best illustrated in Figure 3.

The pin 46 is also provided with a tapered recess 49 whose periphery, when the pin is in operative position, encompasses the end of a relatively small opening 50 extended through the handle in axial alignment with its hub. This permits the pin to be moved to disengage its latch from the shoulder by the mere insertion of a wire into the opening 50. As the wire is forced into the opening, its end engages the tapered recess 49 and thus moves the pin within the periphery of the opening 42 and permits the detachment of the handle. The side of the latch end 45 of the pin opposite the tapered recess 49, is preferably cut off at an angle, as at 51, to automatically move the pin into its aperture as the handle is engaged with the regulator structure, as will be readily apparent, rotation of the pin 46 in its aperture being prevented by the spring 47, one end of which enters a small opening at the apex of the tapered recess 49. The other end of the spring is directed at an angle, and lies within a longitudinal groove formed in the pin, to prevent displacement of the spring.

The weight of the window 12 is off-set by a counterbalance spring 53 received within the drive member 24 and coiled about the cup 22 of the stationary member 18. The inner end 54 of the spring is positioned between the outer wall of the cup 22 and a stop 55 struck from the stationary member 18, as best illustrated in Figures 3 and 4; and its outer free end 56 is preferably provided with a hook which is engaged with one edge 57 of a cut-out portion 58 in the flange of the drive member 24. The cut-out portion preferably forms a chord to the periphery of the drive member so that the end 56 of the spring does not extend beyond the diameter of the drive member.

The guard 40, besides providing one of the bearings for the rotatable elements, guides the movement of the rack sections 16 and 17, and maintains them meshed with the drive gear 26. It is preferably stamped from bendable metal, and consists of a central part 59, in which the opening for the screw 39 is formed, off-set from the major portion 60 a distance substantially equal to the overall thickness of the gear 26, and joined thereto at its top and bottom by arcuate walls 61, axial to the center of the opening in the part 59, see Figure 7. The walls 61 are diametrically opposite and the space between their ends at one side of the member 59 provides an opening through which the periphery of the drive gear extends.

The portion 60 is substantially bifurcated to form radial arms 63, the outer ends of which are directed at right angles and provide legs or spacers 64. Tangs 65 project from the legs 64 to be received in two of the openings 21, through which the tangs 20 of the member 18 pass, to be clinched over the panel 13 and rigidly mount the guard 40. The height of the legs or spacers 64 is such as to accommodate the assembled regulator structure positioned between its portion 60 and the panel as best illustrated in Figure 3.

A continuous laterally projected flange 66 is extended from the inner edges of the radial arms 63 and the portion therebetween to form a guide for the rack sections. The medial part of the flange 66 is positioned substantially vertical and

in line with the movement of the rack, and is so spaced from the central axis that movement of the rack sections away from the drive gear 26 is prevented.

It will be apparent that with the window in the position illustrated in Figure 1, actuation of the handle 15 to raise the same will cause the rack section 16 to move directly upward, and inasmuch as the sill of the window opening 11 would prevent continued upward movement of the section 16, it is deflected out of longitudinal alignment with the section 17 to accommodate further upward movement of the rack sections and the window. Deflection of the rack section 16 out of alignment with the other section 17 takes place when the last or lowermost tooth on the section 16 passes the gear 26, and is brought about by the reaction between the teeth of the rack section 16 and the gear 26, assisted by a spring 80 incorporated in the clamp structure provided for securing the rack sections to the channel 67 of the window and acting on the section 16 in a manner to be later described.

The clamp structure consists of two jaw sections 68 and 69, pivotally connected at their lower ends, as at 70. The jaw 68 is fixed to the lower rack section 17 by rivets 71 or the like, and provides a bearing for a stud 72, extended from the lower end of a member 73, which is secured to the adjacent end of the rack section 16. An offset in the jaw 68 and the upper end of the rack section 17 define a space in which the end of the member 73 is received, to maintain the stud 72 in its aperture, and thus pivotally connect the rack sections. The inner end of the stud 72 extends into the interior of the jaw section 68 and has an eccentrically positioned lug 74 extended therefrom for a purpose to be later described.

The upper ends of the jaw sections 68 and 69 are adapted to grip the window channel 67 upon threading of a wing nut 75 onto a screw 76 to draw the jaw sections together. The screw 76 is passed through aligned apertures in the jaw sections and its inner end has a head 77 formed thereon which is received in the space between the off-set portion of the jaw 68 and the rack 17. One side of the head 77 is cut away to provide a flat surface which engages the bottom 78 of the offset, to prevent rotation of the screw, as will be readily apparent. An expansive spring 79 positioned on the screw and confined between the inner faces of the jaws, normally yieldably urges them apart, to facilitate their disconnection from the window channel.

The eccentrically located lug 74 carried by the pivot stud 72 of the rack section 16 is engageable by the upper end of the spring 80 which is confined in the jaw 68 to normally yieldably urge the eccentric stud 74 and consequently the section 16 to the right, with respect to Figure 5. Movement of the section 16 however, is prevented by the medial portion of the guide flange 66 of the guard 40, as long as the section 16 is in mesh with the gear 26, but as soon as the last tooth on the section 16 leaves the gear 26, the position of the rack, with respect to the top of the medial portion of the flange 66, is such that the section 16 is free to be deflected out of longitudinal alignment with the section 17 as illustrated in Figure 5, and thus permit continued upward movement of the rack to completely close the window.

During opening of the window, the rack section 17 first carries the window approximately to half open position, and then as the rack sections ap-

proach their position illustrated in Figure 5, the section 16 is moved from a position substantially at right angles to the section 17 by engaging a spring member 81 extended from the upper end of the flange 66, so that upon continued downward movement, the rack section 16 is gradually guided into true vertical position, as will be readily apparent. The spring 81 provides a yieldable means for absorbing the slight shock incidental to the movement of the rack section 16 to its vertical position.

To provide a stop for the downward movement of the window 12, the upper end of the rack section 16 is left blank, so that as the handle is actuated to lower the window the engagement of the drive gear 26 with the blank upper end of the rack section 16 stops further movement thereof at exactly the desired point. In window regulators heretofore in use, considerably more expensive means were necessary to limit the downward movement of the window, as the provision of blank teeth on the segment of the raising and lowering arm was not feasible, due to the inherent multiplication of the slight inaccuracy which usually exists in the relationship between the drive gear and the segment. However, with the herein-described type of regulator, the actuating rack moves directly up and down and this objection is therefore not present.

Connection of the clamping device carried by the rack sections with the window channel 67 is extremely simple and does not involve anywhere near the amount of work heretofore necessary to connect the conventional window regulator with the window channel. In the present-day vehicle body construction, the finishing cloth linings 82 are usually provided with snappers 83 which are readily detachably connected with conventional clasp devices 84 fixed to the door frame in any suitable manner. It is, therefore, only necessary to remove a section of the cloth lining 82, reach upwardly, and thread the wing nut 75 onto or off of its screw 76 to secure or remove the clamp from the window channel. As the window is relatively rigid, it provides an efficient means for properly aligning the rack during the application of the clamp.

It will be noted that the width of the drive gear is greater than that of the rack sections which permits the axis of the regulator to be out of right angular alignment with the rack and thus accommodates the unparallel relation of the mounting panel and the window, as illustrated in Figures 2 and 3. This condition therefore does not in any way complicate the design, as the gear merely drives the rack on a slight helix.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art to which an invention of the character described appertains, that I provide a novel window regulator which has numerous advantages over such regulators heretofore in use, principal of which are the facts that the opening and closing force is applied in a direct vertical line and that the cost is cut considerably.

What I claim as my invention is:

1. A window regulator, comprising a rack having pivotally connected sections, means connecting the rack with a window, driving means for moving the rack to open and close the window, and means carried by one rack section and operable to move the other out of its path upon moving of the rack sections.

2. In a window regulator, a rack having pivot-

ally connected sections, means connecting the rack with a window, driving means for moving the rack to raise and lower the window, means carried by the rack normally yieldably urging one of the rack sections out of longitudinal alignment with the other, and means for maintaining said rack section in longitudinal alignment with the other during certain positions of the rack.

3. In a window regulator, a rack having pivotally connected sections, means connecting the rack with a window, driving means for moving the rack to raise and lower the window, means carried by the rack normally yieldably urging one of the rack sections out of engagement with the driving means, and means for maintaining said rack section in engagement with the driving means during certain positions of the rack.

4. In a window regulator, a rack having pivotally connected sections, means connecting the rack with a window, driving means for moving the rack to raise and lower the window, means carried by the rack yieldably urging one of the sections out of longitudinal alignment with the other, and means for maintaining said sections in alignment until the pivotal connection of the sections passes the driving means during movement of the rack in one direction, whereupon said yieldable means moves the sections out of alignment.

5. In a window regulator including a fixed member, a driving element rotatable with respect to said fixed member, brake means adapted to prevent rotation of the driving element, an operating member, means connecting the operating member with the driving element through the brake means to effect rotation of the driving element, an actuating member engageable with the driving element, and means connecting the actuating member with a window whereupon movement of the window is effected by the actuation of the operating member, a central boss being formed in the driving element and telescoped over the fixed member whereby the fixed member forms a journal for the driving element.

6. In combination with a vehicle door frame including a transverse member forming a mounting panel and a window movable in the frame, a window regulator adapted to raise and lower the window and having a plurality of rotatable elements, a member fixed to the mounting panel, and means securing the plurality of rotatable elements together and cooperating with said member to support the rotatable elements.

7. In combination with a vehicle door frame including a transverse member forming a mounting panel and a window movable in the frame, a window regulator adapted to raise and lower the window and including a brake mechanism having a brake cup and a drive gear, a member fixed to the mounting panel and overlying the brake cup, and means carried by said member and forming a bearing for the drive gear.

8. In combination with a window pane, a window regulator for opening and closing the same including a member connected with the window, drive means for moving the member including a drive gear engageable therewith and a brake mechanism for said drive gear including a stationary brake cup, and a member rotatable with the drive gear and having a part journaled on the exterior of the stationary brake cup to rotatably mount the drive gear.

9. In a window regulator a member adapted to be connected with a window to be opened and closed and means for moving said member to open and close the window comprising a drive gear

engageable with said member, means for actuating said drive gear including a brake mechanism having a stationary cylindrical housing, a member rotatable with the drive gear and journaled on the exterior of said cylindrical housing, and a counterbalance spring coiled about said housing and having one end connected with said member journaled on the housing.

10. In a window regulator a member adapted to be connected with a window to be opened and closed and means for moving said member to open and close the window comprising a drive gear engageable with said member, means for actuating said drive gear including a brake mechanism having a stationary cylindrical housing, a member rotatable with the drive gear journaled on the exterior of said cylindrical housing and having a laterally directed flange about its periphery, and a counterbalance spring coiled about said housing and confined within the flange on said member and having one end connected with said member journaled on the housing.

11. In a window regulator to raise and lower a window pane through a predetermined distance of travel, an actuator comprising two pivotally connected sections in non-overlapping end to end relation each having a length substantially one-half the distance of travel of the window pane, drive means operatively engaging the actuator sections, and means rigidly attached to the window pane and connected to the actuator adjacent the pivotal connection of its sections so that force may be directly transmitted to the window pane in either direction by either actuator section without the requirement for guide means above or beneath the engagement of the rack sections with the drive pinion.

12. In a window regulator to raise and lower a window pane, a rack comprising two sections pivotally connected for movement into and out of longitudinally aligned non-overlapping relation, means to attach said rack to the window pane adjacent the pivotal connection of the sections, a drive pinion to successively drive the rack sections, a member providing a journal bearing for the drive pinion and holding the rack in mesh with the pinion, and means on said member to guide the inactive section into alignment with the active section during actuation of the rack.

13. In a window regulator to raise and lower a window pane, a rack comprising two sections pivotally connected for movement into and out of longitudinally aligned non-overlapping relation, means to attach the rack to the window pane adjacent the pivotal connection of the sections, a drive pinion to successively drive the rack sections, a rack guide having a portion overlying the drive pinion to provide a bearing therefor and a part engaging the rack to hold the same in mesh with the pinion, means to deflect one of the rack sections out of alignment with the other as the pinion engages the other section, and means on the rack guide to return said deflected rack section into alignment with the other section upon opposite movement of the rack.

14. In a window regulator to raise and lower a window pane, a rack comprising two sections, means to connect the sections for movement into and out of longitudinally aligned non-overlapping relation, means to attach the rack adjacent the juncture between its sections to the window pane, so that motion can be positively transmitted to the window pane in either direction by either rack section, a pinion to successively drive the connected rack sections, said rack sections hav-

ing a combined length corresponding to the overall travel of the window pane, and means to deflect an inactive rack section out of the path of the active rack section immediately upon the engagement of the pinion with the active rack section.

15. In a window regulator to open and close a window pane, a rack comprising two sections pivotally connected for movement into and out of longitudinal alignment, a clamp rigidly secured to one section adjacent the pivotal connection and adapted to rigidly engage the window pane whereby said rack section is rigid with the window pane, a drive pinion to successively mesh with the rack sections and open and close the window pane, and means carried by the clamp to deflect the other rack section out of the path of the section attached to the window pane upon disengagement of the drive pinion from said rack section to be deflected.

16. In a window regulator to open and close a window pane, a rack comprising a lower and an upper section, means to pivotally connect the sections for movement into and out of longitudinal alignment, means to rigidly attach the lower section to the window pane directly adjacent said pivotal connection so that actuating force can be directly transmitted to the window pane by either rack section, a drive pinion to successively mesh with the rack sections, and means carried by the rack adjacent the pivotal connection of its sections to deflect the upper section out of the path of the lower section as the upper section is disengaged from the drive pinion.

17. In a window regulator to open and close a window pane, a rack comprising a lower and an upper section, means to pivotally connect the sections for movement into and out of longitudinal alignment, means to rigidly attach the lower section to the window pane directly adjacent said pivotal connection so that actuating force can be directly transmitted to the window pane by either rack section, a drive pinion to successively mesh with the rack sections, and means carried by the rack and assisted by the torque of the drive pinion to deflect the upper section out of the path of the lower section as the upper section is disengaged from the drive pinion.

18. In a window regulator to open and close a window, a rack comprising two sections pivotally connected for movement into and out of longitudinal alignment, a drive pinion to successively mesh with and drive said rack sections, means to attach the window to the rack adjacent the pivotal connection of its sections so that force may be directly transmitted to the window by either rack section, an abutment carried by one section and disposed eccentrically with respect to the axis of the pivotal connection of the sections, and yieldable means engaging said abutment to swing said rack section out of the path of the other upon disengagement of said swinging section from the drive pinion.

19. In a window regulator to open and close a window, a rack comprising two sections pivotally connected for movement into and out of longitudinal alignment, a drive pinion to successively mesh with and drive said rack sections, means to attach the window to the rack adjacent the pivotal connection of its sections so that force may be directly transmitted to the window by either rack section, an abutment carried by one section and disposed eccentrically with respect to the axis of the pivotal connection of the sections, yieldable means carried by the other rack

section and tending at all times to swing said first mentioned rack section out of longitudinal alignment with the second rack section, and means to hold said first rack section in longitudinal alignment with the second rack section as long as said first rack section is drivingly engaged by the pinion.

20. In a window regulator to open and close a window pane, a rack comprising two sections, a clamp carried by one section and adapted for attachment to the window pane to secure said rack section thereto, a pivot pin rigid with the

other rack section and connecting the rack sections for movement into and out of alignment with each other, said pivot pin being journaled in part of said clamp, an eccentrically disposed boss on said pivot pin, a spring carried by the clamp engaging said boss to yieldably urge said other rack section out of alignment with the first mentioned rack section at all times, and means to oppose said spring and hold the second mentioned rack section in mesh with the pinion for part of the rack movement.

STANLEY W. NICHOLSON.

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40	115
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70	145
75	150