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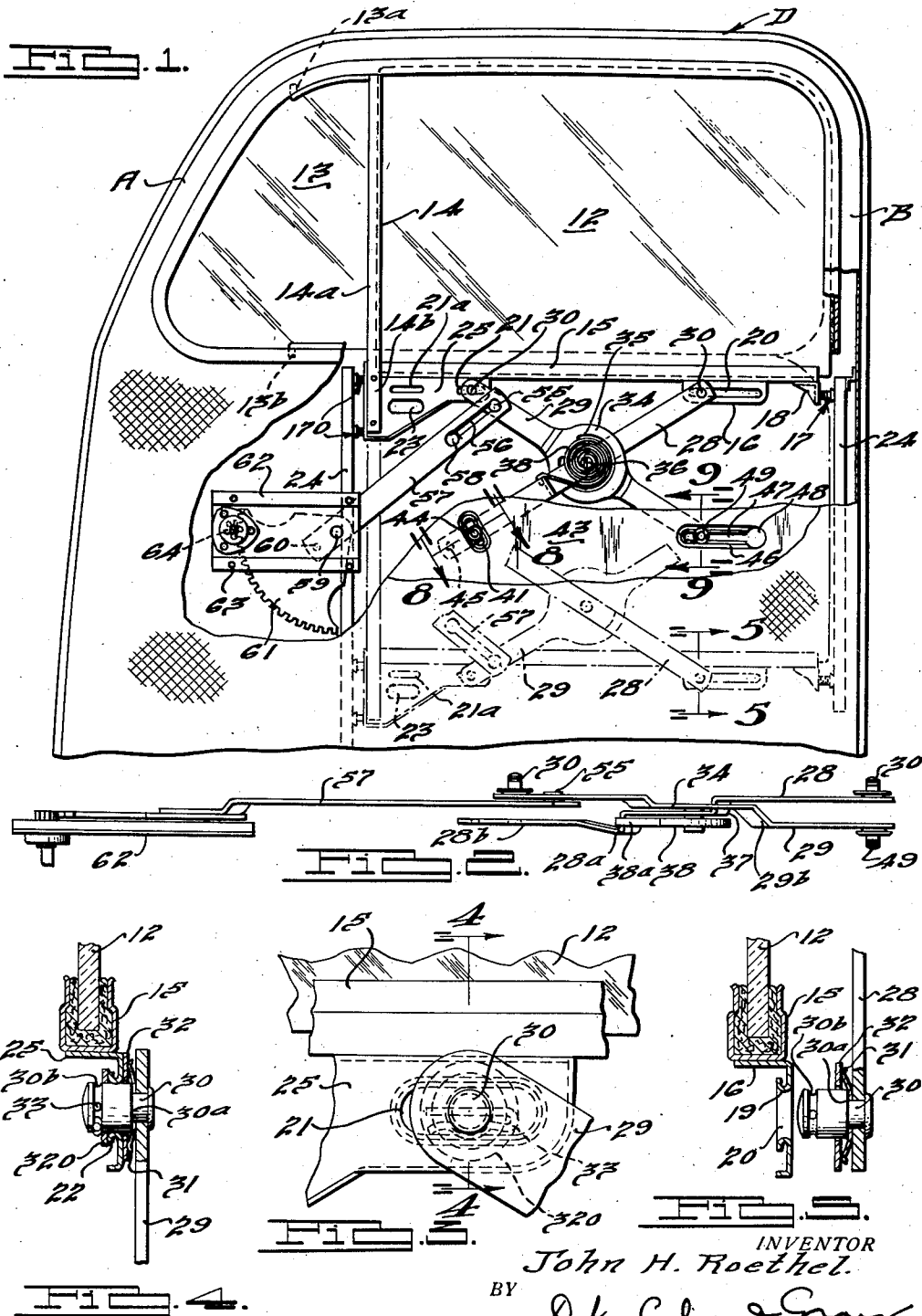
J. H. ROETHEL

2,168,242

WINDOW REGULATOR

Filed Aug. 27, 1938

2 Sheets-Sheet 1



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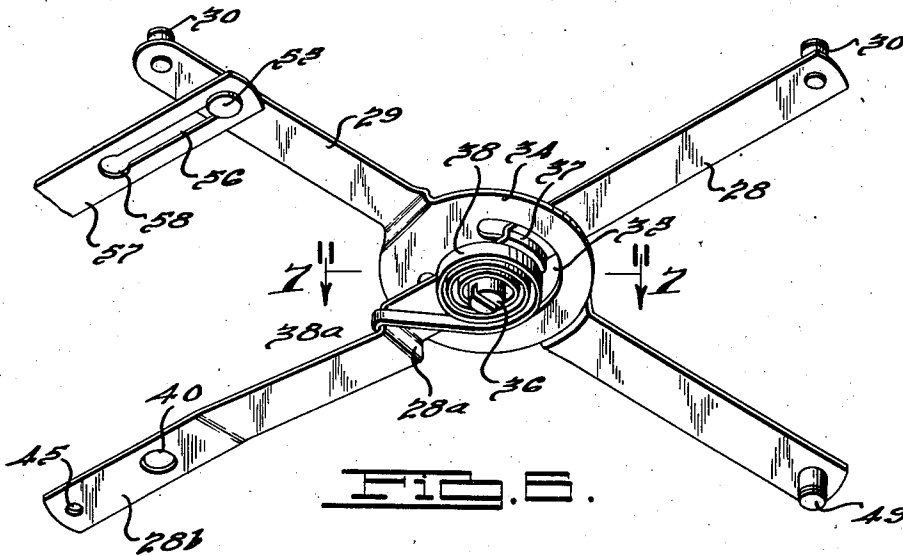
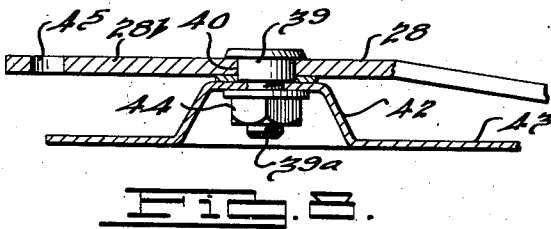
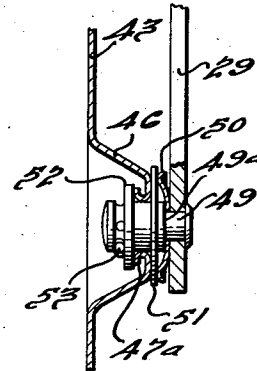
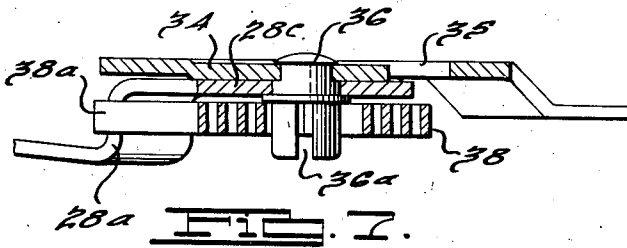
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2 Sheets-Sheet 2



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WINDOW REGULATOR

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Application August 27, 1938, Serial No. 227,219

10 Claims. (Cl. 268—126)

This invention relates to window regulators for raising and lowering the window glass panels of window structures, the invention being particularly adapted for application to windows of various types of vehicles especially motor vehicles or automobiles.

An object of the invention is to provide an improved window regulator, preferably of the intersecting cross arm type, in which the two crossed arms of the regulator, which are connected to the lower edge of the window glass, may be swingingly driven at a point remote from the arms to provide a relatively remote handle location without the necessity of interposed gearing, this being accomplished by means of a third swinging arm connected to one of the two interconnected regulator arms.

A further object of the invention is to provide an improved window regulator of the type having a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, such as the inner door or body panel, and in which driving means is provided for swinging the crossed arms in unison to raise and lower the window panel, such driving means being in the form of a third swinging arm mounted at one of its ends at a point laterally spaced from the crossed arms and having a connection adjacent its opposite outer end portion to the outer end portion of that one of the crossed arms which is nearer to the third driving arm than the outer end of the other crossed arm, the construction being such that the outer end of the third arm is movable through an arc whose center lies at all times outside the area traversed by the cross arm to which the third driving arm is connected.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is an inner fragmentary side elevation, partly broken away and partly in section, of an automobile door, such as a front door, embodying the invention.

Fig. 2 is a top plan view of the regulator mechanism shown in Fig. 1.

Fig. 3 is an enlarged detail view of the connection between the upper end of one of the cross arms and the lower edge of the window glass.

Fig. 4 is a section taken substantially through

lines 4—4 of Fig. 3 looking in the direction of the arrows.

Fig. 5 is an enlarged section taken substantially through lines 5—5 of Fig. 1 looking in the direction of the arrows, this view illustrating the method of assembly of the regulator arm with the bracket at the lower edge of the glass.

Fig. 6 is a fragmentary perspective view of the window regulator shown in Fig. 1.

Fig. 7 is an enlarged section taken substantially through lines 7—7 of Fig. 6 looking in the direction of the arrows.

Fig. 8 is an enlarged section taken substantially through lines 8—8 of Fig. 1 looking in the direction of the arrows.

Fig. 9 is an enlarged section taken substantially through lines 9—9 of Fig. 1 looking in the direction of the arrows.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings there are illustrated certain embodiments of the invention applied, by way of example, to a front and a rear automobile door. It will be understood, however, that the embodiments herein exemplified in part or in whole may be utilized in other relations and in other structures, and in particular that the window regulator mechanism may be employed for raising and lowering window glass panels generally in vehicle bodies or the like.

In Fig. 1 there is illustrated an automobile door D which may be a front door including a front sloping pillar A and a rear upright pillar B rounded or sloping contour at the upper end thereof. The upper portion of the door is provided with a main window opening adapted to be closed by means of a vertically slidable glass or other transparent panel 12 and a laterally swinging glass or other transparent panel 13. In the present instance the panel 13, which is of so-called wing type, is disposed at the forward part of the window opening and the panels 12 and 13 are preferably arranged so that when in fully closed positions they extend in the same or in substantially parallel planes and cooperate together to

close the main window opening. The wing type panel may be pivoted at points 13a and 13b so as to swing laterally about an up and down axis. Secured to the forward upright edge of the sliding glass 12 is a channel bar 14 which at its inner side has a forwardly projecting lip or overlap flange 14a against which the rear edge of the wing seats when the window is fully closed.

Secured to the lower edge of the glass panel 12 is a channel bar or glass retainer member 15 which carries intermediate its ends a depending horizontal guide or bracket member 16 to which the outer end of one of the regulator arms is slidably connected. The glass retainer member 15 which usually comprises a lined channel embracing the lower edge of the glass 12 (see Fig. 4) carries at its rear end a compression guide device indicated generally by the numeral 17 which is mounted upon an angle bracket 18 fixed, as by spot welding, to the bottom of the channel member 15. In the present instance the guide bracket 16 comprises an angle secured, as by spot welding, to the bottom of the channel 15 (see Fig. 5). The depending wall or flange of this guide bracket is formed with a longitudinal horizontal guide slot 20, the edges 19 of which are turned out or rolled.

The forward end of the channel or retainer member 15 carries a generally triangularly shaped bracket 25, the upper out-turned flange of which is secured, as by spot welding, to the bottom of the channel 15 (see Fig. 4). The depending wall or flange of the bracket 25 is formed with a relatively short longitudinal guide slot 21, the edges of which are out-turned or rolled at 22 as in the case of the guideway 20. The vertical wall of the bracket 25 also has a second slot 21a corresponding substantially to the slot 21 which may be provided, if desired, to permit one of the cross arms to be connected to the bracket 25 in the slot 21a instead of the slot 21, as hereinafter explained. Beneath the slot 21a is an enlarged elongated opening 23 which may be provided for the purpose of permitting the workman to insert the fingers therethrough so as to facilitate assembly of the regulator arm in the slot 21a.

The bracket 25 carries at its forward vertical flanged edge a pair of vertically spaced compression guide devices 170, each of which corresponds to the guide device 17. The spring pressed guide devices 17 and 170 engage the spaced parallel edges of a pair of channel guides 24 mounted within the window well of the door or body. These guide devices preferably slide along the edges of the channel guides and spring suspend the glass panel 12 within the window well.

In the illustrated embodiment the bar 14 is secured to the glass 12 and has a depending extension 14b fastened to the forward vertical edge of the bracket 25. It will be understood that the invention is equally applicable where the window is guided otherwise than herein shown. For example, it is equally applicable where the bar 14 is fixed within the window opening and forms a guide for the panel 12, and is also applicable where a single glass panel forms the entire closure for the window opening. It will also be understood that the term "glass" is used herein in a generic sense and is intended to comprehend any panel regardless of the material movable up and down to close a window opening.

The window regulator mechanism includes a pair of intersecting or cross arms 28 and 29. The outer end of the arm 28, see Fig. 5, is provided preferably with a projecting stud 30 having

its reduced end passing through the end of the arm and riveted thereto. The stud 30 carries between the shoulder 30a thereof and the adjacent face of the arm 28 a concave spring washer 31, this washer being mounted on the reduced end of the stud and being clamped between the shoulder 30a and the arm 28. Loosely mounted upon the enlarged head portion of the stud 30 is a flat washer 32 which extends across the guide slot 20 and slidably engages the face of the vertical flange of the bracket 16. The outer end of the stud 30 has an annular groove 30b with a hole 33 extending transversely therethrough. The regulator arm 29 is connected at its outer end to the guide bracket 25 within either the slot 21 or the slot 21a in a manner similar to the connection between the arm 28 and the guide bracket 16, this construction being shown in Figs. 4 and 5. The cross arm 29 also carries at its outer end a stud 30, a spring washer 31 and a flat washer 32, as above described. It will be seen that in each instance (see Figs. 4 and 5) the enlarged cylindrical portion of each stud 30 has a sliding fit against the curled or rolled edges 19 or 22 of the slots 20 or 21. After the stud 30 is passed through the guide slot 20 or 21 a flat washer 320 is placed over the end of the stud, as shown in Fig. 4, and the spring washer 31 compressed sufficiently to permit a cotter pin 33 to be applied to the stud. This pin preferably has a straight shank passing through the hole 33 and a spring shank with a grooved portion adapted to fit into the annular groove 30b, the latter portion of the cotter pin being sprung or tensioned in order to clamp it upon the end of the stud, as shown in Fig. 3.

The arm 29 intermediate its ends has a widened or enlarged portion 34 formed with an arcuate slot 35. The arm 28 is pivoted through the medium of a stud 36 to the portion 34 at the center of curvature of the slot 35 and is formed with an offset 37 extending through the slot 35, thereby positioning the inner end portion of the arm 28 at one face of the arm 29 and the outer portion thereof at the opposite face. The offset 37 may be formed on a radius so as to have a transverse curvature corresponding to or approximating to curvature of the slot 35. When the arms swing in raising and lowering the window glass the offset 37 will travel within the slot 35, this slot being preferably of sufficient length to prevent engagement of the offset with either end of the slot in the extreme positions of the arms during normal operation so as to prevent chatter or vibratory noises when the regulator is idle in either of its extreme operating positions, these positions being shown in full and dotted lines in Fig. 1. The outer end of the arm 29 is offset so as to align the stud 30 thereon with the stud 30 at the outer end of the arm 28, see Fig. 2. The inner or lower end of the arm 28 (considered in the fully raised position of the regulator) is offset inwardly at 28a to provide both a mounting for the counterbalancing spring and also to bring the arm into position for securement to the mounting panel or plate for the cross arms. Correspondingly the inner or lower end of the arm 29 is offset at 29b so that it may also be connected to the mounting panel.

In the present instance the pivot stud 36 has a reduced end extending through a hole in the widened portion or boss 34 and riveted thereto, see Fig. 7. The stud, therefore, is fixed to the arm 28 and the cylindrical portion thereof beyond the portion 34 provides a bearing or journal

for the portion 28c of the arm 28. The enlarged cylindrical end of the pivot stud 36 is provided with a kerf or slot 36a within which is anchored the inner end of a spiral counter-balancing spring 38. The outer end 38a of this spring is bent to provide a hook which is hooked over the upper edge of the offset 28a, thereby anchoring the spring to the arm 28.

In the embodiment of Fig. 1 the swinging arm 28 is pivoted at its inner or lower end to swing about a set pivotal axis. In the present instance, to permit interchangeability of the cross arm unit as hereinafter explained, the arm 28 has in effect an extension 28b and adjacent this end of the arm the latter is provided with a hole 40 for the reception of a headed bolt 39, the reduced shank of the bolt 39a having threads formed thereon. The threaded shank 39a of this bolt passes through an angular or arcuate adjusting slot 41 formed in the flat face of an embossment 42 pressed out of the inner door or mounting panel for the window regulator. The panel 43 may be any suitable type of fixed support for the window regulator, in ordinary practice this comprising a pressed metal sheet or panel extending across the inner side of the door or body and secured to the upright pillars or supports. The pivot stud or bolt 39 may be secured in fixed position within the slot 41 by means of a nut 44. By loosening the nut the pivot stud or bolt 39 may be moved or adjusted within the slot which preferably has its center of curvature at the pivot stud 36. Hence, the set angular position of the arm 28 may be varied with respect to the arm 29 and without changing the position of the latter simply by adjusting the bolt 39 within the curved slot 41. Thus, regardless of the extension 28b the length of the arm 28 is measured from the stud 39 or hole 40 therefor, and in the present instance the cross arms are of equal lengths so as to slide the window glass in a true straight vertical direction. In the regulator of Fig. 1, therefore, the extension 28b, which has a smaller hole 45 at the end thereof, is unused and may be cut off if desired.

The inner or lower end of the cross arm 29, viewed from the fully raised position of the window regulator, is slidingly connected to the inner door or body panel 43, this construction being particularly illustrated in Fig. 9. As shown in this figure, there is riveted to the lower end of the arm 29 a stud 49 which carries an annular spring washer 50 clamped between the shoulder 49a of the stud and the shank of the arm 29. Loosely mounted on the enlarged cylindrical end 55 of the stud is a flat washer 51. This end of the stud extends transversely through an elongated horizontal guide slot 47 formed in an embossed portion 46 of the metal panel 43, the guide slot terminating in an enlarged aperture 48 and the longitudinal parallel edges of the slot being curled or turned in at 47a to provide a sliding fit for the cylindrical shank of the stud 49. The washer 51 engages across one face of the guide slot 47 and a washer 52 on the stud engages across the turned-in edges of the slot. The washer 52 is held on the stud by means of a cotter pin 53 and in the assembled position of Fig. 9 the spring washer 50 is constantly under tension. The construction as shown in Fig. 9 is preferably substantially identical with that shown in Fig. 4.

As illustrated in the embodiment of Fig. 1 the swinging arm 29 of the window regulator is in this instance driven through the medium of a third arm 57. This latter arm at its outer end is provided with an elongated slot 56 terminating in

an enlarged aperture or opening 58. Riveted to the outer end of the arm 29 at a point closely adjacent to the stud 30 is a headed stud 55, the shank of which extends through a hole 54 (Fig. 10) in the arm. The stud 55 extends through and has a sliding fit in the slot 56 and the head of the stud, as shown in Fig. 6, interlocks the stud in the slot against withdrawal during normal operation. Preferably spring anti-rattle washers (not shown) are mounted on the shank of the stud to extend across opposite faces of the slot 56 to prevent chattering or vibratory noises. The diameter of the aperture 58 is such as to permit the head of the stud 55 to be inserted through the aperture, upon installation of the parts, to permit the shank of the stud to ride into the slot 56. The inner end of the driving arm 57 is provided with two spaced apertures, one for the reception of a pivot stud or rivet 59 by which the arm is pivotally mounted. The other and smaller aperture receives a rivet 60 by which the arm 57 is riveted to a gear sector 61. The gear sector and arm are secured together by the studs 59 and 60 and are mounted to rotate about the axis of the stud 59 upon a pressed metal mounting plate 62 having screw bosses 63 by which the mounting plate is secured to the inner door or body panel 43. The gear segment 61 is driven by a pinion 64 on a handle shaft which includes a conventional friction clutch and a crank handle at the outer end thereof.

The regulator in the embodiment of Fig. 1 is preferably assembled with the window glass 12 when the latter is in its lowered position shown in dotted lines in Fig. 1. The cross arm unit in this embodiment is installed upon the mounting panel 43, the stud 49 being installed in the guide slot 47 as above described and the lower end of the arm 28 being assembled by passing the bolt 39 through the hole 40 in the arm and the slot 41 in the mounting panel, the nut 44 at this time being loosely applied to the threaded shank 39a. The mounting plate 62 is also mounted in position and the third arm 57 connected to the arm 29 by passing the head of the stud 55 through aperture 58 and thence into the guide slot 56. The regulator arms are then cranked down to the dotted line position of Fig. 1, the arms 28 and 29 being sprung out to the position shown in Fig. 5 to permit the studs 30 to be transversely aligned with the slots 20 and 21. When so aligned the arms are released and the studs 30, by virtue of the spring of the arms, pass through the guide slots 20 and 21 to the position of Fig. 4. The washers 320 and cotter pins 33 are then installed on the ends of the studs, thereby interlocking the parts together as shown in Fig. 4.

The window regulator of Fig. 1 is shown in connection with the front door of a typical coach or two-door type automobile body having a relatively wide window. Where this regulator is used, for example, with a typical four-door sedan in which usually a narrower window opening is provided the glass retainer channel 15 is shortened to correspond to the narrower width of the glass panel 12 and the stud 30 on the arm 29 is connected within the slot 21a. The opening 23 therebelow permits insertion of the fingers to facilitate installation of the washer 320 and cotter pin 33.

From the foregoing it will be seen that the cross arm unit or parts including the arms 28 and 29 may be used interchangeably with substantially all windows not only of one but of dif-

ferent types of automobile bodies without necessitating the manufacture of a different size cross arm assembly or unit for each different window. For example, the cross arm unit of Figs. 1 and 6, where shown in connection with a right front door, may be interchangeably used without any reversal of the arms in the left rear door or rear window of the body. Moreover, all of the parts, without change, of the cross arm unit of Fig. 1 may be used in the right hand rear door or rear window simply by reversely assembling the arms 28 and 29.

In normal operation of the window regulator it will be understood that by turning the gear 61 to swing the arm 57 or by turning the gear 68 to swing the arm 28 the cross arms 28 and 29 will be swung downwardly from the full line positions of Figs. 1 and 10 to the dotted line position of Fig. 1 and the dotted line position "X" of Fig. 10, thereby lowering the window glass, the arms passing each other during this operation. In the operation of the regulator of Fig. 1 it will be noted that the power is applied to the cross arm 29 at a point 55 which is fixed in the length of the arm and which is located closely adjacent to the stud 30. During the downward swinging movement of the arm 57 to its half-way or horizontal position the point 55 moving in the slot 56 approaches the pivot 59 of the gear 61, and as a consequence there is produced a progressive increase in the power of the regulator at the upper limit of movement of the window glass. In like manner, there is a progressive increase in the lifting power of the regulator near the opposite limit of the window glass when the glass is raised from its dotted line position in Fig. 1.

It will be noted that the pivot 59 of the driving arm 57 is at a point laterally spaced from the crossed arms 28 and 29 and the outer end of the arm 57 moves through an arc whose center lies at all times outside the area traversed by the connected cross arm 29. Hence, it is possible to provide a desirable remote handle location and an effective drive without affecting the cross arms and with the elimination of intervening spacer gears.

Installation of the cross arms with the window glass is materially simplified by virtue of the arrangement of the spring 38 connecting the arms together which tends to urge the arms and hold them in predetermined angular positions. Furthermore, by connecting the arms 28 and 29 together through the counterbalancing spring 38 a relatively lighter and less expensive spring may be utilized than heretofore in window regulators of the two arm type, and easier operation of the window is achieved. Economies in production and in time and labor necessary for installation are possible by virtue of the improved construction and mounting of the counterbalancing spring and associated parts. It will also be seen that the sliding glass 12 or 120 is supported at two relatively widely spaced points 30 and that in operation of the window regulator the cross arms 28 and 29 carry the window glass downwardly and upwards in substantially a straight line direction, thus avoiding any material tilting of the glass in its plane or shifting of the glass endwise in its plane. It will also be particularly noted that by virtue of the present invention it is possible to install the regulator arms by assembling the arms and glass retainer member 15 at substantially one limit of the operative range of travel of the window glass and regulator. In-

stallation may be accomplished at the upper or lower limit of travel of the glass and of the regulator in simple and quick manner and hence it is not necessary, in accomplishing the installation, to shift either the glass or the arms beyond their normal range of travel as heretofore.

I claim:

1. A window regulator comprising a pair of intersecting crossed arms pivoted together at the locality of their intersection, the inner end of one arm having a set pivotal connection with a support in a window well and the outer end thereof having a sliding connection in a longitudinal direction with the lower edge of a window glass, the inner end of the other crossed arm having a corresponding sliding connection with a support in the window well and its outer end having a connection with the lower edge of said glass, and a third swinging arm for swinging said crossed arms in unison and adapted to pass between the crossed arms during the operation thereof, said third swinging arm being pivotally connected adjacent one end to said last named crossed arm at or near its outer end by means movable longitudinally of the third arm during operation of the regulator, the sliding connection of the inner end of said crossed arm permitting bodily displacement of the pivot of the crossed arms away from the end of the third arm as the latter passes between the crossed arms.

2. A window regulator comprising a pair of swinging crossed arms adapted to be connected at their outer corresponding ends to a window glass and pivotally connected together at the locality of their crossing to permit the arms to swing one past the other upon raising and lowering the window glass, the inner end of one crossed arm having a longitudinal substantially horizontal sliding connection with a support, a third swinging arm extending in crossed relation to said last named crossed arm and having its outer end pivotally connected to the outer end of said last named crossed arm at a point movable longitudinally of the third arm as the said inner end of said last named crossed arm slides longitudinally on its support during operation of the regulator.

3. A window regulator comprising a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, and driving means for swinging said crossed arms to raise and lower the window panel comprising a third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from the crossed arms and having a pin and slot connection adjacent its opposite outer end to the outer end of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, the outer end of said third arm and the adjacent end of the connected cross arm being adapted to move downwardly and upwardly in unison, said outer end of the third arm being movable through an arc whose center lies at all times outside the area traversed by said connected cross arm.

4. A window regulator comprising a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, and driving means for swinging said crossed arms to raise and lower the window panel including a

third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from the crossed arms and having a pin and slot connection adjacent its opposite outer end to the outer end of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, the outer end of said third arm and the adjacent end of the connected cross arm being adapted to move downwardly and upwardly in unison and to overlap and pass in such movements the adjacent inner end of the other crossed arm, said outer end of the third arm being adapted to move through an arc whose center lies at all times outside the area traversed by said connected cross arm.

5. A window regulator comprising a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, and driving means for swinging said crossed arms to raise and lower the window panel including a third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from the crossed arms and having a connection adjacent its opposite outer end portion to the outer end portion of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, the outer end of said third arm and the adjacent end of the connected cross arm being adapted to move downwardly and upwardly in unison, said outer end of the third arm being movable through an arc whose center lies at all times outside the area traversed by said connected cross arm.

6. A window regulator comprising a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, and driving means for swinging said crossed arms to raise and lower the window panel comprising a third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from both of the crossed arms and having a sliding pivotal connection adjacent its opposite end to the outer end of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, said sliding pivotal connection between the third arm and crossed arm comprising a device on one arm movable longitudinally of the other arm during operation of the regulator.

7. A window regulator comprising a pair of pivotally connected crossed arms adapted to be connected at their corresponding outer ends to the lower edge of a window panel and at their opposite corresponding ends to supporting means, and driving means for swinging said crossed arms to raise and lower the window panel comprising a third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from both of the crossed arms and having a sliding pivotal connection adjacent its opposite end to the outer

end of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, said sliding pivotal connection between the third arm and crossed arm comprising a pin and slot connection.

8. A window regulator comprising a pair of swinging crossed arms adapted to be connected at their outer corresponding ends to a window panel and pivotally connected together at the locality of their crossing to permit the arms to swing one past the other upon raising and lowering the window panel, the inner end of one crossed arm having a longitudinal substantially horizontal sliding connection with a support, a third swinging arm extending in crossed relation to said last named crossed arm and having its outer end pivotally connected to the outer end of said last named crossed arm at a point movable longitudinally of one of the arms as the said inner end of said last named crossed arm slides longitudinally on its support during operation of the regulator.

9. A window regulator comprising a pair of swinging crossed arms adapted to be connected at their outer corresponding ends to a window panel and pivotally connected together at the locality of their crossing to permit the arms to swing one past the other upon raising and lowering the window panel, the inner end of one crossed arm having a longitudinal substantially horizontal sliding connection with a support, a third swinging arm adapted to be pivotally mounted at one end to supporting means and having its opposite end pivotally connected to the outer end of said last named crossed arm, the adjacent outer connected ends of said third arm and crossed arm being adapted to move downwardly and upwardly in unison, said pivotal mounting of the third arm lying at all times outside the area traversed by the said cross arm which is connected to the third arm.

10. A window regulator comprising a pair of swinging crossed arms adapted to be connected at their outer corresponding ends to a window panel and pivotally connected together at the locality of their crossing to permit the arms to swing one past the other upon raising and lowering the window panel, the inner end of one crossed arm having a longitudinal substantially horizontal sliding connection with a support and the outer end of the other crossed arm having a corresponding sliding connection with the window panel, and driving means for swinging said crossed arms to raise and lower the window panel including a third arm mounted to have a swinging movement for operating said crossed arms in unison, said third arm being mounted at one of its ends at a point laterally spaced from the crossed arms and having a connection adjacent its opposite outer end portion to the outer end portion of one of the crossed arms which is nearer to said third arm than the outer end of the other crossed arm, the outer end of said third arm and the adjacent end of the connected cross arm being adapted to move downwardly and upwardly in unison, said outer end of the third arm being movable through an arc whose center lies at all times outside the area traversed by said connected cross arm.

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