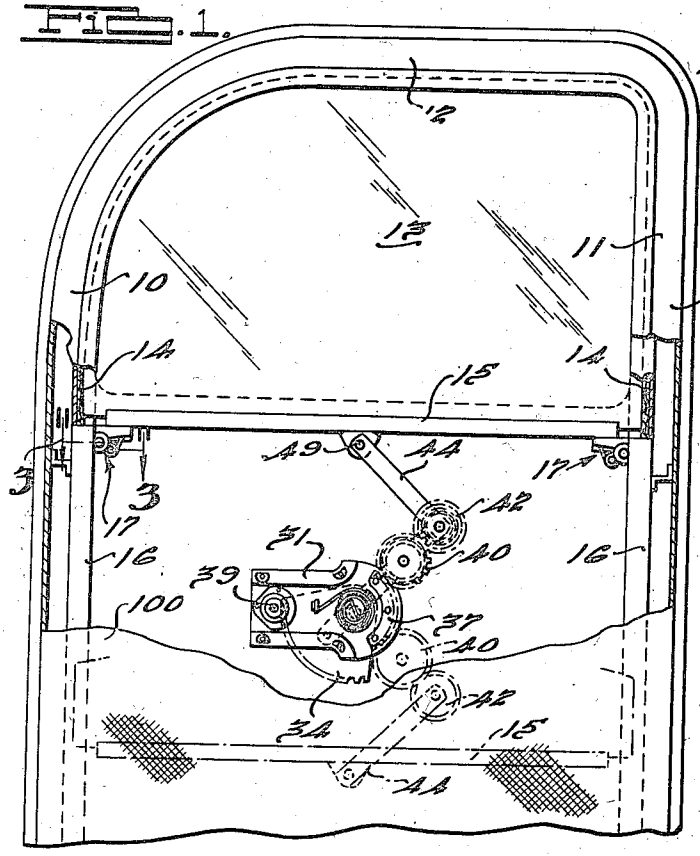
May 11, 1943. J. H. ROETHEL 2,319,088

WINDOW REGULATOR

Filed June 12, 1939 2 Sheets-Sheet 1

FIG. 1.



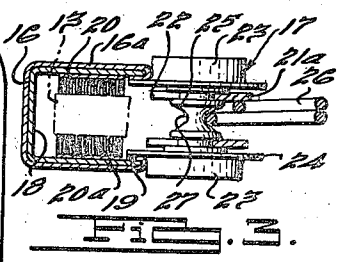


FIG. 3.

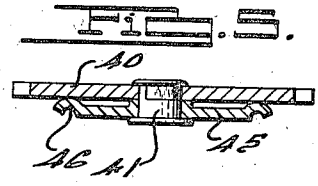


FIG. 5.

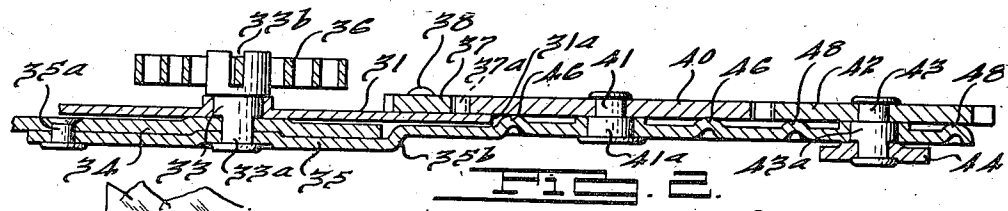


FIG. 2.

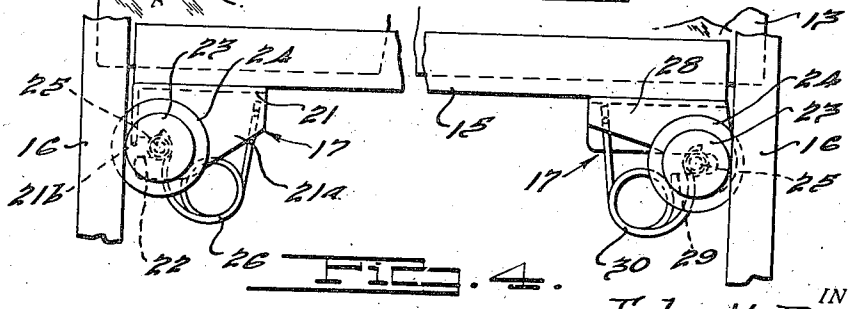


FIG. 4.

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Filed June 12, 1939 2 Sheets-Sheet 2

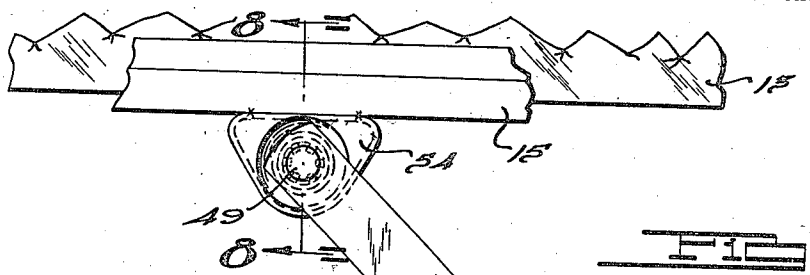

Fig. 10.

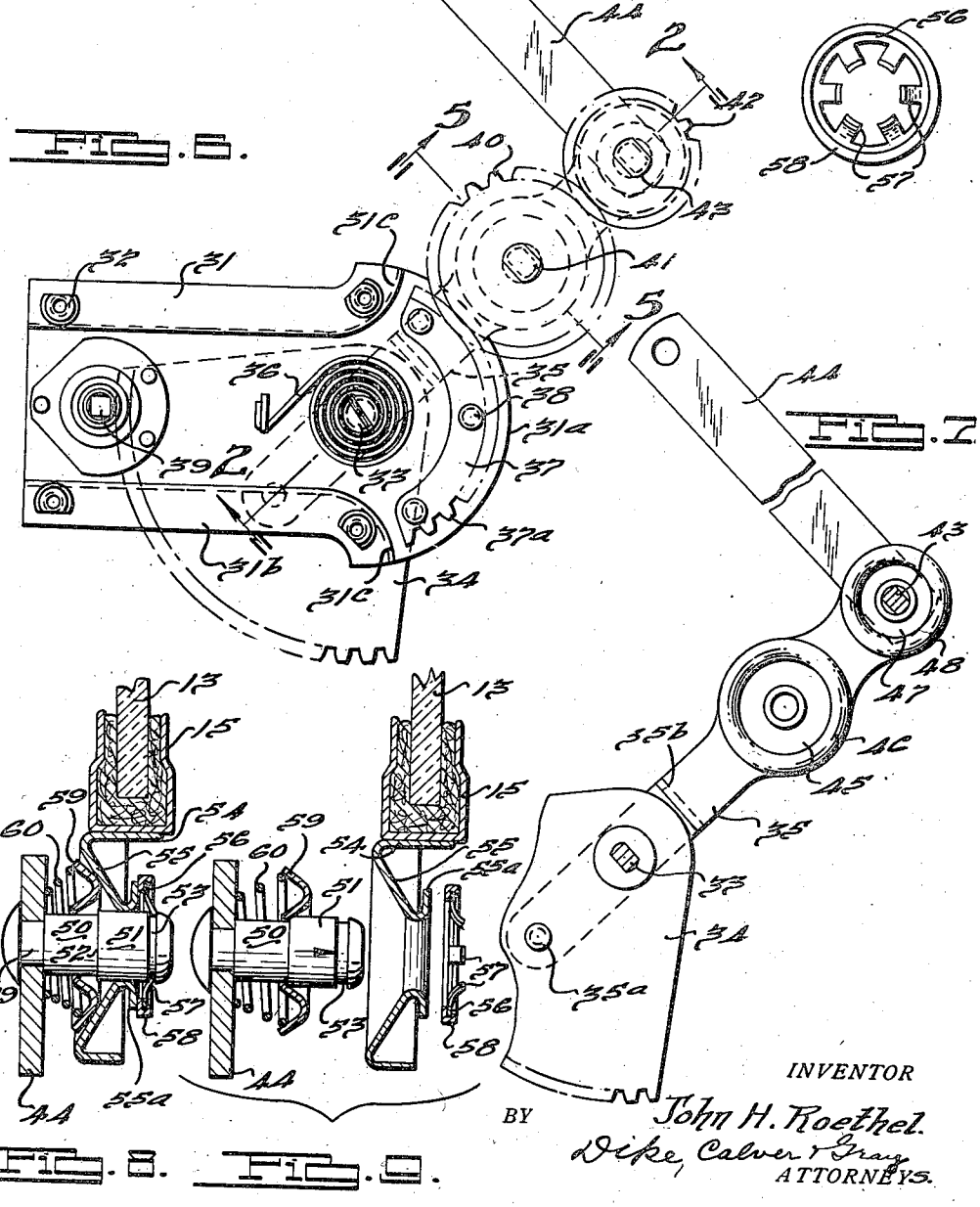

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

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WINDOW REGULATOR

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7 Claims. (Cl. 268—126)

This invention relates to window regulators for raising and lowering the glass or transparent panels of windows, particularly windows of automobiles. The invention is especially useful as applied to the window structure for a vehicle body having a window frame provided with a window well formed between inner and outer body or door panels within which the window regulator of the present invention is installed.

An object of the invention is to provide an improved window regulator including a swinging arm adapted to be connected to the lower edge of the window panel and improved mechanism of compact, durable and efficient construction for swinging the arm to raise and lower the panel in substantially a straight line path without material cocking or tilting of the panel by moving in substantially a straight line path the pivotal point of connection between the arm and the window panel.

A further object of the invention is to provide an improved window regulator having a swinging driving arm and gear mechanism mounted on the driving arm for operating a second arm adapted to be connected to a window panel for raising and lowering the same.

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 embodying the invention.

Fig. 2 is an enlarged fragmentary section taken substantially through lines 2—2 of Fig. 6 looking in the direction of the arrows.

Fig. 3 is an enlarged fragmentary section taken substantially through lines 3—3 of Fig. 1 looking in the direction of the arrows.

Fig. 4 is an enlarged fragmentary side view illustrating the guiding means.

Fig. 5 is an enlarged section taken substantially through lines 5—5 of Fig. 6 looking in the direction of the arrows.

Fig. 6 is a side view of the window regulator.

Fig. 7 is a fragmentary side view of the control arms of the window regulator, some of the gearing being removed.

Fig. 8 is an enlarged section taken substantially through lines 8—8 of Fig. 6 looking in the direction of the arrows.

Fig. 9 is a view similar to Fig. 8 illustrating the parts preparatory to the assembly thereof,

Fig. 10 is a face view of the snap-on washer.

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 of limitation, and it is not intended to limit the invention claimed herein beyond the requirements of the prior art.

In the drawings there is illustrated one embodiment of the invention applied, by way of example, to an automobile door. It will be understood, however, that the embodiment herein exemplified in part or in whole may be utilized in other relations and in other structures, and in particular that the window regulator and the guiding means for the window panel may be used conjointly or independently of each other generally in vehicle bodies or the like in connection with window panels which are adapted to be raised and lowered.

In Fig. 1 there is illustrated an automobile door A including upright side pillars 10 and 11 joined by a header 12, thus providing a window frame in the form of a closed figure defining a main window opening adapted to be closed by means of a vertically slidable glass or other transparent panel 13. The window framing may be provided with grooves or glass runway channels 14, terminating at the bottom of the window opening, and designed to receive the edges of the panel 13.

Secured to the lower edge of the glass panel 13 is a channel bar or glass retainer member 15 to which the window regulator is adapted to be connected as hereinafter described. The window panel 13 is guided within the window well through the medium of spaced upright channel guides 16 fixed in any suitable manner within the window well, the channel member 15 carrying guide devices at opposite ends thereof, generally indicated by the numeral 17, which travel upon the fixed guides 16.

As shown in Fig. 3 each guide 16 is in the form of a channel having a base and inwardly extending parallel flanges 16a. Within each guide 16 is mounted a channel strip 18 which is held therein by the inturned flanges 19 at the outer edges of the flanges 16a. The insert channel strip 18 may be installed by telescoping it through the end of the channel 16 after the

flanges 19 have been formed or the flanges 19 may be crimped over the edges of the channel strip 18 after fitting the same within the channel guide 16. The insert channel strip 18 has secured to the inner opposed faces thereof strips 20 which preferably carry a fibrous pile fabric 20a adapted to engage and cushion the side edges of the glass panel 13.

The guide devices or roller guide unit 17 at one end, such as the forward end, of the window panel comprises an inverted channel bracket 21 provided with downturned parallel side flanges 21a, the upper central web of the bracket being preferably spot welded to the bottom of the channel 15. The side flanges 21a are provided with parallel horizontal slots 22 closed at the rear ends thereof and opening at the forward edges of the flanges 21a. The bracket 21 carries a roller device which comprises a pair of laterally spaced annular roller elements 23 engageable with the parallel tracks or rails formed by the turned edges 19 of the channel guide 16. Adjacent each roller element 23 is an annular flange 24 which projects into the channel guide and overlaps the inner edge portions of the flanges 16a. The roller elements 23 may be integrally or otherwise connected by a shaft portion 25. The shaft 25 is engaged by one end of a tension spring 26 which may comprise a length of spring wire having one or more intermediate coils, the opposite end of the spring being hooked through an aperture in one of the flanges 21a of the bracket. The shaft 25 is turned down centrally at 27 to a relatively narrow diameter at which point the end of the spring 26 engages, the annular parts of the shaft at opposite sides of the constricted portion 27 being of sufficient diameter to overlap the edges of the slots 22.

The guide device or roller guide unit 17 at the opposite end, such as the rear end, of the bottom edge of the window panel may comprise a bracket 28 also in the form of an inverted channel piece having its central web spot welded to the bottom of the channel member 15. This bracket 28 has downturned spaced parallel flanges similar to the bracket 21 and these flanges are provided with parallel horizontal slots 29 reversed with respect to the slots 22 so that the inner ends of the slots are open and the outer ends are closed. The roller unit carried by the bracket 28 may be the same as the roller unit carried by the bracket 21, the flanged rollers 23, 24 in like manner being carried by a shaft 25 slidable within the slots 29, the central reduced portion 27 of the shaft 25 in this instance being engaged by one end of a tension spring 30. Although the spring 30 is similar to the spring 26 it is preferred that the spring 30 be formed of heavier spring wire so as to exert greater force or effort upon the shaft 25 of the roller unit carried by the bracket 28. In other words, as herein exemplified by way of example, the effort exerted by the spring 30 is greater than the effort exerted by the spring 26. Hence, during normal operation as the window panel 13 is raised and lowered the spring 30 will hold the window over so that the shaft 25 at the left in Fig. 4 will be forced back against the action of spring 26 to the closed ends of the slots 22. The spring 30, after assembling the window panel, is at all times under tension and the shaft 25 at the right in Fig. 4 will normally occupy an intermediate position in the slots 29 as shown in said figure. Thus, since the effort of spring 30 will overcome the effort of spring 26 the roller engaged by the latter spring will normally operate as a solid unsprung roller. However, in the event of unusual pressure of the right hand roller 24 in Fig. 4 against the channel guide 16, such as by reason of a longitudinal force against the window glass or the cramping action of a window regulator, which will result in forcing the shaft 25 back against the spring 30, the opposite roller will not become disconnected from its channel guide 16 or fail to track thereupon since in such instance the spring 26 will move the roller shaft within the slots 22 and yieldingly hold the roller at all times in engagement with the tracks of the channel guide. Normally, however, one of the rollers, which is engaged by the lighter spring, will travel solidly against the channel guide and thus maintain one upright edge of the window glass in predetermined alinement or position. It will be seen in Fig. 4 that an abutment 21b projects into the open end of the slots 22 so as to limit the travel of the roller shaft within these slots. If desired a similar stop at the extreme open ends of the slots 29 may be provided to limit extreme retraction of the opposite roller shaft.

In the present instance the window regulator for raising and lowering the window panel 13 is of the single arm center point lift type comprising a suitable pressed metal mounting plate 31 having tapped screw bosses 32 by which it may be secured to the inner door or body panel 100 in the usual manner. Journalled in a bearing in the plate 31 is a pivot shoulder stud 33 which has a flat sided extension 33a rigidly fixed in an aperture in a gear segment 34. Mounted upon the face of the gear 34 and riveted thereto through the stud portion 33a and a rivet 35a is a projecting arm 35, this arm swinging with the gear as the latter rotates. One end of the stud 33 is formed with a slot or kerf 33b to receive one end of a spiral spring 36, the opposite end of the spring being connected to the mounting plate 31.

Riveted at 38 to the mounting plate 31 is an arcuate strip gear 37 having marginal gear teeth 37a which extend along but spaced rearwardly from the correspondingly curved arcuate edge 31a of the plate. The gear 34 may be driven in conventional manner through a drive pinion secured on a handle shaft 39 which preferably includes in its length a friction clutch of any conventional type.

Mounted upon the outer end portion of the control arm 35 is a gear 40, this gear being fixed by riveting to a pivot shoulder stud 41, the stud having an annular portion 41a journalled within a bearing in the arm 35. The gear 40 has peripheral gear teeth meshing with the teeth 37a of the strip gear 37 and also meshing with the teeth of a gear 42 of smaller diameter which is mounted upon the outer end of the arm 35 through the medium of a pivot shoulder stud 43. The stud 43 is fixed to the gear 42 and has an annular portion 43a journalled within a bearing in the arm 35. At the opposite face of the arm 35 there is secured by riveting to the stud 43 one end of a swinging arm 44. This arm normally, when the window is fully raised, extends at an angle, such as an angle of substantially 90°, to the arm 35 and is connected at its outer end to a depending bracket, as hereinafter described, secured to the channel 15 at substantially the center point of the window 13.

It will be seen that the gearing 37, 40 and 42 extends in the same plane and that the meshing gears 40 and 42 lie at one face of the arm 35. This arm has an offset 35b adapted to follow the

curvature of the edge 31*a* during operation, said edge preferably having its center of curvature at the pivot 33. The offset 35*b* causes the outer end of the arm to extend substantially in the plane of the gear 34. It is also preferred that the arm 35 be provided with enlarged or widened portions 45 and 47 formed with circular raised embossments 46 and 48 respectively, see Figs. 2 and 7. The gear 40 engages the embossment 46 and preferably has substantially a line contact therewith and in like manner the gear 42 engages and turns upon the embossment 48. These embossments space the gears over their major areas from the arm 35 and also position the gears in the plane of the strip gear 37. If desired this construction may be reversed and the embossments formed on the gears 40 and 42. From this construction it will be seen that the gears 40 and 42 are supported by the bearing bosses 46 and 48 very near the marginal edges of the gears, thus preventing these gears from twisting or cocking and preventing their teeth from becoming disengaged. This is particularly advantageous since it permits the gears to be stamped or formed from relatively thin or inexpensive sheet metal stock and avoids the necessity of using expensive guides and very heavy or hardened gears which cannot be economically stamped or punched out from sheet metal. Moreover, the overlapping of the gear 40 upon the edge of the plate 31 together with the supporting embossed bearing 46 holds this gear at all times in mesh with the strip gear 37. Thus, the gears are free to rotate with a minimum of frictional resistance and are at all times supported and held against any tendency to become disengaged.

In the present instance the outer end of the swinging arm 44 is connected to the lower edge of the window glass in simple and improved manner as particularly illustrated in Figs. 8 and 9. Riveted to the outer end of the arm 44 is a stud 49 which has cylindrical bearing portions 50 and 51 of different diameters forming a shoulder 52 therebetween, the outer portion 51 of the stud having an annular groove 53 also forming a shoulder. Secured as by spot welding to the bottom of the retainer channel 15 is a marginally flanged bracket 54. The depending wall of this bracket has preferably a circular aperture within which the portion 51 of the stud fits. The depending wall of the bracket is countersunk at 55 to provide an inwardly flared or tapered construction, the edges of the aperture being flanged out at 55*a* to provide a flat bearing surface around the aperture. A snap-on or clinch washer is provided for holding the stud within the aperture in the bracket. This retainer or clinch washer comprises a thin flat metal band or ring 56 having an enlarged central aperture within which projects a series of generally radially extending but outwardly flared spring tongues 57 integral with the marginal band 56 of the washer. This washer is preferably formed from a single piece of relatively thin sheet metal stock, the washer being reinforced around its peripheral edge by a metal ring 58 which is folded over the edge of the washer and adapted to bear against the edge flanges 55*a*. Slidingly mounted upon the cylindrical portion 50 of the stud 49 is a dished metal washer 59 which has a flared or tapered edge portion engageable with the flared or countersunk portion 55. The washer 59 provides a retainer for one end of a conical spring 60 interposed between the washer and arm 44. As shown in Fig. 9, the stud 49—51 may be inserted transversely through the aperture in the wall 55. When the stud is passed through the aperture by pressing upon the end of the arm 44 the washer 59 will be forced back to compress the spring 60. At the same time the snap-on washer 56 is forced over the rounded end of the stud 49 which serves to spread somewhat the spring prongs 57. When the washer reaches the position of Fig. 8 the prongs will spring or snap into locked position behind the shoulder formed by the groove 53 whereupon the washer 56 by reason of the inclination of the spring prongs 57 is locked upon the stud and the stud is held against removal from the aperture in the wall 55. At the same time the snap-on washer by its engagement with the flanging 55*a* will hold the spring 60 at all times under compression.

It will be seen that the regulator arm may be assembled or connected up to the channel 15 at either limit of the normal range of operation of the glass. It is merely necessary at such limit to spring back the arm 44 sufficiently to register the stud 49 with the hole in bracket 54, release the arm to cause the stud to enter the hole, and then force the snap-on washer onto the stud. This simple operation saves time on the assembly line, saves labor costs and provides an extremely neat, simple and efficient construction.

It will be understood that the ratio of the drive or main gear 34 to the compensating gears 37 and 42, the gear 40 constituting in effect an idler between the gearing 37 and 42, is such that as the arm 35 is swung up and down to raise and lower the window panel the pivot point 49 of the arm 44 with bracket 54 will travel vertically in substantially a straight line. Thus, during this operation when the arm 35 reaches a horizontal position the arm 44 will also be in a substantially horizontal position parallel thereto. This construction is preferred, although not necessarily essential, since by providing a straight line center lift the window panel 13 will be precluded from cocking or tilting in its plane by reason of the operation of the window regulator. The gear 40 may be limited at each end of its travel upon the strip gear 37 by stops 31*c* which comprise terminal extensions of embossings 31*b* formed integrally in the mounting plate 31. Thus, at either end of the stroke of the arm 35 the gear 40 will be prevented from running off the gear 37 by engagement with the embossed portions 31*c* of the plate.

I claim:

1. A window regulator comprising a gear adapted to be mounted for rotation upon a fixed support at one side thereof, said gear having a projecting arm, a pair of meshing gears on said arm at one face thereof, a fixed gear adapted to be mounted on the support and meshing with one gear of said pair, a swinging arm secured to the other gear of said pair, said gears being constructed to move the outer end of said swinging arm in substantially a straight line path, said first named gear being interposed between said projecting arm and the support and said fixed gear being mounted upon the support at the side opposite to said first named gear.

2. A window regulator comprising a mounting plate, a main gear mounted for rotation upon said plate and having a projecting arm, a pair of meshing gears on said arm at one face thereof, fixed gear teeth on the plate in the plane of said pair of gears and meshing with one thereof, said last gear overlapping an edge of the plate and

said main gear being interposed between the arm and plate at the side of the plate opposite to said gear teeth, a swinging arm secured to the other one of said pair of gears, and means for connecting the outer end of said swinging arm to a member at the lower edge of a window panel.

3. A window regulator comprising a mounting plate, a gear pivotally mounted at one face of said plate and having a projecting driving arm swingable with the gear, a fixed sector gear mounted at the opposite face of the plate, a pair of rotatable different diameter meshing gears mounted on said driving arm in the plane of said sector gear, the inner of said meshing gears overlapping said second mentioned face of the plate and meshing with said sector gear, a swinging arm adapted to be connected at its outer end to the lower edge of a window panel and secured at its inner end to turn with the outer of said pair of meshing gears.

4. A window regulator comprising a mounting plate, a gear pivotally mounted at one face of said plate and having a projecting driving arm swingable with the gear, a fixed sector gear mounted at the opposite face of the plate, a pair of rotatable different diameter meshing gears mounted on said driving arm in the plane of said sector gear, the inner of said meshing gears overlapping said second mentioned face of the plate and meshing with said sector gear, a swinging arm adapted to be connected at its outer end to the lower edge of a window panel and secured at its inner end to turn with the outer of said pair of meshing gears, said inner end being mounted on the driving arm at the face thereof opposite to said outer gear.

5. A window regulator comprising a mounting plate, a gear pivotally mounted at one face of said plate and having a projecting driving arm swingable with the gear, an arcuate series of gear teeth fixed to the plate adjacent the edge thereof at the opposite face of the plate, a first gear on said driving arm meshing with said gear teeth and rotatable upon the arm, a second gear meshing with the first gear and rotatable upon the driving arm, said gears and gear teeth lying in the same plane at the same face of the driving arm, and a swinging arm for raising and lowering a window panel, said arm being fixed to the second gear and overlapping the opposite face of the driving arm.

6. A window regulator comprising a mounting plate, a gear pivotally mounted at one face of said plate and having a projecting driving arm swingable with the gear, an arcuate series of gear teeth fixed to the plate adjacent the edge thereof at the opposite face of the plate, a first gear on said driving arm meshing with said gear teeth and rotatable upon the arm, a second gear meshing with the first gear and rotatable upon the driving arm, said gears and gear teeth lying in the same plane at the same face of the driving arm, a swinging arm for raising and lowering a window panel, a pivot rotatable in said driving arm and fixed at opposite ends to said swinging arm and second gear.

7. A window regulator according to claim 5 in which the driving arm is offset to extend substantially in the plane of the mounting plate and in close proximity thereto at the side thereof opposite to said gear teeth.

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