March 12, 1940. J. SNEED 2,193,657

WINDOW REGULATOR

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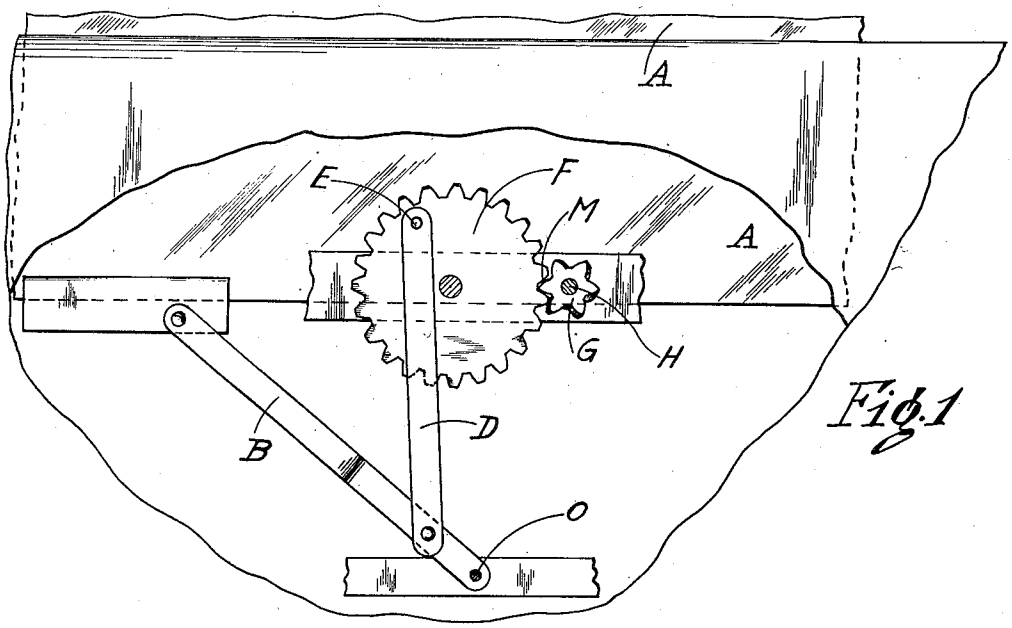


Fig. 1

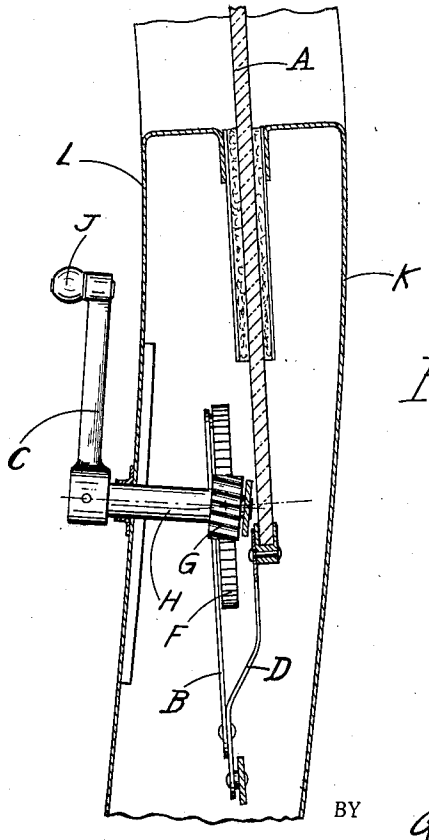


Fig. 2

INVENTOR.
JOHN SNEED

BY Railey & Watts

ATTORNEYS

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WINDOW REGULATOR

John Sneed, Grosse Pointe Shores, Mich., assignor, by mesne assignments, to Ackerman-Blaesser-Fezzey, Inc., Detroit, Mich., a corporation of Michigan

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1 Claim. (Cl. 268—126)

This invention relates to window regulators, particularly of the type used in regulating the windows of automobiles, and has to do especially with the gearing and the provision of means in the gearing whereby compensation is provided between the inclined path of movement of the window glass in relation to the inner finished face of the vehicle door or compartment and the mechanism through which the raising and lowering of the window glass is effected. It is among the objects of my invention to provide dependable yet inexpensive and simple means through which the operating crank and handle of a window lifting mechanism, adapted for use in an automobile door, may be rotated in a plane parallel to the inner finish of a vehicle door, albeit the plane of rotation of the handle is inclined with relation to the plane of movement of the glass to be raised and lowered.

A further object of my invention is to eliminate such means as universal joints and the like for compensating for the tendency to mis-alignment between the plane of rotation of the regulating crank and the plane of movement of the window to be regulated.

A further object is to carry out the foregoing object without sacrifice of the smoothness of mesh and operation of the gears through which the drive of the regulating mechanism is effected.

A further object is to provide a simple gear train adapted to be disposed in a window regulating mechanism, having its axes inclined with respect to each other, in which the gears may be of an inexpensive and simple construction.

Other objects of my invention will appear from the following detailed description of the preferred embodiment thereof, reference being made to the accompanying drawing in which Figure 1 is a more or less diagrammatic lay out of a conventional window lifting mechanism in which are shown the gears formed and arranged according to my invention; and Figure 2 is a diagrammatic vertical section showing in an illustrative fashion the inclined relationship between the parts of the gearing and the plane of window movement and crank rotation.

By way of illustration, I have shown a glass panel A being slidably supported on the end of a lever B, the latter being fulcrumed at O and connected through a link D to a crank pin E on a gear F, which, by rotation through 180° raises and lowers the lever B along with the window A from an upper to a lower position. As shown also in Figure 1, a pinion gear G, meshing with the gear F and being of relatively small diameter, may be driven through a shaft H by a crank C and handle J to raise and lower the window glass A. The axis for the gear F as well as the axis for the pinion G may be mounted in suitable bearings, which, as are well known in the art, may be provided in pierced holes in stampings or otherwise to make a compact assembly within the panel of the door K or other body or housing in which the mechanism may rest and into which the window A may be lowered.

The larger gear F may and preferably does have straight spur teeth. This gear is shown to be mounted to rotate in the plane parallel to the plane of window movement, and also parallel to the plane of movement of the links B and D; that is, the axis of the gear F lies normal to the plane of window movement as has been found to be an advantageous practice in this art.

In carrying out the objects of my invention I mount the pinion gear G on an axis normal to the plane of the inner surface L of the door or body K, whereby the crank C may rotate in a plane parallel thereto. Since the crank is rigid with and at right angles to the axis of the pinion G, the said axis is inclined with respect to the axis of the spur gear F. To compensate for this inclined relationship I form the pinion gear G with helical teeth, which are so inclined with relation to the axis of the pinion and its pitch cylinder that the teeth of the pinion lie substantially parallel to the teeth of the spur gear F in the zone of meshed engagement therewith as at M. The teeth of the pinion G are inclined to the lines of generation of the pitch cylinder of the pinion at substantially the same angle as the inclination of the axes of the two gears to each other. Preferably the teeth of the pinion are somewhat longer than the teeth of the larger spur gear F. It will be appreciated, however, that for the condition of service required, particularly in the window regulator for an automobile, a reasonably free fit between the teeth of the gears affords ample compensation for such slight deviation from theoretical perfection of the mesh as is necessary to provide good and satisfactory operation.

As shown in Figure 1 the centers of the gears F and G lie in a horizontal line. This disposition is made because the intersection of the plane of rotation of the crank C with the plane of window movement will also be in a horizontal line, in this instance above and parallel to the line joining the centers of the gears. Where the inclined relationship is otherwise, the line joining the centers of the gears should be parallel to the

line of intersection of the planes of crank rotation and window movement respectively and the axes of the respective gears should be normal to said planes respectively as above indicated.

In practice I have successfully employed pinion gears of about 5/8" pitch diameter with teeth about 1/4" long (measured parallel to the axis of the pinion) in mesh with a spur of about 3" pitch diameter having teeth about 1/8" long in which the axes of the gears were normal to planes inclined about 15° to each other. The gears which I have used successfully had involute teeth, and since there is a slight axial slippage at the point or line of contact between engaging teeth with the pinion taking relatively greater wear per tooth, I prefer in the instance illustrated herein to harden the teeth of the pinion gear while forming the large spur gear F as by stamping or punching the same from strip stock adapted to good working in a punch press. For the service required in an automobile window regulator the minor imperfections in the punched or stamped teeth of the spur gear will not impair its function, and the hardened teeth of the helical pinion will, in their axially slipping mesh with the spur teeth, tend to polish and perfect the faces of the spur teeth whereby the operation and mesh of the gears will improve with use.

While I have illustrated and described a preferred form of my invention herein, I am aware that modifications and changes therein will occur to those skilled in the art, and I do not care to be limited in the scope and effect of my patent to the particular form herein disclosed or in any manner other than by the claim appended hereto when construed to embrace the full range of equivalents to which I may be entitled in this art.

I claim:

In combination in an automotive vehicle door or body, a window glass vertically adjustable in a plane which is substantially non-parallel to the interior finish of the door or body below said window, a regulator mechanism including a pair of gears each of substantial axial thickness and in mesh with each other, the full width of the teeth of at least one of said gears fully engaging the meshing teeth of the other, one gear lying parallel to the plane of window movement and the other lying in a plane parallel to the interior finish of said door or body and inclined to the plane of window movement, a shaft for said other gear extending through and substantially perpendicularly to said interior finish, one of said gears having spur teeth and the other having helical teeth inclined to the lines of generation of its pitch cylinder at an angle substantially equal to the angle of inclination of said planes, the line joining the centers of said gears being parallel to the line of intersection of said planes.

JOHN SNEED.