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(54) Vehicle window regulator.

(57) Cable actuated window regulator, for example operated by a motor (19), includes pivoted lever means (10, 11) angularly movable to raise and lower the window, the connection (20) of the cable with the lever means being in linearly guided sliding engagement with guide means (17) and, preferably, being arranged so that for at least part of the travel of the window there is greater distance of movement of the latter than the distance moved by the connection.

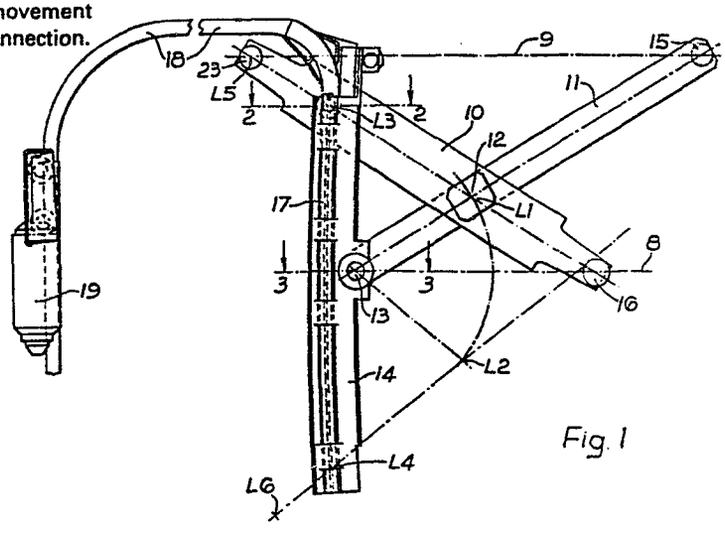

Fig. 1

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VEHICLE WINDOW REGULATOR

This invention relates to motor vehicle window regulators, i.e. to mechanisms for raising and lowering the windows of motor vehicles.

Many different types of window regulator are known and reference should be made to, for example, British Patent Specification No. 1198364 which shows cable-operated window regulators, cord and pulley-type window regulators and arm and segment-window regulators. However each of these different types of window regulators has disadvantages, particularly as regards providing adequate guidance for windows which have to be moved upwardly and downwardly along non-linear paths and as regards meeting packaging requirements either when the regulators are to be fitted within narrow doors or when the distance travel of the window is to be maximised.

In order to achieve economics as regards fuel consumption and to increase interior space/overall size characteristics, it is important not only that the overall thickness of a vehicle door should be minimised whilst retaining adequate strength characteristics but also that the weight of the vehicle door should be kept as low as possible. In addition, in the case of manual window regulators, it is desirable that a smooth winding action should be obtained.

As far as electric window regulators are concerned, freedom to locate the electric motor at any convenient location, for example adjacent the door latch, can be an important design feature simplifying overall design of a door or enabling a standardised electric regulator design to be used in a number

of different doors.

It is accordingly an object of the present invention to provide an improved form of window regulator having the various advantageous features described below.

According to one aspect of the present invention there is provided a motor vehicle window regulator including a guide element for attachment to a door component, a slider element movable along a guide track afforded by the guide element, a cable attached to the slider element, operating means for effecting linear movement of the cable to move the slider element along the guide track, a lever connected to the slider element and means on the lever for attachment to a vehicle window such that, upon movement of the slider element along the guide track, corresponding movement of the lever is effected ro raise or lower the vehicle window.

An important advantage of this arrangement as compared with a conventional cable-operated regulator as described in British Patent Specification No. 1198364 is that the interposition of a lever between the cable and the window attachment means can be arranged to provide that, in at least a portion of the travel of the cable, the distance moved by the window can be greater than the distance moved by the cable such that, if desired, the total distance of travel of the window can be greater than the height of the guide element. This can be of particular advantage if the vehicle designer wishes to maximise the size of the glass in relation to the overall height of the door.

According to a second aspect of the present

invention there is provided a cable-operated window regulator for a motor vehicle in which lever means are provided for obtaining a linear gain, i.e. lever means are provided whereby for at least a portion of the travel of the window, the distance moved by the window is greater than the distance moved by the cable.

The lever means may comprise a pair of levers, the levers being pivotally interconnected intermediate their ends to provide a cross-arm lever system with one of the levers pivotally connected to the slider element and the other lever pivotally connected at its one end to the guide element.

The lever pivotally connected to the slider element is hereinafter referred to as the main lifting arm and is provided at its one end with means for connection to a glass carrier. The slider element is preferably in the form of an end formation for the cable and is arranged for movement within a guide element in the form of a plastic tube carried by a guide rail to which the other lever, hereinafter referred to as the auxiliary lifting arm, is pivotally connected.

The invention will now be described by way of example with reference to the accompanying drawings wherein :-

Figure 1 is a general arrangement of an electrically operated vehicle window regulator;

Figure 2 is a section on line 2-2 of Figure 1, and

Figure 3 is a section on line 3-3 of Figure 1.

The window regulator includes a main lifting

arm 10 and an auxiliary lifting arm 11 pivotally connected at 12 to provide a cross-arm structure. The auxiliary lifting arm 11 is pivotally mounted at 13 on a support rail 14 attached to the door frame (not shown) by suitable fixing brackets. The auxiliary lifting arm 11 is shown in the drawing in one of the limiting positions of its pivotal movement i.e. in the position which it occupies when the window is fully closed. At its upper end, the auxiliary lifting arm 11 is provided with a stud or roller 15 engaged in a channel in a glass carrier (not shown) centred on line 9. The main lifting arm 10 is also shown in the position which it occupies when the window is fully closed and, at its lower end, it carries a stud or roller 16 which engages in a horizontal channel in a guide (not shown) centred on line 8 and fixed to the door. Thus, as the auxiliary lifting arm 11 moves about its pivot 13, the stud or roller 16 will move horizontally within its channel.

The support rail 14 is formed as a metal pressing and carries a generally C-section plastic extrusion 17 which forms a continuation of a plastics tube 18 within which a drive cable is disposed. The drive cable is conveniently a helically wound wire cable to which a brush-like layer of short elastic fibres is applied so as to obviate any noise generation and obtain a smooth drive action, as described in British Patent Specification No. 1091066. Drive of the cable is effected by means of a motor/gearbox unit 19 and the cable terminates in an end formation 20 (Figure 2) which functions as a slider element within the plastic extrustion 17. The end formation 20 is formed as a metal pressing attached to the cable and includes a pair of parallel arms which

pass through an aperture in a plug 21. The ends of the arms are folded over (as indicated) to engage against a washer 22 which serves to retain the plug 21 within an aperture in the main lifting arm 10.

The arrangement is such that the plug 21 is free to rotate within the aperture in the lifting arm 10 so that, as the cable is driven by means of the motor/gearbox unit 19, the slider element 20 will be displaced along its guide track afforded by the plastic extrusion 17 and the main lifting arm 10 will be caused to pivot in an anti-clockwise direction about its pivotal connection 12 to the auxiliary lifting arm 11 while the auxiliary lifting arm 11 is pivoting in a clockwise direction about its pivot mounting 13.

The main lifting arm 10 is provided at its upper end (as shown) with a stud or roller 23 engaged in a channel in a glass carrier (not shown) centred on line 9 and the geometry of the system is such that, as the two arms 10 and 11 move relative to one another, the rates of downward (not upward) movement of the studs or rollers 15 and 23 are the same. The vehicle window is thus guided during its downward movement, being supported at two spaced positions by the arms 10 and 11, so that stable movement of the window is obtained. It is to be noted that, because the position at which the cable is attached to the main lifting arm 10 is spaced from the point at which the arm 10 is connected to the glass carrier, the rate of travel of the glass carrier will not be the same as the rate of travel of the cable. Thus the auxiliary lifting arm 11 will move from a position in which the pivotal connection 12 between the two arms is at a location

L1 to a location L2. During this travel, the end formation 20 of the cable moves from location 13 to location L4 and the stud or roller 23 moves from location L5 to location L6. The window thus moves approximately 30% further than the cable and, for a door design in which glass travel is to be maximised, this will be an important consideration.

With the particular construction shown, the motor 19 is located at a substantial distance from the rail 14, i.e. adjacent the vehicle door latch. This freedom to locate the motor 19, which is a srelatively thick item, at any convenient location is again an important design consideration and enables an electric regulator to be used in circumstances in which there might otherwise be no possibility of locating an electric motor between the vehicle door panels without fouling the glass.

CLAIMS

1. A motor vehicle window regulator including pivoted lever means operatively connected to the window for lifting and lowering movement of the latter, and cable operated drive means having linearly guided connection with the lever means for controlled pivotal movement thereof.

2. A regulator as in Claim 1 wherein said connection of the drive means is arranged so that for at least a portion of the travel of the window in use, the distance of movement of the window is greater than the distance of movement of the connection.

3. A regulator as in Claim 1 or 2 including a guide element for attachment to a door component, a slider element to which the cable is connected movable along a guide track constituted by the guide element, and operating means for effecting linear movement of the cable.

4. A regulator as in Claim 3 wherein the operating means is a motor/gearbox unit operatively positioned remote from the lever means.

5. A regulator as in any preceding claim wherein the lever means comprises a pair of lever lifting arms pivotally interconnected intermediate their ends to provide a cross-arm lever system.

6. A regulator as in Claim 5 wherein said pair of arms comprise a main lifting arm having a first end adapted for operative connection to the window and with which the drive means has linearly guided connection, and an auxiliary lifting arm having

7. A regulator as in any preceding claim wherein said connection comprises a slider element and including a guide element along which the slider element is movable in a linear path.

8. A regulator as in Claim 7 wherein the slider element is an end formation for the cable and the guide element is a plastics formation carried by a guide rail.

9. A regulator as in Claim 8 so far as dependent on Claim 6 wherein the auxiliary lifting arm is pivotally connected to the guide rail.

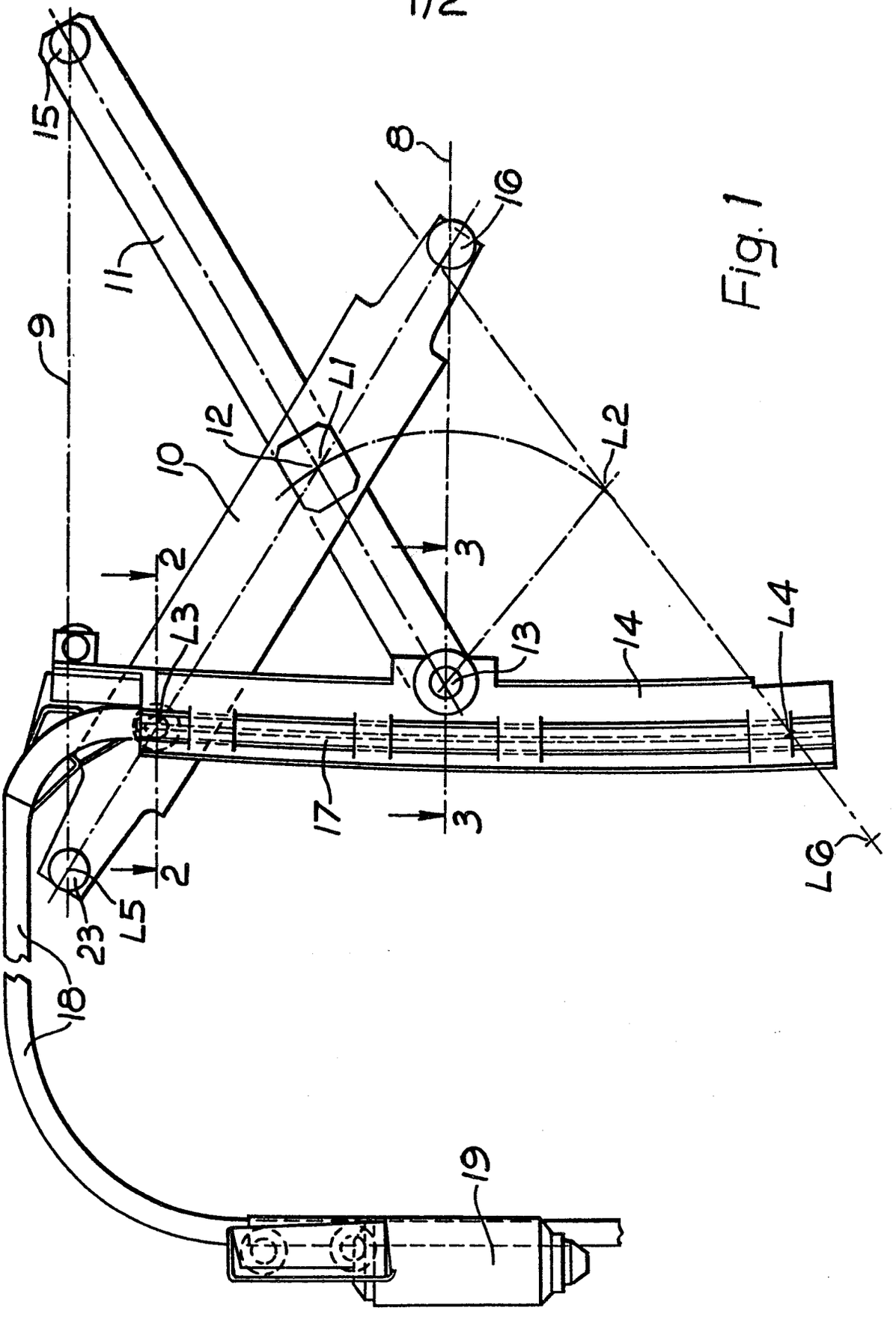

Fig. 1

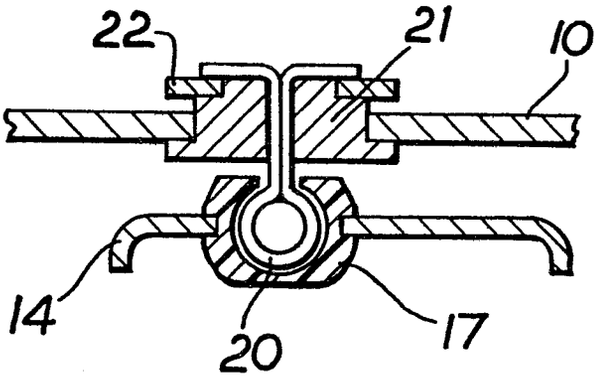

Fig. 2

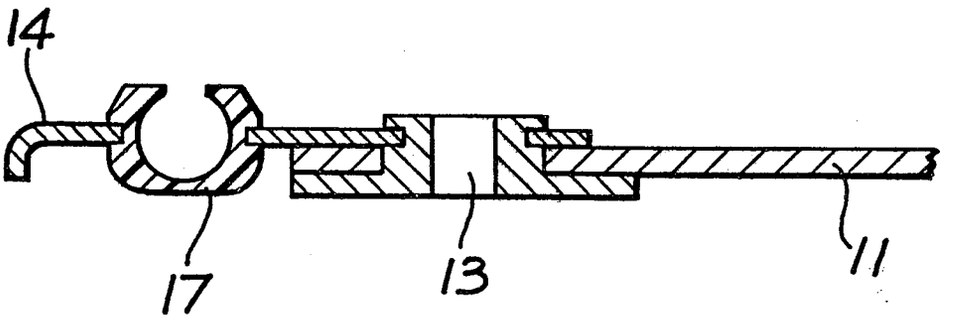

Fig. 3