An operating mechanism, particularly for the windows of motor vehicles, includes a flexible threaded cable which is mounted in a tubular portion formed by two housing parts which are interconnected. The cable is engaged by a driving gear which is driven from a pinion gear which is affixed to a shaft for rotation therewith. The shaft is driven through a spline gear, for example, by a manually operated crank handle or by a driving motor. The pinion gear also meshes with a gear formed on the exterior of a spring pulley. The spring pulley houses at its interior a coil spring which is tensioned or wound during the driving of the motor to move the window operating cable in an opening direction. During the driving of the cable in an opposite closing direction the spring therefore unwinds and aids in the driving operation.

4 Claims, 3 Drawing Figures
Fig. 2
SPRING CLOSEABLE WINDOW OPERATING MECHANISM

SUMMARY OF THE INVENTION

This invention relates in general to window operating mechanisms and in particular to a new and useful device for opening and closing car windows and which includes a coil spring which is energized during the opening movement of the window and which aids in driving the operating mechanism during the closing of the window.

The invention is concerned with window raising devices for sliding windows particularly windows of the type which are employed in motor vehicles and which are driven by a flexible threaded cable during the opening and closing movement thereof. It is known to employ weight balancing springs for facilitating the closing movement of window operating devices. Generally the arrangement of a spring storage or window operating devices with openly arranged force transmission means such as an arm connection to the window does not present any particular difficulties. However, the provision of spring storage for operating devices which include flexible cables for opening the window is much more difficult and is complicated by the construction of the guide tube encasing the cable. It has been proposed for example, in U.S. Pat. No. 3,209,412, that the spring should not act upon the forced transmitting cable. In this arrangement, the spring which is formed as an angle spring, or a screw spring, engages an armature directly on the sliding window and is connected with the vehicle at the inner door plate. In this construction, it is necessary to provide in addition to the mounting places at the inner door plate for the window operating mechanism, an element for the engagement of one end of an angle spring. The necessary space in the window shaft for the accommodation of an angle spring is not always available.

In accordance with the present invention, a window operating mechanism includes a flexible cable with spring storage arranged together in the window shaft in one compact structural unit which will lie outside the path of the lift movement of the window parts connected with the window. The invention provides an arrangement which reduces the necessary drive moment, which is essentially determined by the friction of the threaded cable in the guide tube, when the window is closed by the weight of the glass pane. This is accomplished with the invention by arranging a spring storage at the drive housing and by providing it with a helical spring arranged within a housing formed in part by a spring pulley having external gearing which engages with the drive pinion of the window operating mechanism. The arrangement is such that the opening of the window winds the spring and the closing operation is carried out with the aid of the spring as it unwinds. The spring force acts directly on the drive pinion whereby a very compact structural unit is obtained since the spring storage becomes essentially an integral part of the drive housing. The spring may be arranged within the drive pulley without any additional fastening elements other than those which are necessary for the drive housing, in any event, and these may be arranged at the inner door plate of the vehicle doors, for example. The direct action of the spring storage upon the element which transmits the torsional portion to the drive cable, that is the drive pinion, results in a very good forced transmission efficiency.

In an advantageous embodiment of the invention, a spring pulley, or spring housing gear is rotatably arranged on a hub which is secured non-rotatably on the drive housing and which is particularly embraced by the inner winding of the spiral spring through engagement of a hooked inner end of the spring over a depression formed at the hub. The outer end of the spring is secured to a recess portion of the enclosing pulley housing which is formed on its exterior as a driving gear engaged with the driving pinion. The spring pulley, and the drive housing, are of a material such as plastic. Since the driving pinion as a rule is made of a metal material, there is little friction at the tooth engagement between the plastic teeth of the pulley and the teeth of the drive pinion even without lubrication. Accordingly, it is an object of the invention to provide an improved device for operating windows which includes a driving pinion in meshing engagement with a flexible window operating cable, which is movable in one direction for opening the window and in an opposite direction for closing the window, and which drives a pulley member or gear having a hollow interior which accommodates a spring, the spring being engaged with the pulley at one end and with a fixed portion of the housing at its opposite end and being windable when the cable is moved in an opening direction and unwindable to aid the driving movement when the cable is moved in a closing direction.

A further object of the invention is to provide a driving mechanism for a window which includes a spring aided driving mechanism which is housed within a pulley directly adjacent the driving gear of the mechanism and wherein the pulley is advantageously made of a material such as plastic and has teeth which drivingly engage the driving gear.

A further object of the invention is to provide a window operating mechanism which is simple in design, rugged in construction, and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by these, reference should be had to the accompanying drawings and descriptive matter in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a plan view of a portion of a window operating mechanism constructed in accordance with the invention;
FIG. 2 is a section taken along the line II- II of FIG. 1; and
FIG. 3 is a view similar to FIG. 1 of a portion of the mechanism of another embodiment of the invention.

GENERAL DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings in particular, the invention embodied therein in FIGS. 1 and 2 comprises two housing parts 2 and 3 which fit together and define a tubular portion generally designated 4 for receiving a slotted guide tube 1 which is led through the tubular portion. The guide tube formation 4 includes depressions 5 which engage in the slot of the tube 1 so as to firmly hold the tube to the housing.

In accordance with a feature of the invention, the tubular portion 4 of the housing includes a slotted or cut away portion 6 shown in FIG. 1, through which the drive pinion 7 extends for meshing engagement with a threaded cable 9, which, in turn, is connected through suitable mechanism (not shown) for operating a window in an upward (closing direction) as indicated by the arrow 26, and a downward (opening direction) as indicated by the arrow 25.

The driving pinion 7 is affixed to a drive shaft 8 which is rotatably mounted within the housing parts 2 and 3, and the opposite end thereof includes a spline gear 8 which is adapted to be connected to driving means such as a crank handle of an automobile window operating mechanism (not shown) or a driving motor. The housing part 2 includes a cup portion 34 for a so-called drag spring brake (not shown).

In accordance with a feature of the invention, a mounting hub 12 is provided with a pin 11 having a flattened surface 10 which permits securement in the housing such as by riveting so that the hub 12 may be held in position against rotation. A cylindrical bearing lug 13 which is carried at the hub portion rotatably supports a hollow spring pulley or spring gear housing 14 which forms a housing for a spiral spring 16. The spring pulley includes external gearing 15 which engages with the
drive pinion 7. The spring pulley 14 has a cylindrical wall 17 which is concentric with the hub 12 and which has about the same axial length as the hub 12. The spring 16 includes an inner hooked or bent end 18 which engages into a depression 19 of the hub 12 and an outer hooked end 20 which is engaged in a slot 21 of the cylindrical wall 17. The storage space formed by the spring pulley 14 is closed by a plastic cover 22 and the pulley itself may also be made of a plastic material. The cover is secured at locations 23 of the housing part 2, for example by hull rivets. The housing parts 2 and 3 are also firmly interconnected with each other at 24 by hollow rivets, screws or the like. The bores 33 and the housing part 2 are provided with means for securing the window operating mechanism at a mounting location for example at the inner door plate of the motor vehicle (not shown).

When the threaded cable 9 which comprises a wire thread winding is moved in the opening direction as indicated by the arrow 25, the drive pinion 7 is rotated counter clockwise and the spring pulley 14 is driven by the pinion 7 in the direction of the arrow 27 to cause the winding of the spiral spring 16. When the window is closed the spring 16 transmits the stored force through the gear 15 of the spring pulley 14 to the drive pinion 7 whereby the drive torsion movement is reduced. A spiral spring made of spring steel of about 10 mm width and about 1 mm thickness with about 10 windings is capable of reducing the drive torsion moment required at the drive pinion by about 30 percent and even more.

A further reduction of the drive torsion moment is possible in accordance with the invention by a construction shown in FIG. 3 wherein the guide tube 1 is formed of a rigid plastic material. It is known that the dynamic friction coefficient of steel against steel is substantially harder than that of steel against most plastic materials. In the embodiment shown in FIG. 3, which essentially corresponds to that of FIGS. 1 and 2, in respect to most of the parts which have been similarly designated, it varies from that of the previous embodiment in respect to the construction of the plastic tube 1' which is also held between the housing parts 2' and 3'. In order to secure the plastic tube 1' in the housing sleeves 28 and 29 are arranged to lie closely against the tube profile 4' on both ends of the housing and the sleeves also comprise a plastic material and may be sprayed on the plastic tube 1'. The sleeves 28 and 29 are provided with interengangeable portions for clamping them on the plastic tube 1', for example, the material of the sleeves may be made to run into the material of the tube 1' during the injection molding. The clamping of the sleeves with the tube is supported by the shrinking of the sleeves during solidification. The plastic tubes 29 and 28 are secured against rotation by the interengagement of projections 30 therefore into corresponding recesses 31 of the housing formed by the parts 2' and 3'. In the embodiment of FIG. 3, only in the lifting area of the catch (not shown) a slotted steel pipe (not shown) is provided for the engagement of the window pane through whose slot the catch grips for the connection to the window pane. In the embodiment with a rigid plastic tube which extends over substantial longitudinal areas of the cable 9 for guiding the cable, the inventive arrangement of the spring storage results in a reduction of the required drive torsion moment for a one track window raiser from for example 16.5 cmkg (without spring storage) to 10.1 cmkg.

In FIG. 3, a flexible plastic hose 32 is slid over the end of the plastic tube 1' at the location beyond the sleeve 29 for the purpose of receiving the free cable end away from the window.

Although the invention has been described in connection with the operation of a sliding window provided with a cable drive, it is applicable and results in a reduced drive torsion moment whereof a different drive forces are necessary for adjusting movements by means of a guided threaded cable in both directions of movement of the cable.

What is claimed is:

1. An operating mechanism for opening and closing a window and the like, comprising a drive housing forming an elongated tubular receiving portion, said drive housing comprising two interengangeable parts each shaped to form an axially extending portion of said tubular portion, said tubular portion having a cutaway portion intermediate its ends, a drive pinion rotatably mounted within said housing and having a portion thereof extending through the cutaway portion into said tubular portion, a threaded cable positioned within and extending through said tubular portion, said cable arranged in meshed engagement with said drive pinion extending into said tubular portion for displacing said cable in opposite directions through said tubular portion for opening and closing the window, a spring pulley assembly positioned within said drive housing and including a spring housing having an external gear portion in meshed engagement with said drive pinion, said spring housing comprising a centrally arranged stationary mounting hub and a cylindrical wall concentrically disposed about and spaced outwardly from said hub and forming an annular space therebetween, said external gear portion formed on the exterior of said cylindrical wall, said hub having a recess therein, said cylindrical wall having a recess in its inwardly facing surface, a spiral spring positioned within the annular space and coiled about said hub and said spring secured at its inner end within the recess in said hub and at its outer end within the recess in said cylindrical wall so that said spring can be wound upon driving rotation of said drive pinion for moving said threaded cable in one direction and in the wound condition said spring can transmit its stored energy through said external gear portion to said drive pinion for reducing the drive torsion movement in displacing said threaded cable in the opposite direction.

2. An operating mechanism, according to claim 1, wherein said spring housing is made of a plastic material and including a plastic cover covering said annular space for said spring.

3. An operating mechanism, according to claim 1, including a rigid tubular plastic at least partially enclosing said threaded cable and extending through the tubular portion of said housing.

4. An operating mechanism, according to claim 1, including a plastic sleeve formed over said plastic tube at each end of the tubular portion of said housing and holding said tube in position in respect to said housing.