

[54] **VEHICLE WINDOW LIFTER**

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[56] **References Cited**

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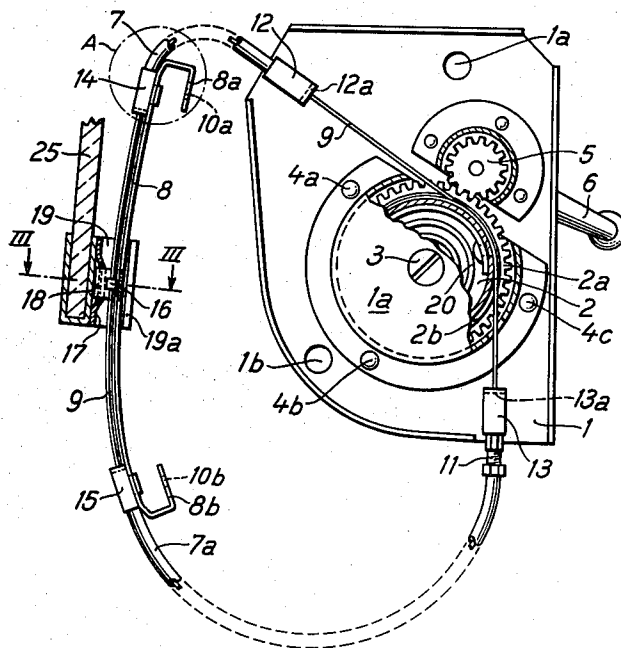
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[57] **ABSTRACT**

A vehicle window lifter is disclosed which is a separate subassembly and may be handled and mounted as such. The window lifter comprises a closed cable loop of which a portion is wound around a rotatable, crank-operated drum. The drum is mounted on a base plate to which the ends of a first and a second length of cable conduit are secured at opposite sides. Between the respective other ends of the conduits a straight, rigid spacer bar is inserted. The cable travels through the conduits and is openly accessible where it extends in parallel to the spacer bar. The latter is to be mounted in the vehicle substantially in parallel to the direction of movement of the window pane which is connected to the openly accessible cable portion for joint movement with the cable when the crank-operated drum is rotated.

8 Claims, 5 Drawing Figures



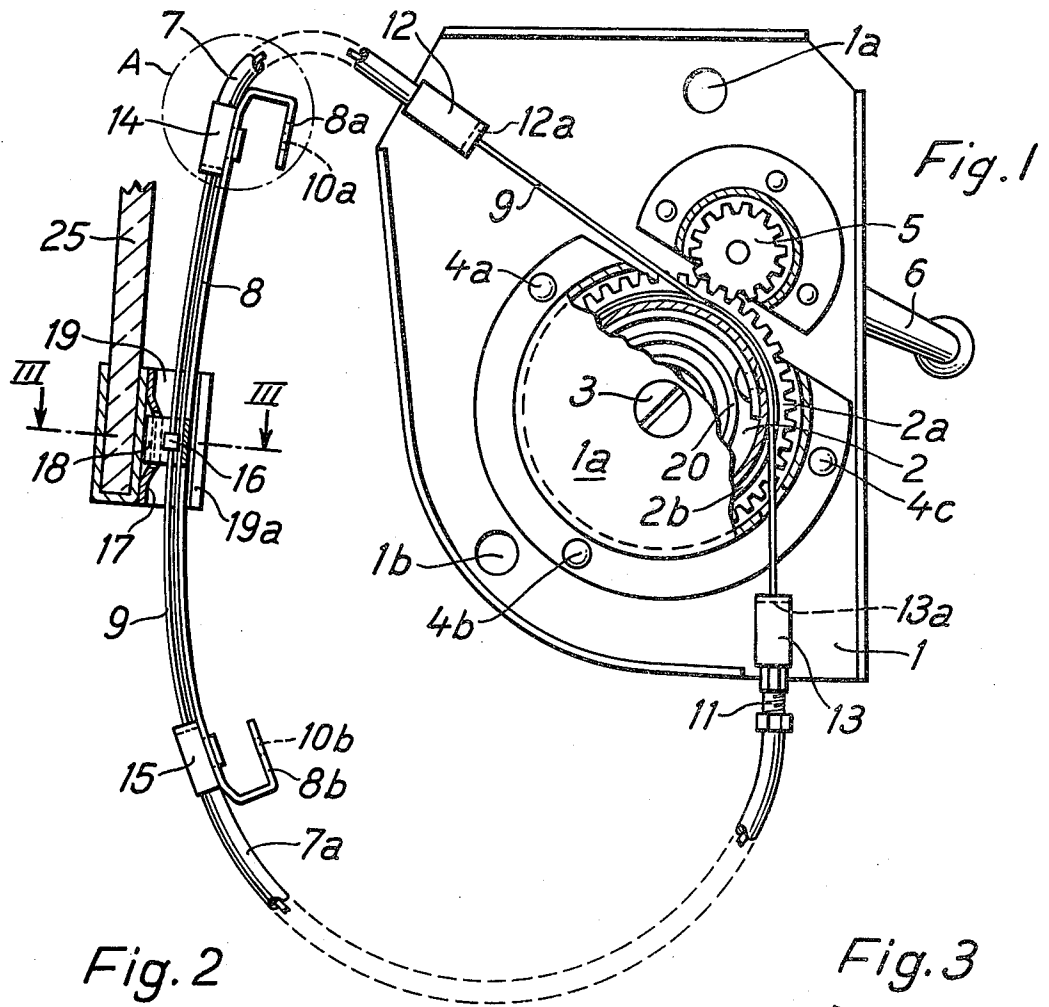
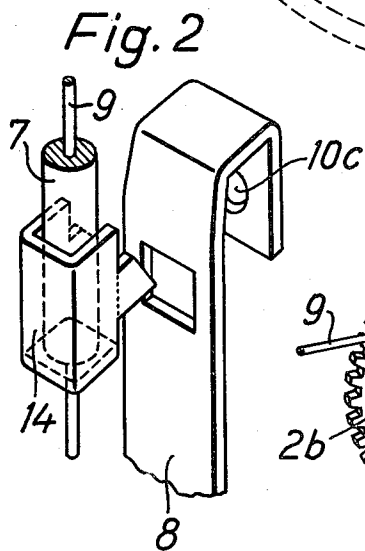
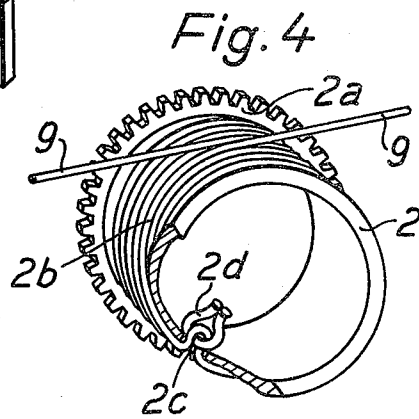
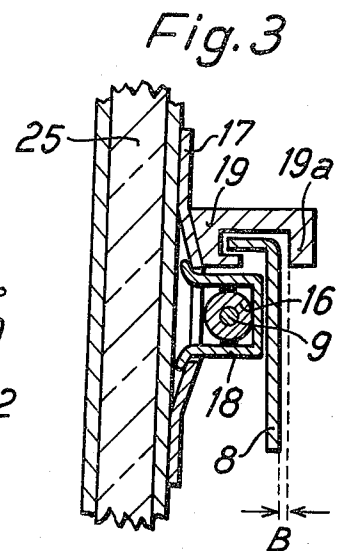
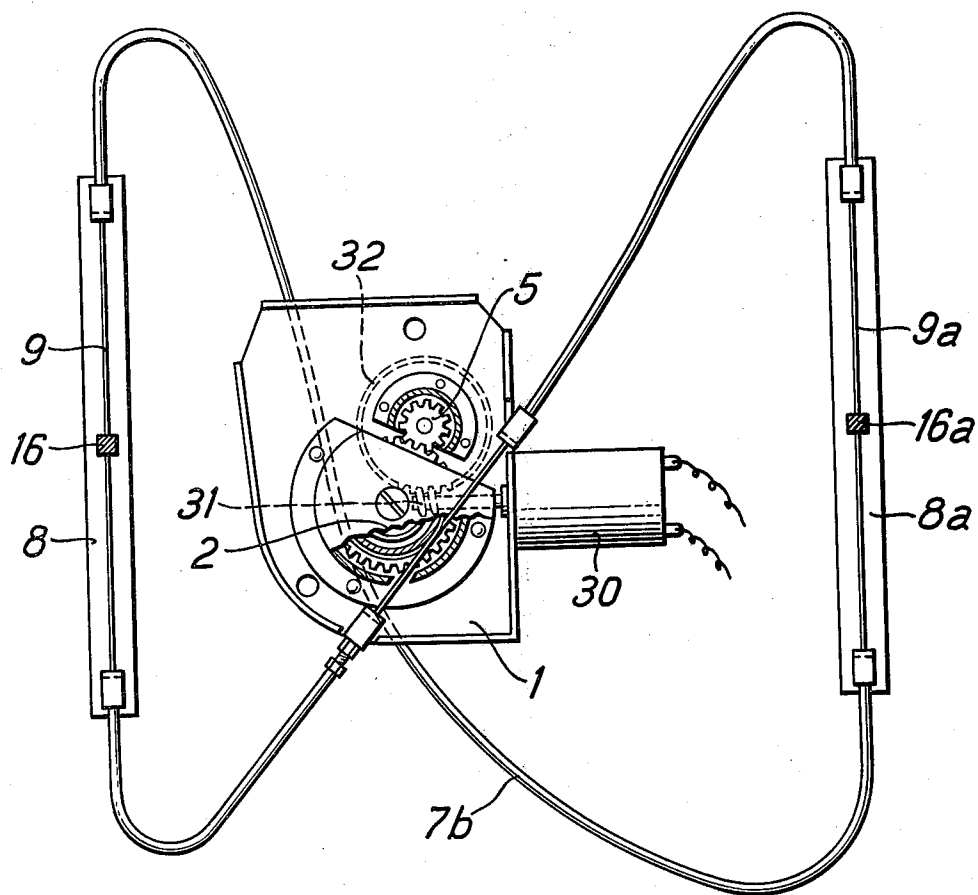


Fig. 5



VEHICLE WINDOW LIFTER

BACKGROUND OF THE INVENTION

The present invention pertains to a window lifter for moving the window panes in automobiles and other vehicles.

For moving window panes in vehicles it is already known to employ a pinion and a toothed segment in mesh therewith which operates a lever that moves the pane up and down. Another known type of window lifter uses a threaded cable which is moved in longitudinal direction by means of a crank-operated pinion. (German patent No. 1,259,730). A portion of the cable is guided in parallel to the direction of displacement of the window pane and to this portion the window pane is fastened for joint displacement therewith. The threaded cable does not form a closed loop. It is merely a certain length of cable which is guided in a partially slotted tube and represents a type of flexible rack. Owing to the rigid slotted tube, however, this window lifter as a whole is not at all flexible but is also very rigid. This is of great disadvantage when mounting the window lifter. The vehicle doors are pressed sheet metal products which are, by the nature of the production process, subject to rather wide tolerances and it is very often difficult to adjust the rigid window lifter to these tolerances.

Further it is already known to use a closed cable loop as a window lifting mechanism. (German patent application No. 1,555,639). The cable is wound around a crank-operated cable drum and travels without the guidance of a tube or cable conduit. The cable is rather supported on idling pulleys which are mounted within the vehicle door so that at least a certain portion of the cable travels in parallel to the direction of displacement of the window pane.

Such a window lifter is easier to mount in the vehicle door as far as the above mentioned tolerances are concerned. However, the cable must be placed individually and separately on each pulley which proves very time-consuming. As a consequence thereof the mounting process is expensive.

It is therefore, an object of the present invention to provide an improved window lifter which overcomes the above outlined disadvantages. It is a particular object to provide a flexible window lifter which, by virtue of its flexibility, may easily be manufactured, stored and handled as a separate subassembly up to the moment it is eventually mounted in the vehicle door.

SUMMARY OF THE INVENTION

The above stated object is attained by a window lifter comprising a closed cable loop, a crankoperated, rotatable cable drum on a base plate around which drum a portion of the cable is wound, a first and a second cable length of cable conduit, each secured with one end to the base plate and being connected with their respective other ends to a spacer bar. The cable extends from the cable drum through the first conduit, then is openly accessible in parallel to the spacer bar, and then extends through the second conduit back to the cable drum.

The invented window lifter may be handled as a separate subassembly which is already mounted as such long before the window lifter is actually incorporated into the vehicle door. The method of mounting the window lifter in the vehicle door is therefore very simple.

At a few points the lifter is screwed to appropriately threaded portions of the door and only the location of these door portions relative to one another has to be fairly accurate. All other door measurements have no influence on the mounting process. Even the location of the threaded door portions relative to one another may be subject to wide allowances because the invented window lifter is flexible in itself and may thus be readily adjusted to all reasonable tolerances.

It is a particular advantage that the conduits which connect the base plate and the spacer bar are flexible in themselves. The whole window lifter may thus be easily adjusted to different shapes and forms of the vehicle door.

Another advantage of the present window lifter is that it is soft and smooth running. The lifter is operated without any toothed gears except for a gear on the crank and on the drum. By means of a nipple pressed on the cable the latter is secured to the drum and is then wound around the drum in the two opposite directions. Upon rotation of the drum the cable is pulled to the one side or to the opposite side without any friction occurring between the cable and the drum. Only inside the conduits there occurs a little friction which, however, is negligibly small.

Moreover, the production costs of the present window lifter are much less than those of the prior art lifters. This will be readily recognized when it is noted of how few parts the whole window lifter is comprised. Many innovations have been introduced with regard to the component parts which are all aimed at achieving a simple and inexpensive mounting process of the device. For example, the fittings at the ends of the conduits are simple u-shaped sheet metal parts which have expedient tabs at one side by means of which these fittings are merely staked together with the base plate and the spacer bar. These staked joints dispense with the expensive prior art turned fittings and are extremely simple to mount.

Normally it will be sufficient if the cable is wound around the drum only once. For the sake of safe operation it is suggested, however, to place the cable around the drum in a plurality of windings in order to enlarge the angle of wrap. In this case it will be advantageous if the drum cylinder is provided with grooves for accepting the cable windings.

The drum may be made of any suitable material. It is, however, suggested that the drum be made from plastic in order to achieve smooth running and little noise.

The drum is a hollow cylinder and in its inner space there is provided a storage spring. One end of the storage spring is fastened to a stationary axle and the other end is secured to the inner drum wall. The spring is tensioned when the window pane is lowered so that some of the potential energy of the pane is stored in the spring. When the window pane is again moved upward the stored energy supports this upward movement.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more readily comprehended from the following description when taken in conjunction with the appending drawings, wherein:

FIG. 1 shows the window lifter of the present invention complete as a separate subassembly,

FIG. 2 is a perspective view of a detail designated A in FIG. 1,

FIG. 3 is a sectional view cut along line III—III in FIG. 1,

FIG. 4 is a perspective view of the cable drum, and

FIG. 5 is a schematic view of the window lifter in a motor-driven embodiment suitable for lifting heavy panes.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, FIG. 1 shows the complete window lifter in the state of a separately mounted subassembly. In this state the window lifter may be separately handled, transported and stored; and in this state it will be incorporated into the vehicle door after the crank has been removed previously.

The window lifter comprises a base plate 1 on which a cable drum 2 is rotatably journaled at one side. The other side of the drum is supported by a cap 3 which is fixedly connected to the base plate at 4a; 4b and 4c, for example by a spot welding process.

On the side adjacent of the base plate the drum comprises a toothed ring 2a which is in mesh with a pinion 5 which is also rotatably journaled to the base plate. The toothed ring and the pinion represent a reduction gear for driving the window pane. A crank 6 is connected to the shaft of the pinion 5 from the remote side by means of which crank the gear is driven. In another embodiment the toothed ring may be a toothed disc whereon the drum is coaxially arranged and secured.

Fittings 12 and 13 are staked to the base plate 1 at substantially opposite sides. The fittings are sheet metal parts bent in a u-shape and being provided with a bottom at one side. The fittings 12 and 13 resemble substantially the fitting 14 as shown in FIG. 2. All these fittings are provided with tabs at one side which fit into appropriate holes both in the base plate 1 and in a spacer bar 8. A safe connection between the respective parts is then brought about by merely bending over the tabs.

The fittings are the end pieces of a first and a second cable conduit 7 and 7a. With one end the conduits are inserted into the fittings 12 and 13 which are fastened to the base plate 1 and with their respective other ends the conduits are inserted into the fittings 14 and 15 which are staked to the spacer bar 8. As will be readily seen from FIGS. 1 and 2 the spacer bar 8 consists of a piece of flat material of which one longitudinal edge is bent over. The ends are provided with bent over edges 8a and 8b by means of which the spacer bar is mounted on the inner wall of the vehicle door.

A cable 9 is guided inside the conduits 7 and 7a. The cable is wound at least once around the drum 2 which, for better guidance, may be provided with an appropriate groove.

Between the two ends of the spacer bar 8, more precisely between the fittings 14 and 15, the cable travels openly accessible and there the cable ends are connected and pressed together with a nipple 16 to form a closed loop.

The nipple 16, at the same time, provides a carrier for a carrier plate 17 to which the window pane 25 to be moved is attached. The connecting means between the nipple 16 and the carrier plate 17 is a u-shaped sheet metal part 18 (FIG. 3) which has on its sides pressed-in spherical caps by means of which it is pushed over and secured to the nipple 16.

For attaching the carrier plate 17 the two u-tabs of the part 18 are then inserted into a hole in the carrier plate 17 and bent over, as shown in FIG. 3. The carrier plate 17 is thus fixedly connected to the cable 9 for joint movement therewith. The simple method of connecting the part 18 and the carrier plate 17 is a further example of an improved joint which brings about an inexpensive mounting method.

On the side facing the spacer bar 8 the carrier plate 17 is provided with a shaped part 19 for guiding the carrier plate along the spacer bar 8, as shown in FIG. 3. The shaped part 19 has a groove wherein the bent over portion 8a of the spacer bar 8 slides. A rear portion 19a of the part 19 extends behind the spacer bar 8 and provides a guidance in the direction perpendicular to the direction of the cable movement. There is, however, a gap B left between the shaped part 19 and the spacer bar so that tolerances in guiding the window pane may be absorbed.

The base plate 1 and the spacer bar 8 are provided with two holes each 9a; 9b and 10a; 10b by means of which the complete window lifter is mounted inside the vehicle door. It is a particular advantage of the window lifter of the present invention that for easy mounting only the location of these two pairs of holes and of the respective threaded portions in the vehicle door must match rather accurately. This simple mounting method, which is not influenced by any other measurement allowances, represents a major improvement over the prior art window lifters.

The fitting 13 which is the lower one on the base plate 1 as shown in FIG. 1 is, further, provided with a set screw 11 for varying the length of the respective conduit 7a. By varying the position of the set screw the closed cable loop may be made play-free.

The window lifter of the present invention operates in the following manner: Rotation of the crank 6 in one or the other direction causes the drum 2 also to rotate and thus to move the cable 9 in longitudinal direction. This, in turn, causes the carrier plate 17 to move up and down between the fittings 14 and 15 so that the window pane 25 is lowered or lifted in its specific guide means. The free distance between the fittings 14 and 15 limits the movement of the carrier plate in either direction and thereby the number of revolutions the crank 6 may make is also limited.

The pinion 5 may be provided with a brake spring which may be used for arresting the cable and the window pane so that the pane will not give way under its own weight when in its upper position. However, the use of such a brake is already known in the art and is not an element of the present invention. For the sake of clarity the brake spring has therefore been omitted in the drawings.

The drum 2 is a hollow cylinder with its open side facing the observer of FIGS. 1 and 4. In the inner cylindrical space there is arranged a support spring 20 having the form of a clock spring. One end of the spring is connected to the inner cylinder wall while the other end is secured to the stationary drum axle. The arrangement is such that the spring is untensioned when the carrier plate 17 with the window pane 25 is in its upper position. When the window is lowered the spring will be tensioned thereby storing some of the potential energy of the window pane. When thereafter the window is again lifted this stored energy will support the lifting process.

The use of such a support spring is already known in the art. However, it is new to arrange the spring in the hollow interior of a drum whereby considerable space is saved.

In order to connect the cable to the drum the latter is provided with a hole 2c in the wall and the cable has a nipple 2d pressed thereon approximately at the middle between the cable ends as shown in FIG. 4. For securing the cable on the drum the cable is folded and threaded from the inside through the drum hole 2c which of course, has to be smaller in diameter than the nipple 2d. The cable is pulled through the hole until the nipple abuts against the inner wall of the cylinder and is then wound in opposite directions around the drum. Further, the cable ends are guided through the fittings 12 and 13 and the respective conduits 7 and 7a. Adjacent the spacer bar 8 the cable loop is then closed in the above-described manner.

FIG. 5 shows an embodiment of the window lifter of the present invention wherein the pinion 5 is motor-driven. An electric motor 30 is attached to the base plate 1 and the rotatable shaft of the motor is provided with a worm 31. The latter meshes with a worm gear 32 which is mounted on the shaft of the pinion 5 in place of the crank 6. Although not shown in the drawing it will be apparent that upon closing of a switch the motor will be energized and the worm 31 will drive the worm gear and the pinion 5 in the same manner as the pinion is driven manually in the embodiment shown in FIG. 1.

Usually motor-driven window lifters are mounted in big cars which have big and heavy window panes. Such panes are difficult to lift if only one carrier plate is provided to which the pane is attached. FIG. 5 therefore, shows an embodiment having two nipples 16 and 16a to each of which one carrier plate (not shown) may be attached. The lifting force is thus applied to the window pane at two different places which are suitably spaced from one another along the lower pane edge.

In order to have two portions of the cable 9 which are openly accessible and which may be arranged in parallel to the direction of the travel of the window pane two spacer bars 8 and 8a are provided. A third length of conduit 7b is inserted between the first and the second spacer bar 8; 8a in addition to the already described conduits 7 and 7a of FIG. 1. The arrangement of the first and second spacer bar and of the three pieces of conduit will be apparent from FIG. 5. The arrangement is such that the nipples 16 and 16a travel both in the same direction whenever the pinion 5 and the cable drum 2 are rotated.

The remaining elements of the embodiment are substantially the same as those described with reference to the FIGS. 1 through 4. This is particularly true with regard to the base plate, the cable drum, the fittings, and the carrier plates.

What is claimed is:

1. A window lifter for vehicles, comprising:

- a. a base plate;
- b. a drum rotatably mounted on said base plate;
- c. a first and a second length of cable conduit, each fastened with one end to said base plate at substantially opposite sides;

- d. a spacer bar inserted between said respective other ends of said conduits;
- e. a cable loop closed by pressing a nipple over both cable ends of which a portion is wound around said drum; said cable extending through said first and said second length of conduit and traveling openly accessible in parallel to said spacer bar;
- f. means for attaching the window pane to said cable hinged on said nipple where said cable is openly accessible along said spacer bar;
- g. means provided at said base plate and said spacer bar for mounting said window lifter in the vehicle door; and
- h. fittings for fastening the respective ends of said first and second length of cable conduit to said base plate and said spacer bar, said fittings consisting of a U-shaped sheet metal part provided with a bottom against which the conduit end rests and having tabs on one side for insertion into appropriate holes of the base plate.

2. A window lifter as claimed in claim 1, wherein said drum is provided with grooves for guiding the cable windings.

3. A window lifter as claimed in claim 1, wherein said drum comprises a toothed ring and wherein a pinion is mounted on said base plate so as to be in mesh with said toothed ring, said pinion being adapted to be rotated by an outside force.

4. A window lifter for vehicles as claimed in claim 1, and further comprising a set screw attached to one fitting for varying the length of the conduit and thereby making the cable loop play-free.

5. A window lifter as claimed in claim 1, and further comprising a storage spring disposed in the interior of the cable drum for storing a portion of the potential energy of the window pane when said pane is lowered; one end of said spring being secured to the inner drum wall and the other end being fastened to the stationary drum axle.

6. A window lifter as claimed in claim 1, wherein a hole is provided in the wall of said drum and a nipple is pressed on the cable at its middle portion and said cable is threaded with both ends through said hole so that said cable is positively attached to said drum.

7. A window lifter as claimed in claim 1, and further comprising an electric motor attached to said base plate for rotating said cable drum when said motor is energized.

8. A window lifter as claimed in claim 7, and further comprising a second spacer bar and one additional length of conduit inserted between said first and second spacer bar for providing an additional cable portion which is openly accessible and may be mounted in parallel to the direction of window travel for fastening a second nipple to the cable to which second nipple a second carrier plate for the window to be lifted may be fastened; the cable extending in such a manner through said first, second and third conduit and along said first and second spacer bar that said first and second nipple travel in the same direction when said cable drum is rotated.

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