April 2, 1963 C. M. LIND 3,084,318

GARAGE DOOR OPENERS

Filed May 4, 1960 2 Sheets-Sheet 1

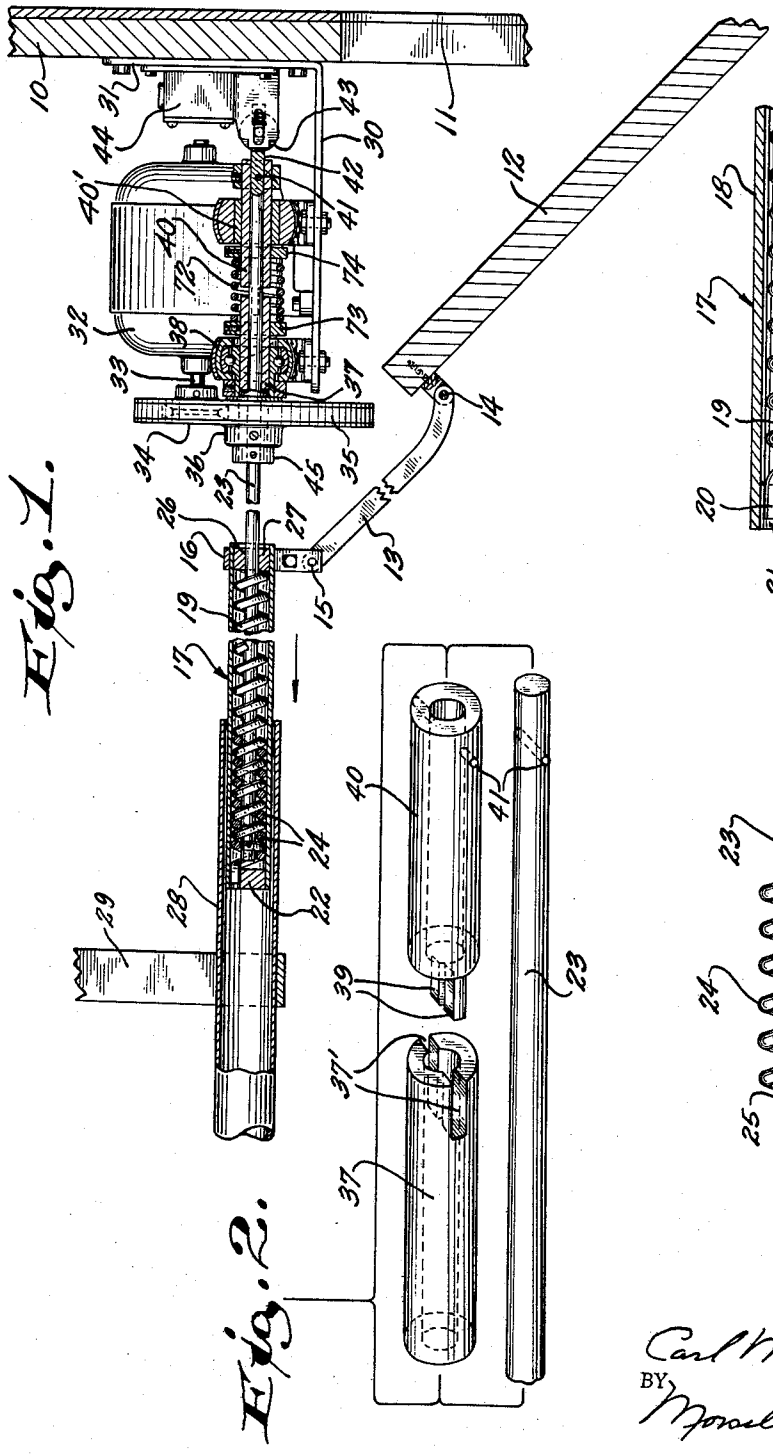


Fig. 1.

Fig. 2.

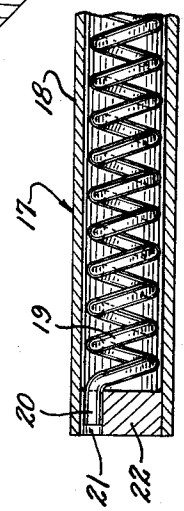


Fig. 4.

Fig. 3.

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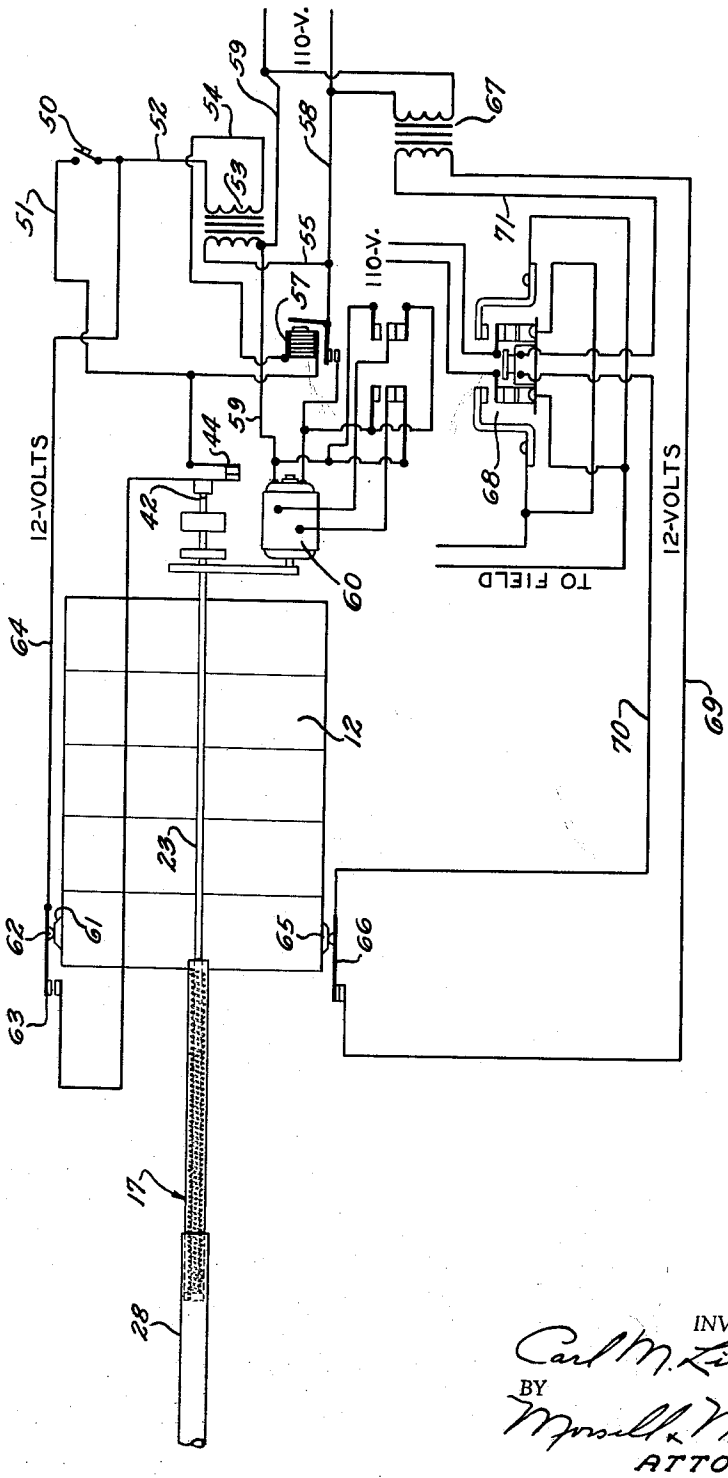


Fig. 5.

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GARAGE DOOR OPENERS

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This invention relates to improvements in garage door openers.

In the use of conventional electric garage door openers if there is an obstruction which accidently gets in the way of the closing door, considerable damage can be done to the mechanism.

It is a general object of the present invention to provide an improved electric garage door opener having novel means operable in response to the door hitting an obstruction during closing movement, for breaking the circuit to the electric motor, the improved mechanism incorporating novel means for preventing damage to the parts as a result of the impact.

A further object of the invention is to provide an improved garage door opener wherein there is a traveling nut connected to the door to raise and lower the latter, together with a screw for causing movement of said traveling nut, the interengaging threads of said two parts being formed in a novel manner to provide a resiliency which will withstand abnormal stresses and which will also serve in conjunction with other parts to provide for movement of a switch actuating part to cut off the electric switch and thereby stop the motor in case the door hits an obstruction during lowering movement.

Other objects of the invention are to provide a garage door opener which is simple and foolproof in operation, relatively inexpensive to manufacture, simple to install, well adapted for use in connection with radar controls, and otherwise well adapted for the purposes described.

With the above and other objects in view, the invention consists of the improved garage door opener, and all of its parts and combinations, as set forth in the claims, and all equivalents thereof.

In the accompanying drawings, illustrating one complete embodiment of the preferred form of the invention, in which the same reference numerals designate the same parts in all of the views:

FIG. 1 is a fragmentary longitudinal vertical sectional view through a portion of a garage showing the garage door opener partly in side elevation and partly in longitudinal vertical section;

FIG. 2 is an exploded perspective view showing certain of the parts which coact with the cut-off switch;

FIG. 3 is a fragmentary side view showing the inner end of the operating screw;

FIG. 4 is a fragmentary longitudinal sectional view showing the inner end of the traveling nut; and

FIG. 5 is a wiring diagram.

Referring more particularly to the drawing, the numeral 10 designates the upper portion of the front of a garage above the door opening 11 and the numeral 12 designates the upper section of an overhead door of the type formed of a multiplicity of hinged-together horizontal sections.

An operating arm 13 has one end pivotally connected as at 14 to the door section 12 and has its other end pivotally connected as at 15 to a bracket 16 on a traveling nut 17. The traveling nut 17 comprises a sleeve 18 within which is internal threading 19. In the preferred form of the invention this threading is formed by a helical wire coil having one end 20 anchored in a hole 21 in a plug 22 at the inner end of the sleeve.

A screw which is formed by an operating rod 23 having threads at its inner end provided by a helical

spring 24, is threaded into the nut 17 as shown in FIG. 1. The coil 24, forming the threading for the screw, has its inner end suitably secured to the inner end of the rod 23 as at 25. The threading formed by the coil 24 may be relatively short as shown in FIG. 3 and is of a pitch to thread between the convolutions of the coil 19 of the sleeve as shown in FIG. 1. The rod 23 extends rotatably through a bearing hole 26 in a plug 27 at the outer end of the traveling nut 17. The traveling nut 17 is adapted to be guided in its longitudinal movement by a guiding sleeve 28 suitably supported from the rafters of the garage by any support such as a plurality of straps 29.

Attached to the front of the garage is any suitable platform 30 having a front vertically disposed attaching face 31. Mounted on the platform is an electric motor 32 having a drive shaft 33 carrying a pulley 34. An endless belt 35 connects the motor pulley 34 with a pulley 36 rigidly mounted on a sleeve 37, the latter having a forwardly projecting portion suitably mounted for rotation in a bearing 38. The sleeve 37 has its forward end slotted as at 37' to longitudinally slidably receive the spaced jaws 39 of a coacting sleeve section 40 to thereby clutch the two sleeve sections together for rotation while permitting limited sliding movement of the sleeve 40 in a bearing 40'. It is to be noted that when the parts are in the normal operating position of FIG. 1 the adjacent ends of the sleeves 37 and 40 are spaced apart to permit inward movement of the sleeve 40. The operating rod 23 extends rotatably through the sleeve section 40 between the two jaws 39. At the forward end of the sleeve 40 the screw rod 23 is pinned to the sleeve as at 41, there being a switch operating end 42 which projects forwardly beyond the sleeve and which is adapted to coact with an operating roller 43 on a cut-off switch 44 in a manner to be hereinafter explained. A set collar 45 on the rod 23, against the hub of the pulley 36 limits forward movement of the rod.

Operation

In operation (referring more particularly to FIG. 5), when the starter button 50 is manually pressed it energizes the 12 volt circuit through wires 51, 52 and 54, from the 12 volt transformer 53 to the starting relay 57, the primary coil of said transformer being connected by wires 58 and 59 with a 110 volt source. This circuit may be designated a door opening circuit. This then completes the 110 volt circuit through wires 58 and 59 to the electric motor 60. Operation of the motor causes rotation of the sleeve 37 (FIGS. 1 and 2), and through the engagement of the jaws 39 in the slots 37', rotation of the sleeve 40. Due to the fact that the screw rod 23 is pinned to the sleeve 40, the screw rod 23 will be rotated to cause rotation of the screw 24 at its inner end. As the screw 24 is rotated in a raising direction it will cause the traveling nut 17 to be moved toward the left, referring to FIG. 1, inwardly in the guiding sleeve 28. Due to the fact that the upper section 12 of the garage door is attached by the arm 13 to the traveling nut, inward movement of the nut will cause raising of the door. When the door has been fully opened, as illustrated in FIG. 5, a cam 61 on the door will engage the cam projection 62 to open the switch 63 to break the circuit through the wire 64 and stop the motor 60, and hence stop the door in fully raised position. At the same time the cam 65 closes switch 66 to close the 12 volt starting circuit from the transformer 67 to the reversing relay 68, through wires 69, 70 and 71. This prepares the motor for operation in a reverse direction. This circuit may be termed a door closing circuit.

To lower the door the starting button 50 must be

again pushed to again energize the 12 volt circuit from the transformer 53 to the relay 57, the latter again closing the 110 volt circuit to the motor 60 to again cause motor operation but in a reverse direction because of the action of the reversing relay 68. This reverse operation of the motor will cause reverse movement of the screw 24 on the screw rod 23 and outward movement of the nut 17 toward the front of the garage, thereby moving the door toward closed position.

As the door is being lowered, if it should hit on obstruction (or at the end of fully closing movement) then there is an inward reaction exerted on the traveling nut 17 which, through the engagement between the screws 19 and 24 formed by the coils, causes slight movement of the rod 23 toward the rear end of the garage. During such movement the rod 23 slides a short distance within the sleeve 37 pulling the sleeve 40 with it. Such movement of the sleeve 40 is permitted by the sliding fit of the jaws 39 of the sleeve 40 within the slots 37' of the sleeve 37. This movement pulls the switch actuating end 42 for the rod 23 out of contact with the switch roller 43 to permit opening of the switch 44 by its spring, the latter being of a normally open type. During such reaction movement, any jars are compensated for by the engagement between the coil spring screws 19 and 24. With the switch 44 open the motor 60 will be stopped to stop lowering movement of the door so that no harm can be done to the mechanism. Thereafter, it is again necessary to push the starter button 50 which will now reopen the door permitting the obstruction to be removed. When the button 50 is again pressed the door will be lowered as before, being stopped at the end of lowering movement by the same stopping mechanism just described, or by a limit switch if desired.

In order to insure returning the switch actuating end 42 of the rod 23 to the normal switch closing position it may be desirable to employ a spring such as the spring 72 which may act between collars 73 and 74 secured to the sleeves 37 and 40 respectively. It is, however, possible to eliminate the spring 72 as the helical coils 24 and 19 can be so worked out that there is enough resiliency in their interengagement to return the rod 23 to switch closing position.

From the above it is apparent that the improved garage door opener can be manufactured in a very simple manner from easily purchased or machined parts and that the assembly of the parts is very simple. It is also apparent that a very simple and positive means for stopping door closing movement when an obstruction is hit has been provided, together with mechanism for preventing damage to parts.

It is to be understood that the present invention is not to be limited to the exact details of construction shown and described, for obvious modifications will occur to persons skilled in the art.

What I claim is:

1. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from a normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod extending through said first sleeve and connected to said second sleeve for rotation therewith, a screw on the inner end of said rod, a traveling nut on said screw adapted to be connected to the garage door to operate the latter, an electric switch in the circuit to said motor engaged by a portion of said rod when said second sleeve is in normal position to maintain the motor circuit complete, said connection between the first and second sleeves permitting axial movement of said second sleeve and rod away from normal position to break said switch engagement when the door has completed lowering movement or has engaged an obstruction during lowering.

2. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from a normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod slidable intermediate its length in said first sleeve and connected to said second sleeve for rotation therewith, a screw on the inner end of said rod, a traveling nut on said screw adapted to be connected to the garage door to operate the latter, an electric switch in the circuit to said motor engaged by a portion of said rod when said second sleeve is in normal position to maintain the motor circuit complete, said connection between the first and second sleeves permitting axial movement of said second sleeve and rod away from normal position to break said switch engagement when the door has completed lowering movement or has engaged in obstruction during lowering.

3. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from a normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod slideable intermediate its length in said first sleeve and connected to said second sleeve for rotation therewith, a screw on the inner end of said rod, a traveling nut on said screw adapted to be connected to the garage door to operate the latter, a normally "off" electric switch in the circuit to said motor engaged by a portion of said rod when the second sleeve is in normal position to be in "on" and maintain the motor circuit complete, said connection between the first and second sleeves permitting axial movement of said second sleeve and rod away from normal position to break said switch engagement when the door has completed lowering movement or has engaged an obstruction during lowering.

4. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod slideable intermediate its length in said first sleeve and connected to said second sleeve for rotation therewith, screw threading on the inner end of said rod, an internally threaded traveling nut on said screw adapted to be connected to the garage door to operate the latter, the threading on at least one of said members being formed by a helical coil, a normally "off" electric switch in the circuit to said motor engaged by a portion of said rod when the second sleeve is in normal position to be "on" and maintain the motor circuit complete, said connection between the first and second sleeves permitting axial movement of said second sleeve and rod away from normal position to break said switch engagement when the door has completed lowering movement or has engaged an obstruction during lowering.

5. In an apparatus for operating an overhead garage door, a rotatably supported sleeve, means including an electric motor for rotating said sleeve, a rod extending through said sleeve, a connection between said rod and

sleeve providing for rotatable driving of said rod when said sleeve is rotated while permitting axial sliding movement of said rod relative to said sleeve, a screw on the inner end of said rod, a traveling nut on said screw adapted to be connected to the garage door to operate the latter, an electric switch in the circuit to said motor, means normally maintaining said switch in "on" position while said door is operating, said sliding connection for the rod permitting axial movement of said rod away from operating position when the door has completed lowering movement or has engaged an obstruction during lowering, and means responsive to said axial movement of said rod for causing said switch to stop said motor.

6. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from a normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod extending through said first sleeve and connected to said second sleeve for rotation therewith, a screw on the inner end of said rod, a traveling nut on said screw adapted to be connected to the garage door to operate the latter, an electric switch in the circuit to said motor, means normally maintaining said switch in "on" position while said second sleeve is in normal position, said sliding support for the second sleeve permitting axial movement of said rod away from normal position when the door has completed lowering movement or has engaged an obstruction during lowering, means responsive to said axial movement of said rod for causing said switch to stop said motor, and means for returning said rod and sleeve to normal position.

7. In an apparatus for operating an overhead garage door, a rotatably supported first sleeve, means including an electric motor for rotating said sleeve, a second sleeve supported in axial alinement with said first sleeve for limited sliding movement away from normal position, a connection between said first and second sleeves providing for rotatable driving of said second sleeve when said first sleeve is rotated while permitting axial sliding movement of said second sleeve relative to said first sleeve, a rod slidable intermediate its length in said first sleeve and connected to said second sleeve for rotation therewith, screw threading on the inner end of said rod, an internally threaded traveling nut on said screw adapted to be connected to the garage door to operate the latter, the threading on at least one of said members being formed by a helical coil, a switch in the circuit to said electric motor, means normally maintaining said switch in "on" position while said second sleeve is in normal position, said sliding support for the second sleeve permitting axial movement of said rod away from normal position when the door has completed lowering movement or has engaged an obstruction during lowering, and means responsive to said axial movement of said rod for causing said switch to stop said motor.

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