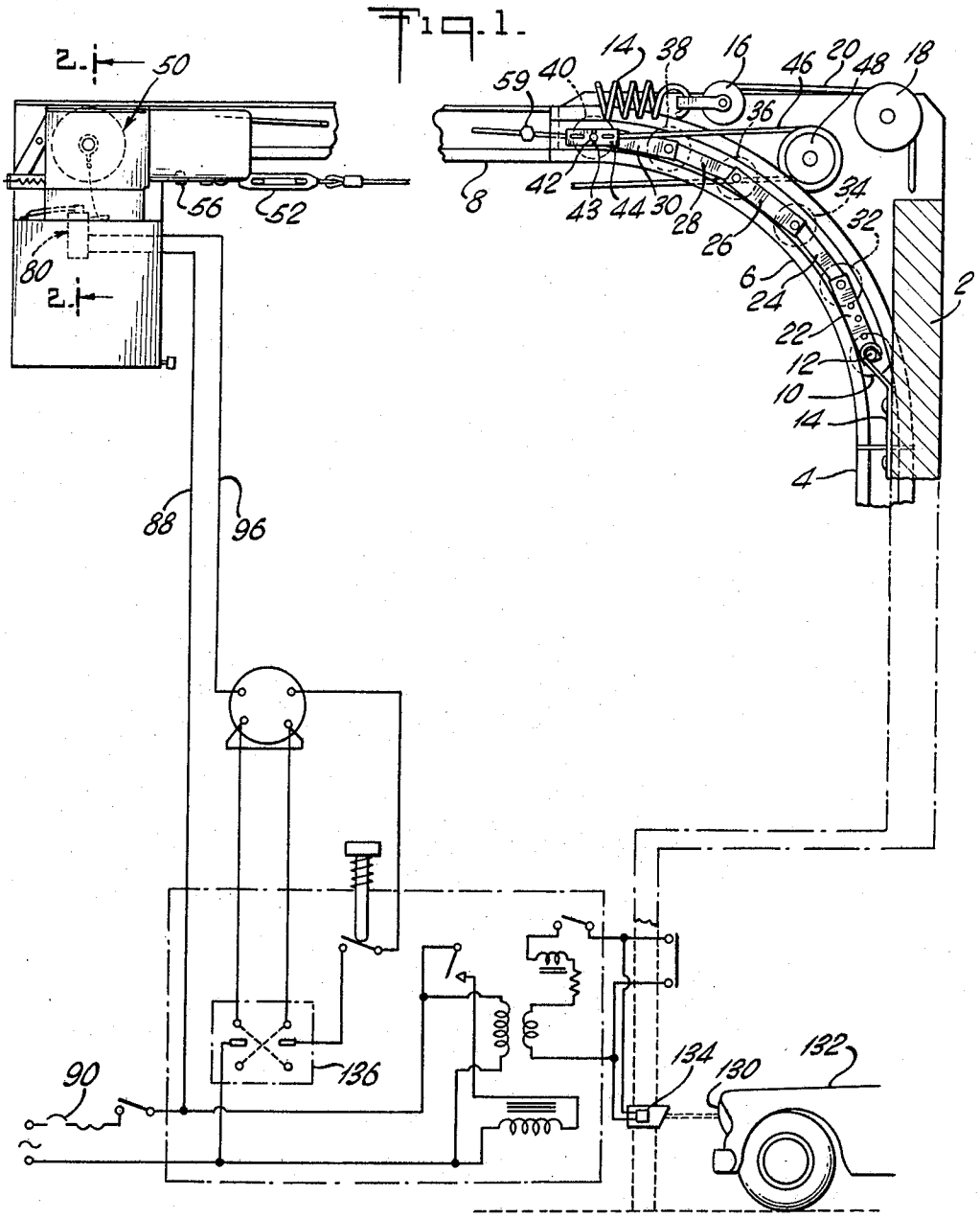
Dec. 2, 1969 F. A. PURDY 3,481,387

DOOR OPERATOR

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Fig. 1.



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DOOR OPERATOR

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Fig. 2.

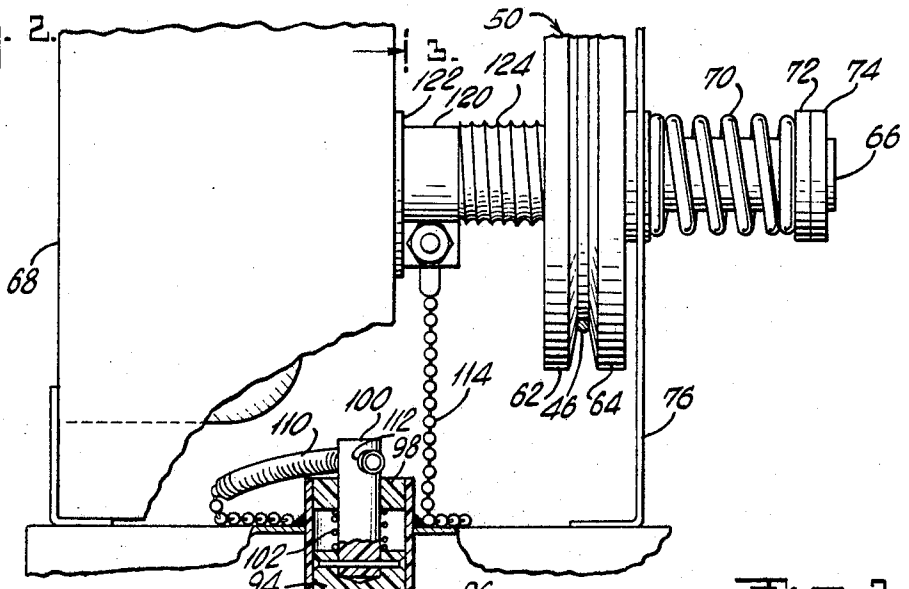


Fig. 5.

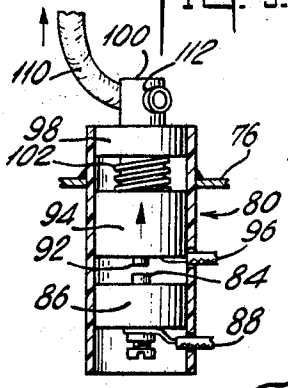


Fig. 3.

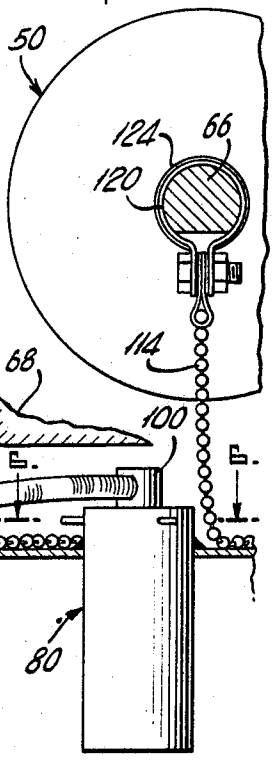
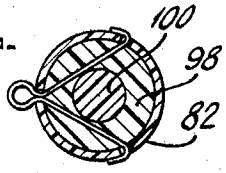


Fig. 6.



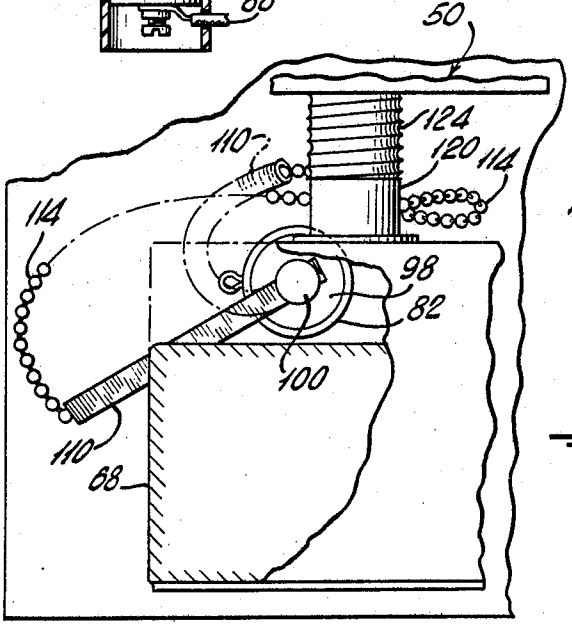


Fig. 4.

United States Patent Office 3,481,387 Patented Dec. 2, 1969

3,481,387

DOOR OPERATOR

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Filed Jan. 18, 1968, Ser. No. 698,901
Int. Cl. E05f 15/20; E05d 15/38
U.S. Cl. 160—188 11 Claims

ABSTRACT OF THE DISCLOSURE

A motor operated door having a light sensitive cell for actuating the door motor for opening and closing the door and a safety switch in the motor control circuit, the safety switch being connected by a spring and chain to a collar on the motor shaft so that, if the door is stopped by an obstruction during opening or closing, the spring and chain will open the switch to stop the motor after the motor has operated through its normal cycle.

BACKGROUND OF THE INVENTION

This invention relates to motor operated doors and, more particularly, to a safety switch in the motor control circuit for such a door.

In my U.S. Patent No. 3,248,630 there is shown and described a motor operated door wherein a motor, connected through a double-disc, spring compressed, grip sheave and cable to the door, is actuated by the headlight beam of a vehicle to open and close the door. When the motor, in opening the door, brings the door to its fully opened position, the motor is reversed and, when next operated, closes the door. Conversely, when the door reaches its fully closed position, the motor is again reversed for subsequent door opening.

As has been noted, the motor is connected to the door through a double-disc, spring compressed, grip sleeve and a cable. The cable is gripped between the spring compressed discs and, in normal operation, the motor, in turning the grip sheave, operates the cable connected to the door. The spring on the grip sheave is adjusted so that, during such normal operation, the discs of the grip sheave grip and turn the cable but, if the door encounters an obstruction, such as, a bicycle, tool, or the like, the cable slips between the grip sheave discs. This, of course, prevents damage to the door, the control mechanism and the obstructing object but, unless the motor is turned off, the motor continues to run.

SUMMARY OF THE INVENTION

In the instant invention, a double-disc, spring compressed, grip sheave is affixed to the end of a door operating motor shaft and the motor shaft is connected to a switch in the electric leads supplying electrical power to the motor. The switch is connected to the motor shaft in such a way that, during normal operation of the motor in the first direction to open the door and in the reverse direction to close the door, the switch remains closed and power to the motor is not interrupted by the switch. However, if the door encounters obstruction, or is otherwise held in position while the motor is running, thereby causing a cable to slip on the grip sheave, after the motor has turned to grip sheave a prescribed distance beyond the grip sheave's normal cycle of operation to open, or close, the door, the switch is then opened, thereby cutting off the power to the motor and stopping the motor.

The switch, and the connection of the switch to the shaft in the instant invention are relatively simple. Once the obstruction holding the door has been removed, the connection of the switch to the motor shaft can be easily reset and the door operator will, thereafter, open

and close the door in the normal cycle, without interference from the switch, until such time as an obstruction to opening or closing of the door again occurs.

DESCRIPTION OF THE DRAWINGS

The instant invention will be understood from the following description and the appended drawings illustrating the preferred embodiment of the invention and in which:

FIGURE 1 is an elevation-view, partially broken away, and partially in diagram, and viewed toward one jamb of a garage-doorway, showing a bracket on the doorway's inner facing and cable-pulleys on the bracket, portions of the vertical and horizontal tracks and the curve track, the door operator motor mounting, with switch, and the motor control circuitry, diagrammatically;

FIGURE 2 is a view, partly in section, taken along line 2—2 of FIGURE 1;

FIGURE 3 is a view taken along line 3—3, FIGURE 2;

FIGURE 4 is a view taken along line 4—4, FIGURE 3;

FIGURE 5 is an elevation-view of the switch; and

FIGURE 6 is a top plan view of a portion of the mechanism of FIGURE 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Door **2** is of the conventional overhead type and is made up, in the usual manner, of horizontally extending sections hinged together, only the top section being shown in FIGURE 1. Door **2** is guided in vertical track **4**, curve track **6** and horizontal track **8** by track engaged roller **10** connected by pin **12** and bracket **14** to door **2**. A counterbalancing spring **14** is connected by pulleys **16**, **18** and cable **20** to door **2**, in conventional manner, for counterbalancing the weight of the door as the door is opened and closed, in the customary manner employed with both manual and motor operated doors.

As shown in FIGURE 1, door **2** is connected by pin **12**, carried by bracket **14**, to links **22**, **24**, **26**, **28**, **30** and rollers **32**, **34**, **36**, **38**, **40**, and by plate **44**, held by cotter pin **43** on shaft **42** of roller **40**, to endless cable **46** which, at the forward end of horizontal track **8**, passes around pulley **48** mounted on the door frame and, at the opposite end of the track, passes around grip-sheave, generally designated **50**. For purpose of adjusting the tension of endless cable **46**, turn-buckle **52** is attached, at its opposite ends, to the ends of cable **46** to form the cable in an endless loop around pulley **48** and grip-sheave **50**. The upper and lower runs of cable **46** have, adjustably affixed to the cable, shipper buttons **54**, **56**, respectively, for purposes later described.

As has been noted, when grip-sheave **50** is rotated in a first direction, door **2** is moved from the closed position to the open position and, when grip-sheave **50** is rotated in the opposite direction, door **2** is moved from the open position to the open position. This is accomplished by reversing the direction of the drive of grip-sheave **50** when door **2** reaches its fully opened and fully closed position by a mechanical linkage, such as shown and described in my U.S. Patent 3,248,630 which mechanical linkage is tripped by shipper buttons **54**, **56**, in the manner described in my aforementioned patent, to control the operation of the electrical control circuitry of the motor driving grip-sheave **50**. For purposes of illustration and a better understanding of the instant invention, the mechanical linkage for controlling the circuitry of the grip-sheave drive motor and for reversing the drive direction of grip-sheave **50** is not shown or described, reference being had to the illustration and description thereof in my aforementioned patent.

Referring to FIGURES 1 and 2, grip-sheave **50** is made up of two tapered faced pulley heads **62**, **64** keyed to shaft **66** of grip-sheave drive motor **68**. Pulley half **64** is urged, by compression spring **70**, on shaft **66**, toward pulley half **62** to grip cable **46** between the tapered faces of pulley halves **62**, **64**. The compression of spring **70**, urging pulley half **64** toward pulley half **62**, is adjusted by nuts **72**, **74** threaded onto the end of shaft **66**. Motor **68** and grip-sheave **50** are supported in frame **76** affixed to horizontal track **8**, or to the garage structure.

Switch, generally designated **80**, having housing **82**, is glued, welded or otherwise suitably attached to frame **76**. Stationary contact **84** is carried in housing **82** by a fixed, non-conductive, mounting **86**, mounted in fixed position in housing **82**. Contact **84** is connected, by lead **88**, to one side of power source **90**. Moveable contact **92**, mounted in non-conductive mounting **94** slideable in housing **80**, is connected by lead **96** to motor **68**, for purposes to be described. At the upper end of switch **80** a non-conductive guide **98** is fixed to housing **80** by cotter key **99** (FIGURE 6). At one of its ends switch actuator rod **100** is connected to mounting **94** of moveable contact **92** and extends outwardly through guide **98**. Compression spring **102** is compressed between member **98** and moveable mount **94**, urging contact **92** toward and into contact with fixed contact **84**.

Referring to FIGURES 2 and 5, rod **100**, with moveable mount **94** and moveable contact **92**, is moveable in housing **80** and guide **98** in the direction of the arrow in FIGURE 5 but, for reasons more obvious hereinafter, is not rotatable in guide **98**. The upper end of rod **100** is connected by tightly coiled spring **110**, press fitted through an opening **112** through the end of rod **100**, and chain **114** to collar **120** clamped on shaft **66** between collars **122**, **124**. For reasons later described, collar **120** is not keyed to shaft **66** but, during normal operation of motor **68**, turns with shaft **66**. Chain **114** is of a length slightly more than one half the length of the circumferential travel of the outer surface of collar **120** and, for the first half of each cycle of rotation of collar **120** during the opening or closing of the door, chain **114** is unwound from collar **120** and during the remaining half of each cycle is wound onto collar **120**, for purposes to be described.

In operation, as described in my aforementioned U.S. Patent 3,248,630 the light beam from the headlights **130** of a vehicle **132**, when directed to light sensitive cell **134**, energizes motor **68** to open, or close, the door, depending upon whether the door is to be opened or closed and the preset condition of reversing switch **136**, all as described in my aforementioned patent. For the first half of the operating of the opening or closing cycle, chain **114** is unwound from collar **120** and, for the remainder of the cycle, is wound onto collar **120**. During normal operation, collar **120** rotates with shaft **66** and there is no slippage between collar **120** and shaft **66**. Because chain **114** is slightly longer than half of the circumferential travel of collar **120**, chain **114** is unwound from and rewound on collar **120** as the collar rotates with the shaft during normal operation. Thus, during such normal operation, there is no movement of contact **92** and, insofar as switch **80** is concerned, electrical power to motor **68** is maintained.

If, during the operation of motor **68** to open, or close, door **2**, door **2** should encounter an obstruction or be held, the increased load on cable **46** overcomes the frictional door-driving urge applied by spring **70** upon cable **46**, allowing slippage by cable **46**, thereby preventing overload and damage to motor **68**. Thus, while door **2** is in engagement and held by the obstruction motor **68** and shaft **66** continue to rotate. Such continued rotation also continues the rotation of collar **120** to wrap chain **114** around rotating collar **120**. After the full length of chain **114** is wound onto collar **120**, the continued rotation of collar **120** with motor **68** and shaft **66** causes

chain **114** and spring **110** to move rod **100**, moveable mount **94** and moveable contact **92** upward in housing **82** of switch **80**, separating contacts **84**, **92** and opening the circuit to motor **68**. When contacts **84**, **92** are opened, electrical power to motor **68** is cut off and the motor is stopped. Thus, when door encounters an obstruction or is held, operation of motor **68** continues only until contacts **84**, **92** are opened. The obstruction, or whatever else might be holding door **2**, can then be removed. Once the obstruction is removed and the door is free to operate, collar **120** can be rotated, manually, on shaft **60**, to free chain **114**, close contacts **84**, **92** and, by continued manual rotation of collar **120**, the interrupted cycle of motor **68**, shaft **66**, whether opening or closing door **2**, can be completed and, after completion, collar **120** can be manually rotated on shaft **66** a few degrees further to reset safety switch **80** for subsequent normal operation of the door. To facilitate manual rotation of collar **120**, or to loosen chain **114**, chain **114** may be detached from collar **120**, by hand, and re-attached after collar **120** is reset. For this purpose, a ball-chain is preferred and the ball-chain **114** may be attached to collar **120** by a suitable ball-chain attachment, such as a Type A coupling as manufactured by Ball Chain Manufacturing Company, Inc., Mount Vernon, N.Y.

If, while door **2** is being held by an obstruction, and motor **68** and shaft **66** are rotating and turning collar **120**, switch **80** should become jammed or frozen so that contacts **84**, **92** cannot be opened by chain **114** and spring **110**, collar **120** slips on shaft **66** thereby avoiding damage to the motor, shaft, switch and housing. It is preferred, however, that contacts **84**, **92** open and stop motor **68**.

In carrying out the instant invention, rod **100** of switch **80** could, of course, be connected to collar **120** by various mechanical connections. Because of the mechanical linkages of the motor reversing mechanism, not shown on the instant drawings, it is preferred, however, to use the illustrated arrangement of spring **110** and chain **114**. In such arrangement, spring **110**, as chain **114** is wound on to and unwound from collar **120**, directs the chain into the area under the motor and out of the way of the mechanical reversing linkage.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention described.

What is claimed is:

1. A door-operator comprising, a motor, a door, a shaft on said motor, a grip-sheave on said shaft, an endless cable connected to said door and around said grip-sheave so that, when said motor is driven in a first direction, said motor drives said grip-sheave and opens said door and, when said motor is driven in the opposite direction, said motor drives said grip-sheave and closes said door, power means connected to said motor for driving said motor in said first and said opposite directions, a switch in the connection of said power means to said motor and means on said motor shaft connected to said switch for opening said switch and stopping said motor after said motor has driven said grip-sheave through a full cycle in a first direction to open said door and through a full cycle in the opposite direction to close said door, said grip-sheave including means for slipping said endless cable on said grip-sheave when said door is obstructed while being driven by said motor in said first and said opposite directions so that after said motor has driven said grip-sheave through a full cycle in said first or opposite direction and said door is obstructed said means on said motor shaft connected to said switch will open said switch and stop said motor.

2. A door-operator as recited in claim 1 in which said means on said shaft is a collar and said collar is connected to said switch by a chain.

3. A door-operator as recited in claim 2 in which said collar is connected to said switch by a chain and spring.

4. A door-operator as recited in claim 3 in which said chain in unwound from and wound onto said collar as said motor drives said grip-sheave.

5. A door-operator as recited in claim 4 in which said chain is about one-half the length through which the circumference of said collar is driven when said motor is driving said grip-sheave through a full cycle to open said door and through a full cycle to close said door.

6. A door-operator as recited in claim 5 in which said grip-sheave includes a first disc, a second disc and a compression spring, said compression spring urging said discs into gripping engagement with said cable.

7. A door-operator comprising, a motor, a door, a shaft on said motor, door-drive connections from said shaft to said door for opening said door when said motor is driven in a first direction and for closing said door when said motor is driven in the opposite direction, power means connected to said motor for driving said motor in said first and said opposite directions, a switch in the connection of said power means to said motor and means connected to said switch for opening said switch and stopping said motor after said motor has driven said door through a full cycle in said first direction to open said door and through a full cycle in said opposite direction to close said door, said door-drive connections from said shaft to said door including means which, when said door

engages an obstruction while said motor is opening or closing said door, permits said motor to drive said shaft while said door is so obstructed so that after said motor has driven said shaft through one of said cycles and said door is obstructed said means connected to said switch opens said switch and stops said motor.

8. A door-operator as recited in claim 7 in which said means connected to said switch is a collar on said shaft and said collar is connected to said switch by a chain.

9. A door-operator as recited in claim 8 in which said collar is connected to said switch by a chain and spring.

10. A door-operator as recited in claim 9 in which said chain is unwound from and wound on said collar as said motor drives said shaft.

11. A door-operator as recited in claim 10 in which said chain is about one-half the length through which the circumference of said collar is driven when said motor is driving said shaft through a full cycle to open said door and through a full cycle to close said door.

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J. K. BELL, Assistant Examiner

U.S. Cl. X.R.

49—25, 28, 360