

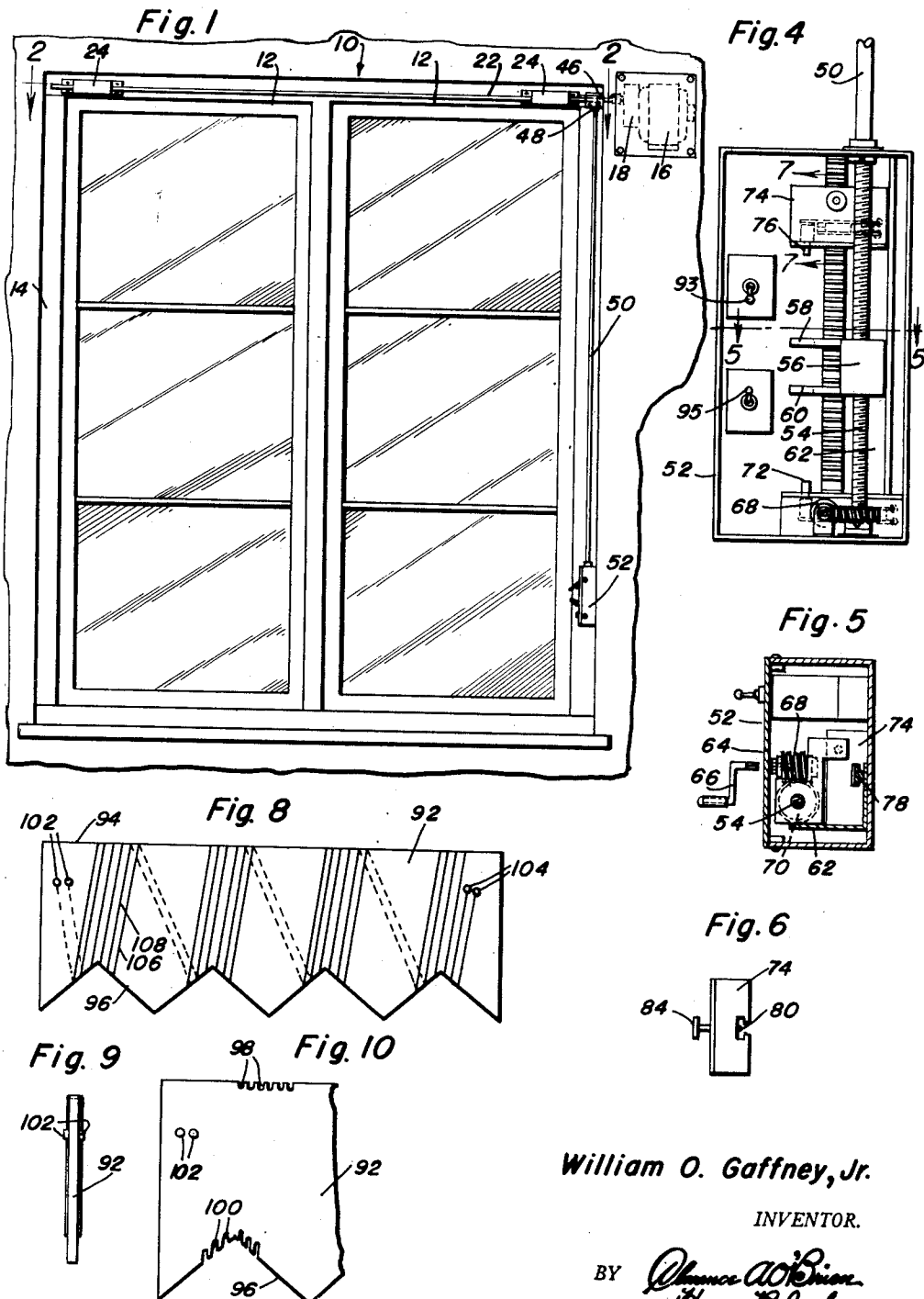
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W. O. GAFFNEY, JR  
AUTOMATIC WINDOW CONTROL

2,684,239

Filed June 25, 1951

2 Sheets-Sheet 1



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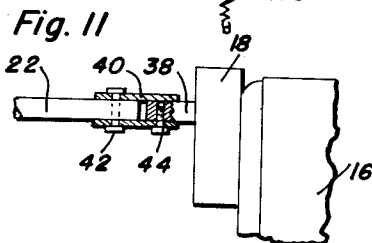
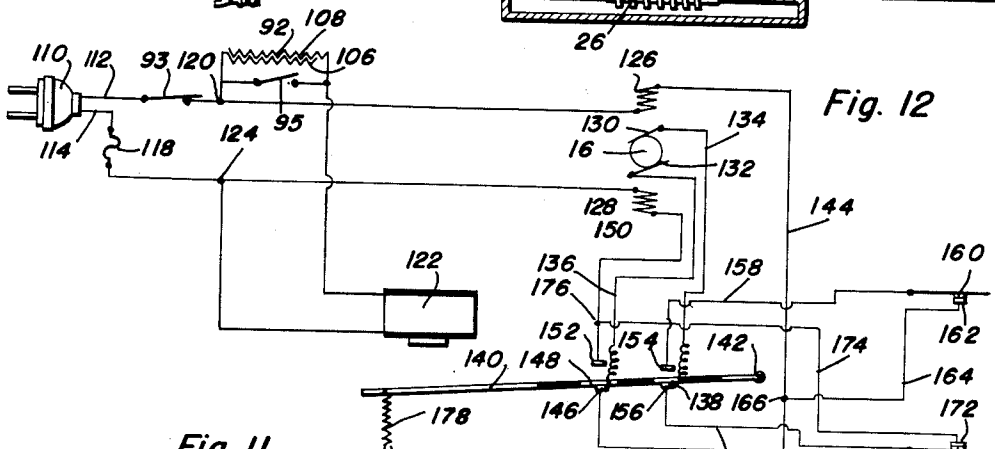
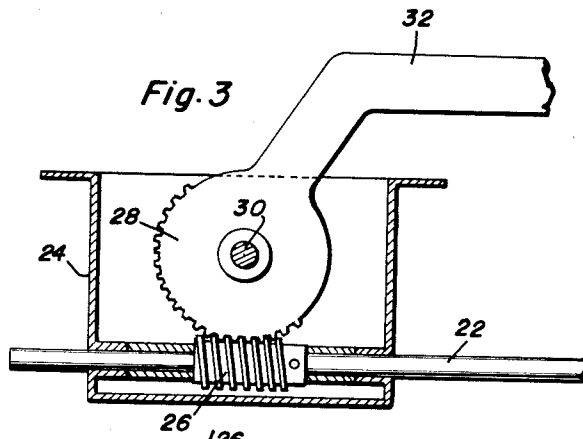
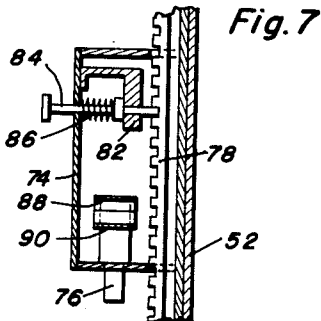
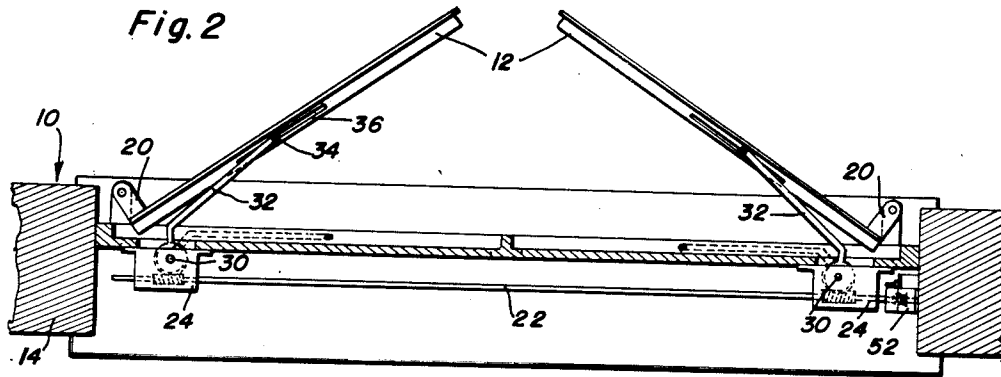
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## UNITED STATES PATENT OFFICE

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## AUTOMATIC WINDOW CONTROL

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5 Claims. (Cl. 268—119)

1

This invention comprises novel and useful improvements in an automatic control and more specifically pertains to a device adapted for association with windows for automatically opening and closing the same in response to a moisture responsive switch associated with the electrical circuit of a motor.

The primary purpose of this invention is to provide a device capable of easy mounting upon and association with windows of different types, such as double hung casement windows and the like, and which shall automatically close the windows when a moisture responsive element has been activated by the presence of rain or the like; and will open the windows when the moisture responsive element has dried thereafter or remains unmoistened.

A still further object of the invention is to provide a device in conformity with the preceding objects which shall include means enabling the operator to manually actuate the mechanism for opening or closing the windows in the event of failure of the automatic control mechanism.

Yet another important object and purpose of the invention is to provide a window control device as set forth in the above mentioned objects wherein the range of movement of the device for opening and closing windows may be readily varied and adjusted.

These, together with various ancillary features and objects of the invention, which will later become apparent as the following description proceeds, are attained by the present invention, a preferred embodiment of which has been illustrated, by way of example only, in the accompanying drawings, wherein:

Figure 1 is an elevational view showing one form of window construction of the double hung casement type having a device in accordance with this invention applied thereto, the window being shown in its closed position;

Figure 2 is a horizontal sectional view through the arrangement of Figure 1, taken substantially upon the plane indicated by the section line 2—2 of Figure 1, the windows being shown in their partially open position;

Figure 3 is a fragmentary horizontal sectional detail view upon an enlarged scale through one of the actuator rods of the device;

Figure 4 is a vertical sectional view, taken upon an enlarged scale, through the limit switch element forming a part of the invention;

Figure 5 is a horizontal sectional view taken substantially upon the plane indicated by the section line 5—5 of Figure 4;

2

Figure 6 is a further detail view of the invention;

Figure 7 is a vertical transverse sectional detail view taken upon an enlarged scale substantially upon the plane indicated by the section line 7—7 of Figure 4 and illustrating the locking means of the adjustable limit switch of the invention;

Figure 8 is an elevational view of a moisture responsive switch forming an essential part of the invention;

Figure 9 is an end elevational view of Figure 8;

Figure 10 is a fragmentary elevational view of a portion of the insulating plate forming a part of the moisture responsive switch shown in Figure 8;

Figure 11 is a fragmentary detail view, parts being shown in elevation and part in vertical section of the driving motor and the detachable coupling for securing the same to the window operating mechanism; and,

Figure 12 is an electrical diagram of the electrical circuits which may be utilized as a part of this invention.

Referring now more specifically to the accompanying drawings, wherein like numerals designate similar parts throughout the various views, it will be seen that the numeral 10 designates generally a conventional window construction, to which the principles and the device of the present invention may be readily applied, the window illustrated being of the conventional double hung casement type comprising a pair of window frames 12 which are suitably mounted in a case-ment indicated at 14 and are hinged for movement about vertical axes at opposite sides of the casement.

Mounted in any convenient location adjacent the window construction 10 is an electric motor 16 of a conventional reversible type, this motor, as also shown in Figure 11, including a reduction and gearing assembly housed in a casing 18 attached to the motor casing, and which is operatively connected to the two window sash 12 in a manner to be subsequently set forth for automatically opening and closing the window sash as set forth hereinafter.

Referring now more particularly to Figure 2 it will be seen that the window sash 12 are provided with hinges 20 whereby the sash may be swung in a horizontal plane about the vertical axes of the hinges 20 from the closed position shown in Figure 1 through the intermediate position shown in Figure 2 and to a fully open position, not shown, but which will be readily understood.

The window operating mechanism for auto-

3

matically moving the window sash towards the open or closed positions includes a drive shaft 22 which preferably extends horizontally either above or below the window construction, the position above the window construction being shown in Figure 1 and being found to be entirely satisfactory in operation. The drive shaft 22 is secured in suitable journal bearings disposed in housings 24 which may be positioned above and at opposite sides of the window construction, as shown in Figures 1 and 2.

In each of the housings 24, the drive shaft 22 is provided with a worm pinion 26 fixedly secured to the shaft and rotating therewith. This worm pinion is constantly in mesh with a pinion gear 28 rotatably journaled upon suitable vertically disposed axes 30 mounted within the housings 24, whereby upon rotation of the drive shaft 22, the pinions 28 will be caused to oscillate in a horizontal plane.

The pinions are integrally formed upon angulated operating arms 32, which arms extend through suitable apertures in the window casement and at their extremities are pivotally and slidably connected as by pivot pins 34 which extend through elongated slots 36 in the frame of the window sash 12. Thus, as the drive shaft is rotated, the actuating arms 32 will be oscillated in a horizontal plane, and by virtue of their connection with the window sash 12 will move the same between their open and closed positions.

Referring now again more particularly to Figure 11, it will be noted that the drive shaft 22 is coupled to the output shaft 38 of the reduction gearing assembly 18 as by means of a coupling sleeve 40 which is secured to the drive shaft 22 as by a pin or the like 42, and to the output shaft 38 as by a set screw 44. It will be understood that the output 38 of the reduction gearing assembly 18 is suitably geared to the armature shaft of the motor 16. It will now be apparent that by removing the coupling member 40 from its engagement with either the output shaft 38 or the drive shaft 22, that the driving connection between the motor and the window actuators 32 will be disconnected for a purpose which will be subsequently apparent.

Adjacent the side of the window casement 14, the drive shaft 22 is provided with a bevel gear 46 which is continuously in mesh with a corresponding bevel gear 48 carried by a vertically disposed lay shaft 50. The latter is suitably journaled upon the casement of the window, and at its lower end extends into and is journaled in a switch box 52 which houses a pair of limit switches which are connected with the electrical circuit of motor 16 for stopping the motor when the window sashes are at the limits of their opening and closing positions for which the limit switches have been set.

By means of the connection of the lay shaft 50 with the drive shaft 22, which connection is on the opposite side of the detachable coupling member 40, above mentioned, it will be apparent that actuation of the limit switches is effected in synchronization with the movement and positions of the window sashes.

Within the housing 52 the shaft 50 is provided with a screw threaded portion 54 and a carriage 56 of any suitable construction is received upon the threaded portion for axial sliding movement thereon. The carriage is provided with laterally extending upper and lower arms 58 and 60 which serve to actuate the limit switches to be hereinafter described, and one side of the carriage

4

abuts a guide surface 62, see Figure 5, formed within the housing 52 to thereby prevent rotation of the carriage during its axial movement.

Adjacent its lower end, the housing 52 is provided with an opening 64 through which may be inserted a hand crank 66, this hand crank engaging in an internally splined socket in a worm gear 68 suitably journaled within the housing and constantly in mesh with a pinion 70 which is fixedly secured to the lower end of the screw threaded portion 54. Thus, by inserting the hand crank, after the coupling member 40 has been released from its engagement with the drive shaft 22 and the output shaft 38, the lay shaft 50 may be rotated and through the bevel gearing 46 and 48 will cause rotation of the drive shaft 22 and through the latter will operate the window sash.

Secured in the lower portion of the housing 52 is a conventional limit switch having a push button 72 disposed in position to be abutted and engaged by the lower arm 60 of the carriage 56 in the lower position of the latter. When the arm 60 presses the button 72, the lower stationary limit switch will be actuated and due to its association with and inclusion in the electric circuit of the motor 16, in a manner to be set forth hereinafter, it will cause cessation of movement of the motor and consequently stop the movement of the window sash 12. It is contemplated that the stationary limit switch shall control the closing movement of the window and shall be so positioned and associated with respect to the geared connection to the window actuating levers 32, that upon the complete closing of the window the lower or closing limit switch will de-energize the circuit for the electric motor.

The opening movement of the window sash 12 is controlled by an adjustable limit switch whereby the extent of the opening movement may be adjusted as desired and whereby the adjustment may be varied as found to be expedient. For this purpose, the upper limit switch is mounted upon a carrier 74 in the form of a housing, the lower surface of this carrier having a push button 76 similar to the push button 72 and disposed in the path of travel of the upper arm 58 on the carriage 56. It will thus be seen in the uppermost position of the carrier 50, its arm 58 will actuate the button 76 and through the limit switch and its association with the electrical circuits of the motor, will de-energize the circuit and cause a stopping of the movement of the window sash 12.

Referring now more particularly to Figures 4 and 7 it will be seen that a rack bar 78 is disposed upon a side wall of the limit switch casing 72 in a vertical position therein, while the movable housing 74 of the upper limit switch is provided with a T-shaped slot 80 which embraces the correspondingly shaped rack bar 78 as will be apparent from Figures 4-7, whereby the carrier 74 is slidably mounted and secured to the rack bar for vertical movement thereupon.

Within the carrier 74 there is provided a supporting bracket 82 and a locking or latch plunger 84 is slidably secured in this bracket and in the wall of the carrier 74, this latching plunger being spring urged as by a compression spring 86 into locking engagement with the rack bar 78. Thus, by withdrawing the plunger 84 manually, the same may be disengaged from the rack bar to permit the body 74 to be adjusted vertically upon the same. By this means the upper limit switch may be adjusted towards or from the sta-

tionary lower switch to thereby limit and adjust the range of travel of the carrier 56 therebetween whether the movement of the carrier is due to the operation of the motor or due to the manual rotation of shaft 50 by hand crank 66, thus regulating the extent of movement of the operating mechanism for the window and consequently of the window sash.

The upper and lower limit switches may be of any conventional known construction, and preferably of identical design. Since the details of such switches are well understood, further explanation is believed to be unnecessary, it merely being noted that there are provided spaced relatively movable terminals 88 and 90 suitably connected to the electrical circuit of the motor, and respectively urged from each other by actuating of the push button 72 or 76 in a manner which will be readily understood.

Suitable manually operated control switches 93 and 95, see Figure 4, may be provided upon the wall of the limit switch casing 52 and appropriately connected to the electrical circuits of the motor whereby the operator may de-energize the entire circuit; or may manually energize the motor to effect opening or closing of the window as desired, without requiring the actuation of the moisture responsive switch to be now described.

Referring to Figures 8-10, it will be seen that the moisture responsive switch consists of a plate 92 of a suitable dielectric material such as glass or the like, which plate is preferably of a substantially rectangular shape having a flat edge 94 and a notched or scalloped edge 96. The upper horizontal flat edge 94 is provided with suitable grooves or recesses 98 therein, while the notched portions 96 from the bottom edge are provided with corresponding notches or grooves 100. At its opposite ends, the dielectric plate 92 is provided with pairs of apertures 102 and 104. A pair of parallel electric conductors 106 and 108 are wound upon the dielectric plate 92, these conductors being seated in the notches 98 and 100 and being maintained in parallel spaced relation with respect to each other thereby. The ends of these conductors are extended through the apertures 102 and 104 as shown in Figure 8 and are suitably connected to the electric circuit for supplying power to the electric motor. The notched lower edges 96 on the dielectric plate serve to shed moisture therefrom in order to effect quick drying of the switch after moisture has ceased falling thereon. The arrangement is such that upon moisture striking the switch, the parallel conductors 106 and 108 will be shorted thereby to thus close the circuit for the electric motor and energize this circuit except as the same may be cut off by the limit switches. Obviously, the moisture switch may be placed in any desired location upon the exterior of a building or the like so that upon the precipitation of rain, the electric motor circuit will be energized to cause the motor to close the windows.

Reference is now made to Figure 12 for an illustration of a suitable electric circuit for connecting the limit switch assembly with the electric motor and with a source of electric power.

Indicated at 110 is a conventional electric plug which may be detachably connected into any suitable electric outlet to provide power from an electric source for energizing the motor circuits and the motor 16. Conductors 112 and 114 extend from the plug 110. The conductor 112 is provided with the manual switch 93 whereby the

entire device may be selectively rendered operative or inoperative as desired. A suitable safety fuse 118 may be secured in series with the conductor 114. The moisture responsive switch 92, having the conductors 106 and 108 thereon is respectively connected at 120 to the conductor 112 and through a solenoid coil 122 and the connection 124 to the conductor 114. The manual switch 95 enables the operator to short circuit the moisture responsive switch in order to effect closing of the window by the mechanism even though the moisture responsive switch is not activated by the presence of moisture thereon.

The conductor 112 is connected to one field coil 126 of the electric motor, and the conductor 114 is connected to the other field coil 128. The motor 16 has its brushes 130 and 132 connected with conductors 134 and 136 respectively. The conductor 134 is connected with the movable switch terminal 138 on a movable switch plate 140 pivoted as at 142. Connected to the other end of the field coil 126 from the conductor 112 is a conductor 144 which is connected to a stationary electrical terminal 146. The brush 132 has a conductor 136 connected thereto, the other end of this conductor being connected to a fixed terminal 148 likewise carried by the movable switch member 140.

A further electric conductor 150 is connected at the other end of the coil 128 from the conductor 114, and is connected to a fixed terminal 152. The terminals 146 and 152 are fixed terminals which are alternately and selectively engaged by the terminal 148 carried by the switch lever 140. A second fixed terminal 154 is positioned adjacent a fixed terminal 156 upon opposite sides of an adapter to be alternately engaged by the terminal 138 carried by the switch lever 140. A conductor 158 connects the terminal 154 with a terminal contact 160 and the latter cooperates with a terminal contact 162 connected by a conductor 164 as at 166 with the above mentioned conductor 144. The terminal 156 in turn is connected by conductor 168 with a terminal 170 cooperating with a second terminal 172 connected by conductor 174 with a conductor 150 as at 176.

The switch lever 140 is yieldingly urged as by a spring 178 into a position whereby the contacts 138 and 148 will respectively engage the contacts 156 and 146. The arrangement is such and the circuits are such that in this position, with the manual switch 116 closed the plug 110 connected to a suitable source of electrical energy, the actuation of either of the switches 92 or 95 will cause the solenoid 122 to move the lever 140 against the resistance of spring 178, thereby causing the contacts 138 and 148 to disengage from the contacts 156 and 146 and to engage the contacts 154 and 152 respectively.

The contact members 88 and 90 in each of the limit switches correspond to the contacts 162, 162 and 170, 172 in the diagram of Figure 12.

From the foregoing, it will be apparent that the presence of moisture upon the switch 92, after the other appropriate switches have been properly set, will cause the mechanism to automatically close the windows; and after the moisture responsive switch has dried, the solenoid 122 will be de-energized and the spring 178 will cause the switch mechanism to reverse the operation and cause the motor to open the windows again.

From the foregoing, the construction and operation of the device will be readily understood and further explanation is believed to be unnecessary.

essary. However, since numerous modifications and changes will readily occur to those skilled in the art after a consideration of the foregoing specification and accompanying drawings, it is not desired to limit the invention to the exact construction shown and described, but all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

Having described the invention, what is claimed as new is:

1. An automatic window operating device comprising an electric motor, circuit means connecting said motor to a source of power, a shaft connected to a window for moving same between open and closed positions, means detachably connecting said motor to said shaft for rotating same, a second shaft operatively connected to said first shaft for rotation therewith at all times, means connected to said second shaft for rotating both of said shafts independently of said motor, a pair of limit means positioned adjacent said second shaft and interposed in said circuit means, means carried by said second shaft for movement thereon between said limit means to control the rotation of said shafts for interrupting the flow of current to said motor and for limiting the operation of said shafts independently of the motor, and means operatively connected with said circuit means for operating said motor.

2. An automatic window operating device of claim 1 wherein one of said limit means is adjustable with respect to the other limit means to control the movement of the means on said second shaft.

3. An automatic window operating device comprising an electric motor, circuit means connecting said motor to a source of power, a precipitation responsive element operatively connected with said circuit for operating said motor, a shaft connected to a window for moving same between open and closed positions, means detachably connecting said motor to said shaft for rotating same, a second shaft operatively connected to said first shaft for rotation therewith at all times, means connected to said second shaft for rotating both of said shafts independently of said motor, a pair of limit means positioned adjacent said second shaft and interposed in said circuit means, means carried by said second shaft for movement thereon between said limit means to control the rotation of said shafts for interrupting the flow of current to said motor and for limiting the operation of said shafts independently of the motor, and a by-pass circuit about said precipitation responsive element and a manually operable switch for said by-pass circuit.

4. An automatic window operating device comprising an electric motor, a circuit means connecting said motor to a source of power, a precipitation responsive element operatively con-

nected with said circuit for operating said motor, a shaft connected to a window for moving same between open and closed positions, means detachably connecting said motor to said shaft for rotating same, a second shaft operatively connected to said first shaft for rotation therewith at all times, means connected to said second shaft for rotating both of said shafts independently of said motor, a pair of limit means positioned adjacent said second shaft and interposed in said circuit means, said second shaft including a threaded portion defining a rotating screw, a carriage mounted on said screw for movement axially thereof and means on said carriage engageable with said limit means for controlling the rotation of said shafts for interrupting the flow of current to said motor and for limiting the operation of said shafts independently of the motor.

5. An automatic window operating device comprising an electric motor, circuit means connecting said motor to a source of power, a precipitation responsive element operatively connected with said circuit for operating said motor, a shaft connected to a window for moving same between open and closed positions, means detachably connecting said motor to said shaft for rotating same, a second shaft operatively connected to said first shaft for rotation therewith at all times, means connected to said second shaft for rotating both of said shafts independently of said motor, a pair of limit means positioned adjacent said second shaft and interposed in said circuit means, means carried by said second shaft for movement thereon between said limit means to control the rotation of said shafts for interrupting the flow of current to said motor and for limiting the operation of said shafts independently of the motor, one of said limit means being adjustable with respect to the other limit means to control the movement of the means on said second shaft, said adjustable limit means having a support, a rack upon which said support is slidably mounted and a latch carried by said support for adjustably locking said support to said rack.

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