

Feb. 20, 1962

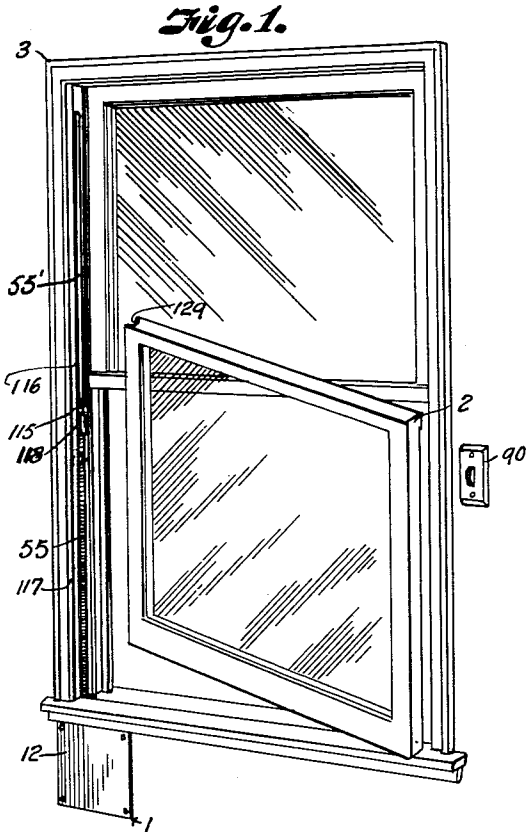
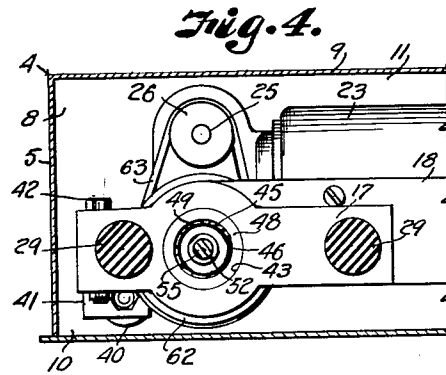
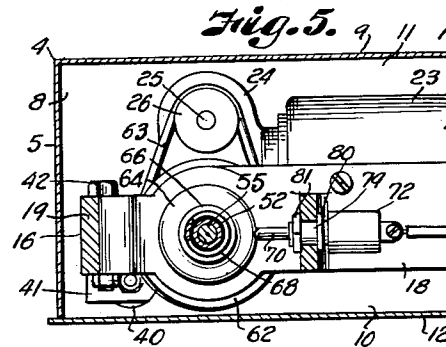
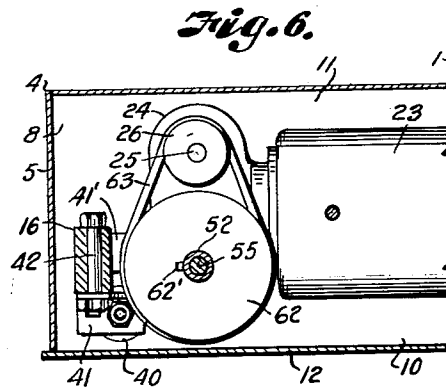
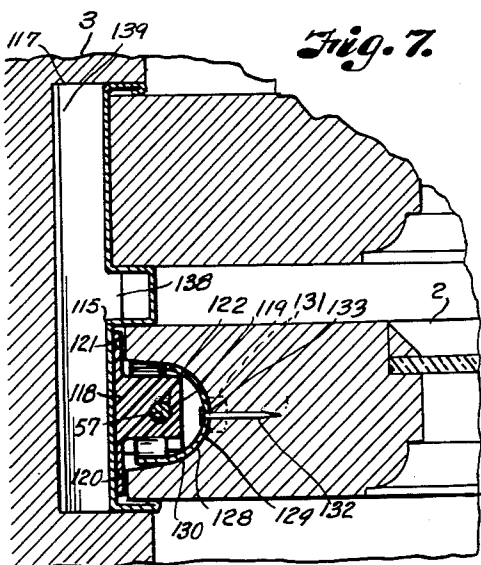
R. L. MARTIN

3,022,065

POWER APPARATUS FOR WINDOWS AND THE LIKE

Filed April 23, 1959

3 Sheets-Sheet 1



INVENTOR.
Robert L. Martin
BY
Paul E. Mullendore
ATTORNEY

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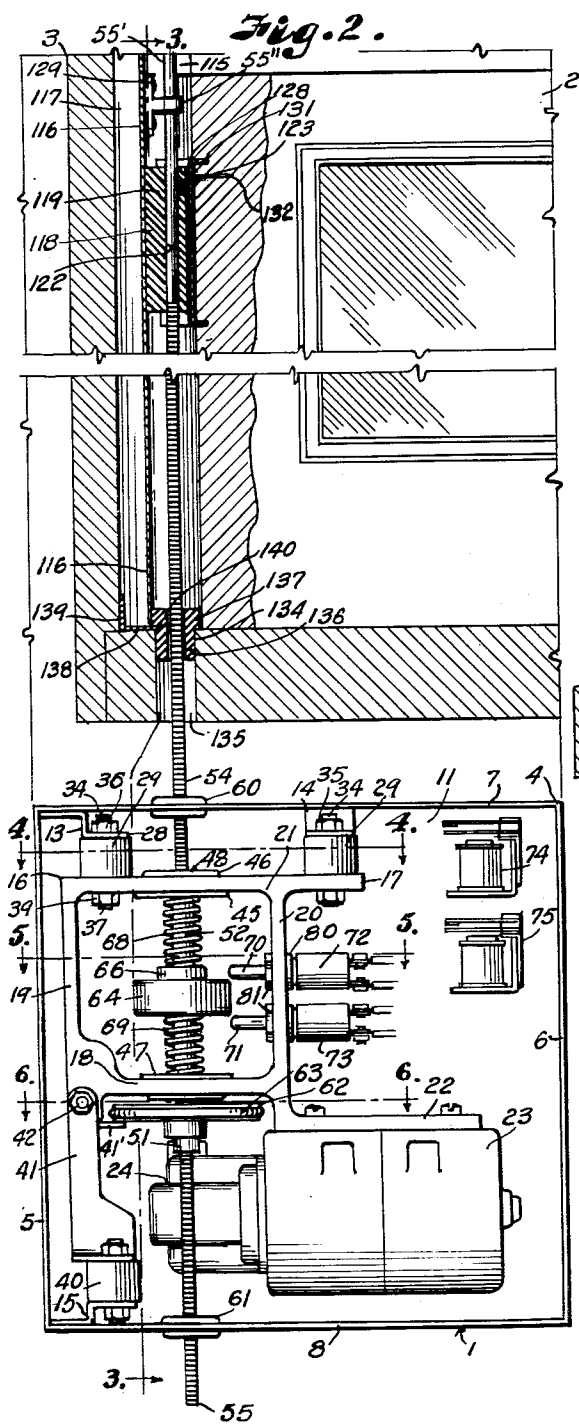
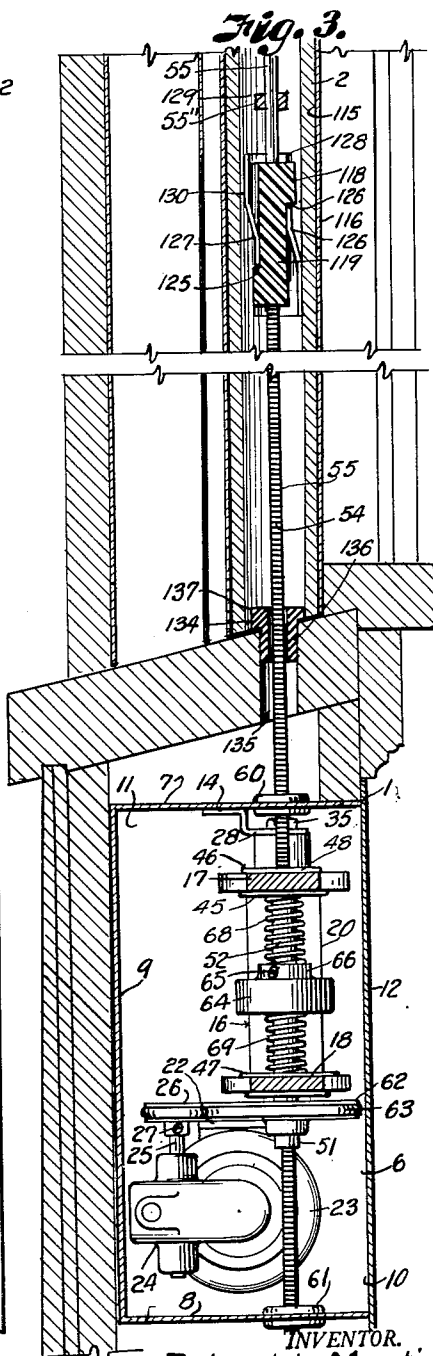
R. L. MARTIN

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POWER APPARATUS FOR WINDOWS AND THE LIKE

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3 Sheets-Sheet 2



INVENTOR.
Robert L. Martin
BY
Paul E. Mullendore
ATTORNEY

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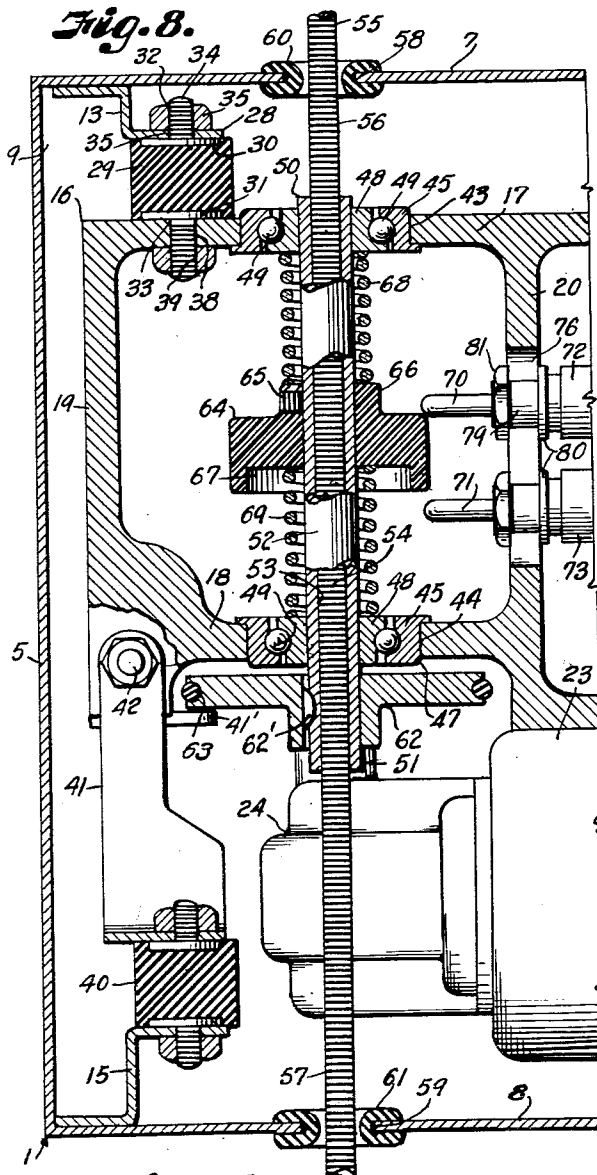
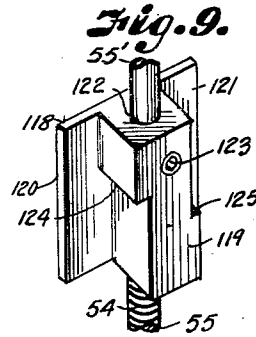
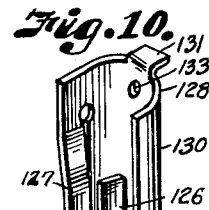
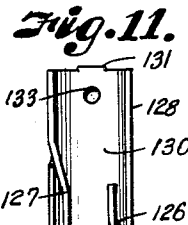
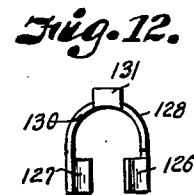
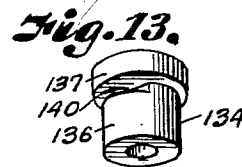
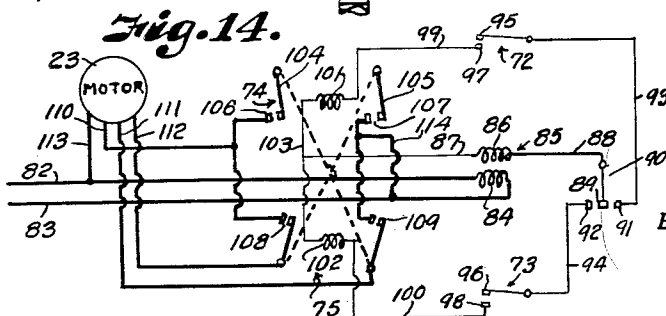
R. L. MARTIN

3,022,065

POWER APPARATUS FOR WINDOWS AND THE LIKE

Filed April 23, 1959

3 Sheets-Sheet 3



INVENTOR.
Robert L. Martin.

BY
Paul E. Mullendore
ATTORNEY

1

3,022,065 POWER APPARATUS FOR WINDOWS AND THE LIKE

Robert L. Martin, Kansas City, Mo., assignor to The Weatherproof Products Corporation, Holmes Park, Mo., a corporation of Missouri
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5 Claims. (Cl. 268—124)

This invention relates to a power apparatus for operating various devices in one and the opposite directions, for example, to open and close a window under remote control.

The principal object of the invention is to provide a simple, relatively inexpensive power unit which is safely operated through remote control.

Other objects of the invention are to provide a power unit which is substantially silent in operation and free of vibration; to provide an alternating power unit which will come to a stop and automatically shut off the electrical current supply to the motor thereof in case of resistance to movement of the object under operation, for example, when the sash of a window becomes completely opened and closed or in case of an obstruction to movement thereof; to provide a power unit for operating sash in a window which is easily incorporated into the window unit with a minimum of skilled labor to provide a power unit which can be depended upon to operate freely and positively; and to provide a power unit that establishes an automatic lock of the sash of a window in any position thereof.

Further objects of the invention are to provide a connection between the power unit and the sash of a window that is easily connected and disconnected to permit removal of the sash when cleaning or painting thereof; to provide a connection between the power unit and sash that is easily disengaged in case of power failure to permit manual opening and closing of the sash; and to provide for automatic reconnection after the power supply has been reestablished, to continue operation by the power unit.

Further objects of the invention are to provide a simplified electric circuit for energizing the motor of the power unit by a current supply of standard voltage and a remote control circuit of low voltage, and to provide automatic control of limit switches by a resiliently mounted drive sleeve having threaded connection with the drive rod of the unit to override the drive rod when resistance is applied to the drive rod or the drive rod reaches its limit of travel.

In accomplishing these and other objects of the invention as hereinafter pointed out, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawings, wherein:

FIG. 1 is a perspective view of a window equipped with a power unit embodying the features of the present invention and showing disconnection of the lower sash and removal of the sash from the window opening.

FIG. 2 is an enlarged elevation of the power unit and sash actuated thereby, with the cover plate of the power unit housing removed to show the internal mechanism, and with the sash and frame of the window in section, to better illustrate connection of the drive rod of the power unit with the sash.

FIG. 3 is a vertical section through the mechanism of FIG. 2, the section being taken on the line 3—3 of FIG. 2.

FIG. 4 is a fragmentary horizontal section through the housing of the power unit, taken on the line 4—4 of FIG. 2.

FIG. 5 is a similar section taken on the line 5—5 of FIG. 2.

2

FIG. 6 is a similar section taken on the line 6—6 of FIG. 2.

FIG. 7 is an enlarged fragmentary horizontal section particularly illustrating the connection of the drive rod with the window sash.

FIG. 8 is an enlarged fragmentary section through a portion of the power unit, to better illustrate the construction thereof.

FIG. 9 is a perspective view of the slide element on the drive rod and which is movable in the sashway of the window frame to connect with a coupling element carried by the sash.

FIG. 10 is a perspective view of the coupling element.

FIG. 11 is a front view of the coupling element shown in FIG. 10.

FIG. 12 is an end view of the coupling element.

FIG. 13 is a perspective view of the resilient bushing for closing the opening in the frame through which the sash drive rod extends.

FIG. 14 is a wiring diagram of the power and control circuits, the power circuit being shown in heavy lines and the control circuit in light lines.

Referring more in detail to the drawings:

1 designates a power unit constructed in accordance with the present invention. While the power unit is especially adapted for raising and lowering sash 2 in a window 3 and is so illustrated in the present application, it may be used to operate other devices in first one and then in another direction. The power unit includes a housing 4 having sides 5—6, a top 7, a bottom 8, and a back 9, all interconnected to form an open front compartment 11 that is closed by a removable cover plate 12, for containing the power assembly and the control switches and provide a fire-proof enclosure therefor, as later to be described.

Resiliently mounted within the compartment 11 on brackets 13, 14 and 15 is a frame 16 having upper and lower cross bar portions 17 and 18 interconnected by spaced apart side bar portions 19 and 20 to provide a generally rectangular frame 21. The upper bar portion 17 extends laterally beyond the upper end of the bar portion 20, and the lower end of the bar portion 20 extends downwardly from the lower bar portion 18 to carry a laterally extending arm portion 22 for attaching a reversible motor 23, which includes a built-in speed reduction gearing indicated by the housing 24. Extending vertically from the housing 24 is a driving shaft 25 operated at a substantially lower speed than the armature shaft of the motor. The driving shaft 25 carries a pulley 26 that is fixed on its upper end by a set screw 27.

The brackets 13 and 14 are fixed to the underside of the top 7 as by welding and have ears 28 inset within the housing from the top 7 to cooperate with the upper bar portion 17 of the frame 16 to connect therebetween shock absorbing and vibration dampeners 29, each of which includes a cylindrical body of resilient material, such as rubber. Vulcanized to the ends of the resilient bodies are heads 30 and 31 of fastening devices 32 and 33. The fastening devices 32 and 33 have threaded shanks 34 that extend through slots 35 in the ears 28 of the brackets 14 and 15 to mount nuts 36 by which the resilient bodies are secured to the ears of the brackets. The shanks 37 of the fastening devices 33 at the opposite ends of the resilient bodies extend through slots 38 in the bar 17 of the frame 16, and are secured by nuts 39, the slots providing for centering the frame 16 horizontally within the housing.

The bracket 15 is connected by a similar resilient body 40 with a bracket 41 that pivotally connects with the frame 16 by a bolt 42, as best shown in FIG. 8. It is thus obvious that the frame 16 is resiliently suspended within the housing 4, to prevent vibrations of the motor and the

parts actuated thereby from being transmitted to the walls of the housing.

The bar portions 17 and 18 of the frame 16 have openings 43 and 44 in vertically registering relation to contain outer races 45 of antifriction bearings 46 and 47, which also include inner races 48 rotatably mounted in the outer races on balls 49. Slidably carried in the inner races are the ends 50 and 51 of a driving sleeve 52 having internal threads 53 for engaging external threads 54 on a drive rod 55 that extends through the drive sleeve 52 and has its opposite ends 56 and 57 extending through openings 58 and 59 in the top and bottom walls 7 and 8 respectively of the housing 4. The openings 58 and 59 are of relatively larger diameter than the rod and accommodate resilient bushings or grummets 60 and 61 that loosely guide the drive rod and prevent contact of the drive rod with the housing 4.

Fixed to the lower end of the sleeve 52 by a key 62' (FIG. 8) at a level with the pulley 26 is a driven pulley 62 of relatively large diameter to provide a speed reduction between the smaller pulley 26 and the larger pulley 62. The pulleys 26 and 62 are preferably provided with grooved peripheries for containing an endless belt 63 to rotate the driving sleeve 52 at a relatively low speed when the motor is connected into an electric circuit, as later described. The pulley 62 is retained in level with the pulley 26 by a tongue 41' projecting from the frame 16 (FIGS. 2, 8 and 6).

With the structure thus far described, it is obvious that if a rotational torque or an end thrust is applied to the drive rod 55, rotation of the driving sleeve 52 will cause axial movement of the drive rod in one or the other of its longitudinal directions, depending upon the direction of rotation of the reversible motor, providing that the sleeve 52 is resiliently retained from sliding movement in the inner races 48 of the antifriction bearings 46 and 47.

In order to resiliently retain the driving sleeve 52 from axial movement and to provide for stopping movement of the drive rod 55 in one or the other of its directions of reciprocation, the sleeve 52 carries a collar 64 that is fixed thereto by a set screw 65 (FIG. 8), the set screw 65 being carried by a hub 66 projecting from the upper face of the collar. The lower face of the collar 64 has a recess 67, as shown in FIG. 8, so that the space between the hub 66 and the lower face of the inner race of the upper bearing 46 and the space between the upper face of the inner race of the lower bearing 47 and the bottom of the recess 67 are substantially the same, to accommodate therebetween coil springs 68 and 69 which are adapted to exert thrust against the inner races of the upper and lower bearings 46 and 47, so that under normal rotation on the drive rod 55, the collar 64 is located relatively to arms 70 and 71 of limit switches 72 and 73 which are adapted to open and close low voltage circuits to interrupt the low voltage relay circuits for controlling relay switches 74 and 75. The limit switches 72 and 73 are adjustably mounted in a slot 76 that is provided in the side bar portion 20, as best shown in FIG. 8, to position arms 70 and 71 of the limit switches relatively to a normal position of the collar 64. The limit switches 72 and 73 have neck portions 79 provided with flanges 80 engaging the outer face side bar portion 20 and nuts 81 that are threaded thereon to engage the inner face side of the bar portion 20, as best shown in FIG. 8. By loosening the nuts 81, the switches 72 and 73 may be moved up and down in the slot 76 to position the contact arms 70 and 71 relatively to the collar 64. Ordinarily, the arms 70 and 71 will be located in substantially close relation with the upper and lower peripheral edges of the collar to provide substantially immediate action when an excessive load is applied to the drive rod 55, as when the drive rod 55 reaches the limits of its travel or when an additional load is applied to resist longitudinal movement thereof.

The wiring circuit is illustrated in FIG. 14, and in-

cludes line wires 82 and 83 which lead from a source of current supply, such as the ordinary house current, to the primary winding 84 of a transformer 85. The secondary 86 of the transformer is connected with a low voltage control circuit by conductors 87 and 88. The conductor 88 is shown as connected with the movable contact 89 of a double acting switch 90, the other contacts 91 and 92 of which are connected by conductors 93 and 94 with the movable contacts 95 and 96 of the limit switches 72 and 73, previously described. The other contacts 97 and 98 of the limit switches are connected by conductors 99 and 100 with the solenoid windings 101 and 102 of the relay switches 74 and 75, the opposite ends of the windings being connected through a common conductor 103 with the conductor 87 previously described. The relay switches include reversing contacts 104 and 105 for the relay switch 74 and contacts 106 and 107. The relay switch 75 has similar contacts for reversing current to the motor from the line conductor by conductor 108 to supply current to the motor leads 110, 111 and 112, depending upon the movement of the switch 90 to energize either relay 74 or 75, as later to be described. The circuits for the motor 23 are connected with the current supply conductors 82 and 83 by conductors 113 and 114.

The drive rod 55 is connected with the object to be actuated, for example, the sash 2 of the window illustrated. The window frame is of substantially standard construction and includes vertical ways 115 for slidably containing opposite side edges of the sash. In order to provide for removable mounting of the sash, the ways 115 at one side of the window frame are contained within a guide member 116 that is yieldingly supported within a recess 117 (FIGS. 2 and 7) in the side of the frame, and which is urged into contact with the sash to provide a weathertight seal therebetween.

Slidably in the guideway for the sash is a slide 118 (FIGS. 2, 3, 7 and 9), including a body portion 119 having lateral flanges 120 and 121 providing a flat face for slidable contact with the guideway, as best shown in FIGS. 2 and 7. The body portion of the slide has an axial bore 122, through which the upper end of the rod 55 extends, for attachment thereto by means of a set screw 123. The opposite sides of the body of the slide have oppositely facing shoulders 124 and 125, adapted to be engaged by oppositely directed resilient tongues 126 and 127 on a sash element 128. If desired, the rod 55 may be extended above the slide 118 to provide a guide portion 55' which is rotatably slidable in a bearing 55'' that is attached to the sash guide 115 (FIGS. 1, 2 and 3).

The sash element 128 is adapted to be fixed within a side groove 129 of, for example, the lower sash 2 of the window. The element 128 includes a body 130 of semicircular cross section to fit closely within the semicircular groove 129 at the side of the sash. The tongues 126 and 127 are preferably struck from terminal edges of the connecting element, with the tongues being shaped so that the ends are adapted to engage the respective shoulders 124 and 125, as later described. The element 128 is secured to the sash by prongs 131, to facilitate positioning thereof in the groove 129 of the sash, and also by fastening devices such as nails or screws 132, shown in FIG. 7, and which devices extend through openings 133 and into the sash as shown in FIG. 7.

The rod 55 extends from the actuating mechanism therefor upwardly through a bushing 134 that is contained in an opening 135 in the window sill to provide a resilient guide for the rod. The bushing 134 is best shown in FIG. 13. The bushing 134 has a body portion 136 that fits within the opening 135 of the sill and has an annular flange-like head 137 that seats on the sill. The bushing 134 is retained in the opening 135 by a flange 138 of an angle 139. The angle 139 is seated on the sill and bears against the back of the recess 117. The flange 138 extends between the under edge of the

guide 115 and the sill and engages in a groove 140 in the side of the bushing, as shown in FIG. 2.

The housing 4 with the mechanism therein is installed in a recess at one side of the window at a point directly below the sill. The opening 135 is provided in the sill. The sash guides are applied and the bushing is retained by means of the angle 139. The slide 118 is mounted on the drive rod 55 and secured by the set screw 123. The bearing bracket 55" is applied on the upward extension 55' of the drive rod, ready for attachment to the guide 115. The drive rod is then positioned within the sashway in which the grooved edge of the sash 2 is to be mounted, so that the lower end drops through the bushing 134 and through the grummet 60 into registry with the internally threaded bore of the drive sleeve 52. The manually operated switch 90 may be mounted alongside the casing of the window, as shown in FIG. 1, or it may be more remotely located, as desired. The relay switches 74 and 75 and motor 23 are connected with a source of current supply, which may be the regular house current of approximately 115 v. The conductors 93 and 94 may then be connected to the wall switch 90. The transformer 85 may be located in the housing 4, or, if the house is equipped with a low voltage electrical control system, the limit switches 72 and 73 and relay windings 101 and 102 of the relay switches 74 and 75 may be directly connected therewith and with the switch 90, wherever it may be located.

By energizing the motor 23 in the proper direction, the drive rod 55 can be turned into engagement with the internal threads of the drive sleeve 52. The resilient member 128 which connects the sash with the slide 118 is secured in proper position within the side groove 129 of the sash, by driving the ears 131 into the wood and application of the fastening devices 132. The drive rod 55 is preferably stopped with the slide thereon located below the level of the sash connecting member 128 when the sash is later installed.

The sash is placed in position in the sashway with the grooved edge of the sash pushing against the flanges 120 and 121 of the slide 118 to urge the sash guide 115 into the recess 117 until the opposite side edge of the sash clears the window stop at that side of the window. The window sash can then be pushed into position between the ways, after which the yieldable guide 115 returns to its outermost position, holding the sash snugly within the window frame.

When the sash is in place, the drive rod 52 is contained between the tongues 126 and 127. Then upon starting the motor to lift the sash, the drive rod carries the slide with the body portion 119 thereof passing through the space between the tongues 126 and 127 until the tongue 126 engages the shoulder 124 and the tongue 127 slips into position to engage the shoulder 129. The sash is then connected with the slide 118 on the guide rod through the sash connecting element or clip 128. Another way of making the connection would be to stop the rod 55 with the slide 118 above the level of the part 128 when the sash is in closed position, and to raise the sash manually until the tongues engage the shoulder on the slide. When the connection has been effected, the sash is readily lowered under power by operating the switch 90. As soon as the sash engages the sill, the drive rod 55 will stop, but since the drive rod cannot turn because of the slide 118, the drive sleeve 52 with the collar 64 thereon will continue to turn, compressing the lowermost spring 69 and allowing the upper spring 68 to expand. This movement of the drive sleeve carries the drive collar into contact with the arm 71 of the lowermost limit switch to effect opening of the circuit connected with that switch. On removal of the finger from the switch 90, the sash will remain in closed and locked position, by reason of the fact that the drive rod is connected with the sash and the threads thereon are engaged with the internal threads of the drive sleeve.

On the next operation of the switch 90 for raising the sash, the circuit, including the limit switch 72, is closed thereby and the motor will be energized to start rotation in a direction to lift the sash so as to open the window. The sash may be adjusted in any position between fully closed and fully open position upon opening of the circuit which includes the switch 90. If it is desired to fully open the sash, the motor circuit will be opened automatically, because as soon as the movement of the sash is stopped in the frame, the drive sleeve will continue to rotate, compressing the spring 68 until the collar 64 engages the arm 70 of the upper limit switch, whereupon the limit switch will open the holding circuit to the relays.

When the window is to be subsequently closed, should an object or the like be placed on the window sill, the sash will start to close upon closing of the circuit through the switch 90. However, as soon as the sash comes into contact with the obstruction, the sash is stopped, and the drive sleeve will continue to rotate sufficiently to bring the collar 64 into engagement with the arm 71, opening the low voltage circuit, which results in opening the motor circuit to stop further movement of the window sash.

When it is desired to remove the sash, the switch 90 may be closed to carry the lower edge of the sash above the sill, where it may be stopped by opening the switch 90. The sash may then be pushed against the guide 116 to shift the sash laterally until the opposite side clears the window stop on that side of the window, whereupon that side of the sash may be swung outwardly and withdrawn from engagement with the slide 118. The sash element 128 is readily disconnected to release the sash, since the tongues 126 and 127 will slip readily from the ends of the shoulders 124 and 125 to free the window sash. The window sash may be easily inserted by reversing the operation, whereupon the sash is lifted manually in the guideways until the tongues 126 and 127 slip into engagement with the shoulders 124 and 125 to reconnect the sash with the drive rod and reestablish automatic operation of the sash.

It might happen that the current supply is interrupted, as in times of storm, and it would become desirable to close the window manually. This is easily accomplished by removing the sash as above described, so that the tongues 126 and 127 slip from contact with the shoulders 124 and 125 of the slide, after which the sash may be replaced, this time with the sash located so that the sash connecting element 128 will be below the slide 118. The sash may then be moved to close position. After the current has been reestablished, the sash is readily reconnected with the drive rod 55 by raising the sash in the window frame until the tongues 126 and 127 contact the sides of the body of the slide 118 and reengage the shoulders 124 and 125, whereupon the sash is again connected with the power mechanism.

While I have particularly illustrated and described the invention in association with a window, it is obvious that the mechanism may be used for operating any reciprocating object within the power range of the motor 23.

From the foregoing, it is obvious that I have provided a simple and relatively inexpensive power unit which may be safely and positively operated through remote control.

What I claim and desire to secure by Letters Patent is:

1. In a window including a frame having guideways on opposite sides of the frame, a sash slidable in said guideways and of a type to be removable therefrom, a reciprocating rod in one of said guideways and having oppositely directed shoulders, a member on the sash having oppositely directed resilient tongues movable over the shoulders to bring the tongues into engagement with the shoulders for suspending the sash therefrom, and electric power means for reciprocating the rod, said tongues being disengageable from the shoulders to permit removal and lowering of the sash when the electrical service is interrupted with the sash in raised position.

2. In a window including a frame having guideways

on opposite sides of the frame, a sash slidable in said guideways, one of said guideways being yieldable in the frame for removal of the sash, a reciprocatory rod in one of said ways, a slide on the rod and having oppositely directed shoulders, a member on the sash having oppositely directed resilient tongues for engaging the shoulders for suspending the sash therefrom, and electric power means for reciprocating the rod to raise and lower the sash, said tongues being slidable laterally from said shoulders for removal of the sash when the electrical service is interrupted with the sash in raised position and said sash being replaceable in the ways of the frame with the resilient member below said slide for reengagement with said shoulders upon manually lifting of the sash in said guideways.

3. In a window including a frame having guideways on opposite sides of the frame, a sash slidable in said guideways and of a type to be removable therefrom, a reciprocatory rod in one of said guideways and having a part provided with oppositely directed shoulders, a resilient member on the sash having oppositely directed tongues for engaging the shoulders for suspending the sash therefrom, said tongues being disengageable from the shoulders to permit removal of the sash from said part when the sash is in raised position and replacement of said sash in the guideways in closed position with the resilient member below said part for reengagement with said shoulders upon manually lifting of the sash in said guideways.

4. A power unit for operating a sash in the sash guides of a window frame, said power unit including a housing below the window frame in alignment with one of the sash guides at one side of the frame, a support, means resiliently mounting the support in the housing, a drive sleeve, means for rotatably and reciprocably carrying ends of the drive sleeve in the support in registry with said sash guide, resilient grummets in the housing in registry with said sash guide, a drive rod extending coaxially through the drive sleeve and having threaded connection therewith, said ends of the drive rod extending through grummets with the upper end of said drive rod reciprocable within said sash guide, a reversible motor carried by the support, a driving connection between the drive sleeve and the reversible motor to rotate the drive sleeve in opposite directions to reciprocate the drive rod, yieldable means for retaining the drive sleeve

from axial movement in the support until longitudinal resistance is applied to movement of the drive rod, a collar on the drive sleeve, a circuit for supplying current to the motor, limit switches on the support and having arms in position to be contacted by the collar for actuating one and the other of the limit switches to open the circuit to the motor, a slide fixed to the drive rod and movable therewith along said sash guide; and a resilient clip member for attachment to the sash for engagement with the slide for suspending the sash from the slide and to raise and lower the sash with movement of the drive rod.

5. An apparatus of the character described, including a support having upper and lower cross bar portions, a housing, means for resiliently mounting the support in the housing, a drive sleeve, bearing means carried in said upper and lower cross bar portions for reciprocably and rotatably journaling ends of the drive sleeve in the support, said housing having opposed walls above and below the support respectively and provided with openings registering axially with ends of the drive sleeve, a drive rod extending coaxially through the drive sleeve and having ends extending through said openings, said drive rod having threaded connection with the drive sleeve, a reversible motor carried by the support, a driving connection between the drive sleeve and the reversible motor to rotate the drive sleeve in opposite directions for initial axial movement of the drive sleeve and for actuating the drive rod, a collar fixed to the drive sleeve intermediate the bearing means, coil springs having inner ends engaging the collar therebetween and outer ends seated against the bearing means for yieldingly retaining the drive sleeve from said initial axial movement, an electrical circuit for supplying current to the motor, and limit switches in said electrical circuit and carried by the support, said limit switches having actuating arms projecting respectively above and below the collar to be actuated directly by the collar upon axial movement of the drive sleeve.

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