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2 Sheets-Sheet 1

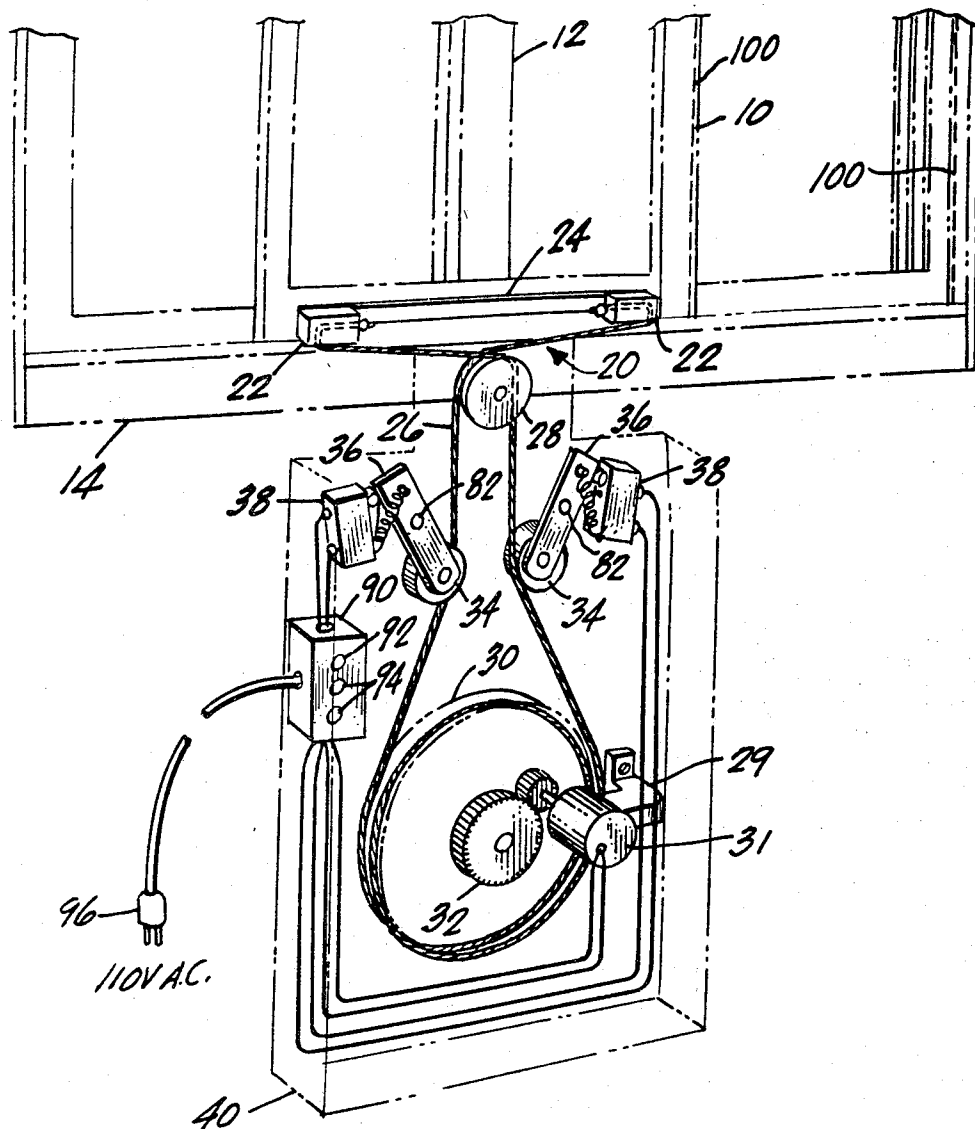


Fig. 1

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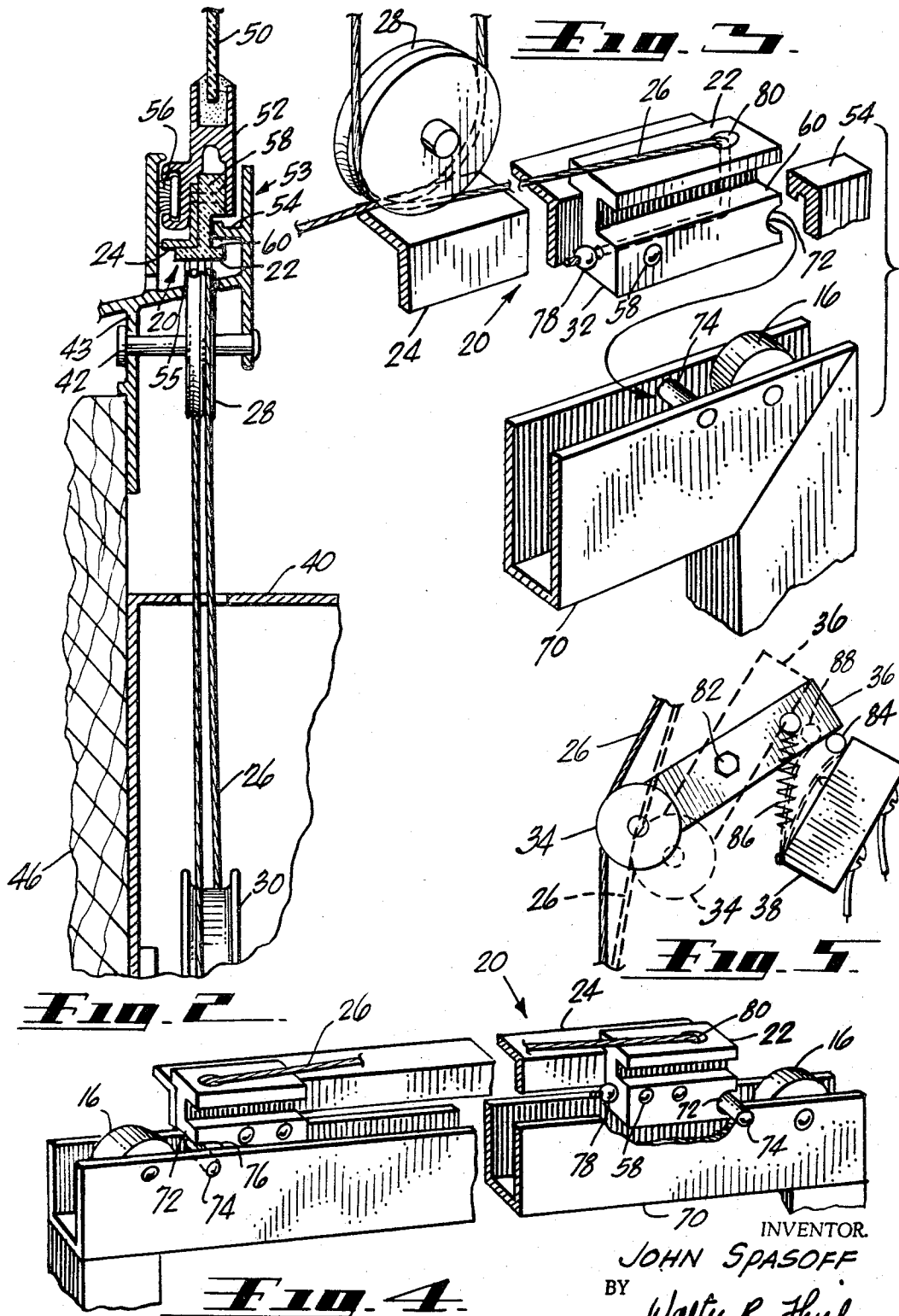
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1

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**ACTUATOR MECHANISM FOR
MOVABLE CLOSURE**
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ABSTRACT OF THE DISCLOSURE

An actuator device for a movable closure, such as a window, having a slider member supported in the channel of the sill of the movable window and coupled to a motor for movement of the slider and the window along the sill. A pair of limit switches are incorporated into the drive mechanism device to deactivate the motor at the extremes of travel of the window or when the window contacts a child's hand or other foreign object during its travel.

This invention relates to sliding closures such as windows and doors and more particularly to an electro-mechanical actuator mechanism for moving such closures. While this invention is adaptable to vertical sliding closures, it is primarily useful in connection with horizontal sliding aluminum windows and will be described in such relationship.

The current trend in home and office design of utilizing large areas of windows and glass doors which are readily movable to open up a room to the surrounding areas such as a patio has developed a need for a simple and inexpensive mechanism to accomplish such movement.

Therefore, an object of the present invention is to provide an improved, self-contained, compact actuator mechanism for movable closures of relatively simple and inexpensive construction which can be readily installed as original construction or as an attachment to already existing structures without significant alteration.

Another object is to provide an improved actuator mechanism for movable closures with improved safety features to prevent objects such as children's hands from becoming caught between the movable closure and the jamb.

A still further object is to provide an improved actuator mechanism for movable closures which may be readily disengaged from the movable closure to enable it to be manually operated in the event of failure of the actuator mechanism.

In general, in its preferred form the invention comprises a uniquely designed slider member which is adaptable to be supported in the channel of the sill member of a conventional movable window to engage the window so that by movement of the slider along the sill the window will also move. To move the slider it is coupled by cables to a motor driven pulley mechanism, thus by rotating the motor in one direction the slider and the window will move in a first direction and by reversing the rotation of the motor, the direction of movement of the window also reverses. A pair of pivotally supported idler pulleys engage the cable and by their movement operate a pair of limit switches to deactivate the electric motor in the event that undesired tension builds up in the cables such as from the window contacting a child's hand or any other object during its travel.

Other advantages of the invention will hereinafter become more fully apparent from the following detailed description of the preferred embodiment of the invention when considered in conjunction with the accompanying

2

drawings throughout which like reference characters indicate like parts and in which:

FIGURE 1 is a perspective view of the primary elements of the actuator mechanism of the present invention showing their relationship with a portion of a sliding closure such as a conventional sliding window. For clarity the unit housing and the window are shown in a schematic form and by dashed lines;

FIG. 2 is a side elevational view shown in section of a portion of a sliding window showing the sill, the movable panel and a portion of the actuator mechanism of the present invention to illustrate the interrelationship between these elements;

FIG. 3. is an enlarged perspective view of a portion of the channel frame of a movable panel, a portion of the slider member, the guide pulley and control cables to illustrate the method of attachment of these members into a unit;

FIG. 4 is a perspective view of the slider member of FIG. 3 partly cut away to show the engagement therewith of a closure member; and

FIG. 5 is an enlarged view of the idler pulley, pivotal arm and a portion of the control cable. These members shown in normal operating condition by solid lines, and in control condition by dashed lines.

Referring first to FIG. 1, the present invention is shown associated with a movable panel 10 forming a part of a window unit also having a fixed panel 12 both of which are held within a frame member 14. The frame member 14 is conventional in construction and typically includes a head, sill and jamb members each constructed of channel sections with the head and sill providing ways in which the movable window is horizontally slidable. Since such construction is well known in the art, the details thereof will not be illustrated herein. The fixed panel 12 and the slidable panel 10 may be of substantially identical construction, each including a glass pane set in a metal frame, the upper and lower members of which are mounted in the channel ways provided by the head and sill members. Also the slidable panel includes a plurality of antifriction rollers 16 (conventionally of nylon material) mounted on one side of the panel for engagement with the sill, such rollers are shown in FIGS. 3 and 4. The fixed panel 12 is rigidly held in one side of the frame in the vertical plane thereof and the sliding panel 10 is adapted to close the other side of the frame. It is movable in another vertical plane thereof immediately alongside the plane of the fixed panel in accordance with conventional construction.

Engaging one side of the slidable panel 10 is a slider member 20 comprising a pair of low friction blocks 22 of a material such as nylon affixed to the ends of a rigid flange or angle member 24. It has been found desirable to utilize a material such as nylon for the slider blocks to eliminate noise as the slider member moves in the sill member of the window. The blocks 22 have attached to them the ends of a control cable 26, this cable passing over a guide pulley 28 and engaging a drive pulley 30. To rotate the drive pulley 30 a conventional reversible electric motor 31 is mounted adjacent to the pulley by a bracket 29 and is mechanically coupled thereto by a conventional spin gear arrangement 32.

An idler pulley 34 is attached to one end of each of a different one of a pair of spring-loaded pivotal arms 36 and rides in engagement with the cable 26. The other end of each of the pivotal arms 36 engages the contact of a limit switch 38 which in the preferred embodiment is normally closed to permit electric power to be continuously provided to the electric motor 31. However, if the pivotal arms 36 are caused to rotate downwardly as shown in FIG. 1, the switch contact of the limit switches opens resulting in an interruption of the electric power

to the motor 31 to stop the movement of the panel 10.

The actuator mechanism is typically assembled into a single unit having a case or housing 40 and may be mounted in a wall cavity such as by securing it to a vertical wall stud 46, the flange 43 of the window unit or other structural members by conventional means such as bolts or screws (not shown). As shown in FIG. 2 a shaft and plate 42 is affixed to the side window flange 43 by conventional means such as rivets for supporting the guide pulley 28.

FIGS. 2 and 3 show a portion of the movable panel in one embodiment of a sliding window wherein the movable panel comprises a pane of glass 50, and a channeled frame 52, while the channeled sill 53 includes a flange-like track 54 engageable by the antifriction roller 16 (FIG. 3) and a weatherstrip 56 of a material such as mohair. The slider member 20 comprises the flange 24 and the blocks 22 affixed thereto by a conventional fastener 58 such as rivets, pins or flush screws and is supported within the channeled sill 53 by the channel walls and a portion of a groove 60 therein engaging the flange-like track 54. The slider member is affixed to the ends of the control cable 26, which passes over the guide pulley 28 into engagement with the drive pulley 30.

From FIG. 2 it is clearly shown that a conventional sliding window unit can be readily adaptable to receive the actuator unit 40 by merely cutting an appropriate slot 55 in the bottom of the sill 53 to permit the guide pulley 28 to extend therethrough and by mounting the actuator unit to the wall studs beneath the sill. Thus, by positioning the slider member 20 in the channeled sill 53 and coupling the ends of the control cable 26 thereto, movement of the control cable results in movement of the slider member 20 and, to be described below, movement of the window.

While there is shown in FIGS. 1 and 2 an embodiment of the present invention to be used with a sliding window from a position below the window, it should be understood that within the scope of the present invention the actuator unit may be positioned anywhere adjacent to the window. Such a relocation of the unit would merely necessitate the inclusion of additional guide pulleys and would not necessitate any redesign of the unit.

Referring to FIGS. 3 and 4, wherein for simplicity the movable panel is shown as a portion of a channel 70, to attach the panel or channel 70 to the slider member 20 each end of the slider 20 includes a transverse slot 72 which is of a dimension to receive a pin 74 extending transversely across the channel 70. One of the slots is of a depth greater than the other one as shown at 76 and the minimum depth is substantially equal to the diameter of the pin 74. This difference in dimension enables the panel 70 to be positioned in engagement with the slider member 22 by first moving the panel so that one of the pins engages the bottom of the deeper slot, thus causing the other pin to clear the edge of the slider member so that it can be aligned with the other slot. Now, by moving the panel in the opposite direction each of the pins will engage one of the slots. The reverse of this operation is followed to disengage the panel 70 from the slider 20. Thus, if it is desired to move the panel manually, or if the actuator unit fails, the panel may be easily disengaged from the slider but yet is freely movable since the antifriction rollers 16 remain in contact with the track 54.

Within the scope of the present invention many methods may be used to affix the ends of the cable 26 to the slider member 20. One preferred method is shown in FIGS. 3 and 4 as comprising a bore 80 in the blocks 22 through which the cable ends extend and a clamp member 78 affixed to the exposed end to prevent the cable end from being pulled from the bore.

The actuator unit also includes an electrical control unit 90 (FIG. 1) which typically would include operating

switches such as an on-off switch 92 and a direction control switch 94 electrically coupled to the electric motor 31 for controlling the direction of rotation thereof and, correspondingly, the direction of movement of the movable panel. Depending upon the specific reversible electric motor 31 utilized, the direction control switch might be a double pole-double throw switch or a single pole-double throw. A conventional power circuit which would be included in the present invention includes the on-off switch coupled in series with a source of electrical power shown in FIG. 1 as a conventional plug 96 such as 110 volts A.C., and with each of the limit switches 38 also coupled in series in the power circuit, and normally maintained in a closed position. Thus, the power circuit could be interrupted by either opening the on-off switch or either of the limit switches. As desired, the electrical control unit could also include current limiting resistors, voltage dropping transformers and rectifiers depending upon the nature of the electrical power used and the type of reversible electric motor utilized.

As desired, for convenience the operating switches may be remotely located from the electrical control unit, such as in a master control panel located in one room of a house from which all of the windows and doors could be operated.

FIG. 5 shows clearly one of the safety control mechanisms comprising the pivotal arm 36, the limit switch 38 and the idler pulley 34. This mechanism provides a safety feature to deactivate the electric motor 31 when undesirable tension is applied to one of the cables 26. Such tension would result from impeding the travel of the movable panel prior to its terminal points, such as by catching a child's hand or any other object between the panel and the jamb. This is accomplished by mounting the arm 36 about a central pivot 82 which could be supported by the housing 40 (not shown) and then pivoting the arm into engagement with the contact 84 of the limit switch through the force of a spring 86 and the cable 26 engaging a pulley 34 affixed to its other end. When the cable is tensioned beyond that of normal operation, as shown in dashed lines, the arm rotates, allowing the contact 84 to spring to an open position 88 opening the switch 38 and deactivating the electric motor 31.

Rather than deactivate the electric motor 31 when the sliding panel contacts a foreign object, for certain operations it may be desirable to immediately reverse the direction of rotation of the motor and, correspondingly, the direction of movement of the sliding panel. Such an operation is easily accomplished by coupling a conventional switching circuit comprising a switch and relay (not shown) to the limit switches 38, the motor 31 and the power supply. Thus, when the window contacts an object such as a child's hand, the pivotal arm 36 rotates, as described, and the limit switch 38 operates the relay and, correspondingly, the other switch to reverse the polarity of the electric motor and direction of movement of the window.

Shown in dashed lines in FIG. 1, an additional safety feature of the preferred embodiment is the addition of a strip 100 of resilient material such as rubber to the edge of the movable window 10 adjacent to the jamb and as desired also to the jamb. Such strips 100 act as a cushion in the event that a hand or any other object does become lodged between the window and jamb.

While the basic principle of this invention has been herein illustrated and has been described in one embodiment it will be appreciated by those skilled in the art that variations in the disclosed arrangement both as to its details and as to the organization of such details may be made without departing from the spirit and scope thereof. Accordingly, it is intended that the foregoing disclosure and the showings made in the drawings will be considered only as illustrative of the principles of the invention and not construed in a limiting sense.

5

What is claimed is:

1. In combination with a support element having a track member, an actuator mechanism for a closure member movable in engagement with said track, comprising:

a slider member positioned in said support element and supported by said track, said slider member being adapted to engage said closure member for linear movement thereof without disengaging said movable closure from in contact with said track;

a reversible electric motor positioned adjacent said slider member; and

a mechanical linkage coupled to said reversible motor and to said slider member for transmitting the rotational movement of said motor to the linear movement of said slider member and, correspondingly, said closure member.

2. The actuator mechanism of claim 1 wherein the slider member includes a pair of slots at opposite ends thereof, and the closure member includes a pair of pins each engageable with one of said slots to affix said closure to said slider member.

3. The actuator mechanism of claim 2 wherein one of said slots has a depth substantially equal to the diameter of said pin and the other has a depth greater than said diameter.

4. The actuator mechanism of claim 3 wherein the slider member includes a pair of blocks of a low friction material affixed to the ends of a rigid support and each

6

having a groove in which a portion of said track is contained.

5. The actuator mechanism of claim 1 including a safety switch mechanism cooperating with said mechanical linkage to deactivate said electric motor under predetermined conditions.

6. The actuator mechanism of claim 5 wherein the mechanical linkage includes a pin gear and pulley coupled to said motor and a control cable coupled to said slider member and passing over said pulley and said safety switch mechanism includes a pivotal arm engaging at one said cable and at the end a switch, wherein during predetermined moving sequence of said closure member said switch remains in a first condition and during all other moving sequences said switch is in a second condition to deactivate said motor and stop the movement of said closure member.

7. The actuator mechanism of claim 6 wherein the end of said pivotal arm engaging said cable includes an idler pulley riding on said cable.

References Cited

UNITED STATES PATENTS

3,269,454 8/1966 Gill et al. ----- 160—331

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