United States Patent [19]

Galis

[11] **3,890,744**

[45] **June 24, 1975**

[54] **PATIO DOOR OPERATOR**

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[73] Assignee: **George Giambalvo,** Winfield, Ill.

[22] Filed: **Mar. 1, 1974**

[21] Appl. No.: **447,097**

[52] **U.S. Cl.** **49/360;** 49/139

[51] **Int. Cl.²** **E05F 15/14**

[58] **Field of Search** 49/31, 139, 360, 118, 123; 74/625; 160/193, 331

[56] **References Cited**

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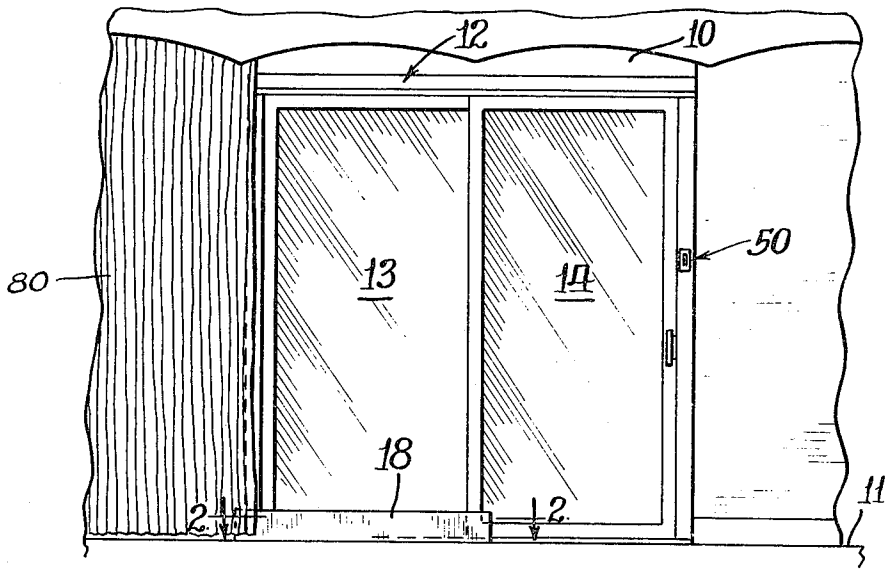
Primary Examiner—Kenneth Downey

Attorney, Agent, or Firm—Darbo, Robertson & Vandenburgh

[57] **ABSTRACT**

A patio door operating unit comprises a housing which mounts on the floor beside the location that the door occupies when the sliding door is in its open position. Within the housing in an endless belt which engages the door adjacent its bottom and is trained for movement along a path at the bottom of the door. This belt is driven by an electric motor. There are limit switches to stop the electric motor at the open and closed positions of the door. The belt is tightened by a solenoid connected to the motor circuit so that when the electric power fails the belt is loose and the door can be moved by hand.

6 Claims, 4 Drawing Figures



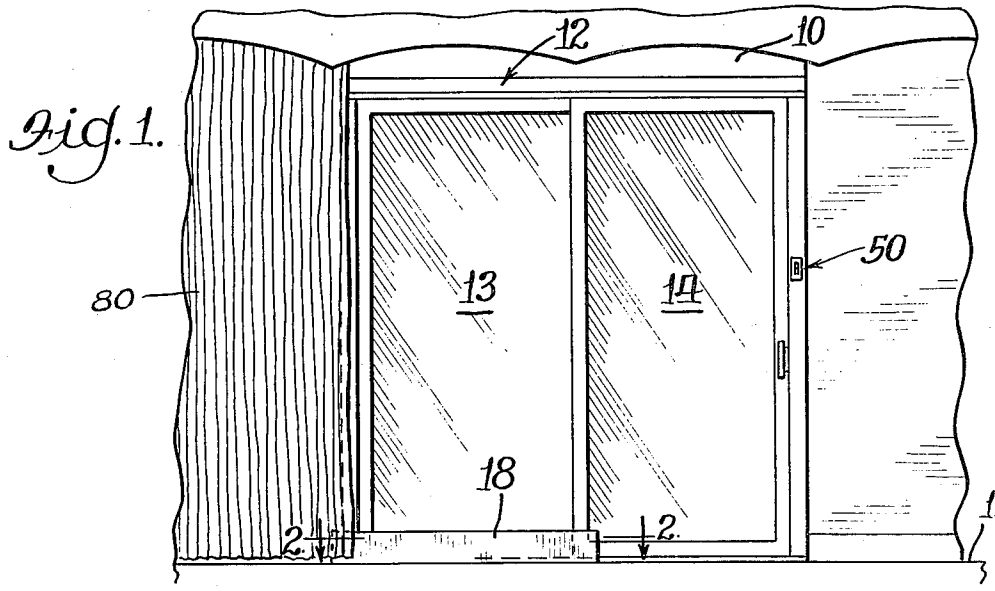


Fig. 1.

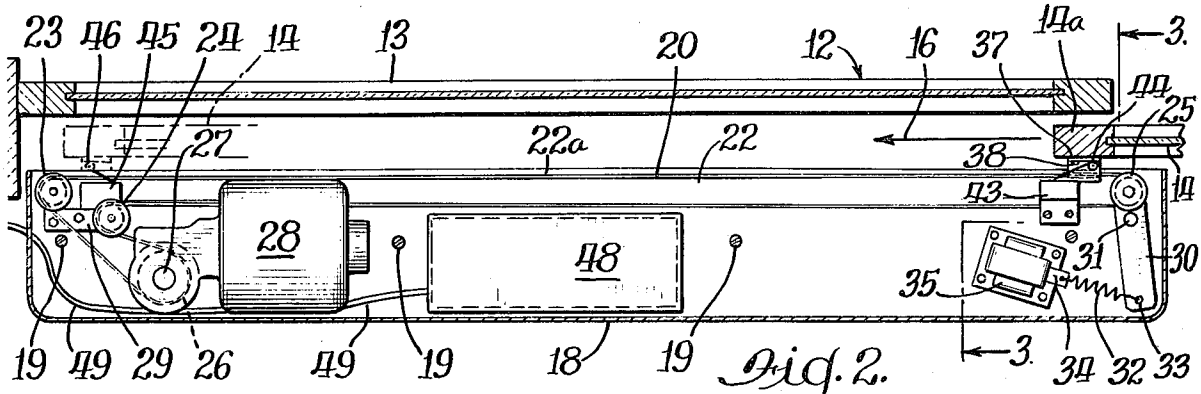


Fig. 2.

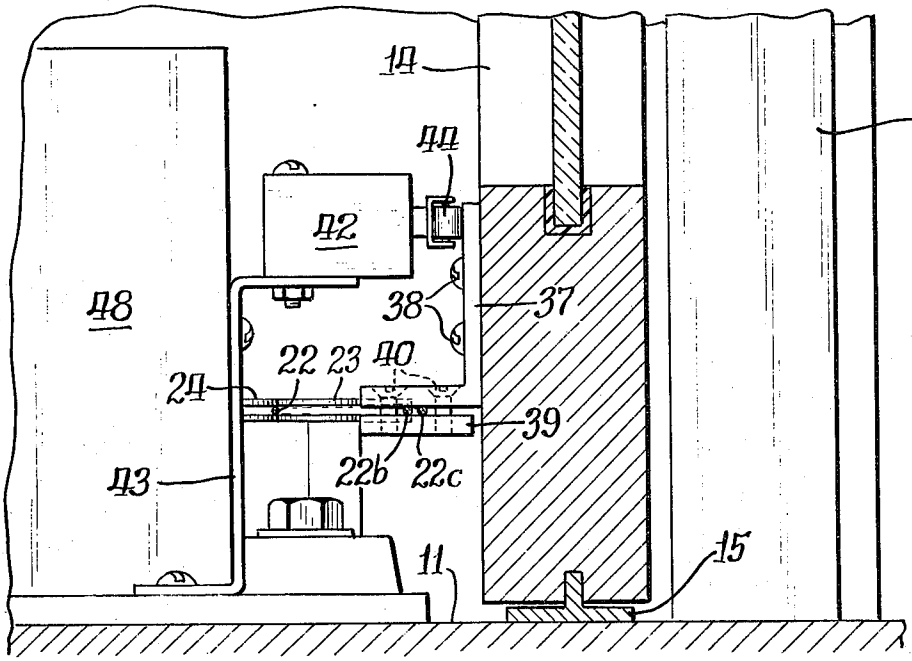


Fig. 3.

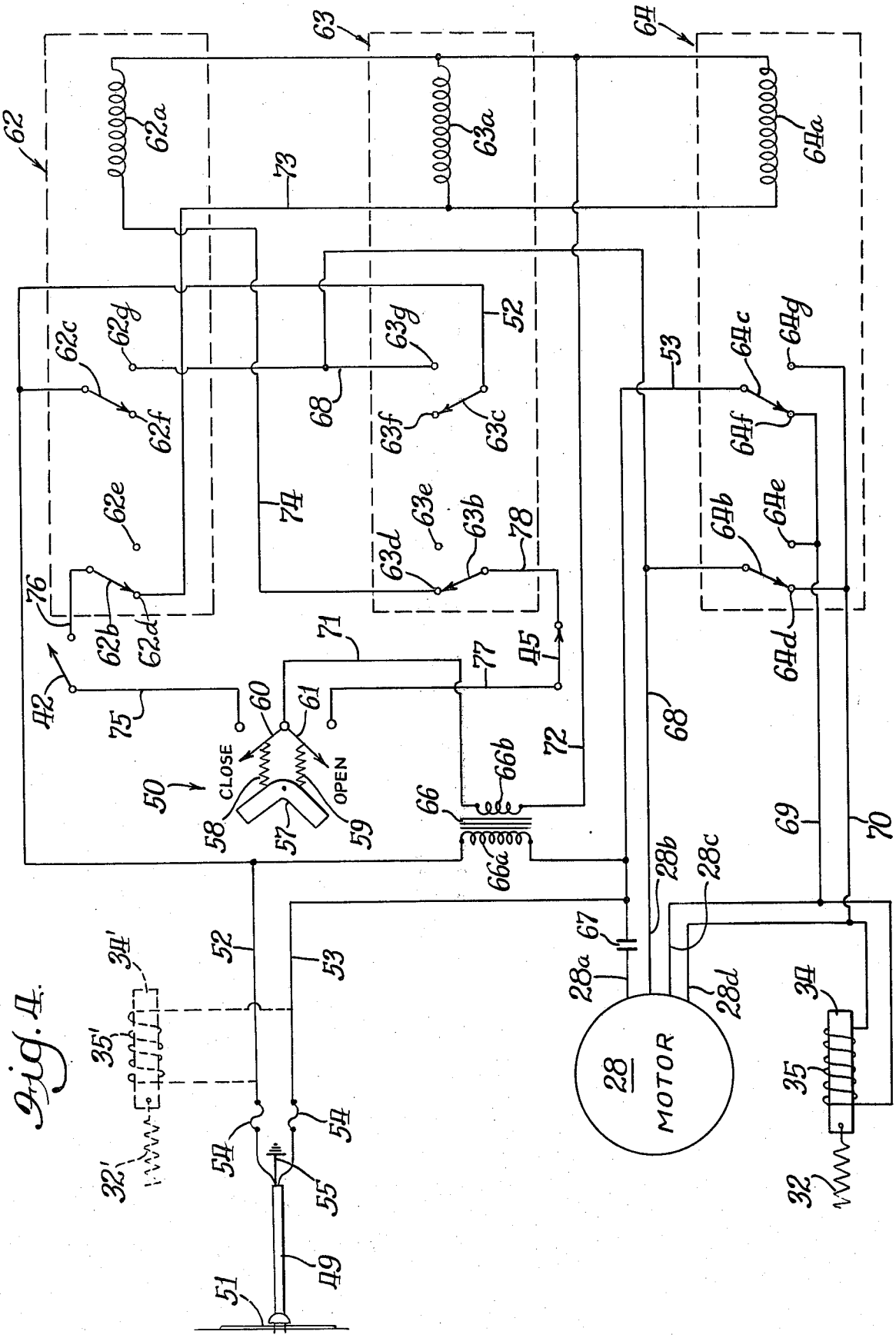

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Fig. 4.

PATIO DOOR OPERATOR

BACKGROUND AND SUMMARY OF THE INVENTION

Electric operators for doors, windows and the like have been in use for a number of years. However, the present invention solves a need which is not met by the existing commercial units; that is, an operator for a patio door which is available as a package and which can be installed by the home handy man without structural modifications to the building. The unit mounts on the floor in a position beside the bottom of the patio door when it is in its open position. Thus, the unit is out of the way and relatively inconspicuous. Yet, it is easy to mount without structural modifications to the building. The unit can be prewired, except for a control switch and a connection to a source of electric power. The latter can merely be an appliance type cord which plugs into a wall socket. The electric switch is low voltage wiring which is easy to install and inconspicuous when installed, primarily because it requires only small wire with little insulation since there is no shock or fire hazard involved. When the unit is thus mounted and wired, there is only the single further necessary act of connecting the belt of the operator to the door.

An important feature of the operator is that it does not interfere with the manual operation of the door in the event of power failure. This is achieved by the use of a solenoid operated belt tightener. If the electric power fails, the solenoid will not be energized and the belt will be loose. Because of the loose belt, the door can be operated manually.

Further objects and advantages will become apparent from the following description and drawings.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an elevational view of the interior of a patio door with an embodiment of the invention secured to the door;

FIG. **2** is a horizontal section as seen at line **2—2** of FIG. **1**;

FIG. **3** is a transverse section as seen at line **3—3** of FIG. **2**; and

FIG. **4** is a schematic wiring diagram for the driving motor and belt tightener.

DESCRIPTION OF SPECIFIC EMBODIMENT

The following disclosure is offered for public dissemination in return for the grant of a patent. Although it is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that purpose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements.

In the drawings a portion of an exterior wall **10** of a building is illustrated. This building has an interior floor **11.** In this exterior wall there is, what is commonly referred to as a patio door unit, generally **12.** This comprises a fixed door or sash **13** and a sliding door or sash **14.** The sliding door has tracks at the top and bottom which guide its movement between the open and closed position, one of which tracks is seen at **15** in FIG. **3.** As illustrated in FIG. **1,** the movable door **14** is in the closed position. It moves toward the open position by movement indicated by arrow **16.** When it is in the open position it is approximately opposite the closed door **13,** as illustrated in dot-dash lines in FIG. **2.** As thus far described, the structure is conventional.

The operator or unit of the present invention comprises a housing **18.** It is adapted to be positioned on the floor **11** immediately opposite the location that will be assumed by the movable door **14** when the movable door is open. It is affixed in position as by means of a plurality of wood screws **19** which engage the floor **11.** A portion of the housing **18** is readily removable to obtain access to the interior thereof, but this feature is not illustrated. The side of the housing immediately adjacent the door is open to form an opening **20.** This opening **20** extends a distance greater than the extent of movement of the side **14***a* of the movable door **14** when that door moves between the closed and open positions.

Within the housing is an endless (i.e., as finally assembled) belt **22** which is trained for movement along a given path by idler pulleys **23–25** and a driving member **26** in the form of a pulley on the output shaft **27** of a reversible gear motor **28.** This is a conventional motor having a relatively slow speed at its output shaft. The electrical connections thereto are such that the rotation of the motor can be reversed simply as hereinafter described. The idler pulleys **23** and **24** are mounted on a support **29.**

The idler pulley **25** is mounted on one end on a pivotal arm or lever **30.** This arm is pivoted on a fixed post **31** forming a part of the housing **18.** A spring **32** hooked in an opening **33** at the other end of arm **30** is also connected to the armature **34** of a solenoid **35.** Thus when the solenoid **35** is energized, the armature **34** pulls in and applies a clockwise (as viewed in FIG. **2**) force to the end of arm **40** thus rotating idler pulley **25** in a clockwise direction to tension belt **22.** The arrangement of the idler pulleys is such that belt **22** has a portion of its path of movement extending across opening **20** for a distance greater than the extent of movement of the side **14***a* of the door **14** when the latter moves between the open and closed position, said portion of the path being identified as **22***a*.

An L-shaped bracket **37** is adapted to be affixed to door **14** adjacent the left end thereof (as viewed in FIGS. **1** and **2**) as by means of screws **38.** The two ends **22***b* and **22***c* of the belt **22** are gripped between bracket **37** and plate **39.** To this end screws **40** extend through bracket **37** and are threaded into plate **39.** This connects the belt to the door and also forms the belt, in effect, into an endless belt.

A closed position limit switch **42** is mounted on a support **43.** This limit switch has an actuating arm with a roller **44** on the end thereof. This roller is positioned so that it contacts the bracket **37** and operates the switch just as door **14** reaches the closed position. An open position limit switch **45** is similarly mounted on a support. It is positioned so that its roller **46** on the operating arm will actuate the switch as the door **14** reaches its open position, illustrated in dot-dash lines in FIG. **2.**

There is a control box **48** which houses the electrical components other than those already described. A **110** volt power supply cord **49** is adapted to be plugged into a suitable wall outlet **51,** i.e. a source of **110** volt A.C. power. There is an operating switch, generally **50,** which is mounted at any convenient location adjacent the door. As hereinafter described, this switch is connected to the rest of the circuitry by low voltage wiring.

Referring now to the wiring diagram of FIG. 4, the power cord 49 terminates in two power supply wires 52 and 53, one or both of which are protected by fuses 54. The power supply wire also has a third grounded wire 55 connected to the metal component of, or within, housing 18. As illustrated, switch 50 is a rocker switch. It has a pivotally mounted insulated operator 57 which is normally centered by springs 58 and 59. In effect, there are two switches 60 and 61. As illustrated, when the operator 57 is rocked in the clockwise direction it closes switch 60. When released, spring 58 returns the operator to the center position. When the operator 57 is rocked in the counterclockwise direction it closes switch 61. Switch 61 remains closed as long as the operator 57 is held, but when the operator is released, the spring 59 returns the operator to the centered position and opens switch 61.

There are three relays, generally 62, 63 and 64. Each has a relay coil (respectively 62*a*, 63*a* and 64*a*). Each has a pair of switch arms (respectively 62*b*, 62*c*; 63*b*, 63*c*; and 64*b*, 64*c*). Each of these switch arms is movable between a normally closed and a normally open contact, the contacts being 62*d*, 62*e*, 62*f*, 62*g*; 63*d*, 63*e*, 63*f*, 63*g*; and 64*d*, 64*e*, 64*f*, 64*g*, respectively.

There is a step-down transformer 66 (e.g., 110 volts to 12 volts) having a primary 66*a* and a secondary 66*b*. As is conventional with a 110 volt reversible gear motor 28, it has four power leads 28*a*, 28*b*, 28*c* and 28*d*. A capacitor 67 connects lead 28*a* to power supply wire 53. A wire 68 connects lead 28*b* to switch arm 64*b*, contact 62*g* and contact 63*g*. A wire 69 connects lead 28*c* to one end of solenoid 35, contact 64*e* and contact 64*f*. A wire 70 connects lead 28*d* to the other end of solenoid 35, to contact 64*d* and to contact 64*g*. Power supply wire 53 connects to one end of transformer primary 66*a* and to switch arm 64*c*. Power supply wire 52 connects to the other end of transformer primary 66*a*, to switch arm 62*c* and to switch arm 63*c*. A wire 71 connects one end of transformer secondary 66*b* to one side of switches 60 and 61. A wire 72 connects the other end of transformer secondary 66*b* to one end of each of relay coils 62*a*, 63*a* and 64*a*. A wire 73 connects the other ends of relay coils 63*a* and 64*a* with switch contact 62*d*. A wire 74 connects the other end of relay coil 62*a* with switch contact 63*d*. A wire 75 connects switches 60 and 42. A wire 76 connects switch 42 and switch arm 62*b*. A wire 77 connects switches 61 and 45. A wire 78 connects switch 45 and switch arm 63*b*.

INSTALLATION AND OPERATION

Generally speaking, an embodiment of the present invention will be sold as a package to be used with a given size of patio door. However, it is readily apparent that variations thereof may be employed. The home owner handy man (or professional installer) will mount the bracket 37 at the required height on the side 14*a* of the frame of movable door 14. He then will position the housing 18 on the floor in proper alignment with the open position of the door and so that run 22*a* of the endless belt 22 is properly aligned with bracket 37. The housing then is fixed in place and the two ends 22*b* and 22*c* of the belt are clamped to bracket 37 by screws 40 and plate 39, thereby completing the endless belt and engaging it with the door. If necessary, adjustments are made as to the position of limit switches 42 and 45 so that they will be actuated at the correct position of the door. Switch 50 is mounted in a convenient location and small size, low voltage wires 71, 75 and 77 are run from the control box 48 to the switch 50. Line cord 49 is plugged into a suitable receptacle. Drapes 80 may be hung so as to conceal the housing when the drapes are closed.

The wiring diagram of FIG. 4 presumes that the door 14 is fully closed. In this position it has actuated switch 42 to open the switch. If one now wants to open the door, he presses on operator 57 in a direction such as to rock it in the counterclockwise direction thus closing switch 61. This completes a low voltage circuit from the transformer secondary, wire 71, switch 61, switch 45, wire 78, switch arm 63*b*, contact 63*d*, wire 74, relay coil 62*a* and wire 72 back to the transformer secondary. This energizes relay coil 62*a* and causes switch arm 62*b* and 62*c* to change their position. Switch arm 62*c* creates a circuit from power supply wire 52 to contact 62*g* and wire 68 to motor lead 28*b* and through switch arm 64*b* to contact 64*d*, wire 70 to motor lead 28*d* and one end of solenoid 35. This energizes the motor 28 and causes it to rotate in a direction such that the bracket 37 is moved in door opening direction, i.e., the direction indicated by arrow 16. The energizing of solenoid 35 pulls in armature 34, tensioning spring 32 and moving idler pulley 25 in a clockwise direction as viewed in FIG. 2, thus tightening belt 22. Immediately upon the door leaving the closed position, roller 44 no longer contacts bracket 37 so that it is able to move outwardly changing the position of switch 42. This closes the switch 42. It has no effect since switch 60 is open.

The opening movement of the door may be terminated in one of two ways, namely, (1) releasing switch operator 57 so as to open switch 61, or (2) allowing the door to move to the limit of its movement thus actuating limit switch 45. Either of these actions breaks the circuit from the transformer secondary through wire 71, etc., and deenergizes relay coil 62*a*. The deenergizing of that relay coil returns the switch arm 62*b* and 62*c* to the position illustrated. This breaks the power supply circuit energizing the motor 28 and the solenoid 35.

If it is now desired to move the door in door-closing direction, switch operator 57 is rocked in a clockwise direction so as to close switch 60. This creates a low voltage electrical circuit from the transformer secondary 66*b*, wire 71, switch 60, wire 75 closed switch 42, wire 76, switch arm 62*b*, contact 62*d*, wire 73, relay coils 63*a* and 64*a*, and wire 72 back to the transformer secondary. Energizing relay coil 64*a* causes the switch arms 64*b* and 64*c* to change position. As will be apparent to those skilled in the art, this merely reverses the electrical connections to motor leads 28*c* and 28*d*; thus causing a reversal of direction of the motor 28 when energized. The energizing of relay coil 63*a* changes the positions of switch arms 63*b* and 63*c*. This creates a power supply connection from supply wire 52, switch arm 63*c*, contact 63*g*, wire 68 to motor lead 28*b* and through switch arm 64*b*, contact 64*e* and wire 69 to motor lead 28*c* and the solenoid 35. The motor 28 is now energized in door closing direction. This door closing operation continues until either (1) actuator 57 is released so as to open switch 60, or (2) the door reaches the fully closed position thus again opening limit switch 42.

It will be apparent that movement of the door can be stopped in any position by releasing actuator 57. If de-

sired, the door can then be moved in the reverse direction merely by turning the actuator **57** in the opposite direction.

As described, the solenoid **35** is connected to wires **69** and **70** so as to be energized when the motor is turned on. Thus at any time that the motor **28** is not energized, the belt **22** will be slack and the door **14** can be moved manually. An alternative arrangement is illustrated in dotted lines in FIG. **4.** Here it will be seen that the solenoid **35'** is connected across the power supply wires **52** and **53.** Thus, the solenoid **35'** is always energized (so long as the unit is plugged in) and the belt **22** remains taut. Thus, it would be extremely difficult, if not impossible, to move door **14** in an opening or closing direction even though the motor **28** was not running. This could permit, for example, the door to be opened only a slight amount without intruders being able to open it farther to gain access to the building. However, if an electric power failure should occur, solenoid **35'** becomes deenergized. This allows the belt **22** to go slack so that the door **14** can be opened or closed manually.

I claim:

1. An apparatus for operating a sliding door unit of the type commonly referred to as a patio door used in a building wherein there is a floor at the bottom of the door unit immediately to one side of the door unit, said door unit being movable between a closed and an open position, and wherein there is a fixed similar unit at the opposite side of said door unit, said door unit having a first end thereof immediately adjacent said similar unit when said door unit is in the closed position and a second end remote from said similar unit when said door unit is in said closed position, said apparatus comprising:

a housing adapted to be mounted on said floor immediately at said one side of said door unit when said door unit is in the open position, said housing having an opening on the side thereof adjacent said door unit, said opening being of a length approximately equal to the width of said door unit, electric motor means within said housing and having a generally circular driving member on the output shaft thereof, a flexible endless member, means mounted on the housing and contacting the endless member for training said endless member in a path of movement within the housing, a first position of said path being in engagement with the driving member so that when said motor is running said endless member will move along said path, a second portion of said path being parallel to said opening, and means extending through said opening and having a portion within the housing engaging said endless member and a position outside said housing for engaging said door unit immediately adjacent said first end thereof for causing said door unit to move with said endless member,

whereby said apparatus can be readily installed without structural modifications to the building by mounting it on said floor adjacent the position occupied by said door unit when it is in the open position.

2. An apparatus as set forth in claim **1,** wherein said endless member is a belt, said training means including a plurality of pulleys, said means extending through said opening including a bracket adapted to be affixed to said door unit, said bracket having means gripping said belt.

3. An apparatus as set forth in claim **2** for use with a source of electric power and including circuit means for connecting said motor means to said source, the improvement comprising:

a belt tightener comprising one of said pulleys, means mounting said one pulley for movement in a direction into the belt, the last means including electric power means for, when energized, moving said one pulley in said direction to tighten the belt, and means connecting said electric power means to said circuit means for energizing said electric power means from said source when said motor means is energized to thereby tighten the belt for engagement with said driving member when the motor means is energized and when said source of electric power fails, said electric power means is deenergized and therefore fails to act to tighten said belt.

4. An apparatus as set forth in claim **3,** wherein said electric power means is a solenoid having an armature, said last means including a pivotally mounted arm, said pulley being mounted on said arm at a distance from the pivot point, means connecting said armature to said arm a distance from said pivot point.

5. In an apparatus for operating a sliding door unit or the like, wherein there is an electric motor means, circuit means for connecting the motor means to a source of electric power, and a unit operating device connecting said unit and said electric motor means, said device including an endless belt and pulleys training said belt for movement along a given path, the improvement comprising:

a belt tightener comprising one of said pulleys, means mounting said one pulley for movement in a direction into the belt, the last means including electric power means for, when energized, moving said one pulley in said direction to tighten the belt, and means connecting said electric power means to said circuit means for energizing said electric power means from said source when said motor means is energized to thereby tighten the belt for engagement with said driving member when the motor means is energized and when said source of electric power fails, said electric power means is deenergized and therefore fails to act to tighten said belt.

6. An apparatus as set forth in claim **5,** wherein said electric power means is a solenoid having an armature, said last means including a pivotally mounted arm, said pulley being mounted on said arm at a distance from the pivot point, means connecting said armature to said arm a distance from said pivot point.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,890,744

DATED : June 24, 1975

INVENTOR(S) : Martin A. Galis

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Abstract, line 5, "in" should read --is--.
Column 5, line 47, "position" should read --portion--.
Column 5, line 54, "position" should read --portion--.

Signed and Sealed this

twenty-fifth Day of *November 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks