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2,909,718

DOOR OPERATING APPARATUS

Filed Aug. 26, 1955

2 Sheets-Sheet 1

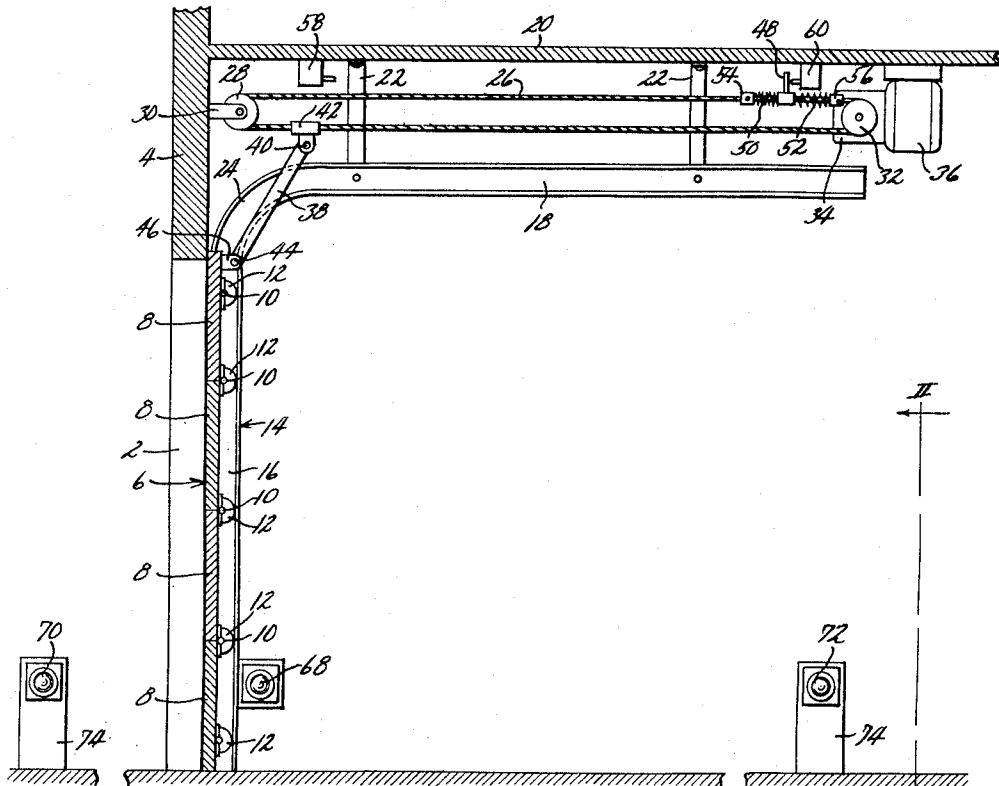


Fig. 1

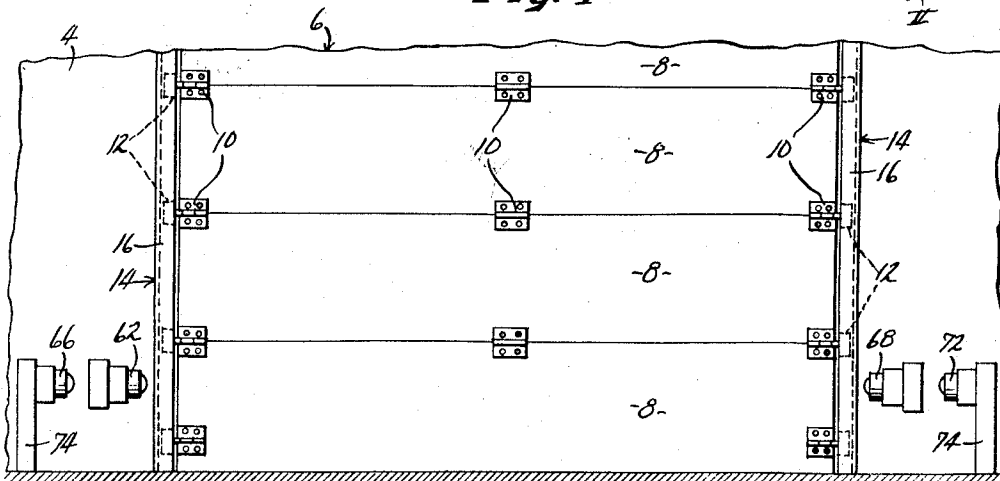


Fig. 2

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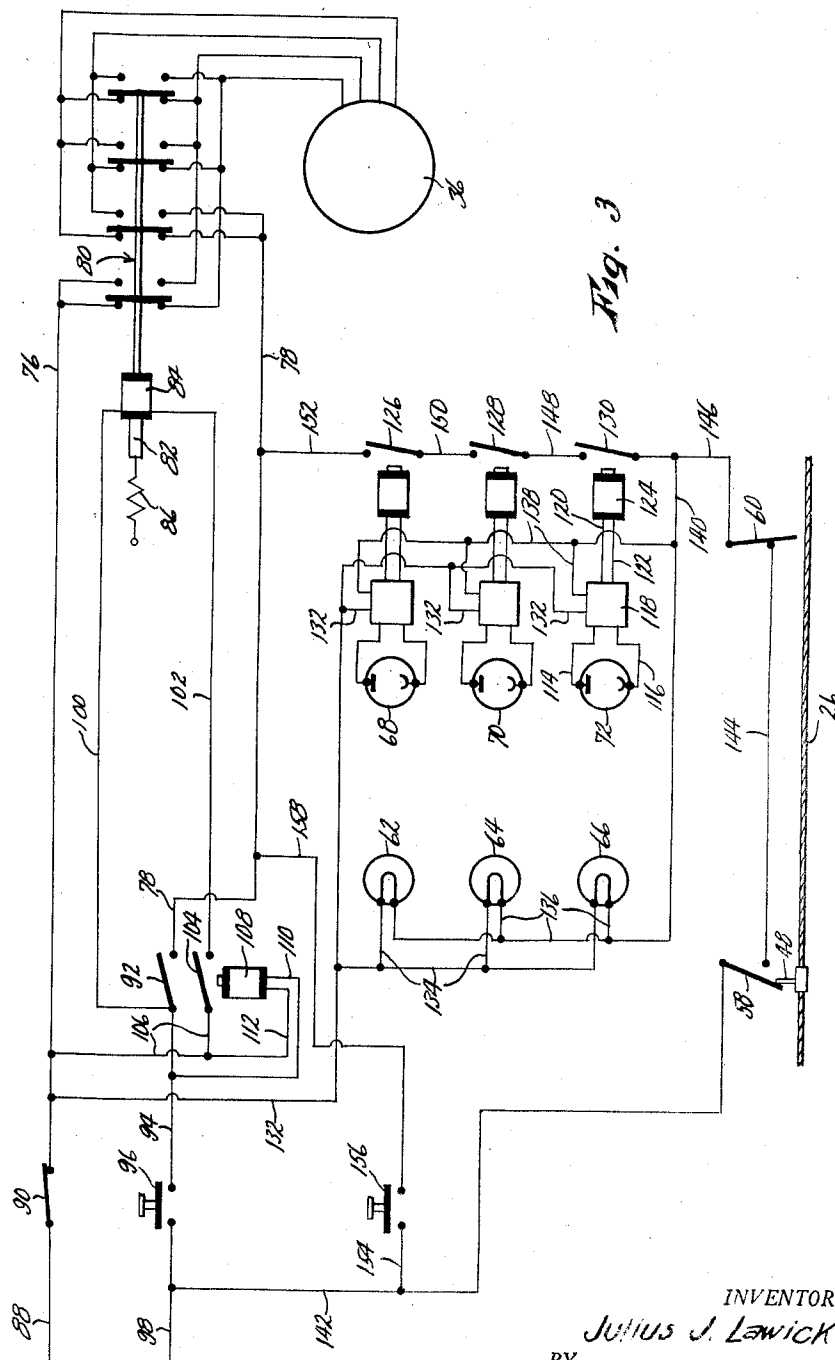


Fig. 3

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DOOR OPERATING APPARATUS

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2 Claims. (Cl. 318—266)

This invention relates to new and useful improvements in door operating apparatus, and has particular reference to doors of the power-operating type such as is commonly used in garages and other public buildings.

Doors of the character described are usually powered by electric motors actuated by manual, momentary closing of electric switches, said motors being then maintained in operation by holding circuits until the door is fully open or fully closed, at which time limit switches function to stop the motors. A disadvantage of this system has been that the operator may press the button without first being sure that the door opening is free of obstructions, or that he may press the button and then walk away, with the result that an obstruction such as a person or an automobile may move into the path of the closing door, with consequent danger of injury or damage.

The principal object of the present invention is, therefore, the provision of a door operating system of the class described with the addition of means operable to stop the operating motor automatically if any obstruction enters or approaches the door as it is being closed. This is accomplished, generally, by providing light beams positioned to traverse the door opening, and the approaches thereto, and photoelectric cells energized by said light beams to close circuits maintaining the motor in operation, whereby if any one of said light beams is interrupted, the motor will be stopped.

Another object is the further provision of means whereby, when the interruption of a light beam is momentary, as might occur if a moving vehicle traverses said beam, the system will function on re-establishment of the beam to raise the door, regardless of whether the door was previously being raised or lowered. This is an added safety feature, and prevents damage to a vehicle which is moving toward a closing door, through carelessness of the driver, by raising the door out of the way.

Other objects are simplicity and economy of construction, efficiency and dependability of operation, and adaptability of the apparatus for use with virtually any type of power operated door.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein:

Fig. 1 is a vertical sectional view through a garage door and related parts, taken at right angles to the plane thereof, and including operating apparatus embodying the present invention,

Fig. 2 is a fragmentary sectional view taken on line II—II of Fig. 1, and

Fig. 3 is a schematic wiring diagram of the operating apparatus.

Like reference numerals apply to similar parts throughout the several views, and the numeral 2 applies to the door opening of a building wall 4, said door opening being provided with a conventional vertically movable door 6 divided horizontally into a plurality of sections 8 pivotally joined together by hinges 10. Along its vertical side edges, said door is provided with a plurality of

rollers 12 which are engaged in guide tracks 14. Each track 14 has a vertical portion 16 affixed to wall 4 and extending along one side of the door opening, and a horizontal portion 18 supported from the building ceiling 20 by hangers 22, said horizontal and vertical portions being joined by a curved connecting portion 24. In opening, the door moves upwardly and rearwardly, rollers 12 being guided in tracks 14, until door opening 2 is uncovered.

The door is operated by an endless cable 26 disposed in a loop above, intermediate, and parallel to track portions 18. The forward end of said loop is trained over a pulley 28 journaled in a bracket 30 affixed to wall 4, and the rearward end thereof is trained over a pulley 32 which is rotatably driven by a gear reduction unit 34 powered by a reversible electric motor 36 mounted on ceiling 20. A link 38 is pivoted at one end, as at 40, to a clamp 42 rigidly fixed on cable 26, and is pivoted at its opposite end, as at 44, to a bracket 46 affixed to the uppermost door section 8. Thus when motor 36 turns in one direction, cable 26 will move clamp 42 rearwardly, pulling link 38 to open the door. When the motor turns in the opposite direction, the action is reversed to close the door.

As seen in Fig. 1, a switch operating member 48 is mounted slidably on the upper reach of cable 26, and is held yieldably in position thereon by a pair of springs 50 and 52 coiled around the cable at opposite sides of member 48 and backed up respectively by clamps 54 and 56. Member 48 operates a pair of normally closed switches 58 and 60 mounted on ceiling 20, said switches being designated respectively the up-limit and down-limit switches. When the door is closed, member 48 engages and opens switch 60, and when the door is fully opened member 48 engages and opens switch 58.

A series of lamps 62, 64 and 66 are arranged along one side of the pathway through the door, and are operable to shine beams of light horizontally across the pathway to actuate photocells 68, 70 and 72 respectively at the opposite side of the pathway. As shown, one of the light beams is disposed closely adjacent the door, and the other two are disposed respectively at opposite sides of the door and at substantial distances therefrom. Said lamps and photocells are disposed in suitable cases affixed either to wall 4, or to posts extending upwardly from the floor, or to any other convenient support.

Referring to Fig. 3, it will be seen that lead wires 76 and 78 to motor 36 are connected to said motor through a reversing switch 80, said switch being connected to the armature 82 of solenoid 84 and movable thereby. It is believed unnecessary to detail the wiring of switch 80 and the motor, sufficing it to say that when said switch is moved to the right by energizing solenoid 84, and current is furnished to lead wires 76 and 78, motor 36 will turn to lower the door. When solenoid 84 is de-energized, the switch will be moved to the left by spring 86, so that when current is then delivered to lead wires 76 and 78, the motor will turn to raise the door.

Lead wire 76 is connected to line wire 88 through a master switch 90, and motor lead wire 78 is connected to the fixed terminal of relay contact 92, said contact being connected through wire 94 and a normally open push-button switch 96 to line wire 98. Wire 94 is connected by wire 100 with one terminal of solenoid 84, and the other terminal of said solenoid is connected by wire 102 with the fixed terminal of relay contact 104, said contact being connected by wire 106 to wire 76. Relay contacts 92 and 104 are operable by a common winding 108, the terminals of said winding being connected to wires 94 and 106 respectively by wires 110 and 112.

Each of photocells 68, 70 and 72 generates a current responsively to light falling thereon, said current passing

through wires 114 and 116 to an amplifier 118, wherein it is amplified and passed through wires 120 and 122 to the winding 124 of a relay, whereby to pull said relay closed. The relay contacts associated with photocells 68, 70 and 72 are designated 126, 128, and 130 respectively. A wire 132 connects wire 76 to each of amplifiers 118, connected in parallel, and through wire 134 to each of lamps 62, 64 and 66, also connected in parallel. The return wires 136 from said lamps, and the return wires 138 from said amplifiers, are united in a common wire 140.

A wire 142 connected directly to line wire 98 is connected in series through limit switch 58, wire 144, limit switch 60, wire 146, photo-relay contact 130, wire 148, photo-relay contact 128, wire 150, photo-relay contact 126 and wire 152 to wire 78. Wire 140 is connected in to wire 146. A wire 154 is connected to wire 142, and thence in series through a normally open push-button switch 156 and wire 158 to wire 78.

The operation of the apparatus is substantially as follows: Let it first be assumed that the system is ready for operation, which the door wide open. The parts will then have the positions shown in Fig. 3, master switch 90 being closed, push-button switches 96 and 156 being open, and up-limit switch 58 being open. If the operator then desires to close the door, he presses push-button switch 96 momentarily. This completes a circuit from line wire 98 through switch 96, wires 94 and 110, relay winding 108, wires 112, 106 and 76, and master switch 90 to line wire 88. Winding 108, thus energized, closes relay contacts 92 and 104.

The closing of relay contact 104 establishes a circuit from line wire 98 through switch 96, wires 94 and 100, solenoid coil 84, wire 102, relay contact 104, wires 106 and 76, and switch 90. Solenoid coil 84, thus energized, draws armature 82 to the right, setting motor reversing switch 80 to turn motor 36 to lower the door, when current is supplied thereto. The closing of relay contact 92 establishes a circuit from line 98 through switch 96 wire 94, relay contact 92, wire 78, switch 80 to motor 36 and return, wire 76 and switch 90 to line wire 88, thereby setting the motor in operation to lower the door.

After a very short movement of the door, up-limit switch 58 will close, thus establishing a circuit from line wire 98 through wire 142, switch 58, wire 144, switch 60, wires 140, 138 and 136 to amplifiers 118 and lamps 62, 64 and 66, and thence through wires 134, 132, and 76, and switch 90 to line wire 88. Amplifiers 118 are of the type not requiring a warming-up period, but come into action virtually instantaneously. Then, if none of the light beams from the lamps are obstructed, they will actuate photocells 68, 70 and 72 to cause all of relay contacts 126, 128 and 130 to close. The closure of these relays completes the main motor circuit from line 98 through wire 142, switch 58, wire 144, switch 60, wire 146, relay contacts 130, 128 and 126, wires 152 and 78 and switch 90, whereby to keep the motor in operation independently of relay contact 92. The closure of the photo-relays also supplies current through wires 152 and 78, relay contact 92 and wires 94 and 110 to relay winding 108, thereby holding relay contacts 92 and 104 closed. Push button 96 may then be released, and the motor will normally continue to operate to close the door until limit switch operating member 48 engages and opens down-limit switch 60. This of course breaks the main circuit to the motor, the circuit to the lamps and amplifiers, and the holding circuit to relay contacts 92 and 104, and the system is at rest.

If, after the door has been started down, any obstruction such as a person or vehicle should enter the door opening, or approach the door, one or more of the light beams will be interrupted. This will cause the corresponding relay contacts 126, 128 and 130 to open. This interrupts the main motor circuit, causing the door to

halt, and also interrupts the holding circuit to relay winding 108, allowing relay contacts 92 and 104 to open, but does not break the power circuit to the lamps and amplifiers. The opening of relay contact 104 breaks the circuit to solenoid 84, allowing switch 80 to be returned by spring 86 to a position to cause rotation of the motor to raise the door, when and if power is supplied to the motor lead wires 76 and 78.

If the interrupted light beam is then re-established, as could occur if a vehicle were moving toward the door and passed through said beam, it will immediately energize its related photocell and close the corresponding relay contact 126, 128 or 130, thereby closing the main motor circuit, which will then operate the motor to raise the door. Relay contact 104 cannot be closed again to set switch 80 to close the door until push-button 96 is closed manually. This is considered an important safety feature, since it provides that the door will raise automatically to avoid an approaching car the driver of which has not noticed that the door is closing.

When it is desired to open the door, push-button 156 is closed momentarily. This completes a circuit from line wire 98 through wires 142 and 154, push-button 156, wires 158 and 78, switch 80 to the motor, and thence through wires 76 and switch 90 to line wire 88. This energizes the motor to raise the door, since relay contact 104 was not closed to energize solenoid 84 to set switch 80 to lower the door. After the door has moved slightly, limit switch 60 will close to establish the main motor circuit as described above, and also the circuit energizing the photocells. Stoppage of the upward movement of the door by interruption of the light beams is not particularly important, but may be useful if a person or vehicle should by accident actually contact the door, and continued upward movement of the door might cause injury or damage.

It is to be noted that while apparatus for only three light beams is shown, a greater number could be used if desired, at greater or smaller elevations from the floor and distances from the door. Since it is desirable that a closing door shall be reversed by an approaching vehicle, and returned upwardly as soon as possible, and since the reversal does not occur until the interrupted light beam is re-established, it is desirable that the beams at a distance from the door be set to strike a portion of the car which is longitudinally short, whereby to interrupt the beam for the smallest possible interval. For this reason, a beam just above the floor, and positioned to strike a wheel of the vehicle, is effective. On the other hand, the beams at the plane of the door itself may be spaced over a considerable vertical distance, whereby to be interrupted by any obstruction whatsoever that may enter the door opening. Light beams could also be directed vertically, if desired.

The door may be stopped at any desired position manually, in case of an emergency, or of failure of the photo-electric equipment, or to establish ventilation, or for any other purpose, by opening master switch 90. The door will then remain in its existing position with all power off. Closing said switch will re-establish the main motor circuit, since limit switches 58 and 60 are closed, but will not close the "down" relay contact 104, and the door will consequently rise from such a rest position regardless of whether the door was rising or lowering when switch 90 was opened. This prevents accidental lowering of the door after such a stoppage. The door may be lowered from an intermediate rest position by holding push-button 96 closed while closing switch 90, but this is a conscious operation which will not occur accidentally.

While I have shown and described a specific embodiment of my invention, it will be apparent that many minor changes of structure and operation could be made without departing from the spirit of the invention as defined by the scope of the appended claims.

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What I claim as new and desire to protect by Letters Patent is:

1. A door operating apparatus comprising an electric motor operable to move said door; a power circuit for said motor including a pair of limit switches positioned to be mechanically opened by said door as said door approaches the respective opposite limits of its travel, and a plurality of relay contacts; a photocell associated with each of said relay contacts and operable when energized by light to close said contact; a lamp associated with each of said photocells and being positioned to direct a beam of light across an approach to said door at a substantial distance from said door to energize said photocell, said relay contacts being connected in series whereby if any one of said light beams is interrupted, said motor circuit will be broken; a power circuit for said photocells and said lamps including said limit switches but not said relay contacts; a reversing switch in said motor circuit and positioned normally to cause operation of said motor to open said door; electric switch operating means operable when energized to set said reversing switch to cause closing of said door; a conductor by-

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passing said limit switches and relay contacts; a normally open push-button switch in said by-pass conductor; a normally open relay contact in said by-pass conductor; a circuit including said push-button switch, switch operating means, and a normally open relay contact; and a circuit including said push-button switch and a relay winding, said relay winding being operable to close both of said last two named relay contacts.

2. A door operating apparatus as recited in claim 1 with the addition of another conductor by-passing said push-button switch and the first named relay contact in said first named by-pass conductor, and a second push-button switch in said last named by-pass conductor.

References Cited in the file of this patent

UNITED STATES PATENTS

1,822,152	Kinnard et al. -----	Sept. 8, 1931
1,972,682	FitzGerald -----	Sept. 4, 1934
2,419,459	McDowell et al. -----	Apr. 22, 1947
2,564,067	Karp -----	Aug. 14, 1951
2,737,621	Hamilton -----	Mar. 6, 1956