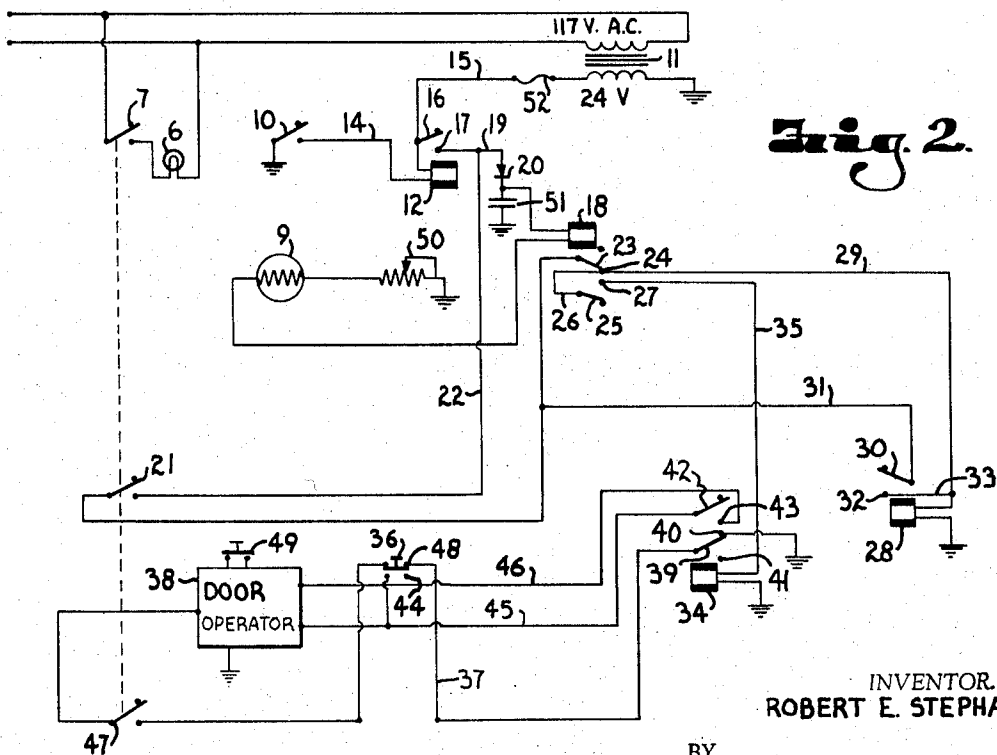
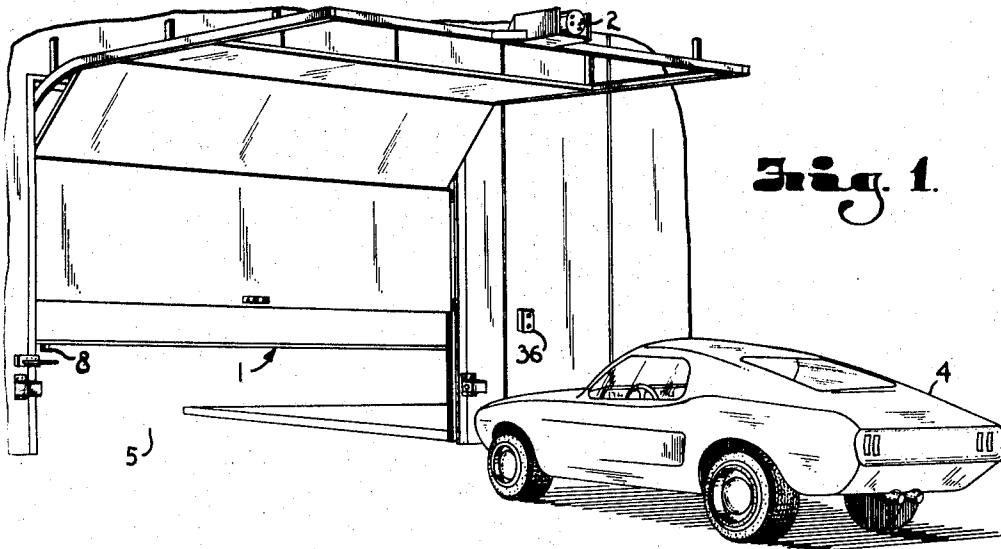


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PHOTOELECTRIC GARAGE DOOR CLOSER SERVING TO CLOSE DOOR  
ONLY AFTER LIGHT BEAM HAS BEEN  
BROKEN AND REESTABLISHED  
Filed Aug. 23, 1967



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1

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## PHOTOELECTRIC GARAGE DOOR CLOSER SERVING TO CLOSE DOOR ONLY AFTER LIGHT BEAM HAS BEEN BROKEN AND REESTABLISHED

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### ABSTRACT OF THE DISCLOSURE

A control circuit produces a signal to close and open power operated door, the signal being sent only upon interrupting and remaking a light beam. Interlocking relays control the sending of the signal. The circuit includes a first loop connected to a down actuator and a safety loop connected to an up actuator, whereby the door can only be closed when the first loop is completed and the safety loop is broken.

Heretofore power operated doors required manual operation of down push buttons to close an open door or a door returned to the open position after being halted in its downward travel by striking an object such as a vehicle or person entering the door opening. The present invention automatically closes the door after a vehicle or person passes through the opening and, further, automatically closes the door after being returned to the open position by a person or vehicle entering the door opening while the door was closing. The present control circuit operates in a stepping sequence preventing the door from closing until a light beam or other suitable presence indicating member has been broken and subsequently remade and yet remains active to halt and reverse the door if the beam is broken while the door is moving toward the closed position.

The present control circuit is particularly adapted for use in conjunction with conventional power operated controls for doors in enclosed automobile service areas, service stations, enclosed car washing installations and the like. Collectively the time spent in manually operating door push buttons in such installations amounts to a considerable number of man hours which could be devoted to more profitable activity.

The principal objects of the present invention are: to provide a control circuit for automatically closing a power operated door only after a vehicle or other object passes through a door opening; to provide such a circuit having a plurality of interlockable relays controlling a safety loop preventing the circuit from closing the door when the loop is unbroken; to provide a line connecting said circuit to a door actuator to stop and reverse travel of the door, and return the door to an open position when a vehicle or other object enters the door opening; to provide a light beam positioned to strike a light dependent element and integrated into a circuit whereby the circuit is completed only upon interrupting and remaking the light beam; to provide such a circuit adapted to operate on low voltage; and to provide such a circuit which is simple in operation, economical to manufacture, and easily installed.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

FIG. 1 is a perspective view of a power operated door

2

supplied with a control circuit embodying features of the present invention.

FIG. 2 is a schematic wiring diagram of the control circuit with the essential operating parts diagrammatically shown.

Referring more in detail to the drawings:

The reference numeral 1 generally designates a power operated door having a suitable motor 2 which is activated by conventional push button controls 3. In the illustrated structure the door 1 is a vertically opening overhead garage type door traveling in a suitable upwardly and horizontally curved track.

The door 1 is closed by a control circuit when an object such as a vehicle 4 passes through the door opening 5 thereby activating an object sensing device such as an electric eye system described below or a pressure plate switch (not shown). In the illustrated circuit a light source 6 is turned on by opening the door 1 and produces a high intensity light beam. A light source switch 7 is mounted adjacent the door 1 and engaged by a bar 8 mounted on the door 1 when the door 1 moves toward an open position. The light source switch 7 turns the light source 6 on upon opening and off upon closing the door 1. The light beam produced by the light source 6 strikes a suitable light dependent resistor 9, such as cadmium sulfide or the like.

A manually operated master on-off switch 10 brings power into the control circuit when closed. The power travels through a suitable reduction transformer 11 which reduces conventional electrical power to an operating voltage in the nature of 24 volts. The master on-off switch 10 is connected to the transformer 11 through a coil of a power source relay 12 by a first line 14 between the master switch 10 and the power source relay 12 and a second line 15 between the power source relay 12 and the transformer 11. A power source relay switch arm 16 is connected to the second line 15 and engages a contact 17 when the relay 12 is energized. The contact 17 is connected to a first control circuit relay 18 by a third line 19.

The first relay 18 is energized only when the light beam strikes the light dependent resistor 9 which is electrically connected to the coil of the first relay 18. A rectifier 20 is placed in the third line 19 to convert the alternating current received from the transformer 11 to direct current delivered to the first relay 18 thereby energizing the first relay 18 only while the light beam strikes the light dependent resistor 9.

A first circuit switch 21 permits current to enter the control circuit when closed. The first circuit switch 21 is placed in a switch line 22 between the third line 19 and a first relay first switch arm 23. The first circuit switch 21 is mounted adjacent the door 1 and above the light source switch 7 so that the bar 8 also closes the first circuit switch 21 upon moving from a closed position toward an open position.

The first relay first switch arm 23 engages a first relay switch arm contact 24 only when the first relay 18 is relaxed. The first relay is relaxed when the light source 6 is turned off and when the light beam is prevented from striking the light dependent resistor 9 as by the vehicle 4 or a person (not shown) passing through the door opening 5. A first relay second switch arm 25 is electrically connected to the first relay first switch arm contact 24 by a line 26. The first relay second switch arm 25 engages a first relay second switch arm contact 27 only when the first relay 18 is energized. The first relay is energized only when the first circuit switch 21 is closed and the light beam strikes the light dependent resistor 9.

A second relay 28 is energized by interrupting the light beam. A second relay first line 29 connects the first relay first switch arm contact 24 and the coil of the second relay

28: The second relay 28 is thereby interlocked with the first relay first switch arm contact 24 and the first relay second switch arm 25 by lines 29 and 26. A second relay switch arm 30 is connected to the switch line 22 by a second relay second line 31. The second relay switch arm 30 engages a second relay switch arm contact 32 only when the second relay 28 is energized. A second relay third line 33 connects the second relay switch arm contact 32 and the second relay first line 29.

A third relay 34 is energized only after the light beam is remade by again striking the light dependent resistor 9 after being once interrupted. A third relay first line 35 connects the first relay second switch arm contact 27 and a coil of the third relay 34. The remaking of the light beam again energizes the first relay 18 thereby completing a circuit including the switch line 22, the second relay second line 31, the second relay switch arm 30, and contact 32, the second relay third line 33, the second relay first line 29, the first relay line 26, the first relay second switch arm 25 and contact 27 and the third relay first line 35.

The circuit closed by the down push button 36 may also be closed by the third relay 34. This occurs only when a safety loop 37 connected to the conventional door operator 38 is broken. The safety loop 37 comprises the electrical portion conventional door operators which reverses the drive motor when the door hits an object in its path before closing. Thus, the door opens and remains open as long as the safety loop 37 is completed. A third relay first switch arm 39 completes the safety loop 37 when the third relay is relaxed by engaging a third relay first switch arm first contact 40. A third relay first switch arm second contact 41 is engaged by the third relay first switch arm 39 when the third relay 34 is energized, therefore breaking the safety loop 37 and permitting the door 1 to be closed.

A third relay second switch arm 42 engages a third relay second switch arm contact 43 only when the third relay 34 is energized. The third relay second switch arm 42 is connected to one of a normally open shorting set 44 in the down push button 36 and the door operator 38 by a third relay second line 45 and the third relay second switch arm contact 43 is connected to another of the shorting set 44 in the down push button 36 and the door operator 38 by a third relay third line 46. The safety loop 37 is broken when the third relay 34 is energized thereby permitting the door to be closed. The control circuit activates the down push button 36 only when the third relay 34 is energized, thereby signaling the door 1 to move toward the closed position.

A safety loop first switch 47 is positioned adjacent the first circuit switch 21 so as to be closed to complete the safety loop 37 upon opening the door 1 as previously described for closing the circuit switch 21. The safety loop 37 prevents the closing of the door 1 until the third relay is energized which occurs only after the light beam is interrupted and remade.

The safety loop 37 is connected through the down push button 36 to permit closing the door 1 manually in the event the vehicle 4 does not drive through the door opening 5 as may happen when one of a series of doors 1 is accidentally or mistakenly opened. The safety loop 37 is connected to a normally closed set of contacts 48 in the down push button 36 so that when the down push button 36 is manually operated the safety loop 37 is broken and the electrical connection to the door operator 38 is completed through the third relay second line 45 and the third relay third line 46.

In operation, the master switch 10 is closed thereby providing power to the first relay 18 then the door 1 may be opened by manually pressing an up button 49 associated with the conventional door operator 38. The opening of the door 1 closes the light source switch 7 thereby turning on the light source 6 and energizing the first relay 18. As the door 1 continues opening, the bar 8 closes the first circuit switch 21 and the safety loop first switch 47. The door 1

will now remain in the full open position until the light beam is interrupted and remade, or the down push button 36 is operated. Interrupting the light beam as by the vehicle 4 entering the door opening 5, relaxes the first relay 18 and locks in the second relay 28 but no circuit to the down push button 36 is complete until the third relay is energized. The vehicle 4 passing through the door opening 5 remakes the light beam and energizes the first relay 18 thereby energizing the third relay 34 through the third relay first time 35. Energizing the third relay 34 breaks the safety loop 37 and closes the circuit to the down push button 36.

In the event any object such as a person or vehicle interrupts the light beam while the door 1 is moving toward the closed position the first relay 18 and third relay 34 are relaxed thereby completing the safety loop 37 and breaking the connection to the down push button 36. The door 1 is stopped by completing the safety loop 37 and is ordered to the full open position by the connection of the safety loop 37 to the up button 49 through the door operator 38. After the object passes through the door opening 5, the door 1 is then closed as previously described upon remaking the light beam.

The first circuit switch 21 and the safety loop first switch 47 are opened as the door 1 closes. The light source switch 7 turns off the light source 6 after the switches 21 and 47 are opened. The master switch 10 may be turned off while the door is closed for operation by the up and down buttons 49 and 36 respectively and upon completion of one day's operation of the respective shop, service station, car wash or the like.

Additional features of the circuit include a potentiometer 50 in the connection between the light dependent resistor 9 and the coil of the first relay 18 to adjust the light dependent resistor 9 to conform with the level of background light. A filter condenser 51 is associated with the rectifier 20. A fuse 52 is placed in the power source relay second line 15 to protect the circuit from overloads and shorts. When the fuse 52 blows or the light source 6 fails or burns out, the safety loop 37 must be manually broken by operating the down push button 36 to close the door 1.

It is to be understood that while certain forms of this invention have been illustrated and described, it is not to be limited to the specific form or arrangement of parts herein described and shown except insofar as such limitations are included in the claims.

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

1. A control circuit for automatically controlling a power operated door upon an object passing through a door opening, said circuit being connected to a power source, said circuit including a door operator having a first actuator adapted to open said door and a second actuator adapted to close said door, said door operator having a safety loop associated with said second actuator and adapted to preventing said second actuator from operating to close said door when said loop is unbroken, said circuit comprising:

- (a) an object sensing device connected to said power source; said object sensing device being responsive to an object in said opening;
- (b) a first control means connected to said power source and to said object sensing device, said first control means being responsive to said sensing device whereby said first control means is respectively activated and deactivated upon the absence and presence of an object in said opening;
- (c) a second control means connected to said power source and to said first control means whereby said second control means is activated upon the deactivation of said first control means, said second control means being adapted to remain activated upon the subsequent activation of said first control means,
- (d) a third control means connected to said door operator whereby upon actuation thereof said safety

5

loop is broken and said second actuator is actuated to close said door, said third control means being adapted for actuation upon the sequential deactivation of said first control means, whereby said door is closed only upon the object passing through said opening.

2. The control circuit as set forth in claim 1 wherein said object sensing device includes:

- (a) a light source connected to said power source, said light source being switch activated; said light source forming a light beam extending across said opening;
- (b) a light dependent element positioned to receive the light beam from said light source; and
- (c) means adjusting said light dependent element corresponding to level of background light, whereby interrupting said light beam indicates an object in said door opening.

3. The control circuit as set forth in claim 1 wherein said first control means comprises:

- (a) a first relay, said first relay having a coil electrically connected to said power source, said connection being broken by said object sensing device sensing an object in said door opening, said first relay having a first switch arm and contact engaged thereby only when said first relay coil is relaxed, said first relay having a second switch arm and contact engaged thereby only when said first relay coil is energized, said first relay first switch arm being electrically connected to said power source, and said first relay second switch arm being electrically connected to said first relay first switch arm contact.

4. The control circuit as set forth in claim 3 wherein said second control means comprises:

- (a) a second relay, said second relay having a coil electrically connected to said first relay first switch arm contact, said second relay having a switch arm and contact engaged thereby only when said second relay is energized, said second relay switch arm being electrically connected to the power source, and said second relay switch arm contact being electrically connected to said first relay first switch arm contact.

5. The control circuit as set forth in claim 4 wherein said third control means comprises:

- (a) a third relay, said third relay having a coil electrically connected to said first relay second switch arm contact, said third relay having a third relay first switch arm and contact engaged thereby only when said third relay first switch arm is relaxed, said third relay having a third relay second switch arm and contact engaged thereby only when said third relay is energized, said third relay first switch arm and contact being electrically connected to said safety loop, and said third relay second switch arm and contact being electrically connected to said second actuator.

6. The control circuit as set forth in claim 4 wherein said second relay includes:

- (a) a second relay first line electrically connecting said second relay coil and said first relay first switch arm contact,
- (b) a second relay second line electrically connecting said second relay switch arm and said power source,

6

- (c) a second relay third line electrically connecting said second relay switch arm contact and said second relay first line, whereby said second relay is energized and said first relay is relaxed upon said light beam being interrupted, said second relay being interlocked with said first relay.

7. The control circuit as set forth in claim 5 wherein said third relay includes a third relay first line electrically connecting said third relay coil and said first relay second switch arm contact whereby said third relay is energized only upon energizing said first relay after said second relay is energized and interlocked with said first relay.

8. The control circuit as set forth in claim 7 wherein said third relay includes:

- (a) a third relay second line electrically connecting said second actuator and said third relay second switch arm,
- (b) a third relay third line electrically connecting said second actuator and said third relay second switch arm contact, whereby said safety loop is broken thereby permitting said door to move toward said closed position and said third relay second line and said third relay third line complete the connection to said second actuator thereby signaling said door to move toward said closed position upon said third relay being energized.

9. The control circuit as set forth in claim 1 wherein said power source includes:

- (a) a master control circuit on-off switch; and
- (b) a power source relay, said power source relay having a coil connected to said master on-off switch by a power source relay first line, said power source relay coil being connected to said power source by a power source relay second line, said power source relay having a switch arm and contact engaged thereby only when said power source relay is energized, said power source relay switch arm being connected to said power source relay second line, said power source relay having a third line connected between said first control means and the power source relay switch arm contact whereby current flows through said third control means to said second actuator only upon an object having passed through said opening.

10. The control circuit as set forth in claim 1 wherein said power source includes:

- (a) a master control circuit on-off switch; and
- (b) a circuit control switch, said circuit control switch being in a line between said power source and said first control means, said circuit control switch being mounted adjacent said door and engageable therewith whereupon said circuit control switch is closed when said door moves toward said open position, whereby current flows through said third control means to said second actuator only upon an object having passed through said opening.

No references cited.

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