

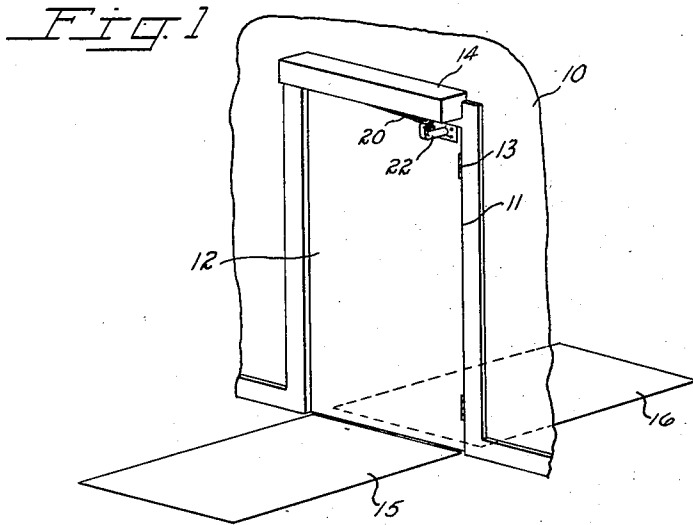
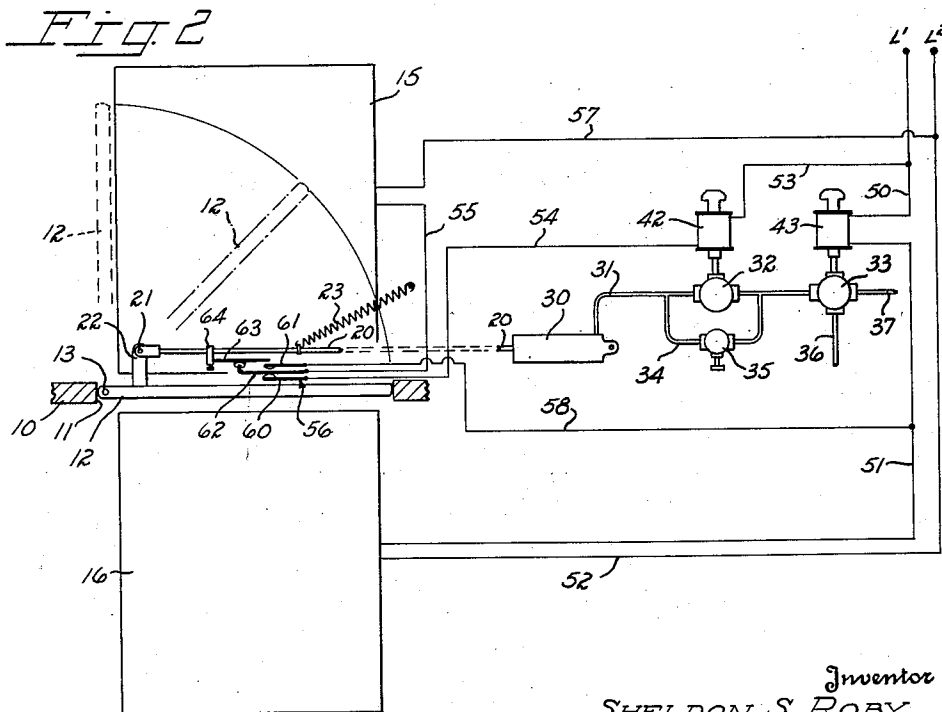
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CONTROL MEANS FOR AUTOMATICALLY OPERATED DOORS

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CONTROL MEANS FOR AUTOMATICALLY OPERATED DOORS

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The present invention relates generally to automatically operated doors and more particularly to a novel door actuating mechanism and including the control means therefor which provides features of safety and convenience which are desirable in installations of automatically operated doors.

It is a principal aim of the invention to provide a door actuating mechanism and control therefor which will eliminate the danger of injury to persons carelessly or otherwise positioned in the path of the door. The benefits of such an arrangement are particularly advantageous for store installations and the like, where customers and children frequently congregate near the door opening and may be seriously injured by the opening movement of the door if they are not aware of the danger of their position. At the same time it is an aim of the invention to avoid having the door rendered inoperative merely because a person or object is in the path of the door, particularly where the person or object can move or be moved without inconvenience.

A further object of the invention is to provide a mechanism or arrangement of the type referred to above, which greatly enhances the usefulness of an automatic door installation from a safety standpoint but which at the same time will not interfere with the normal functioning of the door and will permit the door to operate in the usual manner including operation at a desired rapid speed, except only in the particular case, i. e. when the situation arises, rendering the safety feature necessary.

A further object of the invention is to provide a door operating and control mechanism having the advantages referred to above which, in addition to its greater usefulness and desirability, is yet of simple construction so that it may be fabricated and assembled from readily available materials and parts with a minimum of difficulty and expense and at the same time will function satisfactorily over long periods of time and be fool-proof in operation.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the drawings:

Fig. 1 is a fragmentary perspective view showing an automatically operated door installation embodying the present invention; and

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Fig. 2 is an enlarged diagrammatic view showing the electrical and power connections.

Referring to the drawings, there is shown in Fig. 1 a wall 10, having a conventional door opening 11 which is normally closed by a swinging door 12, hinged as at 13. The mechanism for opening and closing the door, as described more particularly hereinafter, is contained in the housing 14, disposed horizontally in the top of the door opening. The control means for the door actuating mechanism includes two mat switches 15 and 16, disposed on the floor and extending outwardly from opposite sides of the door opening. The arrangement is such that a person wishing to pass through the door opening will first step on the mat 16, which will cause the door to open, and will proceed through the doorway, stepping on mat 15 which retains the door in open position until the person passes beyond the periphery of the latter mat.

The details of construction of the mats 15 and 16 have been omitted for simplicity of presentation, inasmuch as such mat switches are well known and familiar to those skilled in the art. In general, they consist of contactor members (not shown) for establishing a current path through the leads provided thereto.

Referring more particularly to Fig. 2 of the drawings, the mechanism illustrated for opening the door comprises a piston rod 20, which is pivotally connected at 21 to an arm 22, which extends outwardly from the door 12 adjacent the hinge 13. As will be apparent, when the piston rod 20 is moved longitudinally in a lefthand direction, as viewed in Fig. 2, the door 12 will be pivoted in an opening direction. Closing or reverse movement is imparted to the door by a coil spring 23, which is anchored at one end in any convenient manner and is secured at the other end to the piston rod 20.

The piston rod 20 is actuated by a piston (not shown) in the power cylinder 30. The details of construction of the power cylinder 30 are not shown inasmuch as this is also a well-known device. The operation of the power cylinder 30 is such that, when fluid under pressure is admitted through the inlet conduit 31, the piston rod 20 is forced outwardly and then, when the fluid pressure is relieved, the piston rod 20 is permitted to return under the influence of spring 23.

The inlet conduit 31 going to power cylinder 30 is connected to a source of fluid under pressure (not shown) through a two-way valve 32 and a three-way valve 33. Extending around the two-way valve 32 is a bypass 34 containing an adjustable bleeder valve 35.

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As noted, the three-way valve 33 has two connecting conduits 36 and 37, one of which is connected to the source of fluid under pressure and the other of which exhausts to atmosphere. The operation of the valve 33 is to exhaust the conduit 31 to atmosphere when the valve is in one position, and to connect the conduit 31 to the source of fluid under pressure when the valve is in its second position, the second position being referred to hereinafter as the "on" position. The valve is biased into the first position described, i. e. the position which connects the conduit 31 to exhaust and permits the door to close under the influence of spring 23.

The valve 32 is normally biased into opened position so that there is provided a relatively free pathway between the conduit 31 and the three-way valve 33. However, when the valve 32 is closed, the flow path must occur through the bypass 34 and adjustable bleeder valve 35. Bleeder valve 35 may be adjusted for any desired rate of flow.

The valves 32 and 33 are adapted to be actuated respectively by solenoids 42 and 43. When the solenoid 42 is energized, it operates to close the valve 32. When the solenoid 43 is energized, it operates to move valve 33 to the position connecting the power cylinder 30 to the source of fluid under pressure.

The lines L₁ and L₂ represent any convenient source of electrical power, such as the ordinary household lighting circuit, if desired. One terminal of solenoid 43 is connected by lead 50 to line L₁, while the other terminal of solenoid 43 is connected by lead 51 to the mat switch 16 which, in turn, is connected by lead 52 to the line L₂. Accordingly, when the mat switch 16 is closed, such as by a person stepping on the mat 16, the solenoid 43 is connected across lines L₁ and L₂, causing the valve 33 to move to the "on" position, thereby opening the door.

One terminal of solenoid 42 is connected similarly by lead 53 to line L₁, while the other terminal is connected by leads 54 and 55 through a switch 56 to the mat switch 15. Mat switch 15 is connected by lead 57 to power line L₂. The switch 56 comprises two stationary contact arms 60 and 61 and an intermediate movable contactor arm 62. The movable contactor arm 62 is biased so as to be in contact with the arm 61 and separated from the arm 60 when the door is open. However, means is provided to move the arm 62 into contact with arm 60 and to separate it from the contactor arm 61 when the door is closed and also during a predetermined portion of the initial opening movement of the door. For purposes of illustration, this predetermined portion of the initial opening movement of the door is represented in the drawing as the movement of the door through 45 degrees to the position shown in dash-and-dot lines. The means referred to includes a rod 63 adjustably supported in a clamp 64, which is mounted on the piston rod 20. The rod 63 is so disposed relative to the switch 56 as to engage contactor arm 62 and shift the same into contact with arm 60 at any time the door is closed, as shown in Fig. 2, or within 45 degrees of closed position. When the door is opened more than 45 degrees rod 63 will be disengaged from contactor arm 62 to permit said arm to assume its biased position in switch 56, i. e., in contact with arm 61. By adjustment of the clamp 64 and rod 63, as will be readily apparent, the switch 56 may be actuated at any desired degree of opening of the door.

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The leads 54 and 55, previously mentioned, are connected to the switch arms 60 and 62, respectively. Accordingly, if the door is closed, or in any position between closed position and the predetermined position shown, for example, by dash-and-dot lines, the solenoid 42 will be energized if any person or object is positioned on the mat switch 15. As previously mentioned, the energizing of solenoid 42 closes the valve 32, which greatly reduces the flow of fluid under pressure to the power cylinder 30. Accordingly, when this condition exists, the door will open only at a slow rate of speed. This rate of speed may be adjusted by regulating the bleeder valve 35 and generally will be such that no injury will result to any person or object standing in the path of the door, and yet force will be applied by the door which generally will be sufficient to move the person or object out of the path of the door, thereby permitting the door to open to the full extent.

It will be noted that switch arm 61 is connected by leads 58 and 51 to the solenoid 43. Accordingly, when the door has opened sufficiently to close the switch 56 through arms 61 and 62, the solenoid 43 will be under the control of both the floor switches 15 and 16 which are now connected in parallel, the mat 15 being no longer connected for energizing solenoid 42. In the normal operation of a door, a person entering through the doorway will step from the mat 16 to the mat 15 at a time when the door has already reached the dash-and-dot line position. Accordingly, the door will usually open at its rated speed in one continuous movement to the full open position shown in dash line, due to the continued actuation of the solenoid 43. In the unlikely event that a person should step from mat 16 to mat 15 before the door has reached the dash-and-dot position, the door opening movement will be retarded only until the door reaches the dash-and-dot position, following which the door will again open at its normal rate of speed to the full open position shown in dash lines.

When the arrangement shown in the drawings and as above described, it has been found that an automatically operated door may be installed in many locations where the use of automatically operated doors has been avoided heretofore because of the risk of injury. As previously described, the presence of any person or object on the mat 15 when the operation of the door is initiated by someone stepping on mat 16 will immediately prevent the door from opening at a rapid rate of speed. However, the door will open at a reduced rate of speed and, by moving against the obstruction in a safe manner and at a safe rate of speed, will cause the obstruction to move, or be moved, out of obstructing position, whereupon the door will operate in the usual manner. In the event that no person or object is positioned on the mat 16, the door functions in exactly the manner as though the safety feature were not present.

As previously mentioned, the amount of opening movement of the door necessary to trip the switch 56 can be readily regulated, as can be the retarded speed of the door. As a result, the operation of the door can be modified to meet the exact requirements of any particular installation. Furthermore, because of the safety feature provided by the arrangement described above, it is possible, if desired, to operate the door at a greater rate of speed than that which would normally be used if the danger of injury were present. It will be noted that, inasmuch as the safety

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feature is effective when a person is positioned anywhere on the mat 15 and not only when positioned directly in the path of opening movement of the door, an additional margin of safety is provided which is important in the event that anyone is moving in the direction of the door at the same time that a person is approaching the mat 16.

The arrangement is of simple construction and economical to fabricate and assemble, and provides a foolproof and dependable operation at low cost under all conditions of use without the need for frequent repair or replacement, and, in general, has all the advantages of a conventional arrangement of the type not possessing the safety features of the present invention.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim as my invention:

1. Control means for a door having a fluid operated door actuator comprising means including a first valve for admitting fluid under pressure to the door actuator, means including a second valve for retarding the flow of fluid to the door actuator, first and second electrical means for actuating the first and second valve, respectively, first switch means actuatable at one side of the door, second switch means actuatable at the opposite side of the door, means for energizing the first electrical means including a first electrical circuit going through the first switch means, means including a second electrical circuit for energizing the second electrical means, and a two-way switch responsive to position of the door connected to the said electrical circuits and to the second switch means for connecting the second switch means in the second electrical circuit when the door is closed and for connecting the second switch means in parallel with first switch means when the door has been opened a predetermined amount.

2. Control means for a door having a fluid operated door actuator comprising means for admitting fluid under pressure to the door actuator and including a pair of valves in series, first and second electrically operated means for actuating the valves, respectively, first switch means actuatable at one side of the door, second switch means actuatable at the opposite side of the door, means for energizing the first electrically operated means including a first electrical circuit containing said first switch means, a two-way switch responsive to position of the door connected to the first electrical circuit and the second switch means for placing the second switch means in parallel with the first switch means when the door has been opened a predetermined amount, and a second electrical circuit for energizing the second electrically operated means, said second electrical circuit being connectible by said two-way switch to the second switch means when the door is closed.

3. Control means for a door having a fluid operated door actuator comprising means including

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a first valve for admitting fluid under pressure to the door actuator, means including a second valve for retarding the flow of fluid to the door actuator, first and second electrical means for actuating the first and second valve, respectively, first switch means actuatable at one side of the door, second switch means actuatable at the opposite side of the door, said first and second switch means being connected at one terminal to a power line, a switch having two fixed contacts and a movable contact movable selectively into contact with the fixed contacts responsive to position of the door, said movable contact being connected to the second switch means, electrically operated means for actuating the first valve connected at one terminal to a second power line and at its second terminal to the first switch means and to one of said fixed contacts, and electrically operated means for actuating the second valve connected at one terminal to said second power line and at its second terminal to the other of said fixed contacts.

4. Control means for a door having a fluid operated door actuator comprising means for controlling the flow of fluid to the door actuator including a conduit to the actuator, a three-way valve normally connecting the conduit to exhaust and movable to a second position for connecting the conduit to a source of fluid under pressure, a normally open two-way valve for terminating the flow of fluid and a restricted by-pass around the two-way valve, first electrically operated means operable when energized to position the three-way valve in said second position, second electrically operated means operable when energized to hold the two-way valve in closed position, first switch means actuatable at one side of the door, second switch means actuatable at the opposite side of the door, a two-way switch mounted for operation by the door, means for energizing the first electrically operated means comprising a first circuit including the first switch means, additional means operable for energizing the first electrically operated means when the door has been opened a predetermined amount comprising a second circuit including the two-way switch and the second switch means, and means operable for energizing the second electrically operated means when the door is not opened said predetermined amount comprising a third circuit including the two-way switch and the second switch means.

5. Control means for an automatically operated door comprising a door actuator connected to the door for actuating said door from a closed to open position, means including a first electrical circuit for controlling said actuator to cause said door to be moved by said actuator toward open position, a first switch disposed at one side of the door in serial relation with said first circuit for opening and closing same, means including a second electrical circuit for causing said actuator to move said door at a reduced speed, a second switch disposed at the opposite side of the door, a selector switch responsive to the position of the door connected to the said electrical circuits and to the second switch for connecting said second switch in said second electrical circuit to cause said door to be moved at said reduced speed when both said first and second switches are closed, and for disconnecting said second switch from said second circuit and, instead, connecting said second switch in parallel with the first switch after the door has opened a predetermined amount to thereby cause said door to be moved at its normal speed when

either of said first and second switches remain closed.

6. Control means for an automatically operated door comprising a door actuator connected to the door for actuating said door from a closed to open position, means including a first electrical circuit for controlling said actuator to cause said door to be moved by said actuator toward open position, a first switch disposed at one side of the door in serial relation with said first circuit for opening and closing same, means including a second electrical circuit for causing said actuator to move said door at a reduced speed, a second switch disposed at the opposite side of the door, a selector switch connected to said circuits and said second switch having a first position for connecting the second switch in said second electrical circuit to thereby cause said door to be moved at said reduced speed when both said first and second switches are closed and having a second position for disconnecting said second switch from said second circuit and, instead, connecting said second switch in parallel with the first switch after the door has opened a predetermined amount to thereby cause said door to be moved at its normal speed when either of said first and second switches remain closed.

7. Control means for an automatically operated door comprising first a switch actuatable at one side of the door, a second switch actuatable at the opposite side of the door, a door actuator connected to the door for actuating said door from a closed to open position, first control means for said actuator, means for energizing said first control means including a first electrical circuit through said first switch, second control means for retarding opening movement of the door, means for energizing the second control means including a second electrical circuit, and a two-way selector switch responsive to the position of the door con-

nected to the second switch and the first and second electrical circuits arranged to connect the second switch in the second electrical circuit when the door is closed, and to disconnect said second switch from said second circuit and, instead, connect said second switch in parallel with the first switch in the first electrical circuit when the door has been opened a predetermined amount.

8. Control means for an automatically operated door comprising a first switch of the floor mat type for disposition at one side of the door, a second switch of the floor mat type for disposition at the opposite side of the door, a door actuator connected to the door for actuating said door from a closed to open position, first control means for said actuator, second control means for retarding said actuator, means for energizing said first control means including a normally open first circuit containing the first and second switches in parallel, means for energizing the retarding means including a normally open second circuit, and a selector switch connected to the first and second circuits and to the second switch, said selector switch being operated by the door for disconnecting the second switch from the first circuit and connecting it to the second circuit except when the door has been opened a predetermined amount.

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