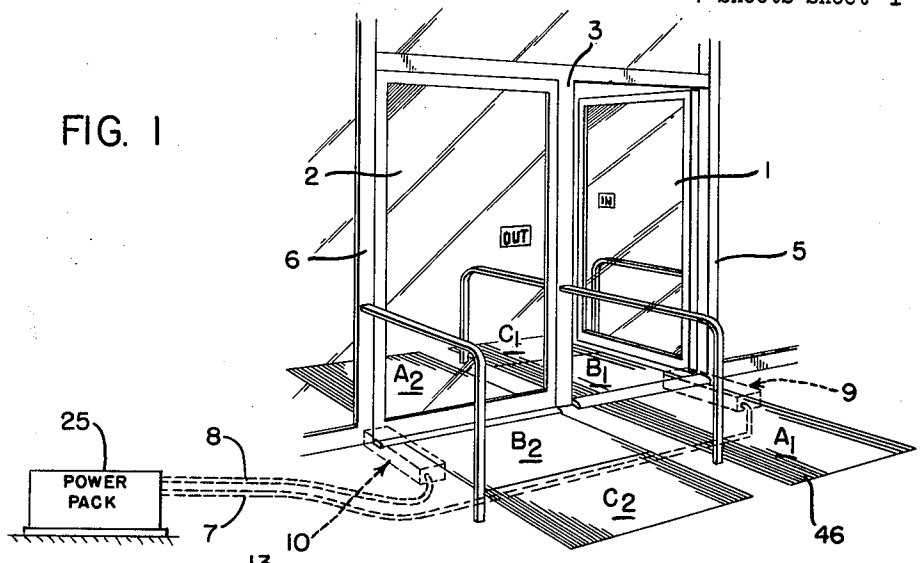
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AUTOMATIC DOOR OPERATOR

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FIG. 1



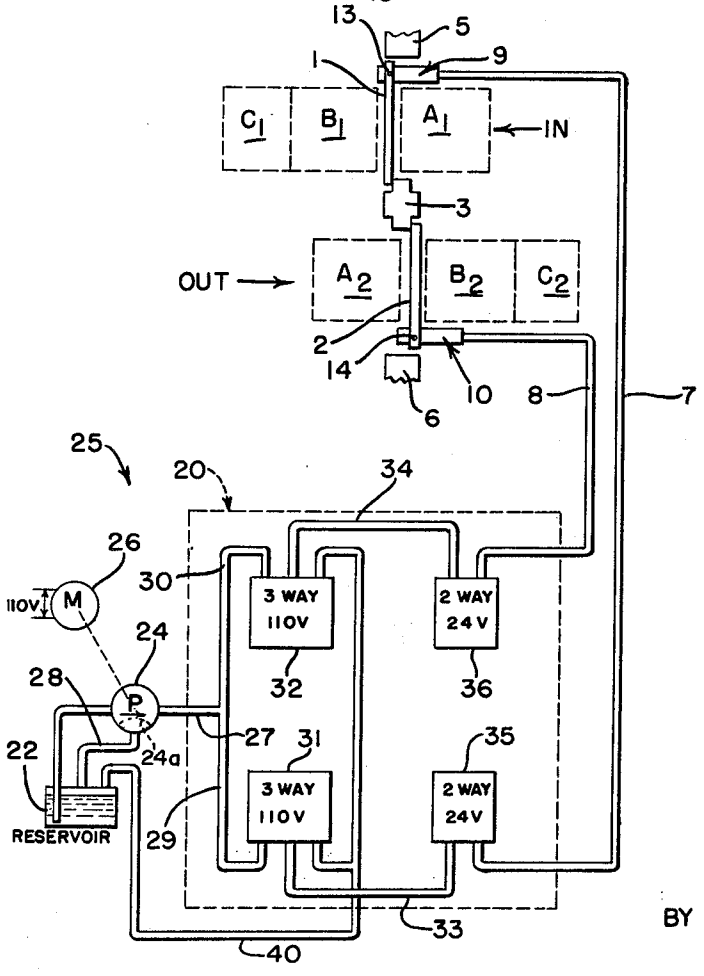


FIG. 2

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AUTOMATIC DOOR OPERATOR

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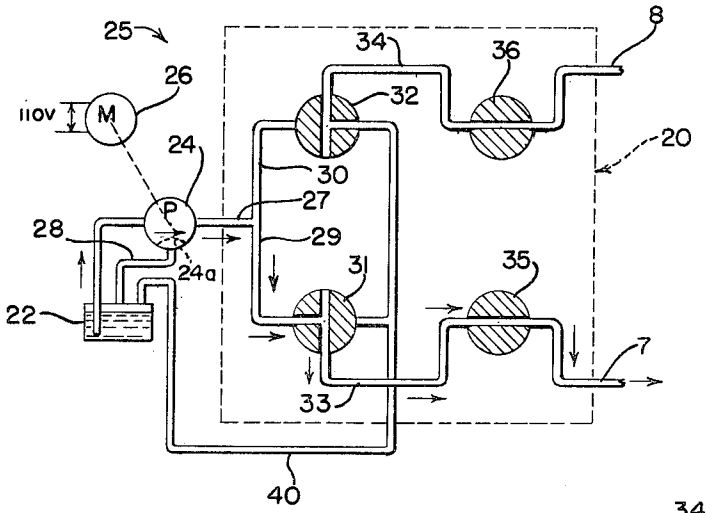


FIG. 3

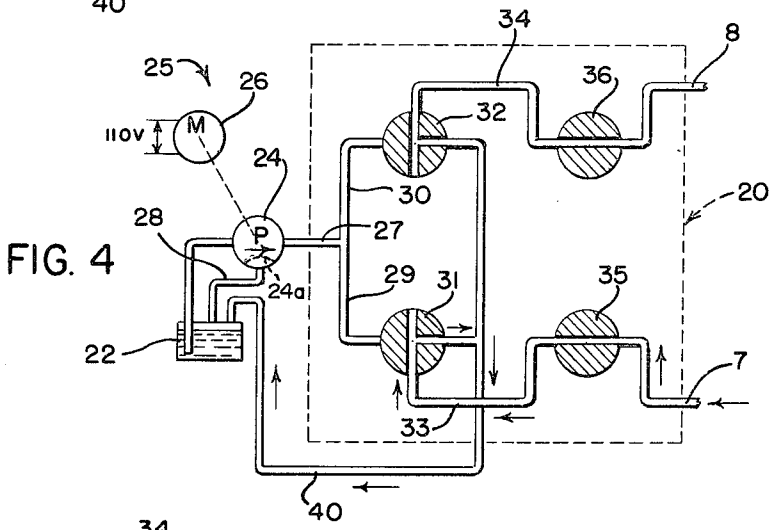


FIG. 4

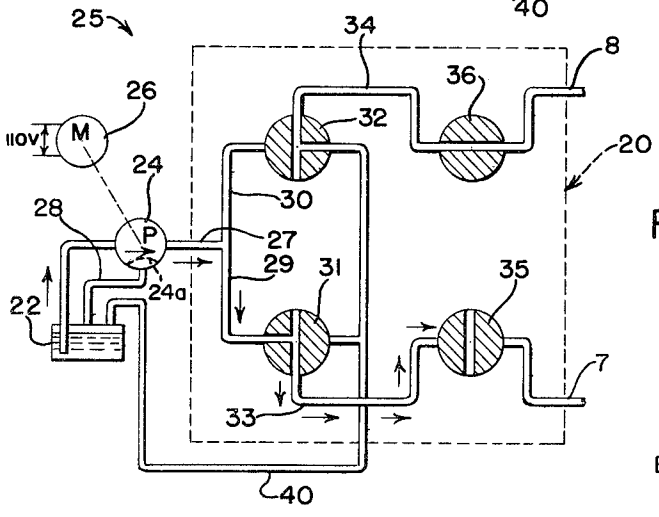


FIG. 5

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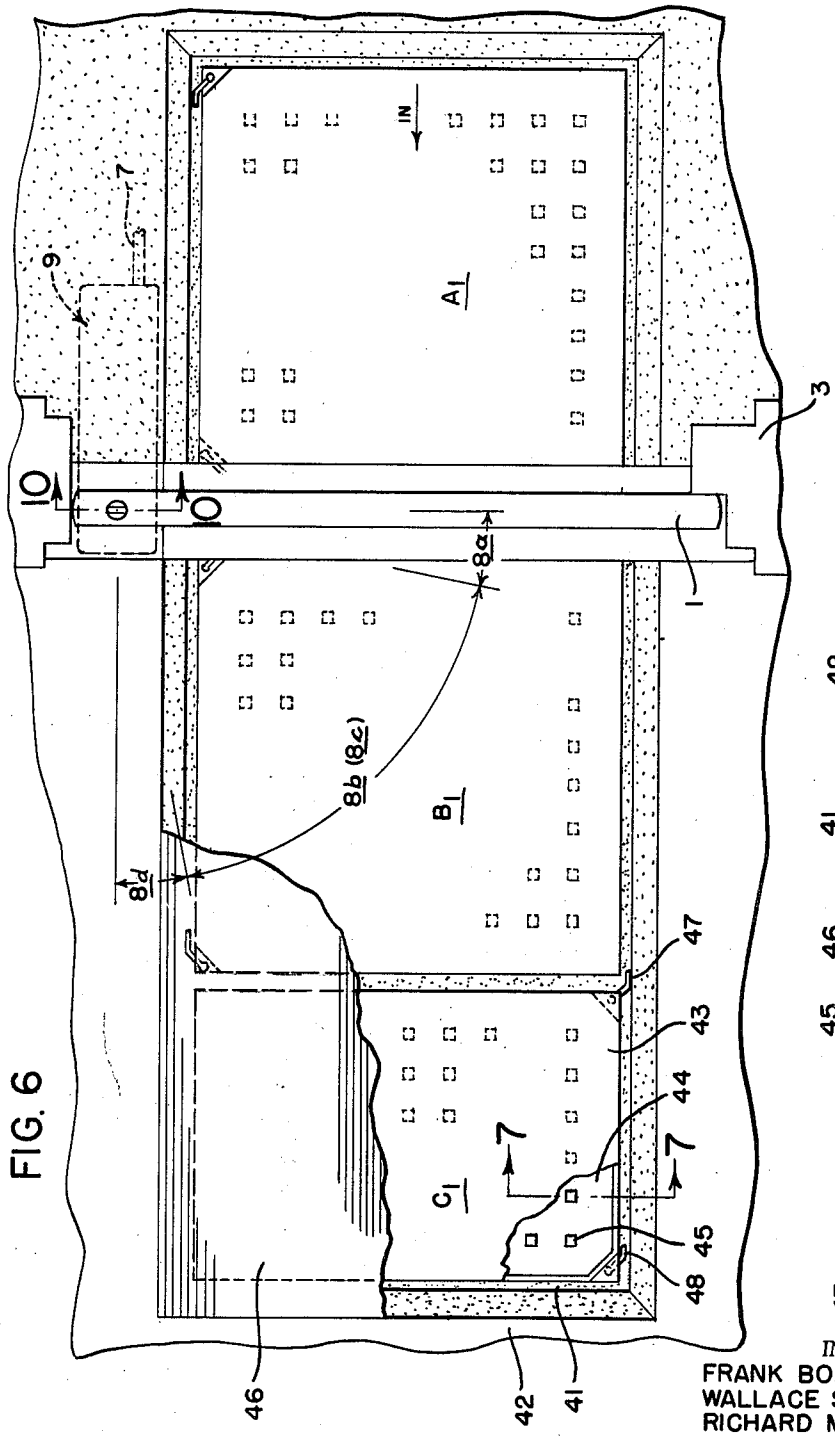


FIG. 6

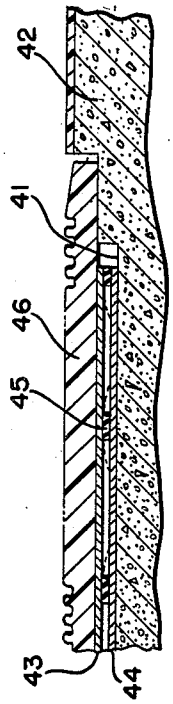


FIG. 7

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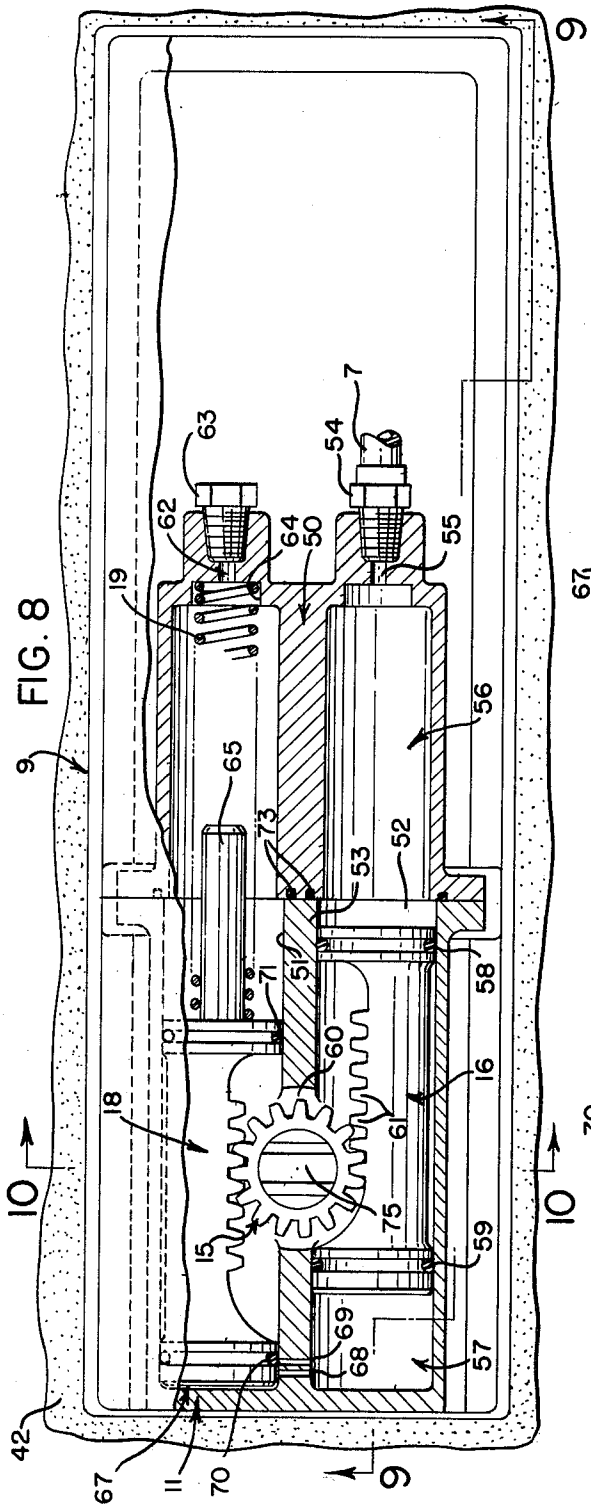


FIG. 8

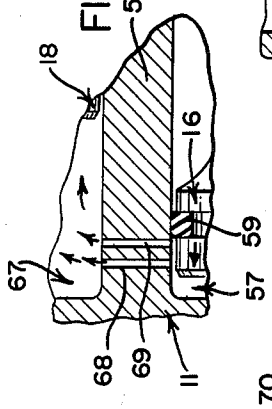


FIG. 8c

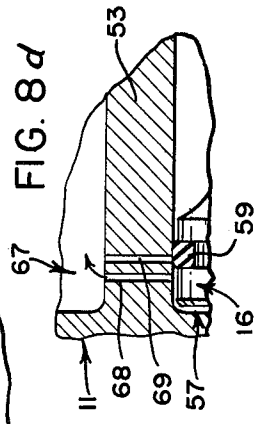


FIG. 8d

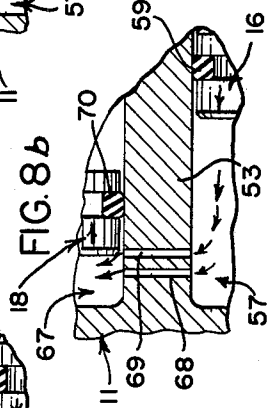


FIG. 8b

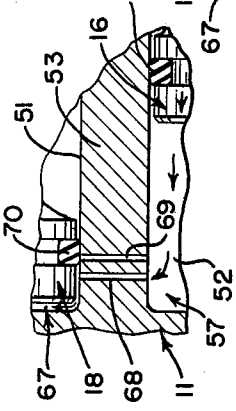


FIG. 8a

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AUTOMATIC DOOR OPERATOR

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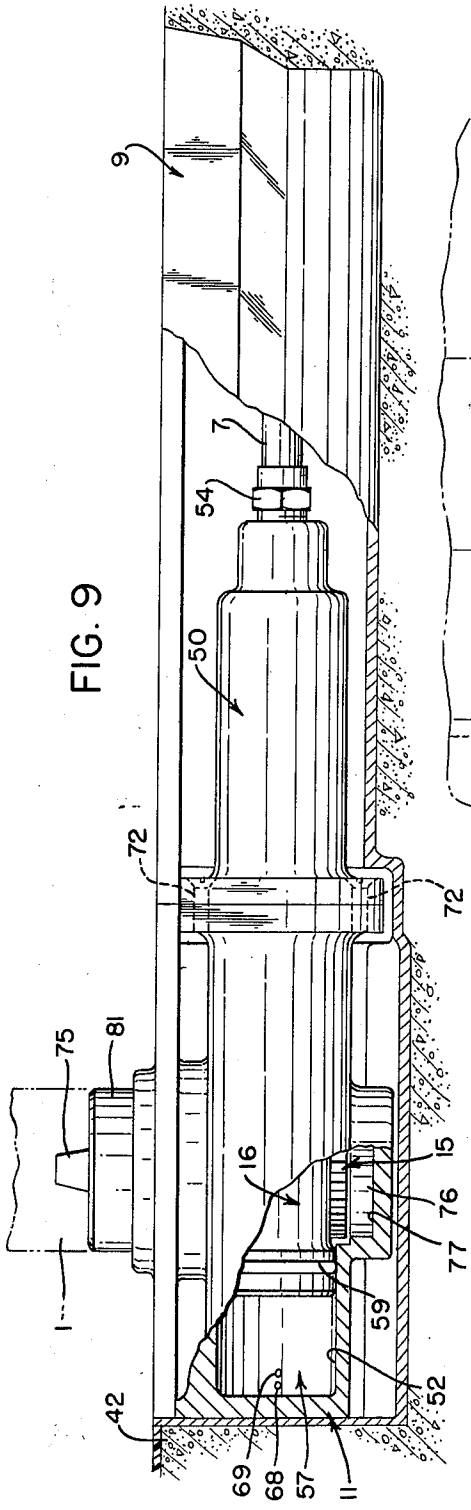


FIG. 9

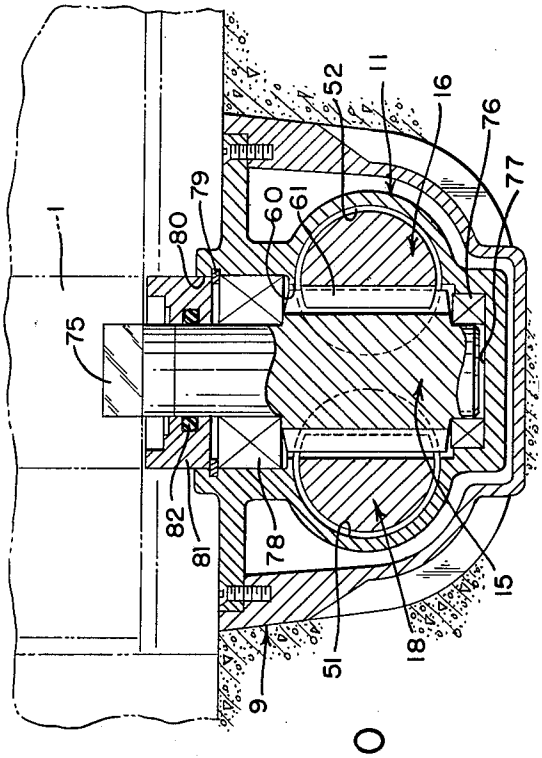


FIG. 10

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AUTOMATIC DOOR OPERATOR

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FIG. 11

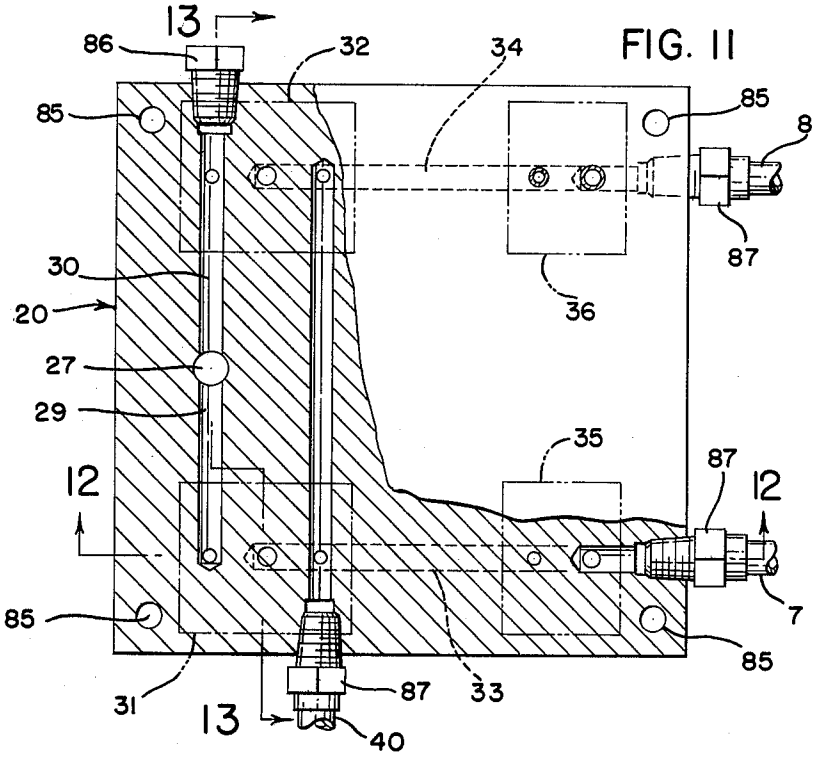


FIG. 12

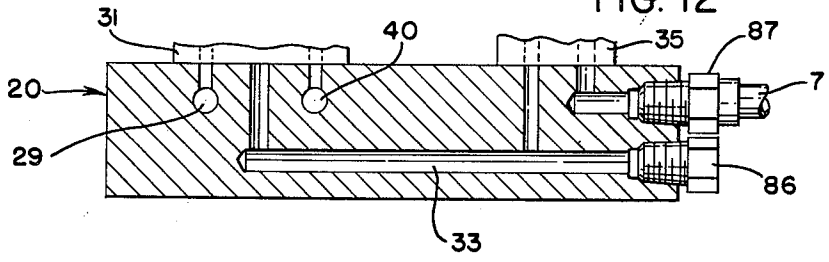
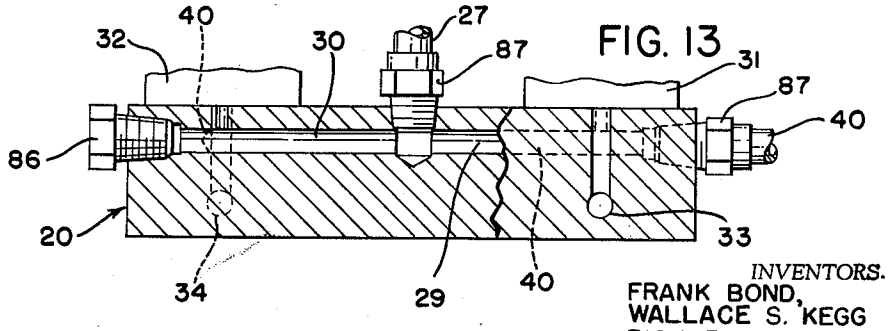


FIG. 13



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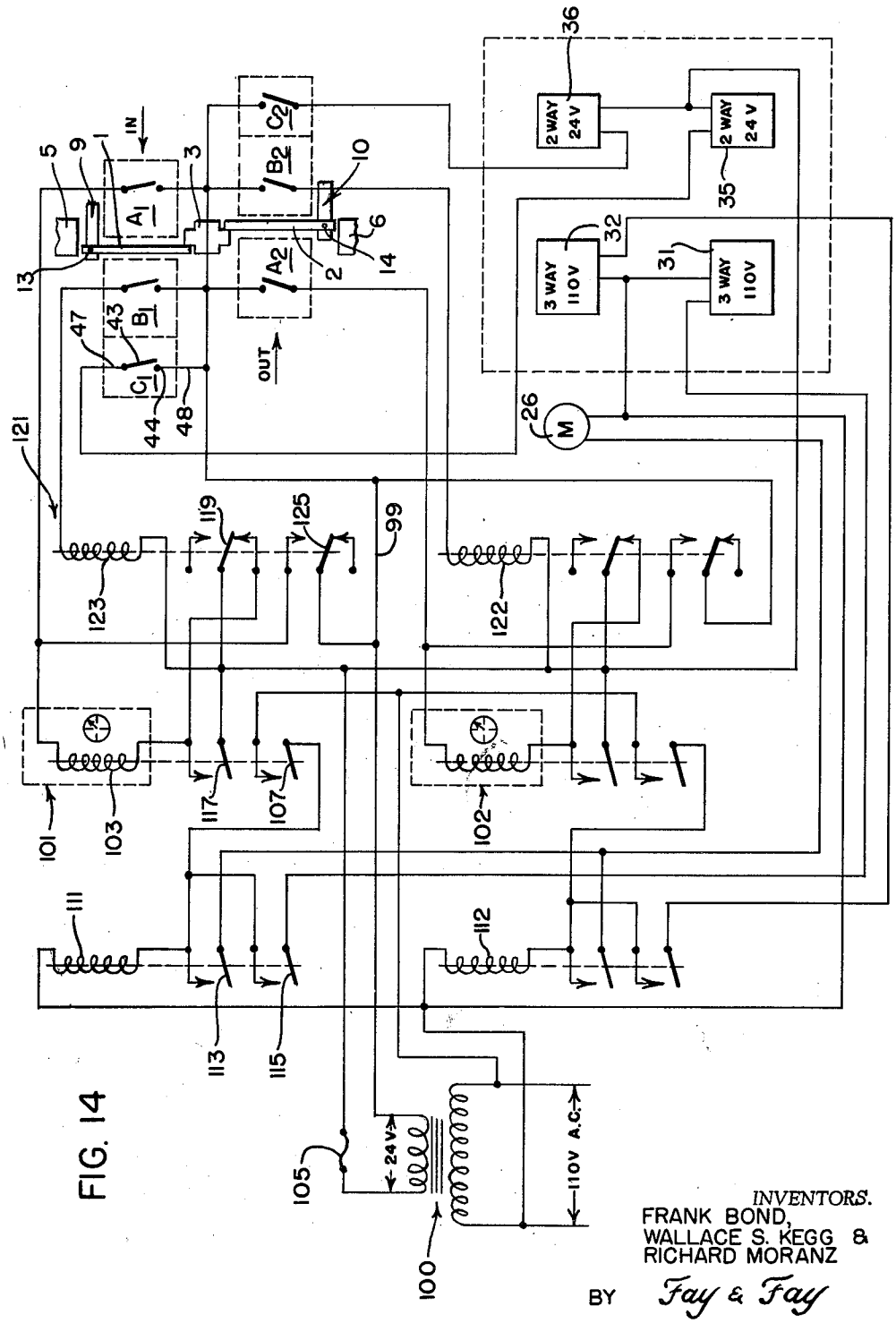


FIG. 14

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United States Patent Office 3,195,879 Patented July 20, 1965

3,195,879

AUTOMATIC DOOR OPERATOR

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Filed Apr. 25, 1962, Ser. No. 190,167
7 Claims. (Cl. 268—33)

This invention relates to an improved automatic door operator for opening heavy doors, particularly for public and semi-public buildings, including supermarkets and the like. These automatic door operators provide simplified, electrically actuated, hydromechanical mechanisms of extremely versatile design having important safety features not heretofore incorporated in such door combinations. More specifically, the safety system includes a novel three-segment mat arrangement for actuating the door operator and sensing the presence of a person in the path of the opening or closing door. The automatic door operator includes a simplified, single flow hydraulic system having an electrically controlled manifold of novel design which cooperates with the protective segmented mat to permit the desired door operations to be performed accurately at the proper time in a manner which assures the safety of pedestrians in the area of the doors. The simple hydraulic drive system cooperates with a mechanical return element and a rack and pinion drive mechanism located remote from the hydraulic fluid, thereby to open and close the door effectively and prevent leakages in the hydraulic mechanism through long usage and wear. The pinion drives the door directly and thereby eliminates complicated yoke and linkage mechanisms and permits use of the door operator mechanism on either right or left hand opening doors with a simple reversal of parts.

The automatic door operator of the present invention is adapted particularly for mounting at right angles to, or parallel to, a door to be actuated. The combination for rotation of a particular door includes generally a ground box enclosure for a cylinder block containing actuating pistons for driving the rack and door mounted pinion arrangement to door-open position by means of a single hydraulic line to the cylinder block and a return spring normally urging the door and rack and pinion arrangement to door-closed position. The hydraulic line is connected to a remotely mounted power pack or combination electrical control system and solenoid valve manifold and is supplied with fluid pressure by means of an intermittently operated pump in combination with a reservoir. The electrical system is connected for selective and timed actuation of the pump and solenoid valves by means of the segmented mat being stepped on by pedestrians entering or exiting the doorway.

The entire mechanism is provided for easy maintenance and can be repaired or adjusted easily without disturbing the system or damaging any of the surrounding building structure. The hydraulic system of the door actuating mechanism is provided with an efficient means for dampening the shock at the beginning and end of the door opening or closing cycle by providing a reduced speed of operation of the door at these cycle extremes.

The prior art door operators generally have been combinations of complicated and expensive apparatus which have not been capable of adequate safety provisions for the protection of people in the vicinity of the doors. These devices, therefore, have presented hazards to those in the path of the opening and closing doors and have resulted in some cases in injured and displeased patrons in the stores or public buildings in which they have been installed. The use of these complicated door operators of the prior art has, of course, resulted in high installation and maintenance costs which are in part traceable to the complicated hydraulic and mechanical systems utilized therein. Furthermore, these prior art door operators have been subject to high maintenance costs resulting from breakdowns caused by shock at the beginning and end of the opening and closing cycles of the door.

With the problems of the prior art devices in mind, it is an object of this invention to provide an automatic door operator which is of extremely simple and versatile design and which insures the safety of those around it.

It is a further object of this invention to provide a door operator mechanism which is extremely simple to maintain and adjust and which is inexpensive to manufacture and easy to install.

It is a further object of this invention to provide an improved automatic door operator which includes a simplified one-line hydraulic system and an easily accessible mechanical system remote therefrom.

It is a further object of this invention to provide an automatic door operator which insures minimum shock transfer to its elements at the beginning and end of the door opening and closing cycles.

It is a further object of this invention to provide a door operator mechanism which is actuated by means of a three-part mat and an electrical control circuit to provide complete safety for persons in the area of the doors.

It is a further object of this invention to provide an extremely simple door operator mechanism which will stop the door automatically should anyone accidentally get into its path when it is opening or closing.

Other and more specific objects of the invention will be apparent from the description to follow.

FIG. 1 is a largely schematic perspective view of a typical automatic door installation equipped with the automatic door operator of this invention.

FIG. 2 is a schematic plan view of the automatic door operators and doors illustrated in FIG. 1.

FIG. 3 is a schematic view of the hydraulic system during opening of the door.

FIG. 4 is a schematic view of the automatic door operating system when the door is closing.

FIG. 5 is a schematic view of the automatic door operating system in the door safety position.

FIG. 6 is a fragmentary plan view of the door and actuating mechanism associated therewith.

FIG. 7 is a cross-sectional view taken along the line 7—7 of FIG. 8.

FIG. 8 is a plan view of the ground box and mechanism therein, of the door operator of FIG. 6.

FIG. 8*a* is a detail view of the door operator pistons in the damped opening position.

FIG. 8*b* is a fragmentary view of the door operator pistons in an early stage of the maximum opening speed position.

FIG. 8*c* is a fragmentary view of the door operator pistons in a later stage of the maximum opening speed position.

FIG. 8*d* is a fragmentary view of the door operator pistons in the damped stopping position.

FIG. 9 is a fragmentary elevational view of the cylinder block mounted in the ground box of the automatic door operator taken along the line 9—9 of FIG. 8.

FIG. 10 is a cross-sectional elevation view taken along the line 10—10 of FIGS. 6 and 8.

FIG. 11 is an elevational view of the valve manifold of the automatic door operator of the invention.

FIG. 12 is a cross-sectional elevation taken along the line 12—12 of FIG. 11.

FIG. 13 is a cross sectional elevation taken along the line 13—13 of FIG. 11.

FIG. 14 is a circuit diagram, schematically illustrating the control circuit for the automatic door operator of this invention.

In FIG. 1 a double-door arrangement is illustrated, showing an "in" door 1 and an "out" door 2 of a building, such as a supermarket or other commercial establishment. Each of the doors 1 and 2 has mounted perpendicular to its respective threshold appropriately provided ground box enclosures 9 and 10 which, as will be seen in connection with door 1 in FIGS. 8–10, contains a cylinder block 11 having a centrally mounted door driving pinion 15 cooperatively associated with opposing reciprocating racks 16 and 18 which are driven hydraulically and returned mechanically by means of spring 19 to enable operation of the door to which it is connected. A single hydraulic line for each door, numbered 7 and 8 respectively, extends from a power pack 25 to each of the ground boxes 9 and 10 to provide fluid pressure in response to the mat actuated electronic and hydraulic control system. The actuating mats for the doors 1 and 2 comprise three sections each, sections A_1 and A_2, respectively, on the approach sides of the doors 1 and 2, and sections B_1, C_1, and B_2, C_2, respectively, on the exit sides of the doors.

Each of the mats is provided such that a person stepping on mat section A will cause the corresponding door to open unless someone is standing on sections B or C, in which case mat section A will not open the door. If it should happen that a person approaching the door from the opposite side as the door is opening places his foot on segment C of the mat, the door will be stopped automatically and thereby be prevented from hitting the approaching person during opening. Upon removal of the person's foot from the mat segment C, and thereby removal of the said person from the region of the opening door and the path of the person passing through it, the opening of the door will continue until it is completed.

The door, upon being completely opened, will remain open as long as a person's foot is on mat segment A and for a definite preset time interval after removal of the person's foot from the mat segment A, and then will be closed automatically by the action of an adjustable time-delay relay portion of the electric circuitry of the control mechanism, in a manner to be explained in connection with FIG. 14. After the door has opened, if the person who has gone through the door or any other person is on the mat section B when the time interval of the timing mechanism of the door expires, the electrical controls of the device will continue to be actuated to prevent the hydraulic mechanism from commencing the closing operation and the door will be held open until such time as the mat segment B is clear. At any time, if a person steps on segment C, controls of the device are actuated to prevent the hydraulic mechanism from either starting or continuing the closing or opening operations and the door is stopped until such time as the mat section C is clear.

FIG. 2 illustrates the in-door 1 and the out-door 2 having a centerpost 3 mounted therebetween in conventional manner and walls 5 and 6, respectively, substantially abutting the outer edges of the door. Hydraulic lines 7 and 8, respectively, are connected to the ground boxes 9 and 10 and the hydraulically actuated rack and pinion mechanisms therein for opening and closing the doors 1 and 2. The pinions are located directly below the hinges 13 and 14 of the doors, such that the doors are driven directly by means of the pinions from the reciprocating racks. It will be apparent that the ground boxes 9 and 10 may also be mounted under the threshold parallel to their respective doors.

As seen in FIGS. 2–5, the control of the surge or flow through the hydraulic lines 7 and 8 is provided by the valves of the manifold 20 acting upon the hydraulic fluid from the reservoir 22. The fluid may be of any conventional type, such as oil. A pump 24 driven by a 110 volt motor 26 supplies pressure in a line 27 connected to the manifold 20. At all times during operation of the pump a pressure of, for example, 750 p.s.i. is produced in the line 27 and maintained constant by means of a pressure relief valve 24*a* and return line 28 built into the pump 24. The line 27 branches into portions 29 and 30 respectively, which have therein three-way solenoid valves 31 and 32, one each of which is necessary for the door mechanisms of door 1 and door 2. The valves 31 and 32 normally are closed to prevent flow in the lines 7 and 8 and thereby to maintain the doors 1 and 2 closed.

Upon stepping upon the mat A_1 of the door 1, for example, valve 31 opens to cause flow of the hydraulic fluid forward as shown in FIG. 3 into the line 33 through the normally open two-way valve 35 and on through line 7 to the ground box 9 to actuate the racks 16 and 18 and turn pinion 15 to open the door 1. Also actuated at this time is a time-delay relay which after the mat A_1 is cleared, holds the door open for a preset time to allow the person to pass through the door and off the mats B_1 and C_1, at which time the normally closed solenoid valve 31 closes off fluid source 29 and communicates the hydraulic line 7 with the reservoir 22 by return line 40 as shown in FIG. 4.

The spring 19 within the cylinder block 11 is compressed by the forward motion exerted on the racks 16 and 18 by the hydraulic pressure created during the opening cycle and upon the opening of the return line 40, as described, is free to urge the racks to their initial position, thereby closing the door and forcing the hydraulic fluid back through line 7 and valves 35 and 31 to the return line 40 and into the reservoir 22. If during the flow through the manifold on an opening or closing cycle, the mat C_1 is stepped on, the circuit connected thereto actuates the 24-volt solenoid valve 35 to close the normally open valve and stop the hydraulic flow in line 7, as shown in FIG. 5, and the movement of the door 1 corresponding thereto. In a similar manner, if during the pumping of the fluid and opening of the door under the action of the mechanism in the cylinder block 11, a person steps on the mat B_1, and thereby is within the path of the opening or opened door, the three-way solenoid valve 31 will remain open and thereby prevent closing of the door until such time as the person steps off the mat B_1 out of the path of the door, thus opening the three-way valve 31 to create normal flow back through the line 7 to the manifold and three-way valve 31 to the return line 40 and the reservoir 22.

As will be seen from the drawings, the operation of the door 2 through branch 30, valve 32, line 34, and valve 36 of the manifold will be exactly the same with respect to its corresponding elements as the described operation of door 1.

FIGS. 6 and 7 illustrate the mats A_1, B_1, and C_1 for actuating the door 1 mechanism through the power pack 25 and the circuit contained therein. Each of the mat segments is a normally open switch mounted in a recess 41 in the floor 42. Each of these switches, as shown, for example, in connection with segment C_1, comprises a pair of superimposed flexible conductive sheets 43 and 44 which normally are separated from each other by regularly spaced resilient insulating material spacer blocks 45. A resilient ribbed outer mate covering 46 is superimposed over the entire recess 41. Upon deflection of the covering 46 conductive sheet 43 affected thereby and lying between the blocks 45 is flexed into contact with the conductive sheet 43 as shown in phantom in FIG. 7, closing the circuit connected thereto by means of connecting lines 47 and 48. As will be seen from the drawings, all of the mat segments operate with respect to their portion of the circuit in the manner described in connection with segment C_1.

FIGS. 8–10 illustrate the ground box enclosure 9 for the door 1 mounted in an approprate recess in the floor 42. It will be obvious from an understanding of the

mechanism that it is possible that the ground box 9 be mounted either perpendicular to the threshold of the door or parallel thereto directly below said threshold. Within the ground box 9 is a cylinder block 11 having an end cap 50 defining therewith two equal and parallel bores 51 and 52 throughout a substantial portion of the length thereof and separated by a web 53. Within the bore 52 a rack 16 is provided for slidable movement as a piston under response from hydraulic pressures created at either end thereof. The hydraulic line 7 is fastened to the cylinder block cap 50 by means of a threaded fitting 54 being received in a tapped portion of a passageway 55 communicating the line 7 with the chamber 56 which is defined by the bore 52 and the end of the rack piston 16. At the opposite end of the rack piston 16 and bore 52 is a chamber 57. Appropriate O-ring seals 58 and 59 adjacent the ends of the rack piston 16 are provided in grooves about the periphery of the rack piston 16 to provide a running seal within the bore 52.

A central opening 60 is provided in the web 53 and the spur gear pinion 15 is symmetrically mounted with respect thereto for cooperation with the teeth 61 of the rack piston 16. Opposing the rack piston 16 and similarly cooperating with the pinion 15 is the rack piston 18 slidably mounted in the bore 51. In the end of the bore 51 adjacent passageway 55 of the bore 52 is provided a tapped passageway 62 similar to the passageway 55 but which contains a threaded plug 63 secured therein to block said passageway. Seated in a counterbore 64 on the inner end of the passageway 62 is the coil spring 19 which abuts the opposing end of the rack piston 18 and is maintained coaxial therewith by means of a projecting stem member 65 thereon telescoped within the spring 19.

At the opposite end of the bore 51 and rack piston 18 is a chamber 67 communicated with a chamber 57 of bore 52 by means of passageways 68 and 69 through web 53. Passages 68 and 69 are parallel to each other with the passageway 68 being nearer to the end wall of the cylinder block 11 defining the chambers 57 and 67. These chambers may be provided with appropriate bleeding plugs to facilitate complete filling during assembly of the actuator. The rack piston 18 is provided with O-ring seals 58 and 59 as on the rack piston 16 and for the same purpose. The cylinder block cap 50 is secured rigidly to the cylinder block 11 by mechanical clamping means 72 or some other suitable means and appropriate sealing rings 73 surround the bores 51 and 52 and prevent leakage of the hydraulic fluid from said bores into the joint between the block 11 and cap 50.

Upon actuation of the pump 24 and the creation of a fluid pressure in the hydraulic line 7, the chamber 56 in communication with the line 7 expands under the pressure created therein and thereby moves the rack piston 16 forward, turning the pinion 15. The rack piston 18 is driven correspondingly by the pinion 15 against the action of the spring 19 thereby compressing said spring. Simultaneously with the motion of the rack piston 16, the chamber 57, which contains captive hydraulic fluid, forces said fluid through the web 53 by means of passageway 68 into the chamber 67.

As will be seen in FIG. 6 and FIG. 8*a*, the seal 70 on the rack piston 18 blocks the passageway 69 during this initial action to provide restricted flow and corresponding slowing of the door and damped motion of the rack pistons and pinion. As the chamber 56 increases in size from the pressure exerted upon it by the hydraulic fluid from the line 7, the rack piston 16 advances in the chamber 57 and reduces the volume of said chamber by an amount equal to the increase in the size of the chamber 67 occasioned by the movement of the rack piston 18.

As shown in FIG. 6 and FIG. 8*b*, as soon as this motion has proceeded to a point where the seal 70 no longer blocks the passageway 69, the opening rate is increased due to the increased flow obtained from the opening of the passage 69 between the chambers 67 and 57. This motion, under pressure from the line 7, continues until the positions reached in FIG. 8*c* are accomplished, at which time the seal 70 on the rack piston 16, as shown in FIG. 8*d*, blocks the passageway 69 thereby reducing the flow of the captive hydraulic fluid, thereby causing a slowing down of the forward motion until door 1 is completely open, rack piston 16 is at the end of its stroke and has substantially closed the chamber 57, and the chamber 67 has expanded to the original volume of the chamber 57 by movement of the rack piston 18 to the end of its stroke against the force of the coil spring 19.

It will be noted that throughout this action, the total volume of the two chambers remains equal and that an increases in volume of one of the chambers results in a corresponding decrease in volume of the other. The position of the door 1 during these different stages of the cycles illustrated in FIGS. 8*a* through 8*d*, will be seen in FIG. 6 and it will be recognized readily by those in the art that the 8*a* and 8*d* portions of the operating cycle occurring at a reduced rate of speed will lessen the shock on the door 1 and operator mechanism at the cycle extremes.

As will be seen from the drawings, upon the communication of the hydraulic line 7 with the return line 40 and the reservoir 22 by action of the valves in manifold 20, the force of the spring 19 will cause the rack piston 18 to move back in the direction of its normally closed position, slowly at first due to the initial blocking of the passage 69 by the O-ring seal 59 on rack piston 16. The force of the spring 19 is sufficient to rotate the pinion 15 and to force substantially all of the hydraulic fluid in the cavity of chamber 67 into the chamber 57, thereby closing the door. Simultaneously with this transfer of fluid, the rack piston 16 diminishes the dimension of the cavity 56 and forces fluid back through the line 7 into the manifold and reservoir. It is this novel use of the spring return system, the O-ring seals, and the manifold which permits the use of a single hydraulic line in the door operator mechanism.

It should be noted that the door operator ground box 9 is mounted to the right when facing the door 1. Should it be desirable to have the door 1 open in the opposite direction, the ground box 9 may be mounted on the opposite side of the door 1 and the rack pistons 16 and 18 switched to the opposite bores from those shown. The spring is then seated in the counterbored recess of passageway 55 and the hydraulic line 7 and fitting 54 transferred to the threaded portion of passageway 62 and the threaded plug 63 transferred to the threaded portion of passageway 55, such that the described operation of the mechanism will be exactly the same with the exception that the pinion 15 will rotate in the opposite direction. An alternative method of accomplishing this change which eliminates the need of the threaded portion of passageway 62 and threaded plug 63 is merely to disconnect cap 50 and reverse both the cap and racks with respect to the cylinder block. It will be noted that the damping function of the O-ring seals 59 and 70 and passageways 68 and 69 through the web 53 will function as previously described.

FIGS. 9 and 10 illustrate the ground box and cylinder block in elevation and as seen in FIG. 10 the pinion 15 cludes a post 75 which projects upwardly above the floor level 42 to engage in locking relationship with the door 1 to provide integral movement therewith. The pinion 15 rests on a conventional annular ring type bearing 76 seated in appropriate depression 77 in the cylinder block 11. Mounted on the upstanding post 75 of pinion 15 is an annular bearing assembly 78 of conventional form, held in position by retaining ring 79 within an opening 80 in the top of the cylinder block. An annular bearing cap member 81 maintains a proper spacing between the door and the retaining ring 79 and bearing 78. Within a groove in the annular cap 81 is an O-ring 82 sealing the assembly from dust and exterior corrosive media.

Of course, during operation of the device, the pinion rack chambers are empty except for lubricant on the teeth and replacement of the pinion does not interrupt the oil chambers.

FIGS. 11 to 13 illustrate the manifold **20** of the door operator assembly in somewhat schematic fashion, there being no illustrated detail of the solenoid valves utilized since these are conventional and easily understood by those skilled in the art. The manifold **20** preferably is in the form of a rectangular block having appropriate mounting holes **85** provided therein for mounting in the power pack **25**.

It will be noted that the passageways **27, 29, 30, 33, 34,** and **40** all are provided by straight through drilling or boring into the block and in certain cases, such as seen in connection with passageway **33** where no outlet is necessary, a tapered plug **86** is provided in the passageway end in threads provided therefor. This provision, of course, enables the simplification of manufacture of the manifold. Appropriate fittings **87** are provided in the threaded passageway ends to which they connect the various external lines. The operation of the manifold **20** has been described previously in connection with FIGS. 2 to 5.

FIG. 14 illustrates schematically the circuit arrangement for the disclosed door operator system which includes the actuating mats and the circuitry in the power pack **25** connected thereto. Mat A_1 upon being stepped on, closes its switch in the 24 volt circuit in the line **99** from one side of transformer **100**, thereby to energize the time-delay relay **101** by passing a current through its coil **103** connected in circuit through normally closed contact **119** of relay **121** to the other side of the transformer through fuse **105** provided for protection in the circuit. If relay **121** previously has been energized by the presence of a person on mat B_1, in the path of the door **1**, the line between coil **103** and transformer **100** is open at contact **119** and the time-delay relay **101** cannot be energized to open the door.

The time-delay relay **101** for door **1** and its corresponding time-delay relay **102** for the door **2** in the 24-volt circuit are of conventional type and sold under the trade name Agastat by the Elastic Stop Nut Corporation of Elizabeth, New Jersey. These devices include very accurate bellows means and bleeders which can be adjusted from minutes to milliseconds so that the relay may be timed very accurately to the exact time interval requirements of the particular door operator installation. Although the Type 1 Agastat in which the time delay starts with energization of the coil may be used in the disclosed circuit, the Type 2 Agastat in which the time delay starts with de-energization of the coil is preferred to utilize fully the described safety feature of the door operator system.

Upon actuation of the relay **101**, connection is made with the 110 volt circuit by means of contact **107** thereof which closes the line and actuates the 110 volt pump motor relay **111**. The energizing of the relay **111** causes a closing of the contact **113** in the 110 volt circuit which energizes the motor **26** connected to the other side of the 110 volt loop. At the same time the relay **111** actuates contact **115** in the 110 volt circuit to complete the 110 volt circuit to the three-way solenoid valve **31**. This places the valves and circuitry in condition for operation of the manifold and opening of door **1** as shown by the flow lines in FIG. 3.

Upon actuation of the time-delay relay **101** a second contact **117** was closed to link the 24 volt transformer directly to the coil **103** and, therefore, current passes through contact **117** to the coil **103** without dependence on the state of normally closed contact **119** in relay **121**. This arrangement is provided so that if during operation of the relay **101**, either from the presence of a person on mat A_1 or from the holding of the bellows during running of the time interval, the mat B_1 is stepped on and the relay **121** thereby actuated to open contact **119**, the holding of the hydraulic flow condition illustrated in FIG. 3 is maintained to continue the open state of the door **1** until it is clear of the person in its path, i.e. on mat B_1. The energized condition of relay coil **103** is maintained without the expiration of the time delay interval, because of the connection made directly through coil **103** on the side opposite contact **117** which results from closing of the contact **125** of the relay **121** upon actuation thereof by stepping on the mat B_1 since until the relay coil **103** is de-energized, the time delay interval does not begin to run.

This holding action of the relay **121** is very important in preventing injuries to one who after stepping on the mat A_1 and opening the door, passes through the door but remains on the mat B_1 past the period of time in which the door normally would begin to close.

The presence of an individual on the mat segment C closes the switch therein and actuates the 24 volt two-way solenoid valve **35** in the condition illustrated by the flow diagram of FIG. 5. This stops all flow in the hydraulic line **7** and, therefore, stops any motion of the door **1** despite the condition of relay **101**.

A similar holding relay **122** is provided in the circuit with the time delay relay **102** for actuating the door **2** to provide this safety feature in the same manner, with the two systems being wired and operating exactly alike. In a similar manner, a relay **112**, of course, is provided to perform the functions of the relay **111** of the door **1** circuitry when the door **2** circuit is energized by stepping on the mat A_2. Through the interconnection of the switch of segment C_2 with the two-way 24 volt solenoid valve **36**, the safety feature of door **1** provided by the mat segment C_1 also is duplicated in the door **2** unit.

Thus, it will be seen that applicants have provided a novel safety insuring door operator which is extremely versatile in application and yet is simple and inexpensive to manufacture, install, and maintain.

For ease of description, the principles of the invention have been set forth with but a single illustrated embodiment showing one convenient form the invention might take. It is not our intention that the illustrated embodiment, nor the terminology used in describing it be limiting inasmuch as variations may be made without departing from the spirit of the invention. Rather, we desire to be restricted only by the scope of the presented claims.

The invention claimed is:

1. A door operator having an electrical safety and actuating control system which includes

first normally open switch means having a closed position for energizing a first circuit means to open a normally urged closed door and maintain said door open for a preset interval of time after said first switch means returns to open position,

second normally open switch means having a closed position for energizing a second circuit means to prevent said first circuit means from being energized if said second circuit is energized first, and for maintaining said door open until after said first and second switch means return to open position and said preset interval of time has expired if said first switch means is closed first and said second circuit is energized while said first circuit is still energized,

third normally open switch means for energizing a third circuit means for stopping the opening or closing movement of the door,

said first switch means being located in a mat segment adjacent the door on the approach side thereof, said second switch means being located in a mat segment adjacent the door on the exit side thereof, and said third switch means being located in a mat segment adjacent said second mat segment on the side of said second mat segment opposite said door,

whereby each of the said normally open switches may be closed by pressure from the weight of a person standing on its corresponding mat segment.

2. A door operator having an electrical safety and actuating control system which includes

first normally open switch means having a closed position for energizing a first circuit means to open a normally urged closed door and maintain said door open for a preset interval of time after said first switch means returns to open position,

second normally open switch means having a closed position for energizing a second circuit means to prevent said first circuit means from being energized if said second circuit is energized first, and for maintaining said door open until after said first and second switch means return to open position and said preset interval of time has expired if said first switch means is closed first and said second circuit is energized while said first circuit is still energized,

third normally open switch means for energizing a third circuit means for stopping the opening or closing movement of the door.

3. The safety and actuating control system of claim 2 wherein the first circuit means which opens the normally urged closed door and maintains said door open for a preset interval of time after said first first switch means returns to open position includes therein an adjustable time delay relay which, when energized, closes a circuit having a relay capable of energizing an electrical pump motor and a solenoid actuator of a three-way valve electrically connected thereto for operation of a one-line hydraulic door operator mechanism.

4. The safety and actuating control system of claim 3 wherein the second circuit means is a circuit breaking relay which prevents said first circuit means from being energized if said second circuit is energized first, by energizing said circuit breaking relay and thereby opening a normally closed contact included in said first circuit and through which said first circuit is connected to its power source.

5. The safety and actuating control system of claim 4 wherein the energization of the circuit breaking relay

after the energization of said first circuit, and before said preset interval of time expires, causes the first circuit to remain energized and the door to remain open as long as said circuit breaking relay of said second circuit means is energized.

6. The safety and actuating control system of claim 2 wherein the third circuit means includes a solenoid actuated two-way hydraulic valve.

7. The safety and actuating control system of claim 2 which includes fourth normally open switch means, fifth normally open switch means, and sixth normally open switch means for a second door and door operator associated with said first mentioned door for travel in a direction opposite thereto,

said fourth, fifth, and sixth normally open switch means being for energization of fourth, fifth, and sixth circuit means respectively in the same manner and for the same purposes with respect to said second door as the energization of said first, second, and third circuit means with respect to said first mentioned door.

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