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AIR OPERATED DEVICE

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Fig. 1

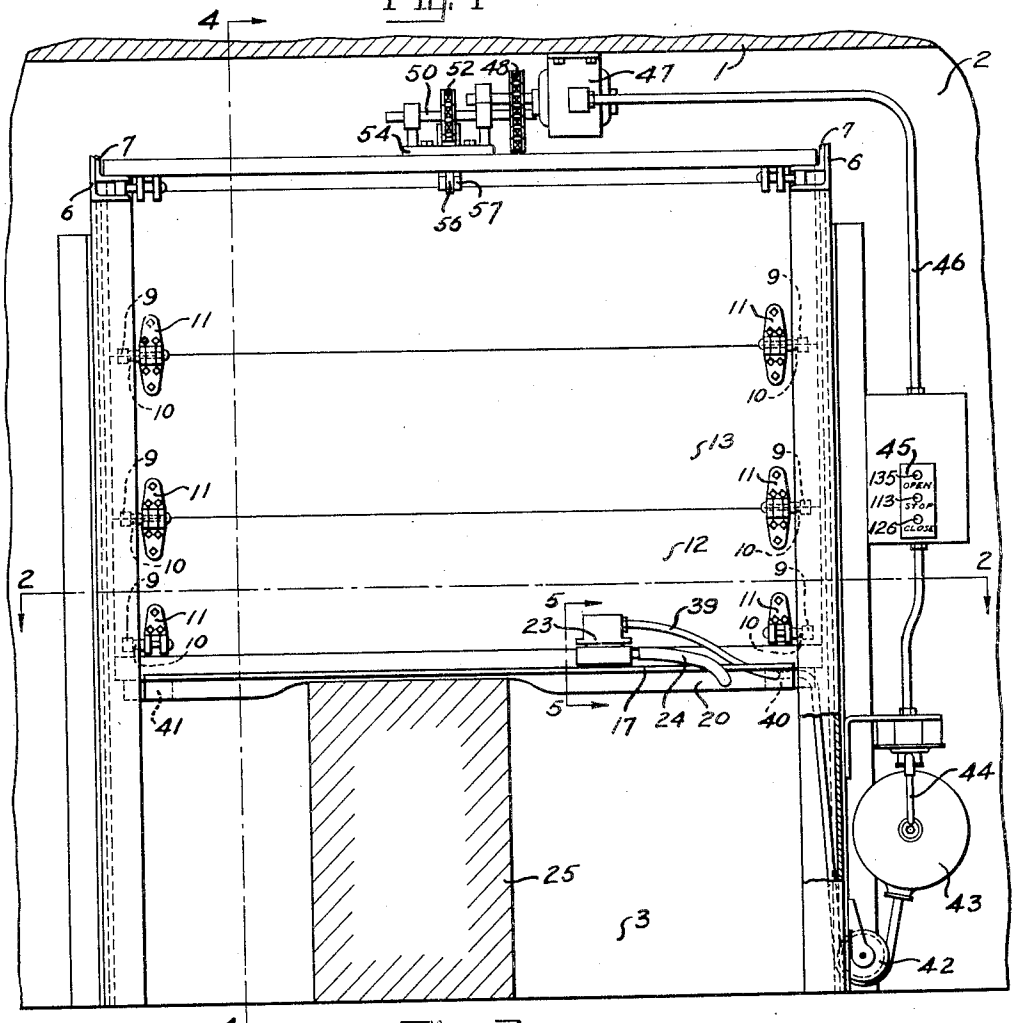


Fig. 2

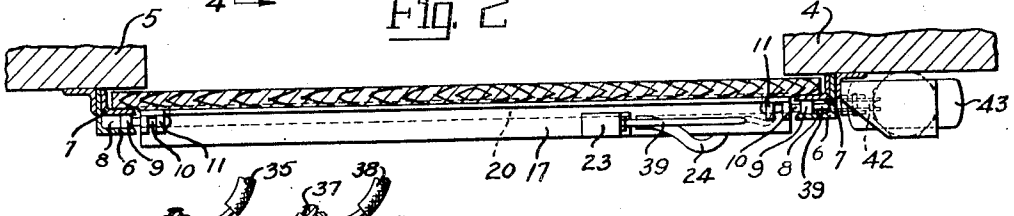
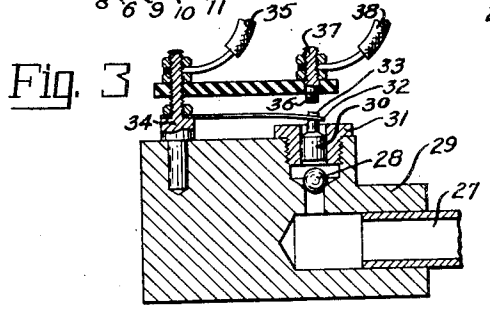


Fig. 3



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Fig. 4

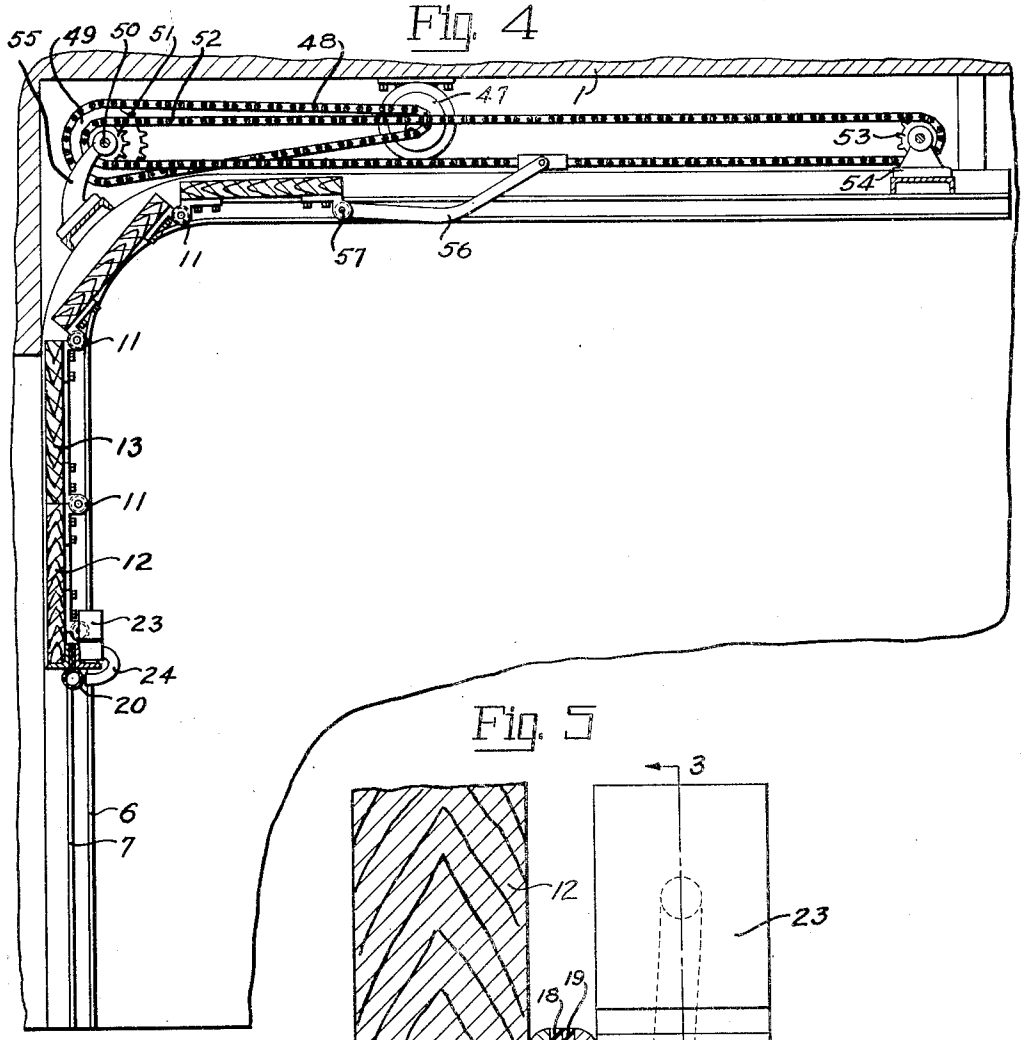


Fig. 5

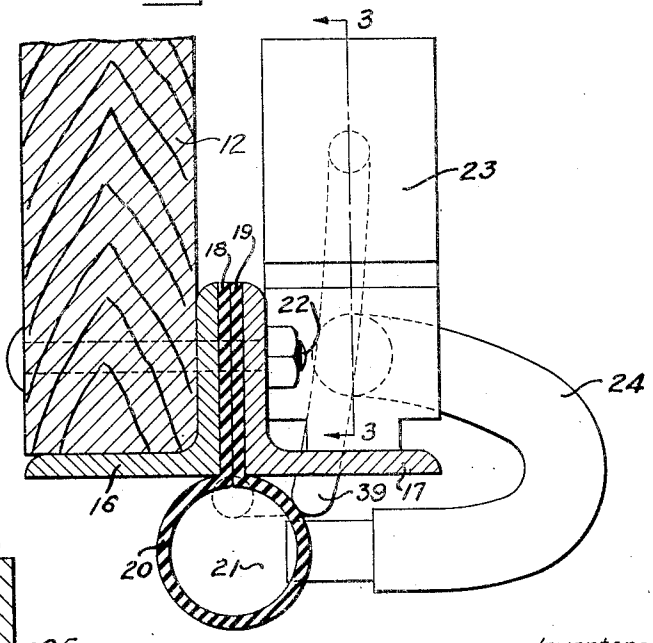
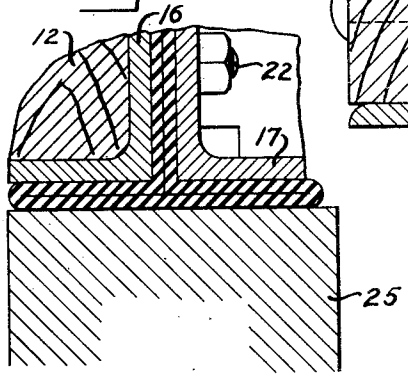


Fig. 6



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Fig. 7

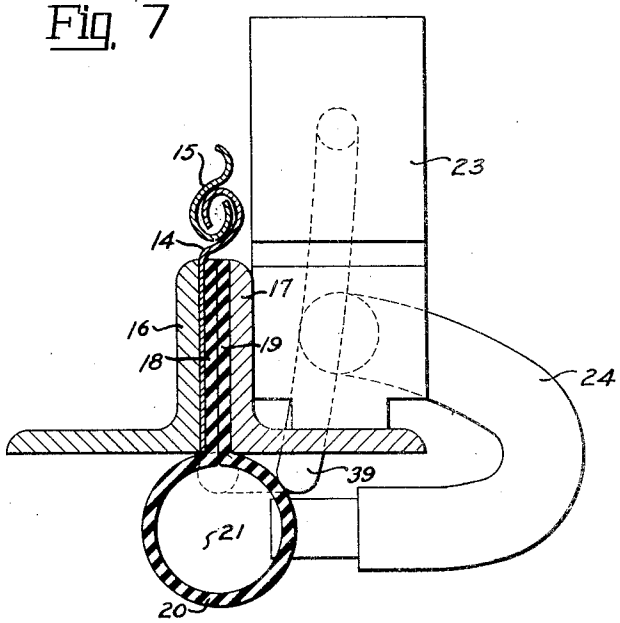


Fig. 8

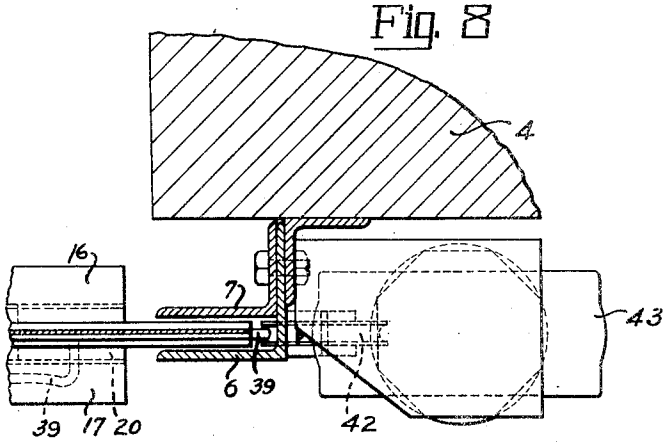
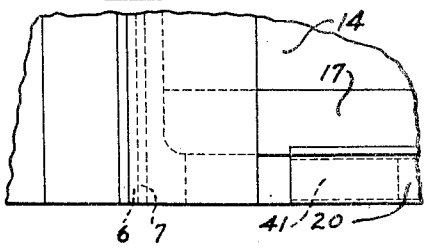


Fig. 9



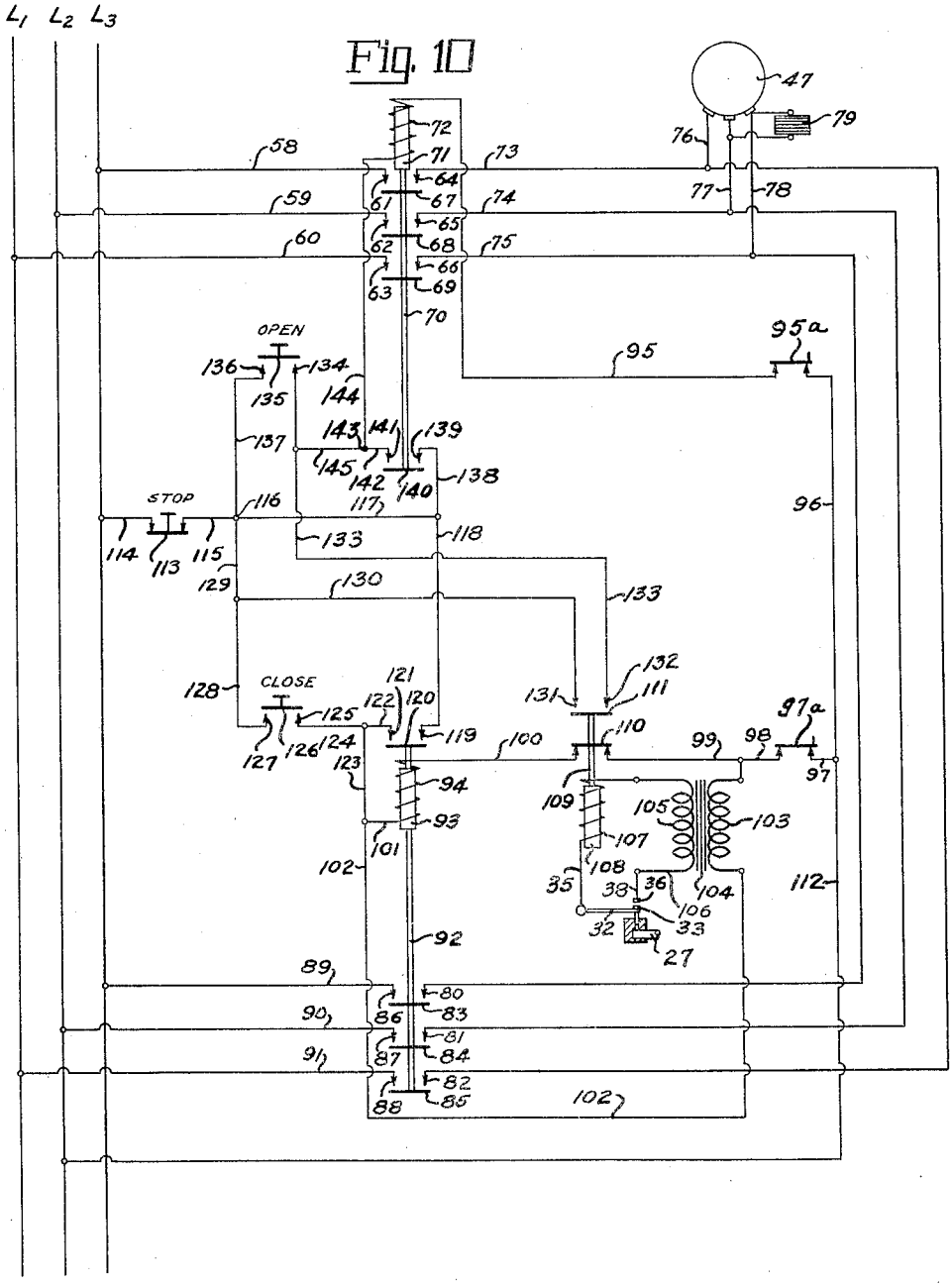
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Fig. 10



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Patented Nov. 12, 1940 2,221,216

UNITED STATES PATENT OFFICE

2,221,216

AIR OPERATED DEVICE

Ralph H. Greegor and William K. Page, Columbus, Ohio, assignors to The Kinnear Manufacturing Co., Columbus, Ohio, a corporation of Ohio

Application June 14, 1938, Serial No. 213,719

1 Claim. (Cl. 268—59)

This invention relates to doors and particularly to apparatus for operating a door to prevent its closure in the event that the door encounters an obstruction, and, under some circumstances, to return the door after it has been stopped by meeting its obstruction.

It is an object of this invention to provide means associated with the door itself which is raised and lowered by an electric motor to open the circuit to stop the motor; and optionally to bring about a reversal of the motor to change the direction of the door after it has once been stopped upon engaging an obstruction.

It is a further object to provide means for protecting the electric cable connected to the pneumatic switch which is mounted upon the door.

It is an object, in this connection, to provide means for automatically maintaining the cable taut and for automatically storing or paying it out as the door rises and falls.

It is an object of this invention to provide means for guiding the door in association with the foregoing inventive ideas, whether the door is made of wood or metal.

It is a further object of this invention to provide a collapsible air chamber on the bottom edge of the door, pneumatically connected to an electric switch for controlling the stopping or reversing of the electric motor raising and lowering the door; and to associate with this combination a reel for reeling the electric cable connected to the electric switch on the door.

It is a further object to guide this cable by the door and by the reel within a protected enclosure that also acts as a door guide.

In the drawings:

Figure 1 is an inside elevation of the door and associated mechanism showing the door stopped by an engagement with an obstruction;

Figure 2 is a section on the line 2—2 of Figure 1, looking in the direction of the arrows;

Figure 3 is a section on the line 3—3 of Figure 5, diagrammatically illustrating the arrangement and construction of the pneumatic valve;

Figure 4 is a section on the line 4—4 of Figure 1, looking in the direction of the arrows, showing the door partially open;

Figure 5 is a section on the line 5—5 of Figure 1, looking in the direction of the arrows, illustrating the nature of the collapsible pneumatic chamber, its connection to the electric switch mechanism and its method of attachment to the bottom of the door when employing wooden panels;

Figure 6 is a similar section showing the collapse of the resilient chamber containing the air;

Figure 7 is a view similar to Figure 5, showing the method of assembly of the pneumatic chamber, the door bottom plates and the metal sections of a metal, articulated door;

Figure 8 is a section taken transversely through a metal section door, showing the relationship between the door guide, the cable and its pulley and take-up mechanism;

Figure 9 is a detail of one corner of the door, showing the manner in which the side edge of the door is concealed between the guide channels;

Figure 10 is a wiring diagram showing the arrangement of the motor controlling pneumatic switch and other mechanism for controlling the starting, stopping and reversing of the door motor.

Referring to the drawings in detail, 1 indicates the ceiling of a building, of which 2 is the front wall. It is provided with a door opening 3 formed by the vertical panel members 4 and 5, on the inside of which there are mounted the spaced angle irons 6 and 7 to form a guide channel 8. This guide channel may guide the door by guiding the sides of the door and any rollers carried thereby, or it may be used solely for guiding the rollers 9 on the pintles 10 carried in the hinges 11 which connect the door panels 12 and 13 to one another.

The exact construction of the door and the nature of its guiding is not important. For instance, in Figure 7, the door is made of articulated metal sections 14 and 15 which are clamped between the angular base plates 16 and 17 which also clamp the vertical portions 18 and 19 of the chamber portion 20 constituting the air chamber 21.

Likewise, in Figures 5 and 6, it will be seen that the wooden panels 12 are connected to the members 16 and 17 by the bolts 22.

The angular base plate 17 serves as a supporting means for the pneumatic and electrical switch box, generally designated 23. This box is connected by the pipe 24 to the chamber 21 which is formed of a rubber body 20. When this body 20 engages an obstruction 25, it collapses, and the resulting pressure causes the switch to operate as follows.

The pressure in the pipe 27 lifts the ball 28 in the casing 29. This lifts the plug 30 in the guide 31 against the spring 32 which carries the contact 33. The spring is mounted upon the terminal 34 connected to the wire 35. The contact

33 engages the contact 36 on the terminal 37 connected to the wire 38. This closes the circuit. These two twires 35 and 38 are combined in a cable 39 which passes through the end plug 40, closing the end of the chamber 21. The other end is closed by a similar plug 41. The cable then passes into the space between the angle irons 6 and 7, where it is protected. It passes downwardly to adjacent the floor, whence it passes over a pulley 42 into a winding drum 43. The end of the cable is connected through the cable 44 to the switch generally designated 45, conduit 46 to the motor 47.

The exact means of raising and lowering the door is unimportant. In the typical arrangement shown in Figure 4, the motor 47 drives the chain 48 on a sprocket 49 which, through a shaft 50, actuates a sprocket 51 and a chain 52. The other end of this chain 52 is carried upon an idler sprocket 53 on a bracket 54. The sprocket 51 is carried on a bracket 55. The chain 52 has connected to it a link 56 which is pivoted at 57 to the top panel of the door. This mechanism serves to raise and lower the door.

Referring to Figure 10, power is supplied through a three-phase line L_1, L_2, L_3. Power is taken off this line, through the wires 58, 59 and 60, to contacts 61, 62 and 63. Opposite contacts 64, 65 and 66 are bridged by the switch blades 67, 68 and 69. These blades are carried on the rod 70 which has a solenoid core 71 within a coil 72. The contacts 64, 65 and 66 are on the ends of the wires 73, 74 and 75 respectively. These lines are connected by the lines 76, 77 and 78 to the motor 47. Across two of these lines is connected a magnetic brake 79 for the motor.

The lines 73, 74 and 75 also terminate in contacts 80, 81 and 82 which are bridged by the switch blades 83, 84 and 85 to connect the terminals 86, 87 and 88 of the wires 89, 90 and 91 to the lines L_1, L_2 and L_3. These switch blades 83, 84 and 85 are mounted on the rod 92. This rod 92 carries a solenoid core 93 within the coil 94. The coils 72 and 94 are connected by the wires 95, 96, 97, 98, 99, and 100 to one another. The other side of the line, beyond the coil 94, at 101, is connected to the line 102 which returns to coil 103 of a transformer 104, the secondary of which is designated 105. This coil 105 is connected on one side 106 to the wire 38 and contact 36. It is adapted to engage the contact 33 which is actuated, as hereinbefore described, by the air pressure in the pipe 27.

The wire 35 is connected to the solenoid coil 107 which is connected on the other side to the transformer coil 105. In this coil 107 is a solenoid 108 connected to a rod 109 and carrying a stop switch 110 for opening and breaking the connection between wires 99 and 100. Also carried on the rod 109 is another switch blade 111 which causes the motor to reverse and start to lift the door. Switch blade 110 merely controls the stopping of the door. The wire 112 extends over to the line L_2.

A stop switch which is hand operated is designated 113 and it controls the closing of the lines 114 and 115. The line 115 is connected at 116 to a line 117 which, in turn, is connected to the line 118 whose terminal 119 is closed by the holding switch blade 120 on the rod 92. Switch blade 120 also engages the terminal 121 of the wire 122 which is connected by the wire 123 to wires 101 and 102. Wire 122 is also connected to wire 124 and terminal 125 which is engaged by the closing switch 126 which also engages the terminal 127 of the wire 128 and is connected by the wire 129 to terminal 116.

The wire 130 is connected to wires 128 and 129 and terminates at 131, where it is engaged with the switch blade 111. Switch blade 111 also engages the terminal 132 of the wire 133 that leads to the terminal 134 engaged by the switch blade 135. This switch blade also engages the terminal 136 of the wire 137 which is connected to terminal 116. The wire 118 is connected by the wire 138, to terminal 139 which is engaged by the holding switch blade 140 on the rod 70.

The switch blade 140 engages the terminal 141 of the wire 142. This wire is connected to the junction 143, at which are connected the wires 144 leading to the solenoid coil 72 and the wire 145 connected to the wire 133.

The method of operation is as follows. If you want to stop the movement of the door, you move the switch blade 113 to open position. If you wish to manually lower the door, you close the switch blade 126, which results in energizing the solenoid 94, thereby closing the terminals 86—86; 81—87; and 82—88. This causes the motor 47 to so rotate as to lower the door.

If an obstruction should be encountered, then the contacts 33 and 36 would close, which would energize the solenoid 107, moving its core 108 upwardly so that the switch blade 110 would open the motor circuit indirectly and stop the motor as follows: The switch blade 110 opens coil 94 and the circuit associated therewith; this drops the contacts 83, 84 and 85, which breaks the motor circuit and stops the motor. In other words, the control circuit is disrupted and then the magnetic switch breaks the motor circuit. It would result in the switch 111 bridging contacts 131 and 132. This would result in energizing the solenoid 72, closing the contacts 61—64; 62—65; and 63—66. This would cause the motor 47 to reverse and to move the door upwardly. The upward movement of the door is limited by the limit switch 95*a*, and the lowering of the door is limited by the limit switch 97*a*.

If it is desired to manually start the door upwardly, the switch blade 135 is moved to closed position. If it is desired to move the door downwardly, then the switch blade 126 is manually closed. If it is desired to stop the door, then the switch blade 113 is moved to open position.

It will be understood that any detail arrangement of electrical circuits and switches may be employed, but the one described is the preferred form. It consists broadly of a power line, reversible motor, switches that are solenoid operated for connecting the motor to move in opposite directions and it consists of a pneumatically operated switch mechanism for breaking the circuit when the door is moving downwardly to stop it and optionally also to connect the motor into reverse position to again raise the door.

Suitable limit switches 95*a* and 97*a* are provided for limiting the normal upward and downward movement of the door. Also the usual switches for stopping the door 113, opening the door 135 and closing the door 126 are provided for usual, normal, manual operation.

It will be understood that we desire to comprehend within our invention such modifications as come within the scope of the claim and the invention.

Having thus fully described our invention, what we claim as new and desire to secure by Letters Patent is:

In combination, a slidable door, a pair of angle

members mounted on and extending along the closing edge of the door, said angle members being mounted with two faces parallel to said door and closely adjacent one another and with their other two faces in line with each other and at right angles to the door and forming a base plate for said door, a collapsible rubber air container extending along the closing edge of the door on the leading side of said angle members and having a normally circular air enclosing portion and a pair of integral ears which are received between said first-named two faces of said angle members, means for holding said angle members together for thereby clamping said ears together, said second-named two faces of said angle members forming a portion wider than said rubber air container when collapsed, means closing the ends of said air container, and means on said door actuated by collapse of said air container upon encountering an obstruction for stopping the closing of the door, said air container being collapsed between the obstruction and the base plate formed by said angle members.

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