P. R. FORMAN.

DOOR OPERATING APPARATUS.

APPLICATION FILED MAY 21, 1915.

1,200,826.

Patented Oct. 10, 1916.

2 SHEETS—SHEET 1.

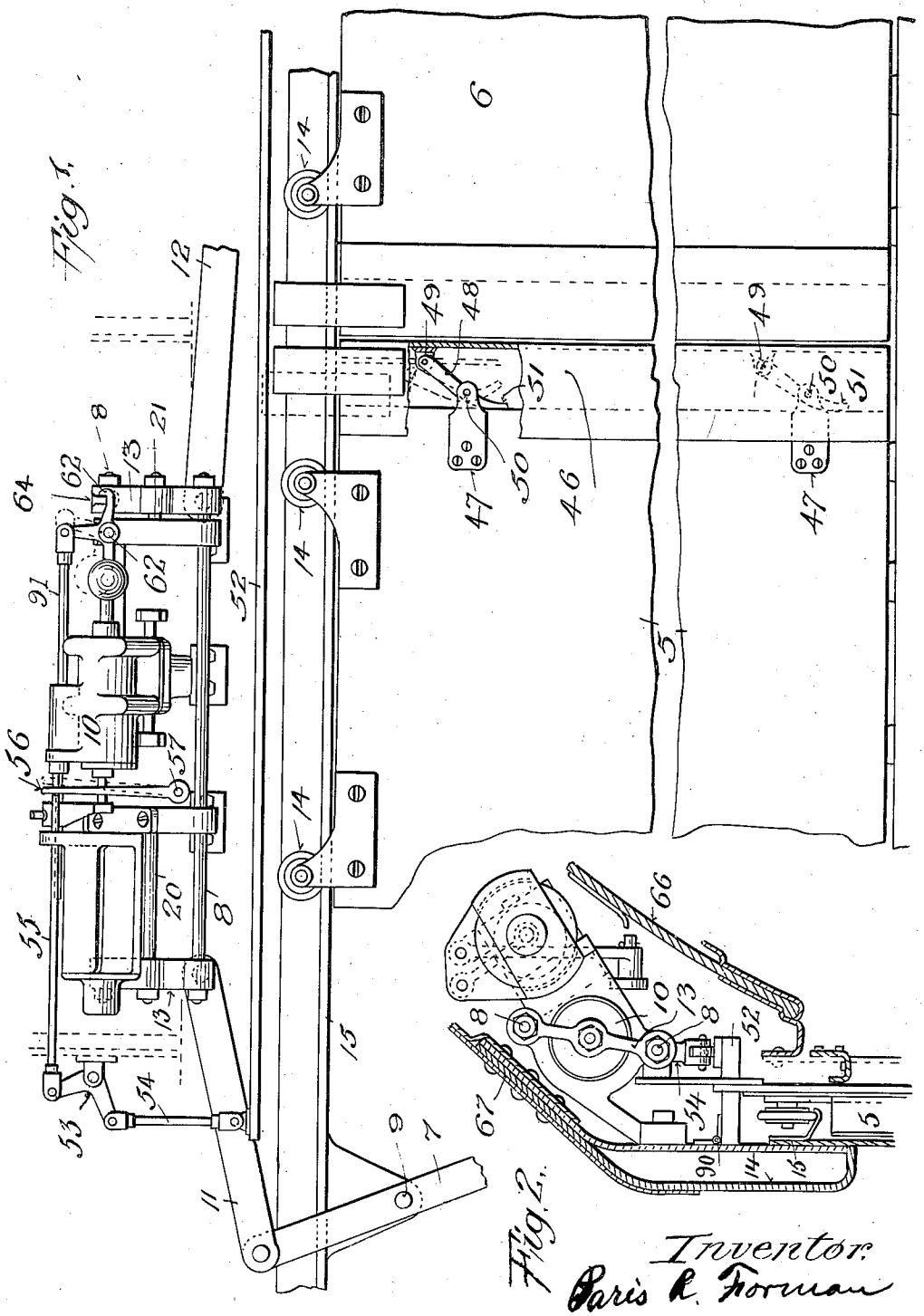


Fig. 1.

Fig. 2.

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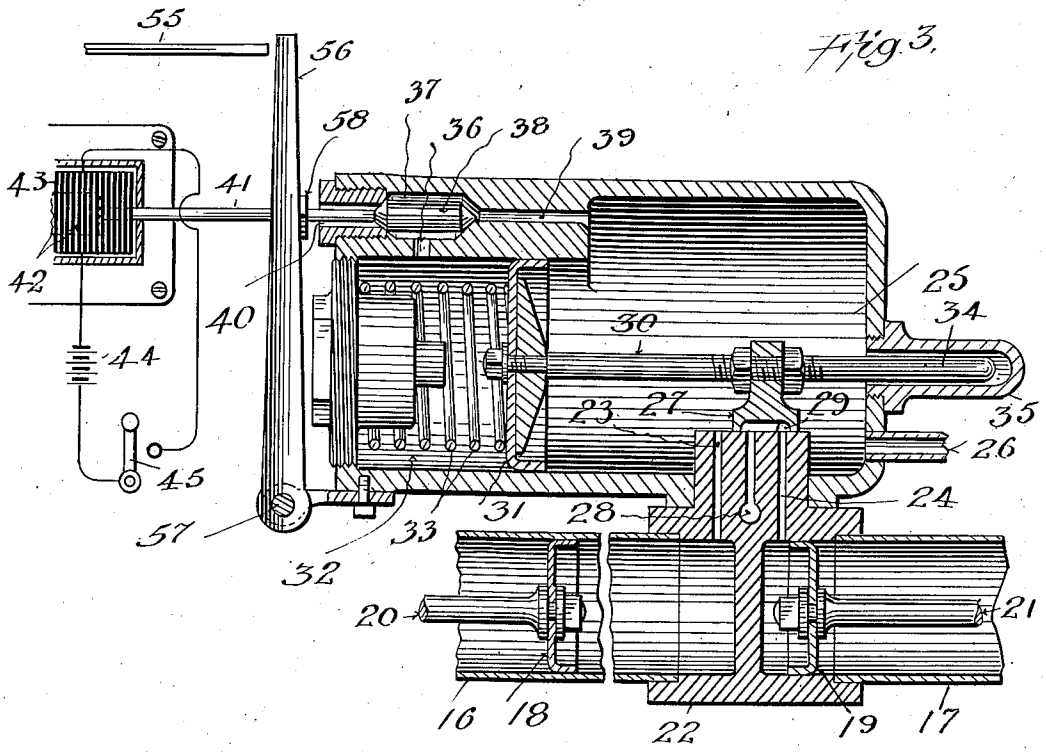
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2 SHEETS—SHEET 2.

Fig. 3.



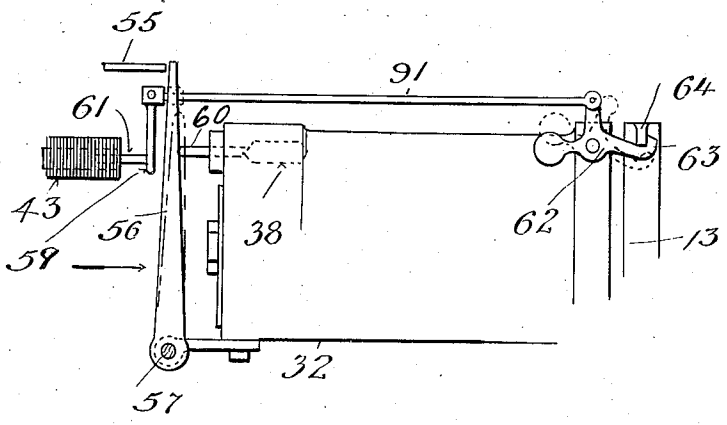


Fig. 4.

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UNITED STATES PATENT OFFICE.

PARIS R. FORMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO NATIONAL PNEUMATIC COMPANY, OF NEW YORK, N. Y., A CORPORATION OF WEST VIRGINIA.

DOOR-OPERATING APPARATUS.

1,200,826. Specification of Letters Patent. Patented Oct. 10, 1916.

Original application filed November 6, 1912, Serial No. 729,730. Divided and this application filed May 21, 1915. Serial No. 29,700.

To all whom it may concern:

Be it known that I, PARIS R. FORMAN, a citizen of the United States, residing at Chicago, county of Cook, State of Illinois, have made a certain new and useful Invention in Door-Operating Apparatus, of which the following is a specification.

This invention relates to door operating apparatus and embodies subject-matter divided from my application Serial No. 729,730, filed Nov. 6, 1912.

The object of the invention is to provide a construction and arrangement of power actuated door operating mechanism which is simple and efficient.

A further object is to provide safety devices for use in connection with door operating mechanism whereby in case the door in closing encounters an obstruction, the power motor is automatically reversed.

A further object is to provide a safety apparatus of the nature referred to which, when the obstruction is removed, again reverses the motor to cause the door to again move toward closed position.

Other objects of the invention will appear more fully hereinafter.

The invention consists substantially in the construction, combination, location, and relative arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawings, and finally pointed out in the appended claims.

Referring to the accompanying drawings, and to the various views appearing thereon, Figure 1 is a broken view in elevation showing a door operating mechanism embodying the principles of my invention. Fig. 2 is a broken view in vertical transverse section. Fig. 3 is an enlarged broken detail view in section showing a form of power mechanism and reversing devices therefor embodying my invention. Fig. 4 is a fragmentary view showing the action of the lock operating connections.

The same part is designated by the same reference numeral wherever it occurs throughout the several views.

In carrying out my invention I propose to employ a power mechanism to open and close doors, gates or the like, and control devices for the power mechanism whereby in case the door, gate or the like, encounters an obstruction in closing the power mechanism will be automatically reversed, thereby causing the door or the like to move toward open position under power operation, and when the obstruction is removed the motor will again be reversed to cause the door to resume its closing movement under power operation, the reversals of the power motor being accomplished automatically.

Referring to the accompanying drawings in which, for illustrative purpose, I have shown my invention applied to a sliding door structure, the door sections are indicated at 5, 6, and operating levers, one of which is shown at 7, are slidably connected at one end in the usual manner to the remote edges of said door sections. The operating levers, in the example shown, are pivotally mounted intermediate their ends, as at 9. The other ends of the levers 7, are connected by links 11, 12, to the respective ends of a reciprocable cross head 13, adapted to be operated by any suitable form of power mechanism.

The type and construction of door shown and above referred to, is of common construction, and is selected as an illustrative example of a practical application of the principles of my invention, and in the details thereof form no part of my present invention.

Where doors of the sliding type are used the door sections are suspended from a trackway positioned thereover, and are carried by rollers 14 operating along said trackway.

The cross head 13 comprises end pieces connected together by rods 8 which are respectively located on opposite sides of the motor shown generally at 10, Figs. 1 and 2. This arrangement is advantageous in that it secures a well balanced action and movement of the reciprocable frame, and an equal distribution of the strains imposed on the motor mechanism in the accomplishment of its functions and purposes.

In the illustrative form of motor mechanism shown cylinders 16, 17, are employed in which operate the pistons 18, 19, carried by piston rods 20, 21. The cylinders 16, 17, in the particular form shown, to which, however, my invention is not to be limited or restricted, are arranged in line with each other and at their proximate ends are sup-

ported by a bracket or casting 22. The proximate ends of the cylinders are closed while their remote ends are open. The pistons 18, 19, are presented toward each other while their respective rods extend in opposite directions and away from each other and through the open ends of the respective cylinders, and are respectively connected to the end pieces of the cross head 13. The casting 22 which supports the proximate closed ends of the cylinders is provided with ports or passages 23, 24, which respectively communicate between the cylinders and a valve chest 25. This casting 22 is also provided with an exhaust port or passage 28. The ports 23, 24, 28, are formed in or through a surface of the casting 22 which extends into the valve chest 25, and constitutes a valve seat over or in coöperation with which works a valve 27. A pressure supply connection 26, delivers into the chamber 25. The under surface of valve 27, is provided with a duct or recess 29 of sufficient extent to embrace the ports 23 and 28, or the ports 24 and 28, at the same time, when the valve 27, occupies the one or the other of its normal limits of movement. The valve 27 is carried by a rod 30, which is connected to a piston 31, operating in a cylinder 32. A spring 33 arranged in the cylinder 32, serves to exert its pressure on piston 31, in a direction to force the latter out of the cylinder 32. The piston 31, forms a movable division wall or diaphragm between the cylinder 32 and the valve chamber 25. The rod 30, is extended, as at 34, into a closed head 35, which forms a guide therefor. The cylinder 32 communicates freely with an auxiliary chamber 37, through a port or passage 36, and passages 39, 40, respectively communicate between the auxiliary chamber 37, and the valve chest or chamber 25, and the outer air. A pilot valve 38, operates in the auxiliary chamber 37, to control passages 39, 40, the pilot valve 38, when moved to one limit of its travel closing passage 39, and opening passage 40, and when moved to the other limit of its travel closing passage 40 and opening passage 39.

The pilot valve 38, may be controlled in any suitable or convenient manner and from any suitable or convenient point. A simple arrangement is shown wherein a rod 41, is connected to the core 42, of a solenoid 43, the free end of said rod extending into the passage 40 into position to engage the end of the pilot valve 38, when said rod is moved endwise, by the energization of the solenoid, thereby shifting the pilot valve into position to close passage 39, and to open passage 40. When the circuit of solenoid 43 is opened the pressure in the valve chamber 25, acting through the passage 39, and against the opposite end of pilot valve 38, throws said pilot valve to its opposite limit of movement, thereby closing passage 40 and opening passage 39.

The circuit of solenoid 43, may be controlled from any desired point. For illustrative purposes I have shown a battery 44 and a switch 45, in the circuit of the solenoid whereby said circuit may be opened and closed whenever desired.

The automatic operation of the pilot valve 38 in emergency or safety operation may be accomplished in many different ways. In the form shown as illustrative of the principles of my invention, a shoe 46 is mounted upon the front edge of the door for movement relative to the door, and in such movement toward or upon the door said shoe is also given a longitudinal movement, which longitudinal movement is utilized to accomplish the automatic operation of the pilot valve. To this end I provide the door with brackets 47 adjacent its front edge, to which are pivotally connected links 48, which are also pivotally connected, as at 49, to the shoe 46, and serve to support the latter. Under normal conditions the links 48, are inclined to a vertical line passing through their points of pivotal connection 50, with the brackets. When in this position tail pieces or extensions 51 of said links 48, project below the pivoted point 50, and bear against the front or vertical edge surface of the door, thereby forming a limit stop to limit the relative movement of the shoe outwardly with reference to and away from the vertical edge of the door. The weight of the shoe serves to hold it in this normal position. When, however, the door, in closing, encounters an obstruction in its path, the shoe, coming in contact with the obstruction is arrested while the closing movement of the door continues. This action causes the links 48 to rock about their pivot points 50, the pivot points 49 thereof moving in an arc about the points 50, thereby causing the shoe 46 to move toward the door edge and also to move longitudinally and upwardly. Positioned above the door to be engaged and moved by the shoe 46 when it is thus shifted upwardly, is a member 52, which, in the form shown, is pivoted as indicated at 90, and which, when moved, as above explained, operates to rock a bell crank lever 53, through a link connection 54, said lever 53, having a rod 55 connected thereto and arranged, when projected by the bell crank lever 53, to engage and rock a lever 56, pivotally mounted as at 57, and arranged when rocked, to engage the pilot valve operating rod 41, in any suitable manner, as, for instance, by a collar 58, thereby shifting the pilot valve.

It may sometimes be desirable to lock the motor against operation. In such case it is necessary to release the lock when it is desired to move the door. A simple arrange-

ment for the purpose is shown wherein a rod 91 is provided with an arm 59, see Fig. 4, which is arranged between the lever 56 and the rod 61 of the solenoid core. In this arrangement the rod 60 which operates the pilot valve is located on the opposite side of lever 56. The rod 91 extends beyond the lever 56, and at its extreme end is pivotally connected to a gravity actuated locking dog 62. Under normal conditions the hooked end 63 of the dog 62, engages a lug 64 on the cross head 13, being held by gravity in locking engagement therewith. The release of the dog is effected by the endwise movement of rod 91, when the solenoid 43 is energized, the said release being effected before the pilot valve 38 is operated.

If desired, the motor mechanism may be located, as shown, between the wall members 66, 67, of a street car, for instance, above the doors in the roof portion of the car.

The operation of the apparatus is as follows:—Assuming the doors to be closed, the pistons 18 and 19 are at the extreme limits of their movements toward the left with port 23 open to the valve chamber and ports 28, 24, in communication with each other. This condition exists when the pilot valve is seated in position to close passage 40 and to open passage 39. Under these conditions the pressure in valve chamber 25 equalizes on opposite sides of piston 31, thereby enabling the tension of spring 33 to become effective to shift and hold the valve 27 in the position shown in Fig. 3. Now suppose it is desired to open the door. The switch 45 is operated to close the circuit of solenoid 43. Thereupon rod 41 is projected and the pilot valve 38 is shifted into position to close passage 39 and to open passage 40. This cuts off pressure from chamber 25 into cylinder 32, and opens the latter to atmosphere. The pressure in valve chamber 25, thereupon becomes effective against the outer face of piston 31, being opposed only by the pressure of spring 33, and overcoming said pressure shifts the piston 31 into cylinder 32, thereby shifting valve 27 into position to open port 24 to the pressure chamber 25, and to bring ports 23, 28 into communication with each other. This opens cylinder 18 to exhaust and supplies pressure to cylinder 17, thereby shifting the pistons 18, 19, and the cross-head 13 toward the right, and opening the door. This movement may be arrested and reversed at any point by merely opening switch 45, whereupon the pressure in chamber 25, acting upon pilot valve 38, through the passage 39, shifts said pilot valve into position to open passage 39, and to close passage 40. When this takes place the pressure in chamber 25 and cylinder 32 again equalizes and the pressure of spring 33 again becomes effective to shift valve 27 toward the right and into the position shown in Fig. 3. This action, therefore, not only arrests the motor, but also reverses it and the door is moved by the motor toward closed position. By again closing the switch 45, the motor is again reversed by the same operations above described and the door is moved by the motor toward open position. In case the lock dog 62 is employed, the energization of the magnet 43, will release the lock before the motor action commences.

If, in its closing movement, the door encounters an obstruction in its path, such as the body, arm, leg, or the like of a passenger boarding or alighting from a car, for instance, the shoe 46 will be shifted, as above explained, which movement through the connections 52, 54, 53 and 55 will cause the pilot valve 38 to be shifted to open passage 40 and to close passage 39, thereby automatically reversing the motor, and moving the door back toward open position. As soon, however, as the obstruction is removed thereby permitting the shoe to return to its normal or retracted position, the lever 56 is automatically released and hence the pressure in chamber 25, again acts upon pilot valve 38, to shift the same into position to close passage 40, and to open passage 39, thereby again reversing the motor and causing the door to resume its movement toward closed position.

Having now set forth the object and nature of my invention, and constructions embodying the principles thereof, I wish it to be understood that variations and changes in the details and arrangements may readily occur to persons skilled in the art through a wide range without departure from the spirit and scope of my invention as defined in the claims.

What I claim as new and useful, and of my own invention, and desire to secure by Letters Patent, is,—

1. In an apparatus of the class described, a door, a motor for moving the same, means actuated by the door encountering an obstruction in its path in closing for reversing the motor, and means whereby when the obstruction is removed the motor is immediately again reversed.

2. In an apparatus of the class described, a door, a motor connected thereto for moving the same, means carried at the front edge of the door and movable relatively thereto and devices operated by the movement of said means alone in either direction relatively to the door for reversing the motor.

3. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe mounted at the front edge of the door for relative movement toward and from the door, and means operated by the movement of the shoe in

either direction for reversing the direction in which the motor is operating previous to said movement.

4. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe mounted at the front edge of the door for relative movement toward and from the door, said shoe being normally held extended from the door, whereby when an obstruction is encountered in the path of the door in closing said shoe is moved toward the door, means operated by the movement of the shoe toward the door to reverse the motor, said means operating to again reverse the motor when said shoe again moves to its normal extended position.

5. In an apparatus of the class described, a door, a motor connected thereto for moving the same, manually operated devices for controlling the motor, and means for automatically controlling the motor including a safety device movably mounted at the front edge of the door, and connections intermediate said safety device and motor for reversing the latter when said safety device alone is moved in either direction relatively to the door.

6. In an apparatus of the class described, a door, a motor connected thereto for moving the same, devices for controlling the direction of operation of the motor, manually operated means to control said devices, and automatically operated means to control said devices, including a safety shoe movably mounted at the front edge of the door for movement toward and from the door, and connections intermediate said shoe and control devices for reversing the motor when said shoe alone is moved in either direction relative to the door.

7. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe, links for suspending the shoe at the front edge of the door whereby the shoe is movable toward and from the edge of the door, and means controlled by the movements of the shoe alone toward and from the door edge for reversing the motor.

8. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe, links for suspending the shoe at the front edge of the door whereby the shoe is movable toward and from the edge of the door, means operated by the movement of the shoe toward the edge of the door for reversing the motor, said means operating by the movement of the shoe away from the edge of the door to again reverse the motor.

9. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe carried at the front edge of the door and held by gravity in displaced relation away from the door edge, means operated by the movement of said shoe alone toward the edge of the door for reversing the motor, said means operated by the movement of the shoe alone in returning to its gravity position to again reverse the motor.

10. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe, links connected to the front edge of the door for movably suspending said shoe, whereby when said shoe is moved toward the door edge it is shifted endwise, means operated by the endwise movement of the shoe alone to reverse the motor, said means operating by the return of the shoe alone to normal position to again reverse the motor.

11. In an apparatus of the class described, a door, a motor connected thereto for moving the same, a safety shoe movably mounted at the front edge of the door, and means operated by the movement of the shoe alone relative to the door when an obstruction is encountered thereby during the closing movement of the door for reversing the motor to move the door toward open position, said means operating to immediately cause the motor to resume its closing movement of the door when the obstruction is removed.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this 6th day of May, A. D., 1915.

PARIS R. FORMAN.

Witnesses:
S. E. DARBY,
M. A. GRAEVE.