P. R. FORMAN.

DOOR OPERATING APPARATUS.

APPLICATION FILED NOV. 6, 1912.

1,285,100.

Patented Nov. 19, 1918.

2 SHEETS—SHEET 1.

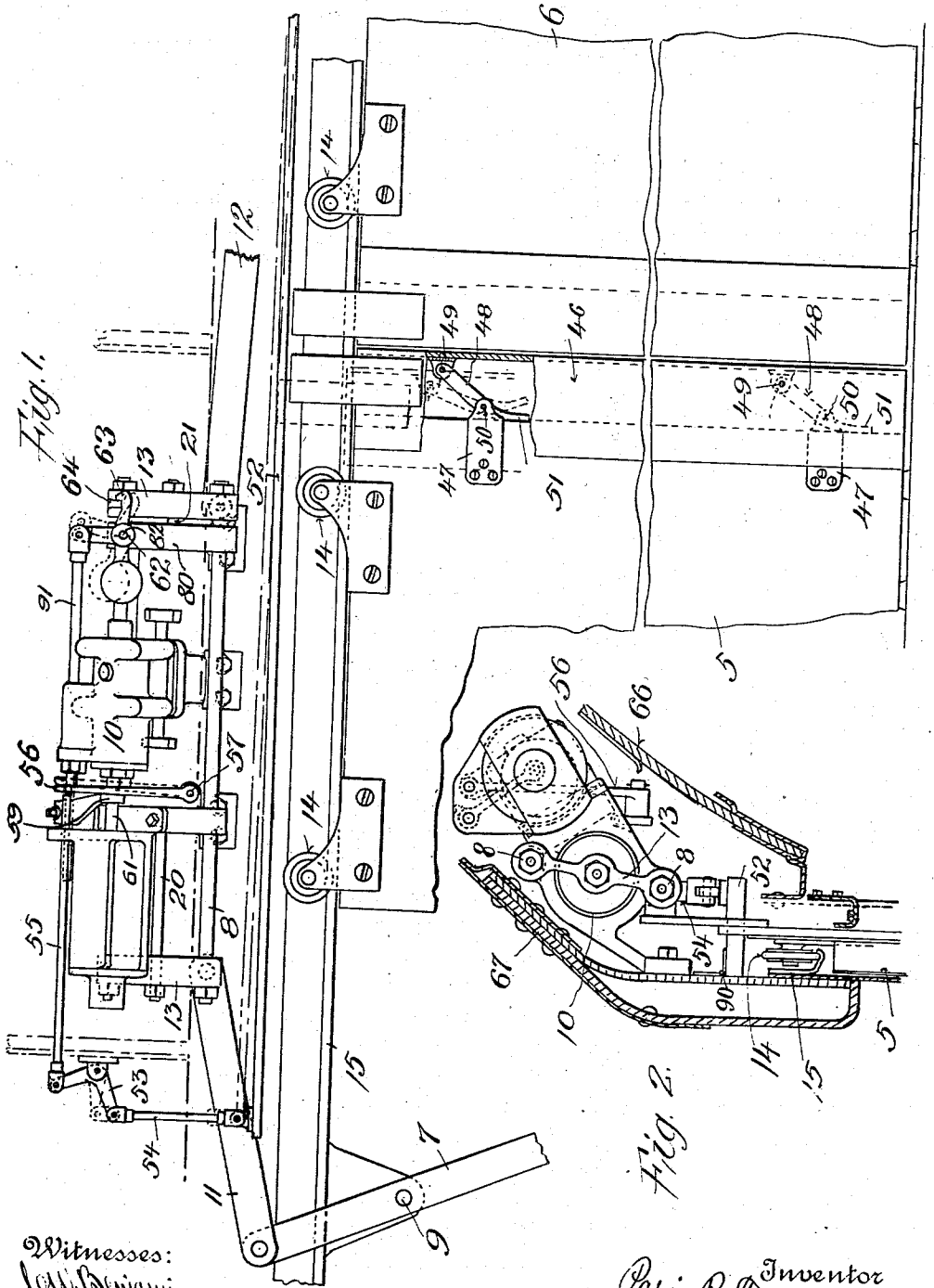


Fig. 1.

Fig. 2.

Witnesses:
W. W. Benjamin
Wm. McGrath

Inventor
Paris R. Forman
By his Attorney
Samuel E. Darby

P. R. FORMAN.

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2 SHEETS—SHEET 2.

Fig. 3

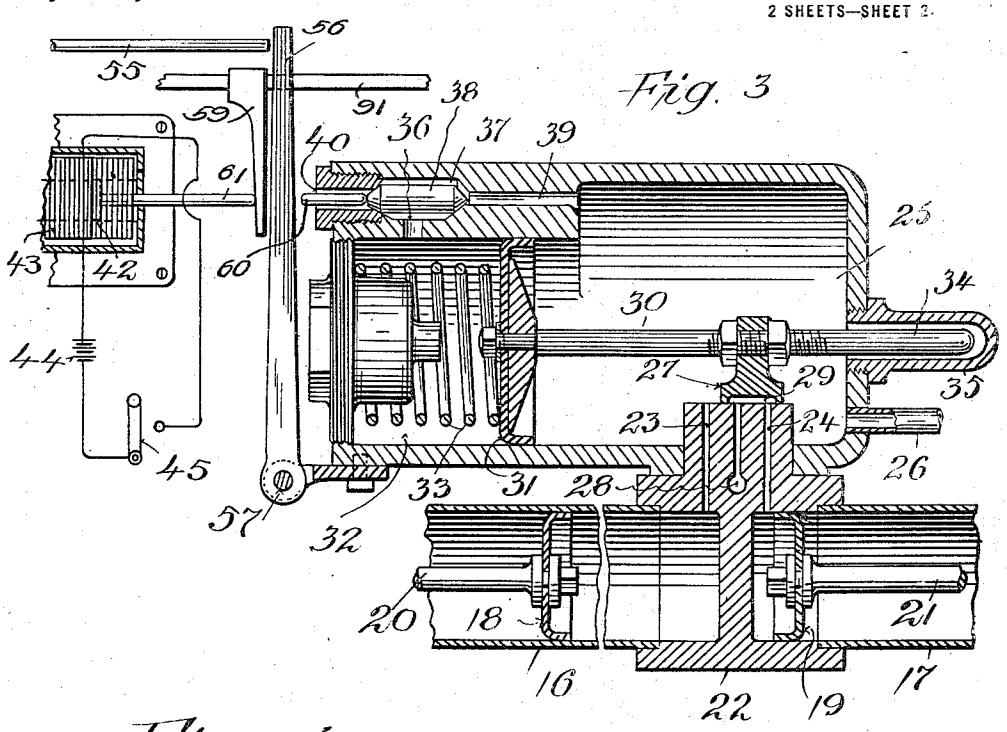


Fig. 4

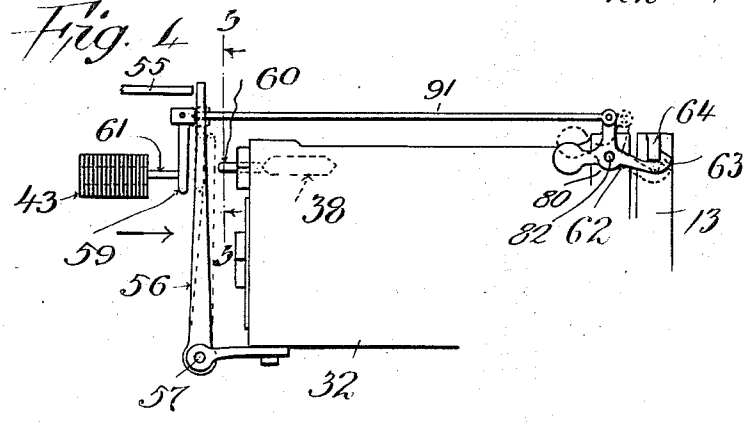
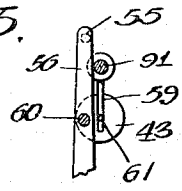


Fig. 5.



Witnesses:
W. Benjamin
Gamel Smith

Inventor
Paris R. Forman
By his Attorney
Samuel E. Darby

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.

1,285,100. Specification of Letters Patent. Patented Nov. 19, 1918.

Application filed November 6, 1912. Serial No. 729,730.

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.

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

A further object of the invention 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 arrested and reversed.

A further object of the invention is to provide means for locking the door in the limit of its movement, the lock mechanism being released automaticallv in advance of the operation of the door moving mechanism.

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.

In the accompanying drawing, Figure 1 is a view in elevation showing a door operating mechanism embodying the principles of my invention.

Fig. 2 is a view in end elevation of a type of door operating mechanism embodying my invention showing the same applied to a car structure, the car structure being shown in vertical section.

Fig. 3 is an enlarged broken detail view in section showing a form of power mechanism employed and control devices therefor embodying my invention.

Fig. 4 is a fragmentary view showing the action of the lock operating connections.

Fig. 5 is a sectional view taken on the line 5—5, Fig. 4 and looking in the direction of the arrows. The same part is designated by the same reference sign wherever it occurs throughout the several views.

Referring to the accompanying drawings, reference numerals 5 and 6 designate sliding door sections to the remote edges of which are slidably connected in the usual manner operating levers, one of which is shown at 7, said levers being pivotally mounted as indicated at 9, and being suitably connected through links 11, 12, to a traveling cross head 13, designed to be operated by a suitable form of power mechanism. The type and construction of door shown and above referred to is of common construction, and is selected for the purpose of illustrating the principles of my invention, and in the details thereof forms no part of my present invention as defined in the claims, and therefore may be varied throughout a wide range. My invention, therefore, is not to be limited or restricted to any particular construction or arrangement of doors or connections thereto for moving the same. Where doors of the sliding type are employed, the door sections are suspended upon rollers 14, operating on a trackway 15 positioned over the doorway and in a well known manner.

The cross head comprises the end pieces 13, which are connected together by rods 8, or otherwise, to form a traveling frame, the rods 8, being respectively located on opposite sides of the motor mechanism shown generally at 10, Figs. 1 and 2. This arrangement is advantageous in that it secures a well balanced action and movement and an equal distribution of the strains imposed on the motor mechanism in the accomplishment of its functions and purposes. The door operating link devices 11, 12 through which the door moving levers are operated, are connected to opposite ends of the cross head 13. This cross head is suitably mounted and guided to be shifted longitudinally by the motor mechanism 10. Where the doors are to slide toward each other in closing and away from each other in opening, the link 11 is connected on one side of the pivot of its door operating lever 7, while the link 12 is connected on the opposite side of the pivot of its corresponding lever not shown, in a familiar and well known manner.

In the form shown the motor mechanism comprises cylinders 16, 17 in which operate pistons 18, 19 having connected thereto piston rods 20, 21. The power cylinders 16, 17 are supported at their proximate ends by

a supporting bracket 22, said proximate ends of the cylinders being closed. The pistons 18, 19, face in opposite direction from each other and the piston rods 20, 21, respectively extend away from each other and from the closed end of the cylinders and through the remote open ends of the cylinders and are respectively connected to the end pieces 13 of the cross head. The casting or support 22 for the proximate ends of the cylinders is provided with port openings 23, 24, respectively, communicating between said cylinders and a valve chest 25. A pressure supply connection 26 delivers into the chamber 25 of the valve chest. The face of the supporting casting 22 which extends into the valve chamber 25 is formed into a valve seat over which operates a slide valve 27. The casting 22 is also provided with an exhaust port 28. The underface of valve 27 is provided with a duct or recess 29 of sufficient extent to bring the ports 23 and 28 or the ports 24 and 28 respectively into communication with each other 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 connected to a piston 31 operated in a cylinder 32, a spring 33 arranged in the cylinder 32 serving to exert its compression upon piston 31, tending to force it out of cylinder 32. The piston 31 forms a division wall or diaphragm between the cylinder 32 and the valve chamber 25. The piston rod 30 is extended as at 34 into a closed head 35 to form a guide therefor. A port 36 leads from cylinder 32 into an auxiliary chamber 37 in which operates a pilot valve 38 adapted to control passages 39, 40, between said chamber 37 and the interior of the valve chamber 25 and the outer air respectively, one or the other of these passages being closed and the other open when the pilot valve occupies one or the other of its limits of travel.

The pilot valve 38 may be controlled manually and also electro-magnetically in any suitable or convenient manner. A simple arrangement of manual operation is shown wherein a rod 91, the purpose for which will be more fully hereinafter discussed, carries thereon a lug 59. The rod 91 is out of alinement with the pivotally mounted lever 56, which bears against the rod 60 arranged to extend through the passage 40 to engage the end of the pilot valve 38. The rod 91 is offset relative to the lever 56 so that, while the rod 91 does not come in contact with the lever 56, the lug 59 thereof will.

The free end of the lug is positioned in alinement with the rod 61 which is connected to the core 42 of a solenoid 43. When the coil 43 of the solenoid is energized the rod 61 is moved endwise against the lug 59 which lug in turn engages the lever 56 and which in turn engages the rod 60 to shift the pilot valve 38 into position to close the passage 39 and to open passage 40. When the circuit of the solenoid is opened the pressure in the valve chamber 25 acting through the passage 39 and against the end of the pilot valve 38 throws said pilot valve into its opposite limit of movement to close passage 40 and open passage 39.

The circuit of the solenoid coil may be controlled in any suitable or convenient manner and from any desired point of control. I have indicated a control arrangement as illustrative of means for accomplishing this result wherein a battery or other source of current 44 is arranged in the circuit of the solenoid coil and a switch device 45 is also located in said circuit, whereby said circuit may be opened or closed whenever desired. The automatic operation of the pilot valve in emergency and for safety operation may be accomplished in many different ways. I have shown a simple arrangement as applied to the operation of doors whereby yielding shoes are mounted upon the front edge of the doors, which, in case the doors encounter an obstruction in their closing movements will automatically shift or move relatively to the doors and this movement is utilized to effect the automatic operation of the pilot valve. In the particular form and arrangement shown for accomplishing this result, I mount a shoe 46 upon the front edge of the door to telescope thereupon, and so mount it that in its telescopic movements upon the door it is also given a longitudinal movement. This longitudinal movement is utilized to accomplish the automatic operation of the pilot valve. To this end I provide the door 5, for instance, with brackets 47 adjacent its front edge and I pivotally mount levers 48 upon said brackets, said levers being pivotally connected at their upper ends, as indicated at 49, to the shoe 46. Under normal conditions the pivoted levers 48 are inclined to a vertical line passing through their points of pivotal connection 50 with the brackets 47, as shown in full lines in Fig. 1. When in this normal position tail pieces or extensions 51 of said levers 48 project below the pivotal point 50 thereof and bear against the 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 door. The weight of the shoe serves to hold it in this normal position. When, however, the door in closing encounters an obstruction the shoe moves toward the door thereby rocking the levers 48, and since their point of pivotal support 50 remains fixed, the pivotal axes 49 thereof describe arcs about the axes 50, as indicated in dotted line in Fig. 1 thereby shifting the shoe 46 upwardly, as it collapses upon or moves toward the door 5. Positioned above the door to be engaged and

rocked by the shoe 46 when it is thus shifted upwardly, as above explained, is a pivoted member 52, pivotally mounted at its rear edge as indicated at 90, Fig. 2, and which, when rocked, as above explained, operates to rock a bell crank lever 53, through a link connection 54 to one of the arms of said bell crank lever, the other arm of said bell crank lever having connected thereto a rod 55, arranged when projected endwise by the rocking movement of the bell crank lever 53 to engage and rock the lever 56 previously referred to, which is pivotally mounted as at 57 to a convenient fixed part of the apparatus, said lever 56 being arranged, when rocked, to engage the pilot valve operating rod 60 as previously explained and move the same to shift said pilot valve. To this end said rod is shown as engaging lever 56 whereby when the rod 60 is operated the lever 56 is rocked about its pivot 57.

From this construction and arrangement it will be seen that the manual and automatic operations of the pilot valve are independent of each other.

It is desirable to provide means for locking the motor against operation and to release the locking mechanism when it is desired to shift the door. Thus it is desirable to maintain the doors locked in their closed position, and the locking mechanism must be so associated that the devices which control the operation of the pilot valve 38 also release the locking means in advance of the operation of the pilot valve when said pilot valve is operated manually, that is by the solenoid controlling means. My invention contemplates the provision of means and mechanism for accomplishing this result, and I have shown a construction and arrangement embodying the principles of my invention in this respect wherein a rod 91 is provided with a lateral arm 59, which is arranged between the lever 56 and the rod 61 of the solenoid core, the rod 60 which operates the pilot valve 38 being located on the opposite side of said lever 56. As shown the rod 91 extends beyond the lever 56 at its extreme end and is pivotally connected to a gravity actuated locking dog 62 carried by a portion 80 of the frame, and pivotally secured thereto by a suitable pin 82, as shown best in Fig. 1. Under normal conditions the hooked end 63 of the locking dog engages a lug 64 upon the cross head 13, being held by gravity in locking engagement therewith and hence preventing any shifting movement of the cross head 13 until the locking dog is released from such engagement. This release is accomplished by the rod 91 when it is projected endwise by the solenoid, as above explained. The arm 59 is located between the lever 56 and the solenoid core rod 61 and the pilot valve operating rod 60 to insure a release of the locking dog 62 whenever the solenoid is operated. After the release of the locking dog, the pilot valve 38 is operated. In the arrangement shown in Figs. 3 and 4 the rod 55 extends into position to bear against the free end of lever 56, whereby when the rod 55 is shifted automatically by the safety shoe the lever 56 is rocked to operate the pilot valve without affecting the lock. In other words, when the solenoid 43 is energized, the arm 59 is moved toward the right thereby moving the rod 91 and lever 56, thus releasing the locking dog 62 and operating the valve 38. When the rod 55, however, is moved toward the right, the lever 56 and consequently valve 38 are operated without effecting any operation or movement of the rod 91.

In Fig. 2 I have shown a motor mechanism embodying the principles of my invention located between the wall members 66, 67 of a street car, for instance, and located above the doors in the roof portion of the car, thus illustrating the economy of space occupied by the motor mechanism constructed and arranged as above described.

The operation of the apparatus will be readily comprehended from the foregoing description, and briefly is as follows:

Assuming the doors to be in their closed position the piston 18 would be at the extreme limit of its movement toward the left and the piston 19 at the extreme limit of its movement also toward the left, that is, port 23 is open and ports 24 and 28 are in communication with each other. This condition exists when the pilot valve 38 is seated in position to close passage 40 and to open passage 39. Under these conditions the pressure of the valve chamber 25 is equalized on opposite sides of valve piston 31, thereby enabling the tension of spring 33 to be exerted to shift and hold the valve 27 in the position shown in Fig. 3. Now suppose it be desired to open the door. To do this switch device 45 is operated to close the circuit of solenoid 43. Thereupon rod 61 is projected endwise against lever 56 to move the pilot valve 38 to force the same into its seat to close passage 39 and to open passage 40. This permits exhaust of pressure from cylinder 32 to the outer air and cuts off pressure supply to said cylinder from the valve chest 25. Thereupon piston 31 is shifted toward the left by the pressure in valve chest 25 which overcomes the tension of spring 33 and shifts valve 27 toward the left so as to open port 24 to the valve chest and to open ports 23 and 28 to each other. Thereupon the cross-head 13 is shifted in the opposite direction and effects through the links 11 and 12 and their associated levers the opening movement of the door. The opening movement of the door will be arrested at any point by merely opening

switch 45, whereupon the pressure in valve chamber 25 acting against pilot valve 38 shifts said valve back again into position to close passage 40 and to open passage 39 to cylinder 32. When this takes place the tension of spring 38 again becomes effective to restore the valve 27 to the position shown in Fig. 3. This not only arrests the motor mechanism but also reverses it and a further reversal will take place when the circuit of the solenoid is again closed or opened. If, now, the door was locked by the locking dog 62 in its closed position, the shifting of rod 60 by the energization of the solenoid causes lever 56 to be rocked toward the right thereby shifting rod 91 toward the right and releasing the dog 62.

If, in closing, the door encounters an obstruction the shoe 46 will move upon the door or telescope upon the front edge thereof and will be shifted endwise by the lever link connections 48, which endwise movement is imparted to the pivoted member 52 and through the link 54 and bell crank 53 cause rod 55 to be shifted endwise, thereby shifting the pilot valve 38.

Having now set forth the object and nature of my invention and constructions embodying the principles thereof, 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 motor, an element to be moved thereby, a lock for the motor, a valve for controlling the motor movements, means for controlling said valve, said valve controlling means also serving to control the motor lock and independent means for controlling the valve without affecting the lock.

2. In an apparatus of the class described, a motor, a lock therefor, controlling means for the motor normally operating to maintain the motor at one limit of its travel and locked, manually controlled devices for actuating said controlling means, independent automatically controlled devices for actuating the motor controlling means, said manually controlled devices also operating, when actuated, to release said motor lock.

3. In an apparatus of the class described, a motor, a lock therefor, a valve for controlling the motor movements, a pilot valve for controlling the movements of the motor controlling valve, and devices for operating the pilot valve, said devices also serving to release the motor lock.

4. In an apparatus of the class described, a motor, a locking device therefor, a motor valve for controlling the movements of the motor, a pilot valve for controlling the movements of the motor valve and manually controlled devices for operating the pilot valve, said devices also operating to release the motor locking device.

5. In an apparatus of the class described, a motor, a locking device therefor, a motor valve for controlling the movements of the motor, a pilot valve for controlling the movements of the motor valve, automatically controlled devices for operating the pilot valve and manually controlled devices for operating the pilot valve, said manually controlled devices also operating to release the motor locking device.

6. In an apparatus of the class described, a motor, a locking device therefor, a motor valve for controlling the movements of the motor, a pilot valve for controlling the movements of the motor valve, manually controlled devices for operating the pilot valve, independent automatically controlled devices for operating the pilot valve, and connections whereby, when the pilot valve is operated by the manually controlled devices the motor lock is released.

In testimony whereof I have hereunto set my hand in the presence of the subscribing witnesses, on this first day of November, A. D., 1912.

PARIS R. FORMAN.

Witnesses:
B. D. JOHNSON,
L. M. SHIELDS.