H. ROWNTREE.

POWER OPERATED MECHANISM FOR MOVING DOORS OR THE LIKE.

APPLICATION FILED OCT. 16, 1912.

1,339,671.

Patented May 11, 1920.

2 SHEETS—SHEET 1.

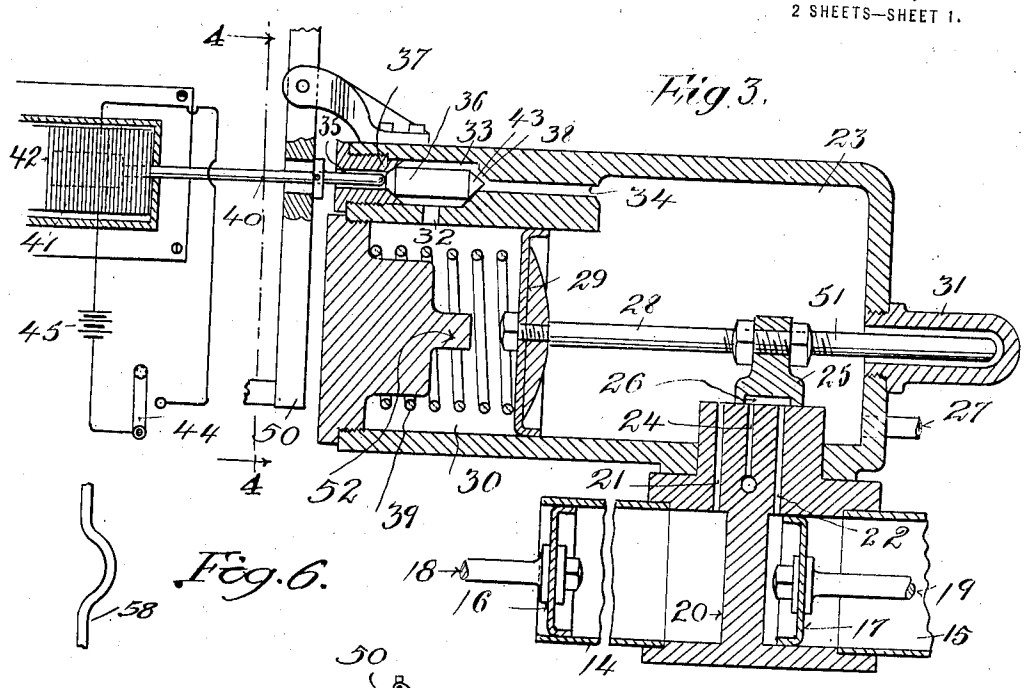


Fig. 3.

Fig. 6.

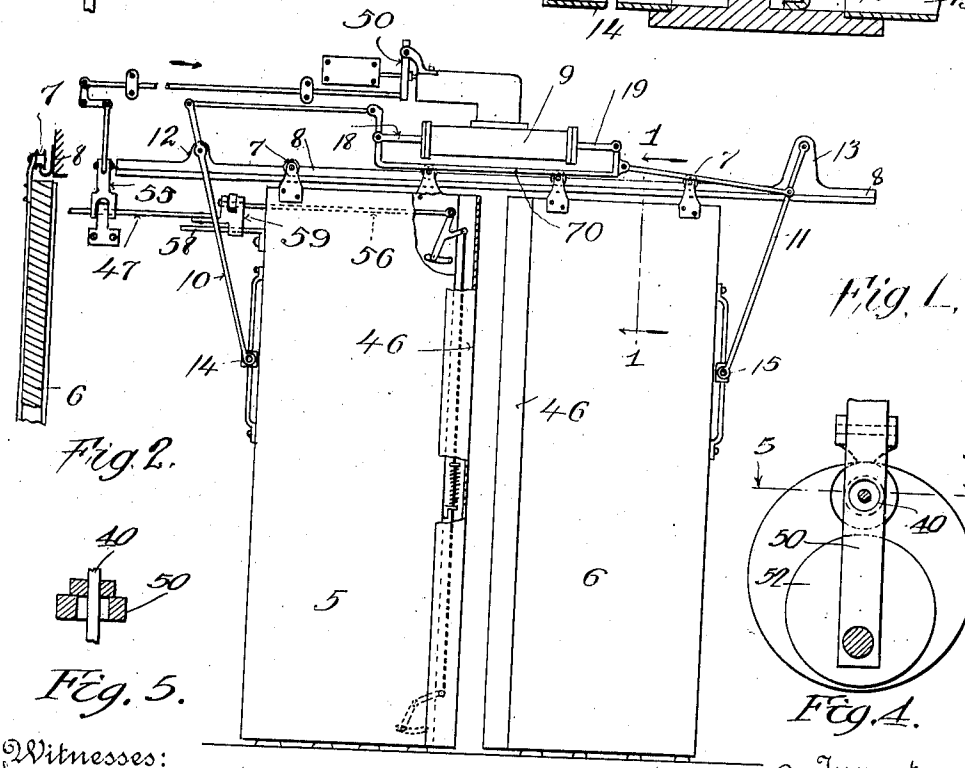


Fig. 1.

Fig. 2.

Fig. 5.

Fig. 4.

Witnesses:
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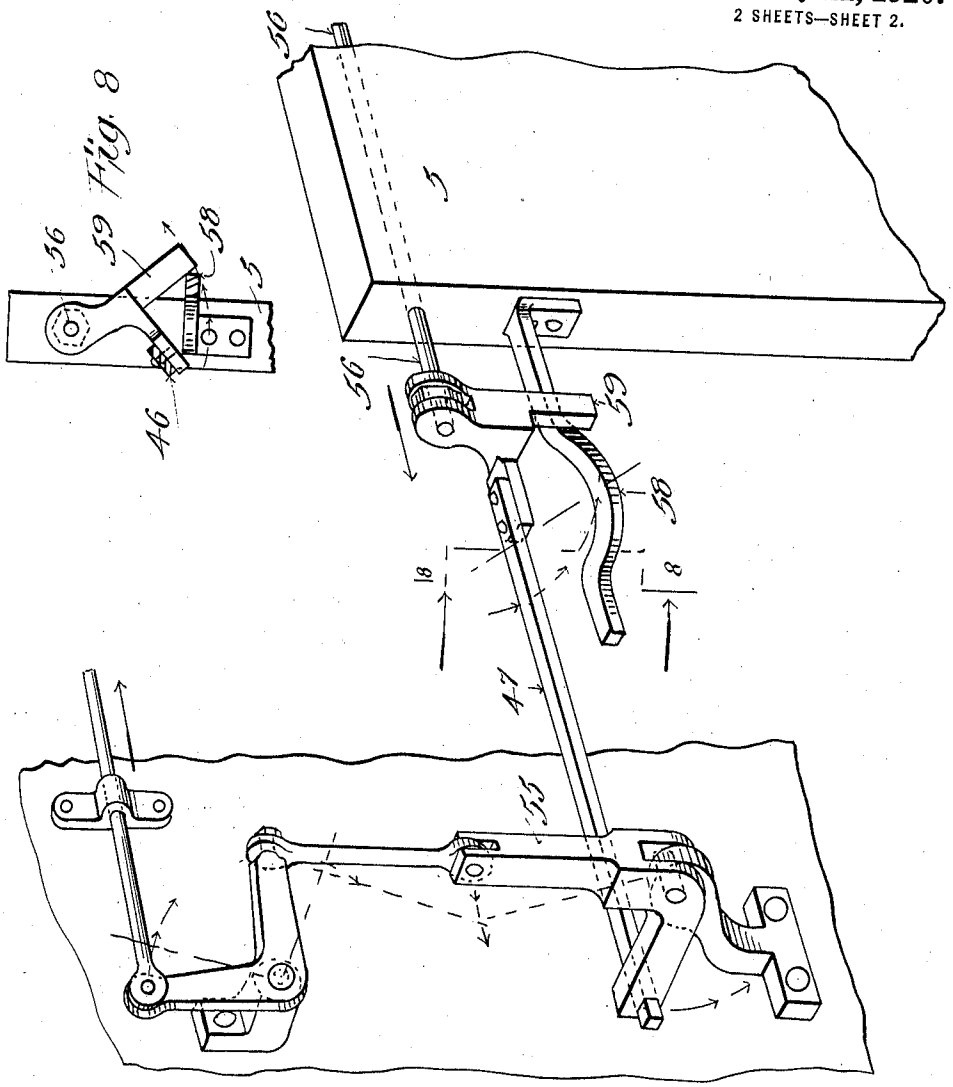


Fig. 7

Fig. 8

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UNITED STATES PATENT OFFICE.

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POWER-OPERATED MECHANISM FOR MOVING DOORS OR THE LIKE.

1,339,671. Specification of Letters Patent. Patented May 11, 1920.

Application filed October 16, 1912. Serial No. 725,985.

To all whom it may concern:

Be it known that I, HAROLD ROWNTREE, a citizen of the United States, residing at Kenilworth, county of Cook, State of Illinois, have made a certain new and useful Invention in Power-Operated Mechanism for Moving Doors or the like, of which the following is a specification.

This invention relates to power operated mechanism for moving doors or the like.

The object of the invention is to provide a construction and arrangement of power operated mechanism for moving doors or the like, which is simple and efficient.

A further object is to provide a mechanism of the character referred to which operates to normally hold the door or other member moved by it, in one limit of such movement, but which is controllable to shift the door or other member toward the limit of its movement in the opposite direction, whenever desired, which last mentioned movement may be arrested at any desired point, and the door or other member permitted or caused to return to its normal position.

A further object is to provide a power mechanism and control therefor of the character referred to, which may be automatically operated in case of exigency, as a safety appliance.

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 drawing and finally pointed out in the appended claims.

Referring to the accompanying drawing, and to the various views and reference signs appearing thereon,—

Figure 1 is a view in front elevation of a power operated mechanism embodying my invention, and showing the same applied to doors for moving the same.

Fig. 2 is a vertical transverse section of the same on the line 1, 1, Fig. 1.

Fig. 3 is a broken detail view in section, showing a control arrangement for the power mechanism.

Fig. 4 is a sectional view taken on the line 4, 4, Fig. 3, looking in the direction of the arrows.

Fig. 5 is a sectional view taken on the line 5, 5, Fig. 4, looking in the direction of the arrows.

Fig. 6 is a detailed view showing the shape of the cam rod employed in accordance with my invention.

Fig. 7 is a view in perspective, considerably enlarged, of the operating connections between the pilot valve and the door as shown in Fig. 1. Fig. 8 is a sectional view taken on the line 8, 8, Fig. 7, 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.

In the operation of doors or other moving members it is desirable to retain the same normally in one limit of the movement thereof but to permit or cause the movement thereof toward the opposite limit under suitable conditions of control, either manual or automatic, whereby the door or other movable member may be operated as necessity requires. It is also desirable to accomplish the movement of the part to be moved by power mechanism. In the accomplishment of these results and particularly where compressed air is employed as the power medium, it is desirable to provide a control mechanism in which the use of stuffing boxes for piston rods, or other sources of leak may be eliminated and avoided.

It is among the special purposes of my present invention to provide a construction and arrangement of power actuated mechanism, and control devices therefor, which is simple and efficient, for accomplishing these and other desirable results.

I have shown, and will now describe, my invention, as applied to the operation of doors, but I wish it to be understood that, in its broadest scope, as defined in the claims, my invention is not to be limited or restricted to such use.

In the drawing 5, 6, designate two doors, shown as of the sliding type, though the particular type of door is not of consequence. In the case of sliding doors, selected for illustrating my invention, the doors are shown as being suspended by rollers 7, operating on a track 8, in a well known manner. The doors or sections 5, 6, in the form shown, are mounted to slide edgewise toward and from each other to closed or open

position. Reference numeral 9, Fig. 1, designates generally, the power mechanism employed for operating the movable doors or members. Any suitable or convenient connections intermediate the power mechanism and the parts to be moved may be employed. A simple arrangement is shown wherein the outer edges of the door sections are slidably engaged as at 14, 15, by levers 10, 11, respectively, which are pivotally carried on brackets 12, 13, and having such relation that when the power mechanism is operated in one direction the movable members, as 5, 6, are shifted in unison away from each other, and when said power mechanism is operated in the other direction said members are shifted in unison toward each other. Where doors or door sections are the movable members, as in the case shown in the drawing, the operation of the power mechanism in one direction or the other, operating through the rock levers 10, 11, causes the door sections to move into closed or open position as the case may be.

In the construction shown in the drawing as illustrative of my invention, the power mechanism employed for effecting the door operations is of the pneumatic type, and consists of two cylinders 14, 15, having the pistons 16, 17, operating respectively therein, the rods 18, 19 of said pistons extending in opposite directions from each other, in the particular form shown. It is obvious, however, that said cylinders may have any desired relation and arrangement so long as in their respective working strokes said pistons operate against each other. The arrangement of cylinders shown wherein they are in line with each other is very simple and convenient, and they occupy comparatively little space, a feature which is desirable on account of the fact that frequently the space available for the installation is limited. Where the cylinders are in line with each other the working faces of the pistons are presented toward each other, as shown, and the piston rods 18, 19, work through the remote open ends of the cylinders. At their proximate ends the cylinders are carried in a support 20, having ports 21, 22, delivering from a closed valve chest or chamber 23, respectively into the proximate closed ends of the cylinders. The support is also provided with an exhaust port 24, communicating with a suitable exhaust connection, not shown. The ports 21, 22 and 24, terminate within the chamber or chest 23, on the face of a portion of the support 20, which forms a valve seat and with which the valve 25, coöperates. This valve on its seating face, is provided with a passage 26 adapted to bring the ports 21 and 24, into communication with each other when the valve 25 is shifted into one position, while at the same time leaving the port 22 in free communication with the chest or chamber 23, and to bring the ports 22 and 24 into communication when said valve is shifted in the opposite direction, and at the same time leaving port 21 in free communication with the chamber or chest 23. The valve chamber or chest 23, is in communication through pipe or other connection 27, with any suitable or convenient source of pressure medium supply.

The valve 25, is carried by the rod 28, of a piston 29, arranged to operate in a cylinder 30, said rod being guided, if desired, in any suitable manner, as, for instance, by having its end 51 operating in a guide hand 31. The piston 29, forms in effect, a diaphragm separating the chamber 23 from the cylinder 30, said cylinder being otherwise closed except for a port 32, leading therefrom, on one side of the piston or diaphragm 29, into a small chamber 33, which communicates through a passage 34 with valve chest 23, and the opposite side of the piston or diaphragm 29. The small chamber 33, also communicates with the outer air to afford an exhaust for cylinder 30 under conditions of operation hereinafter to be described. Such an exhaust opening is afforded by the passage 35. Within the small chamber 33, is arranged a pilot valve 36 with a very slight range of movement, and designed to control the passage 34 and the exhaust opening 35. In the particular form shown to illustrate this feature of my invention the pilot valve 36, is shaped at its ends to seat against valve seats 37, 38, respectively formed at the terminations of the passages 35, 34, so that when in one limit of its movement the pilot valve seats against seat 37, and in the other limit it seats against the seat 38.

The operation of the apparatus so far described is as follows:

With the parts in the relative positions shown, the main valve 25 is in position to uncover port 21, thereby admitting pressure medium to cylinder 14, and to bring ports 22 and 24 into communication with each other, thereby opening cylinder 15, to exhaust. Under this condition the piston 16 is held by the pressure medium in the limit of its working stroke, and hence the parts to be moved, as for instance, the door sections 5, 6, are held, say, in closed position. The main valve 25, is held in this position by the tension of a spring 39, arranged in cylinder 30, to bear against the piston or diaphragm 29. Since, in the positions of the parts shown, the pilot valve 36, is seated against the seat 37, thereby closing the exhaust 35, the cylinder 30 is in free communication through port 32, chamber 33, and passage 34, with the main valve chest 23. Consequently the pressure is equalized on opposite sides of the piston or diaphragm

29, and hence the tension of spring 39 becomes effective to hold the piston 29, its rod 28, and the main valve 25, in their respective positions as shown. Now if the pilot valve 36, be shifted into position to seat against the seat 38, the passage 34, is closed and the exhaust port 35 is opened. Thereby the cylinder 30 is cut off from communication with the main valve chest 23, and consequently from the source of pressure, and the pressure contained in said cylinder is permitted to exhaust to the atmosphere. Under these conditions the pressure medium acts only against that face of the piston or diaphragm 29, which is presented to the interior of the main valve chest 23. This pressure overcoming the tension of spring 39, shifts the piston or diaphragm 29 into the cylinder 30, thereby shifting the main valve 25, into position to uncover port 22 and to bring ports 21 and 24 into communication with each other. This operation opens cylinder 14 to exhaust and permits supply of operating medium to cylinder 15. Thereupon piston 17, accomplishes its power stroke, and the parts to be moved, say, for instance, the door sections 5, 6 are shifted or moved to their open position. This condition will continue until the pilot valve 36, is again shifted into position to close exhaust passage 35, and open communication between the main valve chest 23 and the cylinder 30, through passage 34, chamber 33 and port 32, whereupon there is again an equalization of pressure on opposite sides of piston 29, and hence the spring 39, again becomes effective to shift the piston 29, and with it the rod 28 and valve 25, as above explained, back into their initial positions, whereby the doors will be closed and will remain closed, being held in that position by the power medium acting against the piston 16, until the pilot valve 36, is again shifted into position to close passage 34, and to open exhaust passage 37, when the cycle of operation above pointed out is repeated.

I will now describe means, in accordance with the principles of my invention for controlling the operation of the pilot valve 36. It is obvious that the control of this valve may be accomplished in many specifically different ways. In the first place it is desirable to control the movements of the pilot valve in such a manner that the parts to be moved, such, for instance, as doors, may be opened and closed at will. It is also desirable that the pilot valve be moved automatically as in the case of doors, in order to automatically cause the opening of the doors when, in closing, they encounter an obstruction, such as the arm, foot or other part of a passenger or person passing through the doorway controlled by such doors, in order to prevent accident or injury to such person or passenger. In accordance with my invention I propose to provide means for accomplishing both methods of control of the pilot valve. In describing the control of the pilot valve and in claiming the inventive features contained therein, I will employ the term "manual" operation or control of the pilot valve, intending to include by such expression both the electrical arrangement shown in Fig. 3 and the collapsible shoe control arrangement shown in Fig. 1, both of which arrangements I will now describe.

As illustrative of means for effecting the manual control of the valve I have shown said valve as acted upon by a rod 40, which is arranged to extend into line with and to be engaged or to normally bear against the end of the core 41, of a solenoid 42, being normally held thereagainst by the pressure of the pressure medium in the main valve chest 23, acting against the end face 43, of the pilot valve. This not only normally holds the rod 40, endwise against the core 41, but also holds the valve 36, seated against seat 37, thereby opening passage 34 to cylinder 30, and permitting spring 39, to hold the main valve 25, in the position thereof as shown in the drawing. The circuit of the solenoid 42, may be controlled in any suitable or convenient manner so that when the solenoid coils are energized the core 41, thereof engages the end of rod 40, and shifts the pilot valve into position to close passage 34, and to open passage 35 and to hold it in that position so long as the circuit of the solenoid remains closed. The instant this circuit is opened the pressure medium acting against the face 43, of the pilot valve shifts said valve, and with it the solenoid core 41, back into their initial or normal positions. A simple illustrative arrangement for controlling the circuit of the solenoid 42, is shown comprising a switch 44, arranged in the circuit leads to the solenoid and a suitable source of current therefor as indicated at 45. It is obvious that the switch 44, may be operated or controlled in any suitable or convenient manner or from any convenient point.

Many different ways may be employed for accomplishing the automatic operation or movement of the pilot valve. A simple arrangement is shown as applied to the operation of doors wherein the meeting edges of the door sections are equipped with movable shoes, which yield or telescope onto the doors in case they encounter an obstruction during the closing movement of the doors. Any suitable arrangement of this nature may be employed. In the form shown, the doors or sections 5, 6, are provided with telescoping or yielding shoes 46, mounted to yield or telescope upon their respective section when an obstruction is encountered.

Connected to one of the door sections to move with it is a rod or bar 47, preferably of square or other suitable shape in cross section and arranged to slide freely through an opening in a pivoted lever 55, the relation being such that while said rod is permitted to slide freely through the opening in the lever 55, any rotative movement imparted to said rod will cause a corresponding rocking movement to the lever. The shoe 46 telescopically mounted at the edge of the door is normally held yieldingly distended and connected thereto is a rod 56, which moves with it. The rod 56 is connected to the rod or bar 47. Also connected to the door is an arm 58, having a cam shaped portion or twist in a portion thereof which is designed to pass through a guide 59 carried by a bar 47. When the bar 47 is moved independently of the door, as, for instance, when the shoe 46 yields telescopically onto the door, the cam portion of bar 58, causes axial rotation of the bar 47. This imparts rocking movement to lever 55, which is suitably connected to a lever 50, which when rocked engages the rod 40 of the pilot valve and shifts the same. The yielding or telescoping movement of the shoe upon the door which carries it causes an endwise movement of the rod or bar 47, relative to the door and hence also relatively to arm 58, thereby causing the cam portion or twist of bar 58 to effect a rocking movement of the lever 50 and a consequent actuation of the rod 40, and the pilot valve 36, and a consequent arrest and reversal of the movement of the door or other part being moved.

The movements of the main valve 25, in one direction or the other to cause it to occupy one or the other of its two operating positions may be limited or stopped in any suitable or convenient manner. A simple arrangement is shown wherein the end portion 51, of rod 28, engages the end wall of the guide 31, to limit the movement thereof in one direction, the movement of said rod in the opposite direction being limited by the piston 29, being brought up against a stop 52, carried by the endwall of the cylinder 30. This stop 52, may also serve as a support to hold the spring 39 in place.

The movements of the motor pistons 16, 17, may be stopped by one or the other of said pistons coming up against the endwall of the support 20.

The piston rods 18, 19, are connected to move together. This may be accomplished in any suitable way, as for instance, by means of a bar or link 70, see Fig. 1.

It will be observed that the operating lever 10 is hinged intermediate its ends to bracket 12, and has sliding connection at one end to the member 5 to be moved, while the power device is connected to the other end of said lever. The lever 11, on the other hand, is slidingly connected at one end to the member 6 to be moved and is pivoted at its other end to the bracket 13, and the power mechanism is connected to said lever intermediate its ends. With this arrangement it results that when the power mechanism is operated in one direction the members 5, 6, move simultaneously away from each other, and when said power mechanism moves in the opposite direction said members move simultaneously toward each other.

The operation of the apparatus will be fully understood from the foregoing description in connection with the drawing.

It will be seen that the arrangement shown and described is not only simple and efficient but that the valve operation and control is effected without the necessity of providing stuffing boxes. It will also be seen that a safety arrangement is provided which effects the automatic arrest and reversal of the door operating motor in case the doors, in closing encounter an obstruction, thereby providing against injury or accident by reason of or resulting from the doors closing upon persons or passengers passing through the doorway controlled by the doors.

Having now set forth the object and nature of my invention and a construction 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, and means for controlling the supply and exhaust of operating medium to and from the motor, including a valve, a single piston, and piston rod, for operating the valve, a pilot valve to control the supply of operating medium to one side of the piston and the exhaust of pressure from that side of the piston, means for maintaining a constant supply of fluid pressure in the opposite side of said piston, means effective to hold the valve in one extreme position when the pressure is equalized on opposite sides of said piston, and means manually controlled for controlling said pilot valve.

2. In an apparatus of the class described, a motor, and means for controlling the operation of the motor, including a main valve for supplying fluid pressure to and exhausting the same from said motor, a single piston, and piston rod for operating said valve, means mechanically actuating said piston for normally holding the valve in one position to maintain the motor at one limit of its operation, a pilot valve for controlling the valve operating means, and manually controlled means for controlling the pilot valve.

3. The combination with a motor, a valve for supplying fluid pressure to and exhaust-

ing the same from said motor for controlling the motor movements, fluid pressure actuated means for moving the valve, said means normally operating to maintain the valve in an initial position to permit the motor to stand at one limit of its action, a pilot valve for controlling the valve operating means, and manually controlled means for operating the pilot valve.

4. The combination with a motor, and a valve for supplying pressure to and exhausting the same from said motor for controlling the motor movements, of fluid pressure actuated means for moving the valve, said means operating to normally maintain the valve in an initial position to permit the motor to stand at one limit of its action, a pilot valve for controlling said valve operating means, means manually controlled for operating the pilot valve, and independent electrically operated means for operating the pilot valve.

5. In a motor mechanism, a motor, a main valve for supplying fluid pressure to and exhausting the same from said motor for controlling the operation thereof, a pilot valve for controlling the operation of the main valve, electrically controlled means for operating the pilot valve in its normal operation, and mechanically actuated means for operating the pilot valve.

6. In a motor mechanism, a motor, a valve for supplying fluid pressure to and exhausting the same from said motor for controlling the operation thereof, a cylinder inclosing said valve, a single piston operating in said cylinder, and connected to said valve, a pilot valve for controlling the operation of the piston, and manually controlled means for operating the pilot valve.

7. In a motor mechanism, a motor, a valve for supplying fluid pressure to and exhausting the same from said motor for controlling the operation thereof, a cylinder, a single piston operating therein, a pilot valve for controlling the operation of the piston, electrically controlled means for operating the pilot valve in the normal operation thereof, and independent means for operating the pilot valve.

8. A pneumatic motor having a valve for controlling the same, a chest inclosing said valve and communicating with a source of pressure supply, a cylinder, a single piston operating therein and connected to the valve, an exhaust port for said cylinder, a passage intermediate said cylinder and valve chest, a pilot valve for controlling said exhaust port and passage whereby when either said passage or said exhaust port is opened the other is closed and manually operated means for operating said pilot valve.

9. In an apparatus of the class described, a motor, and means for controlling the supply and exhaust of operating medium to and from the motor, including a main valve, a single piston, and piston rod for operating the valve, a passage for establishing communication to opposite sides of said piston, a pilot valve for controlling said passage, a spring for maintaining said piston at one limit of its movement, and manually operated means for shifting the pilot valve to cause the piston controlling the valve to shift its position.

10. The combination with a motor and a control valve therefor, of a movable piston connected to the valve to operate it, said piston being open to pressure supply on one side thereof, a spring acting against the opposite side of said piston, a pilot valve for controlling the supply of pressure medium to the spring engaged side of the piston, and manually operated means for operating the pilot valve.

In testimony whereof I have hereunto set my hand, in the presence of the subscribing witnesses, on this 25th day of September, A. D. 1912.

HAROLD ROWNTREE.

Witnesses:
W. A. DARBY,
S. E. DARBY.