Aug. 17, 1937. R. D. CONKLIN ET AL 2,089,932

DOOR OPERATING APPARATUS

Filed Aug. 5, 1936 3 Sheets-Sheet 1

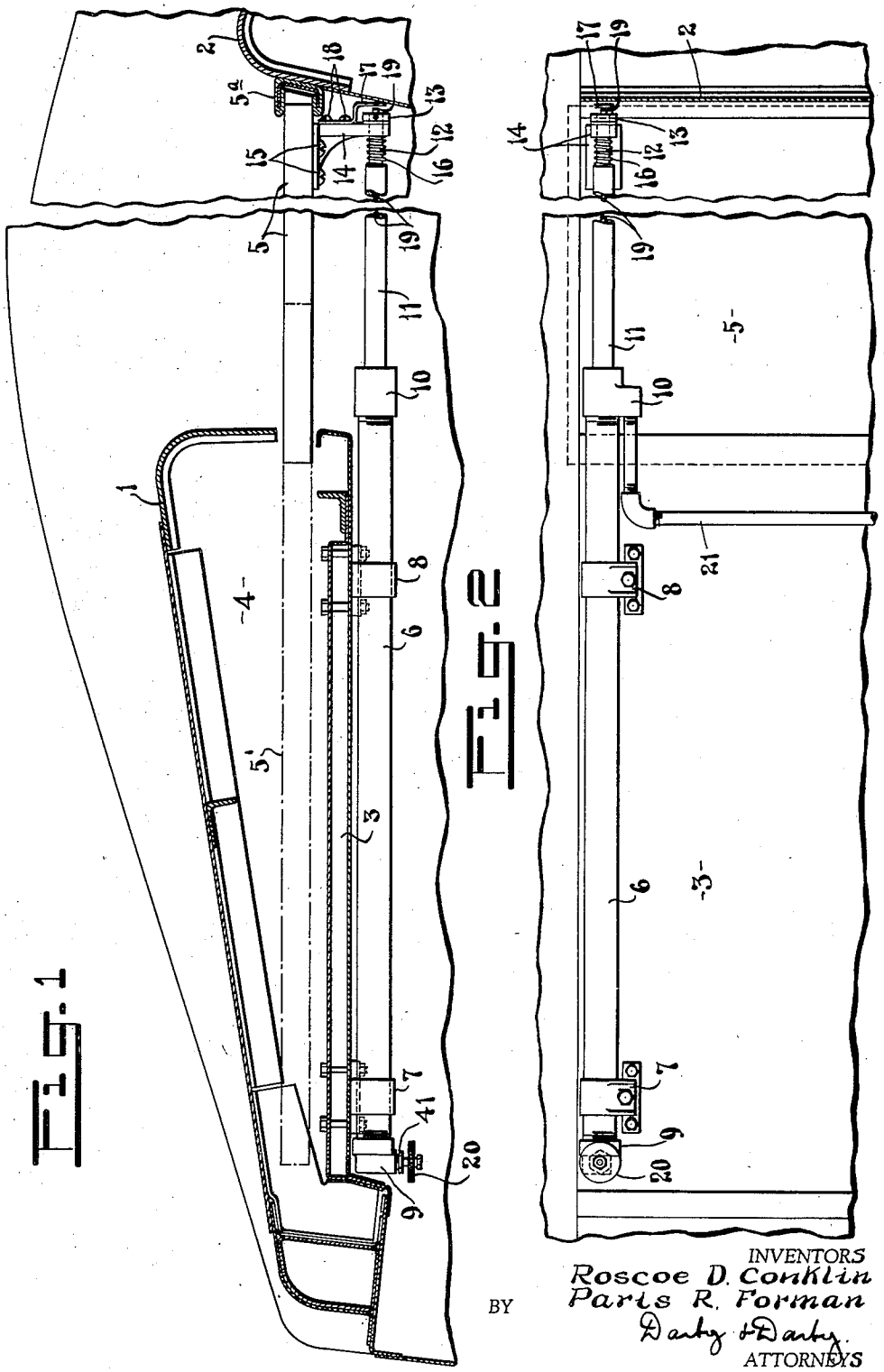


Fig. 1

Fig. 2

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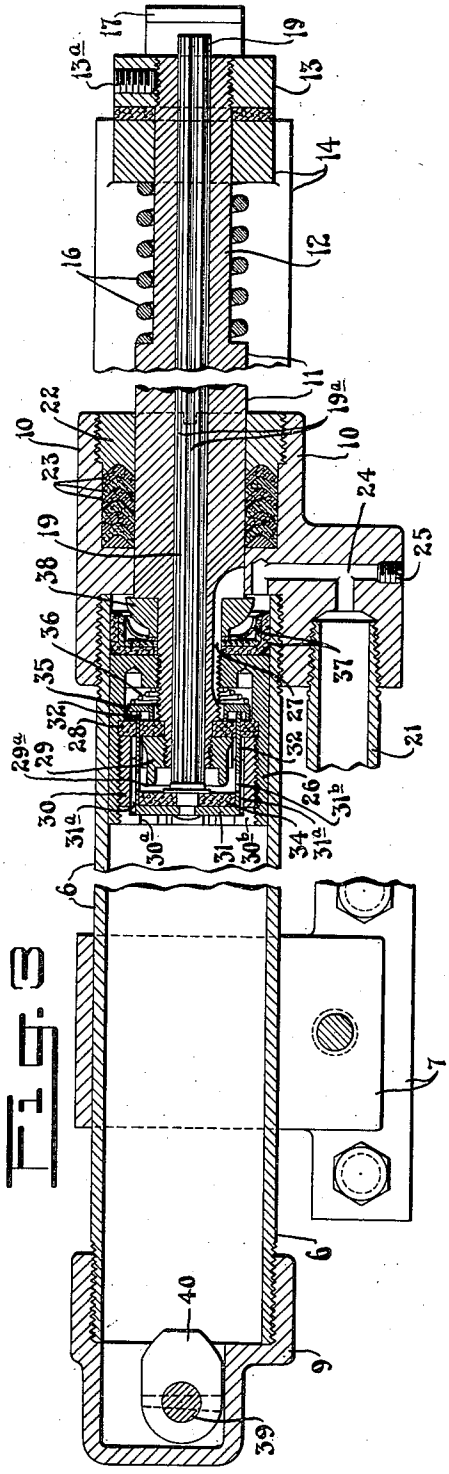


Fig. 3

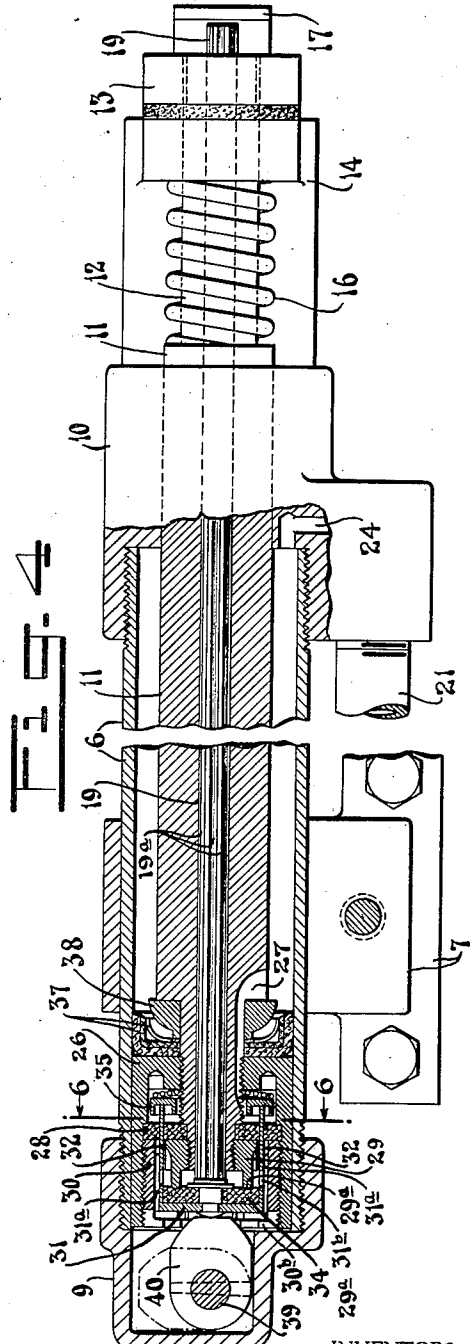


Fig. 4

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Fig. 5

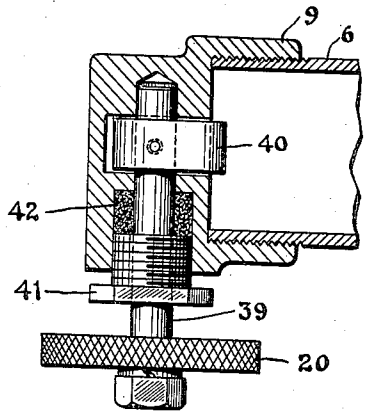


Fig. 7

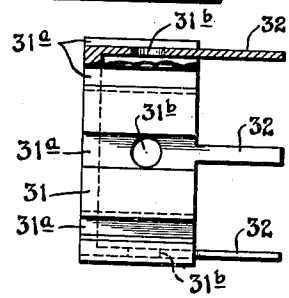


Fig. 8

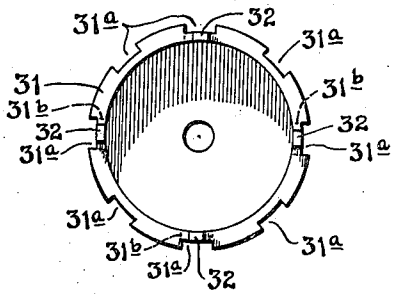


Fig. 6

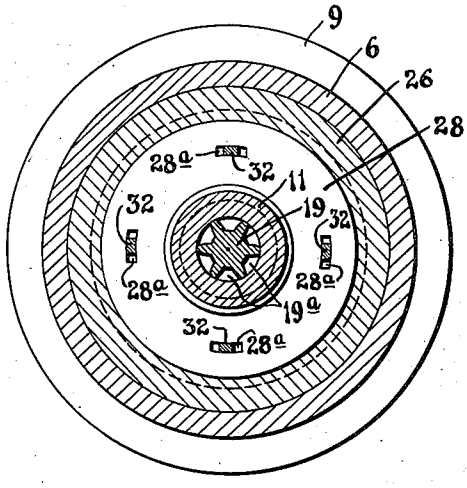
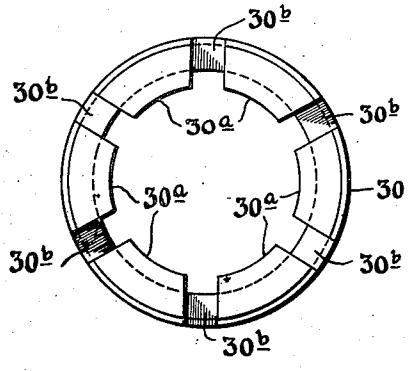


Fig. 9



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2,089,932

DOOR OPERATING APPARATUS

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Application August 5, 1936, Serial No. 94,364

10 Claims. (Cl. 268—50)

This invention is for improved combinations involving doors or other movable objects and a pressure fluid operated engine for moving them.

The general object of this invention is to provide a door motor applied to a door in such a manner that upon initial manual movement of the door the motor is energized to cause the door to move to completely open position.

A further object is to provide a motor in the above combination which automatically, upon opening of the door to full position is energized in the reverse direction to cause the door to completely close.

A still further object is to provide, in a combination of this type, an arrangement wherein the door, if it strikes a person or object in closing, will be reversed in its movement to full open position by reverse energization of the motor.

A still further object of this invention is to provide, in such a combination, mechanism by means of which the motor may be conditioned to maintain the door in open position.

A still further and more specific object of the invention is to provide an arrangement in which the fluid pressure is supplied to the engine at all times for holding the door closed and, when so conditioned, for holding the door open.

These and many other objects, as will appear from the following disclosure, are secured by means of this invention.

This invention resides substantially in the combination, construction, arrangement, and relative location of parts, all in accordance with the following description as related to the attached drawings.

In the accompanying drawings—

Figure 1 is a top plan view with some parts in cross-section and some parts broken away of a complete combination in accordance with this invention;

Fig. 2 is a side elevational view with some parts in cross-section and some parts broken away of the mechanism of Fig. 1;

Fig. 3 is a longitudinal vertical central cross-sectional view through the engine, with some parts broken away showing the valves in position for door opening operation;

Fig. 4 is a similar view showing the valve mechanism in the position it takes just as the motor is at full door open position with the valves in position for door closing operation;

Fig. 5 is an enlarged cross-sectional view of the manually operable mechanism for conditioning the motor to hold the door open;

Fig. 6 is a cross-sectional view taken on the line 6—6 of Fig. 4;

Fig. 7 is a side elevational view, with some parts in section, of one of the valve parts;

Fig. 8 is a right hand end elevational view thereof; and

Fig. 9 is a left hand end elevational view of another part of the valve mechanism.

This invention has been developed particularly with the object in view of providing a motor for operating the end or vestibule doors of cars, such as steam, street, and subway cars. As is the common practice, a plurality of cars are coupled up into a train and communication is had between the various cars through the end or vestibule doors in the end walls of the cars. On subway lines, for example, in swinging around sharp curves, the doors, at present manually operated, if not latched or fastened, swing back and forth and thereby are a source of possible injury to passengers. Furthermore, when a passenger wishes to move from one car to the next it is necessary to manually move these doors, which requires an exertion on the part of the passenger which varies depending upon the freedom of movement of the door and also upon whether, at the time the doors are being opened or closed, the cars are going around a curve, which either tends to resist opening or closing of the doors, or to assist opening or closing of the doors. The arrangement of this invention involves a pressure fluid operated engine permanently connected to doors of this type which is energized to open the doors upon initial manual movement of the doors by the passenger.

A specific form of mechanism by means of which the objects of this invention are accomplished will now be described. The end of a transportation vehicle, such as a subway car, is more or less diagrammatically illustrated in Fig. 1 as comprising the end walls 1, 2, which are separated to provide a doorway at the end of the car. Within the outer walls at 1 is an inner wall structure 3 commonly employed in modern subway car construction. It is between these inner walls that the door 5 slides on tracks or rails or other suitable supporting mechanism into the space 4. These doors are commonly provided with a handle suitably located to be grasped by the person operating them. In accordance with this invention a particular form of engine is mounted on the car body, as shown on the inner wall 3 near the top thereof, by means of suitably formed brackets or clamps 7 and 8. The engine is shown as a rather long extended

structure involving a cylinder 6 closed at one end by a specially formed cap 9, and at the other end by means of a differently formed cap 10. At 11 is the long piston rod which passes through the cap 10 and is connected at the inner end to a particular form of piston valve structure. The outer end 12 is of reduced diameter and passes through a hole in a bracket 14 which is rigidly secured to the forward edge of the door 5 near the top thereof by means of suitable bolts 15. The reduced end 12 of the piston rod, which projects through the bracket 14, is provided, as is clear from Fig. 3, with a threaded collar 13 which is locked thereon by means of a lock nut 13a. Rigidly secured to the bracket 14 by means of screws 18 is an arm 17 which projects across the end of the piston rod so as to be positioned to engage a free longitudinally slidable rod 19 which lies in the central bore extending all the way through the piston rod. Interposed between the shoulder on the piston rod and the bracket 14 is a spring 16 which will be referred to later.

The cap 10 is provided with a threaded passage which receives the fluid pressure supply pipe 21 so as to be in communication with a passage 24 which extends to a point where it opens into the right hand end of cylinder 6. This passage is formed by boring from the outside and is normally closed by a screw plug 25.

The piston assembly comprises a cylindrical cup-like member 26 which is threadedly mounted on the reduced threaded left hand end of piston rod 11 and by which the usual leather piston cups and associated equipment 37 are locked thereon against a collar 38. The cup member 26 is formed so as to have an internal shoulder against which a sealing disc 28 of some suitable material is locked by means of an externally threaded bushing member 30. The disc 28 is locked onto a further reduced threaded portion of shaft 11 by means of an annular nut 29 which terminates at its free end in an annular seat 29a. The piston rod 11 is provided with a short passage 27, the periphery thereof extending axially so as to be open at one end to the interior of cylinder 6 and at the other end to the space between the end wall of the cup member 26 and the disc 28.

Within the space between the bushing 30 and the disc 28 is a valve member 31 of the form clearly shown in Figs. 7 and 8. It is of cylindrical cross-section and of cup-shape and provided at the open edge with four extensions 32 which pass through, as is clear from Fig. 6, holes 28a in the disc 28. These holes are larger than the extensions to provide fluid passages. The periphery of the valve member 31 is provided with a series of axially extending grooves 31a which communicate with radial holes or ports in the said walls of the valve member, as shown at 31b. The bushing 30 is of the form shown in Fig. 9. It is externally threaded and is provided at one end with extensions 30a extending a short distance inwardly in a radial direction to form a stop for the valve member 31. These extensions are separated by grooves or spaces 30b, to be referred to later. Secured to the inner wall of the valve member 31 is a suitable valve disc 34 positioned to engage at the proper time with the annular seat 29a.

In the space between the end wall of the cup member 26 and the disc 28 is a movable valve member 35 which is annular in form and has a central aperture to fit around the reduced end of the piston rod 11. This annular valve member 35 is provided with an annular groove on the face towards the disc 28 so that when it is seated thereon it seals off all of the passages 28a. A spring 36 rests on the annular valve member 35 normally tending to seat it.

Journalled on the end cap 9 is a short shaft 39 which passes through a packing 42 and a packing gland nut 41 and is provided on its external end with a hand operated knob 20. Keyed to the shaft is a cam 40 which may be moved to either of two positions, as is clear from Fig. 4. The piston rod 11 passes through suitable packing 23 in the end cap 10 and a packing gland nut 22. As is clear from Fig. 6, the rod 19 is longitudinally fluted, as indicated at 19a, which fluting extends throughout the length thereof. As shown in Fig. 1, the forward edge of the door 5 is provided with suitable shock absorbing or resilient material to form a buffer and seal in accordance with common practice.

Figs. 1 and 2, from an external viewpoint, show the position of the parts with the door in closed position. Fig. 3 shows the position of the parts of the motor itself in door closed position and just after the following described operation occurs.

A passenger wishing to open the door 5 grasps the usual handle and starts to move the door. This carries bracket 14 along to the left, compressing spring 16 and causing arm 17 to engage the projecting end of rod 19. Further movement of these parts causes rod 19 to move to the left, unseating valve 34 from the seat 29a on which it always rests while the door is closed. At the same time valve 35 seats on disc 28 under the action of spring 36 and the pressure fluid acting through passage 27. This opens the left hand end of cylinder 3 which, prior thereto, is at the same pressure as is present in pipe 21, to the atmosphere through grooves 30b in the bushing 30, grooves 31a in the valve member 31, ports 31b in that member, and to atmosphere through the fluting 19a in rod 19. Thus the left hand end of the cylinder 6 is open to the atmosphere. The full pressure from pipe 21 is on the right hand end of the piston so that the motor immediately picks up the door and causes it to open to full position without any further exertion on the part of the passenger. Spring 16 is sufficiently strong to hold the parts in normally relative position, but not strong enough to noticeably resist the initial manual movement of the door. The motor picks up the door as soon as the piston rod moves sufficiently with respect to bracket 14 to cause collar 13 to engage the bracket. Just as the door is fully opened the cam member 40, which is normally in the full line position shown in Figs. 3 and 4, engages the valve member 31 and holds it against further movement so that the final movement of the piston, which is of a very short amount, causes the annular seat 29a to engage the disc 34. This closes off the left hand end of cylinder 6 from the atmosphere through the piston rod. At the same time the extensions 32 cause the valve member 35 to unseat, compressing spring 36. This position of the parts is clearly shown in Fig. 4.

At this time pressure fluid flows from the right hand of the cylinder 6 through passage 27 through the ports 28a and ports 31b, grooves 31a, and slots 30b into the left hand end of cylinder 6. The area of the piston at this end, as is apparent from the drawings, is larger than the right end area of the piston so that although the same fluid pressure exists on both sides of the

piston assembly, the piston nevertheless begins to move to the right carrying the parts with it. The spring 16 is sufficiently strong to cause the door to move with the piston rod without any relative movement with respect thereto unless the dor strikes an object in closing. If no object is struck the motor continues to move the door until it is fully closed. When the door motor is at full closed position the valve parts stay in the position shown in Fig. 4 and the piston rod and door and related parts stay in the position shown in Figs. 1, 2 and 3. The door will again open when it is again moved a slight distance so that the arm 17 engages rod 19, shifting it to the left to cause valve disc 34 to leave the seat 29a, permitting valve disc 39 to seat. The engine will then move the door to full open position.

If the door should strike an object in closing it will itself come to a stop, but the piston assembly and piston rod will continue to move, compressing spring 16 until rod 19 engages the arm 17. This will cause valve disc 39 to unseat and valve 35 to seat so that the left hand end of the cylinder is open to exhaust and the engine will reverse its movement and move the door to full open position. As before, as it attains full open position, the cam 40 will shift the valve parts to cause the door to immediately begin to close. To hold the door at full open position it is only necessary to turn knob 20 so that cam 40 is swung up to the dotted line position shown in Fig. 4. Under these circumstances, when the piston assembly reaches its extreme movement at the left so that it strikes the shoulder formed by the cap 9 the valves will not shift but will stay in the position shown in Fig. 3 so that the left hand end of the cylinder remains open to exhaust. As soon as the pressure is on the right hand side of the piston assembly the engine will hold the door open. To close the door it is only necessary to swing cam 40 down to the full line position, which will shift the valve parts to cause the engine to move the door to the closed position.

From the above description it will be apparent that this invention resides in certain principles of construction and operation which may be embodied in other physical forms without departure from the scope thereof. We do not, therefore, desire to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What we seek to secure by United States Letters Patent is:

1. In a door operating mechanism, the combination comprising a door, a pneumatic motor mounted adjacent the door, valve means for controlling the motor, means secured to the door and interconnected with the valve means whereby the initial manual movement of the door actuates the valve means to cause the motor to open the door, and means for automatically operating the valve means when the door is fully opened to actuate the motor in reverse direction.

2. In a door operating mechanism, the combination comprising a door, a fluid pressure operated engine mounted adjacent the door, valve mechanism for controlling the energization of the engine, means mounted on the door for operating the valve to energize the motor to open the door upon initial movement of the door, and means for reversing the valve at the end of the opening stroke of the motor to cause reverse energization of the motor to close the door.

3. In a door operating mechanism, the combination comprising a door, a fluid pressure operated engine for operating the door mounted adjacent thereto, comprising a cylinder, a piston in said cylinder, a piston rod connected to the piston and projecting from one end of the cylinder, a valve mounted on the piston, an operating member for the valve extending through and projecting from the piston rod, and means mounted on the door for engaging the valve operating member upon initial movement of the door to operate the valve to energize the motor to open the door.

4. In a door operating mechanism, the combination comprising a door, a fluid pressure engine mounted adjacent the door and having a projecting piston rod, means for connecting the piston rod to the door, said means being relatively movable with respect to the piston rod, and a valve for controlling the fluid pressure engine and operable by said connecting means upon initial movement of the door to operate the valve to cause the motor to open the door.

5. In a door operating mechanism, the combination comprising a door, a fluid pressure engine mounted adjacent the door and having a projecting piston rod, means for connecting the piston rod to the door, said means being relatively movable with respect to the piston rod, a valve for controlling the fluid pressure engine and operable by said connecting means upon initial movement of the door to operate the valve to cause the motor to open the door, and means for actuating the valve to door closing position just as the engine fully opens the door.

6. In a door operating mechanism, the combination comprising a door, a pressure fluid operated motor mounted adjacent the door comprising a cylinder, a piston mounted in the cylinder, a piston rod connected thereto and projecting from the cylinder, means for connecting the piston rod to the door, a two position valve mounted on the piston rod, an operating member for the valve projecting from the piston rod, and means for engaging the operating member when the door is given an initial opening movement to move the valve to one of its positions to cause the motor to fully open the door.

7. In a door operating mechanism, the combination comprising a door, a pressure fluid operated motor mounted adjacent the door comprising a cylinder, a piston mounted in the cylinder, a piston rod connected thereto and projecting from the cylinder, means for connecting the piston rod to the door, a two position valve mounted on the piston rod, an operating member for the valve projecting from the piston rod, means for engaging the operating member when the door is given an initial opening movement to move the valve to one of its positions to cause the motor to fully open the door, and means for engaging the valve at the end of the piston door opening movement to shift the valve to its other position to cause the motor to immediately close the door.

8. In a door operating system of the type described, the combination comprising a door, a pressure fluid operated motor mounted adjacent the door comprising a cylinder, a piston within the cylinder, a piston rod connected thereto and projecting from the cylinder, a bracket secured to the door through which the piston rod extends, said piston rod being relatively slidable with respect to the bracket in one direction, means including a valve for supplying pressure fluid to the engine to operate it in either direction, an

operating member for the valve, and means for causing the operating member to position the valve to open the door when initial movement of the door causes relative movement between the bracket and piston rod.

9. In a door operating system of the type described, the combination comprising a door, a pressure fluid operated motor mounted adjacent the door comprising a cylinder, a piston within the cylinder, a piston rod connected thereto and projecting from the cylinder, a bracket secured to the door through which the piston rod extends, said piston rod being relatively slidable with respect to the bracket in one direction, means including a valve for supplying pressure fluid to the engine to operate it in either direction, an operating member for the valve, means for causing the operating member to position the valve to open the door when initial movement of the door causes relative movement between the bracket and piston rod, and means for causing the valve to be positioned to cause the motor to close the door at the end of its opening stroke.

10. In a door operating system, the combination comprising a door, a pressure fluid motor for operating the door comprising a cylinder, a piston within the cylinder, a hollow piston rod connected thereto and projecting from the cylinder, a two position valve mounted on the piston, an operating member for the valve lying in the hollow piston rod and projecting from the exposed end thereof, and means mounted on the door and interconnected with the piston rod for engaging the operating member upon initial movement of the door to energize the motor.

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