

Feb. 14, 1939.

R. D. CONKLIN ET AL
AIR ENGINE

2,147,150

Original Filed Aug. 5, 1936

3 Sheets-Sheet 1

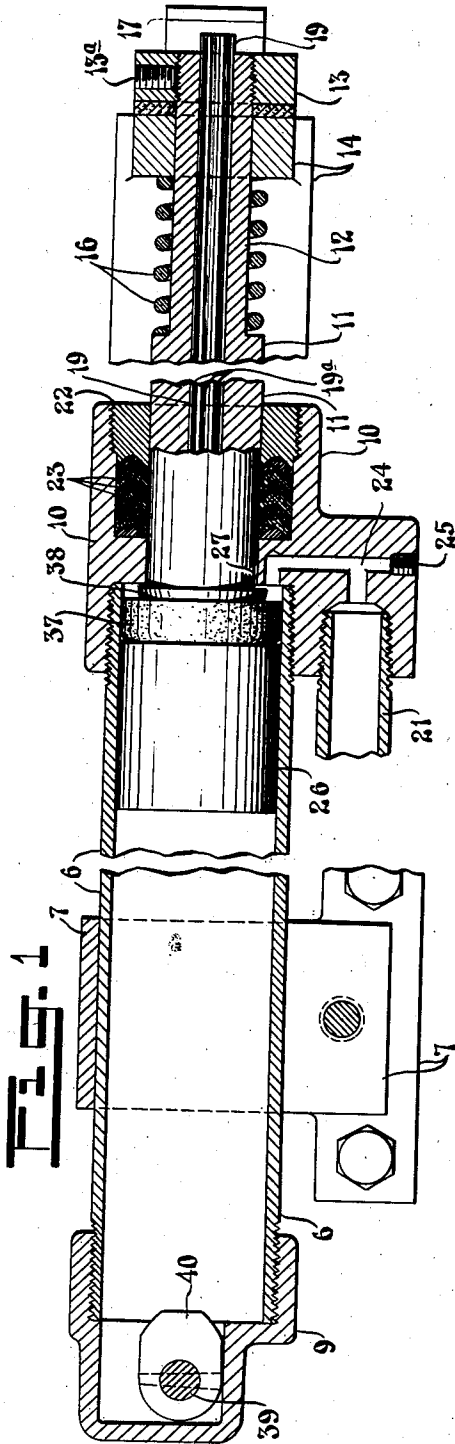
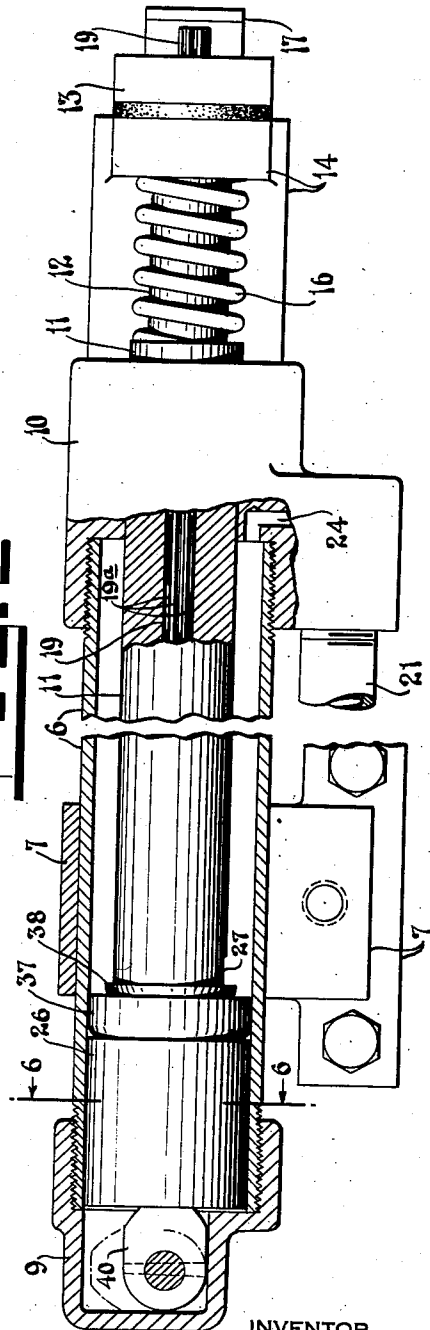


Fig. 2



INVENTOR
ROSCOE D. CONKLIN
PARIS R. FORMAN
BY

Darby & Darby
ATTORNEYS

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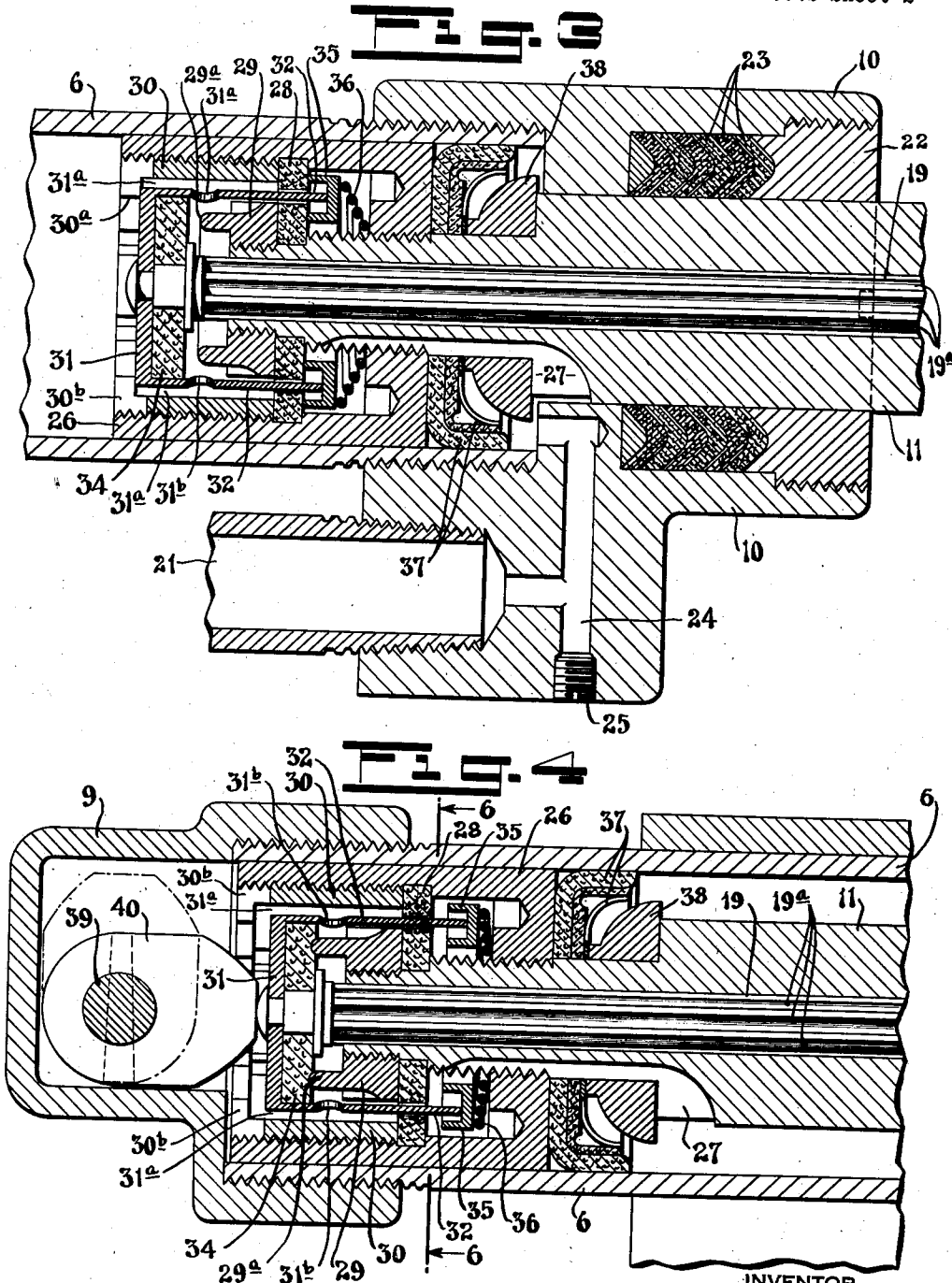
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INVENTOR
ROSCOE D. CONKLIN
PARIS R. FORMAN
BY
Daby Daby
ATTORNEYS

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3 Sheets-Sheet 3

FIG. 5

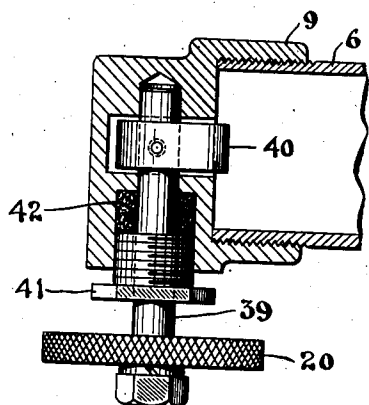


FIG. 7

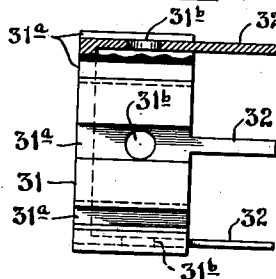


FIG. 8

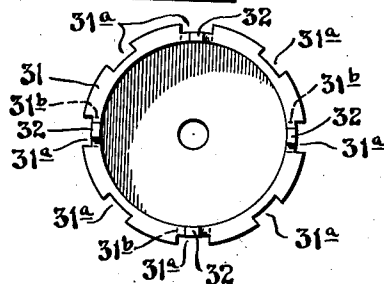


FIG. 6

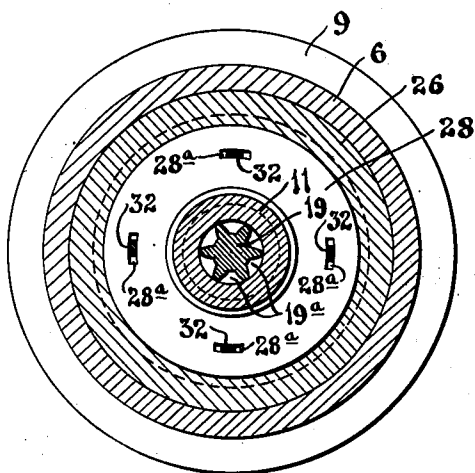
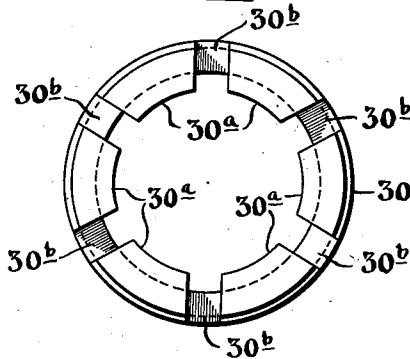


FIG. 9



INVENTOR
 ROSCOE D. CONKLIN
 PARIS R. FORMAN
 BY *Darby & Darby*
 ATTORNEYS

UNITED STATES PATENT OFFICE

2,147,150

AIR ENGINE

Roscoe D. Conklin and Paris R. Forman, Rahway,
N. J., assignors to National Pneumatic Com-
pany, New York, N. Y., a corporation of West
Virginia

Original application August 5, 1936, Serial No.
94,364, now Patent No. 2,089,932, dated August
17, 1937. Divided and this application January
13, 1937, Serial No. 120,371

8 Claims. (Cl. 121-44)

This invention relates to pressure fluid oper-
ated engines of the reversible type which can be
set to automatically return to its initial position
after operating therefrom to the end of its stroke
in one direction.

An object of this invention is to provide in
simplified form a pressure fluid operated engine
which in normal operation is always connected to
the pressure fluid source and which has its con-
trolling valve incorporated into the structure of
the piston and which is provided with an exter-
nally projecting operating member.

A further object is to provide a positionable
member which in one position cooperates with
the valves on the piston to cause the piston to
return to initial position at the end of its stroke
from that position, but when the positionable
member is moved so as not to cooperate with the
valves the piston remains at the end of its stroke
from its initial position.

The invention includes many additional objects
which are successfully secured by means of the
construction herein disclosed and which will be
apparent from the following description.

This invention resides substantially in the com-
bination, construction, arrangement and relative
location of parts, all as will be described in great-
er detail in the following specification.

This application is a division of our co-pend-
ing application Serial No. 94,364, filed August 5,
1936, for Door operating apparatus and issued
as Patent No. 2,089,932 on August 17, 1937.

In the accompanying drawings,

Figure 1 is a vertical, central, longitudinal,
cross-sectional view of the engine with some
parts in elevation and some parts broken away;

Figure 2 is a somewhat similar view to that of
Figure 1 with additional parts in elevation show-
ing the piston and connected parts at the other
extreme position;

Figure 3 is an enlarged, longitudinal, vertical,
central, cross-sectional view through the piston
assembly showing the valves in position for oper-
ation of the piston to the other end of the cyl-
inder;

Figure 4 is a similar view at the other end of
the engine with the valves in the position that
they take just as the piston is at the end of its
stroke towards that end of the cylinder; the
valves being then set to automatically return
the piston to the other end of the cylinder;

Figure 5 is an enlarged, cross-sectional view of
the manually operable or positionable member
which cooperates with the valves on the piston;

Figure 6 is a cross-sectional view taken on the
line 6-6 of Figure 4;

Figure 7 is a side elevational view with a por-
tion in section of one of the valve parts;

Figure 8 is a right hand elevational view there-
of; and

Figure 9 is a left hand elevational view of an-
other part of the valve mechanism.

The engine is shown comprising a cylinder 6
closed at one end by a specially formed cap 9, 10
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 con-
nected 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. The reduced end 12 of the piston
rod, which projects through the bracket 14, is
provided, as is clear from Fig. 1, with a threaded
collar 13 which is locked thereon by means of a
lock nut 13^a. Rigidly secured to the bracket 14
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 30
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 nor-
mally 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 bush-
ing 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 29^a. 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 28^a 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 31^a which communicate with radial holes or ports in the said walls of the valve member, as shown at 31^b. The bushing 30 is of the form shown in Fig. 9. It is externally threaded and is provided at one end with extensions 30^a 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 30^b, 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 29^a.

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 28^a. 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 19^a, which fluting extends throughout the length thereof.

If it be assumed that the engine is to operate a sliding door on a vehicle such as a subway car, it is mounted adjacent the door by means of brackets 7. The bracket 14 is secured to the forward or free end of the door. If a passenger wishes to open the door he applies pressure to it by grasping the usual handle or knob and starts to move it towards opening position. 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 disc 34 from the seat 29^a 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, was at the same pressure as is present in pipe 21, to the atmosphere through grooves 30^b in the bushing 30, grooves 31^a in the valve member 31, ports 31^b in that member, and to atmosphere through the fluting 19^a 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 Fig. 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 29^a 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 28^a and ports 31^b, grooves 31^a, and slots 30^b 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 door strikes an object in closing. If no object is struck the engine continues to move the door until it is fully closed. When the door engine is at full closed position the valve parts stay in the position shown in Fig. 4, and the piston rod and related parts stay in the position shown in Figs. 1 and 3. When in this position the piston remains there having been stopped by the adjacent cylinder head so that no relative movement takes place between the piston and the bracket 14 to actuate the valve. 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 29^a, permitting valve disc 35 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 34 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. So long 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 dis-

closure as given for purposes of illustration but rather to the scope of the appended claims.

What we claim is:

1. A fluid pressure engine as described, comprising a cylinder closed at both ends, a piston within said cylinder, a hollow piston rod connected thereto and projecting from one end of the cylinder, said piston having faces of different areas, a connection for continuously supplying fluid pressure to the smaller face of the piston, valve mechanism mounted on the piston, an operating member for the mechanism lying in the hollow piston rod, the hollow piston rod providing an exhaust passage for the end of the cylinder exposed to the larger face of the piston, said operating member actuating the valve mechanism to close off the connections between the ends of the cylinder, and means for operating the valve mechanism at the end of the movement of the piston in one direction to interconnect the ends of the cylinder and to close the end in which the larger face of the piston is exposed to exhaust through the hollow piston rod, said last mentioned means being positionable so as not to operate the valve mechanism at the end of the piston stroke to cause the piston to stop.

2. A pressure fluid operated engine, comprising a cylinder adapted to be connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to said piston and projecting exteriorly of the cylinder and forming an exhaust passage, a pair of opposed valves mounted on the piston, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating said valves simultaneously to close said passage through the piston and to open the passage through the hollow piston rod so that the piston moves from one end of the cylinder to the other, and means for moving said valves to close the passage through the hollow piston rod and open the passage through the piston at the end of said movement, whereby the piston returns to its initial position and stops.

3. A pressure fluid operated engine comprising a cylinder adapted to be connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of opposed valves mounted on the piston, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating the valve which controls the passage in the piston rod, a spring cooperating with the valve which controls the passage through the piston for normally sealing the passage, and means positioned to engage and actuate said valves by reason of their travel with the piston.

4. A pressure fluid operated engine comprising a cylinder adapted to be connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of opposed valves mounted on the piston, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating the valve which controls the passage in the piston rod, a spring cooperating with the valve which controls the passage through the

piston for normally sealing the passage, and means at one end of the cylinder for engaging the valve which controls the passage through the piston rod to cause it to close that passage when the piston is at that end of the cylinder.

5. A pressure fluid operated engine comprising a cylinder adapted to be connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of opposed valves mounted on the piston, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating the valve which controls the passage in the piston rod, a spring cooperating with the valve which controls the passage through the piston for normally sealing the passage, and means interconnecting the valves whereby the seating of one causes the unseating of the other.

6. A pressure fluid operated engine comprising a cylinder adapted to be continuously connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of opposed valves mounted on the piston so as to be in opposite ends of the cylinder, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating the valve which controls the passage in the piston rod, and means at one end of the cylinder for engaging the valve which controls the passage through the piston rod to cause it to close that passage when the piston is at that end of the cylinder, the fluid pressure in that end of the cylinder holding the valve closed until opened by the means in the piston rod whereby the piston stops at the end of its return stroke.

7. A pressure fluid operated engine comprising a cylinder adapted to be connected at one end to a pressure fluid source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of opposed valves mounted on the piston, a passage through the piston controlled by one of said valves, the other controlling the passage through the piston rod, means mounted in the piston rod and projecting exteriorly thereof for operating the valve which controls the passage in the piston rod, a spring cooperating with the valve which control the passage through the piston for normally sealing the passage, means at one end of the cylinder for engaging the valve which controls the passage through the piston rod to cause it to close that passage when the piston is at that end of the cylinder, and means interconnecting the valves whereby the seating of one causes the unseating of the other.

8. A pressure fluid operated engine comprising a cylinder adapted to be continuously connected at one end to a pressure source, a piston in said cylinder, a hollow piston rod connected to the piston and projecting exteriorly of the cylinder, a pair of valves mounted on the piston so as to be respectively exposed to the pressure in the cylinder ends, said piston having a passage there-through to be closed by one of said valves, the other of said valves sealing the passage in the piston rod, a spring for normally seating the valve which closes the passage in the piston, means mounted in the piston rod for unseating the valve

which seals the passage in the piston rod, means in the cylinder positioned to engage the valve which seals the passage in the piston rod to seat it, and means interconnecting said valves whereby the seating of the valve which closes the passage in the piston rod unseats the valve which closes the passage through the piston, the valve which

seals the passage in the piston rod when seated being held seated by the pressure in the associated cylinder end until unseated by the means in the piston rod.

ROSCOE D. CONKLIN.
PARIS R. FORMAN.