

J. C. BUTTERFIELD.

PNEUMATIC CYLINDER FOR MACHINERY.

No. 264,860.

Patented Sept. 26, 1882.

Fig. 1.

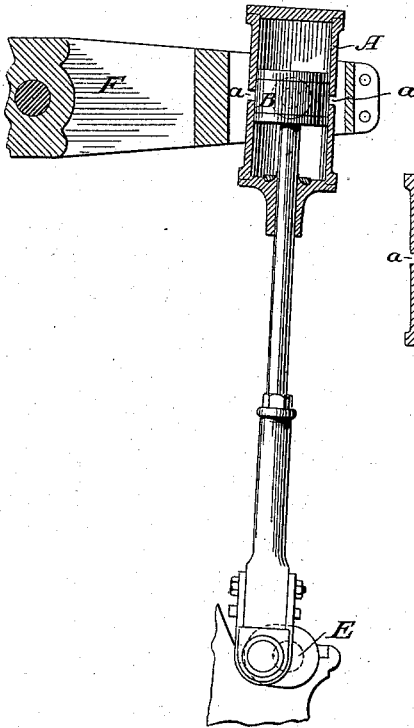


Fig. 2.

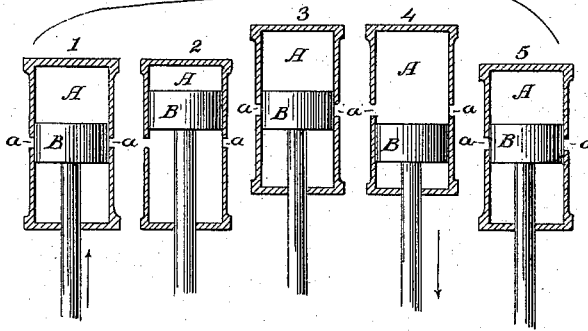


Fig. 3.

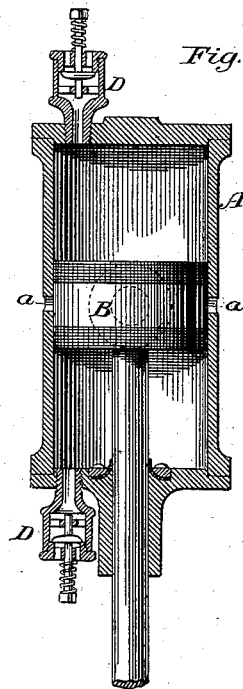
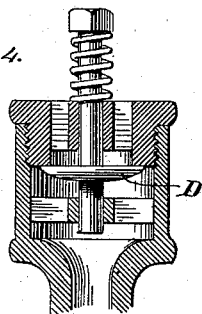


Fig. 4.



Witnesses:

C. Clarence Poole
Aug. Jordan

Inventor:

John C. Butterfield
By his atty R. D. Smith

UNITED STATES PATENT OFFICE.

JOHN C. BUTTERFIELD, OF CHICAGO, ILLINOIS.

PNEUMATIC CYLINDER FOR MACHINERY.

SPECIFICATION forming part of Letters Patent No. 264,860, dated September 26, 1882.

Application filed October 16, 1879.

To all whom it may concern:

Be it known that I, JOHN C. BUTTERFIELD, of Chicago, Cook county, in the State of Illinois, have invented a new and useful Improvement in Pneumatic Cylinders for Driving Machinery; and I do hereby declare that the following is a full and complete description of the same.

My improvement relates to that class of pneumatic cylinders wherein motion is imparted to the piston or cylinder, as the case may be, and communicated to the other of said parts by the expansion of air compressed in the ends of the cylinder alternately. For convenience I will represent the device as having the power applied to the piston, and thereby driving the cylinder and machinery attached thereto, although for some purposes it will be desirable to reverse this arrangement and apply the power primarily to the cylinder, and it is manifest that so far as the principles of operation are concerned it is immaterial to which part the power is primarily applied.

That others may fully understand my invention, I will particularly describe it, having reference to the accompanying drawings, wherein—

Figure 1 is a sectional elevation of the pneumatic cylinder as used before my present improvement; Fig. 2, a series of diagrams illustrating the action of this pneumatic cylinder. Fig. 3 is a sectional elevation of the same with my present improvement. Fig. 4 is an enlarged sectional elevation of the relief-valve.

For a full understanding of my improvement I will first describe the mode of operation of the pneumatic cylinders shown in Fig. 1.

A is the cylinder, and B is the piston. The cylinder A is provided with one or more open ports, *a a*, in its side. The cylinder A and piston B are both capable of motion in the direction of the axis of the piston, and the motion of one is communicated to the other through the medium of the air compressed by said initial motion. Motive power is therefore applied to one, and the driven mechanism is actuated by the motion thus imparted to the other. Starting from position 1, supposing the piston to be moved in the direction shown in position 2, the effect evidently will be to compress the air in front of the piston and cause the cylinder to move with the piston. The return-stroke and corresponding effect in moving the cylinder are

shown in positions 2 4 5 to the completion of one reciprocation and return to the starting-point. In the diagrams, Fig. 2, the arrows indicate the direction in which the parts are supposed to move. When the piston, as in position 2, moves past the port *a*, air enters therein to follow the piston, and during the return-stroke air flows out at the same port until the piston covers and closes it, so that air alternately enters and exhausts at the port *a*. It is apparent that compression commences immediately when the port *a* has been covered by the piston, and continues until the end of the stroke has been reached. It is also apparent that the air so compressed will immediately expand when the return-stroke commences, and will therefore exert a pressure upon the piston concurrent with and in aid of the prime mover. Theoretically this expansion will extend over the same range as that covered by the preceding compression—*i. e.*, until the port *a* is again uncovered; but practically it is impossible to avoid leakage, and hence the limit of expansion is always reached before the port is uncovered, and during that part of the stroke intervening between the limit of expansion and the uncovering of the port *a* the piston is resisted by the back-pressure of a partial vacuum behind it. This back-pressure occurs always about the middle of the stroke, and causes the movement to be irregular and in a measure ineffective.

The object of my present invention is to prevent this partial vacuum and back-pressure by admitting air behind the piston as soon as the limit of expansion has been passed and the internal pressure has become less than the external atmospheric pressure; and it therefore consists in a relief check-valve at each end of the pneumatic cylinder to admit air, as above stated.

The pneumatic cylinder above described is applicable to the transmission of power in a great variety of mechanical operations, and is particularly applicable in case of machinery requiring rapid reciprocation of parts having great inertia, such as power-hammers, ore-stamps, rock-drills, and the like. Such an application to the purposes of a hammer is shown in Letters Patent No. 176,400, granted to me on the 18th day of April, 1876.

Relief-valves D are inserted in or applied to the cylinder A at each end of the same, so that they come into action alternately and relieve

vacuum at each stroke of the piston. The valve D may be of any approved structure, the only requisite condition being that it shall close tightly, open freely, and be of adequate area. It may be placed so as to close by gravity or by a spring. I have preferred to place a spring on the stem, as shown, and thus cause it to work efficiently in any and all positions.

In Fig. 1, E is the driving-crank, and F is a walking-beam or other connection, whereby motion may be transmitted from the cylinder A to the machinery to be operated.

Having described my invention, what I claim as new is—

1. The pneumatic cylinder A and the piston B, whereby air is compressed in the end of said cylinder, combined with a valve, D, and clos-

ing-spring to automatically close said valve against the escape of air from said cylinder, but capable of opening inward to prevent the formation of a partial vacuum in said cylinder, as set forth.

2. A pneumatic cylinder, A, mounted upon and capable of transmitting motion to a walking-beam or other mechanism, combined with a piston, B, fitted to said cylinder, and means for actuating said piston, and valves D, set in said cylinder and independently of the action of said piston automatically closed against the escape of air from said cylinder, as set forth.

JOHN C. BUTTERFIELD.

In presence of—

R. D. O. SMITH,

C. CLARENCE POOLE.