P. P. BOURNE.

ENGINE FOR AIR PUMPS.

APPLICATION FILED JULY 9, 1908.

1,120,015. Patented Dec. 8, 1914.

Fig. 1.

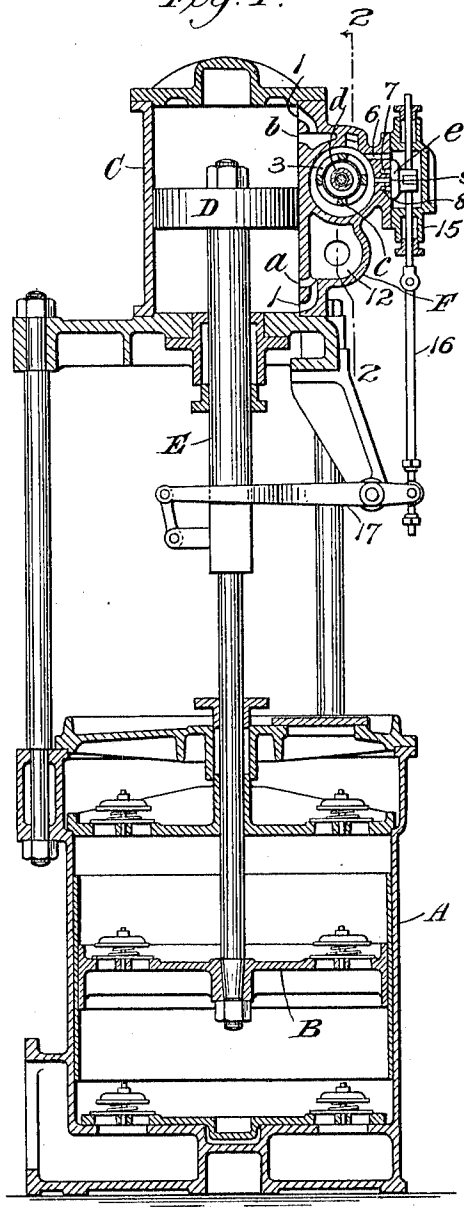


Fig. 2.

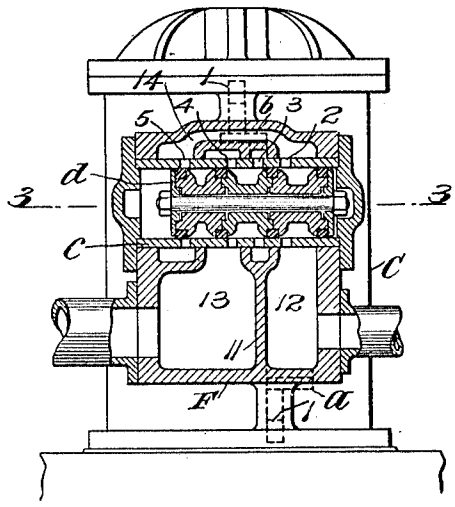


Fig. 3.

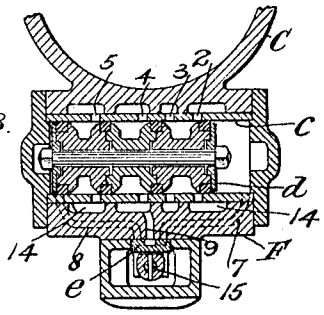
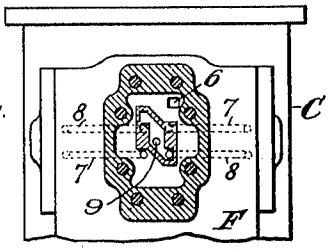


Fig. 4.



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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PHILLIPS P. BOURNE, OF SOMERVILLE, MASSACHUSETTS, ASSIGNOR TO THE BLAKE & KNOWLES STEAM PUMP WORKS, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

ENGINE FOR AIR-PUMPS.

1,120,015. Specification of Letters Patent. Patented Dec. 8, 1914.

Application filed July 9, 1908. Serial No. 442,726.

To all whom it may concern:

Be it known that I, PHILLIPS P. BOURNE, a citizen of the United States, residing at Somerville, county of Middlesex, and State of Massachusetts, have invented certain new and useful Improvements in Engines for Air-Pumps, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of the present invention is to provide a vertical single acting air pump, by which a smooth and efficient action shall be secured, notwithstanding the variations in load on the up and down strokes of the pump.

The further object is to provide an improved valve movement, adapted especially for such pumps.

As a full understanding of the invention can best be given by a detailed description of a construction embodying the invention, such a description will now be given in connection with the accompanying drawings forming a part of this specification and showing the invention applied in its preferred form, and the features forming the invention will then be specifically pointed out in the claim.

In the drawings:—Figure 1 is a vertical section of a single acting air pump embodying the invention. Fig. 2 is a vertical section on the line 2 of Fig. 1. Fig. 3 is a horizontal section on line 3 of Fig. 2. Fig. 4 is a detail plan of the auxiliary valve seat showing the auxiliary valve in section.

In the drawings, A is the pump cylinder shown as having the usual single acting bucket B, and the usual foot, bucket and head valves, C the steam cylinder arranged in line with the pump cylinder and having the steam piston in line with and directly connected by rod E to the pump bucket, thus forming a direct acting steam pump. It will be understood that both foot and head valves are not necessary in the form illustrated and that single acting pumps of other types may be used. The load in such single acting vertical air pumps in chiefly on the up-stroke, and this fact, with the weight of the parts acting on the down-stroke, would prevent practical operation of the pump, if the steam pressure on the piston D were the same on both strokes. In pumps embodying my invention, steam is admitted below the piston D on both the up and down strokes, and above the piston D only on the down-stroke, the steam piston being thus actuated on the up-stroke by steam pressure below the piston acting against exhaust above the piston, and on the down-stroke by steam pressure above the piston acting against steam pressure below the piston, so that the effective downward pressure may be varied as desired in manufacture, according to the working areas on the upper and under sides of the piston, and the down-stroke is thus controlled and practical operation secured. For this result, the steam chest is connected to the steam cylinder C below the piston D at all times, and preferably directly, and a valve mechanism is used which alternately connects the steam cylinder above the piston with the inlet chamber of the steam chest and with the exhaust, the steam cylinder above the piston thus being connected through the steam chest with the lower side of the piston during the down-stroke.

Referring now to the construction shown, the piston rod E below the piston D is made of such size as to secure the different areas of the upper and under sides of the piston desired, according to the size and conditions of operation of the pump. The steam chest F is divided by a partition 11 into inlet chamber 12 and exhaust chamber 13, with which are connected the admission and exhaust pipes. The inlet chamber 12 is connected directly by inlet port *a* with the steam cylinder C below the piston D and by inlet and exhaust port *b* with the steam cylinder above the piston, the ports *a*, *b* being arranged for cushioning and the usual starting ports 1 opening to the extreme end of the cylinder being shown, all as well known.

The inlet and exhaust to and from the upper end of the cylinder C is controlled by a steam thrown piston valve, which in turn is controlled by an auxiliary valve actuated by a moving part of the pump. The valve chamber is formed by the sleeve *c* in which moves the piston valve *d* having four rings, the sleeve *c* having the inlet port 2 connecting with the inlet chamber 12, the port 3 connecting with the inlet and exhaust port *b*

of the upper end of the cylinder C, the exhaust port 4 connecting with the exhaust chamber 13, and port 5 which connects with the steam inlet through port 2 and passage 14 in the steam chest, for a purpose presently to be described. The valve *d* in one position, as shown in Fig. 2, connects the port *b* of the upper end of cylinder C, with the exhaust chamber 13 through ports 3, 4 for the up-stroke of the piston, and in its other position, as shown in Fig. 3, connects the inlet chamber 12 with the port *b* through ports 2, 3 for the down-stroke of the piston. The space between the two rings at the right hand end of piston *d* is supplied with high pressure steam from inlet chamber 12 at all times through port 2, so that the escape of the cushioning steam to this space from the space at the right hand of the piston valve *d* is prevented, and by the passage 14 and port 5, which latter port is always open to the space between the two left hand rings of piston *d*, the same result is secured at the left hand end of piston valve *d*. The cushion steam at both ends of the piston valve *d* is thus prevented from leaking into the exhaust cavity, which might cause the piston valve to hit the head of the valve chamber.

The admission and exhaust of steam at opposite ends of the piston valve *d*, to throw the piston valve in the opposite directions, is controlled by the auxiliary valve *e* which is shown as sliding transversely to the piston valve *d* and sleeve *c* and as connected by stem 15 and link 16 to lever 17 with lost motion between the lever and link, so that the auxiliary valve is thus actuated in proper time as the steam piston approaches the end of its stroke in either direction, as usual in such constructions. Steam is admitted to the auxiliary valve chamber through port 6 connecting with the steam inlet space about the sleeve *c*, so that the auxiliary valve chamber is constantly supplied with inlet steam, and steam is admitted from the auxiliary valve chamber to the opposite ends of the piston valve *d* through admission ports 7 and exhausted through exhaust ports 8 and the central exhaust port 9 which communicates with exhaust chamber 13. The shifting of the valve *d* connects the chambers outside the opposite ends of the piston valve *d* with the steam inlet and exhaust alternately for throwing the piston valve *d* in opposite directions, as now well known in similar steam thrown valve constructions and will be understood from the drawings.

The general operation will be clear from a brief description in connection with the drawings.

Steam is admitted at all times below the piston D through port *a* which is not controlled by the valve *d*. On the up-stroke, the valve *d* is in the position shown in Fig. 2, in which steam is being exhausted from above the piston D through cylinder port *b*, sleeve ports 3, 4 connected by valve *d* and exhaust chamber 13, the up-stroke of the pump thus being performed by steam pressure on the under side of the piston D. On the down-stroke the piston valve *d* is in the position shown in Fig. 3, and steam is admitted to the steam cylinder C above the piston D through cylinder port *b* connected to inlet chamber 12 through sleeve ports 2, 3 connected by piston valve *d*. The down-stroke of the pump is thus performed by the excess of steam pressure on the top of the piston D, due to the reduction of area of the piston D on its under side by the piston rod E. The cylinder spaces on opposite sides of the piston D are directly connected through inlet chamber 12 and the steam ports during the down-stroke of the pump. During both the up-stroke and down-stroke of the pump, the spaces next the outer rings of piston valve *d* are filled with high pressure steam from inlet chamber 12, thus preventing leakage of the valve cushioning steam past these rings, and thus avoiding the danger of the valve piston striking the head on movement in either direction, as above stated.

What I claim is:—

The combination with a steam engine cylinder and piston, of inlet chamber 12 having a constant connection to one side of the steam piston, sleeve *c* having ports 2, 3, 4 for admission and exhaust on the other side of the steam piston, and port 5, passage 14 connecting port 5 with inlet port 2, steam thrown piston valve *d* controlling the sleeve ports, actuating steam chambers at opposite ends of the piston valve and the spaces inside its end rings being constantly supplied with inlet steam by ports 2, 5, and an auxiliary valve and ports for controlling the piston valve, substantially as described.

In testimony whereof, I have hereunto set my hand, in the presence of two subscribing witnesses.

PHILLIPS P. BOURNE.

Witnesses:
ERIC H. NELSON,
A. W. PARKER

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."