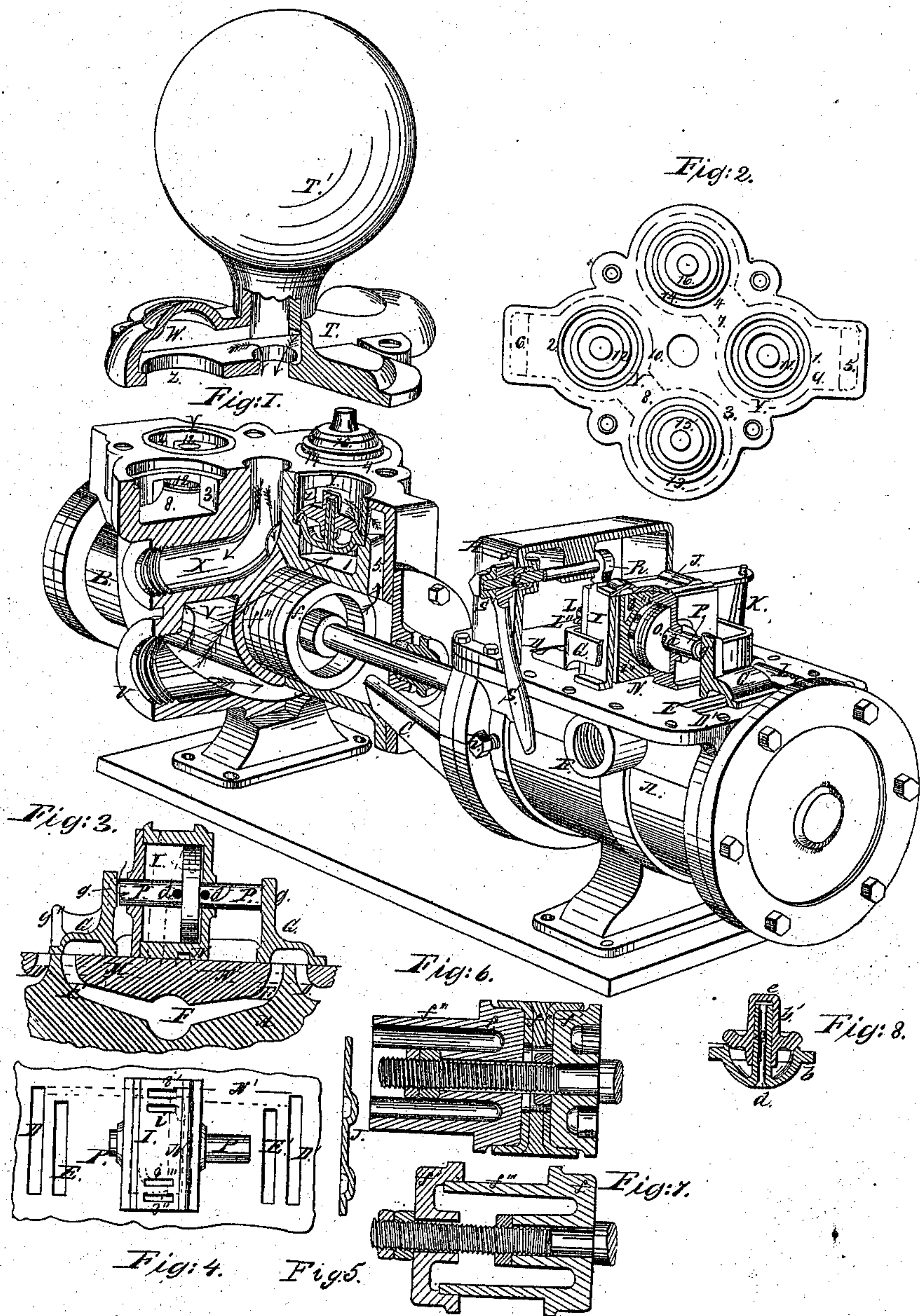


Maxwell & Cope,
Steam Engine Pump.
No 104,616. *Patented June 21, 1870.*



Witnesses:

Henry Millard
A. H. Jeffery

Inventor:

James H. Macculloch &
Cyba Cope
By J. Millard
Attorney

UNITED STATES PATENT OFFICE.

JAMES R. MAXWELL AND EZRA COPE, OF CINCINNATI, OHIO.

IMPROVEMENT IN STEAM-PUMPS.

Specification forming part of Letters Patent No. 104,616, dated June 21, 1870.

To all whom it may concern:

Be it known that we, JAMES R. MAXWELL and EZRA COPE, both of Cincinnati, Hamilton county, State of Ohio, have invented certain new and useful Improvements in Steam-Pumps; and we do hereby declare the following to be a sufficiently full, clear, and exact description thereof to enable one skilled in the art to which our invention appertains to make and use it, reference being had to the accompanying drawings, making part of this specification.

Our invention relates to that class of steam-pumps in which the steam is admitted through a full width of port at the beginning of each stroke, and continued throughout the entire length of stroke; and consists, first, in connection with a main valve for governing the ports of the engine, and an auxiliary valve which derives its motion from the engine, of a supplementary cylinder and piston, the piston being so constructed of itself and with relation to its cylinder, valve of same, and ports of the main cylinder, that, by reason of an exhaust from one end of its cylinder into the port of the main cylinder, at that end which is about to receive steam, occasioned by a movement of the small auxiliary valve, it will move in its cylinder, and, by the act of moving a short distance, admit sufficient "live steam" to cause it to continue its movement, and propel the main valve throughout the entire stroke necessary; second, in the peculiar device for packing the shaft of the lever for operating the main valve by hand; third, in a peculiar construction of valve and seat for governing the water-passages; fourth, in a peculiar construction and arrangement of water-passages and chambers, by which all the valves of the same are located under one cover having but a single joint, and the valve-seats held in place by the same cover; fifth, of a piston for the water-cylinder, so constructed that it is reversible, for the purpose of adapting it to receive either "packing" or "cupped leathers."

In the accompanying drawings, Figure 1 is a perspective view partly in section, the section being taken at right angles to exhibit the interior construction of the devices. Fig. 2 is a plan of the face of the water-chamber. Fig.

3 is a longitudinal section of the slide-valve for the steam-cylinder with the devices for operating the same. Fig. 4 is a plan of the ports in the main steam-cylinder and those connecting with the cylinder containing the auxiliary piston which operates the main slide-valve. Fig. 5 is a longitudinal section of the small slide-valve. Fig. 6 is an axial section of the piston of the water-cylinder, with the parts arranged for cupped leathers. Fig. 7 is an axial section of this same piston with the parts arranged for packing. Fig. 8 represents an axial section of the pump-valve and seat.

A is the steam-cylinder, and B the water-cylinder, connected together by web C. The steam-cylinder is constructed with the customary steam-ports D D' and exhaust-ports E E', the former communicating with the respective ends of the cylinder, and the latter with the exhaust-pipe F. G is the valve governing the ports D D' and E E', which, with slight exceptions, is of the ordinary "double D-valve" form, and H is the valve-chest, to which the supply steam is communicated in the usual manner. A supplementary cylinder, I, is secured to the valve-face, as shown, the valve G surrounding the same in the manner shown. This small cylinder is provided with ports i i' i'' i''', which are exhaust-ports only.

These ports are governed by the small slide-valve J, which is in this case operated by the lever K, rock-shaft L, and the arms E', which project into the cylinder A, and are operated upon by the main piston in the manner explained in our Letters Patent of August 24, 1869. We do not, however, desire to be confined to this device for operating the said valve J.

When the valve J is moved in one direction and occupies the position shown in Fig. 1, the port i' conducts the steam (which it receives from one end of the cylinder I through port i) to the port D through passage M, at the time when the port D, is just completing its exhaust from that end of the cylinder A. When the valve J is moved to the opposite end, the port i'' conducts the steam from the opposite end of cylinder I, which it receives through port i'', and carries the same to the port D' through passages N N'. The cylinder I is

fitted with a piston, O, which is provided with hollow rods P P', open at the ends and perforated at *a a'*. The ends of the hollow rods seat steam-tight against the faces *g g'* of the valve G alternately, the rods being made sufficiently short to permit of a slight motion of the piston O independent of the valve G. This motion is provided for the purpose of admitting live steam direct from the chest to the cylinder I through one or the other of the hollow rods P P' and perforations *a a'*. It will be seen by reference to Figs. 3 and 4 that the ports *i* and *i'''* communicate with the cylinder I at points a short distance from the respective ends of the cylinder, for the purpose of causing the piston O to run over these ports and "cushion" on the steam thus inclosed.

Operation: When the piston in the cylinder A has moved in the direction of the pump B sufficiently far in terminating its stroke in that direction as to force the valve J into the position shown in Fig. 1, by the means before explained, steam is then exhausted from the end of the cylinder I, on which rod P' is situated, into the port D, and the excess of pressure on the opposite end starts the piston in the direction of port D' sufficiently to close the hollow end of rod P' against face *g'*, and open the hollow end of rod P, so as to admit live steam, which serves to continue the motion of the piston, and consequently valve G, until the port D is open to receive steam, and port D' communicates with the exhaust pipe F. This motion is terminated by the piston O cushioning at the cylinder end, in the manner before explained.

In order that the valve G may be moved by hand from the exterior, when necessary, a lip, *g''*, is provided on the valve, between which and the body of the valve the lever R fits, sufficiently loose to permit the valve to move its full stroke independently. This lever is secured to rod Q, which projects through the chest H, and is packed by the hub *s* of the lever S, which slides on a feather on the rod Q, and is tightened by nut *s'*. The lever S is designed to be operated by hand.

The water-cylinder is constructed with four valve-chambers, 1, 2, 3, and 4, which are all exposed by the removal of the cap T, which, as shown, embodies the air-vessel T'. The cap is secured to the cylinder B by four or more bolts.

The chambers 1 and 2 communicate with the suction-pipe U below the valve-seats, through passage V, which nearly surrounds the pump-barrel, and with the pump-barrel through passages 5 and 6 above its valve-seats, and with chambers 3 and 4 by passages 7 and 8 above the valve-seats, so that these chambers receive water freely below the valve-seats from the suction, also discharge water into the pump-cylinder and communicate water to the chambers 3 and 4 from the pump-cylinder. The chambers 3 and 4 merely receive water from the chambers 1 and 2, and the same is dis-

charged through the valves into the passage W, formed in the cap T, and from thence into the pipe X.

The seats 9 and 10 of the suction-valves 11 and 12 are driven snugly into the "counterbores" made to receive them, and are kept down by the skeleton rings Y, against which the cap T rests.

The seats 13 and 14 of the discharge-valves 15 and 16 are driven into the counterbores shown in the drawing, and are held in place by the cap T, the holes Z, through which the valves work, being smaller than the diameter of the seats.

The valves 15 and 16 are limited in their ascent by the shell of the spherical cavities in the cap T, and the suction-valves rise against the joint face of the cap T. All the valves may be returned to their seats by spiral springs, if necessary.

The valves and seats are constructed in a peculiar manner, which is shown in Fig. 8.

The seat *b* has a central guide-stem, *c*, cast in connection with it, which has a hole, *d*, formed through it. The valve *b'* has a hollow socket, *e*, closed at the upper end, into which the guide-stem *c* slides snugly.

The perforation *d* gives a vent for the water which collects in the hollow socket *e*. More than one valve and seat can, of course, be placed in each of the chambers 1, 2, 3, and 4, in large pumps, if desirable.

The piston of the water-cylinder B is composed of the peculiarly-shaped heads *f f'* with the addition, when leather is used, of the washer *f''*.

The head *f* is formed with a hollow cylindrical extension, *f'''*, and the head *f'* is counterbored, as shown in position in Fig. 7, to receive it. By the simple reversal of the heads, the piston is made to receive packing, as in Fig. 7, or cupped leathers, as in Fig. 6.

An important part of our invention, not specified in the preamble of this specification, is in the provision of the set-screw *h*, which is fitted to screw, when necessary, against the solid part of the piston of cylinder A, and firmly hold this piston, its rod, and the pump-piston, and thus enable the pump-piston to be packed without danger of slipping or twisting of the pistons in the cylinders. After packing, the screw *h* is released from contact with the piston by unscrewing slightly.

We claim—

1. In connection with the valve G *g g'* and valve J, the latter operating by suitable connection with the engine, the supplemental cylinder I, ports *i i' i'' i'''*, passages M N N', and piston O P P' *a a'*, combined and operating substantially in the manner and for the purpose specified.

2. The manner of packing the shaft Q by the hub *s* of the hand-levers S, as and for the purpose described.

3. The seat *b*, having a perforated central guide-stem, *c d*, cast in connection with it, in the described combination, with the valve

b, constructed with a hollow socket, *c*, as and for the purpose specified.

4. The water-cylinder B and cap T, when constructed with chambers 1 2 3 4, which are all exposed by the removal of the cap, and when connected with the suction-pipe, pump-cylinder, and discharge-pipe, substantially in the manner described.

5. The piston *f f' f''*, constructed substantially in the manner and for the purpose specified.

6. In combination with the pistons of the cylinders A B, the provision of the set-screw *h*, as and for the purpose specified.

In testimony of which invention we hereunto set our hands.

JAMES R. MAXWELL.
EZRA COPE.

Witnesses:

FRANK MILLWARD,
J. L. WARTMANN.