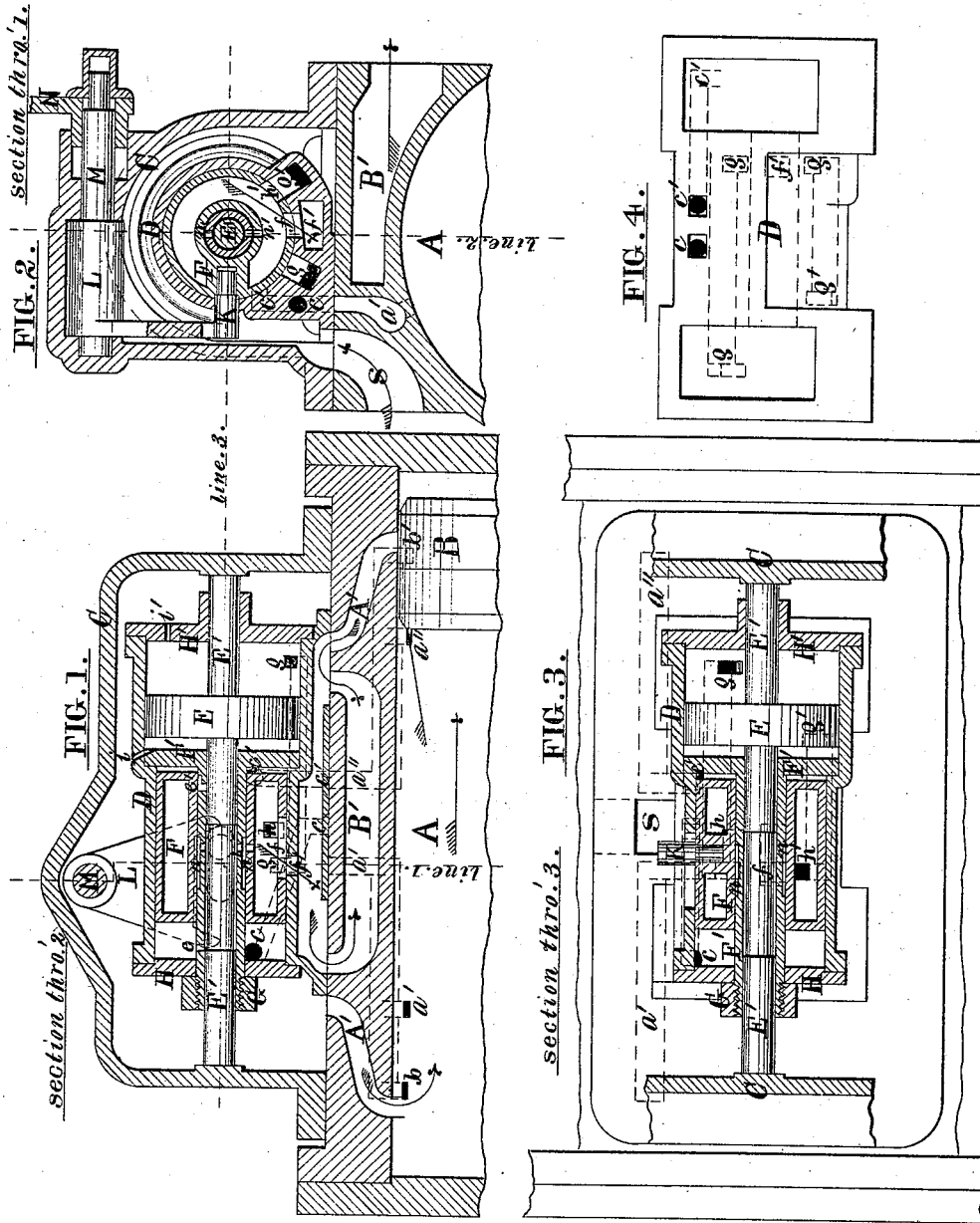


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VALVES FOR STEAM PUMPING ENGINES.

No. 181,822.

Patented Sept. 5, 1876.



WITNESSES:

Saml. W. Greene.  
Robt. C. Mc Kenney.

INVENTORS.

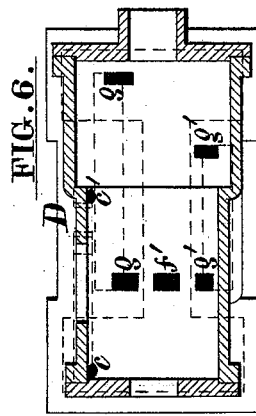
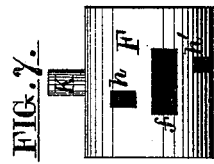
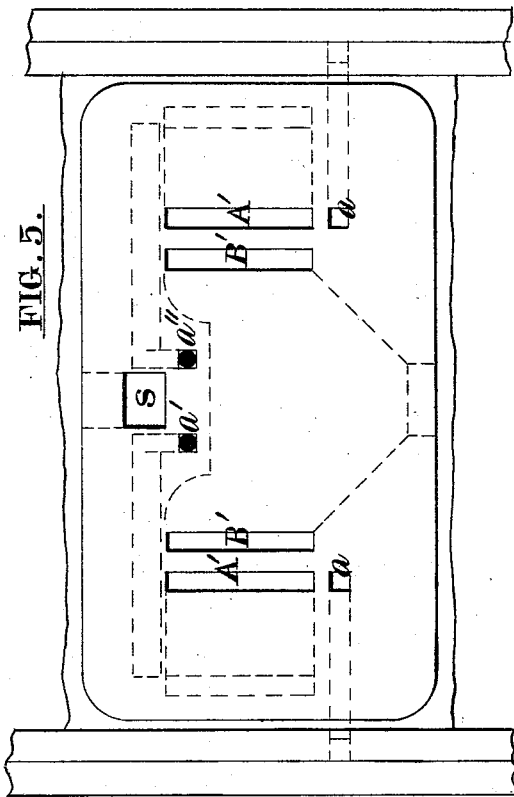
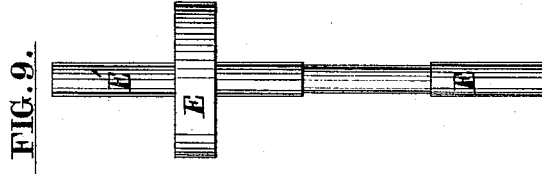
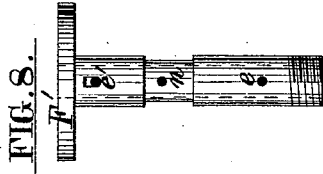
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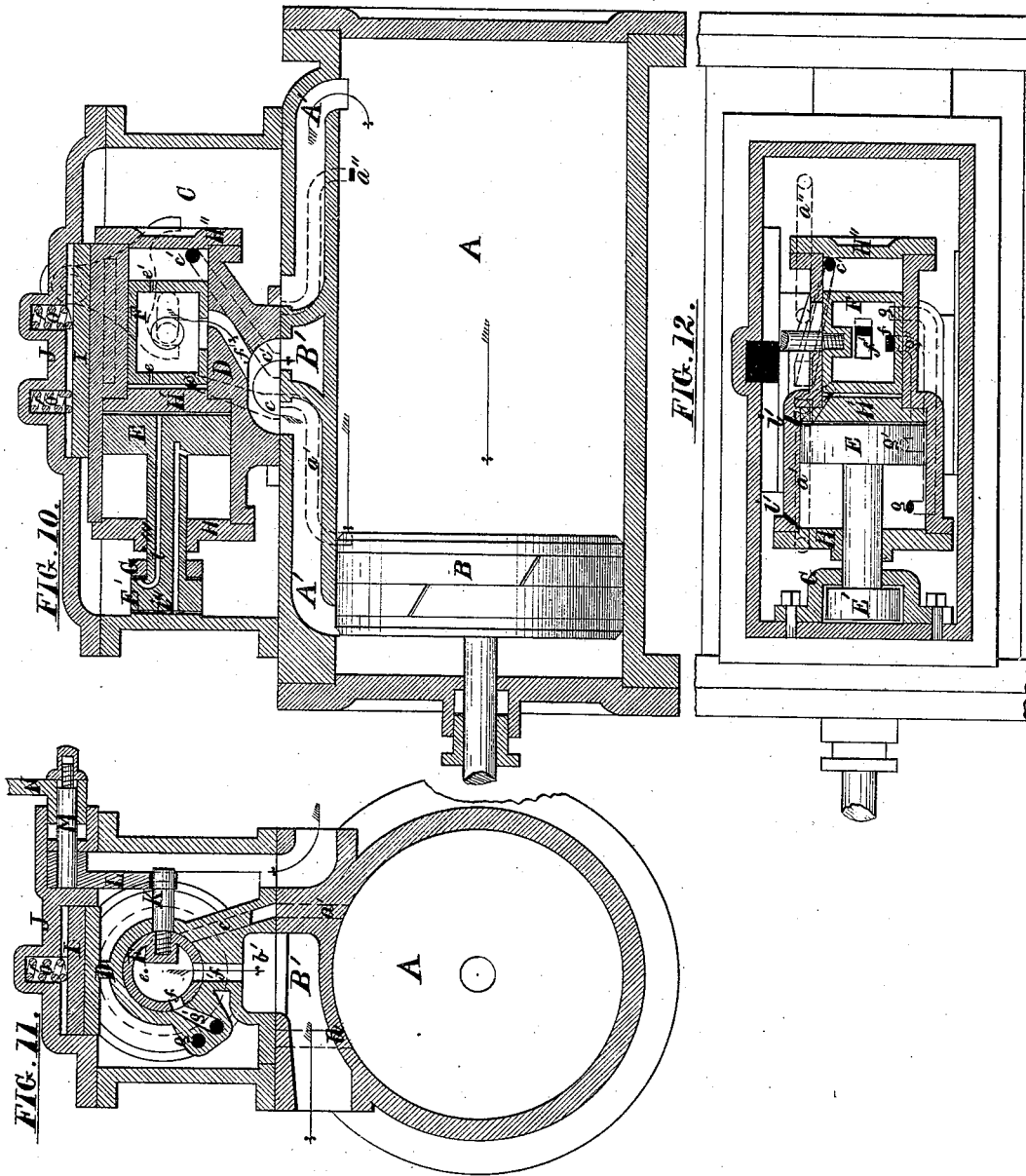
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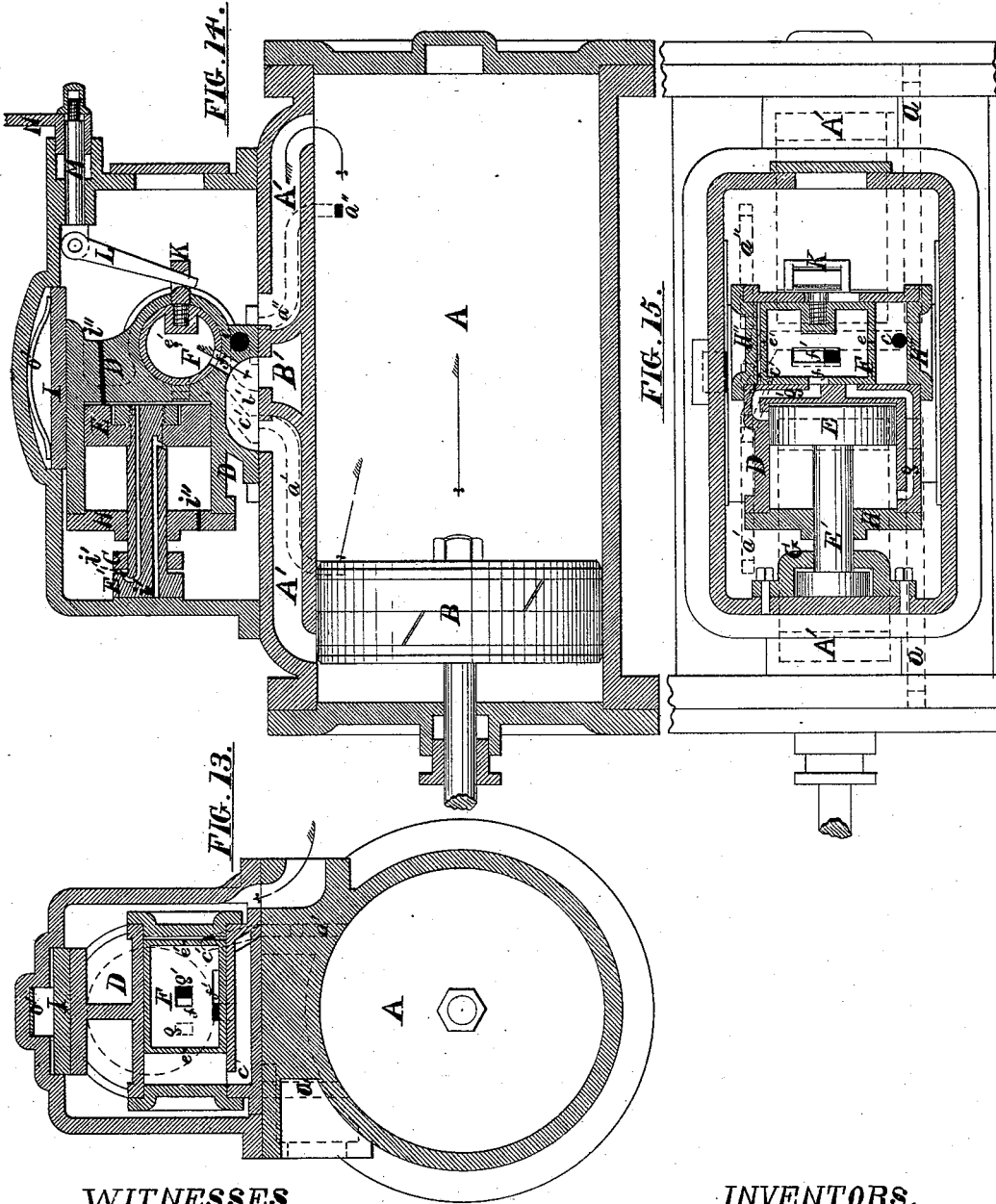
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# UNITED STATES PATENT OFFICE

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

## IMPROVEMENT IN VALVES FOR STEAM PUMPING-ENGINES.

Specification forming part of Letters Patent No. 181,822, dated September 5, 1876; application filed September 5, 1874.

*To all whom it may concern:*

Be it known that we, EZRA COPE and JAMES R. MAXWELL, of the city of Hamilton, county of Butler and State of Ohio, have invented certain new and useful Improvements in Steam Pumping and other Engines; and we declare that the following is a full and complete description thereof, reference being had to the accompanying drawings, which form a part of this specification.

Our invention relates to that class of steam-engines known as direct-acting; and consists in the construction and arrangement of the valves, and the ports and passages for actuating the same, whereby we gain the most prompt and positive action without the use of tappets, cams, cranks, or any similar device, the valves receiving their initial movement from steam taken from the main cylinder.

Figures 1, Sheet 1, 10, Sheet 3, and 14, Sheet 4, are longitudinal sections through the cylinder and valve-gear. Figs. 2, 11, and 13 are transverse sections of the same. Figs. 3, 12, and 15 are horizontal sections through the steam-chest and valve-gear. Fig. 4, Sheet 1, is a bottom view of the main slide-valve. Fig. 5, Sheet 2, is a plan of the cylinder, showing the position of the ports in the valve-seat face. Figs. 6, 7, 8, and 9, Sheet 2, are details of the valve-gear.

In all the drawings like parts are indicated by the same letters, and arrows show the direction of the moving parts, and the flow of steam.

A is the main steam-cylinder; B, the main piston, and C the steam-chest. D is the auxiliary cylinder, constructed in such a manner as to form, also, the main slide-valve. This cylinder, Fig. 6, Sheet 2, is subdivided by the disk F, Fig. 8, the sleeve connected with which surrounds the stem E, and screws into the hub G of the head H. Two smaller cylinders are thus formed, in one of which is the auxiliary piston E, Fig. 9, and in the other the piston-valve F, Fig. 7. The auxiliary piston E is stationary, being held firmly in position by its stem E' abutting against the steam-chest. For convenience, we designate the piston-valve F, Fig. 7, the master-valve, it giving the initial movement to the other valves, and receiving its motion from steam taken from the main

cylinder. The other valves are actuated by high steam from the steam-chest. The lever L, shaft M, and handle N, form an arrangement for moving the valves by hand. The lever L being moved comes in contact with the pin K, which is screwed into the master-valve F. A' A' are the main steam-passages, and B' the main exhaust-passage.

The position and functions of the other ports and passages will be seen in the drawings, and from the description of the operation of our invention, which is as follows:

The valves being in the position shown, steam enters the main cylinder through passage A' at the left, and the main piston is moving to the right, as shown by the arrows. The main piston is represented as having just passed the port a'', which is thus opened, and steam from behind the piston passes through a'' and the passage c' to the right of the master-valve F. Steam is exhausted from the other end of the master-valve cylinder through port e, and thence around the reduced part of the stem E', through the port n, to the reduced part of the sleeve, as shown in Figs. 8 and 9, whence it passes through h to the exhaust. The master-valve will then move to the left. This motion brings port h into communication with the passage g, and steam passes from the right of the auxiliary piston E through g and h to the port f, which communicates with the exhaust. High steam, entering the auxiliary cylinder through the port i upon the left of the auxiliary piston E, presses between the piston and the disk F', forcing the auxiliary cylinder and main slide-valve D to the left, bringing passage e into communication with passage a' ready for the reception of steam upon the passage of the piston on its return stroke, and placing the main ports and passages in position to exhaust steam from the left of the cylinder, and admit it to the right, so reversing the stroke of the main piston. When the main piston passes and opens a' on its return stroke the valves will again be reversed, and thus the main piston will be forced alternately to the right and left while steam is supplied. While the main piston is passing over the port a'' the port b' is open, and steam is, therefore, prevented from accumulating in the passage, so as to reverse the master-valve before

the proper time. Ports *a'* and *b* are similarly placed. The auxiliary piston E may have a slight motion endwise, and passages formed in its stem for the admission of high steam to that part of the auxiliary cylinder containing the auxiliary piston. The manner of operating such passages has been fully set forth in our Patent No. 104,616, dated June 21, 1870. The small ports *i* and *i'* will then be unnecessary.

Sheet 3 presents the previous arrangement somewhat modified in construction. The auxiliary cylinder and main slide-valve are cast in one, as in the preceding. The cylinder D is subdivided into two smaller cylinders by the head H'. The stem of the piston E does not extend entirely through the chest, but is held in place at one end by the collar E' surrounded by the yoke G. The passages *i''* and *i'''* in the stem of the auxiliary piston E admit high steam to that end of the auxiliary cylinder containing the auxiliary piston. The valve-gear is held to its seat by the plate I and the springs *o o*.

In Sheet 4 the master-valve is shown at right angles to the motion of the main piston, where-

as in the preceding it was placed parallel. This change necessitates a slight change in the position of the ports and passages, as is clearly shown in the drawing. In other respects, both of construction and operation, these arrangements are essentially similar.

Having fully described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination of the master-valve F, the auxiliary piston E, and the auxiliary cylinder D, the latter being subdivided to form two cylinders in which the two former operate, substantially as described.

2. The master-valve F, the auxiliary piston E, and the auxiliary cylinder D, in combination with the ports and passages *a'*, *a''*, *c*, *c'*, *g*, *g'*, *f*, *e*, *e'*, and *n*, arranged, constructed, and operated substantially as shown and described.

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Witnesses:

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