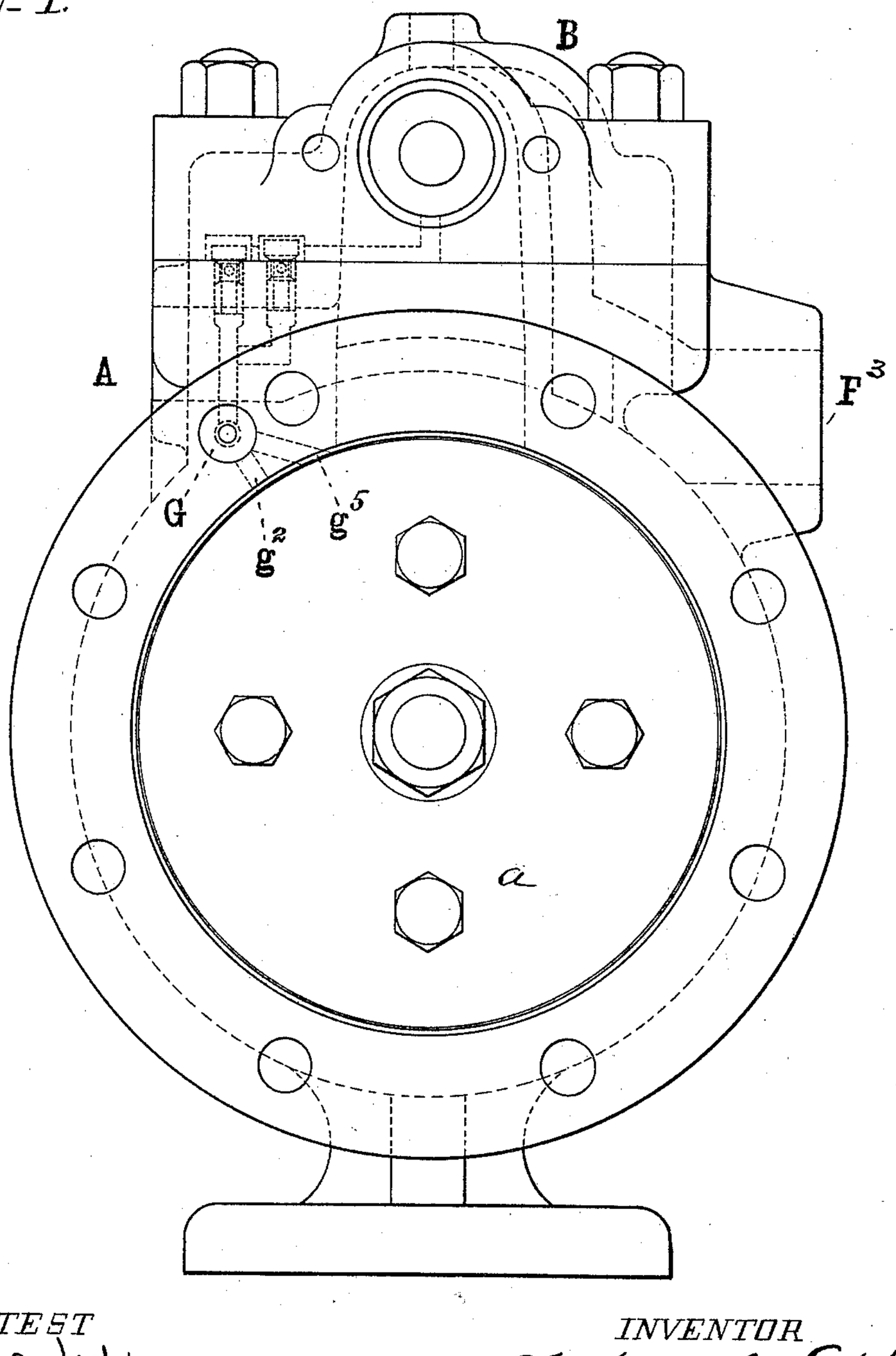
(No Model.) 3 Sheets—Sheet 1.

A. J. SYPHER.

VALVE FOR STEAM PUMPS.

No. 431,413. Patented July 1, 1890.

Fig. 1.



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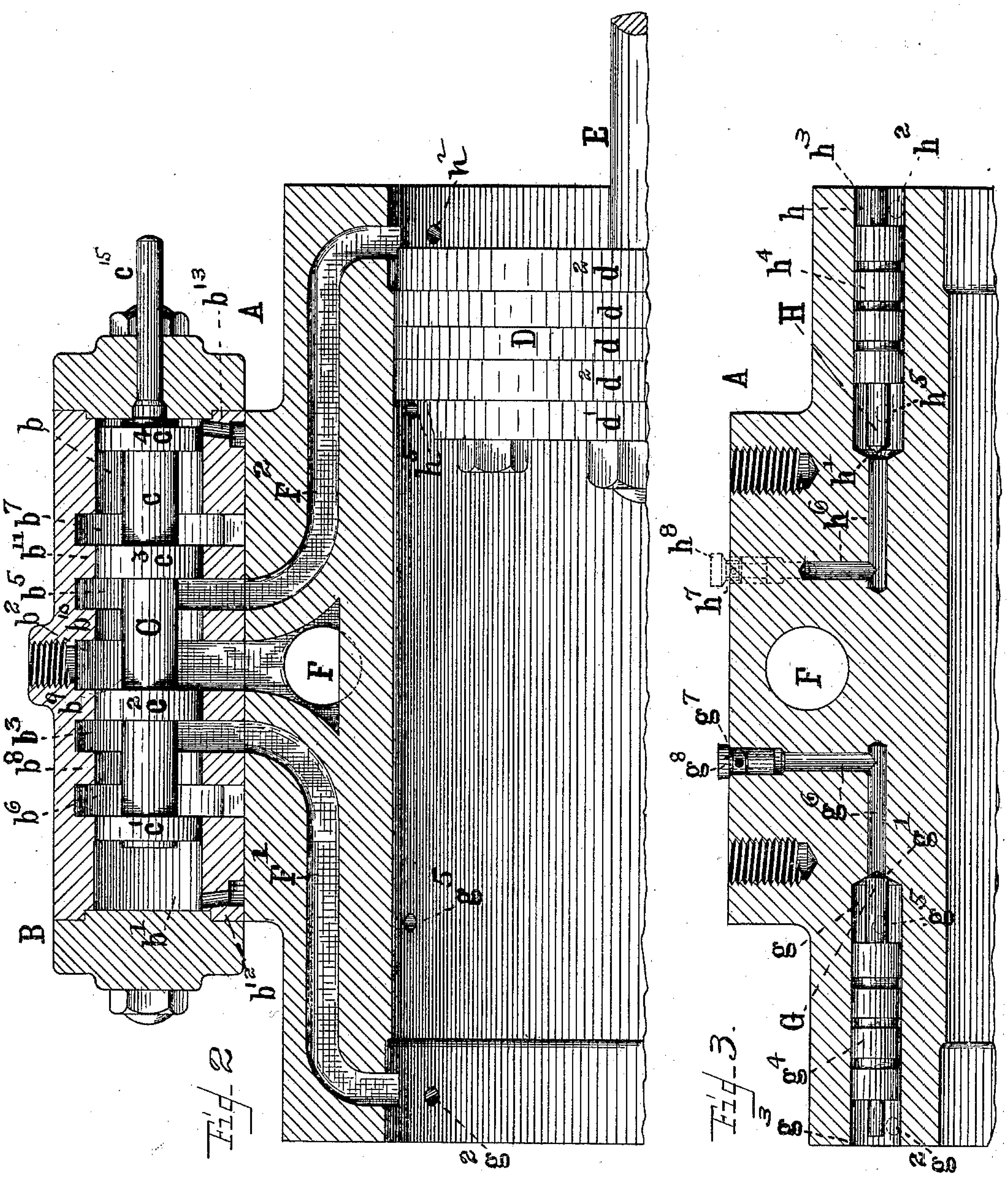

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 3.

A. J. SYPHER.

VALVE FOR STEAM PUMPS.

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Fig. 4.

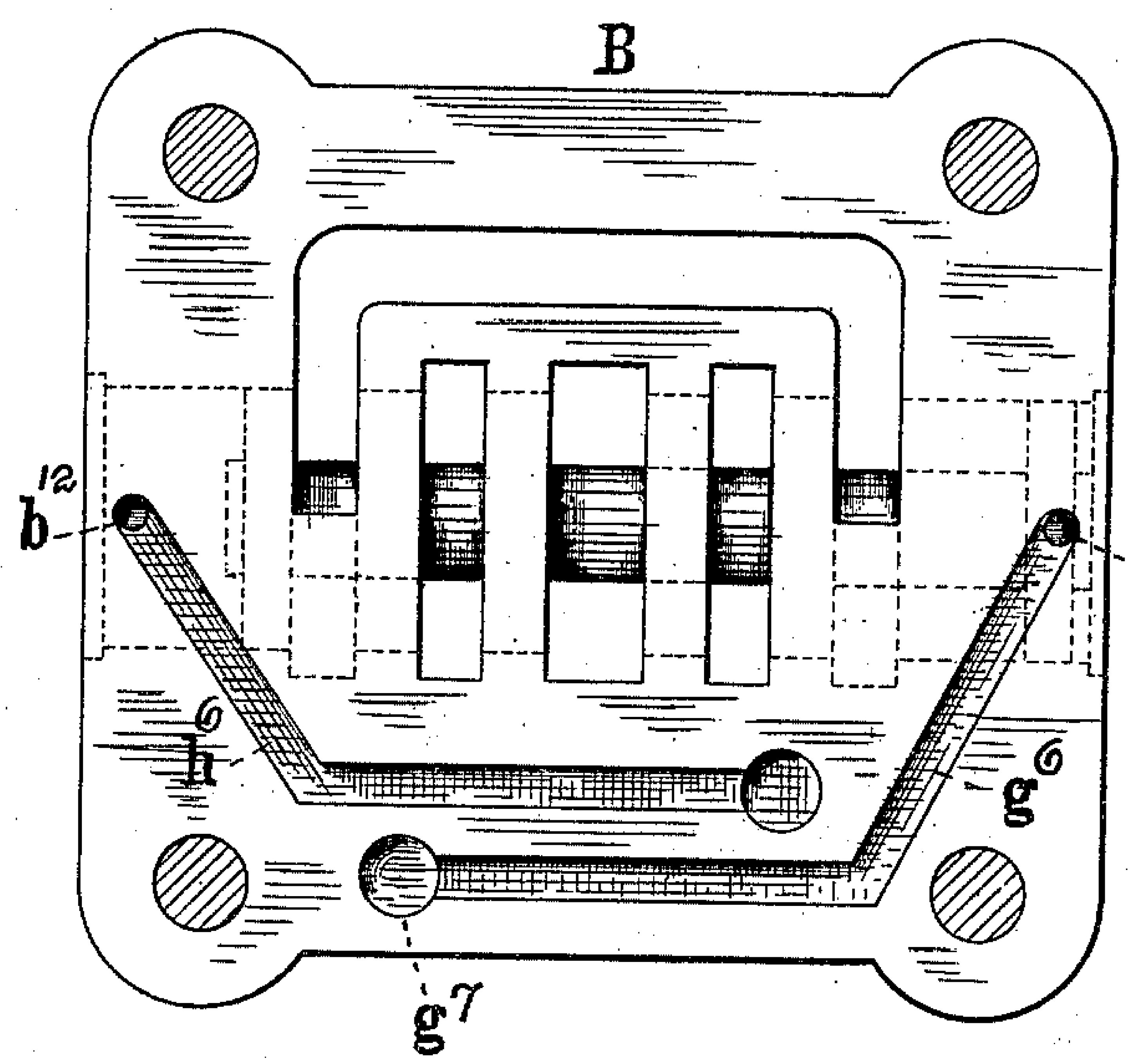
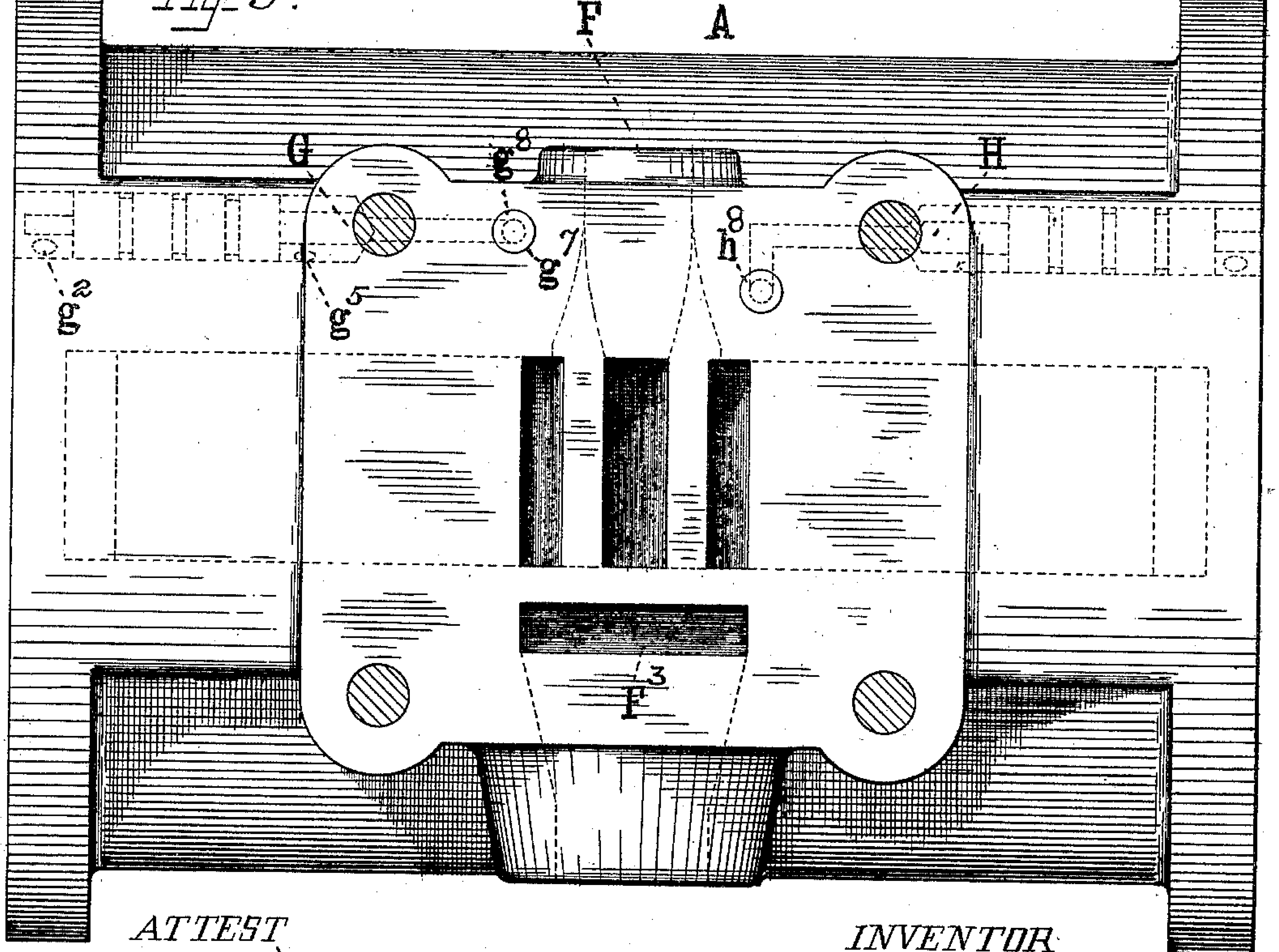


Fig. 5.



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

UNITED STATES PATENT OFFICE.

ABRAHAM J. SYPHER, OF IRON MOUNTAIN, MISSOURI.

VALVE FOR STEAM-PUMPS.

SPECIFICATION forming part of Letters Patent No. 431,413, dated July 1, 1890.

Application filed December 23, 1889. Serial No. 334,606. (No model.)

To all whom it may concern:

Be it known that I, ABRAHAM J. SYPHER, of Iron Mountain, Missouri, have made a new and useful Improvement in Valves for Steam Pumping-Engines, of which the following is a full, clear, and exact description.

The improvement relates to the means for operating the valve of the pumping-engine, substantially as is hereinafter set forth and claimed, aided by the annexed drawings, making part of this specification, in which—

Figure 1 is an end elevation of a cylinder having the improvement; Fig. 2, a vertical longitudinal section on the line 2 2 of Fig. 1; Fig. 3, a vertical longitudinal section on the line 3 3 of Figs. 1 and 5; Fig. 4, a bottom view of the valve-chest, and Fig. 5 a plan of the cylinder having the valve-chest removed.

The same letters of reference denote the same parts.

A represents the cylinder; B, the valve-chest; C, the valve; D, the piston; E, the piston-rod; F F′ F^2, the steam-ports, and F^3 the exhaust-port, all substantially as heretofore constructed, saving as the construction may be modified or supplemented by the improvement under consideration.

The piston D has suitable packing-rings *d d*, piston-heads d^2, and follower *d′*. The packing-rings fit the cylinder in the usual manner. The piston-heads and follower are slightly smaller in diameter than the cylinder. The valve C in the present instance is substantially a stem *c*, having four disks *c′* c^2 c^3 c^4, arranged as shown, and forming what I have heretofore termed a "three-spool" valve. The chest B is shaped to hold the valve and provide for its movement, which is in the direction of its length, to which end there are compartments b' b^4 at the ends, respectively, of the chest for the disks *c′* c^4 to respectively work in. There is a central port b^2, communicating with the steam-supply port F. There are ports b^3 b^5, respectively, at the sides of the port b^2, and communicating, respectively, with the steam-ports F′ F^2. There are the exhaust-ports b^6 b^7, and there are the bridges b^8 b^9 b^{10} b^{11}, which separate the ports b^2 b^3 b^5 b^6 b^7, substantially as shown in Fig. 2. The stem *c* is smaller in diameter than the bridges, so that when a disk is not in coincidence with a bridge there is space around the stem for the passage of steam. At the ends, respectively, of the chest are ports b^{12} b^{13}, through which alternately steam is admitted into the compartments b' b^4 to move the valve *c* to and fro in its seat.

The means for operating the valve C are as follows: At the ends, respectively, of the cylinder A are piston-valves G H, adapted to be moved longitudinally in chambers *g h*, respectively. The valve G seats at *g′* and the valve H at *h′*. A steam-passage g^2 leads from the interior of the cylinder A, Figs. 1 and 2, and into the chamber *g* at a point therein between the outer end g^3 of the chamber *g* and the outer end of the piston g^4 of the valve G when that valve is unseated. Another steam-passage g^5 leads from the interior of the cylinder A to the chamber *g* at a point therein between the inner end of the piston g^4 and the valve-seat *g′* when the valve G is seated. A steam-passage g^6 leads from the valve-seat *g′* through the shell of the cylinder to the point g^7, Fig. 3, and thence the passage g^6 is extended to connect with the port b^{13} in the valve-chest B. This extension of the passage g^6 is in practice formed just at the parting between the cylinder and the valve-chest, substantially as shown in Figs. 1 and 4—that is, when the valve G is unseated steam can pass *via* the passage g^5, chamber *g*, passage g^6, and port b^{13} into the compartment b^4, and there act upon the disk c^4 and cause the valve C to move to the left, as viewed in Fig. 2. At the opposite end of the cylinder A a steam-passage h^2 leads from the interior of the cylinder into the chamber *h* at a point therein between the outer end h^3 of the chamber *h* and the outer end of the piston h^4 of the valve H when that valve is unseated. Another steam-passage h^5 leads from the interior of the cylinder A to the chamber *h* at a point therein between the inner end of the piston h^4 and the valve-seat *h′* when the valve H is seated. A steam-passage h^6 leads from the valve-seat *h′* through the shell of the cylinder to the point h^7, Fig. 3, and thence the passage h^6 is extended to connect with the port b^{12} in the valve-chest B. This extension of the passage h^6 is also in practice formed at the parting between the cylinder

and the valve-chest, substantially as in Fig. 4—that is, when the valve H is unseated steam can pass *via* the passage h^5, chamber h, passage h^6, and port b^{12} into the compartment b', and there act upon the disk c' and cause the valve C to move to the right, as viewed in Fig. 2. Saving in Fig. 1, neither cylinder-head a is shown in position. The improvement operates as follows:

In Fig. 2 the piston D is supposed to be moving to the right, and to be nearly, if not quite, at the end of its stroke, and it has moved in the direction named far enough to uncover the passage h^5, for owing to the follower d' being of the diameter described the steam can pass between the follower and the cylinder-shell, and thence into the passage h^5. The steam enters the chamber h and therein exerts a pressure against the inner end of the piston h^4, and thereby effects the unseating of the valve H. The steam then at once passes into the compartment b' and causes the valve C to be moved into its position. (Shown in Fig. 2.) The live steam can now and does pass from the port F into the port b^2, thence around the stem c into the port b^5, thence into the port F^2, and thence into the cylinder between the piston and the right-hand end of the cylinder, in which position the steam acts in the usual manner to move the piston toward the left-hand end of the cylinder. The live steam also at once enters the passage h^2, and thence into the chamber h, where, by pressing against the outer end of the piston h^4, it causes the valve H to seat again. The live steam continues to enter the cylinder through the port F^2 until the piston D has moved far enough toward the left-hand end of the cylinder to uncover the passage g^5, whereupon the live steam enters the chamber g, unseats the valve G, and passes from the chamber g through the passage g^6 into the compartment b^4, where it acts to move the valve C to the left, as viewed in Fig. 2. The live steam is now cut off from the port F^2 and is turned into the port F', and thence into the cylinder A, between its left-hand end and the piston D, causing the piston to move again toward the right-hand end of the cylinder. The live steam also at once enters the passage g^2, and thence into the chamber g, and effects the seating of the valve G, and so on. Check-valves g^8 h^8, Fig. 3, can be used to prevent any back-pressure through the passages g^6 h^6, respectively. The steam is exhausted from the cylinder A, and also from the valve-chest B, in the ordinary manner.

An additional feature of the improved construction is extending the valve-stem c outward through the shell of the valve-chest, substantially as shown at c^{15}, Fig. 2, thereby to provide means whereby the valve-stem can be reached from the outside of the valve-chest, and the valve C thereby readily adjusted into position to properly act in starting up the pumping-engine.

In carrying out this improvement I prefer to use the three-spool valve C and to construct the steam-passages leading from the chambers g h to the valve-chest B as shown; but I desire not to be restricted precisely thereto, for other forms of valves and passages may be employed. Neither do I wish to be confined to the particular construction of piston D shown in covering and uncovering the passages g^5 h^5.

I claim—

1. The combination, with the cylinder-valve and the valve-chest having the ports b^{12} b^{13} at its opposite ends and portions of the passages or channels h^6 g^6 extending, respectively, from said ports to points h^7 g^7 in the lower face of said valve-chest, of the cylinder provided at its opposite ends with the valve-chambers g h, and having the openings g^2 g^5 and h^2 h^5 extending, respectively, from its steam-space to the chambers g h, and portions of the passages g^6 h^6 extending from the inner ends of said chambers to the points g^7 h^7, respectively, and the piston-valves respectively moving in the chambers g h and having seats at the inner open ends thereof, substantially as specified.

2. The combination, with the valve C, having the disks c' c^2 c^3 c^4 and the valve-chest having the ports b^2 b^3 b^5 b^6 b^7, end ports b^{12} b^{13}, and portions of the passages or channels h^6 g^6 extending from the said end ports b^{12} b^{13} to points h^7 g^7 in the meeting face of the valve-chest, of the cylinder having the valve-chambers G H, ports g^2 g^5 h^2 h^5, and portions of the passages g^6 h^6 extending, respectively, from the inner ends of the chambers G H to the points g^7 h^7 to connect with the portions in the valve-chest, and the piston-valves respectively moving the chambers g h and having seats at the inner ends, substantially as specified.

Witness my hand this 16th day of November, 1889.

ABRAHAM J. SYPHER.

Witnesses:
C. D. MOODY,
B. F. REX.