(No Model.) 2 Sheets—Sheet 1.

J. H. EICKERSHOFF.

VALVE FOR COMPOUND ENGINES.

No. 461,896. Patented Oct. 27, 1891.

Fig. 1

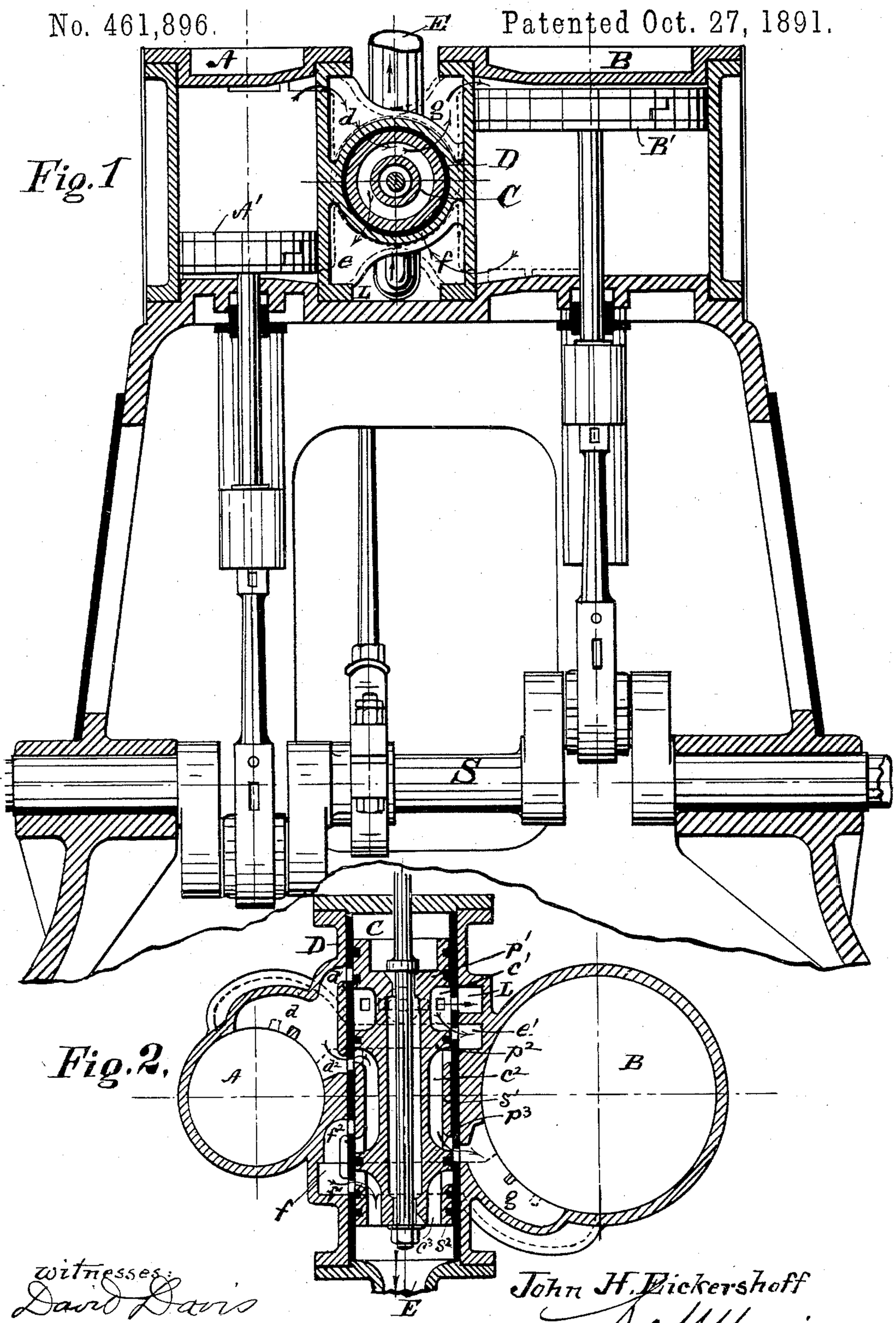

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3

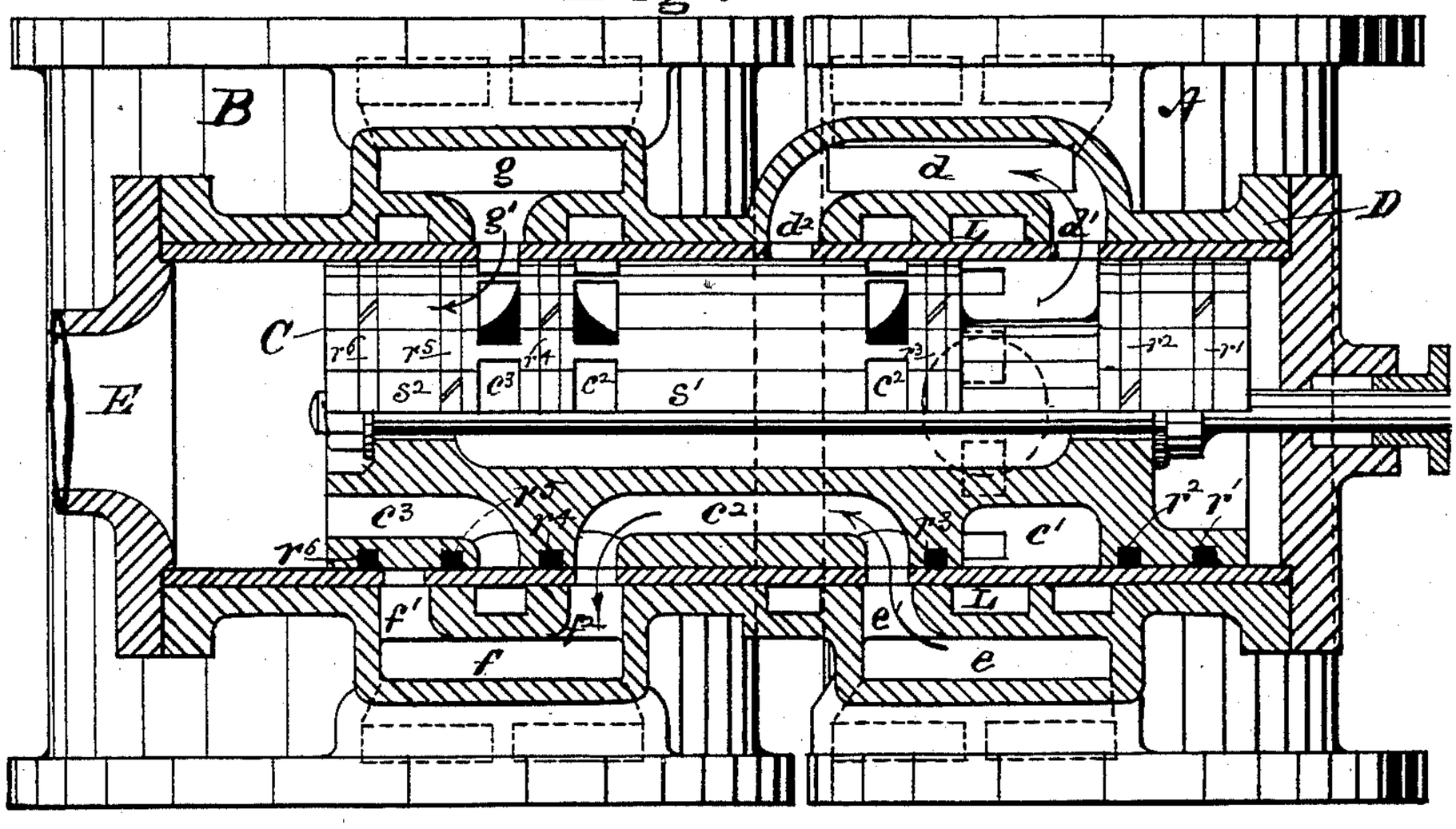
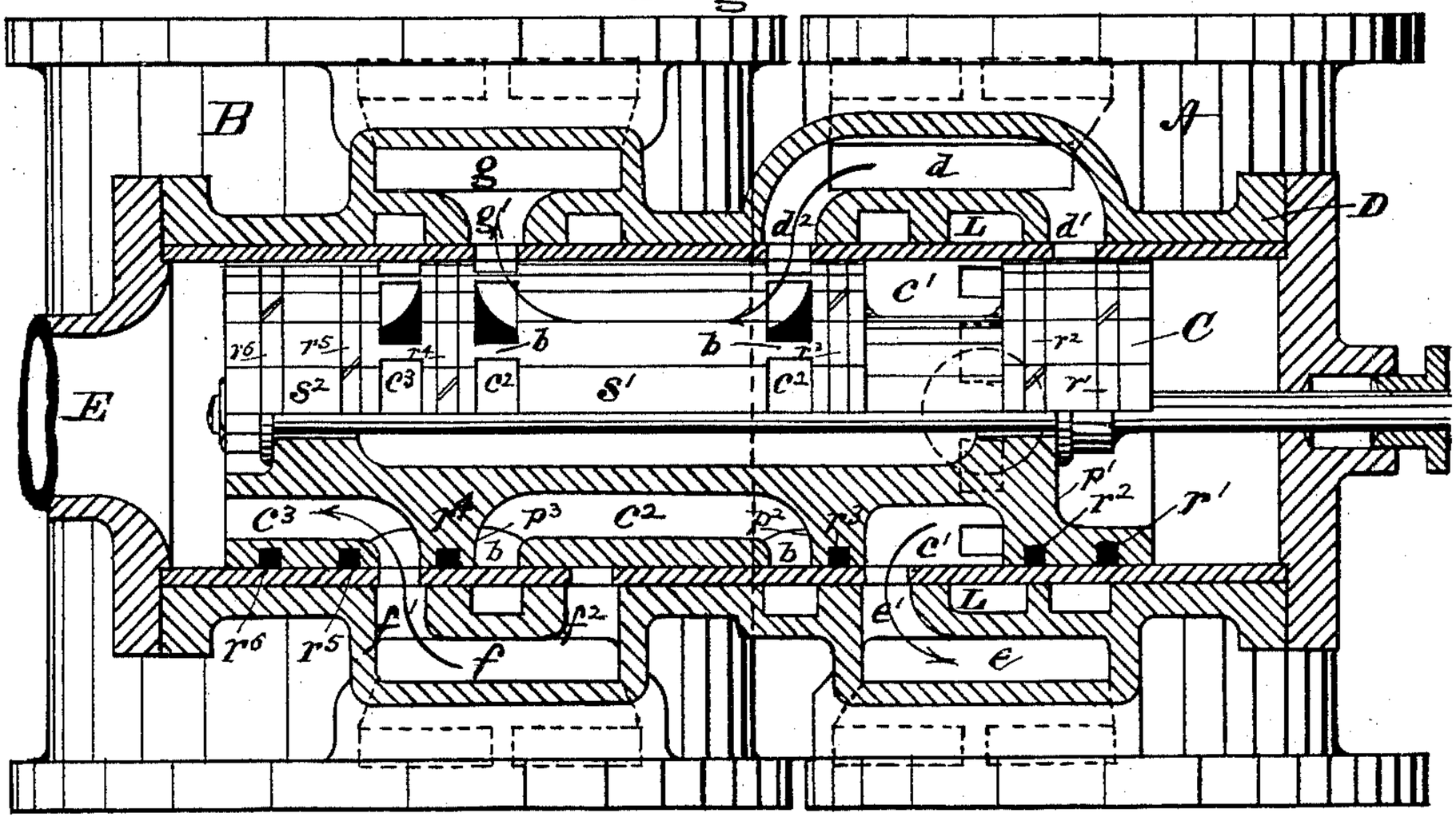


Fig. 4



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UNITED STATES PATENT OFFICE.

JOHN H. EICKERSHOFF, OF CINCINNATI, OHIO.

VALVE FOR COMPOUND ENGINES.

SPECIFICATION forming part of Letters Patent No. 461,896, dated October 27, 1891.

Application filed August 5, 1891. Serial No. 401,809. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. EICKERSHOFF, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented new and useful Improvements in Valves for Compound Engines, of which the following is a specification.

My invention relates to compound steam-engines, its object being to improve the same in respect to the steam distribution, and, as applied to engines of two or more cylinders, to economize in structure and cost, in addition.

To this end my invention consists, primarily, in a novel distribution-valve, which is cheaply made and efficient in operation, tending to simplicity of structure in the co-operating parts of the engine, to conservation of heat, and generally to a more efficient and economical distribution and utilization of steam. Moreover, the valve, by reason of its structural features, is applicable to a wide range of types of engines of the class indicated.

Mechanism illustrating my invention is shown in the accompanying drawings, in which—

Figure 1 is a partial vertical section, in the common axial plane of the cylinders, of a common type of compound engines having a high and a low pressure cylinder with double-acting reciprocating pistons coupled to the same shaft, the valve being shown in cross-section; Fig. 2, a transverse section of the cylinders through the axial plane of the valve; Figs. 3 and 4, diagram sections showing the constructive arrangement of the valve-chest ports in an isometric plane, with the valve at opposite positions of its reciprocation.

One of the leading principles of my improvement is the economy of heat and consequent increase of efficiency in the engine by separating in the valve structure the ports and passages devoted, first, to steam-induction; second, to expansion over, and, third, to final exhaust, these being entirely independent and arranged relatively in their natural order, as here named. These ports and passages being independent of each other, proper compression can be obtained, and also heat is conserved to a much greater degree than in structures where the different functions are performed by and in the same valve-passages. The construction is such also as enables a single valve to perform the entire distributive functions of two or more cylinders with great facility and with the advantages named.

Referring now more particularly to the drawings in aid of the following description, A B, Figs. 1 and 2, designate the cylinders, respectively, of a compound engine having one high and one low pressure cylinder with double-acting pistons A′ B′, coupling to oppositely-set cranks of a common crank-shaft S. The type being common, I need not detail the structure except as related to the construction and arrangement of valve and ports.

The distribution-valve C is a reciprocating piston-valve operating in a cylindrical valve-chest D, arranged, by preference, between the cylinders at mid-length and perpendicular (or approximately so) to the common axial plane of the cylinders.

The valve C consists of an elongated piston having three circumferential grooves c' c^2 c^3 in consecutive order, separated by intervening partitions p^2 p^3, carrying packing-rings r, numbered (with others to be referred to later) as hereinafter stated.

Beginning with the live-steam end of the valve C, the live-steam passage C′ is an open groove bounded laterally at one side by the end partition p' of the valve, carrying packing-rings r' r^2, and at the other by the intervening partition p^2, carrying a packing-ring r^3. Next in consecutive order is the expansion-passage c^2, bounded at the live-steam side by the partition p^2, carrying the packing-ring r^3, (as stated,) and at the other by the partition p^3, carrying the packing-ring r^4. This groove is open at each end outwardly adjacent to the partitions p^2 p^3, but covered centrally by a shell S′, connected across the circumferential openings by suitable bridges b and closely fitting the valve-cylinder C, but without packing-rings, the groove forming a longitudinal passage between its openings beneath the shell S′. The third and last in consecutive order is the exhaust-groove c^3, bounded at the expansion side by the partition p^4 and opening at the other into the exhaust end of the valve-chest C, into which the exhaust-pipe F enters. The groove c^3 opens outwardly adjacent to the partition p^3, but extends through the exhaust end of the valve beneath a shell S^2, carrying packing-rings r^5 r^6.

The construction of the valve chest and ports and the operation of the valve may be best understood from the isometric diagrams, Figs. 3 and 4. Live steam enters the chest through the opening L, with which the groove c' is in constant communication. The passage d, leading to the top of the high-pressure cylinder, divides and enters the valve-chest by two ports d' d^2 in different planes, while the passage e, leading to the bottom of the high-pressure cylinder, enters the valve-chest at e' midway between the planes of the ports d' d^2. The passage f, leading to the bottom of the low-pressure cylinder, divides and enters the valve-chest by two ports f' f^2 in different planes, while the passage g, leading to the top of the low-pressure cylinder, enters the valve-chest by the port g' midway between the plane of the ports f' f^2. In the position of the valve shown in Fig. 3 steam from the boiler flows into the valve-chest D, through the groove c' of the valve into the port d' (the port d^2 being closed by the shell S′) and passage d, and to the upper end of the high-pressure cylinder A, above the piston A′, and drives the same downward. At the same time the steam beneath the piston A′ by expansion flows through the port and passage e' e, through the expansion-passage c^2 of the valve across to the port f^2 and passage f, (the port f' being closed by the shell S^2,) and enters the bottom of the low-pressure cylinder, driving the piston B′ upward. In the opposite position of the valve the course of the live steam is through valve-passage c', cylinder-port e', and passage e to the bottom of the high-pressure cylinder, while the course of the expansion steam is back through passage d, port d^2, valve-passage c^2, cylinder-port g', and passage g to top of low-pressure cylinder.

The valve is applicable to a wide range of types, which I have not thought it necessary to illustrate.

I have given preference to the arrangement of the valve-chest between the cylinders and perpendicular to their common axial plane, because the valve-chest is thus brought into a central uniform relation with all the ports and passages. This, however, is not essential, as the valve may be arranged vertically between the cylinders and operated by a direct connection with the eccentric or wholly at one side of the two cylinders, either parallel or at right angles to their common axial plane.

I claim as my invention and desire to secure by Letters Patent of the United States—

1. In a compound engine, in combination with the working cylinders and their pistons, a single reciprocating self-balanced piston-valve having a live-steam port, an expansion-port, and an exhaust-port wholly within the limits of the valve, adapted to perform the several functions of steam-induction, expansion over, and final exhaust of steam for the cylinders in common, substantially as set forth.

2. In a compound engine having two cylinders or sets of cylinders in a common plane, a reciprocating piston-valve adapted to perform the several functions of steam-induction, expansion over, and final exhaust for the cylinders in common, arranged between the cylinders transversely across and through their common axial plane, substantially as set forth.

3. A distribution-valve for compound engines, consisting, substantially, of a reciprocating balanced piston-valve having a live-steam passage, an expansion-passage, and an exhaust-passage arranged in longitudinal succession in the order named wholly within the limits of the valve, each being complete and independent, in combination with a suitably-ported seat whereby the several functions are performed in and by said valve-passages, each appropriated exclusively to its proper function, substantially as set forth.

4. A self-balanced piston-valve for effecting the induction, expansion over, and exhaust for compound engines, having a live-steam passage near one end, an expansion-passage central, and an exhaust-passage near the opposite end, all within the limits of the valve, substantially as set forth.

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

JOHN H. EICKERSHOFF.

Witnesses:
L. M. HOSEA,
E. HOSEA.