No Model.)

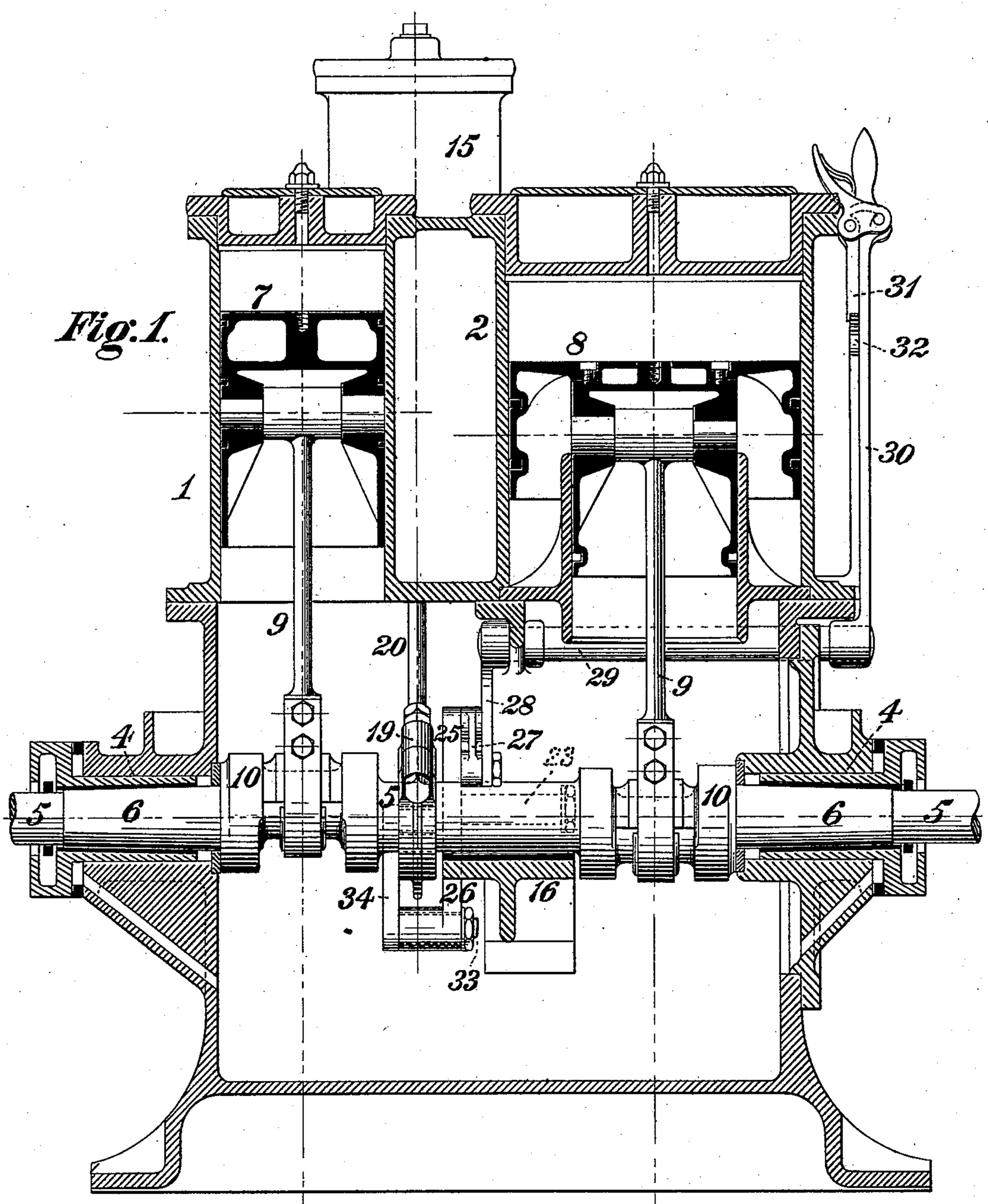
2 Sheets—Sheet 1.

F. M. RITES.

STEAM ENGINE VALVE GEAR.

No. 363,968. Patented May 31, 1887.

Fig. 1.



WITNESSES:

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(No Model.) 2 Sheets—Sheet 2.

F. M. RITES.

STEAM ENGINE VALVE GEAR.

No. 363,968. Patented May 31, 1887.

Fig. 3.

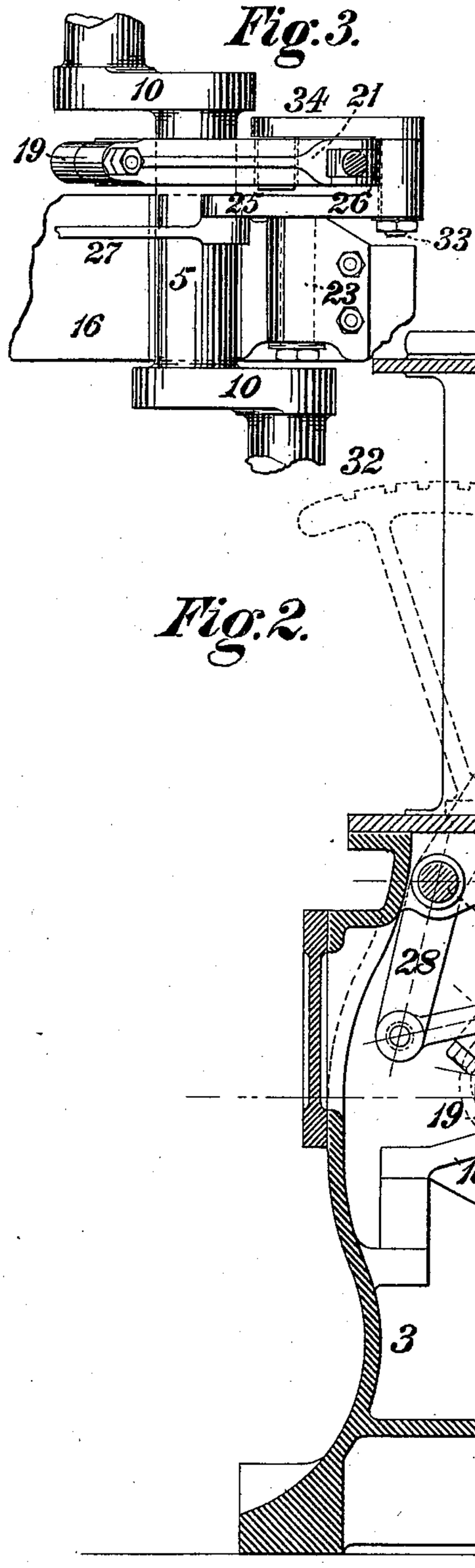
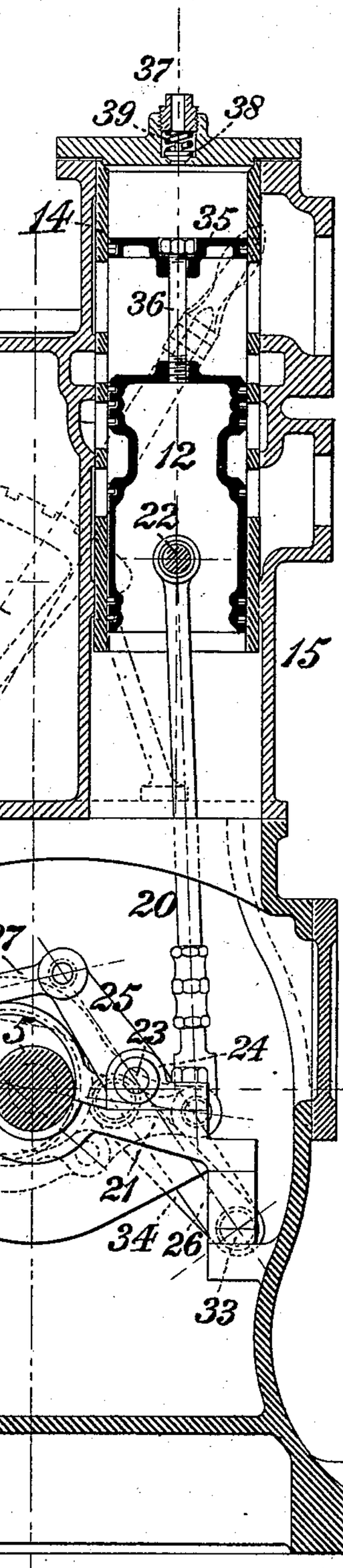


Fig. 2.



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UNITED STATES PATENT OFFICE.

FRANCIS M. RITES, OF PITTSBURG, PENNSYLVANIA.

STEAM-ENGINE VALVE-GEAR.

SPECIFICATION forming part of Letters Patent No. 363,968, dated May 31, 1887.

Application filed September 18, 1886. Serial No. 213,898. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS M. RITES, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, a citizen of the United States, have invented or discovered a certain new and useful Improvement in Steam-Engine Valve-Gears, of which improvement the following is a specification.

The object of my invention, which relates to valve-gears of the single fixed eccentric type, is to provide a simple, compact, and inexpensive mechanism for actuating a steam-engine distribution-valve, which shall be specially adaptable to application in engines whose crank-shafts rotate in closed cases.

To this end my invention, generally stated, consists in the combination with an eccentric fixed upon a main or crank shaft mounted in bearings in a closed crank-case, of an eccentric-strap coupled to a valve-rod, a rock-shaft journaled in a fixed bearing and having one of its arms linked to an external reverse lever, and a link coupled at one end to the opposite arm of the rock-shaft and at the other to the eccentric-strap.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings, Figure 1 is a vertical longitudinal central section through a steam-engine embodying my invention; Fig. 2, a vertical transverse section through the same at the center line of the valve-chest; and Fig. 3, a plan view of the valve-gearing detached.

My invention is herein shown as applied in a vertical single-acting compound engine having a high-pressure cylinder, 1, and a low-pressure cylinder, 2, secured to the top of a closed crank case or receptacle, 3, having end bearings, 4, for the journals 6 of the main or crank shaft 5 of the engine. The cylinders are fitted with pistons 7 8, which are coupled by connecting-rods 9 to pins upon double cranks 10 on the crank-shaft 5. Steam is admitted to the cylinder-space above the high-pressure piston 7, exhausted therefrom into the space above the low-pressure piston 8, and thence exhausted into the atmosphere or a condenser, as the case may be, by a single main or distribution valve, 12, which is adapted to reciprocate in a sleeve or bushing, 14, having suitable ports communicating with the steam supply and exhaust pipes and cylinder-spaces, and fixed in a valve-chest, 15, located above the crank-case and between the cylinders 1 2.

The construction, so far as described, is one of the many types of engines to which my improvement is applicable, and does not in and of itself constitute any part of my present invention.

In the practice of my invention the reciprocation of the distribution-valve 12 to induce rotation of the crank-shaft 5 in either direction is effected by an eccentric, 13, through the intermediation of any suitable adjustable cut-off mechanism, a desirable form of which will be presently described, whereby the degree of expansion may be varied and adjusted from time to time, as required, by the person in charge of the engine.

In order to eliminate strains and disturbing action which would otherwise be incident to the inertia of the valve and its connected reciprocating members, I connect thereto a pressure device, which alternately resists and assists the movement thereof at and adjacent to the extremities of their traverse, thereby counteracting and neutralizing the resistance to the change of direction of the valve at the ends of its stroke, which is due to inertia. In the instance illustrated the pressure device employed consists of a piston, 35, connected by a stem, 36, to the valve 12, and working coincidently with the valve in a chamber formed by a prolongation of the valve-chest, in which chamber a constant average pressure of steam or air is maintained.

Regulation of the pressure in the piston-chamber is effected by means of a check-valve, 38, controlling communication with a pipe, 37, leading out of the piston-chamber and pressed against its seat by a spring, 39. The steam or other fluid in the piston-chamber being alternately expanded and compressed by the movement of the piston 35, acts in the manner of a cushion to counteract the inertia of the valve and connected reciprocating parts of the valve-gear, and in the case of a vertical engine, as shown, the average pressure above the piston 35 is less than that existing in the crank-case

and exerted upwardly on the valve. The piston 35 therefore serves further to balance the gravity of the valve by causing a partial vacuum above the valve to be opposed to atmospheric pressure below it.

A spring connected to the valve-rod or valve in such manner that its tension may be alternately exerted in and oppositely to the direction of movement of the valve may be substituted as a mechanical equivalent for the pressure-piston herein described and shown.

The eccentric 13, which operates the distribution-valve 12, is formed integral with or fixed upon the crank-shaft 5 in or as closely adjacent as may be to the transverse central plane of the valve-chest 15, the longitudinal central plane of which is external to the crank-shaft, and the movement of the eccentric is transmitted to the distribution-valve through a valve-gear of the following construction: The eccentric-strap 19, which incloses the eccentric 13 in the usual manner, is prolonged on the side of the crank-shaft nearest the valve-chest to form an arm, 21, which is coupled to the lower end of a valve-rod, 20, the upper end of which is coupled to a pin, 22, on the distribution-valve, or may be similarly connected to the valve-stem when the same is extended below the valve. A rock-shaft, 23, is journaled in a plane parallel with the crank-shaft in a bearing, 24, which, as shown, is fixed upon the center bearing, 16, of the crank-shaft, but which may be secured to any other suitable and convenient support upon the engine-frame or bed-plate.

The rock-shaft 23 is provided with two arms, 25 26, extending in opposite directions from its axial line, and its upper arm, 25, is coupled by a rod or link, 27, to an arm, 28, fixed upon a reversing-shaft, 29, journaled in bearings in the upper portion of the crank-case. Axial movement is imparted to the reversing-shaft 29 and the rock-shaft 23, coupled to the arm 28 thereof, as from time to time required for varying the point of cut-off or reversing the direction of movement of the crank-shaft, by a reverse-lever, 30, secured upon the outer end of the reversing-shaft and carrying a stop or detent, 31, adapted to engage in any one of a series of notches in a fixed segment, 32. The lower arm, 26, of the rock-shaft 23 is coupled by a pin, 33, to the lower end of a link, 34, the upper end of which is coupled by a pin, 35, to the eccentric strap 19 at a point between the eccentric and the connection of the valve-rod 20 to the eccentric-strap.

From the above construction it will be seen that axial movement of the rock-shaft 23 in either direction in its bearing, as induced by movement of the reverse-lever 30, effects the traverse of the connected lower ends of the arm 26 and link 34 in an arc concentric with the rock-shaft 23, and coincidently moves the eccentric-strap 19, through its connection with the opposite end of the link 34, around the eccentric. Such movement of the eccentric-strap correspondingly varies the position and degree of traverse of the distribution-valve, and thereby varies the degree of expansion or point of cut-off, and, further, when so far extended as results from sufficient movement of the reverse-lever 30 to change the position of the pin 33 from one side to the other of the plane of the distribution-valve 12, reverses the direction of movement of said valve, and consequently reverses the direction of rotation of the crank-shaft.

As shown in the drawings, the position of the parts is such that the greatest degree of traverse for one direction of movement of the shaft is imparted to the valve, and steam is therefore admitted during the longest period practicable of the stroke. Movement of the reverse-lever to the left reduces the traverse of the valve and increases the degree of expansion, rotation being imparted in the same direction to the crank-shaft until the pin 33, which acts as a floating or movable fulcrum, is brought into line with the central plane of the valve, after which continued movement of the reverse-lever in the same direction reverses the direction of traverse of the valve and of rotation of the crank-shaft, and diminishes the degree of expansion in such reversed direction proportionately as the reverse-lever is brought toward the opposite extremity of its throw on the segment 32, and the pin 33 is moved toward its position of maximum distance from the central plane of the valve on the opposite side thereof to that which it occupies in the drawings.

A special structural advantage of my improved valve-gear is found in obviating the necessity of expensive slotting, link-and-pin connections being employed throughout, and the compact arrangement of the parts renders it specially adaptable to use in comparatively confined limits, as in closed crank-cases. Its facilities in operation for ready and speedy reversal and adjustment of cut-off are further advantageously exerted in connection with single-valve compound engines for marine service, in which simplicity of mechanism and certainty of reverse are materially important.

I am aware that valve-gears in which the valve-stem is connected to an eccentric-rod which is varied in position to effect reversal of movement and variation of the point of cut-off by changes of the position of a movable fulcrum relatively to the eccentric-rod were known prior to my invention, and such constructions, broadly, I therefore disclaim.

I claim as my invention and desire to secure by Letters Patent—

The combination of an eccentric fixed upon a crank-shaft mounted in bearings in a closed crank-case, an eccentric-strap having a projecting arm coupled to a valve-rod, a rock-shaft journaled in the crank-case on a bearing

of the crank-shaft, a reversing-shaft journaled in the case and carrying an external reverse-lever, a link coupling an arm on the rock-shaft with an arm on the reversing-shaft, and a fulcrum-pin coupling an opposite arm of the rock-shaft to a link which is coupled at its opposite end to the arm of the eccentric-strap, substantially as set forth.

In testimony whereof I have hereunto set my hand.

FRANCIS M. RITES.

Witnesses:
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R. H. WHITTLESEY.