No. 827,810. PATENTED AUG. 7, 1906.

P. MOHRDIECK.

GAS ENGINE.

APPLICATION FILED APR. 13, 1903.

2 SHEETS—SHEET 1.

Fig. 2.

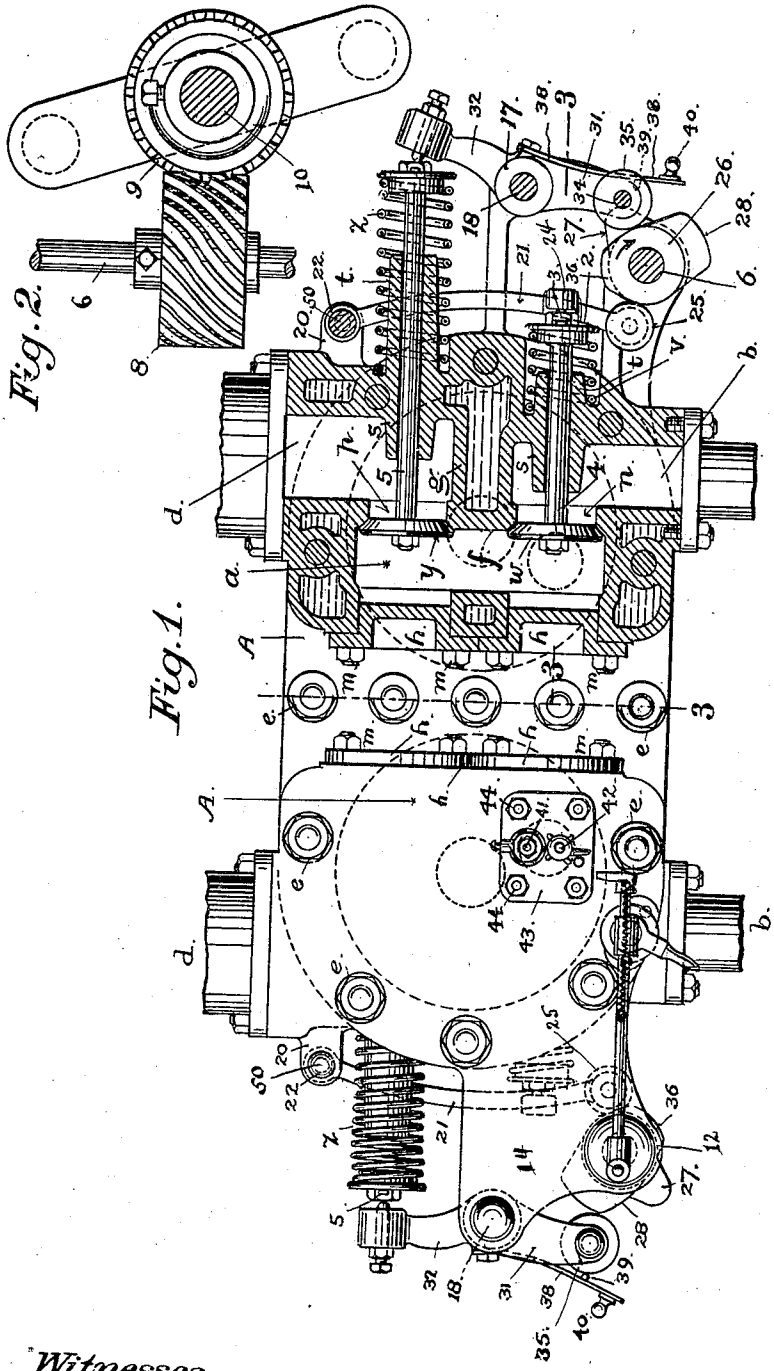


Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

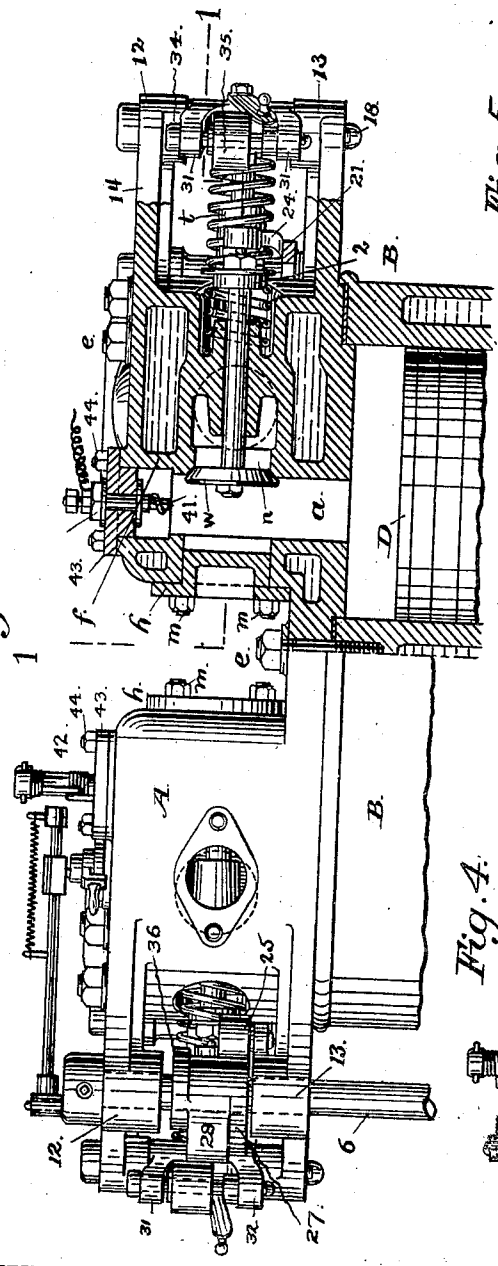



Fig. 5.

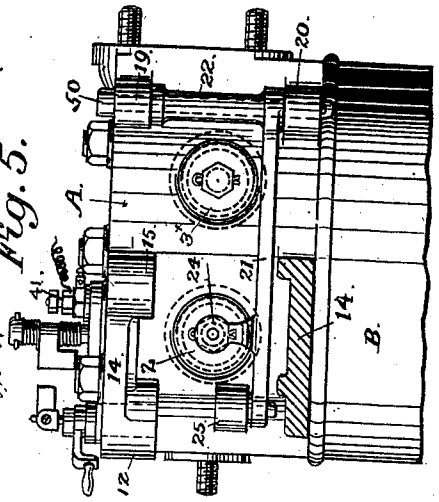
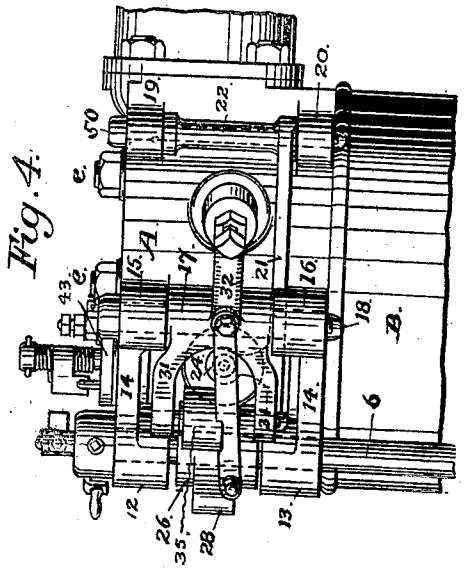



Fig. 4.




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PETER MOHRDIECK, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO STANDARD GAS ENGINE COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION.

## GAS-ENGINE.

No. 827,810. Specification of Letters Patent. Patented Aug. 7, 1906.

Application filed April 13, 1903. Serial No. 152,306.

*To all whom it may concern:*

Be it known that I, PETER MOHRDIECK, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented a new and useful Improvement in Gas-Engines, of which the following is a specification.

My invention relates to improvements in that part of a gas-engine wherein the charge of explosive mixture is admitted and fired and in the mechanism for operating the admission and exhaust valves; and the said improvements comprise certain novel construction and combination of explosive chamber, admission and exhaust valves, and mechanism for operating the valves, all as hereinafter more particularly described and set forth.

The following description explains at length the nature of the present improvements and the manner in which I proceed to construct, apply, and carry out the same, reference being had to the accompanying drawings, that form a part of this specification.

Figure 1 is a top view of the cylinders of a two-cylinder gas-engine of the upright-cylinder type having my invention applied thereto and embodied therewith, the head of the right cylinder of the pair being shown in horizontal section. This view is a section taken on the line 1 1, Fig. 3. Fig. 2 is a detail of the gearing connecting the upright shaft, that actuates the valve mechanism, with the horizontal shaft of the engine. Fig. 3 is a front elevation of the heads and upper portions of the two cylinders and the valve-operating mechanism of each cylinder, the right-cylinder head being shown in section. This view is a section taken on the line 3 3, Fig. 1, in two vertical planes at right angles to each other. Fig. 4 is an elevation of the admission-valve and its operating mechanism of the right cylinder in Fig. 3. Fig. 5 is a similar elevation of the head of the same cylinder, showing the actuating mechanism of the admission-valve removed and a portion of the exhaust-valve mechanism.

In this improvement the explosion-chamber *a*, inlet-passage *b*, and exhaust-passage *d*, and the guides and bearings for the valves and their actuating mechanism are all contained in the head A, which closes the top end of the cylinder B. By removing the bolts *e*, that secure it in place, the head is separated from the cylinder without disconnecting the valves or disturbing the adjustment of the mechanism.

The chamber *a* opens at the bottom directly into the cylinder-space above the piston D and is practically an extension or continuation of the cylinder-space upward into the head A, with the longest dimension corresponding substantially in length to the internal diameter of the cylinder. An upright partition *f*, forming the inner wall of the chamber *a*, separates it from the inlet-passage, and an abutment *g* at right angles to the partition divides the two passages. The outer wall of the chamber is formed of plates *h*, held in place by bolts *m*, which when removed give openings in the side of the head directly in line with the inlet-port *n* and the exhaust-port *p* in the partition *f*. These openings give access to the valves and the valve-seats for finishing and setting, as well as for cleaning and repairs.

A long bearing or guide *s*, bored for the stem of the valve, extends inwardly from that side of the head A which forms the outer wall of the inlet and exhaust passages, and similar guides *t* on the outer side of the same wall surround the valve-stem. Each valve is opened through the medium of a rocker-arm and a face-cam, but is closed by a coiled spring surrounding the stem of the valve, each valve being arranged to act at right angles to the axis of the passage in the head, through which the gas or the exhaust travels.

The coiled spring *v* on the stem of the admission-valve *w* is confined between the side of the head A and a flanged disk or cap 2 on the end of the stem 4, the cap being secured on the threaded end of the stem by a nut 3. The exhaust-valve *y* is returned to its seat by a coiled spring *z*, confined on the valve-stem 5 by a similar means.

Both valves are moved from their seats by face-cams fast on a common shaft 6, to which rotation is given by gears 8 9, connecting it with the engine-shaft 10. One of these gears is fixed on the cam-shaft 6 and the other on the engine-shaft, and as the two shafts are at right angles to each other spiral gears are used to connect them, as seen in the detail, Fig. 2. The upper end of the cam-shaft 6 has bearings at 12 13 on the ends of horizontal arms or brackets 14, which extend from

the head outward at proper distance apart to give room for the cams and also allow the rocker-arm of the exhaust-valve to play between them. Double bearings 15 16 are also provided on the same side of the head for a second shaft 18, carrying the rocker 17 that operates the exhaust-valve, and additional bearings 19 20 are provided for the shaft 50 of the oscillating arm 21, that opens the admission-valve. All these bearings are permanent parts of the head and are so arranged that they are not only readily accessible for boring and finishing, but they also furnish bearings for the parts which are fitted to work in them at two points, one above and the other below the point or locality of greatest strain or pressure.

The arm 21 is a rigid member of a long hub 22, surrounding the stationary shaft 50, and from that center of movement the arm 21 extends across the line of the valve-stem and approximately at right angles to it.

The coiled spring, which returns the inlet-valve to its seat after the opening movement, holds the end of the valve-stem against the arm, and at that point between the two ends where the stem rests against the arm a standing lug or projection 24 takes the end of the valve-stem. The free end of the arm 21 carries a roller-bearing stud 25, that travels in contact with one cam portion 27 of a broad-faced disk 26, fast on the shaft 6. The end of the arm stands in line between the shaft and the head A and is pressed back or in the required direction to open the valve as the cam makes contact with the roller 25. The other cam 28 on that disk operates to open the exhaust-valve through the medium of a rocker composed of the long hub or sleeve 17, loose on the shaft 18, and two arms or members 31 32, extending in opposite directions from the hub, but in the same general plane, one toward the cam-shaft 6 and the other across the end of the exhaust-valve stem 5. The member 31 of the rocker is composed of two parallel arms having bearings in which is mounted the upright axle 34. A roller 35 on this axle has rolling contact with the cam part 28 of the disk 26. The two cams 27 28 are properly shaped and timed to operate the admission-valve and the exhaust-valve in the required alternate manner, holding one open for the proper length of time to charge the explosion-chamber *a* and the other to give an exhaust of full area. The two valves are operated by this means from the single shaft 6, revolving continuously and permanently connected to the engine-shaft, while the parts that apply the necessary force or pressure to open the valves act directly against the ends of the valve-stems without being connected to the stems, thereby leaving the latter free to respond promptly to the reactive force of the coiled springs and to the pressure of the gases against the front side of the valves. The cams 27 28 are arranged in different planes on the shaft 6, the former being in position to operate the arm 21, while the latter is in position to operate the rocker 31 32. In addition to these two cams the disk carries a third cam 36, that is situated above the plane of the exhaust-valve cam 28, so as to clear the roller 35 on the arm 31 of the rocker when that roller is standing in operative relation to the exhaust-cam 28; but by raising the roller 35 it can be thrown above the line of the cam 28 and brought in line with the cam 36. Being set up or down in this manner the roller 35 is adjusted in one position to be acted on by the cam 28 or in another position by the cam 36. The last-mentioned cam is so formed and set with relation to the admission-valve cam 27 that it will throw the exhaust partly open and to a less extent than the movement produced by the main cam 28 for a short period immediately after the admission-valve has admitted the gas and has closed behind the charge, and to that end the cam 36, which may be termed the "supplementary exhaust-cam," is situated behind the cam 27 and has both a smaller degree of projection and is shorter than the main exhaust-cam 28, as will be seen in Fig. 1, where the direction of rotation is indicated by the arrow on the cam-bearing disk.

The adjustment of the valve-actuating lever to the cams 28 36 is effected by so mounting the roller 35 on the axle that it may move longitudinally, and at the same time it will turn with the axle, and means are provided for holding the roller in position when it is raised, while its rotative movement with the axle is not interfered with. A spring-bar 38 is secured at one end to the rocker and is provided with a lug or projection 39 on its inner face, that engages the under surface of the roller 35 and forms a simple means of holding the roller in the elevated position, a knob 40 being provided on the free end of the spring-bar for throwing it in or out of operation.

The function of the supplementary exhaust-cam is to reduce the charge of gas in the cylinder just before compression takes place when the engine is being started, and thereby allowing the engine-shaft to be turned by hand more easily than it is possible to do when the full charge of gas is retained in the cylinder during the compression-stroke. By drawing back the spring 38 the roller 35 will drop from its elevated position, clearing the cam 36 and standing in line with the cam 28.

The charges of gas are fired in the explosion-chamber above the piston by an electric sparking device composed of a stationary electrode 41 and an oscillating electrode 42, both extending through the top of the explosion-chamber from the outside and mount-

ed in a base 43, which also forms the top plate or cover of an opening in the top of the cylinder-head A. This part being secured in place by bolts 44 affords ready access to the parts for renewing the parts when worn.

Having thus fully described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

In a gas-engine, the combination with the cylinder and driving-piston, of an admission-valve, a lever for operating the same, an exhaust-valve, an arm for operating the said exhaust-valve, a shaft continuously driven by the engine-shaft, a cam on said shaft for operating the admission-valve lever, another cam on said shaft for operating the exhaust-valve arm, a supplemental cam on the said shaft for operating the exhaust-valve arm when the engine is started, an adjustable contact-roller on the exhaust-valve arm, and a spring-bar on the exhaust-valve-operating arm for holding the contact-roller in position to be engaged by one or the other of the cams for operating the said arm, substantially as set forth.

In testimony whereof I have signed my name in the presence of two subscribing witnesses.

PETER MOHRDIECK.

Witnesses:
M. REGNER,
EDWARD E. OSBORN.