(No Model.) 3 Sheets—Sheet 1.

J. DAY.

GAS ENGINE.

No. 543,614. Patented July 30, 1895.

FIG. 2

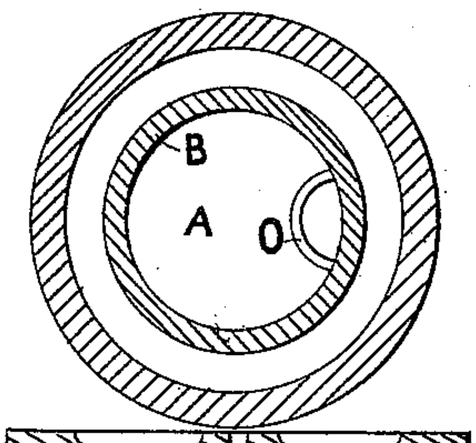
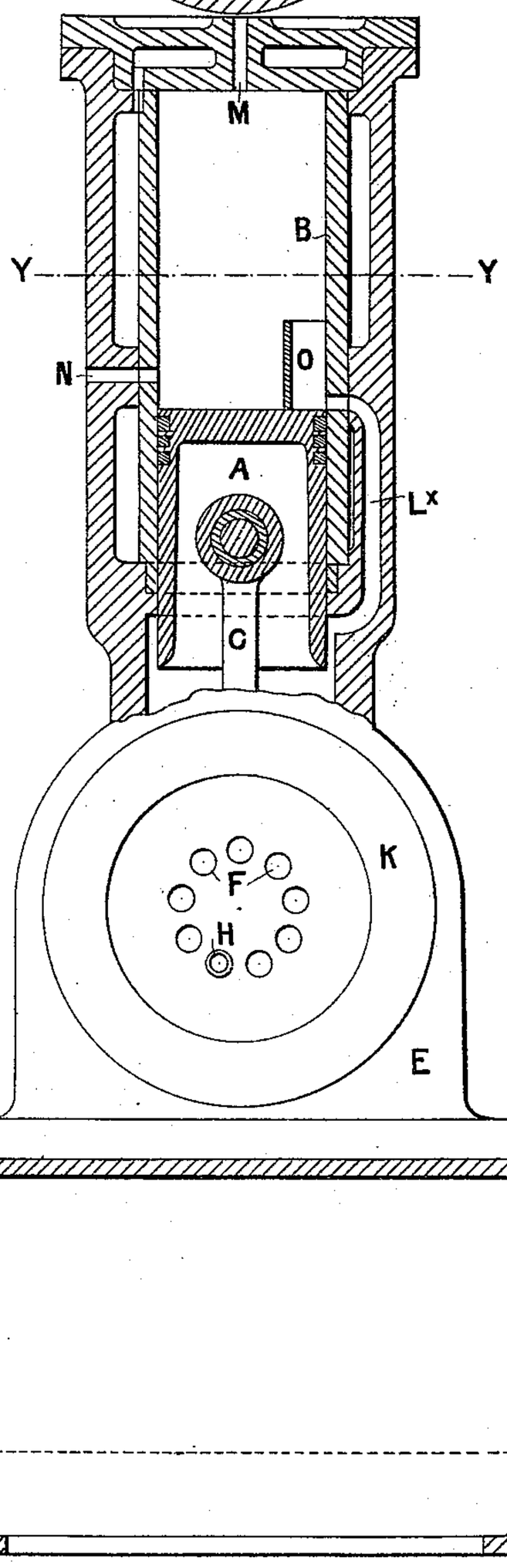


FIG. 1.



Witnesses:-
H. K Boulter
B. Northcliffe

Inventor:
Joseph Day.
By Wm E. Boulter, Attorney

(No Model.) 3 Sheets—Sheet 2.

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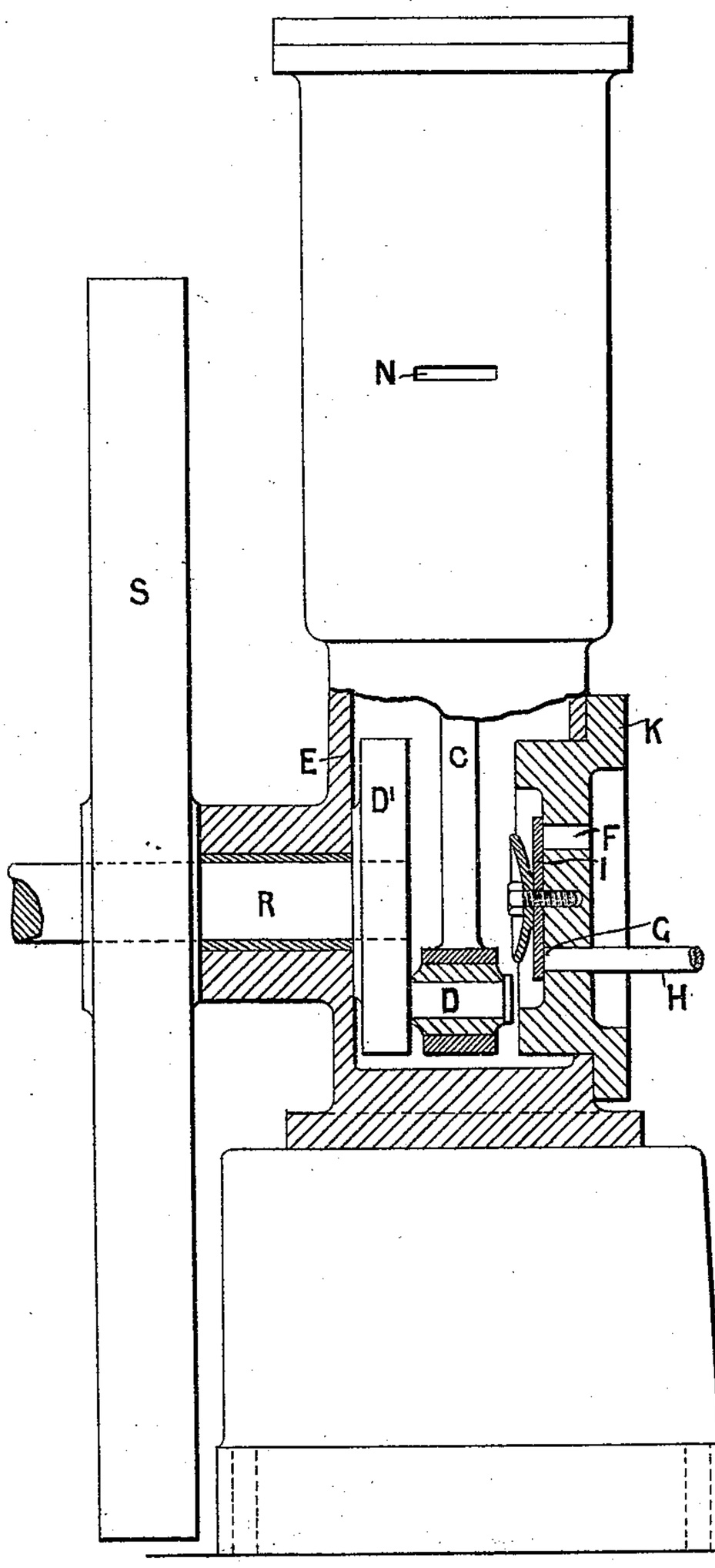
FIG. 3.



Witnesses:
W. K. Boulter
C. E. Northrup

Inventor:
Joseph Day,
By Wm. C. Boulter,
Attorney

(No Model.)

3 Sheets—Sheet 3.

J. DAY.

GAS ENGINE.

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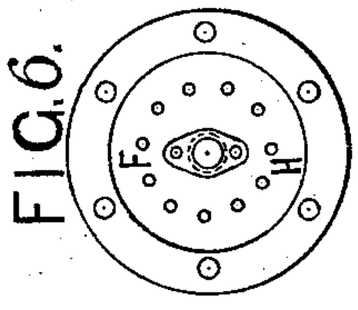
FIG. 6.



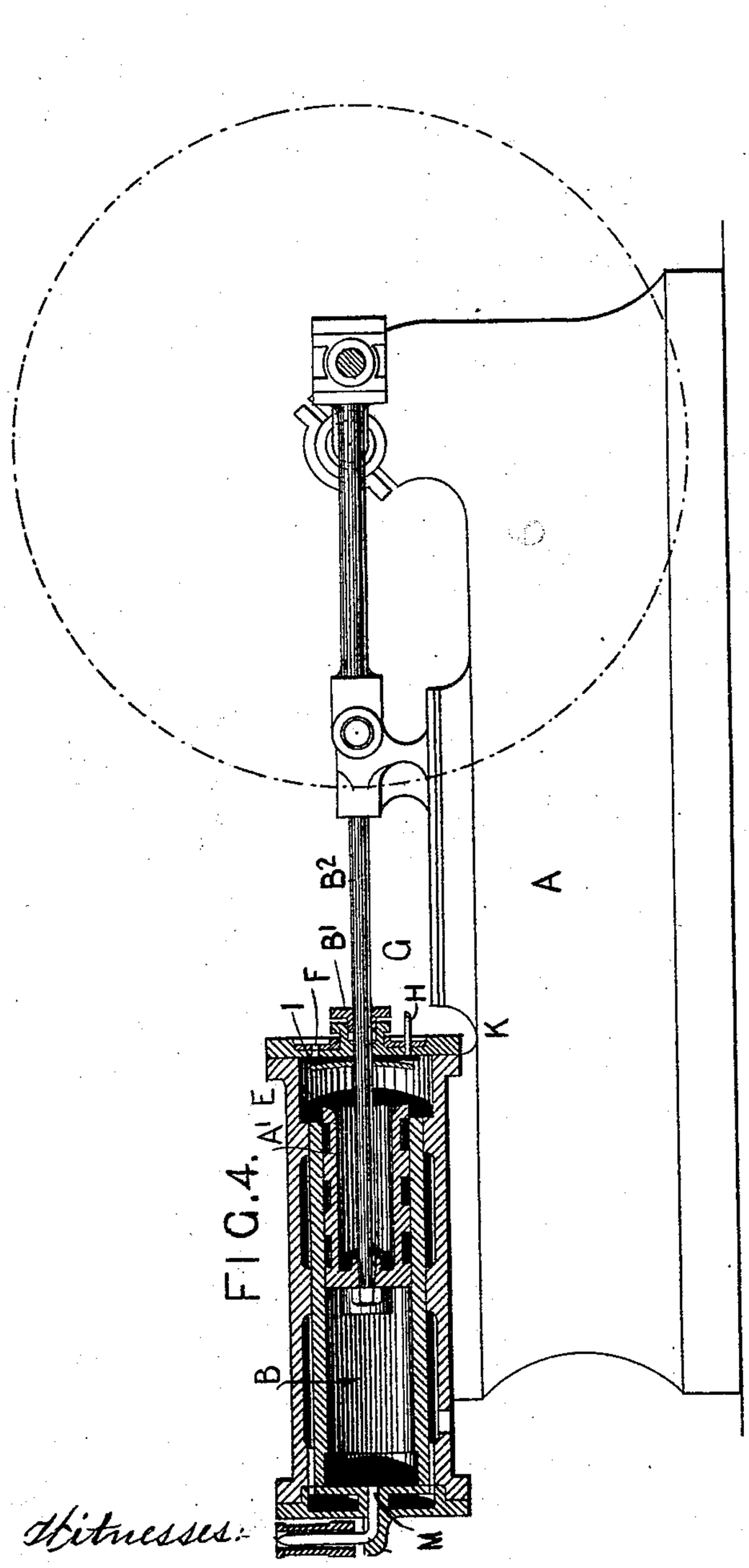


FIG. 4.

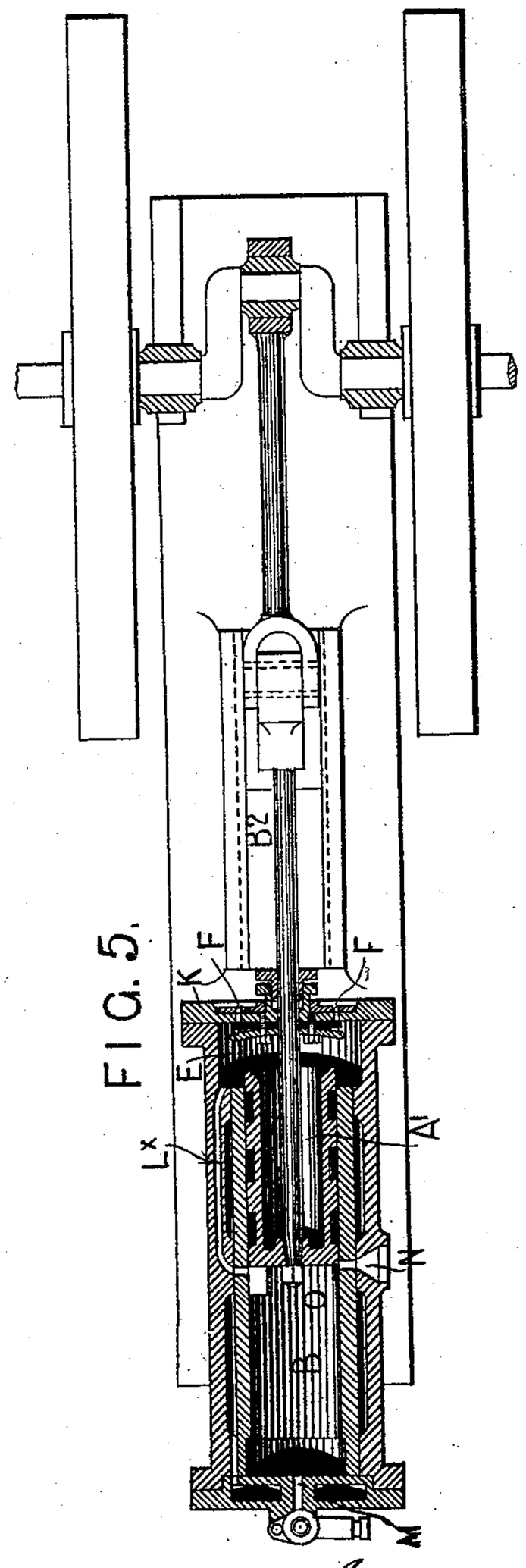


FIG. 5.

Witnesses:-
H. B. Kingsbery
C. L. Wolthuis

Inventor:-
Joseph Day.
by his attorney Wm. E. Boulter.

UNITED STATES PATENT OFFICE.

JOSEPH DAY, OF BATH, ENGLAND.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 543,614, dated July 30, 1895.

Application filed May 21, 1892. Serial No. 433,823. (No model.) Patented in England April 14, 1891, No. 6,410, and June 1, 1891, No. 9,247.

To all whom it may concern:

Be it known that I, JOSEPH DAY, engineer, of Spring Gardens, Bath, in the county of Somerset, England, have invented certain new and useful Improvements in Gas-Engines, (for which I have obtained Letters Patent in Great Britain, No. 6,410, dated April 14, 1891, and No. 9,247, dated June 1, 1891,) of which the following is a specification.

My invention relates to improvements in gas-engines; and it consists in the construction, arrangement and combinations of parts hereinafter described, shown in the drawings, and pointed out in the appended claims.

According to my invention I construct an engine capable of being actuated either by an explosive mixture of gas and air or by the ignition of an explosive vapor, and by my construction, hereinafter to be described, I produce a gas-engine in which eccentrics, cams, valve-rods, and other positively-actuated gear are dispensed with.

In the drawings, Figure 1 is an end view, partly in section, of a gas or vapor engine of the vertical inverted type, in which the crank works in an inclosed space in the framework. Fig. 2 is a plan section on line Y Y, Fig. 1. Fig. 3 is a side view partly in section. Fig. 4 is a side view, partly in section, of a modified form of engine having an ordinary piston-rod with stuffing-box and connecting-rod to crank. Fig. 5 is a plan sectional view thereof, and Fig. 6 is an end view of the cylinder-cover K.

Like letters of reference refer to like or equivalent parts in all the figures.

Referring to Figs. 1, 2, and 3 the plunger or piston A reciprocates in the jacketed cylinder B, which is mounted over and connected by a connecting-rod C to the crank-pin D, which latter is mounted on the crank or crank-disk D, keyed onto crank-shaft R having fly-wheel S. The air and gas are drawn in from below through the casing forming the admission-chamber E respectively by air-ports F, communicating to the outer air, and gas-port G leading from the gas-supply pipe H, and a single disk or other suitable valve I does duty for the admission of both air and gas. This valve I may, as shown, be suitably mounted on a cover K, which is fixed onto the casing forming the chamber E by bolts or otherwise, to allow of the whole valve and its seating to be removed when desired for renewal, adjustment, or cleaning.

Although I have only shown one form of valve I, for the admission of air and gas, it is evident that any suitable construction may be used, and, if desired, a separate valve may be used for the air and another for the gas admission.

The air and gas, as described, enter by the valve I during the early portion of the upstroke and by the revolution of the crank-disk D′ and crank D, and movement of the connecting-rod are intimately mixed. The explosive mixture is conveyed into the upper part of the cylinder at the end of the downstroke or early part of the up stroke by a passage $L^{\times}$ in the outside of the cylinder, while the piston itself serves as a slide-valve whereupon the compression of the mixture above begins, owing to the piston closing the port and thus preventing communication between the upper and lower parts of the cylinder. The ignition then takes place by any suitable igniting device having connection with the interior of the cylinder by a pipe M, and the plunger A is forced down until the exhaust-port N is uncovered thereby, and the majority of the products of combustion escape, while previous to such exhaust a certain amount of compression has been given to the mixture of air and gas below in the chamber E in such manner that, as aforesaid, as soon as the exhaust has taken place the explosive mixture passes by way of the passage $L^{\times}$ into the upper part of the cylinder.

By so proportioning the size of the exhaust-port orifice, I am enabled to leave more or less of the products of combustion in the cylinder at the end of the downstroke, as desired. In order that the explosive mixture may not at the beginning of the upstroke escape by the exhaust, I provide a sort of funnel, shield, or deflector O on the top and at one side of the plunger, or otherwise I may make the port of the passage $L^{\times}$ in such manner that the explosive mixture is directed away from the exhaust-port. The cubical contents of the inclosed lower chamber and the cylinder should bear such relation to one another

that, on the charge being delivered into the cylinder from the lower chamber E, both sides of the plunger should be at or about at atmospheric pressure.

Lubrication of the working parts and the keeping cool of the same are attained by permitting one or more of such parts to move or impinge against oil or water, or a mixture of both, in the bottom of chamber E. The speed of the engine may be governed by means of any suitable governing device acting on the gas-supply or otherwise.

By reason of the direct flow of the explosive mixture through the passage $L^{\times}$, it becomes possible, as evidenced by actual practice, to produce with absolute certainty an ignition at each revolution, and to run the engine at a speed of as much as five hundred revolutions per minute. This has heretofore been impossible.

Figs. 4, 5, and 6 show an engine constructed according to my invention, mounted on a horizontal bed-plate A′, in which the piston is provided with a piston-rod B, having a cross-head in guides and connecting-rod C to the crank instead of a connecting-rod only, as in the engines previously described. The chamber E in this case is formed by the front part of the cylinder B, and the valve I is mounted on the cover K, which has stuffing-box B′ through which the piston-rod B^2 goes. The action is precisely the same as that of the vertical engine before described, and need not be recapitulated here. A passage $L^{\times}$ is shown for passing the explosive mixture from the chamber E to the back part of the cylinder, as in Fig. 1.

The engine just described may naturally be mounted vertically, if desired. Two or more of these engines may be connected to the same shaft and on the same framework or bed-plate, when desired. The engine or engines may be reversed by merely stopping the same and starting it in the opposite direction. The absence of eccentrics, cams, valve-rods, and other gear, and of valves in passages, valve chests or conduits outside of the cylinder greatly simplifies the construction of the engine, the ease of working it, and the facility with which it may be adjusted or cleaned. There is, further, no fear of escape of gas into the outer air.

What I claim, and desire to secure by Letters Patent, is—

1. In a gas engine, the combination of a cylinder having an exhaust port and a piston therein, said piston being provided with a shield, O, opposite the exhaust port, the said cylinder being divided by the piston into an explosion chamber, B, on one side, and a compression chamber, E, on the other side, and a communicating passage $L^{\times}$, the opening from said passage into the chamber B, being opened and closed by the piston, with separate air and gas ports leading into the chamber E, and a disk valve, I, secured to the inside of the said chamber, so that its free edges cover both air and gas ports, the said disk valve being adapted to be automatically opened by the suction of the piston, and to close over the ports by the compressing action of the piston, the exhaust port being so proportioned that a part of the products of combustion may be left in the cylinder at the end of the down stroke, substantially as set forth.

2. In a gas engine, the combination of a cylinder, having an exhaust port and a piston therein, the said cylinder being divided by the piston into an explosion chamber, B, on one side, and a compression chamber, E, on the other, and a communicating passage, $L^{\times}$, the opening from said passage into the chamber B, being opened and closed by the piston, with separate air and gas ports leading into the chamber, E, and a disk valve, I, secured to the inside of the chamber, and surrounding the piston rod, so that the free edges cover both air and gas ports, the said disk valve being adapted to be automatically opened by the suction of the piston, and to close over the ports by the compression action of the piston, substantially as set forth.

JOSEPH DAY.

Witnesses:
L. BRINKWORTH,
W. I. WEEKS.