

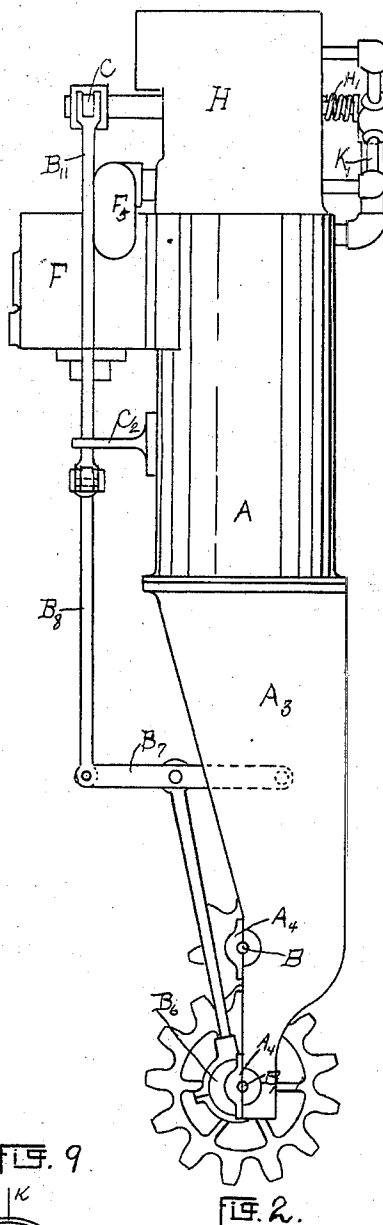
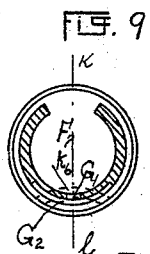
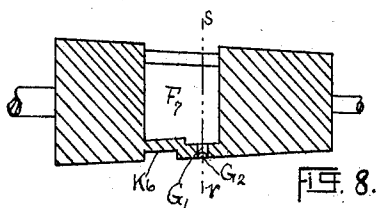
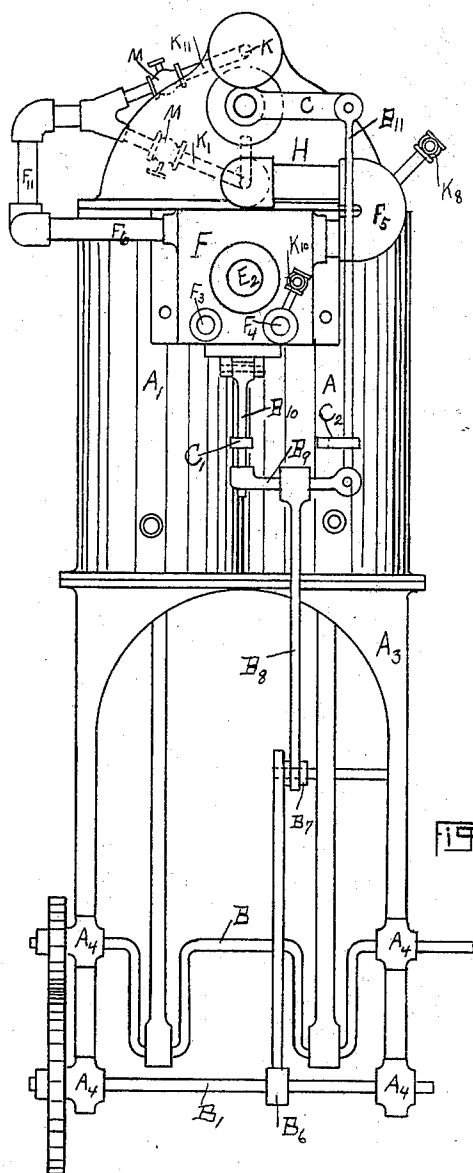
(No Model.)

2 Sheets—Sheet 1.

E. E. BUTLER.
GAS ENGINE.

No. 546,110.

Patented Sept. 10, 1895.



Witnesses.

S.H. Cole
H. Fears

By his Attorney.

Inventor.

EDWARD E. BUTLER

Moore.

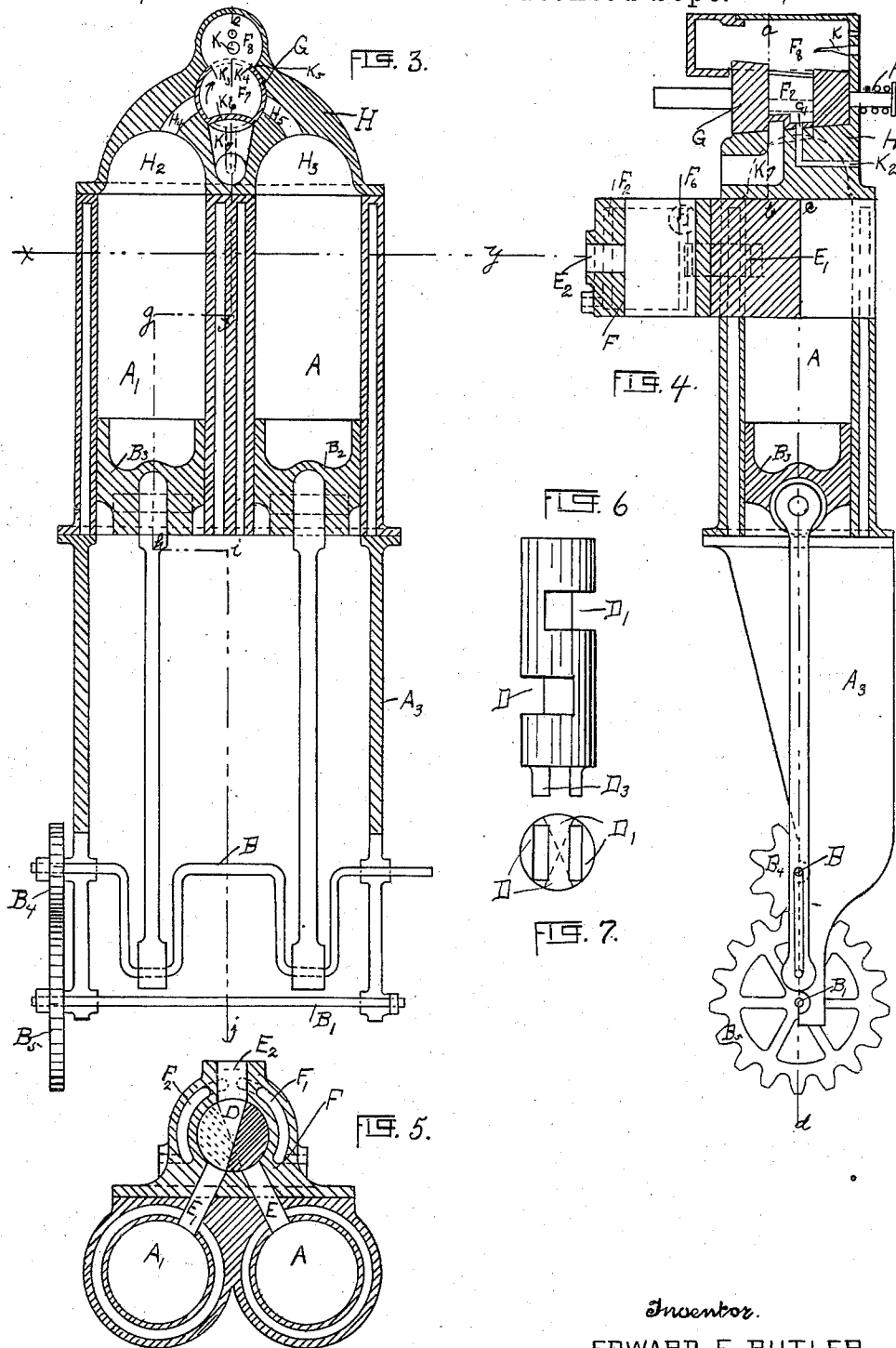
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2 Sheets—Sheet 2.

E. E. BUTLER.
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Witnesses
S. H. Cole
H. E. Hall

By his Attorney

Inventor.
EDWARD E. BUTLER

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UNITED STATES PATENT OFFICE.

EDWARD E. BUTLER, OF ATLANTA, GEORGIA, ASSIGNOR OF ONE-HALF TO
ROBT. P. HORTON, OF SAME PLACE.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 546,110, dated September 10, 1895.

Application filed August 13, 1894. Serial No. 520,736. (No model.)

To all whom it may concern:

Be it known that I, EDWARD E. BUTLER, a citizen of the United States, residing at Atlanta, in the county of Fulton, State of Georgia, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

The object of my invention is to provide a simple gas-engine in which the explosion of gas takes place once every revolution, alternating from one cylinder to the other. I attain this object by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top plan of my engine, and shows the valve mechanism, the gas-generator, and pipe connections. Fig. 2 is a side view of same. Fig. 3 is a section on line *a b c d*, Fig. 4. Fig. 4 is a section on line *e f g h i j*, Fig. 3. Fig. 5 is a section on line *x y*, Fig. 3. Figs. 6 and 7 show a detail elevation and plan, respectively, of my exhaust-valve. Fig. 8 is a section of my admission-valve on line *k l*, Fig. 9. Fig. 9 is a section of same on line *r s*, Fig. 8.

Similar letters refer to similar parts throughout the several views.

My engine consists of two parallel cylinders made in one casting, which is bolted to the frame or bed *A*¹. The bed is fitted with bearings *A*⁴, in which the double crank-shaft *B* and eccentric-shaft *B'* revolve. In each cylinder there is a piston *B*² *B*³, each being connected to the crank in line with it by a pitman. On the crank-shaft *B* is a gear-wheel *B*⁴, which meshes with a gear *B*⁵ on eccentric-shaft *B'*. The velocity of these gears is two to one, the large gear being on the eccentric-shaft *B'*. The eccentric *B*⁶, Figs. 1 and 2, is connected to a rocker-arm *B*⁷. By means of a pin-joint the rocker-arm *B*⁷ has connected to it a rod *B*⁸, in the end of which there is fastened a cross-arm *B*⁹. The exhaust-valve rod *B*¹⁰ is secured to one end of this cross-arm, and the admission or gas valve-rod *B*¹¹ to the other end. Each end of the valve-rod *B*¹¹ is bifurcated and slips over the end of the cross-arm *B*⁹ and valve-arm *C*, to each of which it is secured by a pin-joint. The end of the exhaust-valve rod *B*¹⁰ is secured in the end of the cross-arm *B*⁹, with a set-screw which will admit of an adjustment for the ex-

haust-valve. Each valve-rod is supported in guides *C'* *C*², the guide *C*² being slotted to allow the rod to move parallel to itself.

The exhaust-valve reciprocates in a seat provided for it in the generator, to be described hereinafter. Referring to Figs. 6 and 7, the construction of this exhaust-valve is as follows: It consists of a solid cylinder with transverse grooves *D* *D'* cut through the center of cylinder and ears *D*³ on its end to secure the valve-rod to.

Referring to Fig. 5 it will be seen that the angle at which the slot is cut should be such that when one exhaust-port *E* is closed the other port *E'* shall be in communication with the exhaust-pipe *E*², and vice versa.

The gas-generator *F* is bolted to the top of the cylinders at or near one end. This generator consists of a casting which contains two circular chambers *F'* *F*², extending partially around the casting. These chambers do not connect one with the other. They are supplied with gasoline from a tank through pipes. The pipe *F*⁵, leading from chamber *F'*, supplies the engine with its material, and the pipe *F*⁶, leading from the chamber *F*², supplies the lights that burn in the chambers *F*⁷ and *F*⁸. The generator also contains ports that will coincide with and be a continuation of the ports *E'* *E'* in the cylinders. Through the center of the generator and parallel to the center line of cylinders a hole is bored. This furnishes a seat for the exhaust-valve.

The admission-valve *G*, as seen in Figs. 8 and 9, consists of the frustum of a cone hollowed out near the middle, forming a chamber *F*⁷. A small hole *G'* is drilled through the wall of the chamber and a half-round circular groove *G*² extends partially around the valve and passes through the hole *G'*. The seat for this valve is made into the sphere-shaped head *H*, and the valve is held tightly in this seat by means of the spiral-spring *H'*. The chambers *H*² *H*³ in the head *H* are the explosion-chambers and are connected at the proper time with the generator-pipes by means of ports *H*⁴ *H*⁵.

The operation of the engine is as follows: The gas in cylinder *A* we will consider has just exploded and driven the pistons to the end of the stroke. The cylinder *A* is full of

gas mixture. Now as the cranks revolve the pistons move toward the other end of the cylinder, the slot in the exhaust-valve, Fig. 5, places the port E' in communication with the exhaust-pipe E², and the piston B³ drives the products of combustion out of the cylinder A'. The cylinder A being full of the explosive mixture of air and gas, the piston B³ will compress same as it approaches the other end of the stroke. While the piston B² is compressing the mixture the pipe K' is supplying pure gas from the chamber F² of the generator to the small port K². It passes along this port K² and through the hole G' into the chamber F⁷, where it is lighted and burns in that chamber. The gas in chamber F⁷ is lighted by the continuously-burning jet K in the chamber F⁸. Now as the valve G revolves in the direction of arrow the gas will be supplied to the chamber F⁷ by means of the circular groove G², Figs. 8 and 9, and hole G'. As the valve moves around the edge K³ of the opening to chamber F⁷, it will pass the edge K⁵, and the chambers F⁷ and F⁸ are disconnected. At the instant the chambers are disconnected the edge K⁴ of the opening passes the upper edge of the port H⁵, and the burning gas in chamber F⁷ will ignite the explosive mixture contained in the chamber H³. At the instant of explosion the valve G, by means of the circular port K⁶, has connected the port H⁴ with port K⁷. This port K⁷ being fed with gas and air from pipe F⁵ and air-valve K⁸, the cylinder A' will fill with the explosive mixture as the pistons move forward, due to the pressure in cylinder A. When the pistons have reached the end of the stroke, as shown in Figs. 3 and 4, the valve G will have moved back to its central position shown, due to the eccentric. The gas in chamber F⁷ having been blown out by the explosion will relight from jet K, the chambers now being connected by opening in valve G. The exhaust-valve will have moved forward until the slot D' connects the port E with pipe E², when the cylinder A will exhaust on the return-stroke. During this return-stroke the valve G will move in the opposite direction of the arrow, and the operation of exploding the mixture in cylinder A' and of filling the cylinder A is similar to the operation just performed. In order to explode two cylinders, one on each revolution of the crank, it is easily seen that the eccentric operating the valves will move only one-half revolution, while the crank moves an entire revolution. To produce this effect I put the eccentric on another shaft B', and connect same with crank-shaft B by means of gear-wheels, which will

give a velocity ratio between the shafts B and B' of two to one, respectively. If the air-valves K⁸ and K¹⁰ be closed, engine will stop. The jet K is supplied with gas from the generator by means of pipes F¹⁰, F¹¹, and branch. When the engine is not running, the gas-jets may be closed off by closing valves M. To relight the jet K the cap can be taken off the top of chamber F⁸, the gas turned on with valve M, and lighted.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a gas engine the combination of the double cylinders, with the head H, containing ports H⁴, H⁵ explosion chambers H², H³, gas ports K² and light chamber F⁸, the rotary admission valve G and the reciprocating exhaust valve, means for operating the valves substantially as herein described.

2. The combination, in a gas engine, of double cylinders, the head H the gas generator and exhaust valve seat, the geared eccentric shaft and eccentric for operating valves with the reciprocating exhaust valve and rotary admission valve, substantially as herein described.

3. In a gas engine, having two cylinders and two pistons, the cranked shaft to which the piston rods are connected, and a gear on its end, combined with an endwise moving valve, a rotary valve, an operating rod or rods which operate the two valves simultaneously, a shaft for operating an eccentric, and which revolves but once while the crank shaft revolves twice, and a rocking rod to which both the eccentric and the valve rods are connected, substantially as specified.

4. In a gas engine, the casting provided with the two cylinders, and a cylinder head, having the two passages connecting with the ends of the two cylinders, a chamber F³, and a seat for a rotary valve, combined with a rotary valve, provided with suitable passages for the passage of both air and gas; a reciprocating valve provided with transverse grooves for connecting with the discharge passages of the cylinders; the pistons, a crank shaft, operated by the pistons, and a separate eccentric shaft for operating the valves simultaneously; the two shafts being geared together and the crank shaft made to revolve twice as fast as the eccentric shaft, substantially as set forth.

EDWARD E. BUTLER.

Witnesses:

H. R. HART,

E. A. WERNER, Jr.