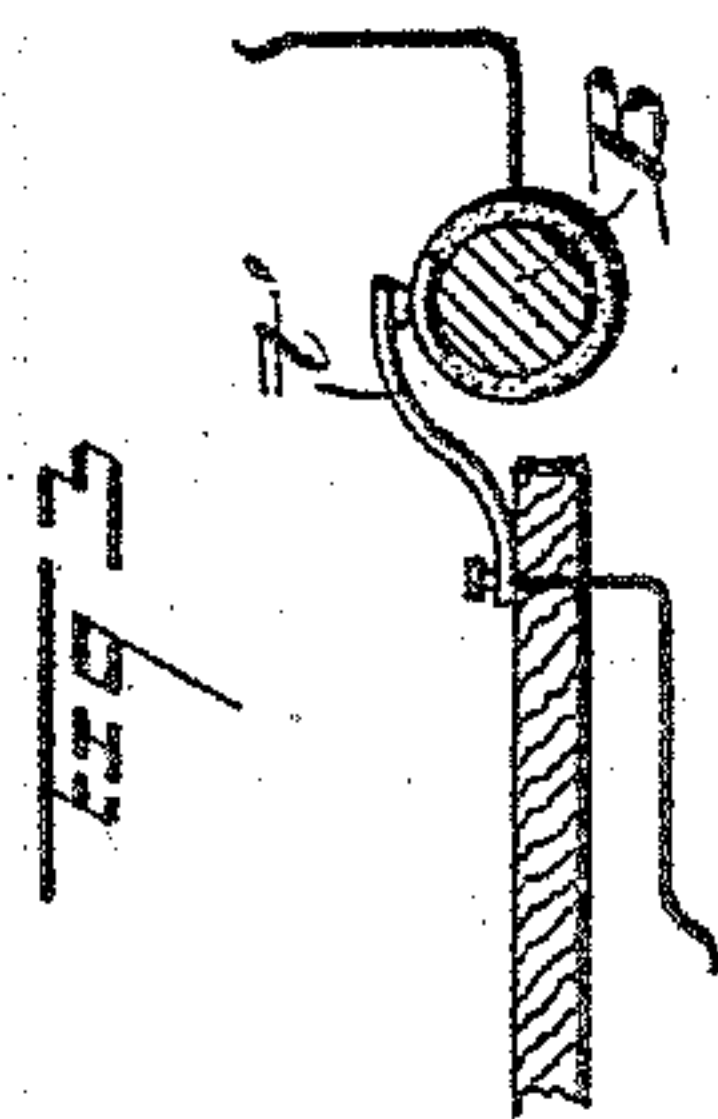
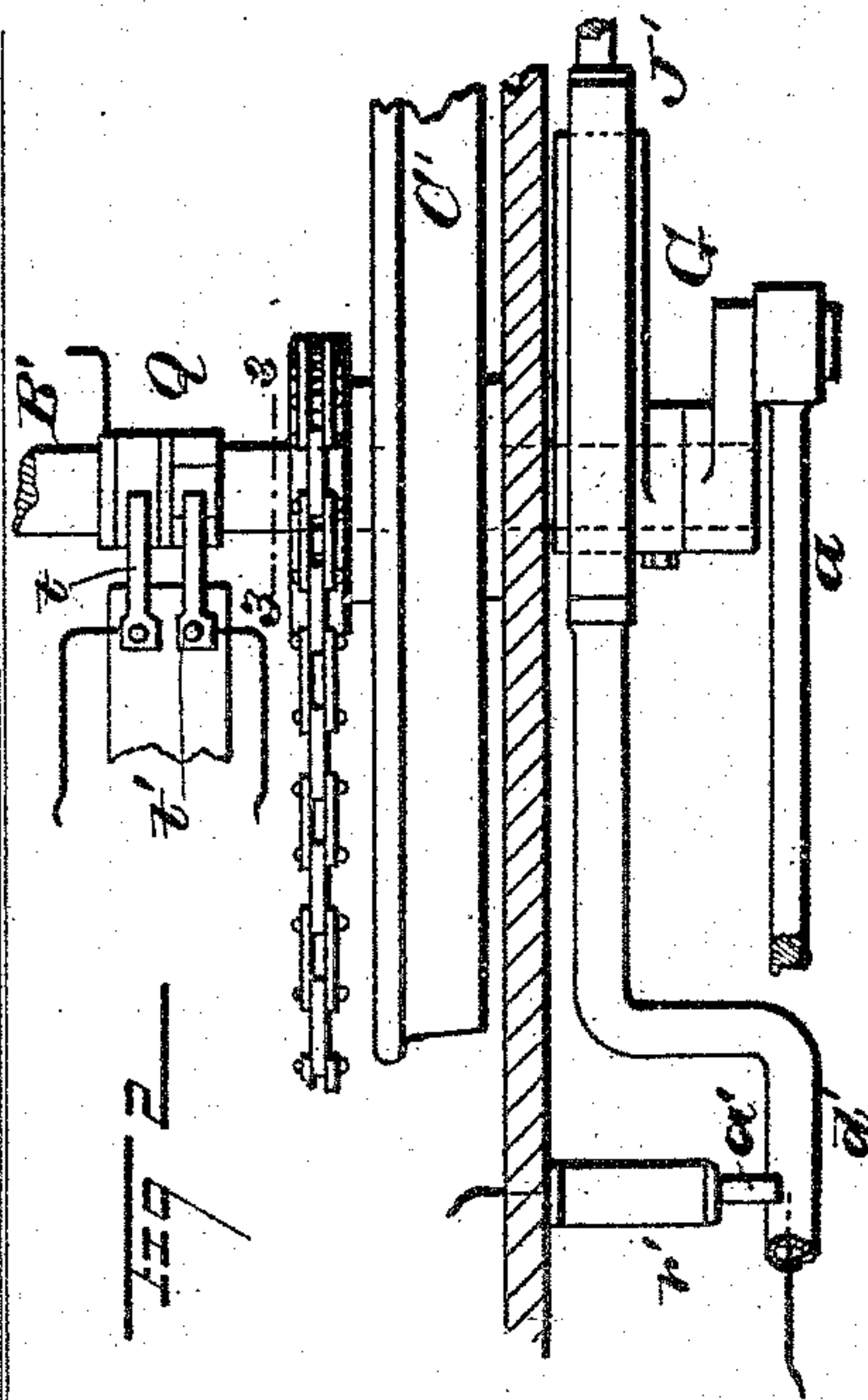
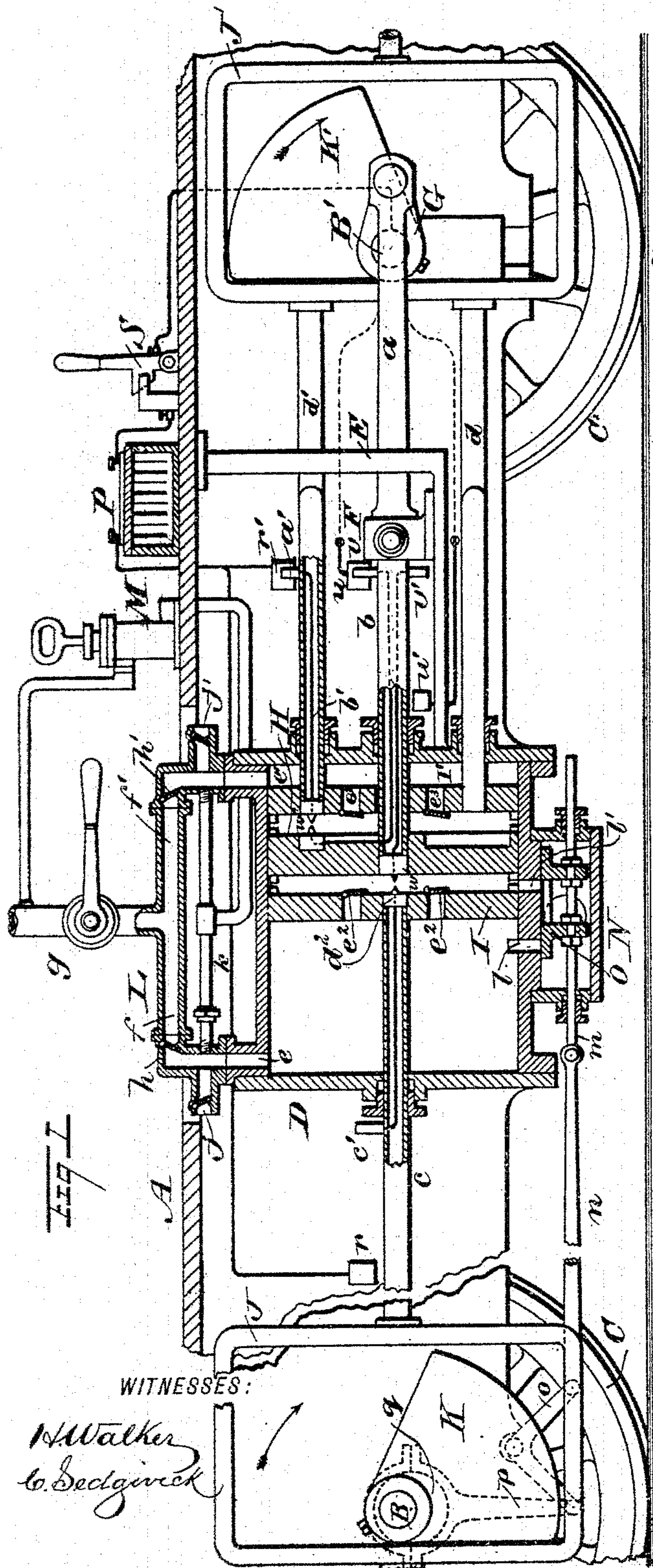


(No Model.)

J. S. BIGGAR.
GAS ENGINE.

No. 491,403.

Patented Feb. 7, 1893.



INVENTOR
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UNITED STATES PATENT OFFICE.

JOHN STUART BIGGAR, OF WHITESBOROUGH, CALIFORNIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 491,403, dated February 7, 1893.

Application filed October 12, 1891. Serial No. 408,431. (No model.)

To all whom it may concern:

Be it known that I, JOHN STUART BIGGAR, of Whitesborough, in the county of Mendocino and State of California, have invented a new and Improved Gas-Engine, of which the following is a specification, reference being had to the annexed drawings, forming a part thereof, in which—

Figure 1 is a side sectional elevation of a gas engine built according to my improvement; Fig. 2 is a plan view of a portion of the engine, showing the contact breakers, the crank shaft, and the cam movement; and Fig. 3 is a transverse section taken on line 3—3 in Fig. 2.

Similar letters of reference indicate corresponding parts in all the views.

The object of my invention is to construct a gas engine provided with a double-acting piston adapted to take in the combustible mixture and compress it upon either side of the power piston; also to provide an electric ignitor for igniting the combustible charge, all as will be hereinafter more fully described.

In the present case I have shown the application of my improvement to a locomotive, but I do not limit or confine myself to this use.

The frame A, supported upon the axles B, B', of the drive wheels C, C', supports the cylinder D, and the ways E, which guide the cross-head F. The axle B' is provided with a crank G, which is connected by the rod a with the cross-head F, and the said cross-head F is attached to the outer end of a tubular piston rod b, the inner end of which is secured to the piston H. Upon opposite sides of the said piston H, are arranged pistons I, I', which draw in the combustible mixture into the cylinder preparatory to its being compressed by the piston H. The piston I, is connected by a tubular piston rod c with the rectangular frame J, which is acted on by the quadrant cam K on the axle B. The piston I', is provided with two piston rods d, d', the piston rod d' being tubular. These rods pass through suitable stuffing boxes in the cylinder head, and are connected with the rectangular frame J', which incloses the quadrant cam K' secured to the axle B'.

At the top of the cylinder D is placed a valve chest L, furnished with ports e, e', entering the cylinder D, passages f, f', commu-

nicating with the gas supply pipe g, and furnished with check valves h, h', opening toward the cylinder D, also with air passages j, j', opening into the passages f, f'. In a cavity underneath the passages f, f', is arranged a T-pipe k, which communicates with the passages f, f', and with a gas pump M, by means of which gas may be taken from the supply pipe g, and forced into the said passages f, f'.

In the under side of the cylinder D, are formed ports l, l', covered by the valve chest N, in which is placed a double valve O, capable of opening and closing the said ports in alternation. The rod m of the valve O is connected by a connecting rod n,—with a bell crank lever o, which in turn is connected with an eccentric rod p, embracing the eccentric q on the axle B.

On the frame A, is located a battery P, one pole of which is connected with the contact plates r, r', the other pole being connected with the switch S, which in turn is connected with the commutator Q, which directs the current alternately to the contact springs t, t', the said springs being connected electrically with the contact plates u, u'.

The piston rod b is provided with two contact springs v, v', connected with the contact points w, w', in opposite sides of the piston H, and otherwise insulated from the working parts of the engine. The piston rod d' is provided with a contact spring a', capable of touching the plate r', when the piston I' makes its out-stroke, and the said spring is connected electrically with the contact point b', in the inner face of the piston I'. The piston rod c carries a spring c', capable of contacting with the contact plate r, at every out-stroke of the piston I. The said spring c' is connected with the contact point d² in the inner face of the piston I. The pistons I, I', are furnished respectively with valves e², e³, opening inwardly toward the piston H.

The operation of my improved gas engine is as follows: The combustible charge having been exploded in the cylinder, and the piston H having been forced to the extremity of its stroke, as shown in the drawings, the valve O opens the port l', and allows the products of combustion to escape, and while the piston H is moved toward the position shown, the

piston I, is made to follow it by the cam K, thereby drawing in the combustible mixture through the port *e*, taking the gas from the passage *f*, and the air from the passage *j*, so that at the time the exhaust port *l'* is opened by the movement of the valve O, the space between the piston I and the head of the cylinder D will be filled with the combustible mixture. As soon as the products of combustion have been exhausted, the exhaust port *l'* is closed, and the piston I, is drawn toward the head of the cylinder by the cam K, thereby transferring the combustible mixture to the space between the said piston I, and the piston H. The explosion of the combustible mixture on the opposite side of the piston H, forces the said piston forward and compresses the combustible mixture between the pistons H, I, so that as the piston H completes its return stroke, the contact point *w* touches the contact point *d*², thereby completing the electric circuit, the spring *c'* having by this time reached the contact plate *r*. Just as the crank G passes the center, the contact points *w*, *d*² separate, thereby causing a spark which ignites the charge and moves the piston H forward to the point of starting. What has already been described upon one side of the piston takes place in precisely the same way upon the other side of the piston, the two operations proceeding in alternation.

When it is desired to start the engine from a state of rest, gas is drawn by the pump M from the supply pipe *g*, and forced into the cylinder which already contains sufficient air to form an explosive mixture, and the charge thus introduced is ignited as soon as the electrical contact is made and broken in the manner already described. To cause the axles B, B', to rotate together, they are connected by

an endless chain running over sprocket wheels on the axles.

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

1. The combination with the cylinder and a power piston having contacts on both faces, of the valved transfer pistons at opposite sides of the power piston and each having a contact to engage those of the power piston, and the electrical connections, substantially as set forth.

2. In a gas engine, the combination of the power cylinder, the power piston provided with a tubular piston rod, and electrical contact points, the transfer pistons provided with check valves and furnished with tubular piston rods and contact points, and the electric generator and electrical connections, substantially as specified.

3. In a gas engine, the combination of the power cylinder provided with inlet and exhaust ports, a power piston, two transfer pistons, said three pistons each having a tubular piston rod, contact points on both sides of the power piston, a contact point on the inner face of each transfer piston to respectively engage the contacts on the power piston, electric connections leading from said contact points through the piston rods to the outside of the cylinder and there connected with contacts on the rods, contact plates in the paths of the piston-rod-contacts and means for operating the transfer pistons, substantially as specified.

JOHN STUART BIGGAR.

Witnesses:

W. J. BIGGAR,

FRED C. STODDARD.