(No Model.)

J. & W. PATERSON.

GAS ENGINE.

No. 528,489. Patented Oct. 30, 1894.

Fig. 1.

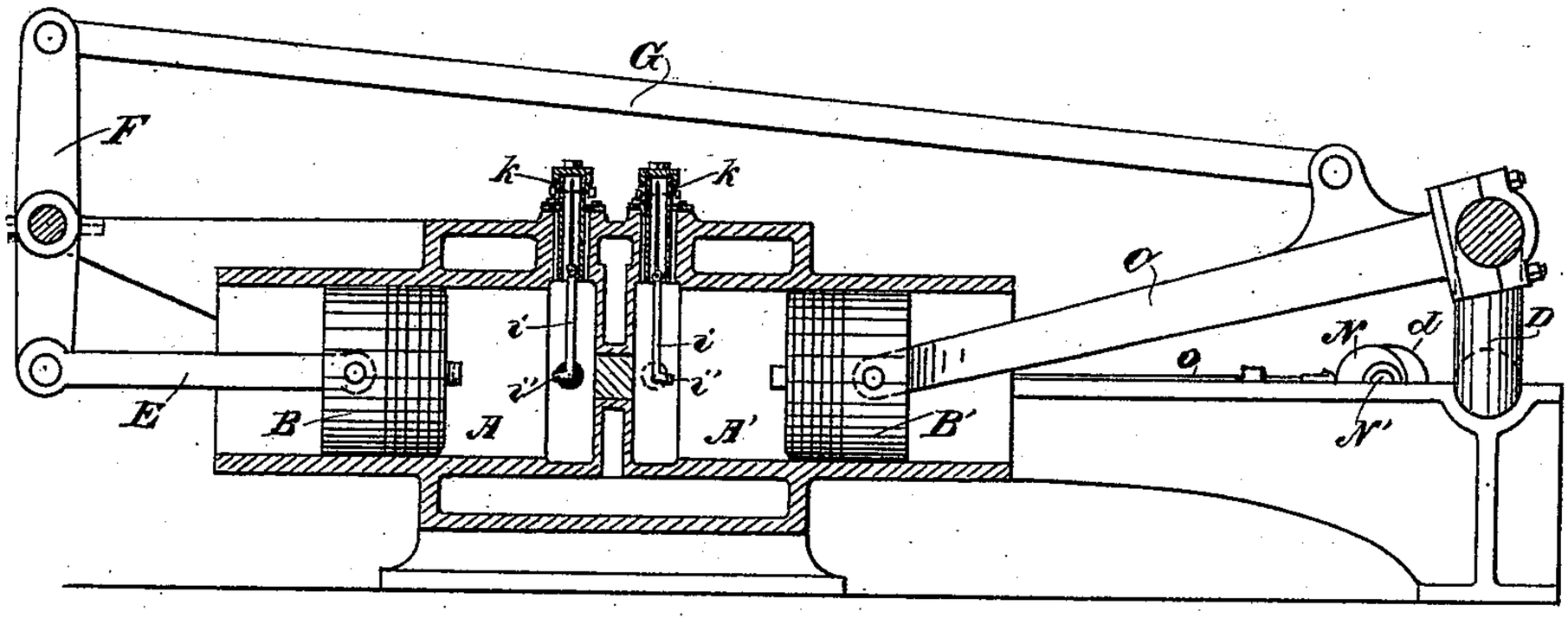


Fig. 2.

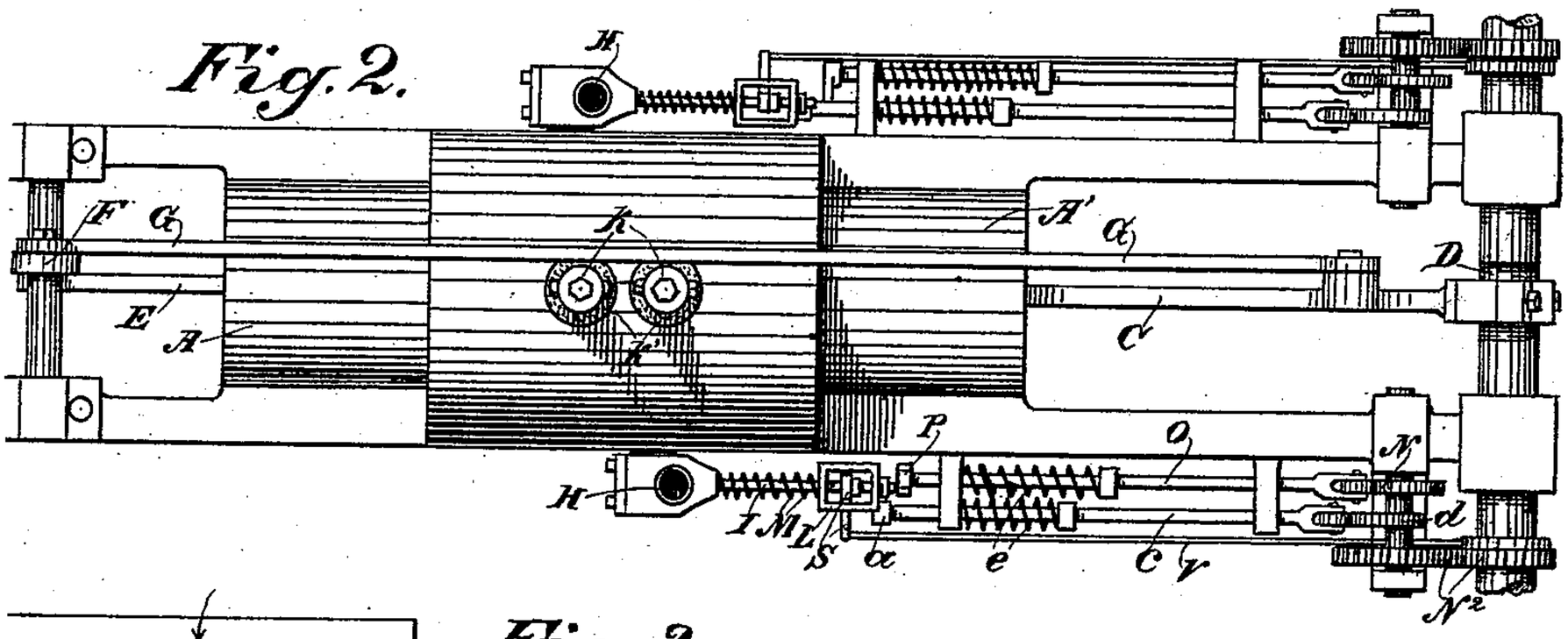


Fig. 3.

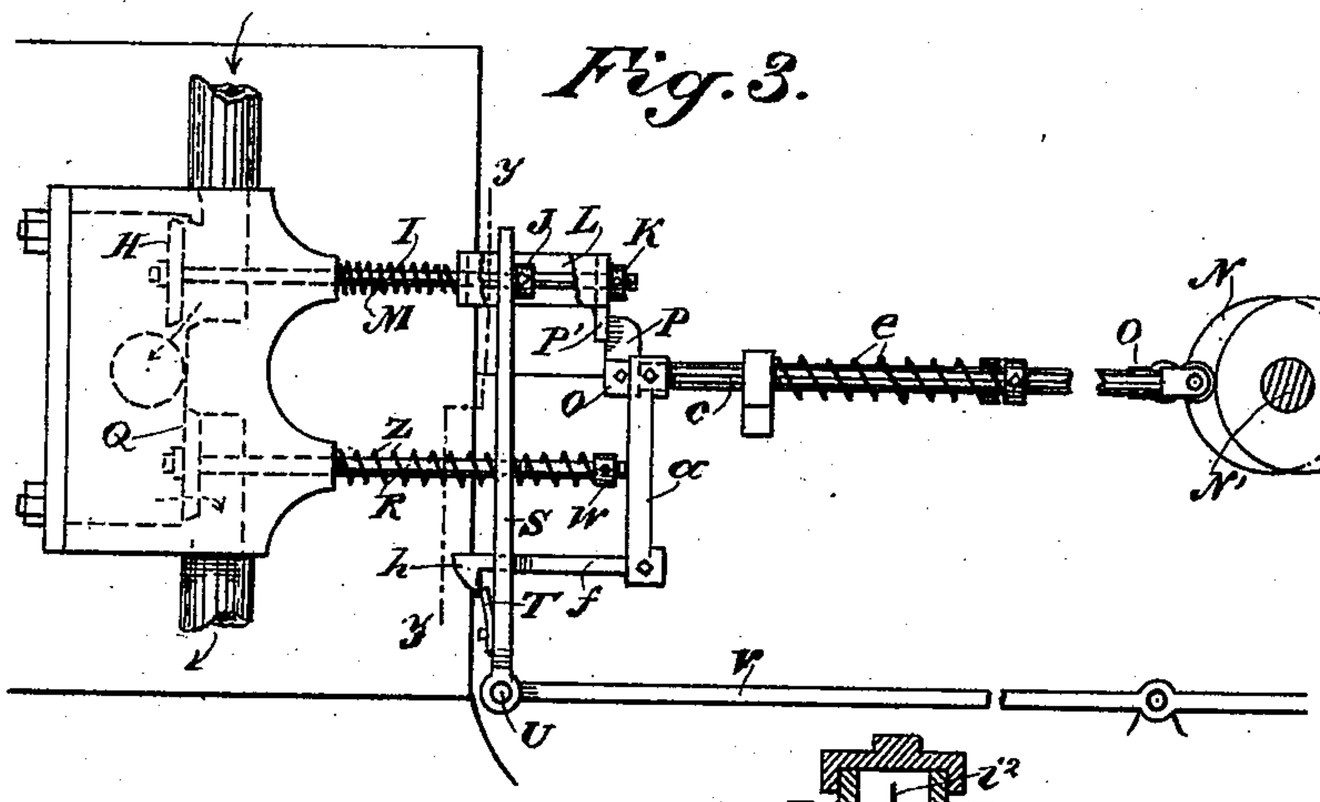
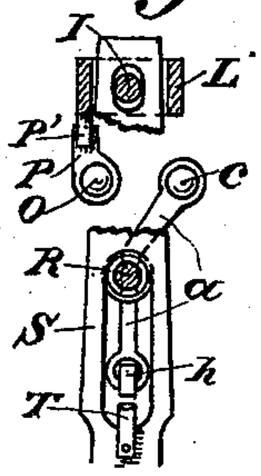


Fig. 4.



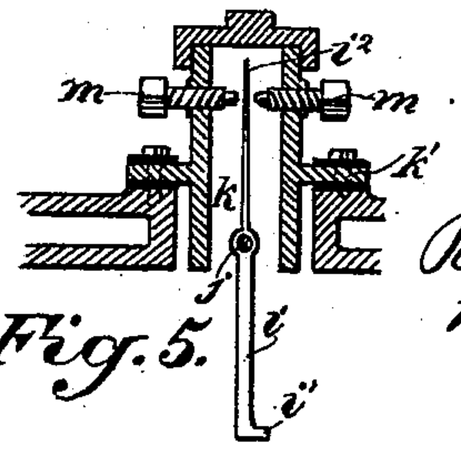


Fig. 5.

Witnesses,
J. L. Stowe
H. F. Ascheck

Inventors,
James Paterson
William Paterson
By Dewey & Co.
Attys

UNITED STATES PATENT OFFICE.

JAMES PATERSON AND WILLIAM PATERSON, OF STOCKTON, CALIFORNIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 528,489, dated October 30, 1894.

Application filed June 14, 1894. Serial No. 514,547. (No model.)

To all whom it may concern:

Be it known that we, JAMES PATERSON and WILLIAM PATERSON, citizens of the United States, residing at Stockton, San Joaquin county, State of California, have invented an Improvement in Gas-Engines; and we hereby declare the following to be a full, clear, and exact description of the same.

Our invention relates to improvements in gas or vapor engines.

It consists in certain details of construction which will be more fully explained by reference to the accompanying drawings, in which—

Figure 1 is a vertical section taken through the engine. Fig. 2 is a plan view. Fig. 3 is an enlarged view of the valve gear. Fig. 4 is a section on line *y—y* of Fig. 3 looking toward the drive shaft. Fig. 5 is a sectional view, showing the igniting device.

In the construction of our engine we employ two cylinders A A′ abutting against each other at one end and having their axes in line. B B′ are pistons adapted to reciprocate in these cylinders. The piston B′ has a connecting rod C extending from it directly to the crank D. The piston B has a connecting rod E uniting with the lower end of the rocker arm F. The upper end of this arm is connected by a rod or pitman G with the crank or with the connecting rod C at a point near the crank. The cylinders are surrounded by the usual water chambers to prevent too great an increase in heat. Each cylinder is chambered at the inner end, and has valve mechanism by which the explosive gas or vapor is admitted, and also a valve mechanism by which the products of combustion are allowed to exhaust. The valves so act with relation to each other and the movements of the pistons, that each piston is acted upon alternately. The valves, as shown in the present case, are puppet valves.

H is one of the inlet valves having a valve stem I extending out through the end of the valve chamber and having fixed upon it, near its end, the collars J and K. Surrounding this stem is a yoke L through which the valve stem moves freely. Between this yoke and the valve chamber is a spring M which acts normally to press the yoke L outwardly against the collar K, and thus retain the inlet valve normally closed. The collar J is fixed to the valve stem in the open space between the ends of the yoke as shown.

N is an eccentric upon a counter-shaft N′ which is driven by gears N^2 from the engine shaft, and O is an eccentric rod which has an upturned end P adapted to engage a corresponding spur P′ projecting from the yoke L, so that when the shaft revolves, the eccentric acting against an anti-friction roller upon the end of the eccentric rod, forces the rod forward, and when the spur P engages the spur P′, the yoke L is moved. As this yoke slides freely upon the valve stem I, it will be manifest that the valve H will not be opened by this movement, but it is relieved from the pressure of the spring so that it can be opened by the suction caused by the movement of the piston in the cylinder, and thus admit an explosive charge.

The exhaust valve Q has a stem R extending out from the valve chamber parallel with the stem I and passing through a swinging yoke S which is fulcrumed as shown at U and connected with an arm V which is actuated by the governor as will be hereinafter described. The yoke S has an opening at the top through which the valve stem I passes, and another at the bottom through which the valve stem R passes.

W is a collar fixed upon the end of the valve stem R and between this and the end of the valve chamber is a spring Z which normally acts like the spring M of the valve stem I to keep the valve closed. This valve stem R and the connected valve are forced inwardly so as to open the exhaust valve by the arm *a* fixed to and actuated by the eccentric rod *c* from the eccentric *d* fixed upon the counter-shaft adjacent to the eccentric N which operates the inlet valve. Springs *e* serve to return these eccentric rods and their connections as soon as the eccentrics are retracted, they being simply forced forward by the pressure of the eccentric and retracted by the action of the spring as no eccentric straps are used. The arm or yoke S has fixed to it a spur T.

f is an arm fixed to the arm *a* and having a hook at the end as shown at *h* which is adapted to engage the spur T whenever the yoke S has been raised by the action of the

governor until the spur T is in line with the hook *h*. This spur projects above the bottom of the lower opening in the yoke S for this purpose.

When the engine is running in its normal condition, the rotation of the shaft acting through the eccentrics N and *d* and the eccentric rods and yokes L allow the inlet valves to open to admit a charge of explosive gas or vapor, as above described, which is compressed in the usual manner, and exploded to force the pistons outward from the inner ends of the cylinders, and the exhaust valve is correspondingly opened by its eccentric and connecting mechanism to allow the escape of the products of combustion after the explosion has taken place, and the piston is returning to the valved end of the cylinder. If the engine begins to run faster than is desired, the action of the governor upon the arm V raises the yoke S until the spur T comes in line with the hook *h*, and as the eccentric *d* advances the arm *a* carrying the hook *h*, the latter will be engaged by the spur T and will be held in this position and prevented from moving backward when the eccentric passes away from it. In this position, as the arm *a* presses upon the valve stem R, the exhaust valve will remain open and the upper end of the yoke S will be caused by the pressure upon it to swing to one side so that it will press against the collar J, and thus prevent the inlet valve from being opened by the action of the piston, although the movements of the eccentric N, eccentric rod O, arm P and yoke L still continue. Whenever the speed of the engine decreases sufficiently to allow the governor to act and depress the yoke S, the hook *h* will be disengaged from the spur T, and the parts will then be in position to act normally again.

The igniting device consists of an arm *i* having a projection at *i'* at the lower end against which the piston forms contact at the instant when it has returned so as to compress the gas or vapor in the explosion chamber at the inner end of the cylinder. This arm *i* is fulcrumed as shown at *j* in the lower part of a vertical chamber *k* which extends upward from the top of the cylinder. Above the fulcrum point *j* the arm *i* is made very much thinner so as to form a spring as shown at i^2, this spring portion extending into the upper part of the chamber *k* so as to be out of reach of the direct heat caused by the explosion of the gas, and this preserves its spring temper and prevents its being so heated as to lose it. The upper end of the elastic arm i^2 lies between the meeting ends of two screws *m* which enter the chamber from opposite sides, and these screws serve to adjust the arm $i\,i^2$ about its fulcrum point *j* so as to advance or retract the contact end *i'*. It will be seen that by this adjustment the contact between the piston which is connected with one of the electrodes of the exploding battery, and the arm *i* which acts with the other electrode, is regulated so that the explosion may take place sooner or later as desired.

The chamber *k* has a flange *k'* by which it is secured upon the top of the cylinder, and this is insulated from the cylinder, itself, by suitable insulating disks or plates, as shown, the chamber *k* being sufficiently smaller than the opening in which it is fitted to prevent any contact with the cylinder, itself, so that one electrode being connected with this chamber the electrical current will pass through it and the arm *i* while the other electrode can be connected with the piston in any suitable or desired manner.

The peculiar connection of the piston rod E with the crank D by means of the oscillating arm F, causes the two pistons to reciprocate to and from each other, so that the explosion taking place alternately in each of the cylinders when the pistons are nearest together, will act through the connecting rods and rocker arms upon the crank and crank shaft, and an impulse is given the crank at each revolution, instead of every second revolution as in the ordinary operation of this class of engines.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. An explosive engine consisting of two cylinders abutting against each other with their axes in the same line, pistons reciprocating therein, one of said pistons having a connecting rod uniting it directly with the crank upon the crank shaft, and the other connected with one end of a centrally fulcrumed oscillating lever, the opposite end of which is connected with the crank, whereby the pistons reciprocate simultaneously to and from each other and the power of both is applied to the crank.

2. An explosive engine consisting of the cylinders, connecting rods and crank united, as shown, independent inlet and exhaust valves having valve stems and springs by which they are normally closed, the counter-shaft, eccentrics upon the counter-shaft with eccentric rods and arms adapted to engage the exhaust valve stems and open the valves, an intermediate yoke sliding upon the inlet valve stem and moved by an eccentric to compress the valve closing spring and allow the valve to be opened by the vacuum caused by the piston.

3. In an explosive engine, a piston reciprocating in the cylinder, an inlet valve having the stem extending out through the end of the valve chamber, a yoke sliding loosely upon the valve stem and a spring intermediate between the yoke and the valve chamber whereby the valve is normally closed, an eccentric upon a counter-shaft driven by the main engine shaft, an eccentric rod adapted to engage the yoke to cause it to reciprocate and compress the spring to allow the valve to

be opened by the vacuum produced by the movement of the piston, an exhaust valve having a spring surrounding its stem whereby it is normally closed, an eccentric rod and contact piece whereby the exhaust valve stem is moved to open the valve as the engine shaft revolves, an arm or yoke hinged at the lower end and connected with the governor so as to be raised or lowered by its action, said yoke having a spur upon it which engages with a hook upon the exhaust actuating eccentric rod whereby the latter is held out of contact with its actuating eccentric during the engagement, and the upper end of the yoke is tilted so as to engage a collar upon the inlet valve stem to prevent the inlet valve from being opened.

4. An explosive engine having a cylinder, a piston reciprocating therein, a crank shaft and crank with which it is connected, inlet valves for the admission of the explosive vapor and an exhaust valve for the discharge of the products of combustion, and an igniting device consisting of an arm fulcrumed so as to extend into the cylinder and form contact with the piston when the latter approaches the explosion chamber, a hollow chamber into which the opposite end of said arm projects exterior to the cylinder, said arm being made elastic and adjustable within its chamber.

5. In an explosive engine, an igniting device consisting of an arm fulcrumed so that one end projects into the cylinder to form contact with the piston when the latter approaches the explosion chamber, and having the opposite end made elastic, a chamber extending transversely outward from the cylinder into which the elastic end of said arm projects, and screws entering said chamber from opposite sides whereby the arm is moved about its fulcrum point so that contact with the piston is regulated.

In witness whereof we have hereunto set our hands.

JAMES PATERSON.
WILLIAM PATERSON.

Witnesses to Jas. Paterson:
S. H. NOURSE,
H. F. ASCHECK.

Witnesses to Wm. Paterson:
MATTIE KIDDLE,
CHARLES H. LEE.