(No Model.)

# H. J. DYKES.

## GAS ENGINE.

No. 539,122. Patented May 14, 1895.

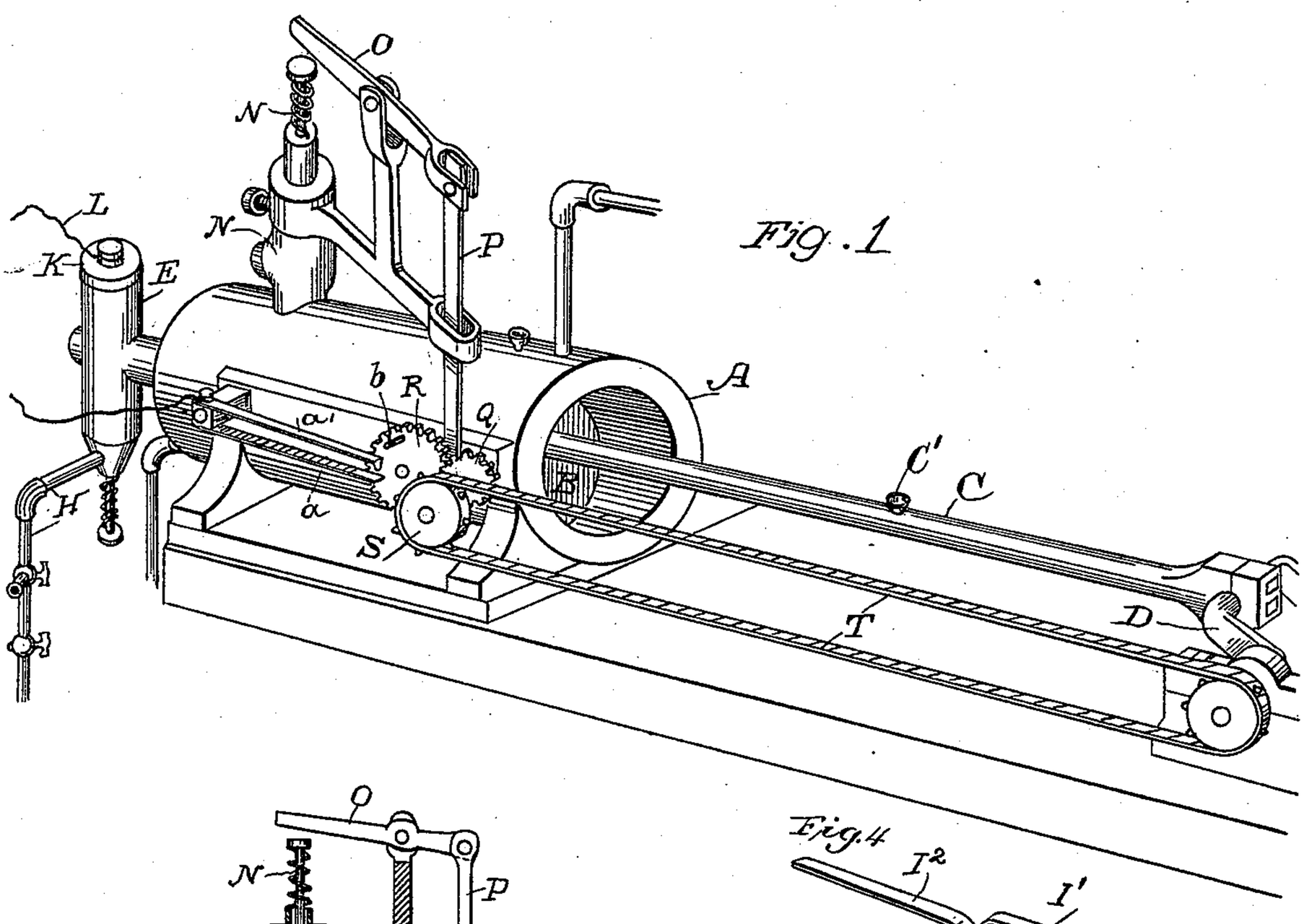



Fig. 1

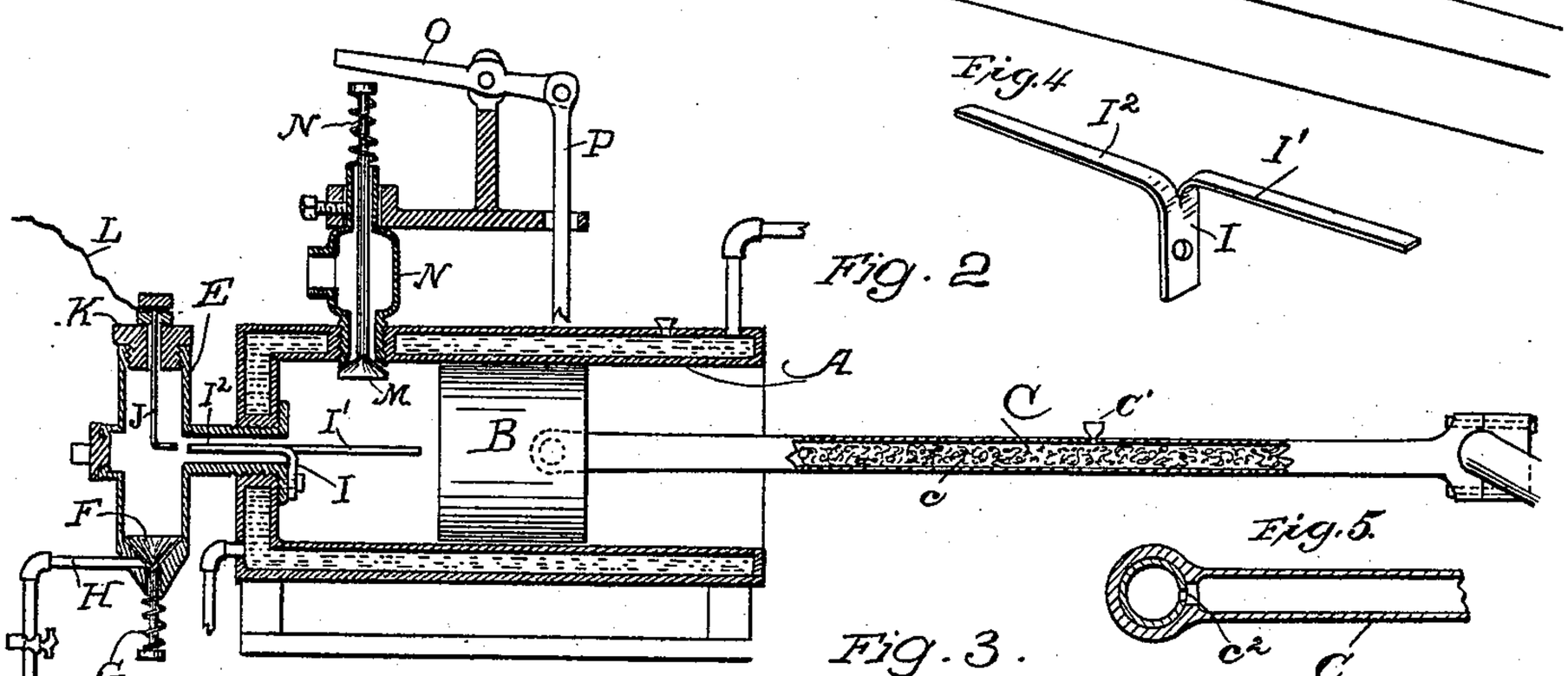



Fig. 2

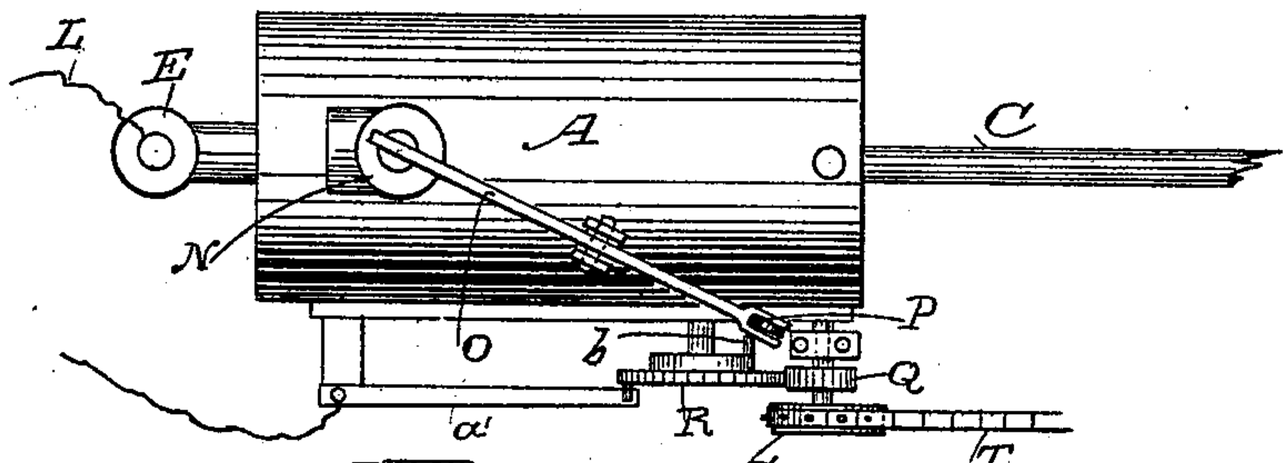



Fig. 4

Fig. 3.




Fig. 5.



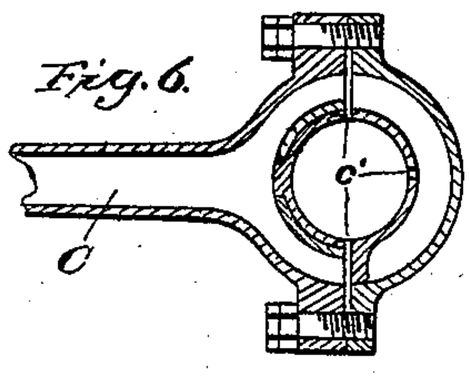




Fig. 6.

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# UNITED STATES PATENT OFFICE.

HUGH J. DYKES, OF PERALTA, ASSIGNOR OF ONE-HALF TO JULIUS A. FROST, OF OAKLAND, CALIFORNIA.

## GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 539,122, dated May 14, 1895.

Application filed March 16, 1894. Serial No. 503,934. (No model.)

*To all whom it may concern:*

Be it known that I, HUGH J. DYKES, a citizen of the United States, residing at Peralta, county of Alameda, State of California, have invented an Improvement in Gas-Engines; and I hereby declare the following to be a full, clear, and exact description of the same.

My invention relates to certain improvements in gas or explosive 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 perspective exterior view of the cylinder and part of the engine. Fig. 2 is a longitudinal vertical section of the cylinder. Fig. 3 is a top view of the same. Figs. 4, 5, and 6 are details hereinafter referred to.

A is the cylinder of the engine which is made with double concentric walls to admit water to circulate around it for the purpose of keeping the cylinder cool. B is the piston adapted to reciprocate therein.

C is the connecting rod or pitman, one end of which connects with the piston, and the other with a crank D upon the crank shaft. This piston rod is made hollow and is stuffed with sheep's wool or other absorbent.

The rod C is provided with an oil cup C′ by which oil is introduced into the absorbent material *c*. See Figs. 1 and 2.

Through one end of the rod an opening *c′* (see Fig. 6) is made through the brasses which form the joint upon the crank pin, so that the lubricant may gradually pass through this opening and lubricate that joint, and at the opposite end, similar connection $c^2$ (see Fig. 5) is made with the joint pin where the rod connects with the piston, thus lubricating both parts with but little attention.

E is a chamber exterior to the rear cylinder head, and having a passage connecting directly through the center of said head with the interior of the cylinder.

F is a conical valve adapted to close upon a correspondingly shaped seat in the bottom of the chamber E. The stem of this valve passes through the bottom of the chamber and is surrounded by a spring G which is compressed when the valve is raised and acts when the valve is released to close it upon its seat.

Into the passage below the valve F opens a supply pipe H connecting with a source of supply for the explosive gas which is to be used in the engine.

When the engine piston is withdrawn, it forms a vacuum within the cylinder and within the chamber E, and this opens the valve F and allows a supply of the explosive fluid to enter the chamber E and the cylinder.

When the piston returns in its stroke it immediately closes the valve F and compresses the gas which has been drawn in by the previous stroke, and the gas thus compressed is ready to be ignited at the instant when the crank is passing the center in its position nearest to the cylinder.

The explosion is effected by means of a novel device for producing an electric spark, by making and breaking the contact between the electrodes at the proper time. This consists of a steel plate I, the lower part of which is bolted to the interior of the cylinder head as shown. The upper part is split from the top downward, and the two ends are turned in opposite directions as shown at I′, $I^2$. See Fig. 4.

The arm I′ extends into the cylinder toward the piston while the other arm, standing approximately in line with the arm I′ extends through the channel or opening from the cylinder into the chamber E.

Within the chamber E is an elastic arm J passing down through proper insulating devices in the cap K which closes the upper part of the chamber E. With this arm J is connected one wire L from an electrical battery. The other wire is connected with the arm *a* of two arms *a a′* which are insulated from each other, while the second one *a′* is connected with the cylinder, and through it with the arm I.

The ends of the arms *a a′* stand normally at a little distance apart, and they are forced into contact for an instant just as the piston arrives at the proper point for ignition of the charge. At the same instant the points $I^2$ and J will be in contact or in the act of separating, and the spark is thus instantaneously

produced without wasting the battery by a long contact. These contact points are all preferably made of platinum.

The operation will then be as follows: When the piston having drawn a charge of explosive gas into the cylinder and chamber E returns, it compresses this gas, as before described, and just at the instant when its inward stroke is finished and when the crank is passing its dead center, the inner end of the piston B strikes the projecting end I′ of the spring plate. The plate moves about its point of fastening at the lower end so that the other end $I^2$ is forced a short distance into the chamber E and forms contact with the spring arm J which, being connected with the other pole of the battery by the wire L, immediately produces a spark. This spark ignites the gas within the chamber E, and through the passage between the chamber and the cylinder, the ignition is communicated to the gas within the cylinder, the explosion of which takes place and this forces the piston to the opposite end of its stroke. Upon the return of the piston again toward the rear end of the cylinder, the exhaust valve M is opened in the following manner: This valve is actuated through a stem N by an oscillating lever O fulcrumed upon a standard exterior to the cylinder. From the opposite end of the lever O, a rod P connects with a crank or cam mechanism which is actuated by a rotating spur wheel R pivoted upon the exterior of the cylinder. This spur wheel engages the spur pinion Q and this again is actuated by a chain sprocket wheel S fixed upon the same shaft. From this chain sprocket wheel the chain belt T passes around a corresponding sprocket wheel upon the engine shaft. The relative diameters of the pinion R and the wheel Q are such that the exhaust valve M will be opened at each second stroke of the piston, the opening of the valve corresponding with the return of the piston after the explosion has taken place, thus allowing the products of combustion to escape immediately after they have acted to force the piston to the end of its stroke. The contact pieces *a a′* are also actuated by a pin *b* upon the wheel R so fixed that it presses the plates together and forms an electrical connection at the instant when it is necessary to produce the spark to explode the charge in the cylinder.

The mechanism thus constructed is extremely simple and little liable to get out of order.

The elastic igniting arm extending from within the cylinder to the ignition chamber, and having the elastic portion extending at right angles therewith, is practically moved in a straight line by the contact of the piston with one end which forces the other end into contact with the arm J as before described, while the portion I standing at right angles acts to return it and form the support about which the movement takes place, and the usefulness of the battery is much extended by the limited time of contacts and the flow of the electrical current.

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

1. In an explosive engine, a cylinder having a piston reciprocating therein, a connecting rod uniting the piston with the crank fixed upon the crank shaft, a chamber exterior to the cylinder head having an inwardly opening puppet valve by which explosive fluid is admitted into the chamber, and a passage between said chamber and the cylinder whereby the retraction of the piston acts to fill the chamber and cylinder with explosive fluid, an igniting device consisting of the insulated elastic arm J extending into the chamber, connected with one of the poles of the battery, the oscillating spring plate I fixed to the cylinder head having the oppositely projecting arms I′ and $I^2$ extending transversely to it, one of said arms projecting so as to form contact with the piston when the latter approaches the end of its stroke, and the other arm extending through the passage between the cylinder and the chamber so as to form contact with the insulated arm J within the chamber, substantially as herein described.

2. An igniting device for gas engines consisting of a spring arm I fixed to the interior of the cylinder head and connecting with one pole of the battery, arms formed by splitting said plate and bending these arms in opposite directions and at right angles with the plate, an ignition chamber exterior to the cylinder head having a passage from it through the cylinder head, a spring arm electrode in said chamber, one of the arms of the plate extending through said passage into the chamber and adapted to form contact with the spring arm electrode and the other arm extending toward the piston within the cylinder whereby the contact of the piston with said arm forms a contact between the electrodes which is broken by the retraction of the piston, substantially as herein described.

3. A gas engine comprising the cylinder, its piston, and crank-shaft, an explosion chamber E having a tubular connection with the cylinder through its head, an exhaust valve for the cylinder, an electric contact in the explosion chamber, and connected with a battery wire, a longitudinally movable ignition plate, or arm, extending through the said tubular connection with one end entering the explosion chamber in line with said contact, and its other end projecting into the inward path of the piston, contact devices on the exterior of the cylinder, for electrically connecting the said longitudinally movable ignition arm with the other line wire, and mechanism operated from the engine-shaft for actuating said external contacts and opening the exhaust valve, substantially as described.

4. A gas engine comprising the cylinder the piston and its crank shaft, the gas inlet valve, the ignition devices; the exhaust valve

having a spring pressed stem, a lever O pivoted above the cylinder and crossing the upper end of the stem, an arm P, depending from the other end of the lever, a gear-wheel journaled alongside of the cylinder, geared to the engine shaft and having a projection or cam to press the arm P upward, and a second projection on its other face, and a pair of spring-arms *a a'* one above the other, and secured at one end to the cylinder; the fixed end of the lower arm being in electric connection with the ignition devices, through the said cylinder, and the arm *a'* being insulated from the cylinder and connected with one line or battery wire; the free end of the arm *a'* extending into the path of the other projection on said gear, substantially as described.

In witness whereof I have hereunto set my hand.

HUGH J. DYKES.

Witnesses:
S. H. NOURSE,
H. F. ASCHECK.