(No Model.) 2 Sheets—Sheet 1.

J. W. RAYMOND.

GAS ENGINE.

No. 488,483. Patented Dec. 20, 1892.

Fig. 1.

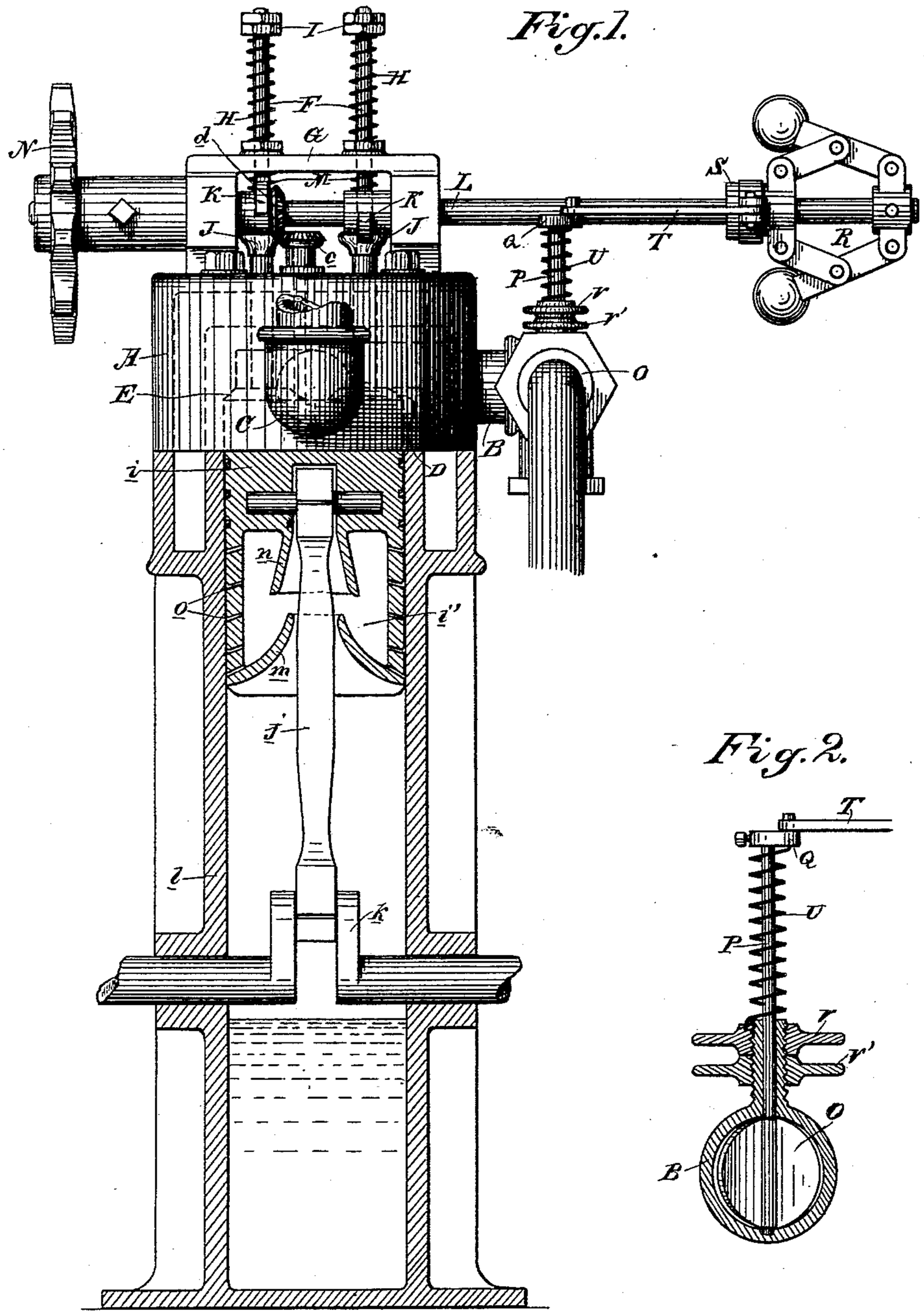

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3.

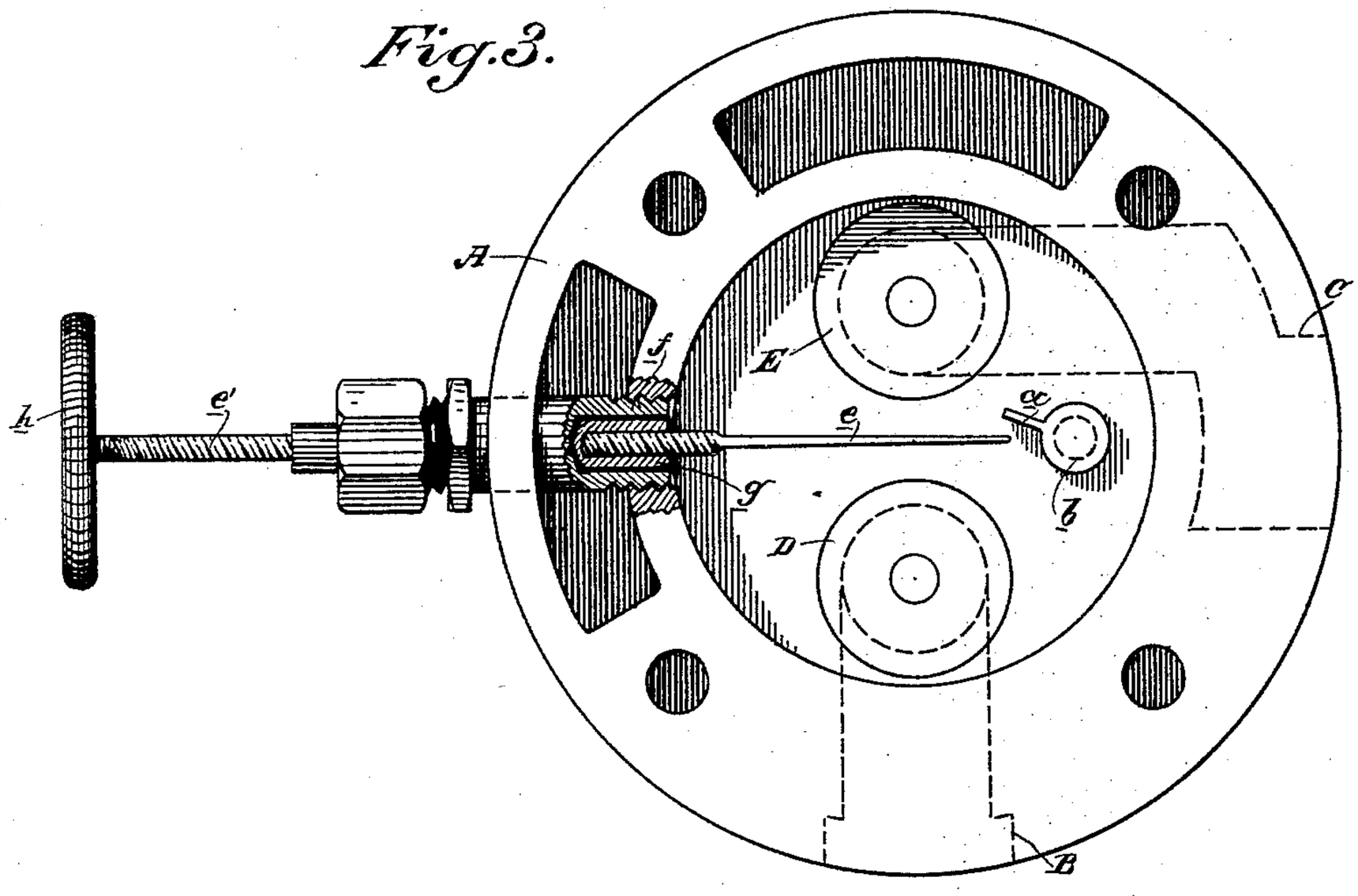
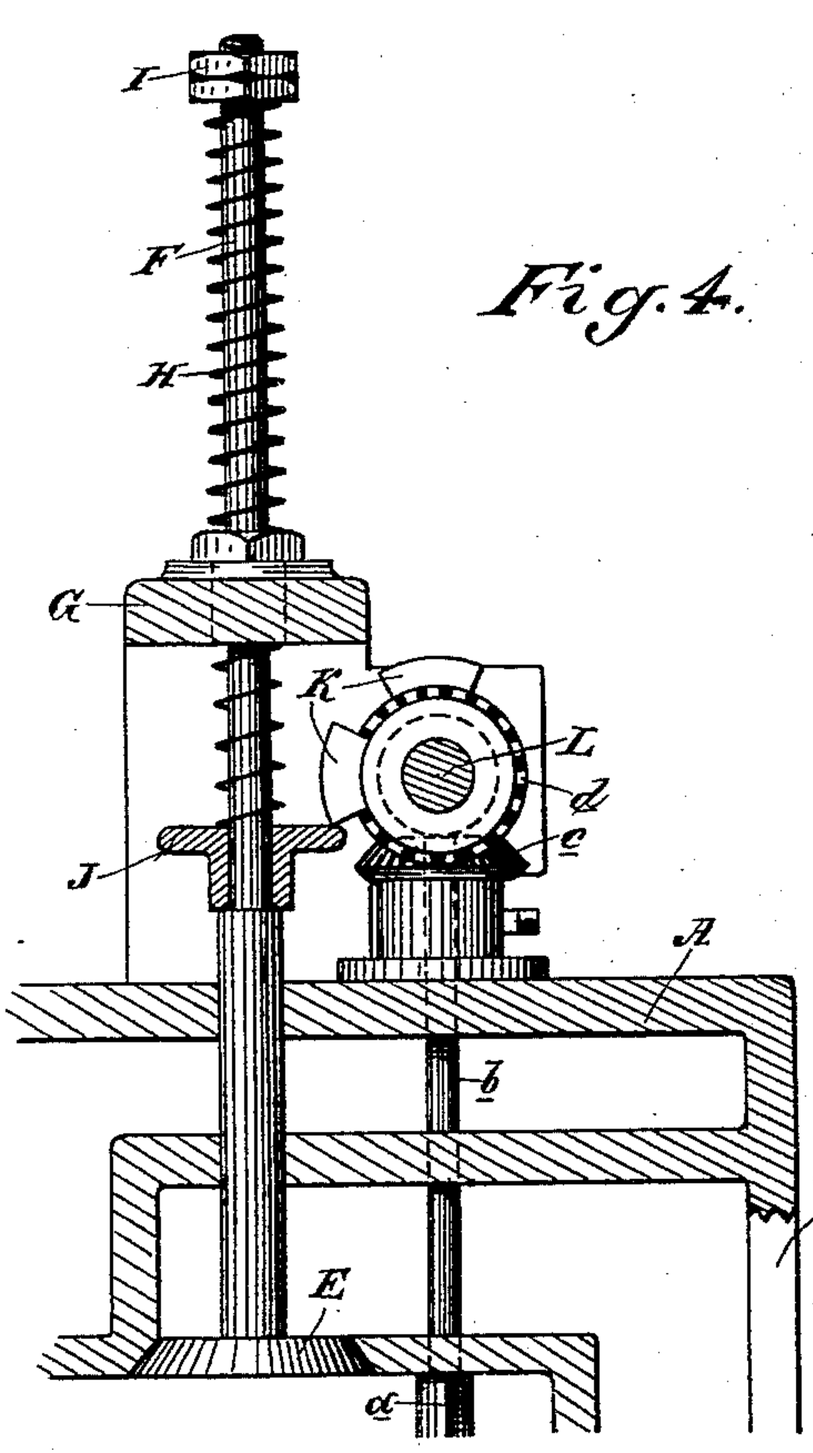


Fig. 4.



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UNITED STATES PATENT OFFICE.

JOHN W. RAYMOND, OF SAN FRANCISCO, CALIFORNIA.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 488,483, dated December 20, 1892.

Application filed November 20, 1891. Serial No. 412,567. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. RAYMOND, a citizen of the United States, residing in the city and county of San Francisco, 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 engines in which the moving force is a gas or vapor mixed with air in such proportions as to produce an explosive compound and which are usually denominated "gas 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 an elevation of my engine, showing the cylinder in section. Fig. 2 is a sectional detail view of the supply controlling valve and its connections. Fig. 3 is a bottom view of the head showing the igniting device. Fig. 4 is a detail view of the valve operating device.

A is the receiving end or chamber through which the gas or explosive vapor is admitted to the cylinder behind the piston. This head is cast with the usual chamber for the circulation of water to keep it down to the proper temperature, and the supply and exhaust pipes B and C are connected with corresponding chambers within this head.

D and E are the inlet and exhaust valves respectively. They are fixed to valve stems F extending outwardly through the end of the chamber, and through a guide yoke G. Spiral springs H surround these stems outside the yoke pressing against nuts I which screw upon the outer ends of the stems and by these nuts the tension of the springs may be adjusted, and the valves are closed with proportionate rapidity when released from the cams which open them. These valve stems are of larger diameter where they pass through the head of the chamber than the exterior portion which passes through the guide yoke, thus forming a shoulder where the larger and smaller diameters meet, or they may have collars fixed upon them for the same purpose. Upon these shoulders the disks J rest, moving loosely upon the outer portion of the valve stems. By pressure upon these disks toward the head, the valve stems and the valves which are carried at their inner ends are forced open so as to allow the explosive vapor or gas to be admitted to the cylinder by one of the valves, and to allow the products remaining after the explosion to be exhausted from the other valve. These valves are opened by cams K mounted upon a horizontal shaft L journaled across the end of the chamber in such proximity to the valve stems and the disks as to allow the points of the cams to strike the disks and open the valves at the proper intervals, and they are closed by the springs H before described.

The shaft L is rotated by a sprocket wheel N fixed to it and receiving motion from the main engine shaft, not here shown, by a chain passing around a corresponding sprocket wheel upon the shaft. As the disks J are fitted loosely upon the outer part of the valve stems, they can easily slip away from the shoulders or collars to prevent damage to the valves or other parts in case the engine is accidentally turned in the wrong direction so as to bring the cams in contact with these disks from the under side instead of the outer side. They are held normally in contact with the shoulders or collars of the valve stems so as to be in readiness for the proper action of the cams, by light spiral springs, as shown at M.

The pipe B through which the supply of explosive gas is delivered into the engine cylinder has a valve O at a suitable point within it, the stem of this valve extending out through the side of the pipe, as shown at P, and having upon its outer end a crank arm Q.

Upon the end of the shaft L on the opposite side from the sprocket wheel N is mounted a governor R and the collar S which is caused to slide upon the shaft L by the movement of the governor is connected with the crank Q by a connecting rod T. It will be manifest from this that when the governor runs at any considerable speed it will move the collar S and through the connecting rod T and crank Q will rotate the valve stem P, and thus close the valve O more or less according to the speed at which the engine is running.

In order to adjust and regulate the tension

and to open the valve when the engine relaxes its speed, and the governor runs more slowly, I have shown a spring U surrounding the valve stem P having one end connected with the crank Q and the other end with a nut V which screws upon the projecting neck or stuffing-box through which the valve stem P passes. This nut V is locked in place by a second nut V′. By slacking this second nut, the nut V can be turned around so as to increase or decrease the torsion of the spiral spring U and may then be locked in the desired position by means of the nut V′. By this construction the valve is closed when the governor runs at a high speed and is opened by the action of this spring as the speed of the governor is reduced.

The igniting device consists of a lug or spur *a* which is fixed upon the shaft *b*, extending out through the head of the chamber A, and having upon its outer end a beveled gear *c*. This beveled gear is engaged by a beveled gear *d* upon the shaft L, and the shaft *b* and the lug *a* are thus caused to rotate. This rotating device or lug is connected with one pole of the battery which supplies an electric spark for the ignition of each charge of gas within the cylinder. The other pole of the battery is connected with the elastic spring arm *e*, which is suitably insulated from the metal work, and extends through a short sleeve *f* which screws into the side of the head A, so that the end of the spring *e* may be adjusted to form a contact with the lug *a* at each revolution of the shaft *b* which carries the lug. This adjustment is always a source of considerable trouble, and in order to make it, and also to compensate for wear upon the spring which takes place by constant rubbing contact with the revolving lug, I form a long elastic spring *e* upon the end of a threaded spindle *e′*. This spindle passes through the internally threaded sleeve *g* which fits into the sleeve *f*, and is surrounded with insulating material. The sleeve *f* is of sufficient diameter to contain the screw spindle, and its outer sleeve and the insulating material, and the whole may be screwed out of the head A if it is necessary to replace the spring by reason of breakage or other accident, so that it is only necessary to have an extra spring with its threaded extension on hand to make such a repair in short time. The adjustment is made by screwing the threaded shank *e′* of the spring in or out of the tubular sleeve through which it passes until the point of the spring stands at the proper relation to the rotating lug A to produce a sufficient spark upon the breaking of the contact between the two. Whenever the spring is worn, a half turn of the screw will adjust it again to the proper position. Upon the outer end of the screw spindle *e′* is a milled head *h* by which it can be turned. This milled head has a line drawn diametrically across it which corresponds with the plane of the flattened spring portion *e* at the inner end, so that by means of this line, the spring can be properly and accurately adjusted with relation to the revolving lug. When this adjustment has been made the screw is locked by a lock nut in the usual or any suitable manner.

The piston *i* is connected by a piston rod *j* with the crank *k* upon the crank shaft. In the vertical arrangement here shown, this crank is inclosed in a casing *l* which continues downward from the lower end of the cylinder and contains water and a lubricant, which stands at such a level that the crank will splash into it at each rotation of the shaft. The piston *i* has hollow chambered extensions *i′* at its lower end, and upon each side of the slotted channel which extends across it in one direction to allow the piston and connecting rod *j* to have the proper movement as it follows the rotation of the crank. These chambers upon each side have the lower part formed by the inward and upwardly turned flanges *m* and the flanges *n* diverge above the upper inner ends of the flanges *m* so that the lubricant which is splashed up by the crank will pass up between the upwardly turned flanges *m* and will fall into the chambers in the lower part of the piston, previously described. From these chambers it passes out through openings *o* into annular grooves or channels surrounding the piston, and thus serves to keep the piston lubricated at all times. Any surplus lubricant will flow down the sides of the cylindrical inclosing chamber *l* and fall again into the tank.

The mechanism which I have here described enables me to open the inlet and the exhaust valves independently of each other, by the cams upon the single shaft in close proximity to the valve stems and the head of the ignition chamber, and the adjustable springs will close the valves with a rapidity proportioned to their tension. This in the inlet valve may be made to act as a cut off to regulate the amount of explosive gas admitted to the cylinder. By opening the inlet valve by direct pressure of a cam, I admit the explosive gas freely, and in a larger quantity, than when the valve is opened by the vacuum produced by the movement of the piston, and the compression commences immediately when the piston commences its return stroke.

The ignition chamber is shallow, and the inlet and outlet valves open directly into it, so that all the products of an explosion will be entirely expelled when the piston returns after the explosion has taken place.

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

1. A gas engine consisting of the cylinder and piston reciprocatlng therein and ignition chamber with inlet and exhaust passages, puppet valves by which these passages are closed within the chamber, valve stems extending outwardly from said valves through the head of the chamber, and having shoulders or col-

lars formed upon them, springs by which the valves are normally closed, tappets fitting loosely upon the valve stems exterior to the shoulders, and held normally in contact with the shoulders or collars by springs whereby they are acted upon by cams upon a rotary shaft to open the valves, while the springs allow the tappets to slip along the valve stems without action upon the other parts when the cams are rotated so as to strike the tappets from the opposite direction, substantially as herein described.

2. A gas engine consisting of the cylinder, a reciprocating piston, a head containing the ignition chamber, valves within the chamber, and a mechanism exterior thereto by which they are independently operated so as to alternately admit an explosive gas into the ignition chamber and allow the waste products to be exhausted therefrom, a shaft extending into the chamber, having a projecting lug or tappet upon its inner end, a beveled gear by which it is constantly rotated from the shaft which operates the valves, said shaft having connection with one pole of a battery, a spring arm with which the other pole of the battery is connected, which arm makes and breaks contact with the lug or tappet at each revolution of the shaft, a screw shank extension of said spring arm having a milled head upon the outer end by which it may be turned so as to move the spring arm and adjust its contact with the rotating lug, substantially as herein described.

3. The rotary shaft extending through the head into the ignition chamber having a lug or tappet upon its inner end and connected with one pole of a battery, an elastic arm having a screw threaded shank connected with the other pole of the battery, said shank passing through a screw-threaded sleeve which is contained within and insulated from an exterior screw-threaded sleeve within which it is movable to adjust the point of the spring with relation to the rotary lug, the exterior sleeve and spring being removable together from the ignition chamber, substantially as herein described.

4. A gas engine comprising the combination of a cylinder, a reciprocating piston and ignition chamber, independently actuated valves through which the explosive gas is admitted and the products of explosion are exhausted, the supply pipe B, the valve O therein having its stem projecting vertically through the pipe and provided at its upper end with a crank arm, a rod connecting the crank with the governor whereby the valve O is closed by an increase of speed, a torsional spring surrounding the valve stem having one end attached to the crank, a disk adjustable upon the pipe and having the opposite end of the spring connected with it to regulate the tension of the spring, and a lock nut to hold the disk in its adjusted position, substantially as herein described.

5. A gas engine consisting of a cylinder, a reciprocating piston, a head containing the ignition chamber, independent puppet valves with seats on the inner end of the chamber, stems extending out through the head, with shoulders exterior thereto, tappets moving loosely upon the stems exterior to the shoulders and held in contact therewith by springs, a shaft journaled across the outer end of the head transversely to the valve stems and rotating devices connecting it with the engine shaft, cams upon the transverse shaft which engage the tappets to open the valves, springs acting upon the valve stems to close the valves when released from the cams, and screw nuts by which the tension of the springs is regulated, substantially as herein described.

6. A gas engine having a cylinder, a piston reciprocating therein, a chamber extending downwardly and forming a continuation of the cylinder, a crank shaft extending through said continuation having a crank rotating within this chamber connected by a rod with the reciprocating piston, said chamber containing a lubricant into which the crank dips at each revolution, a chamber or chambers forming an extension of the lower part of the piston with openings in the lower part into which the lubricant is splashed by the action of the crank, annular passages surrounding this extension, and holes connecting the interior of the chambers with these passages whereby the lubricant is constantly supplied between the piston and the cylinder, substantially as herein described.

7. In a gas engine, a cylinder, a piston reciprocating therein, a closed chamber containing lubricant and forming an extension of the cylinder, a crank shaft journaled transversely across the chamber, a pitman connecting the crank with the piston, an extension of the piston having a central transverse slot through which the pitman passes to the piston, chambers upon each side of the slot with flanges *m* and *n*, holes *o* through the outer sides of the chambers, and annular grooves around the exterior of the extension, with which the holes connect, substantially as herein described.

In witness whereof I have hereunto set my hand.

JOHN W. RAYMOND.

Witnesses:
S. H. NOURSE,
J. A. BAYLESS.