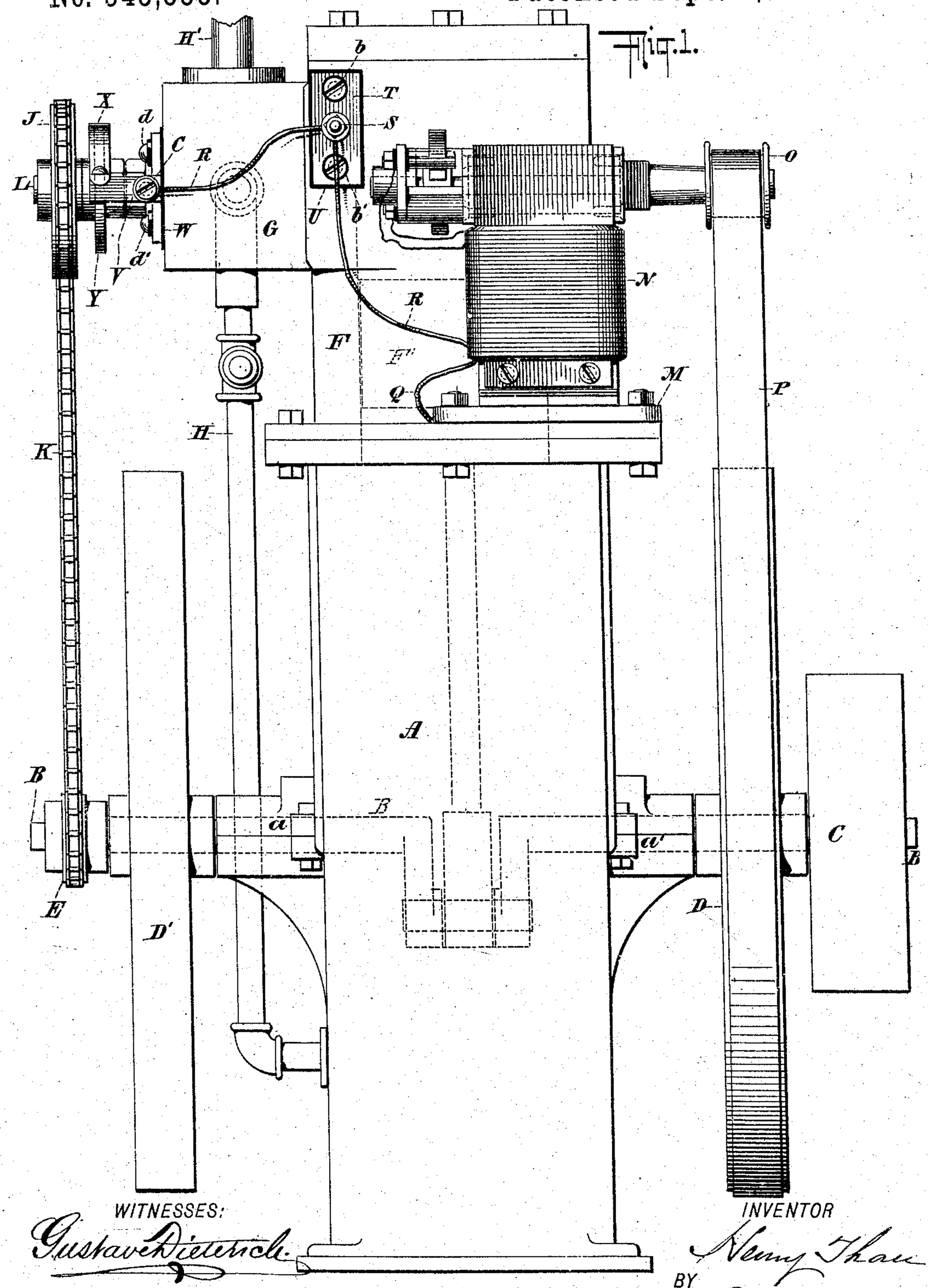
(No Model.) 2 Sheets—Sheet 1.

H. THAU.

ELECTRIC IGNITING APPARATUS FOR GAS ENGINES.

No. 545,553. Patented Sept. 3, 1895.

Fig. 1.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

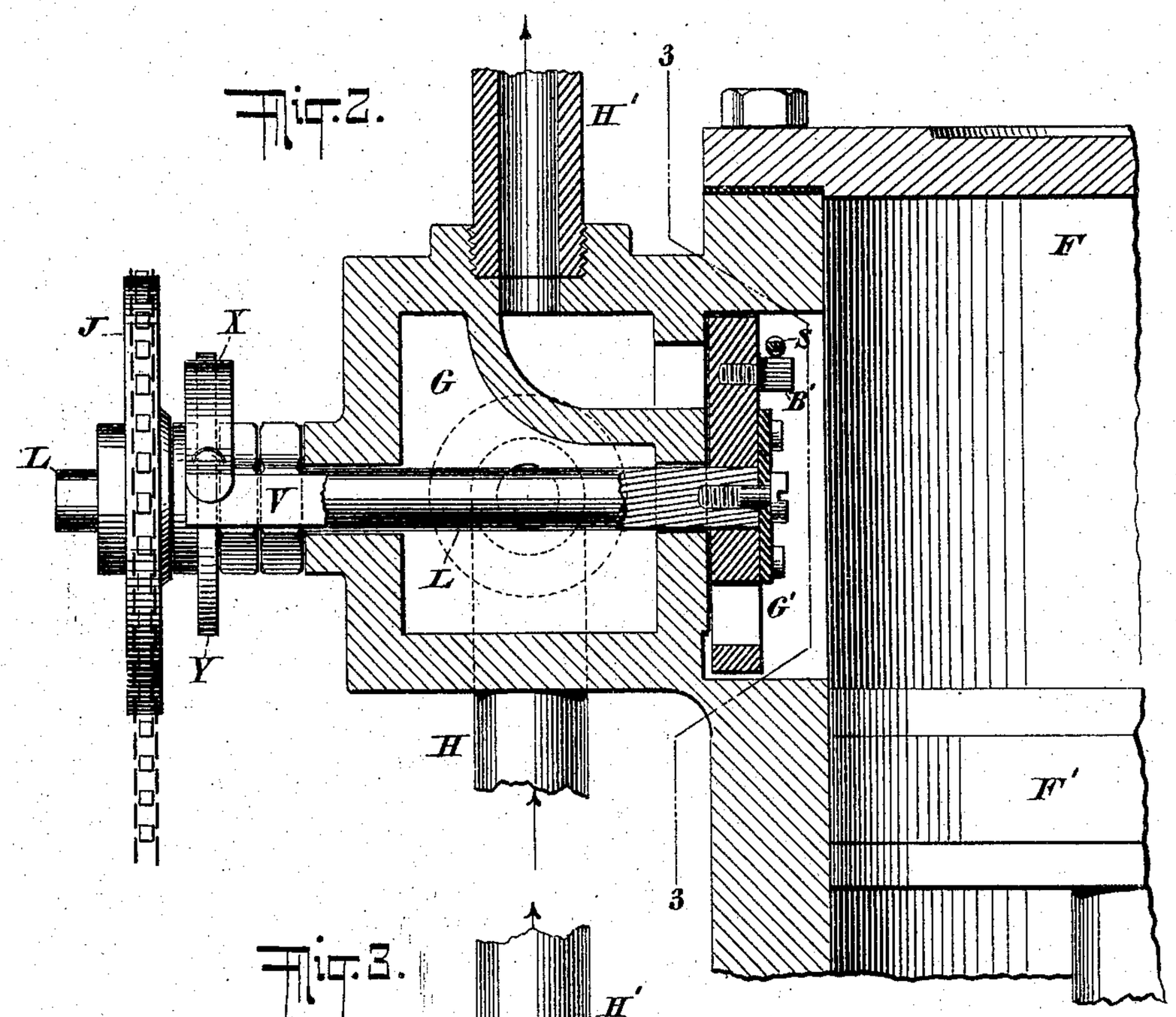


Fig. 3.

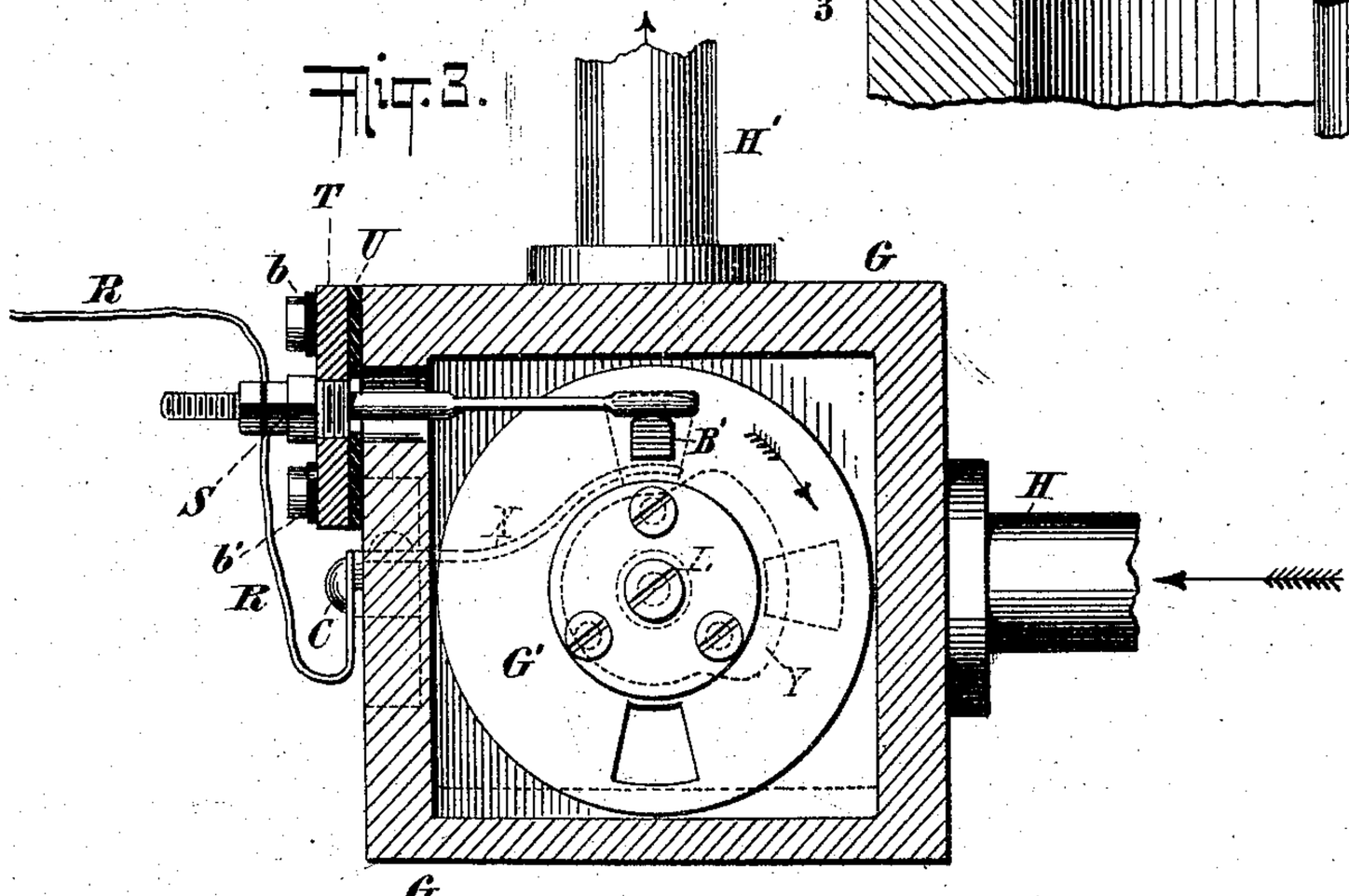
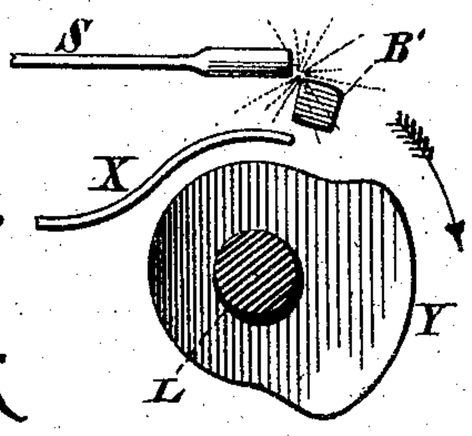


Fig. 4.



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UNITED STATES PATENT OFFICE.

HENRY THAU, OF NEW YORK, N. Y., ASSIGNOR TO JAMES W. IRWIN, OF SAME PLACE.

ELECTRIC IGNITING APPARATUS FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 545,553, dated September 3, 1895.

Application filed October 20, 1894. Serial No. 526,433. (No model.)

To all whom it may concern:

Be it known that I, HENRY THAU, a citizen of the United States, residing at the city of New York, in the county and State of New York, have invented certain new and useful Improvements in Electric Igniting Apparatus for Gas-Engines, of which the following is a full, clear, and exact description.

My invention relates more particularly to that class of igniting apparatus wherein the charge of gas in the cylinder is exploded by means of an electric spark; and it consists in the combination, connection, and arrangement of parts hereinafter more fully set forth.

The object of my invention is to provide a simple, efficient, and reliable means for producing an electric current just before the spark is required to explode the gas-charge in the cylinder, and then break the circuit immediately with the production of the spark and permit the circuit to remain so until a current is again required.

The further object of my invention is to accomplish the above results without diverting any appreciable part of the output of power of the engine.

In the accompanying drawings, forming part of this specification, wherein like letters indicate like parts, Figure 1 shows a side elevation of a gas-engine with my improved igniting apparatus applied thereto. Fig. 2 is a detail central vertical section of the valve-chest, showing the rotary valve and the contacts within and without the cylinder operated by the valve-shaft. Fig. 3 is a section of the same on the line 3-3 of Fig. 2, showing the position of the contacts within the cylinder and (in dotted lines) the contacts outside of the cylinder, consisting of the spring-contact and cam-disk on the valve-shaft. Fig. 4 is a diagram showing the relative positions of the cam-disk and the spring-contact at the moment when the wiping-contacts within the cylinder produce a spark to ignite the gas-charge therein.

In the drawings, A designates the base of the gas-engine provided with journals *a a'* to support the crank-shaft B, having keyed thereto a pulley C, two fly-wheels D D', and a sprocket-wheel E. Upon the base A is supported the cylinder F, within which works a piston F', having the piston-rod connected to the crank-shaft B.

Integral with the cylinder F and having ports communicating therewith is the valve-chest G, provided with a gas-supply pipe, an air-pipe H, a mixing-valve, and an exhaust-pipe H' leading from the top thereof. Within this chest G, upon a seat, works the rotary valve G', keyed to and operated by the shaft L, sprocket-wheel J, chain-belt K, which passes over said sprocket-wheel J, and the sprocket-wheel E on the crank-shaft B. This latter sprocket-wheel E, being just one-half the diameter of the sprocket-wheel J, enables the same to make two complete revolutions to each one revolution of the sprocket-wheel J and the rotary valve G' within the chest G, the sprocket-wheel J and rotary valve G' being keyed to the shaft L.

Upon a platform M, bolted to the gas-engine, is firmly supported a small dynamo N, operated by the belt P, which passes over the fly-wheel D of the engine and the pulley-wheel O on the armature-shaft.

The wire Q, constituting one pole of the dynamo, is grounded on the engine, and the other wire R, constituting the opposite pole, is connected to the contact S, extending through and into the cylinder F and supported in the block T, which is insulated from the engine and cylinder by a plate of non-conducting material U, and the said block T and plate U are held in place by insulated screws *b b'*. From the contact S the wire R passes to the T-shaped support V, to which it is connected by a screw. This support is likewise insulated from the engine proper by a similar plate of non-conducting material W, placed between the engine and the support, and is held in position by insulated screws *d d'*. From the projecting end of this T-shaped support V extends a spring-contact X, fastened thereto by a screw and forming an electrical contact with the cam portion of the disk Y when the same rubs against it. This cam-disk Y and spring-contact X, representing the two terminals of the dynamo-circuit, will, when the cam portion of the disk Y rubs against the spring-contact X, complete the

circuit and excite the dynamo, which up to the time of the completing of said circuit had been running idle.

Before describing the operation of my improved igniting apparatus it will be necessary, in order to properly understand the working thereof, to briefly describe the operation of a gas-engine. As is well known a cycle of operations in a gas-engine consists of two complete revolutions of the crank-shaft during the time the shaft operating the valve governing the supply and exhaust mechanism makes but a single revolution. With the first or outward stroke of the piston a vacuum is created in the cylinder and a charge of air and gas mixed in the proper proportions is drawn into the cylinder. With the return-stroke the charge is compressed, and at the completion of said stroke ignited and exploded, thereby driving the piston F′ before it and imparting motion to the crank-shaft, and with the second return stroke of the piston the discharged or refuse gases remaining in the cylinder are expelled through the then open exhaust and the engine is then prepared to take in a fresh charge and repeat the above-described operations.

From the description of the working of the gas-engine it will be observed that the engine generates power during one-quarter only of its working time, the momentum acquired by the fly-wheels during the working quarter being sufficient to carry forward the machinery driven by the engine during the rest of the time. It therefore becomes apparent that there is no necessity for the generation or accumulation of electrical energy or wasting of material necessary to produce the same during the remaining three-quarters of the working time. To prevent this waste of electrical energy and material necessary to produce the same where an electrical current is utilized to ignite the gas, and to save the quantity of gas required to feed the flame where a flame is used as an igniter, and to save that which escapes between the time the flame is blown out by the explosion and relighted by the pilot-flame, is the object of my invention. It has been found that if the dynamo used to accomplish this purpose be permitted to generate a current during the entire working time of the gas-engine it requires the greater part of the output of power generated thereby to drive the dynamo, and thus leaves little power to be utilized for the purposes for which the gas-engine was intended. According to the means shown by my invention, I begin to excite the dynamo with about the commencement of the compressing stroke of the piston F′ within the cylinder F—*i. e.*, begin to excite the dynamo just before the beginning of that quarter-revolution of the valve-shaft preceding the igniting and exploding of the gas-charge—and then allow the dynamo to run without generating any current during the remaining three-quarters of the working time. This will enable the fly-wheels to acquire during that period sufficient momentum to overcome the resistance occasioned by the drag of the armature during the quarter in which current is being generated and prevent any appreciable variation in the speed or power developed by the gas-engine, and simultaneously with the production of the spark break the dynamo-circuit and permit the dynamo to run idle until the current is again required.

The operation of my apparatus is as follows: If we assume that the piston F′ has just completed the second return stroke and discharged the refuse-gas remaining in the cylinder, the gas-port will then be open, and with the outward stroke of the piston a mixed charge of air and gas will be drawn into the cylinder. This outward stroke of the piston causes a half-revolution of the crank-shaft B, and by reason of the difference in diameter of the sprocket-wheels J and E cause the sprocket J, shaft L, and rotary valve G′ to make a quarter-revolution in the direction of the arrow. As the disk Y′ is also secured to the shaft L and rotates therewith, it will, near the completion of this quarter-revolution, cause the cam portion of said disk Y to rub against the spring-contact X and complete the dynamo-circuit. The dynamo thereupon begins to generate a current. As the shaft L continues to revolve, the contact-stud B′ on the face of the valve G′ will wipe against contact S, extending into the cylinder. Immediately after this contact has been formed the conducting continuity formed by the cam-disk Y and spring-contact X is broken, and the circuit is then continued by the contacts S and B′ within cylinder until the spark is produced to ignite and explode the gas-charge. Simultaneously with the production of the spark the dynamo-circuit is broken and the dynamo thereupon ceases to further generate current. As before stated, this operation takes place during about one-quarter of the working time of the engine, and during the remaining three-quarters the dynamo runs idle—*i. e.*, generates no current. It will be observed that I begin to cause the dynamo to become operative only at such a time before the spark is required as will enable the same to arrive at the full extent of its developing power at the moment when the spark is required. This I accomplish by passing the belt operating the dynamo over the fly-wheel of the engine, and the great difference of diameter existing between the fly-wheel and the pulley on the armature-shaft of the dynamo will cause the latter to make a large number of revolutions while the fly-wheel makes but a partial revolution.

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

1. In an electric igniting apparatus for gas engines, the combination of a gas engine, and a dynamo suitably supported thereon having a belt passing over the armature pulley and

the fly-wheel of the engine with the circuit closing device arranged to operate without the cylinder, of the sparking device arranged to operate within the cylinder to form a contact therein before the circuit completed without the cylinder is broken, and to continue said contact within said cylinder after the conducting continuity of the circuit closing device without the cylinder is broken until a spark is produced within said cylinder to ignite and explode the gas charge therein, and the dynamo circuit broken, substantially as specified.

2. In an electric igniting apparatus for gas engines the combination of conductors; a cam disk carried by the valve shaft; said valve shaft being operated by the crank shaft, a contact secured to an insulated support on the engine, said contact and cam disk representing the two terminals of the dynamo circuit, a fixed contact extending into the cylinder supported in an insulated block secured to the engine, and adapted to form a wiping contact with a stud on the face of the rotary valve operating the supply and exhaust mechanisms, combined with a dynamo supported on a platform secured to the engine, said dynamo having one pole thereof grounded on the engine, and the other connected to the spring contact and the contact extending into the cylinder, and a belt passing over the dynamo pulley and the fly wheel of the engine to operate the dynamo, substantially as, and for the purposes set forth.

Signed at the city of New York, in the county and State of New York, this 17th day of October, 1894.

HENRY THAU.

Witnesses:
EDWARD G. BLACK,
ROBERT V. S. SAMUELS.