No. 717,466. Patented Dec. 30, 1902.

E. J. STODDARD.

ELECTRICAL IGNITER FOR GAS ENGINES.

(Application filed Oct. 10, 1901.)

(No Model.)

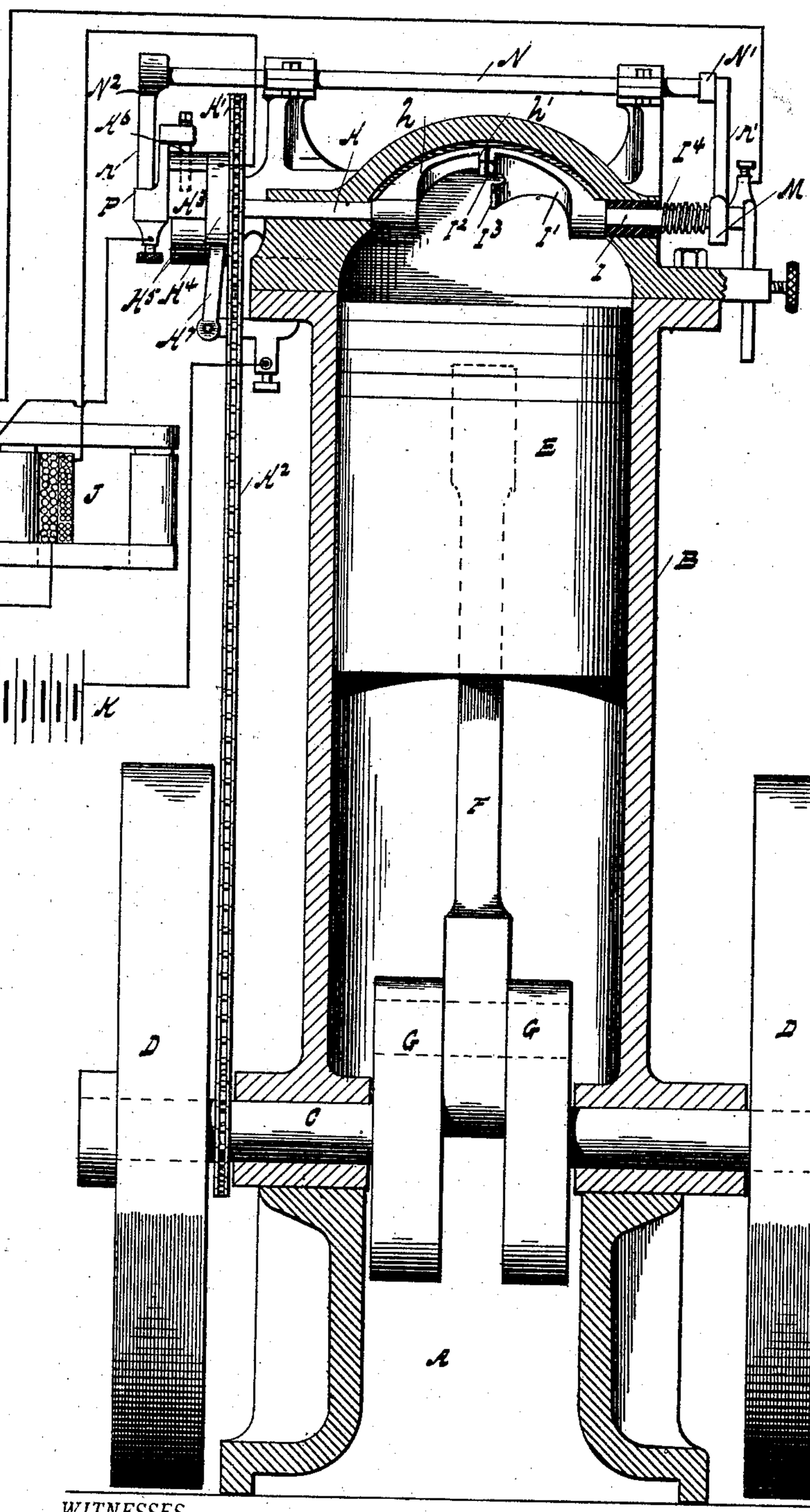

Fig. 1.

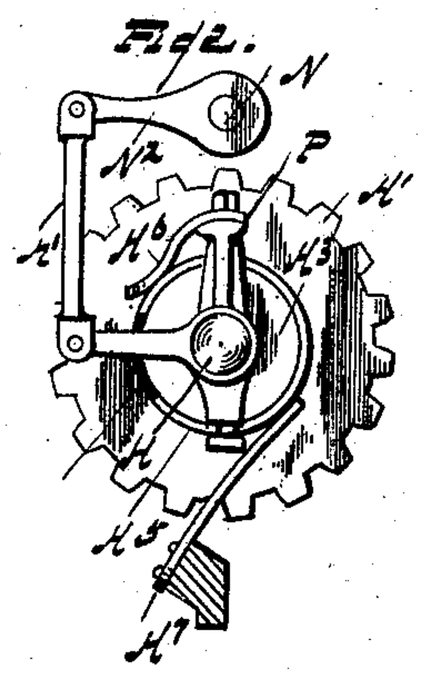

Fig. 2.

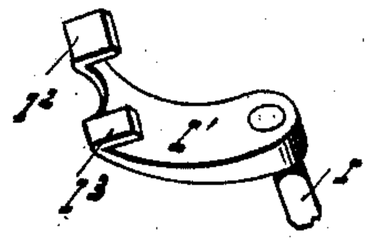

Fig. 3.

WITNESSES

J. G. Massey.
Geo. P. Davis

INVENTOR

By Elliott J. Stoddard
Parker & Burton.
Attorneys.

UNITED STATES PATENT OFFICE.

ELLIOTT J. STODDARD, OF DETROIT, MICHIGAN, ASSIGNOR TO CHARLES F. BURTON, TRUSTEE, OF DETROIT, MICHIGAN.

ELECTRICAL IGNITER FOR GAS-ENGINES.

SPECIFICATION forming part of Letters Patent No. 717,466, dated December 30, 1902.

Application filed October 10, 1901. Serial No. 78,165. (No model.)

To all whom it may concern:

Be it known that I, ELLIOTT J. STODDARD, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Electrical Igniters for Gas-Engines; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to electrical igniters for gas-engines; and it consists in the improvements hereinafter described, and pointed out in the claims.

Referring to the accompanying drawings, Figure 1 shows a sectional elevation of a gas-engine with an igniting apparatus embodying my invention attached thereto. Fig. 2 is an elevation of that part of the apparatus which is at the left and top of the engine in Fig. 1. Fig. 3 is a perspective view of the part carrying the contact-points.

The same reference-letter indicates the same part in all the views.

A is the base, B the cylinder, C the main shaft, D D the fly-wheels, E the piston, F the connecting-rod, and G the crank, of the gas-engine.

H is a shaft extending through the wall of the cylinder B into the combustion-chamber of the engine and adapted to revolve in a bearing in said wall.

h is a finger attached to the inner end of the shaft H and carrying a contact-point *h'* at its end eccentric to said shaft.

H' is a sprocket-wheel upon the shaft H outside of the engine-cylinder.

H^2 is a sprocket-chain engaging with the teeth of the sprocket-wheel H' and also engaging with the teeth of a sprocket-wheel upon the shaft C, so that the rotation of the shaft C shall produce a rotation of the shaft H.

H^3 is a cylinder of insulating material upon the outer end of the shaft H.

H^4 is a strip of metal surrounding the cylinder H^3 at one end thereof.

H^5 is a strip of metal connected with the strip H^4 and partly surrounding the cylinder H^3, but leaving a gap between its ends.

H^6 is a brush contacting the strip H^5, and H^7 is a second brush contacting the strip H^4. The brushes H^6 H^7 are insulated from the engine and connecting parts and from each other, but are connected together through the strips H^4 H^5 when the brush H^6 contacts the strip H^5.

I is a cylindrical rod extending through the wall of the cylinder B and insulated therefrom. The rod I is opposite and axially in line with the shaft H.

I' is a finger upon the inner end of the rod I.

I^2 I^3 are points upon the outer end of the finger I', adapted to be contacted by the end of the finger *h*.

I^4 is a spring acting to draw the rod I inward.

J is a sparking coil having a complete or approximately complete iron magnetic circuit.

J' is a primary coil.

K is a generator of electricity as a battery. One pole of the battery K is connected with one of the brushes H^6 or H^7, and the other pole leads through the primary coil J' to the other of said brushes.

One end of the wire constituting the secondary coil is connected to the rod I and the other end is connected to the shaft H. The strips H^4 H^5 are so arranged that the brush H^6 shall pass from the strip H^5, and thus break the circuit through the primary when the point *h'* is in contact with the first one of the contact-points I^2 I^3 or just before such contact occurs. If the circuit through the primary is broken when the circuit through the secondary is incomplete, there will be a sparking at the primary brush unless such effect is obviated by a condenser.

With the above apparatus arranged as above described there will be an induced current set up in the secondary which will continue for a short time, apparently depending upon the completeness of the iron magnetic circuit, but also depending in some measure upon the number of coils in the secondary. The larger the number of coils the longer the current seems to endure and the more com-

plete the iron magnetic circuit the longer the current seems to continue. When the point h' passes out of contact with the point I^2 a spark will occur, and a second spark will occur when the point h' contacts and passes out of contact with the second point I^3. These sparks may be of equal intensity, and in case the first does not ignite the charge the second will generally do so. The double spark may also be obtained with a primary current only, provided sufficient time of contact is given on the first contact.

A greater number of sparks than two may be obtained by successive contacts if the coil is constructed for that purpose. I have obtained six or eight sparks. It is necessary to give the battery-current an appreciable time to magnetize the coil, but the second and subsequent contacts may be quite short, much shorter than necessary to obtain a spark with the battery-current.

While a primary current may be used instead of a secondary, as above described, the spark occurring by self-induction, I prefer to use a secondary circuit, because it is easier to obtain a comparatively high voltage.

The successive contacts occur in rapid succession, though the best distance apart, as also the best breadth of the second or subsequent contact-points, seems to depend somewhat upon the construction of the coil.

With a square coil having less than four inches in length and four (4) inches apart, and a square cross-section 1.25 inches on the side, I have used one hundred and thirty-five turns of No. 14 wire for a primary and four hundred and seventy-seven turns of No. 22 wire as a secondary with sparking points about three-sixteenths of an inch apart and about the same distance across the face. With this apparatus I have obtained good sparks at speeds from four hundred and twenty-five to seventeen hundred and twenty-eight revolutions per minute.

In the apparatus shown in the drawings the rod I may be turned and adjusted to various positions, so as to fix the igniting-point of the engine, the brush H^6 being turned by the same mechanism, so that the relation between the breaking-point of the primary and the making and breaking points of the secondary are not altered. This is effected by the following-described mechanism: M is an arm upon the rod I. N is a rock-shaft extending over the top of the cylinder. N′ is an arm upon the rock-shaft N. n is a rod connecting the outer ends of the arms N′ and M. P is a bell-crank lever upon the shaft H, adapted to turn upon said shaft. The brush H^6 is secured to the upper end of the vertical arm of the bell-crank lever P. N^2 is an arm upon the rock-shaft N. n' is a connecting-rod between the outer ends of the arm N^2 and the horizontal arm of the bell-crank lever P.

What I claim is—

1. In an electric-lighting system, the combination of a sparking coil, means for completing the electric circuit through the windings thereof, to energize said coil, and means for breaking said circuit, to produce the spark at the point where the circuit is broken, two or more times in so short an interval of time that a spark shall be formed at each break due to the energy imparted to the coil during the time at which said circuit is complete before the circuit is broken.

2. In an electric-lighting system, the combination of a sparking coil having a complete or approximately complete magnetic circuit, means for completing the electric circuit through the windings of said coil to energize the coil, and means for breaking said circuit, to produce the spark, at the point where the circuit is broken, two or more times in succession in so short an interval of time that a spark shall be formed at each break due to the energy imparted to the coil during the time at which said circuit is complete before said circuit is broken.

3. In a sparking apparatus, the combination of a coil provided with a primary and secondary winding, means for completing the secondary circuit, means for making the circuit through the primary winding, and means for breaking the circuit through the primary winding while the secondary circuit is complete, and means for breaking the secondary circuit so proximately after the break in the primary circuit that the current induced in the secondary shall be interrupted at the break of the secondary and the igniting-spark thereby produced.

4. In a sparking apparatus, the combination of a coil provided with a primary and a secondary winding, means for making the circuit through the primary winding and breaking the same while the secondary circuit is complete, and means for completing the secondary circuit and breaking the secondary circuit after the primary circuit is broken, two or more times in so short an interval of time that a spark shall produce a spark at each break of the secondary.

5. In a sparking apparatus, the combination of a coil having a complete or approximately complete magnetic circuit and provided with a primary and a secondary winding means for making the circuit through the primary winding and breaking the same while the secondary circuit is complete, and means for completing the secondary circuit and breaking the secondary circuit after the primary circuit is broken, two or more times in so short an interval of time that the electromotive force induced in the secondary by the break of the primary shall produce a spark at each break of the secondary.

6. The combination with a gas-engine of a sparking coil having a primary and a secondary winding, means for making and break-

ing the circuit through the secondary winding within the cylinder, and means for completing the primary circuit outside of the cylinder and breaking the same outside of the cylinder while the secondary is complete and so proximately before the break in the secondary that current induced in the secondary shall be interrupted and form a spark at the point of breaking the secondary.

7. The combination with a gas-engine of a coil having a primary and a secondary winding, an adjustable means for making and breaking the circuit through the secondary winding within the cylinder, an adjustable means for making and breaking the primary circuit outside of the cylinder, the means for breaking the two circuits being so arranged that the break at the primary shall occur while the secondary is complete and just before the break in the secondary, the means for breaking the two circuits being so connected that the movement of one shall produce a corresponding movement of the other.

8. In a sparking apparatus, the combination of a coil provided with a primary and secondary winding, means for completing the secondary circuit, means for making the circuit through the primary winding, and means for breaking the primary circuit, and means for breaking the secondary circuit so proximately after the break in the primary circuit that the current induced in the secondary shall be interrupted at the break of the secondary and the igniting-spark thereby produced.

In testimony whereof I sign this specification in the presence of two witnesses.

ELLIOTT J. STODDARD.

Witnesses:
NETTIE V. BELLES,
LOTTA L. HAYTON.