No. 780,221. PATENTED JAN. 17, 1905.

J. W. PACKARD.

ELECTRIC IGNITER.

APPLICATION FILED JAN. 10, 1903.

2 SHEETS—SHEET 1.

Fig. 2.

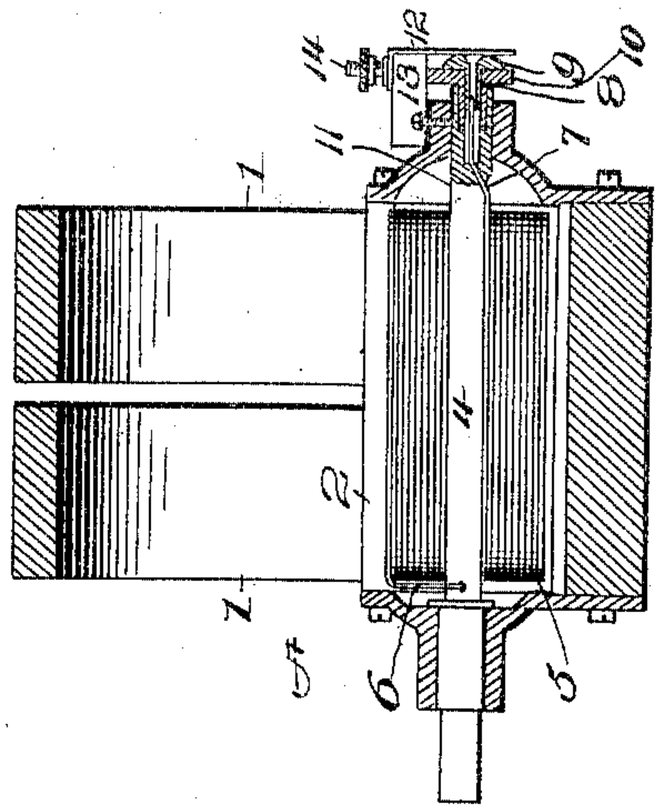


Fig. 3.

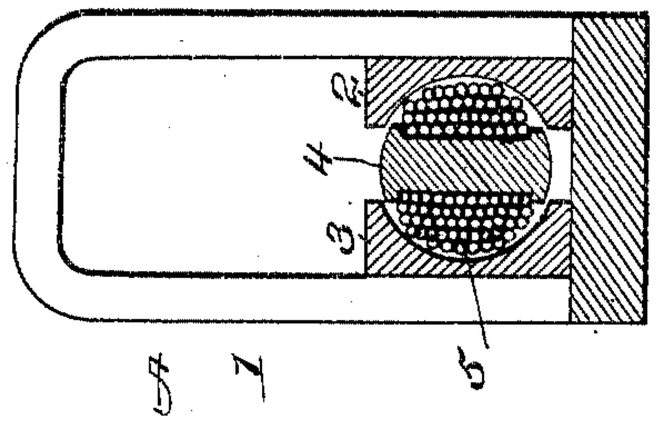
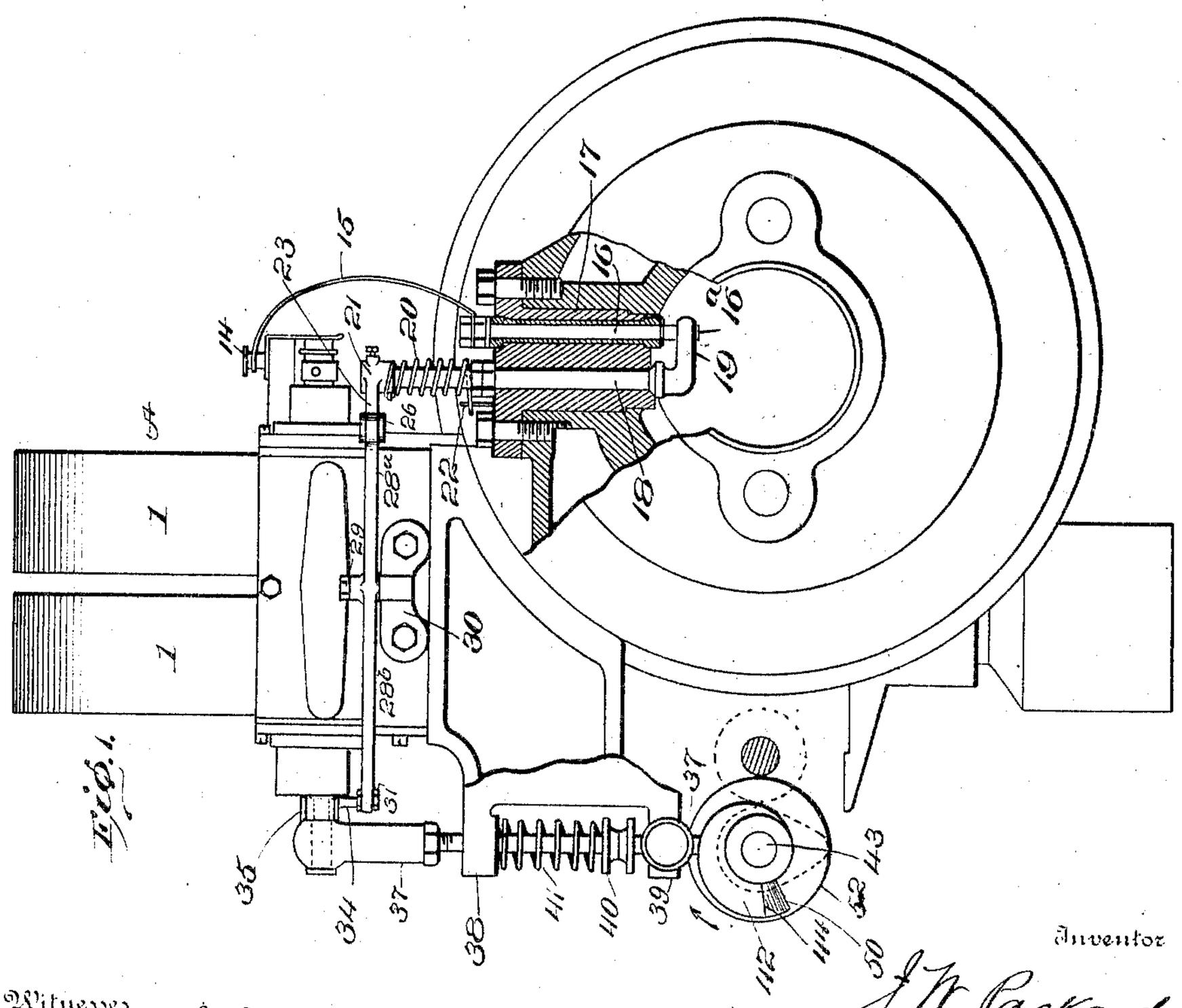


Fig. 1.



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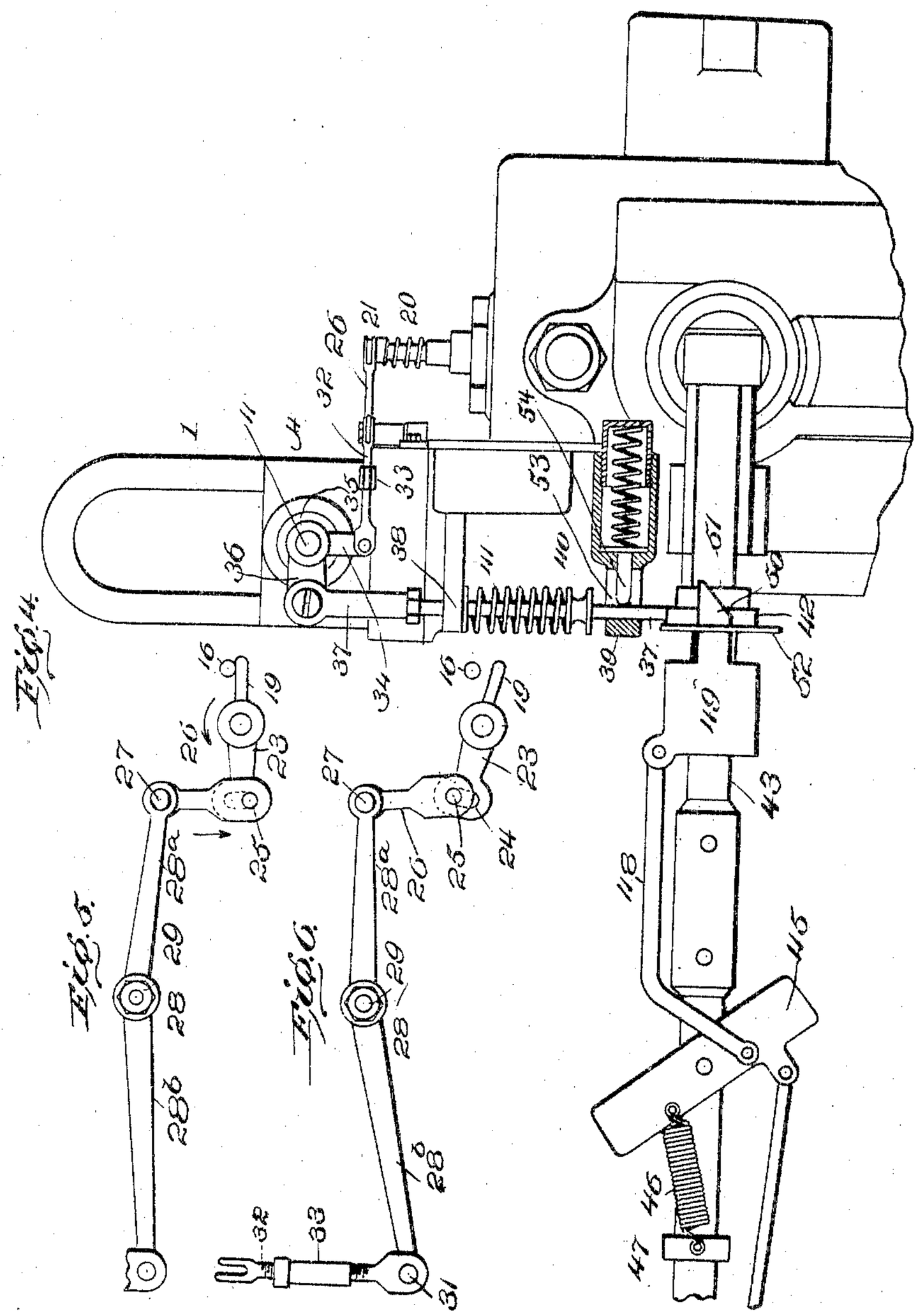

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UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

ELECTRIC IGNITER.

SPECIFICATION forming part of Letters Patent No. 780,221, dated January 17, 1905.

Application filed January 10, 1903. Serial No. 138,501.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Electric Igniters, of which the following is a specification.

This invention comprises improvements in electric igniters for explosive-engines; and it includes an electric generator, means for intermittently operating said generator, means for separating the electrodes of the sparking device while the generator is in operation, and means for automatically varying the time of operation, and consequently of ignition, relative to the engine-stroke according to the speed of the engine.

In the accompanying drawings, Figure 1 is a rear end view of a gas-engine cylinder, partly in section, with the igniting apparatus applied thereto. Fig. 2 is a vertical longitudinal section through the center of the generator. Fig. 3 is a central transverse section through the same. Fig. 4 is a side view of the rear end of the cylinder with the igniting apparatus applied thereto and showing also the governor for controlling the time of ignition. Fig. 5 is a plan view of the levers for operating the movable electrode, said levers being shown in their normal position; and Fig. 6 is a similar view illustrating the manner in which the electrodes are separated when the current is being generated.

Referring to the drawings, A indicates an electric generator, preferably a magneto-generator, consisting of one or more permanent horseshoe-magnets 1, having internal pole-pieces 2 and 3, between which is arranged an H-armature 4, having insulated copper wire 5 coiled thereon. One end, 6, of the coil of wire is grounded upon the shaft, as shown in Fig. 2, and the opposite end, 7, is connected to a shank 8 upon a metal contact-disk 9. This shank extends into a tubular insulating-bushing 10, which fits into a socket in the end of the armature-shaft 11. A spring contact arm or brush 12, secured upon an insulating-block 13, bears upon the contact-disk 9 and conducts the current to a binding-post 14 upon said block. A wire 15 connects the binding-post 14 with a stationary electrode 16, secured within and insulated from an igniter-plug 17. The conducting-wire 15 is the only necessary wire external to the generator. The end 6 of the generating-coil is electrically connected, through the generator and engine-frames and the various metal parts of the apparatus, with a movable electrode 18, which is capable of oscillation about its vertical axis and is provided at its lower end with the contact-arm 19, which latter is normally held against the lower end 16^a of the stationary electrode by a spiral spring 20, which is coiled about the upper end of the movable electrode. The upper end of this spring is connected to a collar 21, which is secured upon the movable electrode, and the lower end of the spring is connected to a fixed pin 22, which is secured to the igniter-plug. The spring tends to turn the movable electrode in the direction indicated by the arrow, Fig. 5, and normally presses the contact-arm 19 of said electrode against the stationary electrode, as shown in said figure and also in Fig. 1. Connected with the collar or hub 21 is a short lever-arm 23, having a slot 24 at its outer end, into which extends a pin 25 upon a link 26, which link is connected by a pivot-pin to one arm, 28^a, of a lever 28. This lever is mounted upon a pivot-pin 29, which is supported by a bracket 30 at the rear of the generator, and the longer arm, 28^b, of the lever is connected by a pivot-pin 31 to a link 32, which is adjustable in length by means of a turnbuckle 33. The link 32 is connected to one arm, 34, of a bell-crank lever 35, which latter is secured upon the armature-shaft 11. The other arm, 36, of said bell-crank lever is pivotally connected to a rod 37, which is movable vertically in bearings 38 and 39. Between said bearings is arranged a collar 40, and between said collar and the bearing 38 is a compression-spring 41, which normally tends to force the rod 37 downwardly against a cam 42, which is secured upon a horizontal shaft 43. As shown in Fig. 1, the radius of the cam, starting near the shaft, gradually increases and the cam terminates abruptly at its highest point 44. Arranged upon the shaft 43 is a governor 45,

consisting of a block or bar of metal pivoted centrally to the shaft. The centrifugal force when the shaft is in motion tends to throw the metal block or bar at right angles to the shaft against the tension of a spring 46, which is connected to the bar 45 at one side of its pivot-point and to a collar 47. A link 48 is connected to the bar 45 at the opposite side of its pivotal point, and this link is pivotally connected with a collar 49, movable longitudinally of the shaft and having a part 50, which projects longitudinally of the shaft in front of the abrubtly-terminating end of the cam. The outer surface of the part 50, as shown in Fig. 1, is flush with the periphery of the cam, and said part forms a continuation of the cam. The rear face 51 of the projection 50 is beveled, as shown in Fig. 4, and it will be apparent that as the part 50 forms a continuation of the cam the position of said part will determine the time in the revolution of the shaft 43 when the rod 37 will drop from the higher onto the lower part of the cam. The projection 50 extends through a suitable guide-opening in a flange 52 at the side of the cam.

The shaft 43 is suitably geared to the engine and makes one revolution during each cycle of operations. The rotation of the cam raises the rod 37 slowly, and this rod in turn rocks the bell-crank lever 35, thereby moving the armature at a comparatively slow speed in one direction. At the same time the link 32 is drawn to the left in Fig. 4, thereby moving the lever 28 and forcing the link 26 in the direction indicated by the arrow, Fig. 5. This movement of the link 26 is not accompanied by a movement of the lever-arm 23 on account of the slot 24 in the link, which allows relative movement between said parts. The electrodes therefore are held in contact by the spring 20 during this movement of the parts. At the proper moment for the ignition of the charge in the engine-cylinder the rod 31 passes off of the elevated portion of the cam and is quickly depressed by the spring 41. The armature is thereby given a quick oscillation and an electric current is generated in its coils, the circuit being at the same time closed through the electrodes. While this current is being generated the electrodes are separated by the reverse movements of the link 32, lever 28, link 26, and lever 23. The movement of the lever 23 and the electrode does not take place until after the armature is in motion, so that a current of full intensity is generated before the electrodes are separated. The lost motion between the link 26 and lever 23, it will be seen, delays the separation of the electrodes, as the lever 23 will not be moved by the link until the pin 25 travels from one end of the slot to the other. Fig. 6 shows the relative positions of the parts at the time when the electrodes are separated to cause a spark.

The time of ignition is regulated according to the speed of the engine by the adjustable portion 50 of the cam; the position of which is controlled by the centrifugal governor. When the engine is operating slowly, the entire width of the part 50 will pass under the rod 37, and as this movable part of the cam is drawn to the left in Fig. 4 with an increase in speed it will be seen that the cam-surface will be shortened, thus permitting the rod 37 to drop at an earlier point in the revolution of the engine. The time of ignition is thus automatically controlled. I do not wish to confine myself to any particular form of generator or to any particular arrangement of levers and parts for operating the generator and separating the electrodes, as it will be evident that the parts may be variously constructed and arranged to accomplish the desired ends.

It will be evident that if it is desired to employ a jump-spark instead of a spark caused by separating the electrodes, the generator may be used to operate an induction-coil having its secondary winding connected to two separate electrodes in the combustion-chamber in the usual manner. Instead of operating the rod, which is tripped by the cam, with a spring, the said rod or member may be operated by a weight, which for all practical purposes is the equivalent of a spring.

The bearing 39 has a slot 53, through which the tripping-rod 37 extends, and the rod is normally held in position upon the cam-surface by a spring-pressed pin 54. In case of the reversal of the engine at any time the tripping-rod instead of being caught and bent or broken by the cam extension 50 will be moved laterally against the pressure of the pin 54 by the inclined face 51 of the cam extension.

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

1. In an electric igniter for explosive-engines, a generator, a spiral cam having a transversely-adjustable extension at its rear end, said extension having one end inclined to the axis of the cam, and a spring-pressed member bearing upon said cam and operatively connected to the movable member of the generator.

2. In an electric igniter for explosive-engines, a generator, a spiral cam having a transversely-adjustable extension at its rear end, said extension having one end inclined to the axis of the cam, and a governor arranged to vary the position of said cam extension according to the speed of the engine.

3. In an electric igniter for explosive-engines, a generator, a cam-shaft, a spiral cam upon said shaft, a collar movable longitudinally upon the shaft and having a part projecting longitudinally of the shaft and forming an extension of the cam-surface, the end

of said part being inclined to the axis of the shaft, a centrifugal governor connected to said collar, and a spring-pressed member connected to the movable member of the generator and bearing upon said cam.

4. In an electric igniter for explosive-engines, a fixed electrode, an electrode movable about its axis and having an arm arranged to bear against the fixed electrode, a spring normally holding said electrodes in contact with one another, a generator having coils connected to said electrodes, a cam, a spring-pressed member arranged to be tripped periodically by said cam, a bell-crank lever connected with the movable element of the generator and having one arm connected to said member, a centrally-pivoted lever connected to the other arm of said bell-crank lever, a link pivoted to said arm, said link having a pin at its outer end, and a lever-arm connected with the movable electrode and having a slot engaged by said pin.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:

EDITH GORTON,

G. B. PORT.