No. 849,820. PATENTED APR. 9, 1907.

R. VARLEY.

SPARK IGNITION SYSTEM FOR EXPLOSION ENGINES.

APPLICATION FILED APR. 6, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

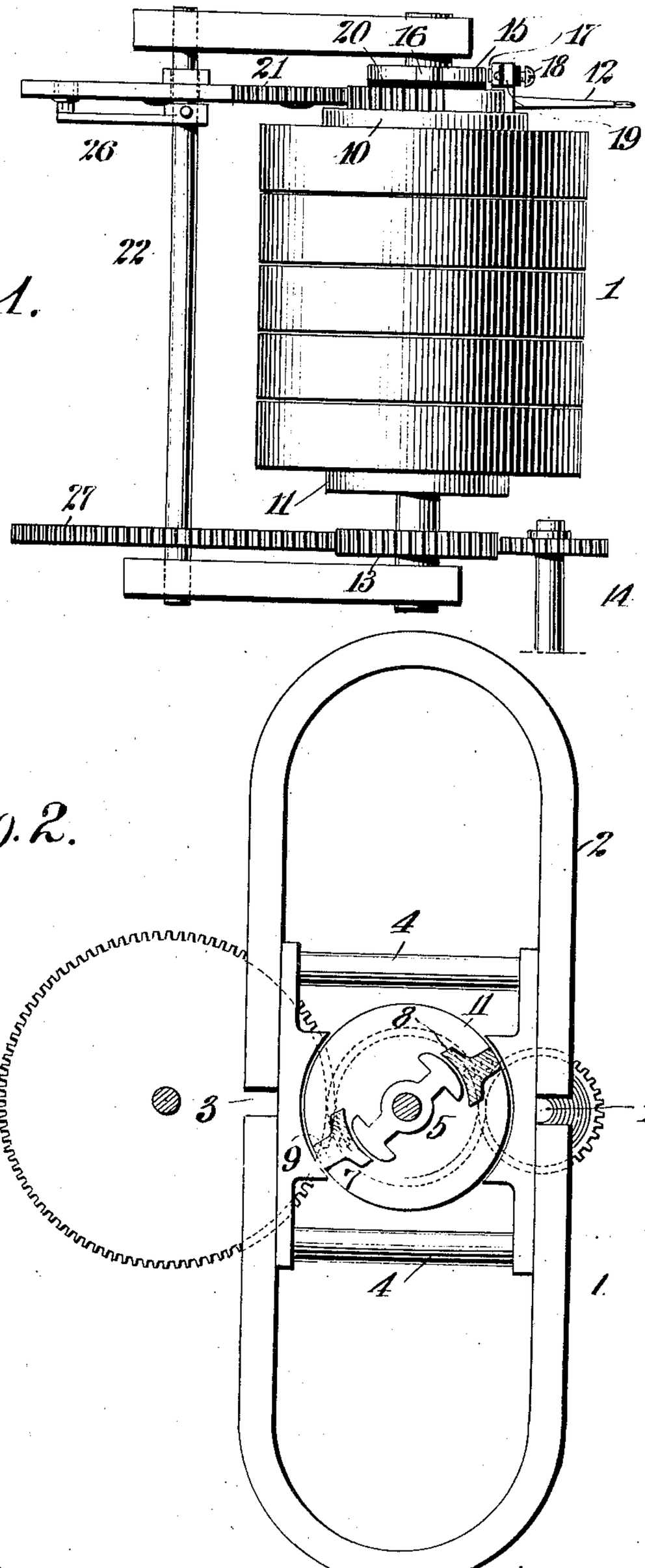

Fig. 2.

Witnesses
Waldo M. Chapin.
A. B. Mallinckrodt.

Inventor
Richard Varley
By his Attorneys
Rosenbaum & Stockbridge

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2 SHEETS—SHEET 2.

Fig. 3.

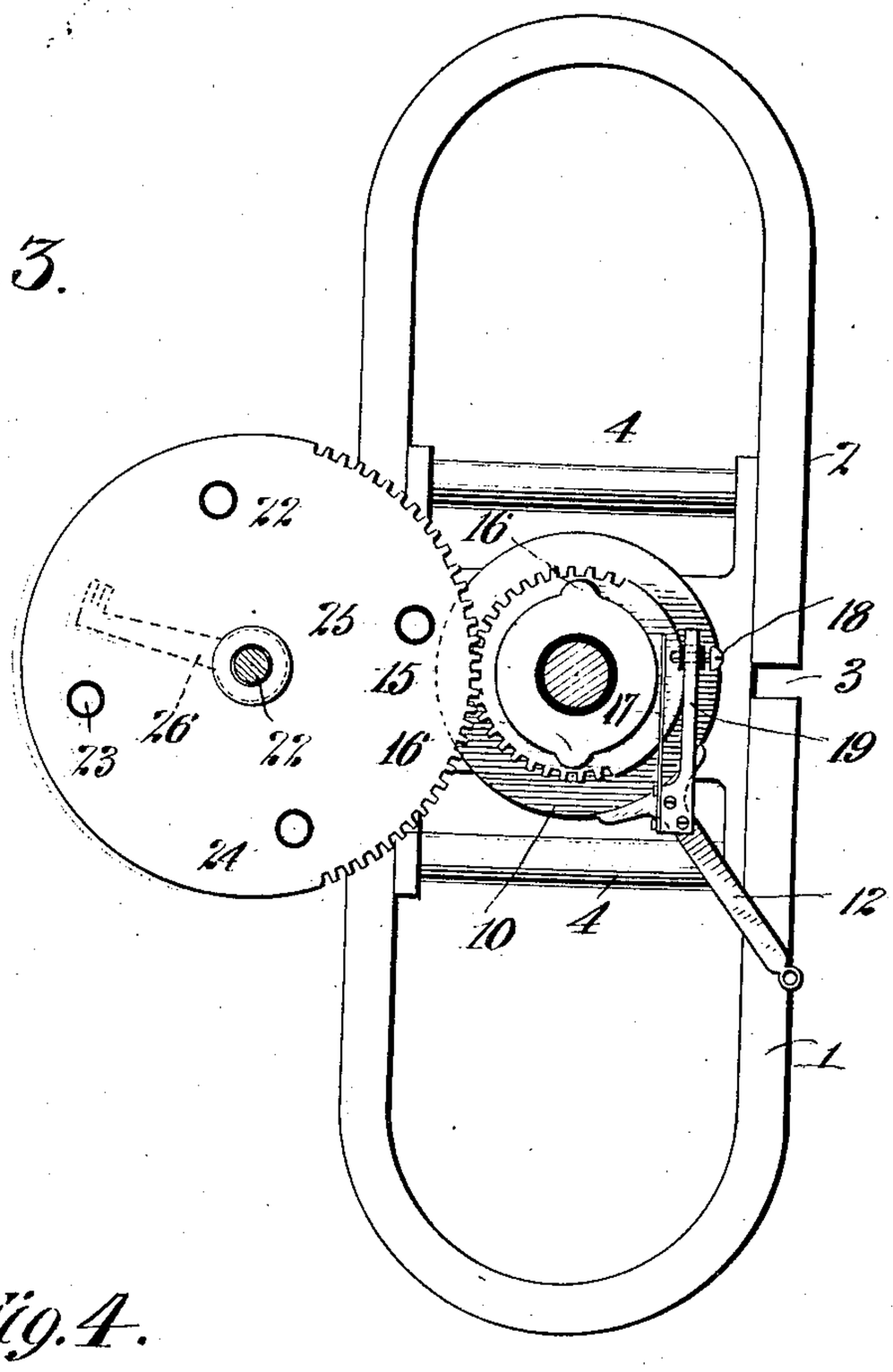
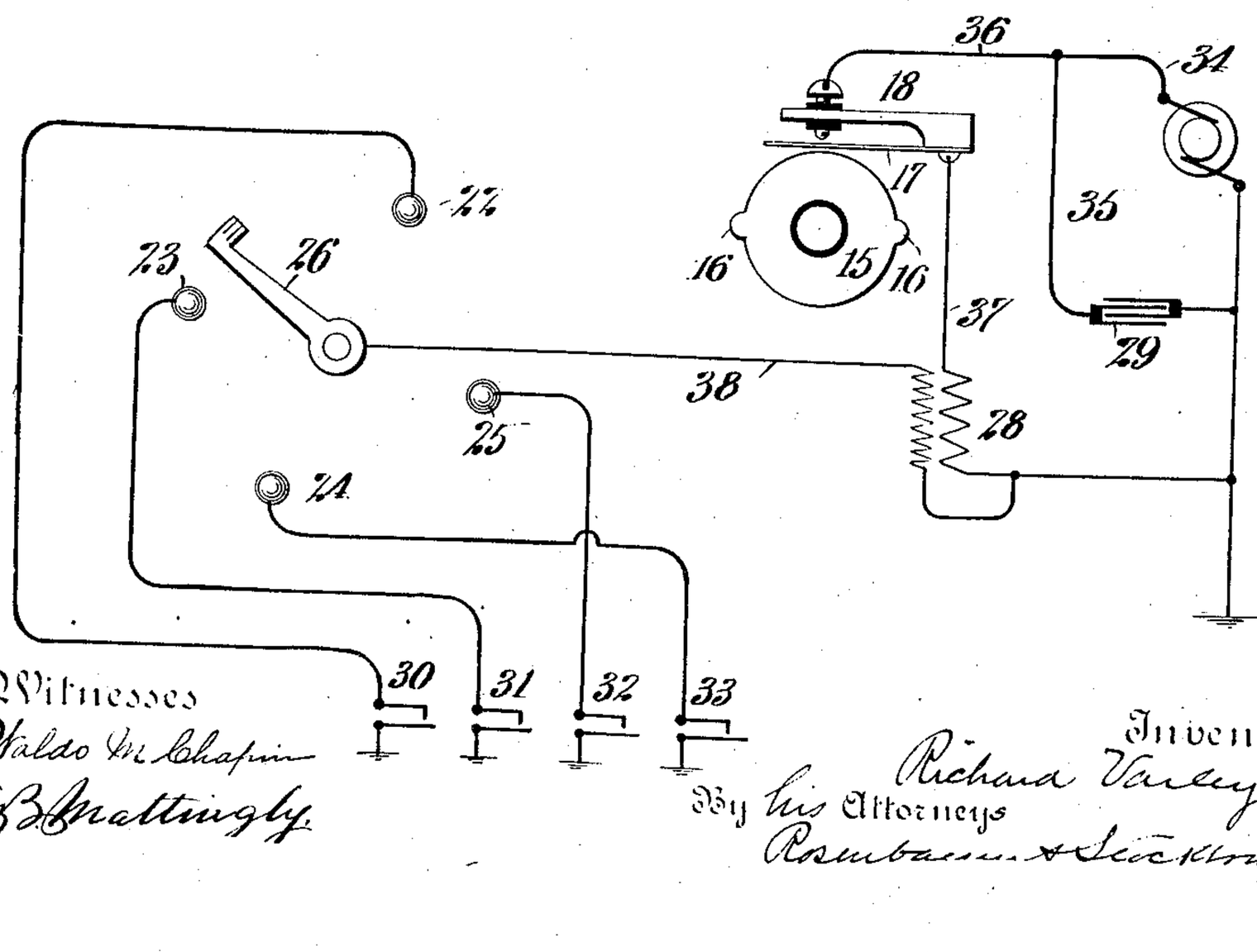


Fig. 4.



Witnesses
Waldo M. Chapin
A. B. Mattingly.

Inventor
Richard Varley
By his Attorneys
Rosenbaum & Lockwood

UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF ENGLEWOOD, NEW JERSEY, ASSIGNOR TO THE AUTOCOIL COMPANY, A CORPORATION OF NEW JERSEY.

SPARK-IGNITION SYSTEM FOR EXPLOSION-ENGINES.

No. 849,820. Specification of Letters Patent. Patented April 9, 1907.

Application filed April 6, 1905. Serial No. 254,072.

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Englewood, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Spark-Ignition Systems for Explosion-Engines, of which the following is a full, clear, and exact description.

This invention relates to ignition systems for explosive-engines. It has special reference to a system comprising a mechanically-driven generator of electricity, such as a magneto-electric machine.

The object of the invention is to provide simple and easily-operated means for altering the point or points in the cycle of the engine where the ignition shall take place, also an arrangement of circuits and circuit-controllers in connection with a condenser, an induction-coil, and the generator, whereby under all conditions the generator will charge the condenser during that part of its rotation up to the peak of the wave or impulse, whereupon the condenser will be for an instant connected with and permitted to discharge through the primary of the induction-coil to induce the required high-tension current in the secondary thereof for igniting the charge in the engine.

A feature of the invention is the means whereby the various contacts are closed at the proper time with respect to each other, regardless of the adjustment of the "spark-advancer."

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a plan of the magneto-electric machine fitted with my improved circuit-controlling devices. Fig. 2 is a sectional view of the generator, taken through the fields and armature thereof. Fig. 3 is an end elevation of the circuit controlling and adjusting devices, and Fig. 4 is a diagram of the circuits.

The magneto-electric machine may have any of the usual constructions as to its field-magnet, the type shown comprising the usual horseshoe sectional magnets 1 and 2, placed pole to pole to produce consequent poles in the pole-pieces to which they are mechanically fastened. The pole-pieces are supported by brass spacing-rods 4. The armature 5 is of the ordinary shuttle type having a single coil. (Not shown.)

A feature of my invention is the provision of two supplemental and adjustable pole-pieces 7. These parts each comprise a body of iron of substantially the length of the armature-core and having shoe portions 8, facing the armature-core, and neck portions 9, extending toward the main pole-pieces 3. These supplemental poles are mechanically separate from the main poles 3 and are sustained by two brass end disks 10 and 11, mounted loosely on the armature-shaft, bolts being passed through the disks and into the ends of the iron pieces. It will be seen that by rotating these disks upon the armature-shaft the diametrical position of the supplemental pole-pieces will be altered. The neck portions 9 of the supplemental poles are much narrower circumferentially than the faces of the main poles 3, so that when the supplemental poles are adjusted across the faces of the main poles the magnetic flux in the supplemental poles can be maintained constant through considerable range of adjustment. Since the lines of force flowing through the supplemental pole-pieces is the same in all of their positions so long as they remain in front of the main poles, it will be seen that the point in the rotation of the armature at which the highest induction takes place will be determined by the position of the supplemental poles. This fact I take advantage of by adjusting the poles to that position in the rotation of the armature corresponding to the point where the charge in the engine is to be fired. When the point at which the charge is to be fired is advanced or retarded, I correspondingly advance or retard the position of these supplemental poles, and thereby have available at the instant of firing the highest potential of which the generator is capable. For the purpose of thus shifting the supplemental poles I attach to one of the disks—say 10—a radial arm 12, by means of which by manual or other operation the two disks, together with the interconnected pole-pieces, can be swung through a sufficient arc to accomplish the required adjustment.

Upon the armature-shaft is a pinion 13,

meshing with gear connections on a shaft 14, so as to rotate synchronously with the engine-shaft. On the armature-shaft, but insulated therefrom, there is also mounted a cam-disk 15, having two diametrically-placed lugs 16 16, and in the path of these lugs is mounted a spring contact-plate 17, adapted to be forced into contact with the tip of a screw 18. The plate 17 and screw 18 are mounted in a bracket 19, from which the screw is insulated, as shown, and this bracket is mounted in any suitable way to move with the disk 10. As shown, it is bolted to the operating-arm 12, with which arrangement it will be seen that as the supplemental poles are shifted the point at which the lugs 16 will engage the plate 17 will be correspondingly shifted, and vice versa. Fixed to the disk 10 is another disk or pinion 20, having a segment of gear in mesh with a gear-wheel 21 of twice the size. This latter wheel turns loosely on a shaft 22 and is, in fact, more of a disk than a wheel, since it normally remains stationary. Its particular function is to carry the contact-points 22, 23, 24, and 25, one for each of the four engine-cylinders.

Shaft 22 carries a contact arm or brush 26, that moves with the shaft and makes contact successively with the points 22 23, &c. Shaft 22 is driven by means of a gear-wheel 27 from the pinion 13, the gear being twice the size of the pinion. It will thus be seen that when the machine is in operation the shaft 22 rotates at one-half the speed of the armature-shaft. The induction-coil is indicated at 28 and a condenser at 29, while the different plugs or igniting devices for a four-cylinder engine are indicated at 30, 32, 32 and 33.

The circuits will now be described in connection with the operation. The magneto being driven by the engine, it will be seen that as the core of the armature approaches the diametrical line connecting the supplemental poles 6 and 7 a current will be induced in the coil of the armature, which will continue to rise until the central line of the armature approximately coincides with the central line of the pole-pieces. One terminal of the armature-coil leads by wires 34 and 35 to one side of the condenser 29, while the other side of the armature-coil, as well as the other side of the condenser, are grounded. Thus upon the rise of current in the armature-coil the condenser will be charged. At the instant that the current in the armature-coil rises to the peak of the wave one of the lugs 16 on cam-disk 15 momentarily strikes the plate 17 and forces it into contact with the screw 18. Thereupon the condenser, together with the armature-coil of the generator, becomes short-circuited through the primary winding of the induction-coil 28 over the following circuit: from one side of the condenser and generator, by wires 35 and 36, contact-screws 18, plate 17, wire 37, primary of induction-coil, to the other side of the condenser and generator, which may be grounded. Hence when this occurs the condenser will discharge momentarily through the primary winding, which circuit is immediately broken and a high-tension current induced in the secondary winding of the coil. At the same instant or slightly before the contact-brush 26 connects with one of the contacts 22 23, &c., and the current induced in the secondary winding, which flows by way of wire 38 to the brush, is caused to pass through an igniting device in one of the cylinders of the engine and ignite the charge therein. Thus it will be seen that at the peak of the wave or instant of highest induction in the armature of the generator all contacts are closed to deliver a high-potential current to the igniting devices. This operation is repeated twice for each rotation of the crank-shaft of the engine and four times during each rotation of the brush 26. If now the spark or point of ignition is "advanced" or "retarded," by setting the plate 17 and screw 18 forward or backward with respect to the direction of rotation, which is done by swinging the radial arm 12, it will be seen that the supplemental pole-pieces 6 and 7 will at the same time be shifted correspondingly, so that the point at which the peak of the wave in the armature-circuit will occur will correspond to that at which the ignition is to take place. Likewise the distributing-disk 21 will be proportionately rotated, so that an igniting device in the engine will be connected with the brush when the induced impulse is created.

It is obvious that any type of mechanically-driven electrical generator having relatively rotating members may be used in carrying out my invention by properly providing for the supplemental poles, and it is also obvious that the broad idea of charging a condenser between explosions and discharging the same through an induction-coil at the instant the charge is to be ignited can be carried out without the aid of a mechanical generator of electricity.

Having described my invention, I claim—

In an ignition system for explosion-engines, a generator having a field-magnet with curved pole-faces, an armature having a single coil journaled concentrically between said faces, field-magnet poles adjustable in proximity to said pole-faces and having supplemental pole-faces also concentric with the armature, each of said field-magnet pole-faces being substantially T-shaped in section whereby the magnetic path to the lines of force is substantially constant for all angular

positions of said pole-faces, a distributing-switch having contacts, gear connections between the contacts of said distributing-switch and said field-magnet pole-pieces whereby said contacts and said pole-pieces are adjustable together, and means for closing and interrupting the circuit of said armature at a position of its rotation which varies angularly with the adjustment of the pole-pieces.

In witness whereof I subscribe my signature in the presence of two witnesses.

RICHARD VARLEY.

Witnesses:

FRANK S. OBER,

WALDO M. CHAPIN.