No. 869,601. PATENTED OCT. 29, 1907.

R. VARLEY.

IGNITION SYSTEM FOR EXPLOSION ENGINES.

APPLICATION FILED APR. 5, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

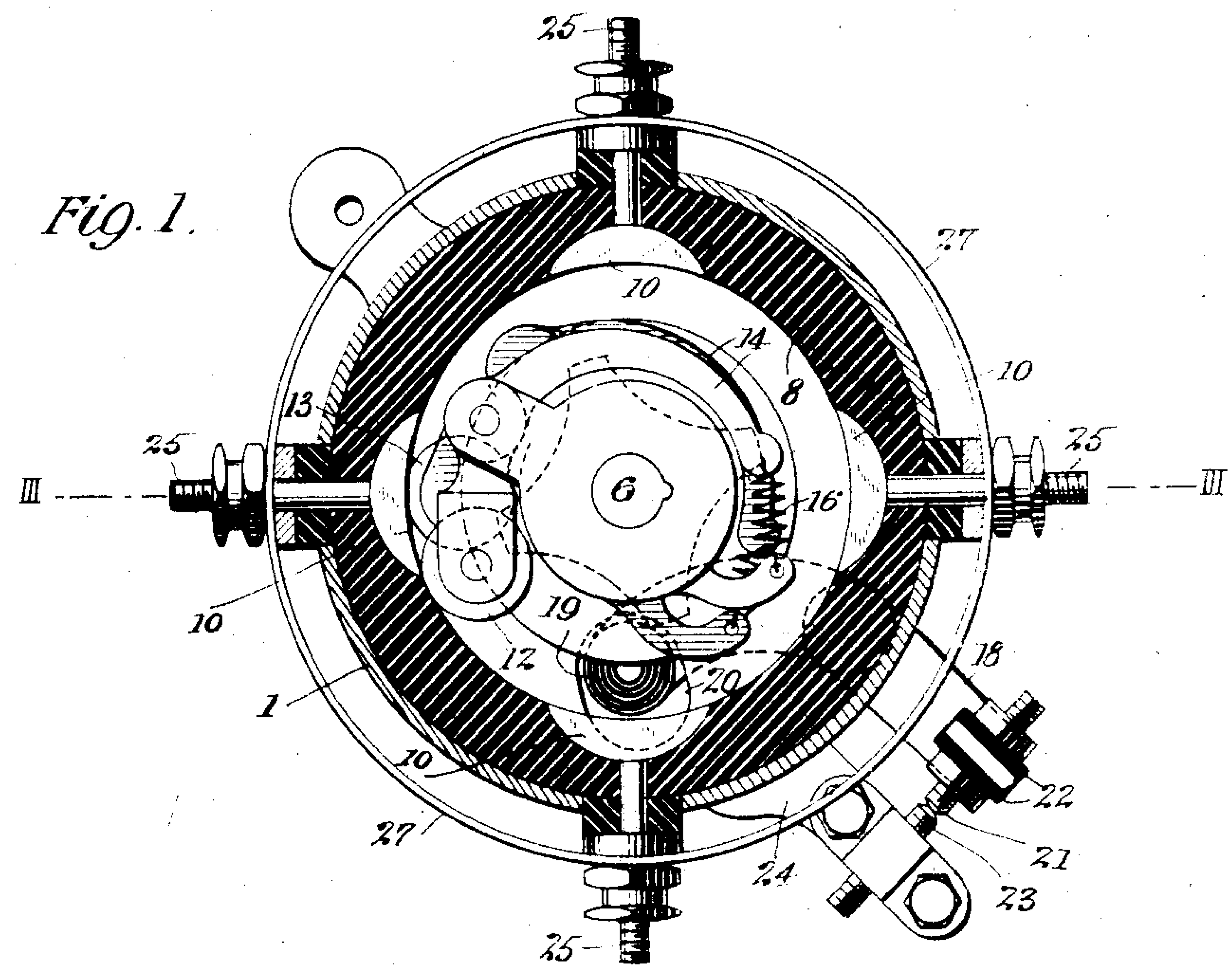
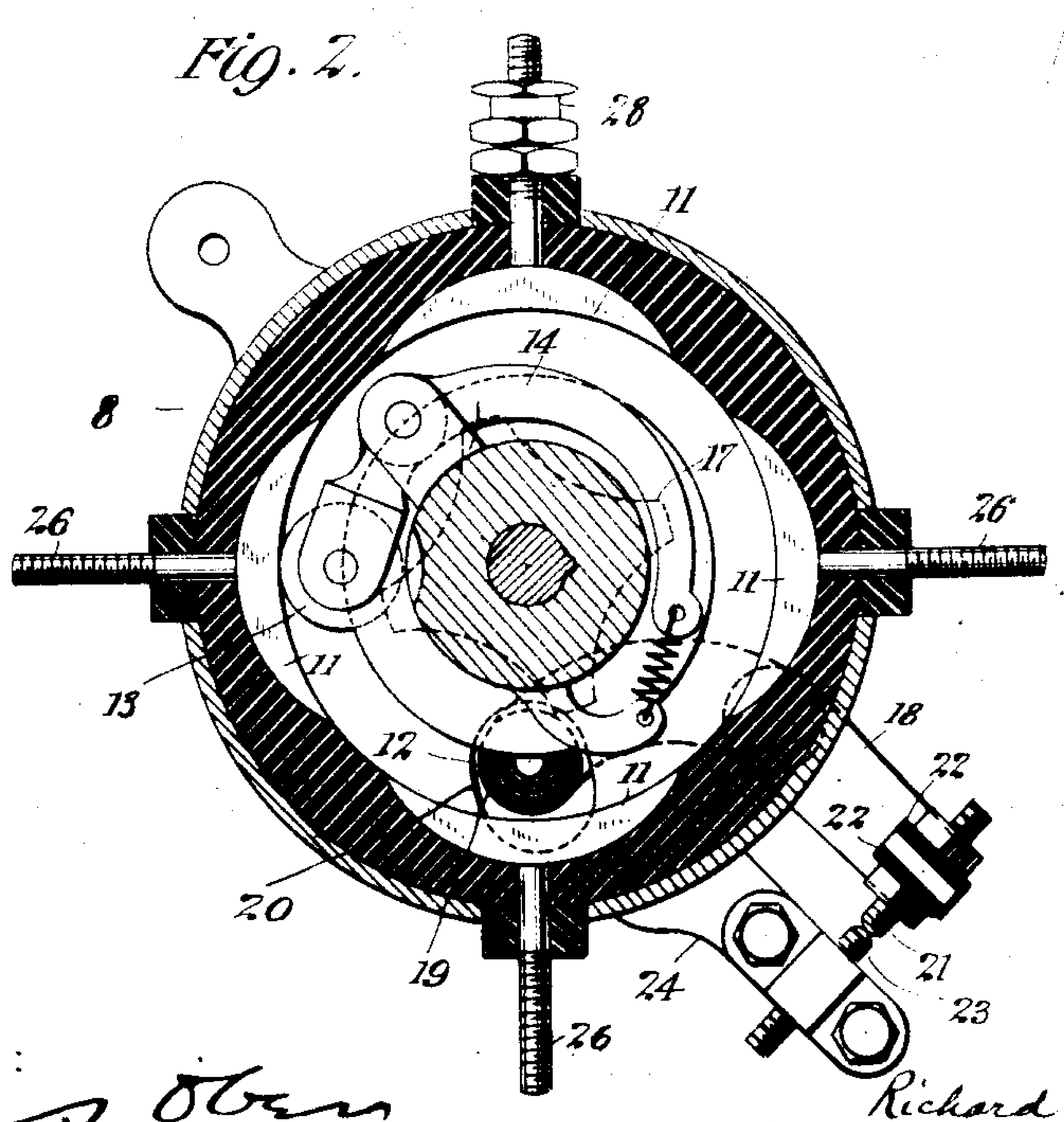


Fig. 2.



Witnesses:

[illegible]

[illegible]

Inventor

Richard Varley.

By his Attorneys

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2 SHEETS—SHEET 2.

Fig. 3.

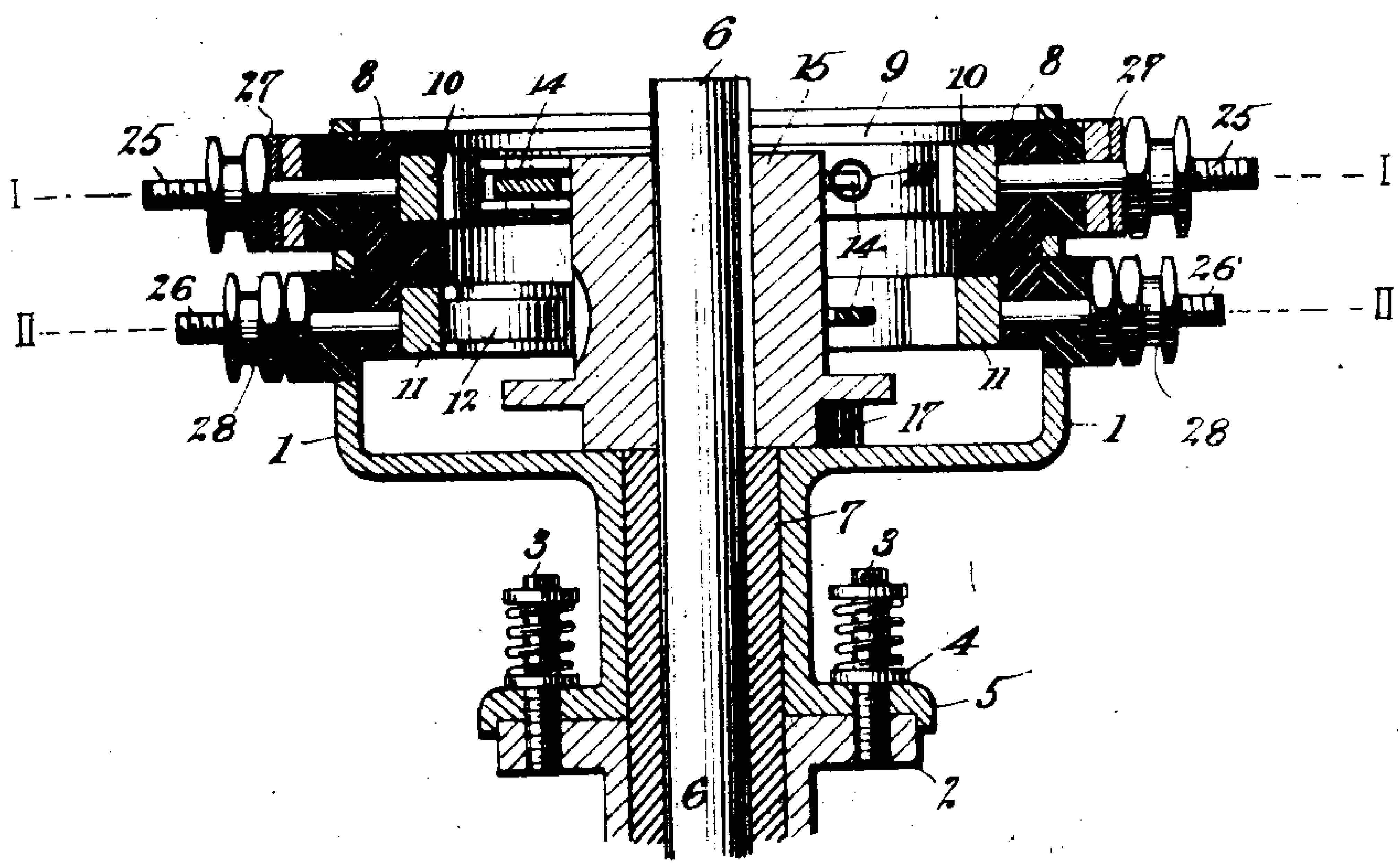
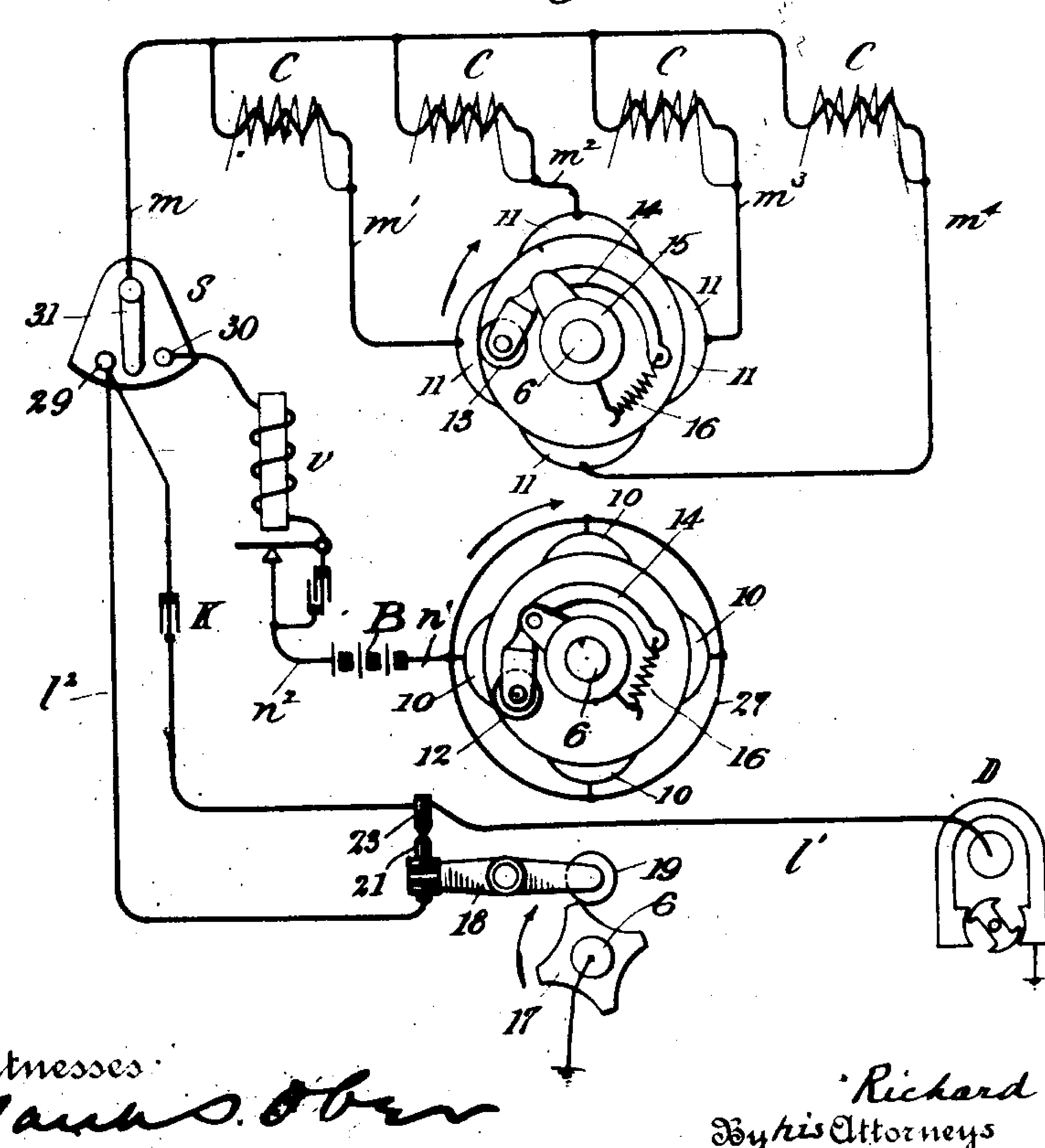


Fig. 4.



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UNITED STATES PATENT OFFICE.

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

IGNITION SYSTEM FOR EXPLOSION-ENGINES

No. 869,501. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed April 5, 1907. Serial No. 366,462.

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 Ignition Systems for Explosion-Engines, of which the following is a full, clear, and exact description.

My invention relates to ignition systems in which both a battery and a magneto generator or dynamo are used as alternative sources of current. In systems of this class each current source has its own particular requisites and these should be rigidly complied with in all respects.

As is well known, dynamo ignition is generally secured by a non-vibrator coil or coils which are caused to produce a jump spark by merely a single opening or rupture of the primary circuit at a positively impelled circuit breaking lever or "kick-off." The large self induction of a dynamo or magneto makes it necessary to have the circuit rupture accomplished in this way, that is to say, between non-fusible contact points which are separated with very great suddenness or abruptness. But the single spark produced is very hot and sufficient to secure perfect ignition. On the other hand, the single sparks obtained by breaking the primary circuit when batteries are used, are not hot or powerful but as the battery has little or no self-induction, a great many sparks instead of a single spark may be obtained by the use of a trembler or vibrator. It will be observed that the timing is not the same in the case of a vibrator, as it is with non-vibrator coils in the absence of special circuit controlling means. The dynamo ignition with a non-vibrator coil occurs at the termination of the primary current flow while battery ignition with a trembler coil occurs at substantially the beginning of the current flow when the trembler begins to act. In the last case the ignition continues during the entire current flow in a continuous spark cascade which ceases when the primary current is broken at the usual circuit controller. It is clear, therefore, that the ignition of the battery begins considerably earlier in the engine cycle unless means are provided to prevent this. In a prior application I have shown means to make use of the usual circuit opening lever or kick-off for completing the battery circuit by an additional stop or contact which limits its outward throw. This arrangement operates very sucessfully in practice, completing the battery circuit at about the same instant that the dynamo circuit is broken. It is necessary, however, to have the cams and parts properly proportioned and made to avoid the shock of impact of the lever against the back contact setting up vibrations which might interfere with the proper completion of the battery circuit. In carrying out the present invention I provide means to wholly overcome this practical difficulty, at the same time securing all the requisite and desirable functions and characteristics of a dual ignition system in which the time of ignition is not disturbed by changing from one current source to the other. A further feature of the invention lies in the fact that one single coil or set of coils is employed both for the battery and for the dynamo, means being provided by which vibrator action is secured in one case and non-vibrator in the other.

In the drawings: Figure 1 is a sectional view of a circuit controller embodying the principles of my invention; this section is taken on the line I—I of Fig. 3; Fig. 2 is a similar section taken on the line II—II of Fig. 3; Fig. 3 is a sectional view on the line III—III of Fig. 1; and Fig. 4 is a diagram of the circuits and connections.

Referring to the drawings in which like parts are designated by the same reference sign, 1 indicates a box or casing in which all of the parts are received and operatively supported. This casing is mounted on a fixed support 2, by means of the studs 3, and spring pressed washers 4, which coöperate with arcuate slots in a flange 5 of the casing in the usual way which need not be described or shown in detail. 6 indicates a shaft journaled concentrically in the bushing 7, of the casing 1, and which rotates commensurately with the speed of the engine. This shaft is generally known as the half-time shaft.

The casing 1 has an annular ring or bed 8 of insulating material, the interior surface 9 of which is co-axial with the shaft 6. There are two banks or series of segments 10 and 11 embedded in this insulating ring 8. Fig. 1 illustrates the upper series 10, while Fig. 2 shows the lower series 11. It will be noted that the segments 11 are larger than the segments 10. In practice the segments 11 are made with an angular extent of 80°, while the segments 10 cover 40°. These figures are, of course, merely practical values which may be varied at will. The purpose of having the segments of one series longer than those of the other will later more fully appear.

Contacting with the series of segments 10 there is a spring impelled roller 12, and a similar roller 13 engages the segments of the series 11. Both of these rollers are carried on arms 14, pivoted on a common hub 15, on the shaft 6, and spring impelled outward therefrom by the springs 16. The relation of the two banks or series of segments and their respective rollers is such that the roller 13 has traversed 30° or 40° on the long segments 11 at the instant when the roller 12 is entering upon a short segment 10. The purpose of this relation will later more fully appear. While I have

shown this particular arrangement employing stationary banks or series of segments and movable brushes or rollers engaging the same, I do not desire to be limited or restricted thereto since any equivalent plan of circuit controlling segments may be used, or other form of circuit controller.

Integral with the hub there is formed a cam 17, which coöperates with the cam lever 18, pivoted on the casing 1. The cam lever 18 is pivoted exteriorly of the casing 1, but carries a roller 19, which enters the casing, through an elongated slot 20, in the bottom thereof, so as to fall in the path of the cam 17. The lever 18 constitutes the circuit breaking lever or kick-off having for this purpose a contact screw 21, supported on the lever 18 by insulating bushings 22. Movable contact 21 engages a fixed contact 23, supported by an arm 24, projecting from the casing 1. By this arrangement of a lever 18 exterior of the casing 1 with a roller projecting through a slot in the casing to engage the cam therein, it is possible to keep the contact points 21 and 23 clean and free from the oil and grease which is contained in the casing 1 for the purposes of lubrication.

The circuit connections are made with the various segments 10 and 11 and the contacts 21 and 23 in any desired way. I have shown the segments provided with studs 25 and 26, of which 25 are combined in a common circuit by the metallic ring or band 27. The studs 26 have nuts 28, which constitute binding posts. The kick-off contacts 21 and 23 are joined by flexible wires to any convenient binding post or supporting point (not shown.)

The above constitute the essential features of the circuit controller or commutator. This apparatus may be used in various ways with a coil or coils to secure proper circuit controlling and timing for a dual ignition system.

In Fig. 4 is shown a diagram of circuits illustrating an arrangement employing four non-vibrator coils. v denotes a small supplemental or auxiliary vibrator or trembler which causes the rapid interruption across a condenser of current flowing therethrough in a manner well understood by those skilled in the art, and which need not be described. The coils are shown at C, the battery at B, and an ordinary magneto generator or dynamo at D. S is a switch which may be located on the dash, or at any convenient point. A connection is made from the generator D, through wire l', and vibrator contacts 23, 21, and wire l^2 to one point 29 of the switch. K is the condenser, bridging the contacts 21 and 23. The battery B has one terminal n connected to the common ring 27, of the segments 10, while its other terminal n^2 is connected to the switch contact 30, through the vibrator v. m is a common connection from the coils C to the switch arm 31. m', m^2, m^3, and m^4 are connections from the coils C to the various segments 11. It is evident that the segments 10 and 11 are grounded by the rollers 12 and 13 passing thereover, these rollers being supported by metallic connections from the half time shaft 6.

The operation is as follows: Supposing the switch arm 31 to be resting on the contact 30, circuit is made from battery B, wire n^2, vibrator v, switch arm 31, wire m, first coil C, wire m' to segment 11 and roller 13 to ground. The other terminal n' of the battery is simultaneously grounded by the roller 12 moving in the direction of the arrows and passing on to a segment 10. The circuit of the battery is therefore complete and the first coil C acts to impel a cascade of sparks through its connected plug under the action of the vibrator v, which causes the primary current to be pulsating or intermittent in its action. It will be noted that this action commences at the position shown at Fig. 4 when roller 12 is just passing on to the segment 10. The action continues until the roller 13 passes off of its segment 11. The roller 13 is so positioned with respect to the other roller and the various segments that it has traversed a certain distance, say, 30° or 40° on its segment 11 before roller 12 engages a segment 10; in other words, the battery ignition commences when roller 13 has traversed about half the angular extent of the segment over which it is passing. I will now assume the switch lever 31 to be moved on to the contact 29. The battery is now entirely out of action, being open circuited at the point 30, but the dynamo is connected for operation as follows: through wire l', kick-off contacts 23, 21, wire l^2, switch arm 31. wire m, first coil C, wire m', segment 11, and roller 13, to ground, thereby completing the circuit. It will be noted that the cam 17 is just on the point of engaging the roller 19 so that the kick-off contacts 21, 23, are on the point of being separated. When this separation occurs, primary current of the coil C is broken, and a single spark is produced from the secondary thereof. Inasmuch as the coil was energized by a dynamo current under these circumstances the secondary discharge will be a powerful one, although only a single instead of a multiple discharge. The circuit rupture is accomplished between the contacts 21 and 23 of non-fusible alloy, and the separation is positive and abrupt by reason of the cam impelled lever. These features are important requisites in case of dynamo or magneto ignition, on account of the large self induction of the circuit and the comparatively heavy current which flows at the moment of the primary break.

There is a further and extremely important requisite in connection with dynamo or magneto ignition, and this is attained in carrying out my invention, as follows: As above stated, the conditions in Fig. 4 are those at the instant of firing, and this is true for both the battery and the dynamo or magneto. The battery circuit is on the point of completion through a vibrator which causes an immediate ignition spark, and the dynamo circuit is on the point of rupture through the kick-off lever which also produces a single ignition spark, but a powerful ignition will not be obtained from the magneto or dynamo circuit, unless time has previously been given for the current to build up or increase to its full value. The time required for this is comparatively long, partly because of the large self induction of the dynamo or magneto, and partly because the actual current flow for a single spark from a non-vibrator coil is required to be many times as great as that necessary with a battery and vibrator or trembler coils. On account of these two factors it is desirable to have an appreciable interval, commonly known as the "charging period", during which the dynamo or magneto circuit is completed through its coil before such circuit can be broken to obtain the spark required. This preliminary period during which the current flows uninterruptedly

through the coil is obtained in my present invention by the portions of the segments 11 initially engaged by the roller 13. The roller 13 traverses 30° or 40° of the segments 11 before the kick-off lever 18 operates to separate the contacts 21 and 23, and break the circuit. During all this time the current is therefore flowing uninterruptedly through the primary circuit for one of the coils which is thereby fully "charged" or magnetized to the point where it will produce a hot spark. It will be understood that the cam 17 is so shaped as to make the circuit closing period of the contacts 21 and 23 at least 30° or 40° of rotation of the half time shaft. The coils therefore operate as non-vibrator coils with the dynamo or magneto and have 30° or 40° of rotation of the half time shaft in which to become charged. On the other hand, they act as trembler coils with the battery, and have 30° or 40° of angular rotation in which to produce a cascade discharge. Finally, and of maximum importance, the initial discharge with the dynamo or magneto after the charging period, is exactly co-incident in time with the initial discharge due to the trembler or vibrator action. These requisites are all which are required in a dual ignition system, and they are all very important ones in practice.

In the above description I have referred to the generator D as a dynamo or magneto. It is to be understood that any form of mechanical generator may be used, either of the type having permanently magnetized fields, or that having a self energized electromagnetic field. By the term dynamo I therefore do not desire to limit myself to any particular type but wish to include either the permanently magnetized or self exciting or separately excited forms.

What I claim is:

1. In an ignition system for explosion engines, a single circuit controller permanently connected to the primary circuits of a plurality of induction coils, a dynamo circuit including a kick-off, a battery circuit including segments, and a switch for completing either of said last named circuits through said circuit controller and its permanently connected coils.

2. In an ignition system for explosion engines, two banks of segments, the segments of one bank being longer than those of the other, a kick-off, a dynamo circuit including said kick-off and the long segments to the exclusion of said short segments, and a battery circuit including said short segments and the long segments to the exclusion of said kick-off.

3. In an ignition system for explosion engines, a pair of banks of segments, separate means rotating to engage said segments successively, one such means being in contact with the segments of one bank earlier than the other means with the segments of the other bank, a battery circuit completed by the segments of the second bank, a dynamo circuit, and means for interrupting said dynamo circuit at the instant when said battery circuit is adapted to be completed.

4. In an ignition system for explosion engines, a bank of segments, a second bank of segments shorter than the first, a dynamo circuit completed through said first named segments, a kick-off adapted to interrupt said dynamo circuit, and means engaging said second segments to complete a battery circuit at the instant of operation of said kick-off.

5. In an ignition system for explosion engines, two banks of segments, separate means engaging said segments, one such means engaging the segments of one bank earlier than the other means engaging those of the other bank, a dynamo circuit completed through the segments of said first named bank, means for interrupting said dynamo circuit, and a battery circuit adapted to be completed through the segments of the second bank simultaneously with the operation of said interrupting means.

6. In an ignition system for explosive engines, two banks of segments, a plurality of coils having their primaries connected to the segments of one bank, a battery having one terminal in a common circuit with the segments of the other bank, means for grounding said segments successively, the first named segments being grounded earlier than the second segments, a dynamo circuit, means for completing said battery or dynamo circuit through said first named segments, and entirely separate means for interrupting said dynamo circuit at the instant when the segments of the second bank are grounded.

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

RICHARD VARLEY.

Witnesses:
WALDO M. CHAPIN,
MAY BIRD.