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R. VARLEY.

IGNITION SYSTEM FOR EXPLOSIVE ENGINES.

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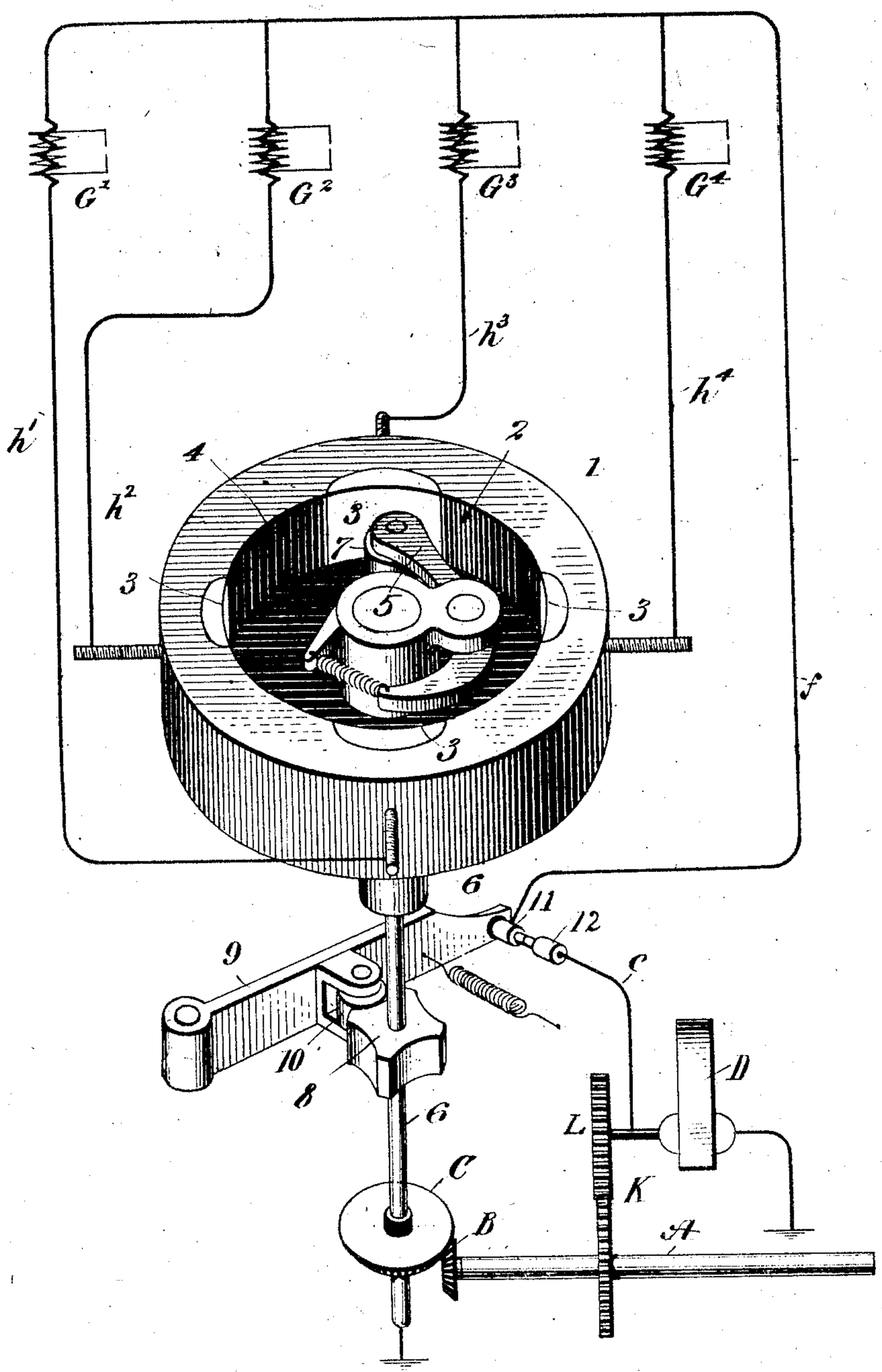


Witnesses
Paul O. Ober
Walas M. Chapin

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.

## IGNITION SYSTEM FOR EXPLOSIVE-ENGINES.

No. 861,921. Specification of Letters Patent. Patented July 30, 1907.

Application filed November 3, 1906. Serial No. 341,926.

*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 means for controlling the primary circuit of a plurality of induction coils which are designed to operate a plurality of spark plugs of an explosion engine, in a predetermined order.

In order to avoid distributing the secondary current or having any movable high tension parts, it has been proposed to employ a primary circuit controller which connects a single potential source successively with the primaries of different coils. This arrangement operates satisfactorily when a battery with low and constant voltage, and vibrator or trembler coils are used because the circuit rupture is not accompanied by large self induction and destructive sparking. When a dynamo is used for ignition, trembler coils cannot be satisfactorily employed because of the large self induction and variable voltage of a dynamo. A single break in the primary circuit is sufficient to produce ignition, but if this takes place on a circuit controller having the ordinary metallic segments, the latter will be quickly destroyed by the arcing, particularly at low speeds.

The circuit controller of the type having a continuous surface of revolution constitutes, however, the only practical means for efficiently completing the various circuits, and it is the purpose of my present invention to use a circuit controller and overcome the destructive arcing, hitherto proving such an obstacle, in a special way. The arcing being overcome, it is evident that the problem of distributing the current from an inductive source through different circuits is successfully solved, since such a circuit controller fulfils every other desirable condition, except taking care of destructive arcing. In other words, the circuit controller has, first, a mathematically exact time of closing each circuit with respect to the rotation of the engine shaft. Secondly, it automatically keeps the surfaces bright by the friction of contact and rotation. Thirdly, it has no vibrating, but only evenly rotating parts so that the perfect continuity of the circuits during their closure is insured, making better contact at high than at low speeds on account of centrifugal force. Fourthly, it permits of being made heavily and strongly so as to stand the wear and tear of rough usage. These are all the possible requisites that could be desired for controlling the circuits, assuming that the single difficulty of excessive arcing can be overcome.

Referring to the drawing in which like parts are designated by the same reference sign, 1 indicates broadly a circuit controller, the essential principle of which is a perfect surface of revolution 2, which has alternately conducting and non-conducting areas thereon.

3 indicates the conducting areas, and 4 the non-conducting areas. These are carefully faced so as to occupy a continuous surface of revolution as above stated. By having these areas in a perfect surface of revolution it is possible to have a member revolve in contact therewith without vibration, no matter how great speeds are employed.

The rotatable member is shown at 5, on a spindle 6, exactly concentric with the surface of revolution 2. This member is preferably made in the form of an outwardly spring impelled arm.

7 indicates a roller at the outer extremity of this arm and which rolls on the surface of revolution 2. When the spindle 6 rotates the above apparatus fills all the conditions of an ideal circuit controller, as above outlined. The roller 7 makes contact with the successive conducting areas 3 at mathematically exact points in its revolution, and does not vibrate however great its speed may be. In connection with this apparatus I employ means for overcoming the defect of sparking. For this purpose a cam 8 is fixed to the same spindle 6 which carries the arm 7.

9 indicates a pivoted finger with a roller 10 in the path of the cam 8.

11 denotes a contact on the finger 9, and 12 denotes a stationary contact in proximity thereto. These contacts are of platinum or non-fusible compound. The form of the cam 8 is such that it engages and positively impels the finger 9 outward as many times during the rotation of the spindle 6 as there are conducting areas 3 within the circuit controller 1. Moreover the cam is so adjusted with relation to the arm 5 that it moves the lever to break contact at the points 11 and 12 a minute interval of rotation before the roller 7 leaves any one of the areas 3. The electrical circuits are so organized with the above that the circuit controller 1 performs all of its usual functions with its characteristic efficiency, but all the sparking that occurs is taken care of between the non-fusible contacts 11 and 12.

The arrangement of circuits is illustrated diagrammatically in the drawing.

A indicates a shaft which may be considered the shaft of an explosion engine.

B and C are gears having the ratio of 1 to 2, so that the spindle 6 rotates at half the engine speed or other commensurate relation.

D is a generator either of the magneto or the self-exciting type, and which may be generally termed a dynamo in this description. *e* is a potential terminal of this dynamo, and which is connected to the non-fusible contact 12. The contact 11 is electrically connected to the primary windings of induction coils $G'$, $G^2$, $G^3$ and $G^4$, by a wire *f*. The other primary termi-

nals are in electrical connection with segments 3, through wires $h'$, $h^2$, $h^3$ and $h^4$.

The operation is as follows: As the engine shaft A rotates, the spindle 6 also turns at a rate exactly commensurate thereto, in practice, once for every two turns of the engine. At exactly spaced intervals of time the roller 7 moves on to the various conducting areas 3, and which in each case completes a predetermined primary circuit as follows: From dynamo D, through wire $e$, contacts 12, 11, wire $f$, primary of induction coil $G^3$, (for example) wire $h^3$, segment 3, and arm 5 to ground. In this way the induction coil is put in a magnetized condition ready to induce a secondary discharge. The dynamo D also acquires a condition to induce an extra current, especially if it is of the self-exciting type. Therefore unless the above circuit is broken abruptly, and across non-fusible contacts, an arc will be drawn and this would be particularly the case, and particularly injurious, if the rupture were made at the circuit controller segments. Accordingly I arrange the parts so that before the roller 7 leaves the conducting areas, 3, the cam 8 will impinge against the roller 10, and positively separate the contacts 11 and 12. Since the above circuit was traced directly through these contacts, the circuit is thereby broken between the non-fusible contacts and so rapidly that no arc is drawn or harm done. Thereafter, and as short an interval of rotation afterward as it is desirable to adjust the mechanism, the roller 7 passes off of the conducting area 3 with which it was engaged, and of course no spark whatever is drawn at the segments to injure the exactly true internal surface of the circuit controller. Therefore by the above arrangement the circuit controller is not blistered or burned, and maintains its perfect surface of revolution 2. The circuit controller is relied upon for efficiently completing the circuits in their proper order and keeping them closed through the required duration of angular movement. The only function of contacts 11 and 12 is to break the circuit and thereafter close together again as rapidly as the inertia of the finger 9 will allow. This interval is not exactly ascertainable, but it is short enough to satisfy the requirements of the circuit controller 1 at any ordinary speed with which explosion engines are run. It will be observed that by the above arrangement it is utterly impossible to draw a single destructive arc at the conducting areas 3 of the circuit controller, no matter whether or not the points 11 and 12 make a good contact, or whether the lever 9 returns soon or late after being impelled outward. The action of the cam 8 is positive with respect to the rotation of the spindle 6, so that nothing can prevent the contacts 11 and 12 separating at the proper instant and before the circuit is broken in the circuit controller, except actual breakage of the parts.

A feature of the invention lies in the arrangement of the parts which I employ. I arrange the spindle 6 to project upwardly. This is a common arrangement, and is the only satisfactory disposition of the circuit controller which is thereby accessible for inspection and repairs. But in addition to having the spindle 6 positively geared by ordinary gears B and C to the engine shaft A, the dynamo D is positively geared to the engine shaft by spur gears K and L. In this way the dynamo also rotates exactly commensurate to the engine and also to the spindle 6. The ratio of the gears K and L is an exact multiple, and the dynamo D has an ordinary H armature so as to generate two electric impulses each revolution. In this way the armature may be so set as to produce impulses at the particular instants that the various primary circuits are closed. In this way the dynamo does not have a circuit controller, but merely has a one wire connection with the armature winding, the other terminal being grounded. By having the spindle 6 with a bevel gear connection, and the dynamo D with a spur gear connection to the engine shaft, it is possible to have the dynamo compactly arranged in the frame and efficiently driven, while the spindle 6 is conveniently arranged in the frame and at the same time commensurately rotated with respect to the dynamo, so as to produce the effect above stated.

What I claim, is:—

In an ignition system for explosion engines, a circuit including a dynamo having one terminal grounded on the frame of the engine, a pair of non-fusible contacts both insulated from the frame of the engine and one connected to the potential terminal of said dynamo, a circuit controller having a revoluble arm grounded on the frame of the engine and having a surface of revolution concentric with the axis of revolution of said arm, said surface of revolution having a number of conducting areas, a plurality of non-vibrator induction coils connected thereto, said induction coils being also connected in a common circuit with the other one of said non-fusible contacts, and means for separating said non-fusible contacts before said arm is on the point of leaving each of said conducting areas.

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

RICHARD VARLEY.

Witnesses:
FRANK SCHOBER,
WALDO M. CHAPIN.