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R. VARLEY.

IGNITION SYSTEM.

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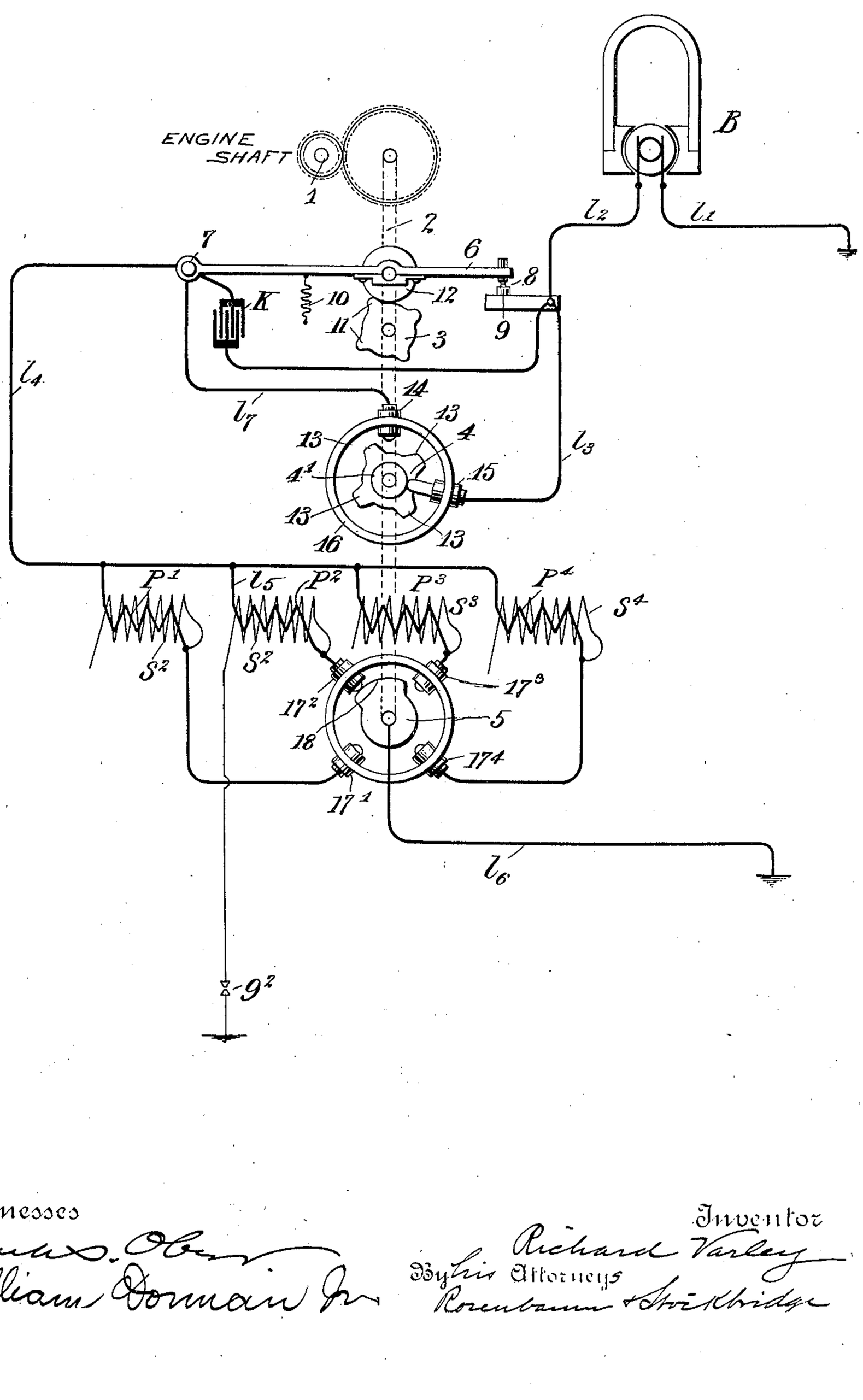

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IGNITION SYSTEM.

No. 846,810. Specification of Letters Patent. Patented March 12, 1907.

Application filed November 27, 1905. Serial No. 289,179.

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, of which the following is a full, clear, and exact description.

My invention relates to ignition systems for explosion-engines, and particularly those in which an electric jump-spark is employed. Sparks for this purpose are commonly produced by an induction coil or coils which have their primary circuits completed and broken for each explosion of the engine. On account of the self-induction of the primary windings there is a considerable impedance to the necessary magnetization of the coils, and when the engine is running at high speed it frequently happens that insufficient time is given for the complete magnetization thereof unless the current has a comparatively high potential, which is objectionable for various reasons.

The object of my invention is to prolong the time of action of the primary current in each induction-coil to its greatest possible limit, so that complete magnetization is secured with a low-potential primary current and at the highest working speeds of the engine.

With this and other objects in view my invention consists in the construction, combination, location, and arrangement of parts, all as will be more fully hereinafter set forth, as shown in the accompanying drawing, and finally particularly pointed out in the appended claims.

The drawing illustrates diagrammatically the circuits and mechanical parts of a system embodying the principles of my invention.

In the case of a four-cylinder explosion-engine two sparks are required at every revolution, so that if the engine is running at nine hundred r. p. m. thirty sparks are required each second, and it is evident that if an ordinary circuit-breaker is depended upon to complete and break the primary circuit there will be very little time for it to make an efficient circuit. In other words, it is very difficult and in practice almost impossible to arrange a vibrating lever that will break the primary circuit and then again complete it for a perod of sufficient duration to allow the primary coil to attain its full efficiency for the rapid speeds required.

In carrying out my invention I wholly overcome this defect and provide means by which the primary circuit is broken in the abrupt and positive way required and then again closed thoroughly and efficiently, so as to let the primary current flow uninterruptedly for the extreme maximum period which is theoretically possible in practice corresponding to nearly ninety degrees' rotation of the half-time shaft. I do not depend upon the vibrating circuit-breaker lever for closing the primary circuit, but use another or auxiliary closing-circuit which is not liable to inefficiency by chattering or sluggishness or any other cause of improper circuit-closing action.

Referring to the drawing and to the various views and reference-signs appearing thereon, in which like parts are designated by the same reference-sign, 1 indicates the engine-shaft, and 2 denotes what I shall term the "half-time" shaft geared or otherwise connected thereto.

While the speed and arrangement shown is adapted to a four-cylinder engine, it is evident that my system is not limited to this use, since the shaft 2 may be run at any necessary speed commensurate with the engine and the number of contacts hereinafter described varied for engines of a different character.

Rigidly fixed to and rotating with the shaft 2 are a plurality of cams or contact members 3, 4, and 5, which have a special relation to one another, hereinafter described. While the method of mounting these parts upon the same shaft is the most practical and convenient one, I do not desire to be limited or restricted thereto, since the cams or contact members 3 4 5 may be rotated synchronously in other ways.

The part or cam 3 is disposed adjacent to a circuit-breaking lever 6, pivoted or otherwise flexibly attached at 7 and having a contact-point 8, which normally rests against and makes electrical connection with a stationary contact 9. The circuit-breaking lever 6 is pressed by any suitable means, such as a spring 10, into the position shown, where it normally makes a connection with the pri-

mary ignition-circuit. The cam 3 has projections 11 thereon, which engage a cam-wheel 12 upon the circuit-breaking lever, and the arrangement is such that as the cam 3 rotates the projections 11 come successively into contact with the wheel 12 and lift the circuit-breaking lever 6 positively and abruptly to break the primary circuit at 8.

The rotating part 4, which I shall term the "primary-circuit-closing conductor," is preferably made of copper or some good conductor of electricity and has projecting segments or faces 13 corresponding in number to the projections 11 of the cam 3, above described. 14 and 15 indicate brushes held by an insulating ring or support 16, so as to engage the conductor 4. The brush 15 bears against a ring 4′ on the conductor and makes continuous electrical connection therewith. The brush 14 lies in the path of the segments 13, so as to complete an electrical circuit with the conductor 4, and thereby with the brush 15, a plurality of times for each revolution of the conductor.

The rotating part 5, above referred to, and which I shall term the "circuit-controller," rotates in proximity to spaced brushes 17′, 17^2, 17^3, and 17^4 and has a segmental section 18 thereon, which successively makes contact with said brushes. In a practical form of my invention I make the segment 18 a little less than ninety degrees in length, so that it contacts with the brushes 17′, 17^2, 17^3, and 17^4 successively and each for a period of nearly one-quarter a revolution of the half-time shaft.

I will now describe the arrangement of the electrical circuits and connections by which the above apparatus is embodied in my system. B indicates any suitable source of electric current, preferably a magneto-generator driven from the engine, and l' and l^2 indicate the terminal connections therefrom. The connection l' is preferably grounded, while l^2 is led to the contact member 9, above described. An additional or branch circuit l^3 is also lead to the brush 15 of the primary-circuit-closing contactor. As the half-time shaft rotates, the parts take, for example, the position shown in the figure, in which a protuberance 11 on the cam 3 is just at the point of engaging the cam-roller 12. At this time a circuit is completed from the generator B as follows: wire l^2, contacts 9 8, lever 6, wires l^4 l^5, primary P^2, and brush 17^2, segment 18, wire l^6, back to ground. At the proper instant the circuit-breaking lever 6 is abruptly raised by the protuberance 11 on the cam 3, so that the primary circuit is sharply broken, the condenser K, bridged across the contacts, absorbing the spark in the usual way. The breaking of the primary circuit in the coil P^2 is effective to induce a high-potential current in the secondary S^2 of such coil, which causes a spark to jump the gap g^2 at the ignition-plug in the usual way.

The motion of the circuit-breaking lever 6 is quite abrupt, so that a very small fraction of a revolution after the break occurs the contacts 8 and 9 are quite widely separated. A very small time afterward, and possibly before the lever 6 has had time to return, a segment 13 of the primary-circuit-closing conductor 4 comes into contact with the brush 14 and completes a new path for the primary current—namely, through the wires l^3 and brush 15, conductor 4, brush 14, wire l^7, wire l^4, as before. The circuit at the brush 17^2 is, however, now broken; but a new contact is made at the brush 17^3 by the plate 18, through which the current now passes to wire l^6 and ground as before, passing now, however, through primary P^3 instead of primary P^2. The current from the magneto is therefore enabled to start promptly in building up the primary circuit of coil P^3. The contact-lever 6 almost immediately afterward and before the segments 13 has passed away from the brush 14 drops again into contact with the point 9, so that the break when made will be done by the lever 6 and not by the segments 13, which would not have a sufficiently abrupt movement to make a desirable break of the circuit. By the use of the circuit-closing conducter 4 I am enabled to complete the primary circuit almost instantly after its break and to retain it closed for a period of nearly ninety degrees' rotation of the half-time shaft and until the succeeding break at the circuit-breaking lever 6. It is evident, therefore, that I secure a very efficient primary circuit, in which good electrical contacts are made, and for a sufficiently long period to secure adequate magnetization of the successive induction-coils.

In practice the ring 16 is conveniently made angularly adjustable with respect to the vibrator 6, so that the interval between the instant the circuit is broken at 8 and that when it is closed by the segments 13 may be regulated to any determined amount and as finely as desired. In like manner the shaft 2 or the entire system involving the levers 6 and the ring 16 and the brushes 17′, 17^2, &c., may be displaced angularly with relation to the cycle of the engine, so as to vary the time of the ignition in the usual way.

What I claim is—

1. In an ignition system for explosion-engines, an induction-coil, means for breaking the primary-current circuit therein to induce a jump-spark from the secondary, and separate means for immediately reclosing said circuit at a different point therein.

2. In an ignition system for explosion-engines, an induction-coil, means for breaking the primary-current circuit therein to induce a jump-spark from the secondary, and means

for immediately reclosing said circuit at a different point therein.

3. In an ignition system for explosion-engines, an induction-coil, means for breaking the primary-current circuit therein to induce a jump-spark from the secondary, and means for reclosing said circuit at a different point thereof an indefinitely small period of time behind said circuit-breaking action.

4. In an ignition system for explosion-engines, means for breaking a primary induction-coil circuit to produce a jump-spark, and means for reclosing said circuit, at a different point thereof, any desired minute interval thereafter, however small this may be.

5. In an ignition system for explosion-engines, a half-time shaft having a cam with four protuberances thereon, a circuit-breaking lever having a cam-roller in the path of said protuberances, an auxiliary primary circuit including a brush, a conductor upon said shaft and having four segments adapted to pass successively into contact with said brush and complete the primary circuit immediately after it has been broken at the circuit-breaker.

6. In an ignition system for explosion-engines, an induction-coil, a pair of contact-points, means for positively separating said contact-points to break the primary circuit of such induction-coil to induce a jump-spark from the secondary, and separate means for immediately reclosing said circuit at a different point therein.

7. In an ignition system for explosion-engines, a continuously-rotating shaft having separate means thereon for breaking and subsequently closing a circuit, a series of induction-coils, and means upon said shaft for connecting the primaries of the different coils successively into said circuit.

8. In an ignition system for explosion-engines, an induction-coil, a pair of contact-points, means for positively impelling said points apart to break the primary circuit of said induction-coil and induce a jump-spark from the secondary, and positively-impelled means for immediately reclosing said circuit at a different point therein.

9. In an ignition system for explosion-engines, a continuously-rotating shaft having a cam thereon, a circuit-breaking lever in the path of said cam and adapted to abruptly break the primary circuit, and a circuit-closing conductor also fixed to said shaft and having segments arranged to complete the primary circuit a small fraction of a revolution behind said initial break.

10. In an ignition system for explosion-engines, a half-time shaft having a cam with four protuberances thereon, a circuit-breaking lever having a cam-roller in the path of said protuberances whereby said lever is abruptly moved to break the primary circuit, a conductor having segments also fixed upon said half-time shaft, and a brush in the path of said segments arranged to complete said primary circuit immediately after each break thereof.

11. In an ignition system for explosion-engines, a half-time shaft having a circuit-breaking cam thereon, a circuit-closing conductor also disposed upon said shaft and arranged to complete the primary circuit immediately after each break thereof, and a circuit-controller having a segment of substantially quadrant shape also rotating with said shaft and adapted to complete the primary circuits of a plurality of induction-coils successively.

12. In an ignition system for explosion-engines, a magneto-generator having a divided circuit, a cam-operated circuit-breaker in one branch of said circuit and a synchronously-moving circuit-closer in another branch thereof; said circuit-closer being adapted to complete the circuit immediately after the break thereof, a plurality of induction-coils, and means for connecting said induction-coils successively into said circuit.

13. In an ignition system for explosion-engines, a magneto-generator having a divided circuit, a cam-operated circuit-breaker in one branch thereof, a synchronously-moving circuit-closer in another branch thereof adapted to operate immediately after the break of said circuit-breaker, and an induction-coil having its primary in such circuit.

14. In an ignition system for explosion-engines having an induction-coil with a primary ignition-circuit, a half-time shaft and means thereon for breaking the primary ignition-circuit and immediately closing it for an interval of nearly ninety degrees of angular movement, four times in each revolution of said shaft.

15. In an ignition system for explosion-engines having an induction-coil with a primary ignition-circuit, a half-time shaft carrying a circuit-breaking cam and a circuit-closing conductor fixed thereto, and means whereby the primary circuit is alternately broken by said cam and completed by said conductor.

16. In an ignition system for explosion-engines a primary circuit including a circuit-breaking lever and a circuit-closing conductor in multiple with one another, and means whereby the circuit is first broken at said lever and subsequently completed at said conductor.

17. In an ignition system for explosion-engines having an induction-coil with a primary ignition-circuit, a continuously-rotating shaft, a cam having protuberances thereon, a circuit-breaking lever contacting with said cam, a circuit-closing conductor also mounted on said shaft, and means whereby the pri-

mary circuit is broken by said lever and immediately afterward closed by said conductor before the lever has had time to return to its normal position.

18. In an ignition system for explosion-engines having induction-coils with primary ignition-circuits, a continuously-rotating shaft having a cam thereon, a circuit-breaking lever arranged to be engaged by said cam, a circuit-closing conductor having segments adapted to make the primary circuits immediately after it has been broken at the circuit-breaker, and means for directing the primary current into the series of induction-coils successively.

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

RICHARD VARLEY.

Witnesses:
FRANK S. OBER,
WILLIAM DONNAN, JR.