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R. VARLEY.

SPARK IGNITION SYSTEM FOR EXPLOSION ENGINES.

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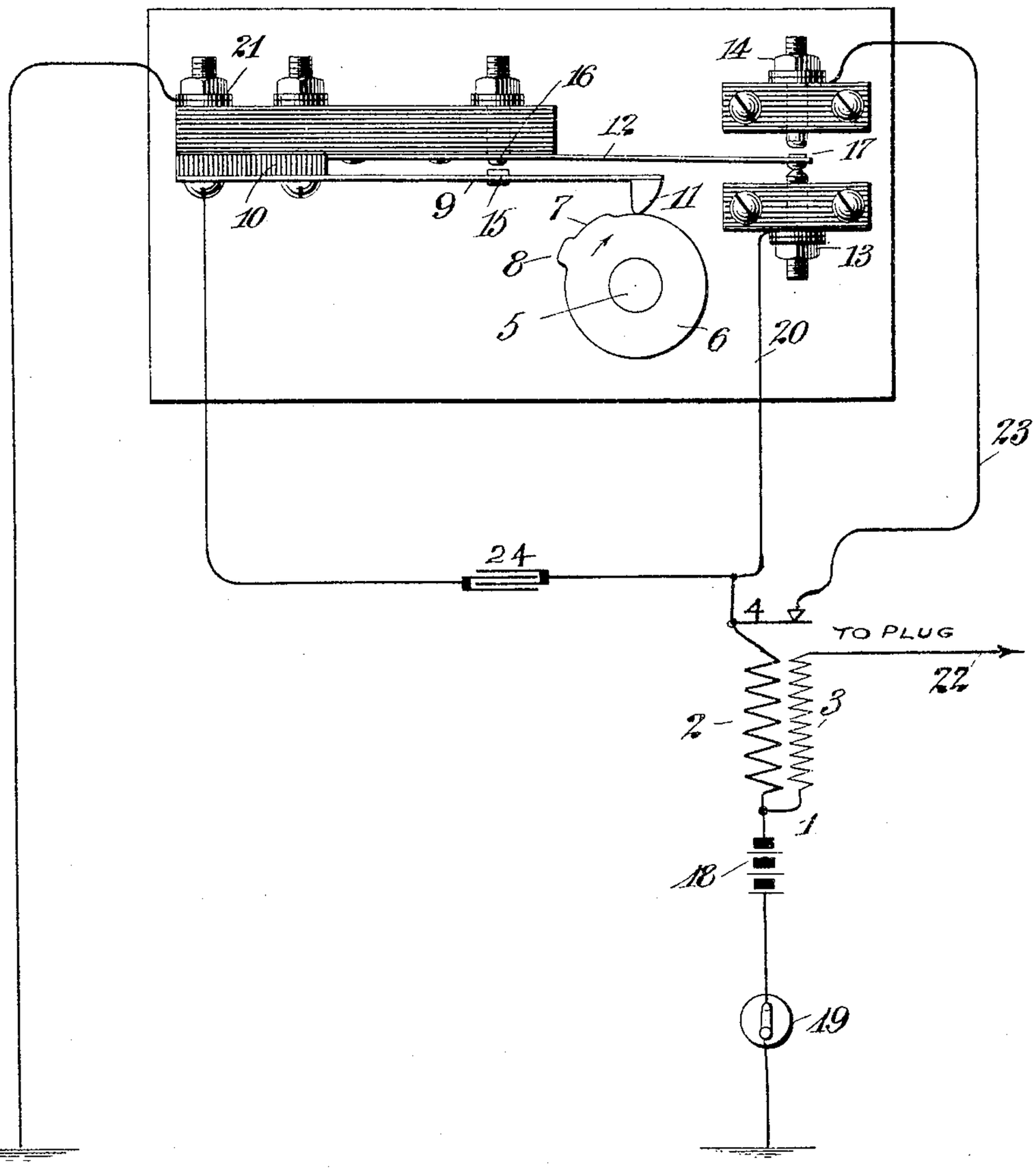

Witnesses
Frank S. Ober
Walas M Chapin

Inventor
Richard Varley
By his Attorneys
Rosenbaum & Stockbridge

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. 808,958. Specification of Letters Patent. Patented Jan. 2, 1906.

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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 electric ignition apparatus for explosion-engines, the object being to provide a circuit-controlling device which will automatically afford the advantages of either the single make-and-break or the trembler or vibratory method of interruption at such times in the operation of the engine when those methods are respectively the more advantageous.

It is understood in the art that when running an engine at high speeds, or even at what may be called "normal" speeds, the single make-and-break or non-vibrator method of ignition which provides for a single spark between the electrodes of the firing device in the engine-cylinder is more advantageously used than the vibrator or trembler method wherein a rapid succession or torrent of sparks is created for each ignition in the cylinder. The reason for this is that the make and break can be better relied upon to produce the spark at the same point in the stroke, the time necessary to sufficiently magnetize the core of the coil and get the trembler into vibration being eliminated. In other words, the single make and break is more accurate. Another disadvantage of the trembler method is apparent especially on multiple-cylinder engines where the trembler is thrown into action at such short intervals that it does not have time to settle down between times, and the result is erratic firing, the spark taking place at different points in the stroke in successive cycles; but for running an engine at very slow speed and for testing purposes the trembler method is superior to the non-vibrator method. At the slow speeds with a single make and break the action of the cam upon the circuit-breaking element is so sluggish that inductive action of the coil is less pronounced and only a weak, if any, spark is produced. This often accounts for the skipping of explosions when an engine is running at low speed. The trembler-coil corrects this, in that when the circuit is closed by the engine the vibrations of the trembler act with the same efficiency on the circuit as they do at the high speeds, and a torrent of sparks is insured at each closure and skipping of explosions avoided. In testing the ignition apparatus to ascertain if the ignition-spark is being properly supplied at each igniting device the trembler method is better than the single make and break, because the torrent produced by it is of longer duration than a single spark, and therefore can be more readily observed.

Therefore the object of this invention, as above stated, is to afford the advantages of both the vibrator and non-vibrator types or methods of ignition and to provide for the automatic introduction of each method at such times as they will be most useful and advantageous. In other words, it is an automatic utilization of the plain make-and-break or non-vibrator method for high speeds and the utilization of the vibrator or trembler method for low speeds and for testing. A mechanism for carrying out this idea will now be described with reference to the accompanying drawing, in which the figure represents such portions of an engine and electric ignition system as are necessary to illustrate the invention.

An induction-coil is shown conventionally at 1 and having the usual primary winding 2 and secondary winding 3. It is also equipped with a vibrator 4 of any approved form and actuated, as usual, by the magnetism of the coil.

5 is a shaft driven by the engine at any suitable speed proportionate to the crank-shaft. It carries a cam-disk 6, having a compound cam on its periphery comprised of two cams 7 and 8, arranged in succession, the former being the lower projection and merging directly into the latter.

9 is a spring-blade fixed at its heel to a base 10, of insulating material, and carrying at its free end a lug 11, arranged to be struck successively by the cams 7 8, so as to deflect the blade 9 first to the extent of the elevation of the cam 7 and immediately thereafter to the further extent of the cam 8. Attached to the same base 10 is a second spring-blade 12, substantially parallel to the first and immediately back of it. This blade is se-

cured at its heel and reaches forward to a point where its free end stands between two contact-screws 13 and 14, respectively. The blades 9 and 12 have corresponding platinum contacts 15 16, the latter being located at a rigid point of the blade 12 and said contacts being so arranged as to be brought together when the cam 7 engages the lug 11. The end of blade 12 is equipped with a double platinum contact 17 for engagement with the ends of the respective screws 13 and 14, and the blade normally rests against the screw 13. The construction is such, however, that when the lug 8 engages the cam 11 of blade 9 the end of said blade will be forced against blade 12 and force the said blade over until its contact 17 leaves the screw 13 and engages with the screw 14.

18 is a battery supplying the necessary current for the ignition system.

19 is a hand-switch for putting the system into and out of operative condition, and the various circuits will be pointed out in connection with the description of the operation, which now follows: It will be understood that the cams 7 and 8, comprising a compound cam on the disk 6, actuate the lug 11 at the instant in the cycle of the engine when the ignition is to take place. Assuming switch 19 to be closed and the engine to be running, when cam 7 engages lug 11 the contacts 15 and 16 are brought together, and a circuit is closed from battery 18 through the primary winding 2, wire 20, contact-screw 13, blade 12, contacts 15 and 16, blade 9, binding-screw 21 to ground or frame of the engine and thence back to the battery. This energizes the induction-coil, and although the vibrator may be attracted and drawn away from its back contact it does not in any way affect the circuit, since the current is not now flowing through that portion of the primary circuit containing the vibrator. The lug 11 dwells upon cam 7 only long enough to charge the primary winding, whereupon it is engaged by the cam 8, and it is thereby forced over until it strikes blade 12 and breaks the circuit before traced between the contact 17 and screw 13. This sharp opening of the circuit induces a single high-tension impulse in the secondary winding 3 of the induction-coil, which flows to a plug or ignition device in the engine-cylinder by way of wire 22, creating a single spark in the cylinder to fire the charge and the current returning through the ground or frame to the other terminal of the secondary. After thus producing this single break in the primary circuit the continued excursion of blade 12 under the action of cam 8 causes it to engage contact-screw 14, and the primary circuit is thus for an instant closed through the vibrator or trembler 4, as can readily be traced through the wire 23. When cam 8 has passed lug 11, both blades return to their normal position, and the operation is repeated at the next instant when a charge is to be fired.

Now it will be seen that if the engine is running at high speed the elongated surface of cam 7 will afford ample time for the primary winding to be energized before its circuit is broken between contact 17 and screw 13, and the sharp break then afforded by the action of cam 8 will induce the necessary high-tension current in the secondary to insure the ignition of the charge. The additional action of cam 8, which throws in the trembler, is negligible, since at the higher speeds the dwell upon cam 8 is so short as to hardly start the trembler; but even if the trembler is slightly actuated no harmful effects will be produced, since it can only augment the first and hotter spark; but if the engine is running slowly the spark produced by the break between contact 17 and screw 13 will not be so pronounced as before, because the moving parts act more sluggishly and the magnetism of the coil tapers off, rather than being sharply terminated, and the resulting spark is unreliable; but cam 8 in actuating lug 11 and dwelling in contact therewith for a longer period on account of the slow speed will hold contact 17 and screw 14 in engagement long enough to give a substantial series of interruptions at the trembler, which will insure the ignition of the charge. An engine may therefore be slowed down to any extent without failure of the ignition system to act properly.

In making tests of the ignition system it is customary to turn over the engine slowly by hand while watching the spark at the plugs. It will be seen that with this device the cam 7 would be of little service, since in all probability no spark at all would be observable at the plugs when contact 17 and screw 13 were separated; but when the lug 8 is brought into engagement with cam 11 it may be held there for any length of time, and so long as it is so held the trembler will act and the sparks will or should continue to show at the plug. Any plug that does not show the sparks under this test is beyond question out of order.

The condenser commonly used to prevent arcing at the circuit-controlling contacts is indicated at 24 and connected between wire 20 and post 21, so as to protect the trembler and main contacts.

It will be seen that the device described affords the combined advantages of the vibrator and non-vibrator systems and that no operation or minipulation is required of the engine to bring them into service when their respective advantages are most required.

The cam-disk 6 with the blades 9 and 12 and the contacts which they control constitute as a whole a circuit-controlling device, but comprises two circuit-controllers, one of which controls the contacts 15, 16, and 13, actuated by the cam 7, while the other con-

trols contacts 15, 16, and 14, actuated by the cam 8.

Having described my invention, I claim—

1. In an ignition system for explosion-engines, the combination of an induction-coil, an igniting device, and means whereby according to the speed of the engine a single spark or a series of sparks will be created at the igniting device.

2. In an ignition system for explosion-engines, an induction-coil, a vibratory circuit-controller and a single make-and-break circuit controller therefor, and means dependent upon the speed of the engine for determining which of said circuit-controllers shall produce the ignition of the charge.

3. In an ignition system for explosion-engines, the combination of a primary circuit including a vibrator and a branch of the primary circuit shunting the vibrator, a circuit-controlling device adapted to close said circuit and branch successively and an engine-shaft actuating said circuit-controller.

4. In an ignition system for explosion-engines, the combination of a primary circuit including a vibrator and a branch of the primary circuit shunting the vibrator, a circuit-controller adapted to close said circuit and branch successively and a compound cam adapted to actuate said circuit-controller.

5. In an ignition system for explosion-engines, the combination of an induction-coil, a vibrator, and two circuit-controllers with means for actuating them in succession, one circuit-controller adapted to control the primary circuit of the induction-coil independent of the vibrator, and the other adapted to control a circuit including the primary and the vibrator, for the purpose set forth.

6. In an ignition system for explosion-engines the combination of an induction-coil, a vibrator, and two circuit-controllers with means for actuating them in succession, one circuit-controller adapted to control the primary circuit of the induction-coil independent of the vibrator, and the other adapted to control a circuit including the primary and the vibrator, and means for holding one circuit closed longer than the other.

7. In an ignition system for explosion-engines, the combination of an induction-coil, two circuits each including the primary winding of said coil, a circuit-controlling device adapted to control both of said circuits and an engine-shaft adapted to actuate the controlling device so as to break one circuit and complete the other in succession.

8. In an ignition system for explosion-engines, the combination of an induction-coil, two circuit branches each including the primary winding of said coil, a circuit-controller adapted to control both of said branches, and means whereby one of said branches will be broken and the other completed in succession at each period of ignition of a charge.

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

RICHARD VARLEY.

Witnesses:
FRANK S. OBER,
WALDO M. CHAPIN.