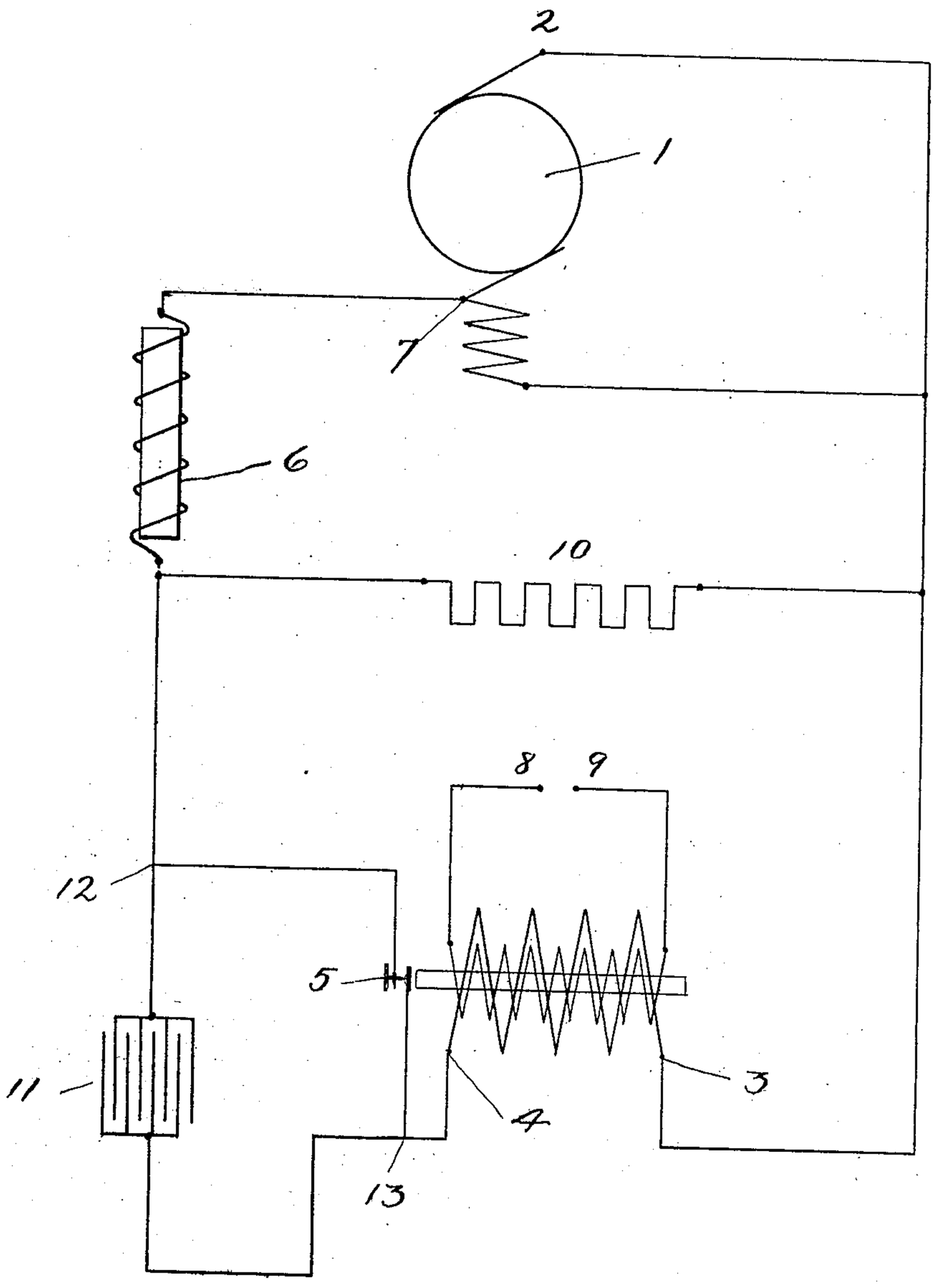
E. S. LINCOLN.

JUMP SPARK IGNITION SYSTEM.

APPLICATION FILED DEC. 5, 1907.

917,736.

Patented Apr. 6, 1909.



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UNITED STATES PATENT OFFICE.

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JUMP-SPARK IGNITION SYSTEM.

No. 917,736. Specification of Letters Patent. Patented April 6, 1909.

Application filed December 5, 1907. Serial No. 405,218.

To all whom it may concern:

Be it known that I, EDWIN S. LINCOLN, a citizen of the United States, residing at Brookline, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Jump-Spark Ignition Systems, of which the following is a specification.

My invention relates to electric ignition systems, and more especially finds its application to that system of electric ignition known as the jump spark system. The principal use of such jump spark ignition systems today is in connection with the ignition systems of explosive engines, and the like, but such ignition system is adapted for use in many other connections.

As is well known, where the jump spark ignition systems are employed in explosive engines, a gaseous mixture in the cylinder of an explosive engine is ignited at the desired moment by means of an electric spark, formed by the passage of a high tension current across the gap separating the terminals of a spark plug located in said cylinder. The high tension current employed for this purpose is ordinarily that generated in the secondary winding of an induction coil by the rapid making and breaking of the circuit of the primary winding by means of a vibrator, or similar device. The current for energizing the primary winding of the induction coil, and for operating the vibrator is commonly that derived from dry or storage batteries and the like.

So far as I am aware low tension dynamos have not hitherto been successfully employed for the purpose of supplying current for energizing an induction coil used in connection with a jump spark ignition system. The reason for this, as understood by the writer is explained as follows. In the operation of an induction coil the interruption of the current by which the primary winding is energized, by the operation of the vibrator, results in the generation in that winding of a self-induced current which ordinarily has an electro-motive force considerably higher than that of the battery by which the energizing current was supplied. While I am not able to state definitely the technical reasons which are responsible for such unsatisfactory results, it is believed that the self-induced currents, which are generated in the primary winding of the induction coil when the energizing current is interrupted by the operation of the vibrator, although of relatively high voltage compared with said energizing current, either in some way come into interference with the currents produced in the generator, through which said self induced currents tend to discharge themselves, or, owing to their fluctuating character, are impeded in their passage through the generator windings, so that they cannot discharge themselves from the primary winding with the same rapidity and facility with which they may be discharged through a battery or an analogous source of electricity. The result is a largely increased sluggishness of action of the current in the primary coils of a generator operated induction coil, as compared with the action of the same when energized by a battery, or the like, which impairs the strength of the current induced in the secondary windings of the coil, and rendering the coil as a whole unreliable as a means for energizing the ignition system. Thus the use of the dynamo as an energizing means for the induction coil has been found unsatisfactory.

My invention aims to render possible the satisfactory employment of a low tension dynamo for energizing the primary winding of an induction coil used in connection with a jump spark ignition system.

To this end my invention consists in the use in connection with the ignition system of electrical apparatus designed to overcome the difficulties hereinabove described as tending to produce a sluggish action of the induction coil energized by a dynamo.

In the drawing I have presented a figure illustrating diagrammatically, the invention, in its preferred form.

In said figure 1 is a direct current shunt wound generator of any approved type. From one brush 2 the circuit leads to one terminal 3 of the primary winding of an induction coil. From the other terminal 4 of said primary winding the circuit leads through the vibrator 5 and the inductive resistance 6 back to the other brush 7 of generator 1. At 8 and 9 are shown the adjacently located spark points connected to the terminals of the secondary winding of the induction coil. In the circuit between the primary winding and the generator is the inductive resistance 6, so constructed as to combine low resistance with high induct-

ance. The conductors between the generator brushes and the terminals of the primary winding of the induction coil are connected by the non-inductive resistance 10, which embodies high resistance with little or no inductance. This non-inductive resistance 10 is located so that the inductive resistance coil 6 is situated between one of the generator terminals and the point at which non-inductive resistance 10 engages the conductor leading from that terminal to one terminal of the induction coil. To use technical language it may be stated that the inductive resistance is in series with the generator, and both are in series with the primary winding of the induction coil; the non-inductive resistance and the induction coil being both connected in parallel as to the generator and the inductive resistance.

The manner of operation of my invention is as follows. Assuming generator 1 to be rotating, current will be generated which will proceed from one brush 7 through the inductive resistance 6, the vibrator 5, and the primary winding of the induction coil, back to the other brush 2. Owing to the comparatively steady and continuous character of the current produced by the generator the inductive resistance will not retard the free flow of current through the same. A small amount of current will flow between the main leads by means of the non-inductive resistance 10, but enough resistance should be provided by the same to render such flow, at the normal operating voltage of negligible and harmless amount. As the primary winding of the induction coil is energized the vibrator 5 will be caused to act, causing the separation of the contact points of the same and consequently interrupting the flow of current. The result of this interruption of current will be to produce in the primary winding a self induced current which is of a relatively high voltage, and which, except for my invention would tend to discharge itself through, and thus come into interference with the currents generated in the generator, or be impeded by the windings thereof. Owing, however, to the fluctuating character of this self induced current it is choked off from the generator by the inductive resistance 6, leaving as a more available path of discharge the connection 10, which, although of low conductive capacity for currents of the normal operating voltage of the generator, will be of ample conductive capacity to permit the discharge therethrough of currents having the relatively high voltage of the self induced currents produced in the primary windings. As a result of the increased facility of the discharge of the self induced currents from the primary winding of the induction coil, the efficiency of the induction coil as a whole is increased.

In many cases an improvement in the operation of a generator energized induction coil may be noted when the non-inductive resistance 10 is employed alone without the inductive resistance 6; the interference with, or impedance to the discharge of the self induced current through the generator afforded by the generator itself performing in part the function ordinarily performed by the inductive resistance 6.

It is ordinarily found advisable in jump spark ignition systems to make use of a condenser 11 for the purpose of quickening the electric activities of the induction coil. Such condenser is shown in the figure, being connected in at 12 and 13 so as to shunt the vibrator points. Its use is indicated merely for the purpose of illustrating my system in its most efficient form, but the use of a condenser of itself is well known and forms no part of my invention.

Where my invention is employed in connection with ignition work for explosive multi-cylindered engines it is evident that a timer must be used for the purpose of controlling the sparking at the proper cylinder, and the time of such sparking. Such timer may operate in the usual manner, and is not shown in the drawings, as being no part of my invention.

Having described my invention, what I claim is:

1. In an ignition system, in combination, a generator; an induction coil having a primary winding, an inductive resistance, and a non-inductive resistance; said non-inductive resistance being in parallel with the primary winding of the induction coil, and both non-inductive resistance and the primary winding of the induction coil being in series with the inductive resistance and the generator.

2. In a jump spark ignition system, in combination with a direct current generator, and an induction coil adapted to be energized thereby, a non-inductive resistance electrically interconnecting the conductors connecting the generator and the induction coil, and an inductive resistance located in one of said conductors between the generator and the point at which said non-inductive resistance is connected to said conductor.

3. In a jump spark ignition system, in combination, with a direct current generator and an induction coil adapted to be energized thereby, an inductive resistance in circuit with the generator and the primary winding of the induction coil, and a non-inductive resistance adapted to electrically connect the terminals of the primary winding of said induction coil.

4. In an induction coil, means electrically connecting the terminals of the primary winding, said connection embodying a resistance sufficient to preclude the substantial leakage of the induction coil energizing current therethrough but insufficient to pre-

vent the discharge therethrough of the self-induced currents induced in the primary windings.

5. In an ignition system, in combination with a generator, and an induction coil having the terminals of its primary winding electrically connected in operative relation with said generator, a non-inductive resistance permanently connecting the terminals of said primary winding, said non-inductive resistance having a conductive capacity adapted to prevent the substantial passage therethrough of current at the normal operating voltage of the generator, but permitting the free discharge through the same of the self-induced currents of relatively high voltage produced, in the operation of the induction coil, in the primary winding of the same.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN S. LINCOLN.

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