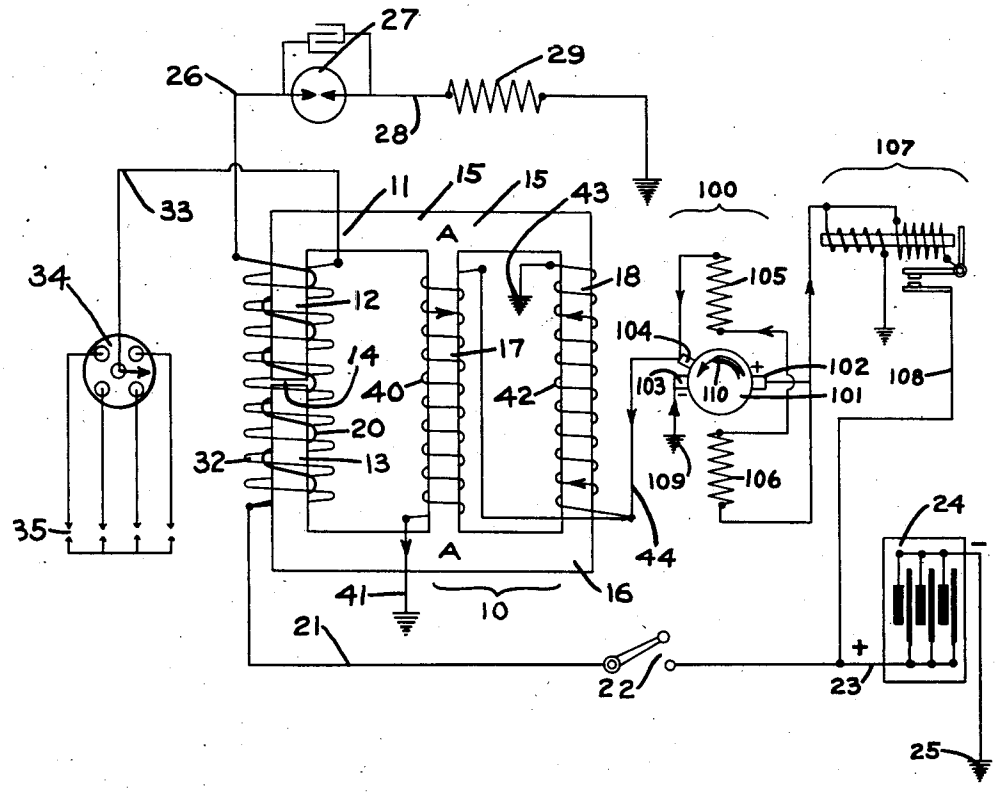
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J. H. HUNT

IGNITION SYSTEM

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UNITED STATES PATENT OFFICE.

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IGNITION SYSTEM.

Original application filed September 3, 1918, Serial No. 252,316. Divided and this application filed December 11, 1919. Serial No. 344,205.

To all whom it may concern:

Be it known that I, JOHN H. HUNT, a citizen of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Ignition Systems, of which the following is a full, clear, and exact description.

This invention relates to ignition systems for internal-combustion engines and the like.

This application is a division of my copending application Serial No. 252,316 filed September 3, 1918.

One of the objects of the invention is to provide an ignition system including an ignition coil which is constructed in such a manner that the coil can be placed in the vicinity of metallic bodies, such as the cast iron cylinders of the engine, without substantially affecting the operation of the coil.

Another object of the invention is to provide an ignition coil in which for a given ratio of secondary and primary turns the best ratio of transformation can be obtained.

A further object of the invention is to provide an ignition system including an ignition coil in which the inductance can be varied in accordance with the operation of the engine with which the system is employed.

More particularly it is an object to provide an ignition coil which while the engine is running at a low speed will have a high inductance in order to obtain a hot spark while the engine is starting or running slowly, and devices for reducing the inductance of the coil at high engine speed in order to obtain a faster working coil, so that although a large number of sparks are required at high speed the efficiency of the spark will be maintained at a maximum.

Other and further objects of the present invention will be apparent from the following description, reference being made to the accompanying drawing, in which an embodiment of the invention is shown.

In the drawings:

The figure is a wiring diagram of an ignition system embodying the present invention.

In this drawing 10 designates as a whole an ignition coil including a core 11. Said core 11 includes main core portions 12 and 13 which are separated by a relatively narrow gap 14, and yoke portions 15 and 16 which are connected together by auxiliary cores 17 and 18. The primary ignition winding 20 is wound upon the main cores 12 and 13 and has one end thereof connected by a wire 21 with an ignition switch 22 which is connected by wire 23 with a battery 24 which is grounded at 25. The other end of the primary winding 20 is connected by wire 26 with a timer 27 which is connected by wire 28 with a grounded resistance 29.

The secondary ignition winding 32 is wound around the main cores 12 and 13 and the primary winding 20 and has one end thereof grounded through the battery by means of the wire 21, switch 22 and wire 23, and the other end thereof is connected by wire 33 with a distributor 34 which is connected with the various spark plugs 35 of the engine (not shown.)

A controlling winding 40 is mounted on the auxiliary core 17 and one end thereof is grounded at 41 and a controlling winding 42 is mounted on the auxiliary core 18 and is grounded at 43. Both windings 40 and 42 are connected in parallel with the wire 44 which is connected with a generator 100 in a manner to be described.

100 refers as a whole to a shunt field third brush regulating generator having an armature 101, brushes 102, 103 and 104, and field windings 105 and 106. The positive brush 102 of the generator 100 is connected with the reverse current relay 107 which is connected by wire 108 with the wire 23 connected with the battery 24. The negative brush 103 of the generator 100 is grounded at 109 thereby effecting a connection with the negative side of the battery through the ground 25. The armature 101 is rotated in the direction of the arrow 110. The shunt windings 105 and 106 are connected between the third brush 104 and the brush 102. The third brush is connected by wire 44 with the windings 40 and 42 which are grounded at 41 and 43 respectively. When the generator is operated, the third brush 104 being at a higher potential than the brush 103, current will flow through the wire 44 and the windings 40 and 42 to ground connection 41 and 43 respectively and back through ground 109 to the brush 103. When the generator is running slowly with slow engine

speeds, the potential difference between brush 104 and brush 103 will be very small, consequently the windings 40 and 42 will have very little regulating effect. As the speed of the generator increases with increased engine speed the field will be distorted due to armature reaction with a result that the potential difference between brushes 104 and 103 will be materially increased. This regulating effect is taken advantage of in previous devices to reduce the battery charging rate of high speeds, since the output of the generator is reduced with the reduction of field excitation at high speeds. But while the field excitation is reduced due to the drop in potential between brushes 102 and 104, the potential between 104 and 103 will increase with increased engine speed and this characteristic can be taken advantage of to cause an increased amount of current to flow through the windings 40 and 42. It has been found that an ignition system embodying the tvpe of coil described in combination with a third brush regulating generator will have very satisfactory characteristics. Thus the desired effect obtained by regulating the inductance according to speed can be produced automatically through the agency of a third brush regulating generator which is generally employed in the electrical equipment of an automobile engine. It will be noted that the magnetic circuit is completed through the yokes 15 and 16, and the auxiliary cores 17 and 18 act in parallel as far as the flux due to the primary is concerned. Since the change of flux due to the winding 20 will be substantially the same in cores 17 and 18, and since the windings 40 and 42 have an equal number of turns and are connected as shown in Fig. 1, the electro-motive forces generated in said windings 40 and 42 by the pulsations of the main flux will be opposed, and will be substantially balanced, and substantially no current will be induced in the windings 40 and 42. With the windings 40 and 42 thus arranged, a direct current sent through them tends to send flux around cores 17 and 18 and the end yokes without directly affecting the magnetic or electric circuit as at the left of the line A—A.

By reason of the ability of regulating the inductance of the type of coil disclosed in the manner described, an ignition system including said coil possesses certain advantages over the system using the conventional type coil. The coil can be constructed so as to have the minimum inductance available when the coils 40 and 42 are fully excited, said inductance being of the proper value for the highest speed work that is required of the coil. At low engine speeds the coil can be run without an excitation in the regulating coils 40 and 42 with a result that, the inductance being higher, the ignition coil produces a hotter spark for starting or for low speed running conditions. Where the inductance of a coil cannot be varied according to the speed of the engine construction of the coil is restricted between certain limits. The limit on one hand is the inductance required at starting but which would be too high for high speed conditions; and the limit on the other hand is the inductance required at high speed which would be far too low to obtain a hot spark at starting or slow speed conditions. The inductance of the coil of the conventional type is somewhere between these limits but cannot be the ideal value for all engine speeds. But with the type of coil disclosed it is possible to reduce the inductance 30%, for example, of the initial value, permitting the inductance for slow speed work to be over 40%, for example, greater than would be otherwise possible where the inductance could not be varied, and, at the same time, providing for ignition required for highest speeds. It was found by experiment that the striking distance of the spark at high speeds was better in case of type of coil disclosed than the conventional type, when operated at the same speed.

While the form of mechanism herein shown and described constitutes a preferred form of embodiment of the invention, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. In an ignition system for internal-combustion engines, the combination with a storage battery and a third brush regulated generator driven by the engine for charging the battery; a coil including a core and windings; sparking devices connected with the battery and the winding; auxiliary windings for saturating a portion of the core, connected with the third brush of the generator whereby the inductance of the coil may be varied according to the speed of the engine.

2. In an ignition system for internal-combustion engines, the combination with a generator driven by the engine; of sparking devices for the engine; an ignition coil including a core, and windings adapted to be connected with the sparking devices; means associated with the core for varying the inductance of the coil; and provisions for regulating the output of the generator and cooperating with said means to render the same effective to vary the coil inductance.

3. In an ignition system for internal-combustion engines, the combination with a generator driven by the engine; of sparking devices for the engine; an ignition coil including a core, and windings adapted to be connected with the sparking devices;

auxiliary windings cooperating with the core and adapted to saturate a portion thereof; and provisions for regulating the output of the generator and for regulating the amount of current delivered by the generator to the auxiliary windings.

4. In an ignition system for internal-combustion engines, the combination with a generator driven by the engine; of sparking devices for the engine; an ignition coil adapted to be connected with the engine; and means controlled by variations in voltage between certain generator brushes for varying the inductance of the coil.

5. In an ignition system for internal-combustion engines, the combination with a generator driven by the engine; of sparking devices for the engine; an ignition coil adapted to be connected with the engine; and having auxiliary windings adapted to saturate a portion of the core of said coil controlled by variations in voltage between certain generator brushes for varying the current passing through said auxiliary windings whereby the coil inductance is varied.

6. In an ignition system for internal-combustion engines, the combination with a generator driven by the engine; of sparking devices for the engine; an ignition coil including main windings cooperating with the generator and sparking devices and a core including a main core portion cooperating with the main windings and auxiliary core portions of equal magnetic dimensions arranged in parallel with each other and both together in series in the magnetic circuit containing the main core portion; auxiliary windings cooperating with the auxiliary cores; and means for automatically controlling the passage of current through the auxiliary windings in accordance with the operation of the generator.

7. In an ignition system for internal-combustion engines, the combination with a generator having third brush regulation driven by the engine; of sparking devices for the engine; an ignition coil including main windings cooperating with the generator and sparking devices and a core including a main core portion cooperating with the main windings and auxiliary core portions of equal magnetic dimensions arranged in parallel with each other and both together in series in the magnetic circuit containing the main core portion; and auxiliary windings cooperating with the auxiliary cores, said windings being connected with the third brush of the generator.

8. In an ignition system for internal-combustion engines, the combination with a generator having third brush regulation driven by the engine; of sparking devices for the engine; an ignition coil including main windings cooperating with the generator and sparking devices and a core including a main core portion cooperating with the main windings and auxiliary core portions of equal magnetic dimensions arranged in parallel with each other and both together in series in the magnetic circuit containing the main core portion; and auxiliary windings cooperating with the auxiliary cores, said windings being wound so as to produce opposite magnetic effects upon the auxiliary cores, and said windings being connected in parallel with each other and both together in series with the third brush of the generator.

In testimony whereof I affix my signature.

JOHN H. HUNT.

Witnesses:
MILDRED PEARE,
HAZEL SOLLENBERGER.