June 21, 1938. L. L. HENDERSON 2,121,385

IGNITION SYSTEM

Original Filed May 19, 1936

Fig. 1

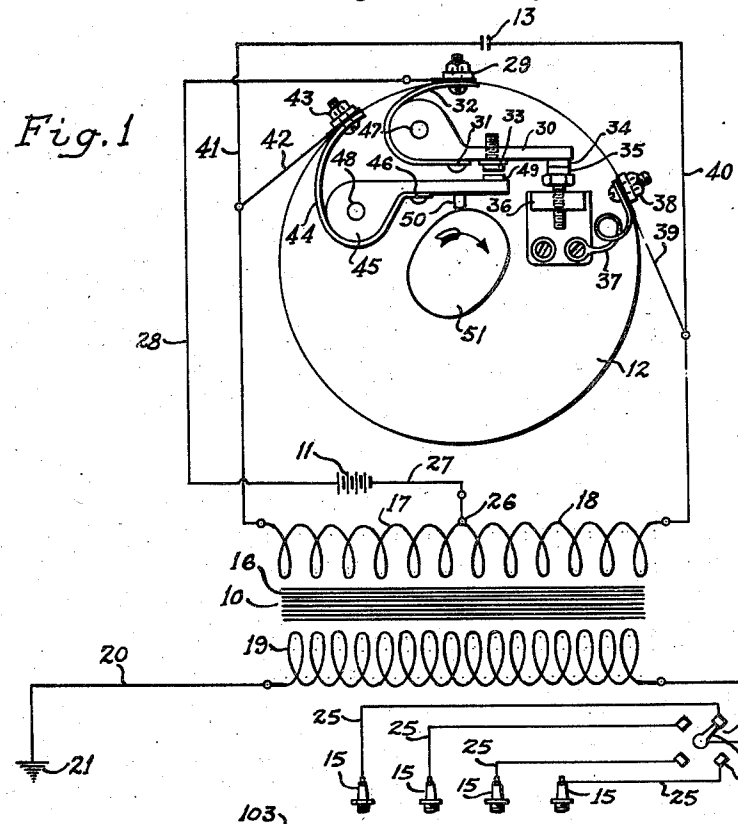
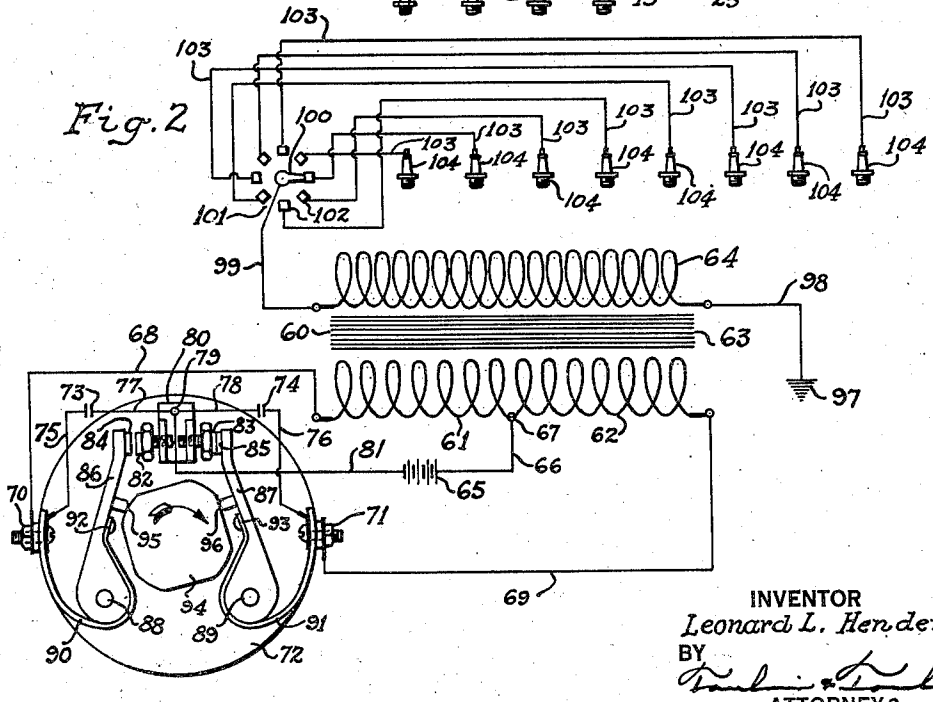


Fig. 2



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Patented June 21, 1938

2,121,385

UNITED STATES PATENT OFFICE

2,121,385

IGNITION SYSTEM

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Application May 19, 1936, Serial No. 80,573
Renewed May 9, 1938

6 Claims. (Cl. 123—148)

This invention relates to ignition systems such as are used for igniting the charges in internal combustion engines.

One object of this invention is to provide an ignition system including an ignition coil with double primary windings connected in electrical opposition to each other, and in inductive relationship with a single secondary winding, together with suitable means for timing the distribution of current to the primary windings so that the electrical circuit is completed in one primary winding substantially at the instant the circuit is opened in the other primary winding.

Another object is to provide an ignition system having an ignition coil with double primary windings connected in electrical opposition with each other, and arranged in inductive relationship with a secondary winding, together with timing means whereby the circuit is closed in one primary winding while it is opened in the other primary winding so that the opposed windings assist in bringing the field flux to zero, thereby intensifying the spark obtained in the secondary circuit by building up the field fully in opposite directions from the zero point.

Another object is to provide an ignition system employing an ignition coil with a double primary and a single secondary, together with a timing device having a pair of switch arms operated alternately so as to provide for high-speed operation, each switch arm having a condenser associated therewith for absorbing the flux of the coil and reducing sparking across the terminals.

In the drawing:

Figure 1 is a wiring diagram of one ignition system, according to my invention, and

Figure 2 is a wiring diagram of a modified form of ignition system, according to my invention.

Referring to the drawing in detail, Figure 1 shows the ignition system of my invention as containing an ignition coil of special type, generally designated 10, a battery or similar source of electrical energy, generally designated 11, a timing device, generally designated 12, a condenser, generally designated 13, a distributing device, generally designated 14, and spark plugs 15. The ignition coil 10 is provided with a core 16 having associated therewith a pair of primary windings 17 and 18 connected in electrical opposition with each other, and a secondary winding 19 connected by the line 20 to the ground, as at 21, and also connected by the line 22 to the arm 23 of the distributor 14, the poles 24 of which are connected by the high tension lines 25 to the spark plugs 15.

The primary windings 17 and 18 may consist of independent windings or of a single primary winding attached at an intermediate point, such as 26. One terminal of the battery 11 is connected by the line 27 to the common point 26 between the two primary windings 17 and 18, and the other terminal is connected by the line 28 to the breaker arm terminal 29 of the timer 12. The breaker arm terminal 29 is connected to the breaker arm 30, as at 31, by the spring 32 and carries the contact points 33 and 34, respectively. The contact point 34 is arranged to engage an adjustable contact point 35 mounted upon the supporting member 36, which is connected by the line 37 to the terminal 38, the latter being connected by the line 39 to the line 40, which connects one side of the condenser 13 to the outer end of the primary winding 18. The opposite side of the condenser 13 is connected by the line 41 to the outer terminal of the primary winding 17.

From the line 41 the line 42 runs to the terminal 43, from which the spring 44 extends to the breaker arm 45 to which it is connected at 46. The breaker arms 30 and 45 are pivotally mounted upon pivot pins 47 and 48, respectively. The springs 32 and 44 urge the arms 30 and 45 downwardly in Figure 1. The breaker arm 45 is provided with a contact point 49, arranged to engage the contact point 33 upon the breaker arm 30, and to this end the breaker arm 45 is provided with a finger 50 adapted to engage the timing cam 51. The latter is illustrated as a two-lobed cam adapted to be used with a four-cylinder engine. It will be evident, however, that a four-lobe cam might be employed for use with an eight-cylinder engine.

In the operation of the system shown in Figure 1 the timing cam 51 is rotated, as by the usual cam shaft of the engine, whereupon the breaker arm 45 is moved up and down by the engagement of its finger 50 with the cam 51. As the breaker arm 45 rises, its contact point 49 engages the contact point 33 on the breaker arm 30, and raises the contact point 34 out of engagement with the contact point 35. Accordingly, the current from the battery 11, or other source of electrical energy, is caused to cease traversing the primary winding 18 and to begin passing through the primary winding 17.

Each time the circuit is made and broken in this manner a high tension current is induced in the secondary winding 19 and flows along the line 22 to the arm 23 of the distributor 14. This arm is rotated in a similar manner to the

cam 51, usually upon the same shaft, and distributes the high tension current to the various poles 24 of the distributor, from whence the current passes along the lines 25 to the spark plugs 15 and causes a spark to jump across the terminals, igniting the explosive charge within the cylinders. The condenser 13, which is bridged across the outer ends of the primary windings 17 and 18, serves to absorb the flux of the coil and reduce sparking across the terminals. This condenser also will discharge into the primary coil and boost the effect thereof.

The arrangement of the double primary coils in electrical opposition to each other, and the synchronism of the breaker points 33, 49, 34 and 35 cause the electrical circuit to be completed in one primary circuit at the instant the circuit is opened in the other primary circuit. By this arrangement there is no loss of time in starting to build up the magnetic field in the ignition coil, because the opposed windings assist in bringing the field flux to zero. The spark obtained is intensified because the secondary electro-motive force is proportional to the field density and rate of change of field flux, whereby the opposed windings not only assist in the field drop, but build up the field in the opposite direction after passing through the zero point. This gives a variation which fluctuates by double the amount of a single primary winding and on opposite sides and polarities of the zero point.

The arrangement shown in Figure 1 is particularly adapted for use with slow and medium speed engines. In extremely high-speed engines the weight and inertia of the moving parts of the timer 12 tend to slow down the action, and the increased tension required in the springs 32 and 44 causes excessive wear. Under such circumstances the arrangement shown in Figure 2 is found to eliminate these disadvantages.

The ignition system of Figure 2 is shown as applied to an eight-cylinder engine. This modified system consists of an ignition coil 60, similar to the coil 10 of Figure 1, and having similar double primary windings 61 and 62, core 63 and a common secondary winding 64. A battery 65 is connected by the line 66 to the meeting point 67 of the two primary windings 61 and 62, the opposite ends of which are connected respectively by the lines 68 and 69 to the terminals 70 and 71 of the timer 72. Bridged across these terminals are condensers 73 and 74 connected thereto by the lines 75 and 76, and having their opposite lines 77 and 78 meeting in the common point 79 connected to the contact point mounting 80. The remaining terminal of the battery 65 is connected by the line 81 to this meeting point 79.

On the contact point mounting are arranged adjustable contact points 82 and 83, which respectively engage similar fixed contacts 84 and 85 on the ends of the twin breaker arms 86 and 87. The breaker arms 86 and 87 are pivotally mounted upon the pivot pins 88 and 89 and having springs 90 and 91 secured thereto, as at 92 and 93. The opposite ends of these springs are secured to the terminals 70 and 71, and urge the breaker arms 86 and 87 toward a four-lobed cam 94, which the arms engage by means of the fingers 95 and 96 attached to the arms. The secondary winding 64 of the coil 60 is connected to the ground, as at 97, by the line 98, and its opposite terminal is connected by the line 99 to the distributor arm 100 of the distributor 101, the fixed poles 102 of which are connected by the lines 103 to spark plugs 104. The distributor arm 100 is driven synchronously from the engine, and according to the usual practice is driven from the same shaft as the cam 94.

The operation of the ignition system of Figure 2 is similar in principle to that of Figure 1. The double breaker arms 86 and 87 are arranged relatively to the cam 94 so that one set of contact points, such as 83 and 85, is making contact while the other set, such as 82 and 84, is separated. Thus the two sets of contact points alternately make and break the circuit, including the opposed primary windings 61 and 62, whereupon the current flows through these windings alternately in opposite paths. A high tension current is thus induced in the secondary winding 64, this current varying from a maximum of one polarity, through zero, to a minimum of the opposite polarity so that the high tension current varies from one extreme, through zero, to the opposite extreme. By this principle, as stated in Figure 1, the spark is intensified because the secondary electro-motive force is proportional to the field density and rate of change of the field flux. As before, the condensers 73 and 74 serve to absorb the flux of the coil, reduce sparking across the terminals and intensify the effect by discharging into the primary and thereby boosting it.

In Figure 1 the circuit is shown as applied to a four-cylinder engine, whereas in Figure 2 it is shown applied to an eight-cylinder engine. It will be evident, however, that by obvious variations in the arrangement of the breaker arms and cams and also in the distributor poles, the circuit may be adapted to engines of any number of cylinders.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an ignition system for engines, an induction coil having a pair of primary windings arranged in electrical opposition to one another and a secondary winding, a source of electrical energy, means for alternately directing said energy to said primary windings, said directing means comprising devices including twin sets of contact points, and means arranged to engage one set of contact points while simultaneously disengaging the other set, and means for distributing the induced current from said secondary winding to said engine.

2. In an ignition system for engines, an induction coil having a pair of primary windings arranged in electrical opposition to one another and a secondary winding, a source of electrical energy, means for alternately directing said energy to said primary windings, said directing means comprising devices including twin sets of contact points, means arranged to engage one set of contact points while simultaneously disengaging the other set, said engaging means being adapted to actuate said contact points at substantially equal successive time intervals, and means for distributing the induced current from said secondary winding to said engine.

3. In an ignition system for engines, an induction coil having a primary winding and a secondary winding, a source of electrical energy connected to an intermediate point in said primary winding to arrange the twin portions thereof in electrical opposition to one another,

means for alternately closing the circuit in one primary portion while simultaneously opening the circuit in the other primary portion, and means for distributing the induced current from said secondary winding to said engine.

4. In an ignition system for engines, an induction coil having a pair of primary windings arranged in electrical opposition to one another and a secondary winding, a source of electrical energy, means for alternately directing said energy to said primary windings, means for distributing the induced current from said secondary winding to said engine, said directing means comprising a plurality of pairs of switch points and means for engaging one pair while simultaneously disengaging the other pair, said engaging means being adapted to actuate said contact points at substantially equal successive time intervals.

5. In an ignition system for engines, an induction coil having a pair of primary windings arranged in electrical opposition to one another and a secondary winding, a source of electrical energy connected thereto, a switch in circuit with each primary winding and said source, means operatively responsive to the operation of said engine to alternately close one switch while simultaneously opening the other switch, and means for distributing the induced current from said secondary winding to said engine.

6. In an ignition system for engines, an induction coil having a pair of primary windings arranged in electrical opposition to one another and a secondary winding, a source of electrical energy connected thereto, a switch in circuit with each primary winding and said source, means operatively responsive to the operation of said engine to alternately close one switch while simultaneously opening the other switch, and means for distributing the induced current from said secondary winding to said engine, said engine-responsive means being operative to close and open said contacts at substantially equal successive time intervals.

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