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IGNITION SYSTEM FOR HIGH SPEED ENGINES

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FIG. 1

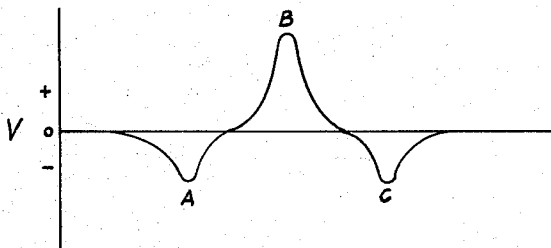
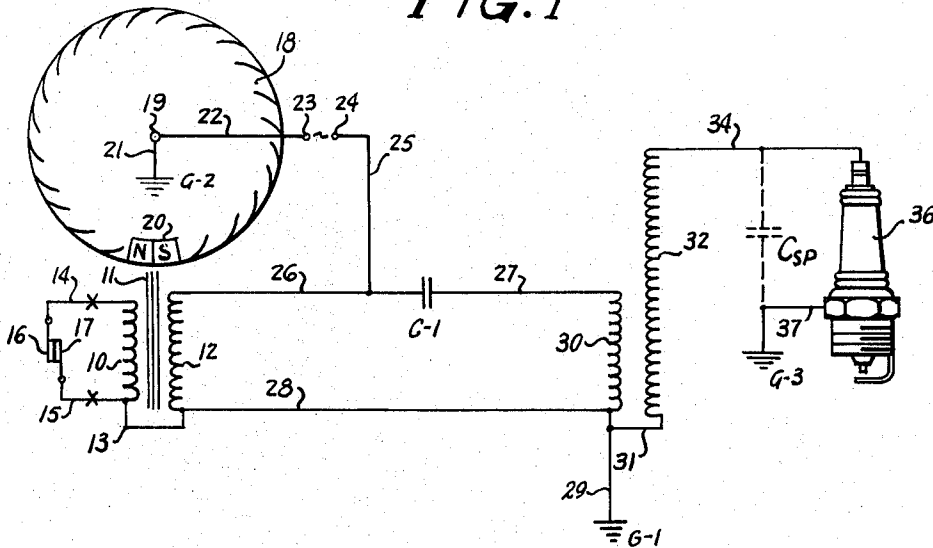


FIG. 2

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IGNITION SYSTEM FOR HIGH SPEED ENGINES

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1 Claim. (Cl. 123—148)

This invention relates to an ignition system for use on high speed internal combustion engines. Such engines frequently operate in the speed range of 15,000 to 20,000 r.p.m. or even higher. One application of such engines is on racing "Karts."

The present invention meets a threefold need: (1) The ignition systems at present used on high speed internal combustion engines do not have any means for effectively adjusting the timing of the sparkplug firing while the engine is running. This results in maximum power not being attained at all speeds. (2) The mechanical points tend to "float" at high speed and thus the firing of the sparkplugs becomes erratic and weak. By "floating" is meant the condition that the timer rocker arms do not either reach their rest positions or the movable contacts carried by same do not fully close on the fixed contacts. (3) The ignition systems for high speed internal combustion engines now in use do not function properly under any one or a combination of rather minor conditions. Among these are a carbon coated sparkplug, a particle of dirt on the sparkplug points, which either stopped the firing completely or caused severe misfiring; a minor crack in the ignition coil; a pin hole in the sparkplug wire; or even a sparkplug having a gap which had been eroded to a slightly larger size, which also stopped the firing completely or caused severe misfiring.

The object of the present invention is to provide an ignition system for high speed internal combustion engines which provides correct timing at all engine speeds without the addition of a particular timing device.

Another object of the present invention is to provide an ignition system for high speed internal combustion engines which will provide an effective automatic advance or retardation of the spark over approximately 12° of crank shaft rotation in the speed range of 7,000 to 17,000 r.p.m.

A further object of the present invention is to provide an ignition system for high speed internal combustion engines in which the stepped up voltage to the sparkplugs remains constant for a constant input voltage even at a high rate of firing per second.

An additional object of the present invention is to provide an ignition system for high speed internal combustion engines which includes a minimum number of moving mechanical parts, which parts can be located on the outside of the engine and which are substantially unaffected in their operation by the presence of mud, oil, grease or dirt.

Still other objects, advantages and improvements will become apparent from the following specification, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a circuit diagram of the ignition system according to the present invention;

FIGURE 2 is a graph of the output voltage wave of the magneto used in the ignition system.

Referring now to the drawings in detail and to FIGURE 1 in particular, there is shown a magneto comprised in part by a primary winding 10, a core 11, and a secondary winding 12. One side of the primary winding 10 is connected to one side of the secondary winding 12 by a conductor 13. In the conventional magneto ignition circuit one side of the primary winding 10 is connected by a conductor 14 to a fixed contact 16, and

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the other side of the primary winding is connected by a conductor 15 to a movable contact 17 on the rocker arm of the ignition timer. In the ignition circuit according to the present invention, the primary winding 10 is not used. The movable contact 17 may be permanently separated from the fixed contact 16 of the ignition timer, or the conductors 14 and 15 may be cut and taped at the points marked X—X. The secondary winding 12 then functions as an induction coil in a manner to be now explained.

The flywheel of the engine is shown at 18 and is rotatably mounted with a shaft 19. On the circumference of the flywheel there is mounted a permanent magnet having the usual north and south poles "N" and "S," respectively. The magneto is positioned in close proximity with respect to the fly wheel so that, as the latter rotates, the permanent magnet 20 sweeps past the end of the core 11. As the north pole "N" passes the core 11, followed by the south pole "S," a magnetic flux is produced in the core first in one direction and then in the opposite direction. This induced magnetic flux, and its immediate reversal, produces an induced voltage across the secondary winding 12 as shown in FIGURE 2. The rotating permanent magnet 20 and the secondary winding 12 thus function as an impulse generator.

The secondary winding 12 of the magneto is connected to the primary winding 30 of an air core transformer by conductors 26 and 28. The conductor 26 extends from one side of the secondary winding 12 of the magneto to a capacitor C-1, a conductor 27 from the capacitor to one side of the primary winding 30 of the air core transformer, and a conductor 28 from the other side of the secondary winding 12 to the other side of the primary winding 30.

The latter side of the primary winding 30 is also connected to one side of the secondary winding 32 of the air core transformer by a conductor 31 which is connected with ground G-1 via conductor 29. The other side of the secondary winding 32 is connected by a conductor 34 to the center terminal of a sparkplug 36. It will be understood that the body of the sparkplug 36 is grounded on the cylinder block of the engine in the usual manner but, for complete illustration, a ground is shown on the body over a conductor 37 and at G-3. It will likewise be understood that the sparkplug 36 has a certain inherent capacity. However, again for complete illustration, a capacitor C_{sp} is shown shunted across the conductors 34 and 37 in phantom lines.

In the ignition circuit according to the present invention, the usual ignition timer is replaced by a rotary gap 23-24. It will further be understood that the flywheel 18 and the crank shaft 19 are grounded. Nevertheless, also for complete illustration, a ground is shown on the crankshaft 19 over a conductor 21 and at G-2. An arm 22 is carried by the flywheel 18 and is the movable element of the rotary gap. At its outer end this arm 22 carries a point 23, which cooperates with a fixed point 24 mounted on the engine frame at any suitable location and insulated from the latter. When the poles "N" and "S" are aligned with the core 11, the rotatable point 23 is in alignment with the fixed point 24. This fixed point 24 is connected by a conductor 25 to the conductor 26, which extends from one side of the secondary winding 12 of the magneto to the capacitor C-1.

As above stated, during the rotation of the flywheel 18 the permanent magnet 20 induces a voltage across the secondary winding 12 of the magneto, which voltage is illustrated by the graph of FIGURE 2. This voltage charges the capacitor C-1. The circuit is from one side of the secondary winding 12 of the magneto over the conductor 26, through the capacitor, over the conductor

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27, through the primary winding 30 of the air core transformer, and over the conductor 28 to the other side of the secondary winding 12 of the magneto. When the movable point 23 is in alignment with the fixed point 24 of the rotary gap, the voltage across the capacitor C-1 has reached its maximum positive value, as shown at "B." Owing to the breakdown of the air gap to establish a conductive bridge between points 23 and 24, an LC oscillatory circuit is established that includes primary 30, conductor 27, capacitor C-1, conductor 25, the gap between points 24 and 23, conductor 22, crank shaft 19, conductor 21, ground G-2, ground G-1 and conductor 29. This circuit oscillates at a frequency which is a function of the capacitance of capacitor C-1 and the inductance of primary 30, as is known in the art. Because of the coupling between coils 30 and 32, a corresponding oscillation is established in the secondary circuit including secondary 32, conductor 34, the electrodes of sparkplug 36 (having the stray capacitance C_{sp}), conductor 37, grounds G-3 and G-1, and conductors 29 and 31. The LC product of the secondary circuit is the same as that of the primary circuit and thus, due to the high inductive value of the secondary winding 32, a voltage of a radio frequency is developed across the secondary winding, until an arc is formed across the gap of the spark plug.

In the drawings, the rotary arm 22 is of such current resistive value that the battery will not short circuit between contacts 23 and 24.

Having now fully described my invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

An ignition system for an internal combustion engine including a flywheel and at least one sparkplug having a pair of electrodes, comprising

a primary oscillatory circuit including a primary winding (30), a first capacitor (C-1), a movable point (23) carried by the flywheel, a stationary point (24) spaced from said movable point by an air gap, and first conductor means (27, 25, 22, 21, 29) con-

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necting in series said primary winding, said capacitor, and said movable and stationary points;

a secondary oscillatory circuit including a secondary winding (32) in transformer coupled relationship with said primary winding, and second conductor means (34, 37, 29) connecting said secondary winding in series with the sparkplug electrodes, said sparkplug having an inherent stray capacitance value (C_{sp}) associated therewith, the LC products of said primary and secondary oscillatory circuits, respectively, being equal;

and means for charging said first capacitor comprising a magneto winding (12) wound on an iron core (11), conductor means (26, 28) connecting said magneto winding in parallel across said air gap points, and permanent magnet means including at least one pair of north and south poles carried by said flywheel for inducing in said magneto winding a pulsating voltage having successive peaks of opposite polarity and unequal magnitude, respectively, said magnet means and said movable point being so arranged relative to said magneto winding and said fixed point, respectively, that the air gap between said points becomes conductive when the voltage induced in said magneto winding is a maximum.

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