

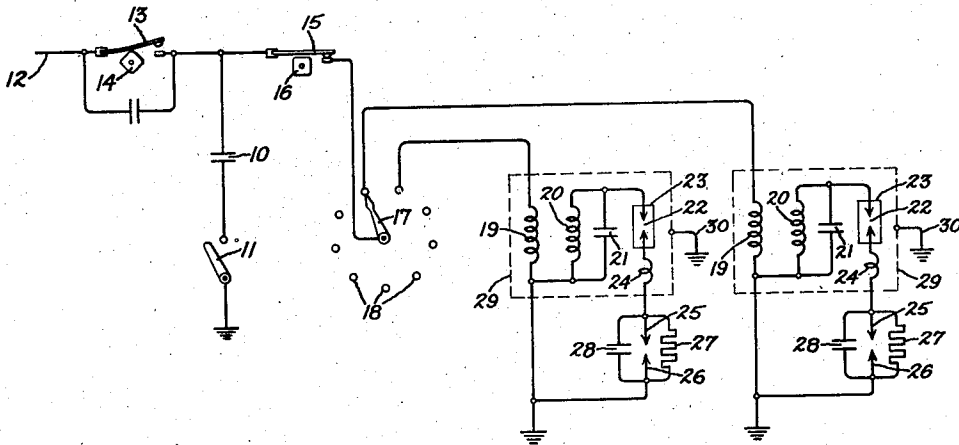
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T. F. ROBINSON ET AL

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IGNITION SYSTEM

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Inventors:
Thomas F. Robinson,
Reginald T. Coe,
Douglas F. Welch,
by *Hany E. Imbhorn*
Their Attorney.

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IGNITION SYSTEM

Thomas F. Robinson, Kenilworth, and Reginald T. Coe and Douglas F. Welch, Rugby, England, assignors to General Electric Company, a corporation of New York

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Our invention relates to ignition systems for internal combustion engines of the type in which the ignition current is generated and distributed at relatively low voltages and is transformed to the requisite high voltage for supply to the spark plugs by individual high voltage transformers for each spark plug. These high tension transformers may be located at the plugs or in the circuits between the distributor and the plugs.

An object of our invention is to provide an improved low voltage ignition system for efficient operation at widely different altitudes.

Another object of our invention is to provide an improved ignition system utilizing a high frequency oscillation discharge circuit provided with a spark gap and means for stabilizing the discharge of the spark gap including a resistance connected across the spark plugs of the system.

Further objects and advantages of our invention will become apparent and our invention will be better understood from the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

The drawing schematically illustrates an ignition system provided with an embodiment of our invention.

In a low tension ignition system, it has been found desirable to provide for the discharge of the spark plugs at a relatively high frequency of a value between 0.5 to 20 megacycles. Under such high frequencies, the rapid rate of voltage rise across the spark plug discharge electrodes provides a sufficient breakdown or sparking voltage even when the plug is heavily fouled by a leakage resistance across the spark plug gap of the order of 1000 ohms. A high frequency impulse or oscillation may be generated by the sudden discharge of a relatively small high voltage capacitance, preferably having a capacity greater than that of the spark plug and its associated circuit, connected across the secondary of a high tension transformer. The discharge is effected at a predetermined voltage by the breakdown of a spark gap connected in series with the high voltage end of the high voltage capacitance and with the central spark plug discharge electrode. This spark gap preferably is of the enclosed pressure gas filled type to provide a quenched spark gap. The voltage across the spark plug gap is partly determined by the voltage breakdown of the series spark gap and the electrical constants of the high voltage capacitance and the spark plug circuit inductance and

capacity. In order to stabilize the breakdown value of the series spark gap, a resistance of predetermined value is permanently connected across the spark plug connected to the gap. The value of this resistance may be of the order of one-half a megohm and may conveniently be included in the spark plug insulator or may be connected across the electrodes and outside of the spark plug. Preferably a series impedance also is included in the lead from the high voltage capacitance to the spark plug in order to limit the current flowing to the plug to minimize the erosion of the spark plug electrode points. This inductance may have a value of a few microhenries and may be located on either side of the series spark gap. This inductance may be replaced by a series resistance, although an inductance is preferable.

Referring to the drawing, I have shown a low voltage ignition system in which a condenser 10 is adapted to be connected by an ignition switch 11 across a suitable source of alternating current electrical power supply 12, such as a magneto, through a circuit breaker 13 arranged to be operated by a suitable cam 14 which is actuated at a predetermined relative speed to the speed of the engine and the frequency of the alternating current supplied by the source 12. This provides for alternately charging the condenser 10 to opposite polarities by the voltage across the source 12 and subsequently discharging the condenser 10 through an ignition circuit which includes a circuit breaker 15 operated by a cam 16 at a predetermined speed and angular position relative to the breaker cam 14, such that when the condenser 10 discharges, the circuit breaker 15 is closed and the circuit breaker 13 is opened, thereby providing for the discharge of the condenser 10 through an ignition distribution circuit to engine spark plugs. The circuit breaker 15 connects the condenser 10 to a distributor including a distributor arm 17 operated at a predetermined speed relative to the cams 14 and 16 to provide for the sequential distribution of ignition voltage to a plurality of distributor electrode contacts 18. Each of these distributor electrode contacts 18 is adapted to be connected to a distribution circuit which includes a transformer having a primary winding 19 and a secondary winding 20. The distribution voltage to the transformer primary winding 19 is of the order of 200 volts.

The desired high frequency impulse is generated in an oscillatory circuit by the sudden discharge of a condenser 21 connected across the transformer secondary winding 20 and takes place

when the voltage across the condenser 21 has built up to a value sufficient to cause breakdown in a discharge path including a spark gap 22 preferably formed in a quenched spark gap device 23 connected in series with a current limiting inductance 24 and the discharge electrodes 25 and 26 of a spark plug. A stabilizing resistance 27 is connected across the spark plug electrodes 25 and 26 and a capacitor 28 is also connected across the spark plug electrodes 25 and 26. The arrangement of the capacitor 28 and resistance 27 across the spark plug electrodes 25 and 26 assures that the discharge circuit including the spark plug will be at substantially ground potential whenever voltage is applied to the transformer primary winding 19. In order to minimize electrical interference with other equipment adjacent the ignition system, a metal casing 29 is arranged about the transformer windings 19 and 20, the condenser 21, the spark gap device 23, and the inductance 24 which form the oscillatory electrical circuit, and this casing 29 is connected to ground in any suitable manner, as by a conductor 30.

While we have described a particular embodiment of our invention, modifications thereof will occur to those skilled in the art. We desire it to be understood, therefore, that our invention is not limited to the particular arrangement disclosed, and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States, is:

1. An ignition system having means including a quenched spark gap for producing high frequency electrical oscillations, a spark plug connected to said high frequency oscillation producing means, and means including a resistor of predetermined value connected across said spark plug for stabilizing the operation of said quenched spark gap.

2. An ignition system including a source of electrical voltage, an oscillating high frequency circuit including a quenched spark gap connected to said source of electrical voltage, a spark plug connected to said high frequency circuit, a capacitor connected across said spark plug, and a resistor of predetermined value connected across said spark plug for stabilizing the operation of said quenched spark gap.

3. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a capacitor connected across said transformer secondary winding and a quenched spark gap connected to said transformer secondary winding for providing a high frequency oscillating circuit, a spark plug connected to said spark gap, and a resistor connected across said spark plug for stabilizing the operation of said quenched spark gap.

4. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a first capacitor connected across said transformer secondary winding and a spark gap con-

nected to said transformer secondary winding for providing a high frequency oscillating circuit, a spark plug connected to said spark gap, a second capacitor connected across said spark plug, and a resistor connected across said spark plug for stabilizing the operation of said spark gap.

5. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a capacitor connected across said transformer secondary winding and a quenched spark gap connected to said transformer secondary winding for providing a high frequency oscillating circuit, an inductance connected in series with said quenched spark gap, a spark plug connected to said inductance, and a resistor connected across said spark plug for stabilizing the operation of said quenched spark gap.

6. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a first capacitor connected across said transformer secondary winding and a quenched spark gap connected to said transformer secondary winding for providing a high frequency oscillating circuit, an inductance connected in series with said quenched spark gap, a spark plug connected to said inductance, a second capacitor connected across said spark plug, and a resistor connected across said spark plug for stabilizing the operation of said quenched spark gap.

7. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a capacitor connected across said transformer secondary winding and a spark gap connected to said transformer secondary winding for providing a high frequency oscillating circuit, an inductance connected in series with said spark gap, a spark plug connected to said inductance, a resistor connected across said spark plug for stabilizing the operation of said spark gap, and a grounded shielding casing arranged about said transformer, capacitor, spark gap, and inductance.

8. An ignition system including a source of electrical voltage, a transformer having a primary winding connected to said source of electrical voltage and a secondary winding, means including a first capacitor connected across said transformer secondary winding and a quenched spark gap connected to said transformer secondary winding for providing a high frequency oscillating circuit, an inductance connected in series with said quenched spark gap, a spark plug connected to said inductance, a second capacitor connected across said spark plug, a resistor connected across said spark plug for stabilizing the operation of said quenched spark gap, and a grounded shielding casing arranged about said transformer, first capacitor, spark gap, and inductance.

THOMAS F. ROBINSON.
REGINALD T. COE.
DOUGLAS F. WELCH.