

[54] SPARK IGNITION SYSTEMS

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[58] **Field of Search** ..... 123/148 E, 149 R, 149 D,  
123/149 C, 148, 149

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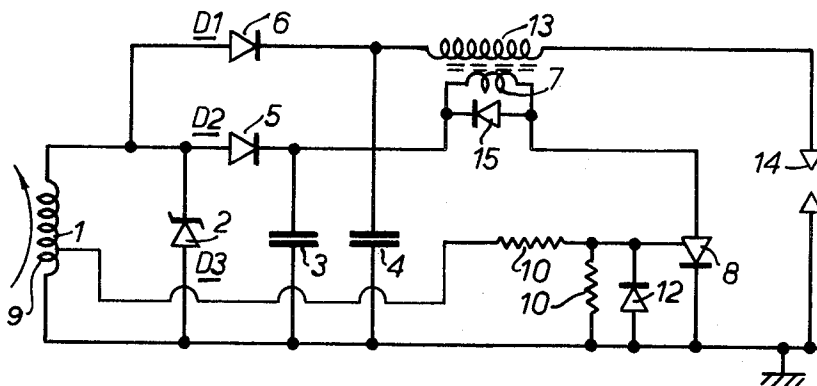
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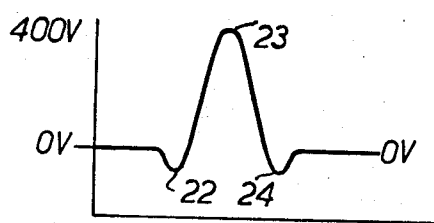
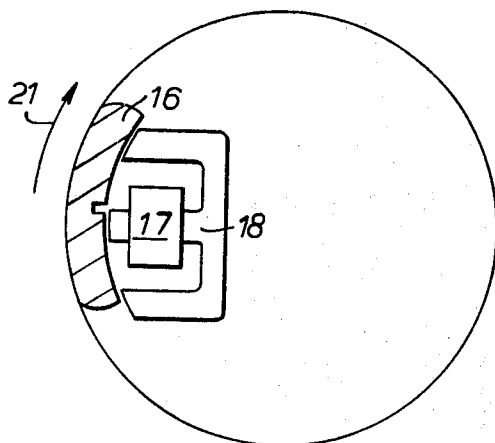
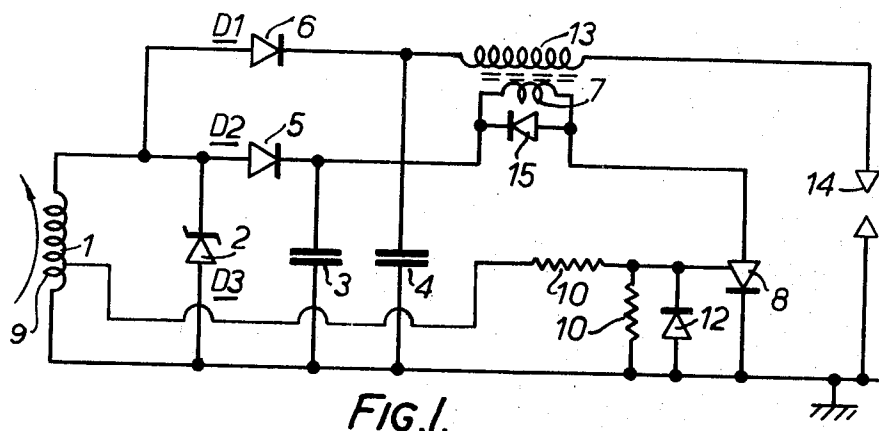
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[57] **ABSTRACT**

A spark generator or ignition system in which an arc is struck by applying an E.H.T. voltage pulse, of some thousands of volts, across a spark gap, and maintaining the spark by the current from the discharge of a capacitor charged only to an H.T. voltage (typically 400v), which produces spark intensifying energy.

### 1 Claim, 3 Drawing Figures





## SPARK IGNITION SYSTEMS

This invention relates to spark ignition systems for internal combustion engines.

According to the present invention we provide an internal combustion engine ignition system comprising a winding, a storage capacitor, a diode through which the storage capacitor is charged by current in one sense induced in said winding by movement produced between the said winding and a magnet operatively associated with said engine, a thyristor responsive to a trigger pulse induced in said winding by said magnet and of opposite sense to the said current, said trigger pulse being effective for rendering conductive the said thyristor so that the said capacitor is discharged through the primary winding of an ignition coil thereby to produce an ignition pulse in the secondary winding of the ignition transformer which is applied to a spark gap of the said engine.

Some exemplary embodiments of the invention will now be described with reference to the accompanying drawings in which

FIG. 1 is a circuit diagram of a magneto driven spark ignition system according to the invention,

FIG. 2 is a generally schematic diagram of the parts of a magneto, and

FIG. 3 is a waveform diagram showing a typical magneto waveform.

Referring now to FIG. 1 the circuit includes a magneto coil 1 in which a voltage pulse is induced of the order of 400 volts and having a configuration as shown in FIG. 3. A zener diode 2 is provided in shunt with the coil 1 to limit the peak value of the voltage developed across the winding. The voltage pulse output from the winding is applied via rectifiers 5 and 6 to capacitors 3 and 4 respectively which are charged to the peak value of the voltage pulse developed across the magneto coil 1. The primary winding 7 of an ignition coil of the system is connected to the capacitor 3 in series with a switch defined by a thyristor 8. The thyristor is caused to conduct by the application of a trigger pulse, the production of which will hereinafter be described, from a pickup coil 9. The trigger pulse is fed to the thyristor gate terminal from the pickup coil 9 via a potential divider consisting of resistors 10 and 11. In order to protect the thyristor from reverse voltage at its gate terminal a diode is connected thereto which conducts if the gate is reverse biased.

In operation of the system, when the thyristor switch 8 is closed by a pulse from the pickup coil 9 the capacitor C1 discharges through the primary winding 7 of the ignition coil and a large induced E.H.T. voltage is developed in the secondary winding 13 of the ignition coil which is applied to across a spark gap 14. The resistance presented by the spark gap 14 drops as the gap ionises and the capacitor 4 which was charged to H.T. voltage, i.e., about 400 volts via diode 6 discharges through the secondary winding 13 to provide spark intensifying energy.

In order to reduce the impedance of the secondary winding to current flowing from capacitor 4 a diode 15 is connected across the primary winding such that the primary winding is effectively short circuited through the diode as the capacitor 4 discharges thus minimising the impedance presented by the secondary winding to the spark intensifying current from capacitor 4.

Referring now to FIG. 2 a magneto suitable for use in the system comprises a rotating magnet 16 and a stationary magneto assembly including a coil 17 corresponding to the magneto coil 1 and pickup coil 9 of FIG. 1 which is mounted on a soft iron pole piece 18. As the magneto coil rotates in the direction of the arrow 21 past the magnet a voltage is induced in the coil which is utilised for spark production purposes. With this arrangement the phases of the windings are arranged such that the signal provided on the pickup coil is in antiphase to the signal induced in the magneto coil. Thus in operation of such a circuit, upon generation in the pickup coil of a first part 22 of the pulse shown in FIG. 3 the thyristor 8 will be switched on but at this stage neither capacitor 3 nor capacitor 4 will be charged and thus no spark will be produced. When the next main part 23 of the pulse arrives capacitors 3 and 4 will be charged through the diodes 5 and 6 respectively. The polarity of this part of the waveform however will not be correct to fire the thyristor 8. When the next and final part 24 of the waveform occurs the thyristor will again be fired to produce, as hereinbefore described, a spark across the gap 14 as the capacitors 3 and 4 discharge sequentially. It will be appreciated that the polarity of the part 24 of the waveform shown in FIG. 3 is opposite to the main part 23 of the waveform and that therefore the part 24 will be blocked by rectifiers 6 and 5 and will not serve to charge the capacitors 3 and 4 but only to discharge the thyristor 8.

In an alternative arrangement of the system of FIG. 1 the diode 6 and the capacitor 4 may be omitted, with the end of the secondary winding to which they were connected, connected to earth. With this arrangement all of the spark energy is fed from the primary winding 7 and no spark intensifying current at H.T. potential is provided.

Although in the foregoing example a magneto coil is shown as an H.T. voltage source it will be appreciated that an alternative suitable source of H.T. voltage may be provided fed from a battery. Such a source may for example comprise a battery driven solid state inverter.

An arrangement as just before described is particularly suitable for use in internal combustion engines utilising magneto ignition and such engines may be two stroke or four stroke engines for use in lawn mowers, outboard motors, chain saws and the like. Although the foregoing examples have been concerned with a pickup coil which forms a part of a magneto assembly, it will be appreciated that the pickup coil may equally well be positioned on or associated with some rotating or other moving part of an engine such that a spark will be produced at the appropriate time as will be well appreciated by those skilled in the art.

It is envisaged that in use of a system according to the invention the ignition coil or coils may be defined by transformers mounted immediately adjacent or on top of a spark plug as described in our co-ending G.B. Patent application Ser. No. 49695/70 and for multi cylinder applications it is envisaged that a system as described in our copending G.B. Patent application Ser. No. 49696/70 may be utilised to provide control signals for the thyristor switches corresponding to the thyristor 8 of FIG. 1.

What we claim is:

1. An internal combustion engine ignition system comprising a winding, a storage capacitor, rectifier

means through which the said storage capacitor is charged by a current of one sense induced in the said winding by relative rotation between the said winding and a magnet operatively associated with the said engine, a thyristor responsive to a trigger pulse induced in the said winding by the said magnet and of opposite sense to the said current, the said trigger pulse being effective for rendering conductive the said thyristor so that the said capacitor is discharged through the primary winding of an ignition transformer thereby to produce an ignition pulse in the secondary winding of the said ignition transformer for application to a spark gap

of the said engine and a further storage capacitor and further rectifier means coupled to the said secondary winding so that in operation of the system the said further capacitor charges contemporaneously with the said storage capacitor through the said further rectifier means and discharges through the said secondary winding of the said ignition transformer consequent upon production of the said ignition pulse thereby to provide current which increases the intensity of the said ignition pulse applied to the said spark gap.

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