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(54) Ignition circuit for internal combustion engine.

(57) A distributorless ignition system utilizes a capacitor discharge arrangement wherein the capacitor (15) is charged by voltage pulses derived from an inverter (14) through an ignition transformer (10). The capacitor (15) which is located in the secondary circuit of the transformer (10) is discharged by a controlled switching device (16) also located in the secondary circuit.

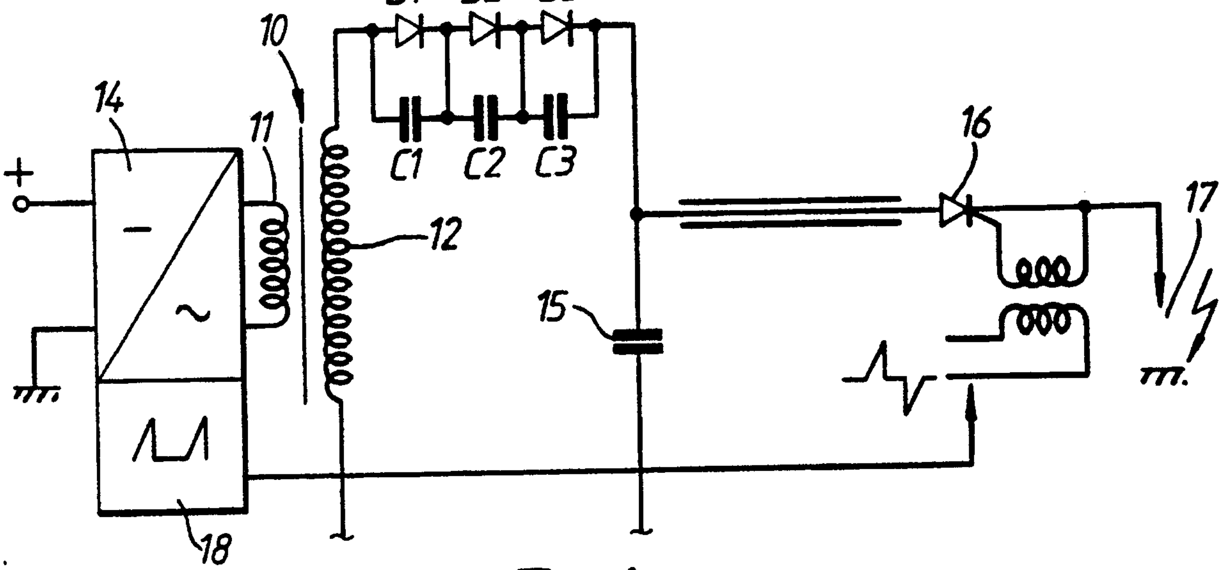

FIG.1.

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Ignition Circuit for Internal Combustion Engine

The present invention relates to an ignition system and particularly a so-called distributorless ignition system for an internal combustion engine where the conventional rotating contact arrangement is replaced by electronic circuitry.

Distributorless ignition systems have been proposed for use with existing internal combustion engines but the advent of lean-mix engines has resulted in the need for a high-energy ignition circuit capable of completely igniting the lean air/fuel mixture in a very short period of time. The present invention proposes that a capacitor/discharge type ignition circuit be utilized.

Capacitor/discharge ignition is well known for conventional ignition circuits utilizing a conventional distributor. In this case, the ignition energy is stored in the electric field of a capacitor. The capacitance and charging voltage of the capacitor determine the quantity of stored energy. The capacitor together with the charging device for the capacitor and the triggering varistor are all customarily located in the primary circuit of the ignition coil and triggering can be achieved either by using breaker-triggered or breakerless devices. It has also been previously been proposed to utilize an inverter to provide high voltage pulses as charging pulses for the capacitor.

The present invention provides an ignition circuit for an internal combustion engine comprising a coil having primary and secondary windings, an inverter for providing voltage pulses, a capacitor for storing voltage pulses and a controlled switching device for discharging the capacitor at a time determined by a timing device, characterized in that the inverter is arranged in the primary circuit of the transformer and in that the capacitor an controlled switching device are connected in the is secondary circuit of the transformer.

This arrangement renders the circuit much more suitable for distributor less ignition systems where it is customary for the timing of the spark to be controlled by a controlled switching device in the secondary circuit.

Preferably, the capacitor is charged from the secondary winding of the ignition transformer via one or more rectifier devices which may be diodes or controlled rectifier devices.

In order that the present invention be more readily understood, embodiments thereof will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 shows a circuit diagram of a first embodiment of the present invention;

Fig. 2 shows a circuit diagram of a modification of part of the circuit shown in Fig. 1;

Fig. 3 shows diagrammatically a three-cylinder ignition system according to the present invention;

Fig. 4 shows diagrammatically a distributorless ignition system where an ignition spark is generated in two spark plugs simultaneously.

Referring now to the drawings, Fig. 1 shows an ignition circuit comprising an ignition transformer 10 having a primary winding 11 and a secondary winding 12. A battery powered inverter 14 supplies voltage pulses to the primary winding of the ignition transformer 10 and high voltage pulses are derived from the secondary winding 12 which are fed via rectifying devices in the form of diodes D1, D2, D3 to a capacitor 15. In this embodiment, the capacitor is a 100 mF 20 kV capacitor which means that the diodes D1, D2, D3 must be high voltage devices and they are preferably provided with shunt capacitors C1, C2, C3 respectively to provide breakdown protection.

As is customary, the charge on the capacitor 15 is discharged when it is required to generate an ignition spark. In this case, discharge of the capacitor is triggered via a controlled switching device 16 connected in series with the spark plug 17. As indicated, the controlled switching device is operated from a timing unit 18 which receives ignition position signals from any suitable sensor.

Various modifications may be made to the above circuitry. For example, as shown in Fig. 2, the secondary winding 12 may be formed by discrete coils located between the diodes D1, D2 and D3. Further, the controlled switching device 16 may be located in a spark plug connector physically attached to the top of the spark plug itself. Also, in view of the fact that the switching device 16 has to be rated at a very high voltage, it may be preferable to utilize a number of series connected switching devices which are triggered simultaneously.

Turning now to Fig. 3, this shows an arrangement which utilizes a single primary winding and battery powered inverter arranged to supply voltage pulses to a plurality of compartmented secondary windings, in this case three secondary windings so as to supply charging voltage pulses to three separate capacitors. Each of the secondary circuits may be as described in relation to Fig. 1.

In Fig. 4 a slightly different arrangement is shown to that described in relation to Fig. 1 but in Fig. 4 the same reference numerals are used to represent the same parts as are used in Fig. 1. In Fig. 4, the controlled switching device 16 is located adjacent the ignition transformer 10 and the capacitor 15 and is connected between one plate of the capacitor 15 and earth whereas the other plate of the capacitor 15 is directly connected to the central electrode of the spark plug 17. For the above arrangement is shown for a positive earth system, it will be appreciated that by reversing the plurality of the diodes and the plurality of the controlled switching device a negative earth system could also be achieved.

Further, because the controlled switching device is on the earth side of the capacitor 15, more than one ignition pulse can be generated simultaneously simply by connecting a plurality of spark plugs in parallel to the other side of the capacitor 15.

It will be appreciated that the compartmented coil arrangement of Fig. 3 could also be adapted to take the secondary circuit arrangement described in relation to Fig. 4.

Claims

1. An ignition circuit for an internal combustion engine comprising an ignition transformer (10) having primary and secondary circuits comprising primary (11) and secondary (12) windings respectively, and inverter (14) in the primary circuit for providing pulses of voltage, a capacitor (15) for storing said voltage pulses, and a controlled switching device (16) for discharging the capacitor at a time determined by a timing device (18) characterized in that the capacitor (15) and controlled switching device (16) are connected in the secondary circuit of the ignition transformer and are arranged to be directly connected to an ignition device (17).

2. An ignition circuit according to claim 1, wherein the ignition transformer (11) comprises one primary winding and a plurality of secondary circuit comprising a compartmented coil, a capacitor (15) and a controlled switching device (16).

3. An ignition circuit according to claim 1 or 2, wherein the capacitor (15) has one plate thereof connected to earth and the other plate connected to the switching device (16).

4. An ignition circuit according to claim 1 or 2, wherein the capacitor (15) has one plate thereof connected via the switching device to earth and the other plate is arranged to be connected to at least one ignition device (17).

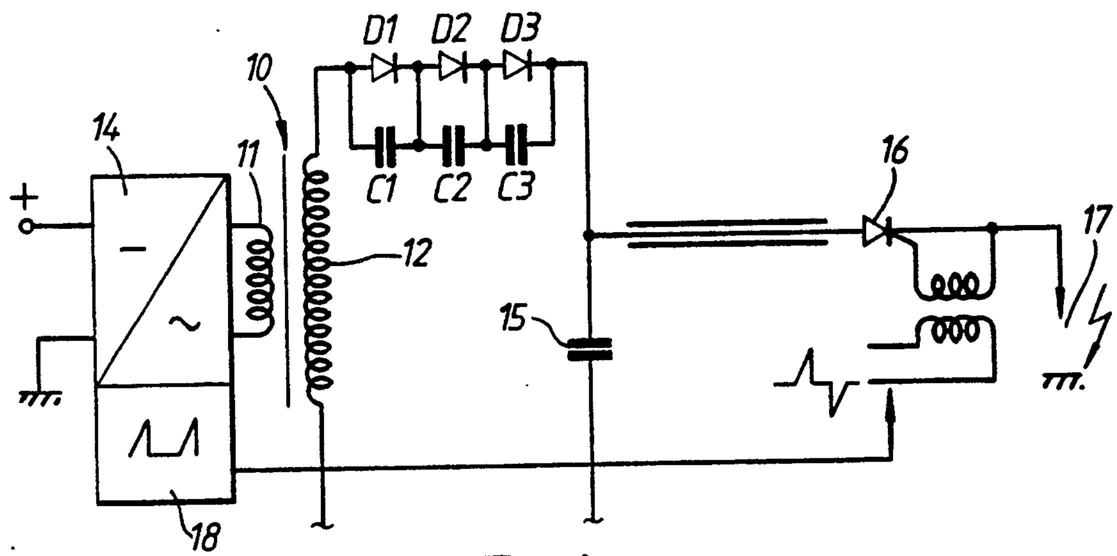

FIG.1.

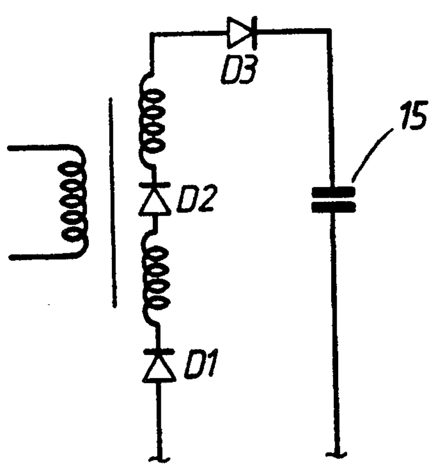

FIG.2.

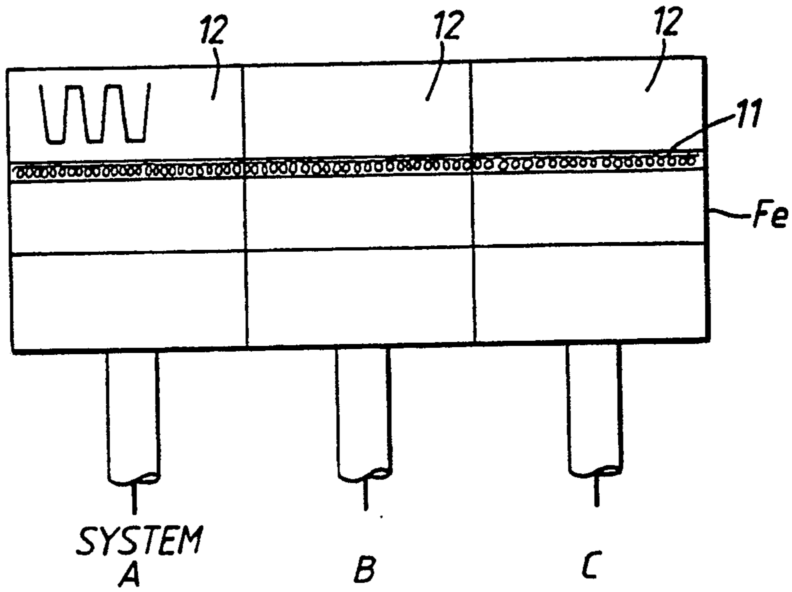

FIG. 3.

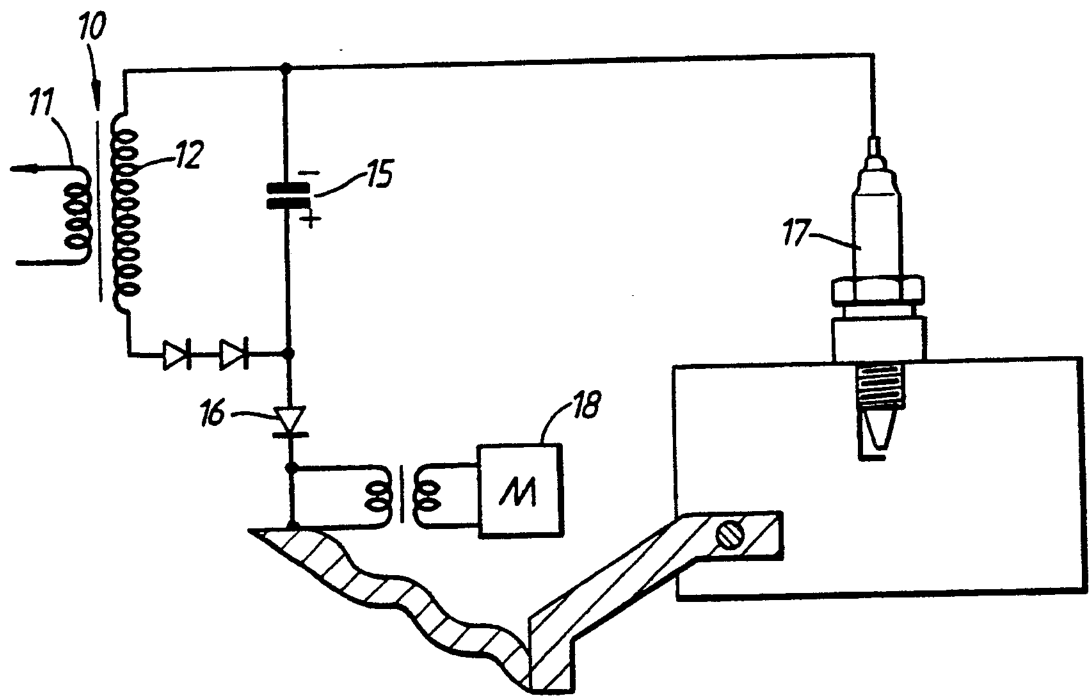

FIG. 4.

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EUROPEAN SEARCH REPORT

Application Number

EP 89 10 0639

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	NL-C- 69 862 (SMITSVONK) * Figure 1; page 1, line 82 - page 2, line 57 * ---	1,3	F 02 P 3/09 F 02 P 7/02
X	FR-A-1 247 459 (RENAULT) * Page 1, left-hand column, lines 19-29; page 2, left-hand column, lines 4-51; figure 4 * ---	1,3	
X A	US-A-4 223 656 (HAMLEY) * Column 2, lines 26-64; column 3, line 14 - column 6, line 35; figures 1-3 * ---	1,3 2	
X	GB-A- 725 619 (SMITSVONK) * Page 1, lines 44-80; page 1, line 92 - page 2, line 29; figure 1 * ---	1,3	
Y	BE-A- 406 990 (R. BOSCH) * Whole document * ---	1	**TECHNICAL FIELDS SEARCHED (Int. Cl.5)**
Y	FR-A-2 378 386 (R. BOSCH) * Page 7; figure 1 * -----	1	F 02 P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	05-09-1989	LEROY C.P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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