

[54] SPARK IGNITION CIRCUITS
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[22] Filed: Feb. 13, 1973
[21] Appl. No.: 332,082
[52] U.S. Cl. 307/314, 307/254, 315/209
[51] Int. Cl. H03k 3/36
[58] Field of Search 307/314; 315/209 T; 123/148 E

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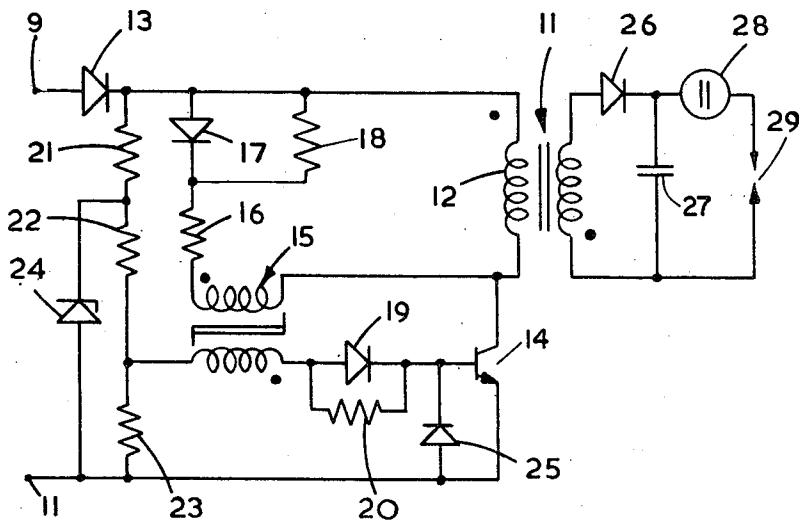
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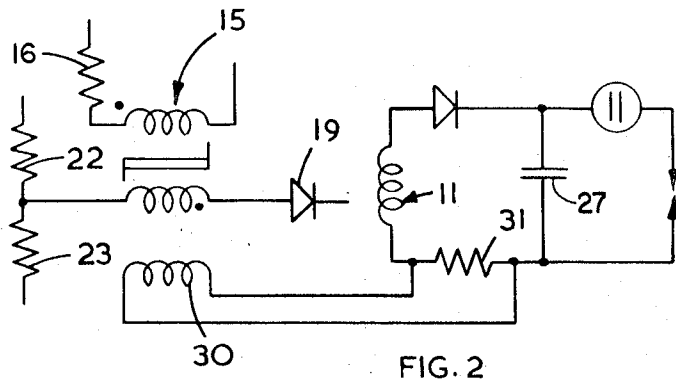
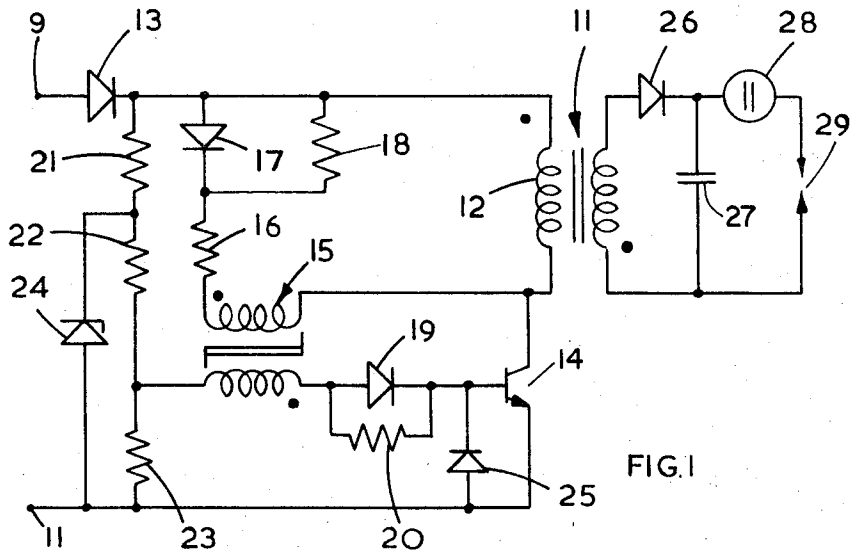
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[57] ABSTRACT

A spark ignition circuit includes an output transformer having a secondary winding, and a primary winding which is connected in series with the collector emitter path of a transistor and the source of d.c. supply. The secondary winding charges a capacitor to a rectifier and the capacitor is discharged periodically through a spark circuit. The circuit further includes a switching transformer having a saturable core, and the switching transformer provides base drive for the transistor during the conduction period thereof, the transistor becoming substantially non-conductive when the core of the switching transformer saturates the core of the switching transformer being reset by the voltage developed in the primary winding of the output transformer when the flux collapses, and by a voltage developed in the circuit of the secondary winding of the output transformer.

6 Claims, 2 Drawing Figures





SPARK IGNITION CIRCUITS

This invention relates to spark ignition circuits of the kind intended to operate from a source of d.c. supply and comprising an output transformer having a secondary winding, a primary winding on the transformer, a transistor having its collector emitter path connected between the primary winding and the source of d.c. supply, circuit means for causing switching of the transistor whereby the primary winding of the transformer is periodically connected to the source of the d.c. supply, a capacitor charged through a rectifier by the voltage developed across the secondary winding of the transformer, and a barrier gap in series with the capacitor and a spark plug, the barrier gap breaking down when the voltage across the capacitor attains a value determined by the barrier gap.

The object of the invention is to provide such a circuit in a simple and convenient form.

According to the invention a circuit of the kind specified includes a switching transformer having a saturable core, the switching transformer providing base drive for the transistor during the conduction period thereof, the transistor becoming substantially non-conductive when the core of the switching transformer saturates.

Examples of ignition circuits in accordance with the invention will now be described with reference to the accompanying circuit diagrams.

With reference to the circuit diagram of FIG. 1 there are provided terminals 9 and 11 for connection to the positive and negative terminals of a source of d.c. supply. Also provided is an output transformer 11 having a primary winding 12 one end of which is connected to terminal 9 by way of a diode 13. The other end of the primary winding of the transformer is connected by way of the collector emitter path of a transistor 14 to terminal 11, the diode 13 provides protection for the transistor in the event that the incorrect polarity is applied to the terminals 9 and 11.

There is also provided a switching transformer 15 having a saturable core and one end of the primary winding of the transformer is connected to the collector terminal of the transistor whilst the other end of the primary winding is connected by way of a resistor 16 to the cathode of a diode 17 the anode of which is connected to a point intermediate the diode 13 and the primary winding 12 of the transformer 11. Moreover, in parallel with the diode 17 is a resistor 18. The secondary winding of the switching transformer has one end connected to the base terminal of the transistor by way of a diode 19 having in parallel therewith a resistor 20. The other end of the secondary winding of the switching transformer is connected to a divider chain including resistors 21, 22 and 23, the divider chain being connected between the terminal 11 and a point intermediate the diode 13 and the secondary winding 12. Moreover, a Zener diode 24 is connected in parallel with the resistors 22 and 23. Also provided is a diode 25 which is connected intermediate the base and emitter terminals of the transistor 14.

In use, when the terminals 9 and 11 are connected to the source of supply a small base current will flow in the transistor and sufficient to cause a small flow of current in the primary windings of the two transformers. The action of the current flowing in the primary winding of the switching transformer is to increase the

base drive to the transistor 14 thereby increasing the flow of current in the primary windings of the two transformers. The effect is cumulative and the transistor is switched hard on. When the core of the transformer 15 is saturated the base drive to the transistor ceases and thereby the transistor is switched off with the result that current ceases to flow in the primary windings of the two transformers. As a result of this action an a.c. voltage is developed across the secondary winding of the transformer 11 and this is rectified by a diode 26 and charges a capacitor 27 during collapse of the flux in the transformer 11. In parallel with the capacitor 27 is a barrier gap 28 and an igniter plug 29 of a gas turbine ignition system. When the capacitor voltage attains a predetermined value the barrier gap 28 breaks down and a spark occurs between the electrodes of the igniter plug 29.

The resistor 16 is provided to limit the current flowing in the primary winding of the switching transformer when the core of the switching transformer saturates. During the period when the transistor is substantially non conducting, the flux in the core of the switching transformer is re-set by the voltage developed in the primary winding of transformer 11 by the collapse of the flux in the core thereof. The purpose of the diode 17 and the resistor 18 is to balance the flux swing of the core. The peak current is substantially independent of variations in the input voltage since it is the switching transformer which determines the conducting time of the transistor. In view of this the spark discharge rate at the igniter plug 29 will be proportional to the supply voltage. The spark rate can be determined by adjusting the value of resistor 18.

In a further arrangement shown in FIG. 2 a further control winding 30 is provided on the switching transformer 15 and is connected in parallel with a resistor 31 which is connected in the secondary circuit of the transformer 11.

During the capacitor charging process the volt/secs per cycle across the winding 30 are high when the voltage across the capacitor is low and reduce as the capacitor voltage increases. The winding 30 is connected to assist the resetting of the core of the switching transformer 15 particularly when the capacitor voltage is low.

We claim:

1. A spark ignition circuit comprising an output transformer having a primary and a secondary winding, a capacitor, half wave rectifier means for charging the capacitor from the secondary winding of the transformer, during collapse of flux therein the voltage across said capacitor being utilized to provide a spark across a spark gap connected across the capacitor, a transistor having a collector emitter path connected in series with the primary winding of the transformer and a source of d.c. supply, the circuit further including a switching transformer having a saturable core, a first winding on said core, a conductive path through which said first winding is connected in parallel with the primary winding of the output transformer, a second winding on said core to provide base drive for the transistor during the conduction period thereof, the transistor becoming substantially non-conductive when the core of the switching transformer saturates, the core of the switching transformer being at least partially reset by the voltage induced in the primary winding of the output transformer during collapse of flux therein, said

3

voltage being applied to said first winding through said conductive path, a third winding on said core and a resistor in series with the capacitor and through which the charging current of the capacitor flows, said resistor being connected in parallel with said third winding, the current flow in said third winding acting to assist re-

setting of the core of the switching transformer.
2. A circuit as claimed in claim 1 in which one end of said first winding of the switching transformer is connected to one end of the primary winding of the output transformer, the other ends of these windings being connected through said conductive path, said conductive path comprising the parallel combination of a diode and a first resistor, the diode being connected to permit current flow through said first winding of the switching transformer when the transistor is turned on.

4

3. A circuit as claimed in claim 2 including a second resistor in series with said parallel combination of said diode and first resistor and said first winding.

4. A circuit as claimed in claim 3 in which one end of said second winding of the switching transformer is connected in series with a further diode to the base of the transistor, the other end of said second winding being connected to the emitter of the transistor by way of a third resistor.

5. A circuit as claimed in claim 4 in which said third resistor is connected in a divider chain across the source of d.c. supply.

6. A circuit as claimed in claim 5 including a Zener Diode connected across a portion of said divider chain including said third resistor.

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