

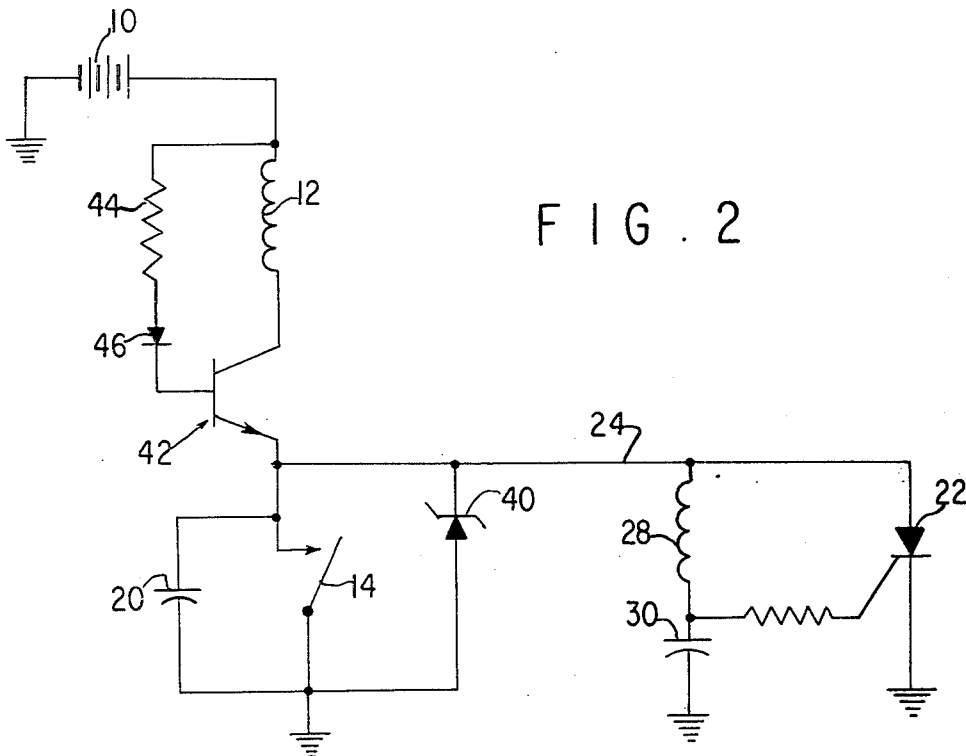
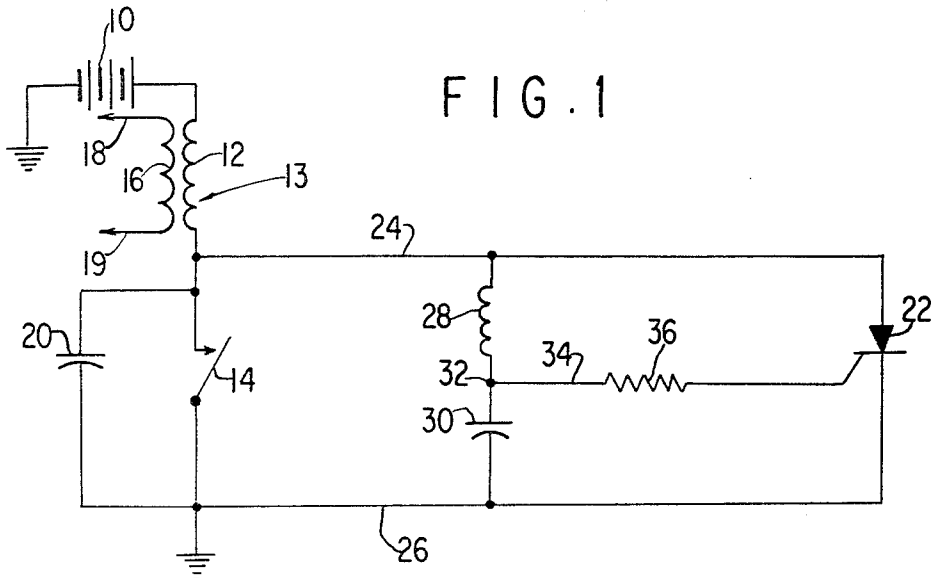
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SWITCHING CIRCUIT

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SWITCHING CIRCUIT

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4 Claims

ABSTRACT OF THE DISCLOSURE

A switching circuit particularly useful for ignition systems in which an energy storing inductance such as the primary winding of an ignition coil is connected in series with a periodically operated interrupter switch, and a SCR switching means provides a bypass circuit around the interrupter switch. A time delay circuitry provides for closing the bypass circuit a predetermined time after opening of the interrupter switch to provide a shunt path around the interrupter and effect buildup of flux in the energy storing inductance prior to subsequent closing of the interrupter.

This invention relates to switching circuits for energy storing inductive devices and more particularly to ignition systems for internal combustion engines or the like.

The present invention is an improvement over the invention described and claimed in copending application Ser. No. 435,303, filed Feb. 25, 1965, now Patent No. 3,363,615, issued Jan. 16, 1968, by the same inventor and has as its principal object the provision of a more simplified transistorized system for accomplishing the objects of the prior invention.

More specifically, it is an object of the present invention to provide a high tension interruptive system in which a silicon controlled rectifier (SCR) or like switching means provides a shunting bypass around the interrupting switch.

A further object is the provision of simplified circuit means for controlling delayed operation of the SCR bypassing means.

A still further object is the provision of a SCR time delayed bypassing circuit in which the voltage applied to the SCR bypassing circuit and interrupter switch is controlled by a Zener diode or the like.

In one aspect of the invention, a SCR switching circuit is connected across the contacts of the interrupter switch so as to directly shunt the interrupter when the SCR is conductive. A timing circuit comprising a series connected impedance and capacitance is also connected across the interrupter switch in parallel with the SCR switch. A connection from the timing circuit provides for gating (turning on) the SCR a predetermined time after the interrupter switch opens thereby to re-energize the ignition coil or the like prior to reclosing of the interrupter switch.

In a second aspect of the invention, a Zener diode or the like may be connected across the interrupter switch to provide a predetermined fixed voltage for the SCR timing circuit and interrupter. This aspect of the invention also provides a simplified control for a transistor connected in series with an ignition coil or the like and the interrupter switch which absorbs the voltage due to inductive reaction of coil when interrupter is opened.

The above and other objects, features and advantages of the invention will be apparent from the following description and the accompanying drawing which illustrates exemplary embodiments of the invention.

In the drawing:

FIG. 1 is a circuit diagram of one form of the invention; and

FIG. 2 is a circuit diagram of a modified form of the invention.

Referring to FIG. 1, there is shown a typical ignition system for internal combustion engines or the like in which a battery 10 provides energy to the primary 12 of a transformer (spark coil) 13 connected in series with an interrupter switch 14. The secondary 16 of the transformer 13 supplies current at high voltage to the spark plugs of the engine through leads 18 and 19 in the usual manner. A capacitor 20 may be connected across the interrupter switch 14 as is well known in the ignition art.

In accordance with the present invention, however, a SCR or like switching device 22 is also connected across the interrupter switch 14 by leads 24 and 26 so as to provide a direct shunt around the interrupter switch when the SCR 22 is closed (rendered conductive). Gating or operation of the SCR switching means is effected by a timing circuit which in the illustrated embodiment is shown as an L/C timing circuit comprising the inductance 28 and capacitance 30 connected in series across the lines 24 and 26. The midpoint 32 between the inductance 28 and capacitor 30 is connected through line 34 and resistance 36 to the control or gating electrode of SCR 22.

In operation, the system operates as follows. When the interrupter switch 14 first opens, the coil or energy storing inductance 12 is de-energized but a voltage begins to build up on the capacitor 30 at a rate depending upon the time constant of inductance 28 and capacitor 30. Once the capacitor 30 is charged to a predetermined level, a gating signal is imposed on the control electrode of SCR 22 and causes the SCR to close thereby effecting a direct shunt around the open interrupter 14. This in turn causes an energizing current to flow through primary coil 12 to store energy therein, which is dissipated through secondary 16 and leads 18 and 19 upon opening of the interrupter switch. The time constant of the L/C circuit 28-30 is such that the SCR 22 is turned on a predetermined time after opening of the interrupter switch 14 and before the reclosing thereof to allow a build up of flux in the energy storing or inductive coil 12.

FIG. 2 illustrates a modification of the invention in which like parts have been given like reference numerals. In this modification, a Zener diode 40 is connected in shunt with the interrupter switch 14 and provides a constant source of voltage for the timing circuit 28-30 and SCR 22 and limits the voltage across the interrupter switch (which prevents burning). The use of this Zener diode has particular significance in a circuit employing a transistor 42 in the main circuit between the battery and the interrupter switch, since it provides a simple means for re-energizing (rendering conductive) the transistor after opening of the interrupter 14. The resistor 44 and diode 46 of FIG. 2 prevents the base-emitter junction of transistor 42 from being reversed biased. The Zener diode 40 may range from 10 to 200 volts but is preferably in the range of 50 to 100 volts.

What is claimed is:

1. In an ignition system or the like which includes a D.C. source of power, an energy storing ignition coil winding and an interrupter switch connected in series, the combination which includes a bypass circuit directly shunting said interrupter switch, a switching means of the gated silicon controlled rectifier type for opening and closing said bypass circuit, a timing circuit means directly connected across said interrupter switch in parallel with said switching means, and means connected to said timing circuit means for gating said switching means to initiate current flow through said ignition winding a predetermined time after opening and prior to reclosing of said interrupter switch.

2. A combination as defined in claim 1 wherein said timing circuit means includes a serially connected impedance and capacitor, directly connected across said interrupter, and said gating means is connected to a midpoint between said impedance and capacitor.

3. A combination as defined in claim 1 in which a constant voltage means of the Zener diode type is connected across said bypass shunt circuit in parallel with said interrupter switch.

4. A combination as defined in claim 3 in which a transistor is provided in the series circuit between the energy storing winding and the interrupter switch, and means is provided for preventing reverse base-emitter bias.

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