

[54] **IGNITION ARRANGEMENTS FOR
INTERNAL COMBUSTION ENGINES**[72] Inventors: **Günter Strüber**, Fleischmannstr. 40;
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123/149 C; 315/209 M, 209 CD, 209 SC;
307/252

[56]

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[57]

ABSTRACT

The alternating current from the engine magneto charges the ignition capacitor on one half-wave and triggers the thyristor to discharge the capacitor on the next half-wave. The discharge current induces in the secondary of the spark coil a high voltage pulse that causes the spark plug to arc.

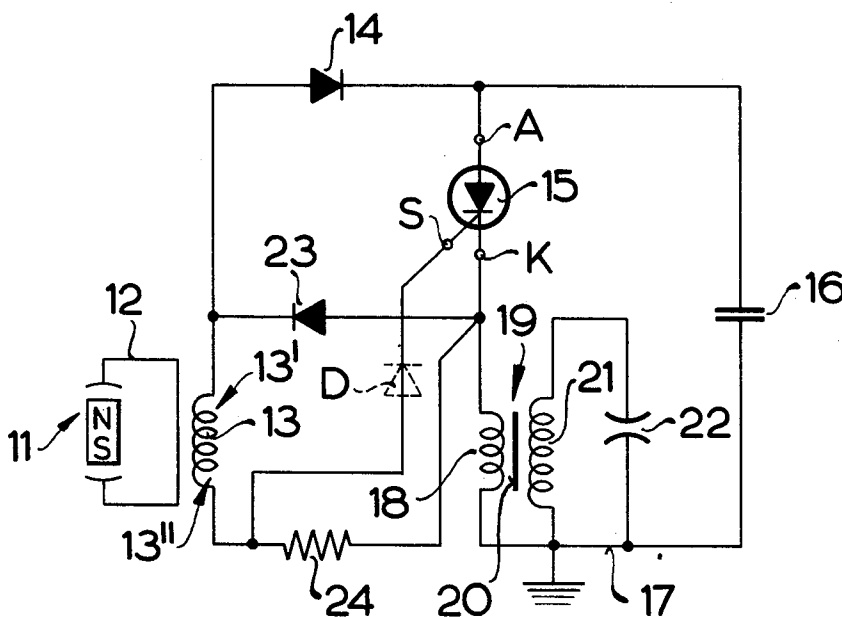
10 Claims, 2 Drawing Figures

FIG.1

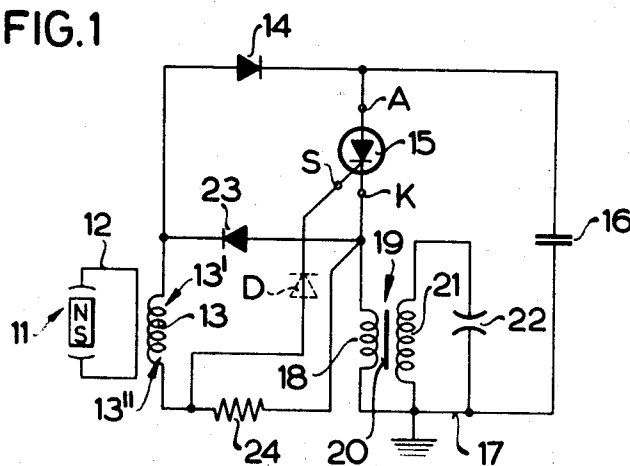
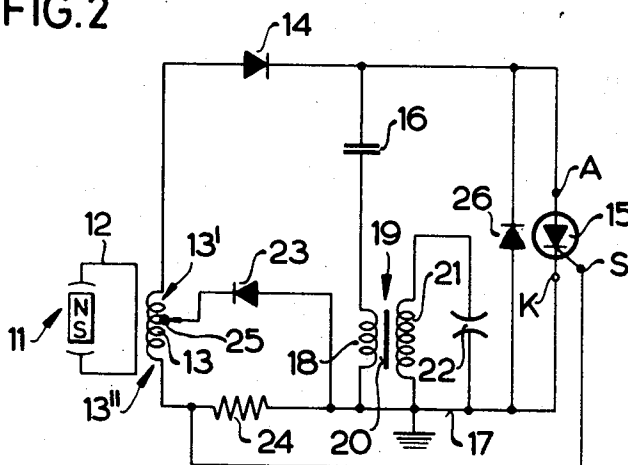


FIG.2



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IGNITION ARRANGEMENTS FOR INTERNAL COMBUSTION ENGINES

BACKGROUND OF THE INVENTION

The invention relates to an ignition arrangement for internal combustion engines, the arrangement having an ignition capacitor that is periodically charged by an alternating current induced in a charge winding by the engine driven magneto. A diode connected in series with the charge winding rectifies the charging current. An electronic switch periodically permits the charged ignition capacitor to discharge through the primary winding of a spark coil, the secondary of which is connected to a spark plug.

Ignition arrangements of this kind are chiefly used where no battery is employed to supply electric power.

In the prior art, these ignition arrangements incorporate a separate control winding for triggering the electronic switch. The mounting of these control windings absorbs a relatively large amount of time and labor.

SUMMARY OF THE INVENTION

An object of the invention is an ignition arrangement of which the charge winding is used both to charge the ignition capacitor and to trigger the electronic switch, thereby eliminating the need for a special control winding.

The invention consists essentially of a charge winding, a magneto magnetically coupled to the charge winding to induce therein an alternating voltage when the engine is running, first rectifying means connected in series with the charge winding at one end thereof, ignition capacitor means connected to the charged by the winding through the rectifying means, electronic switch means having an anode, a cathode, and control electrode, spark coil means having a primary and a secondary, the primary being connected to the ignition capacitor means and to the electronic switch means to permit discharge of the ignition capacitor means when the electronic switch means is conductive, and the secondary being connected to at least one spark plug to spark the latter when the ignition capacitor means is discharged, second rectifying means connected to the charge winding at some point not coincident with the other end of the charge winding, the polarity of the second rectifying means preventing conduction of the latter during that part of the alternating voltage that charges the ignition capacitor means, a voltage dropping resistor connected in series with the second rectifying means and between the other end of the charge winding and the cathode of the electronic switch means, and means electrically connecting the other end of the charge winding to the control electrode.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

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

FIG. 2 is a circuit diagram of a second embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to FIG. 1, the ignition arrangement is intended for an internal combustion engine, not shown. Coupled to the internal combustion engine, is a magneto 11 that is rotated while the engine runs, thereby inducing an alternating voltage in a charge winding 13 mounted on a schematically shown yoke 12. The end 13' of the winding 13 is connected to the anode of a charge rectifier 14, the cathode of which is connected to the anode A of a thyristor discharge switch 15 and to the positive plate of an ignition capacitor 16. The negative plate of the ignition capacitor is connected to a grounding line 17. One end of the primary winding 18 of a spark coil 19 is connected to the grounding line 17, and the other end is connected to the cathode K of the electronic discharge switch 15. The spark coil secondary winding 21, which, together with the primary 18, is wound on a common iron core 20, is connected across a spark plug 22, one end of the winding 21 and one terminal of the spark plug being connected to the grounding line 17.

When the ignition arrangement of the invention is to be used with a multi-cylinder combustion engine, there is provided, in a known manner, an ignition distributor, not shown, which enables a series of spark plugs to be connected consecutively to the secondary 21 of the spark coil 19.

The necessary control voltage, required at the control electrode S, to trigger the thyristor discharge switch 15, is obtained from the charge winding 13. For this purpose, the end 13' of the charge winding 13 is connected to the cathode of a diode 23, the anode of which is connected by a voltage dropping resistor 24 to the other end 13'' of the winding 13. The terminal of the resistor 24 connected to the end 13'' is also connected to the control electrode S, and the other terminal of this resistor is also connected to the cathode K.

In order to prevent excessive negative voltage peaks from being conducted to the control electrode S of the switch 15, it is advisable to interpose at least one protective diode D in the connection between the one terminal of the resistor 24 and the control electrode, the cathode of the diode D being connected to the control electrode and the anode being connected to the resistor. The protective diode D is shown in broken line in FIG. 1.

The ignition circuit just described operates in the following manner. When the internal combustion engine is in operation, the magneto 11 rotates and induces an alternating voltage in the charge winding 13. During the induced half-wave that the winding end 13' is positive, the charge rectifier 14 is conductive; and the ignition capacitor 16 is charged through the voltage dropping resistor 24 and the primary winding 18 of the spark coil 19. Because of the polarity of the voltage, diode 23 does not conduct during this half-wave, so

that a triggering voltage is not conducted to the control electrode S of the switch 15. During the following half-wave, however, the diode 23 does conduct, permitting a triggering current to flow through the voltage dropping resistor 24. The resulting voltage drop across the resistor 24 renders the control electrode S positive with respect to the cathode K, thereby triggering the thyristor and permitting the ignition capacitor 16 to discharge through the thyristor and the primary winding 18 of the spark coil 19. A high-voltage pulse is consequently induced in the secondary winding 21 of the spark coil, and a spark appears across the gap of the plug 22.

The embodiment shown in FIG. 2 differs from that shown in FIG. 1 in that the cathode of the diode 23 is connected to a tap point 25 located between the ends 13' and 13'' of the charge winding 13, and that the thyristor discharge switch 15 and the ignition capacitor 16 are reversed in their positions in the circuit. As a consequence, the diode 23 need not handle the full charging voltage, and the cathode K of the electronic discharge switch 15 is connected to the grounding line 17, both of these features sometimes being advantageous. To ensure a perfectly satisfactory triggering of the switch 15, it is advisable to shunt the latter by a diode 26, the polarity of which is such that the diode conducts in a direction opposite to that in which the switch conducts. Aside from these differences between the two embodiments, the embodiment in FIG. 2 operates in the same manner as that shown in FIG. 1.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of circuits differing from the types described above.

While the invention has been illustrated and described as embodied in ignition arrangements for internal combustion engines, it is not intended to be limited to the details shown, since various modifications and circuit changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. An ignition arrangement for an internal combustion engine including, in combination, a charge winding; a magneto magnetically coupled to said charge winding to induce therein an alternating voltage when the engine is running; ignition capacitor means; first circuit means connecting said charge winding to said capacitor means for charging the same during one polarity of said induced voltage; second circuit means connected in a series loop circuit comprising; at least a part of said charge winding, a rectifying means, and including resistor means for generating a signal

thereacross during the other polarity of said induced voltage; and switch means for discharging said capacitor means in response to generation of said signal having a pair of electrodes connected directly across said resistor.

2. An ignition arrangement as defined in claim 1, wherein said charge winding has first and second ends, and said first circuit means includes an other rectifying means connected between said first end and said capacitor means and arranged to conduct current from said charge winding to said capacitor means; said switch means comprises a thyristor, and said electrodes are the control and cathode electrodes of the said thyristor, the anode electrode of said thyristor being connected to a point between said other rectifying means and said capacitor means.

3. An ignition arrangement as defined in claim 2, wherein the first mentioned rectifying means comprises a diode connected between said cathode electrode and a point on said charge coil intermediate said first and second ends and arranged to conduct current from said cathode electrode to said point; and wherein said resistor means is connected between said cathode electrode and said second end of said charge winding, whereby said second circuit means is prevented from conducting current during said one polarity but only during said other polarity to thereby develop said signal across said resistor means.

4. An ignition arrangement as defined in claim 3, wherein said ignition arrangement has at least one spark plug, and further comprising spark coil means having primary and secondary windings, said primary winding being connected to said capacitor means and to said cathode electrode to permit discharge of said capacitor means when the anode-cathode path of said thyristor is made conductive, and said secondary winding being connected to at least one spark plug to spark the latter when said capacitor means is discharged.

5. An ignition arrangement as defined in claim 3, further comprising at least one diode connecting said control electrode to a point connecting said second end of said charge winding and said resistor means.

6. An ignition arrangement as defined in claim 2, wherein the first mentioned rectifying means comprises a diode connected between said cathode electrode and said first end of said charge winding.

7. An ignition arrangement as defined in claim 3, wherein said charge winding has a tap at said intermediate point.

8. An ignition arrangement as defined in claim 7, wherein said primary winding and said electronic switch means are connected in series.

9. An ignition arrangement as defined in claim 4, wherein said capacitor means is connected in series with said primary winding of the spark coil and said thyristor is connected in parallel with the series connected ignition capacitor means and primary winding.

10. An ignition arrangement as defined in claim 9, further including diode means shunted across said thyristor, the polarity of said diode means being such that the latter is non-conductive when said electronic switch means is conductive.

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