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TRANSISTOR IGNITION SYSTEM FOR GAS ENGINES

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FIG. 1

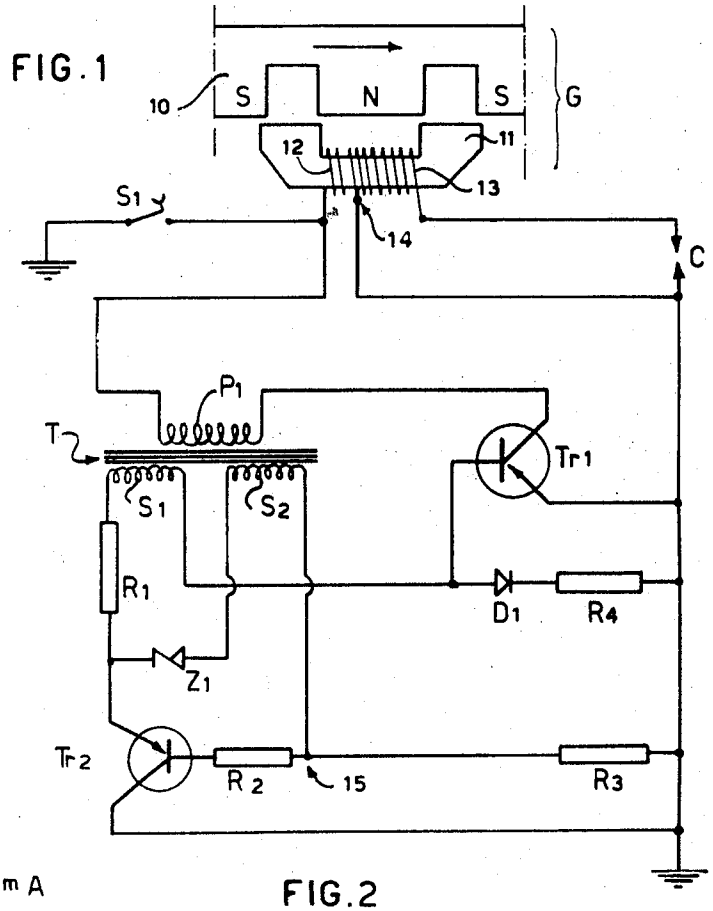
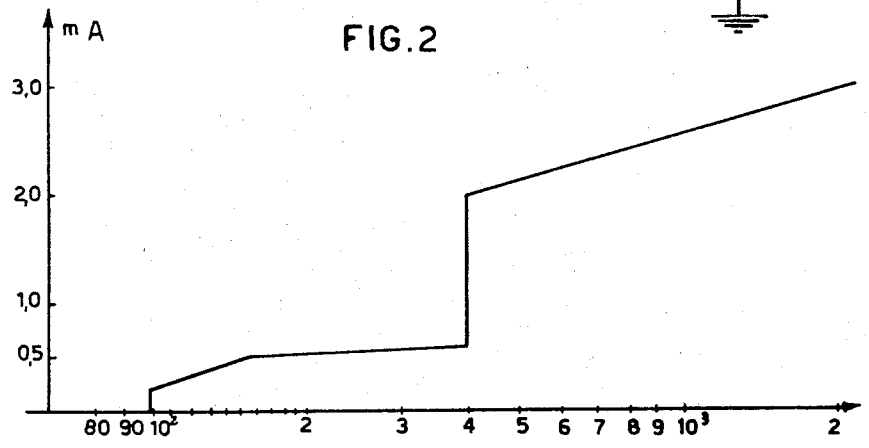


FIG. 2



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TRANSISTOR IGNITION SYSTEM FOR GAS ENGINES

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ABSTRACT OF THE DISCLOSURE

A transistorized magneto for internal combustion engines comprising a transistor for breaking the primary current and means responsive to the speed of the motor for regulating the base current of said transistor.

This invention relates to ignition systems for internal combustion engines, in which the contact breaker in the primary circuit is replaced by a transistor.

Generators suitable for use in such systems have the characteristic of supplying at intervals and in the periods of time immediately before and after the instant of ignition, a substantially sinusoidal primary voltage wave, comprising a powerful half-wave of a certain polarity (which may be negative), extending over 180° of the electrical cycle, interposed between two weak quarter-waves of contrary polarity (i.e., in this case positive) each extending over 90°, the breaking of the primary current being carried out at the peak of said sinusoidal wave. In order to obtain this effect it is necessary to have a magnet and an armature operating in synchronism with the rotation of the motor, one of which has three poles, while the other has only two, which at a certain fixed instant of the relative motion between the magnet and armature extend as a bridge between the central pole and the corresponding side poles of the three pole component.

One of the objects of this invention is to provide, in combination with a generator of the above type, a transistor ignition circuit, in which the breaking transistor is controlled by the primary current of the generator so as to operate at exactly the right moment to interrupt the primary current and be locked in its interrupting position. Generally speaking, the device according to this invention is characterized by the fact that it comprises in combination with a generator of the specified type a locked oscillator, supplied by the primary generator winding and including the breaking transistor.

According to a more specific characteristic the base current of the breaking transistor is automatically regulated by a pilot transistor, which is in turn regulated by a transformer winding of the oscillator through a threshold element, for example a Zener diode, so that its base current is reduced when the motor exceeds a certain number of revolutions per minute.

A preferred embodiment of my invention is illustrated in the accompanying drawings, in which:

FIGURE 1 is an electrical diagram of the ignition system, and

FIGURE 2 is a graph showing the average current (in milliamperes) in the secondary winding of the generator as a function of the number of motor revolutions per minute, according to the preferred embodiment of the invention.

In FIGURE 1, G indicates a generator of the flywheel type comprising a magnet **10**, having a plurality of poles, which forms part of the flywheel rim and passes before a two pole inductor **11**. The inductor carries a low voltage primary winding **12** and a high voltage secondary winding **13**, with a common terminal **14**, connected to ground.

The high voltage winding **13** supplies a spark plug C of the motor, which is, in the illustrated embodiment, a single cylinder motor.

When the inductor **10** rotates, an $E=f(t)$ sinusoidal wave is generated in the primary winding **12**.

Tr**1** indicates the breaking transistor which, together with the primary winding **12** of the generator and a transformer T, forms a locked oscillator. The collector-emitter path of the transistor Tr**1** is connected in series with the winding **12** of the generator and with the primary winding *p***1** of the transformer T. This comprises a conventional secondary winding *s***1**, one end of which is connected to the base of the transistor Tr**1**, while its other end is connected through a limiting resistance R1 to the emitter of a pilot transistor Tr**2**. The base of the breaking transistor Tr**1** is also connected to ground through a resistance R4 in series with a diode valve **1** protecting it against inverse currents. The collector of the pilot-transistor Tr**2** is directly connected to ground, while its base is connected to ground through a series of two resistances, R2 and R3. Finally, the transformer T comprises a secondary control winding *s***2**, one end of which is connected to the point **15** between the resistances R2 and R3, while its opposite end is connected to the emitter of the transistor Tr**2**, through a Zener diode Z1. The "live" end of the primary winding **12** of the generator may be connected to ground through the ignition switch S1, of the motor.

This engine operates in the following manner:

At low speeds, for instance below 400 revolutions per minute of the motor, the circuit acts as a locked oscillator. The windings P1 and *s***1**, of the transformer T are connected as in a conventional magneto ignition system. Under these conditions, with the components suitably proportioned, the voltage induced in the secondary winding *s***2** of the transformer T is smaller than the threshold voltage of the Zener diode Z1. The object of this secondary winding *s***2** is to keep the breaking transistor Tr**1** locked for a certain period of time after the breaking. At high speeds, that is when the motor runs at more than 400 revolutions per minute, the voltage induced in the secondary winding *s***2** exceeds the threshold voltage of the Zener diode Z1. It thus reduces the base current of the transistor Tr**2** and keeps the breaking transistor Tr**1** locked in the proper phase.

A practical embodiment of the device illustrated in FIGURE 1 may comprise the following components:

Generator G:
- Primary winding **12**: 100 turns; diameter=0.8 mm.
- Secondary winding **13**: 15,000 turns; diameter=0.06 mm.

Transformer T:
- Primary winding P1=19 turns; diameter=0.5 mm.
- Secondary winding *s***1**=380 turns; diameter=0.3 mm.
- Secondary winding *s***2**=190 turns; diameter=0.3 mm.

Transistor Tr**1**: ASZ 15
Transistor Tr**2**: ASY 80
Zener diode Z1: OAZ 206
Diode D1: OA 200
Resistance R1: 3.3 ohm—power absorbed about ¼ watt
Resistance R2: 820 ohm—power absorbed about ⅛ watt
Resistance R3: 820 ohm—power absorbed about ⅛ watt
Resistance R4: 390 ohm—power absorbed about ⅛ watt

With these components the average current in the secondary winding **13** of the generator G, as a function of the motor revolutions, is as illustrated in FIGURE 2 (at room temperature, i.e., 25° C.).

The foregoing embodiment has been described purely by way of example and may be modified as to detail without thereby departing from the basic principles of the invention, as defined by the following claims.

What is claimed is:

1. An ignition system for internal combustion engines, comprising:
(a) a generator having a primary winding,
(b) a transformer having a primary winding, a first secondary winding and a second secondary winding,
(c) a first transistor,
(d) said primary winding of said generator, said primary winding of said transformer and said first transistor being connected in a series circuit,
(e) a second transistor,
(f) said first secondary of said transformer providing base current for said first transistor,
(g) a Zener diode connected to said second secondary winding and said second transistor,
(h) said second transistor being operative to control, when the breakdown voltage of said Zener diode is exceeded, the conductive state of said first transistor.

2. An ignition system as set forth in claim 1 wherein, said generator is of the magneto type.

3. An ignition system as set forth in claim 1 wherein:
(a) the conductive state of said first transistor is determined, at low engine speeds, by the direction of its collector current, and
(b) the conductive state of said first transistor is determined at high engine speeds, by the conductive state of said second transistor.

4. An ignition system as set forth in claim 3 further comprising:
(a) a secondary winding on said generator,
(b) a spark plug connected between said secondary generator winding and ground,
(c) wherein a voltage is developed in said generator primary winding as a function of the rotation of said engine,
(d) a change in conduction of said first transistor causes a voltage to be induced in said generator secondary winding, and
(e) said voltage in said generator secondary winding is applied to said spark plug.

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123—148, 1; 315—209