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SPARK IGNITION APPARATUS FOR INTERNAL COMBUSTION ENGINE

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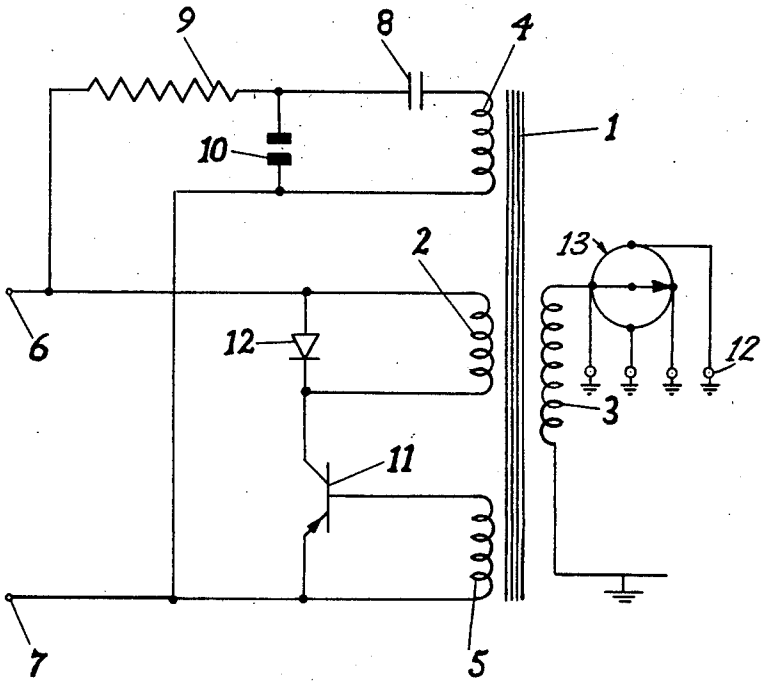

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SPARK IGNITION APPARATUS FOR INTERNAL COMBUSTION ENGINE

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This invention relates to spark ignition apparatus for internal combustion engines, and of the kind including an ignition coil.

Ordinarily, the coil comprises a primary and a secondary winding mounted on an iron core, and current is supplied to the primary winding from a storage battery through a rotary interrupter driven by the engine. One of the factors which adversely affects the efficiency of an ignition coil of conventional construction is associated with sparking at the interrupter contacts and the amount of electromagnetic energy which can be transmitted through the coil is limited by the amount of current which can be effectively controlled by the interrupter.

The primary object of the present invention is to provide an ignition coil in a form whereby the above disadvantage can be minimised or obviated.

An ignition coil in accordance with the invention comprises a primary winding, a secondary winding, a pilot winding, and a control winding all mounted on an iron core, the function of the pilot winding being to effect excitation of the control winding by an intermittent current supplied under the control of an interrupter, and the function of the control winding being to control a transistor through which energising current is supplied to the primary winding.

The invention further resides in an ignition system comprising a coil as specified in the preceding paragraph, an interrupter for controlling the supply of current from a battery to the primary winding, a transistor for controlling the supply of current from the battery to the primary winding, and a diode interconnecting the ends of the primary winding.

An example of the invention is illustrated diagrammatically in the accompanying drawing.

Referring to the drawing there is provided an ignition coil comprising an iron core **1** on which is mounted a primary winding **2** capable of generating the required magnetc flux in the core **1** by a current supplied from a source of direct or rectified alternating current such as, for example, a 12-volt battery. Also on the core are mounted a secondary winding **3** adapted to produce the required sparking voltage and connectible to the engine spark plugs **15** in turn through a distributor **14**, a pilot winding **4** and a control winding **5**.

There is further provided a pair of terminals **6**, **7** adapted for connection to the battery so as to be of negative and positive polarity in use respectively. One end of the winding **4** is connected to the terminal **6** through a capacitor **8** and a resistor **9**, whilst the other end of the winding **4** is connected to the terminal **7** and through an engine-driven interrupter **10** to a point intermediate the capacitor **8** and resistor **9**. Further, one end of the winding **2** is connected to the terminal **6**, whilst its other end is connected to the terminal **7** through the collector and emitter terminals of a p-n-p type transistor **11**, the base terminal of which is connected to the terminal **7** through the winding **5**. Moreover, the ends of the winding **2** are bridged by a diode **12**.

In operation, whilst the interrupter **10** is open the capacitor **8** is charged. On closing of the interrupter **10**, however, the capacitor discharges through the winding **4**. The resulting partial magnetisation of the core **1** includes a voltage in the winding **5**, which initiates the action of the transistor **1**. Current is passed through the transistor to the winding **2**, increasing rapidly by regenerative action and thereby causing rapid magnetisation of the core, and inducing a high voltage in the winding **3**. The primary current reaches its peak value (at which the core is magnetically saturated) in a very short period; when this value is reached, there is no further change of flux in the core, and no further energy fed back to the winding **5**. The transistor thus reverts to its initial state and interrupts the current in the primary circuit. The back E.M.F. induced in the winding **2** by the switching off of the transistor is conducted through the diode **12**, which suppresses high voltage peaks which would otherwise damage the transistor.

If desired, either of the terminals **6**, **7** could be earthed, but preferably the terminal **7** is earthed so as to obviate the need for insulating both contacts of the interrupter **10**. Further, with suitable modifications an n-p-n- transistor could be employed.

Since the current required in the pilot circuit is small, no serious result can follow from any small amount of sparking that may occur at the interrupter contacts. Consequently, a greater uniformity of action occurs in the secondary winding, both as regards the timing of the discharge and the energy content of the sparks at the sparking plugs of engine. The arrangement illustrated has the additional advantage that the danger of large currents being drawn through the pilot winding in the event of the engine becoming stalled with the interrupter closed is obviated.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

Spark ignition apparatus for an internal combustion engine, comprising a direct current source, an ignition transformer having a core, a primary winding on the core connected to the direct current source, and a secondary winding on the core connectible through a distributor to spark plugs of the engine in turn, a monostable oscillator operation of which causes rising current to flow in the primary winding to induce a spark at one of said plugs, said oscillator including a transistor in series with the primary winding, a control winding on the core connecting the base and emitter of the transistor for providing feedback thereto, a pilot winding on the core for inducing a voltage in the control winding, one end of the pilot winding being connected to one terminal of the direct current source, and a capacitor and resistor connected in series between the other end of the pilot winding and the other terminal of the direct current source, the apparatus further including an interrupter driven by the engine and connected across the pilot winding and capacitor for operating the oscillator, upon closing of the interrupter, in timed relationship to the engine, and a diode connected across the primary winding for absorbing back electromotive force induced therein after the production of each spark.

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