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TRANSISTOR IGNITION

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1 Claim. (Cl. 123-148)

This invention relates generally to the field of transistorized ignition for internal combustion engines, and more particularly to an improved form thereof in which the circuitry is materially simplified as contrasted with existing prior art devices, with an accompanying improved operation, durability and lowering of cost. Devices of the present type are known in the art, and the invention lies in specific constructional details permitting such improved results.

It is among the principal objects of the present invention to provide an improved transistorized ignition in which there is no battery current drain except during the period when the transistor elements are conductive.

Another object of the invention lies in the provision of an improved transistorized ignition system in which there has been a complete elimination of capacitor type elements, and in which the need for energy storing devices which are discharged at the moment of ignition has been completely eliminated.

Yet another object of the invention lies in the provision of an improved transistorized ignition circuit including means for regulating the degree of gain of a signal received from the distributor shaft driven magnetic pick-up, so that output voltage is maintained at a maximum during periods of low revolutions per minute, as for example when the engine is starting, and is tapered off, as the revolutions per minute increases.

A further object of the invention lies in the provision of an improved transistor ignition circuit employing a selective pulse amplifier, utilizing only negative pulses from the magnetic pick-up.

A feature of the invention lies in the fact that no adjustments are necessary once the device has been installed upon an internal combustion engine.

These objects and features, as well as other incidental ends and advantages, will more fully appear in the progress of the following disclosure, and be pointed out in the appended claim.

In accordance with the invention, the device, generally indicated by reference character 10 includes first and second signal pick-up elements 11 and 12, which are driven by the distributor shaft 13 of the internal combustion engine upon which the device is installed. The signal pick-up elements each include a magnetic pole piece as at 14-15, and a coil at 16 and 17, the coils 16 and 17 being series connected by a conductor 18 therebetween. In the preferred embodiment, the pole pieces 15 and 16 are not exactly 180° apart, providing a degree of overlap for a longer signal period.

The series output of the signal pick-up elements 11 and 12 is fed to the base 19 of a first transistor 20 of moderate gain PNP type. The collector 21 of the transistor 20 is grounded. The emitter 22 is connected to the primary winding 24 of a transformer 25. The secondary winding 26 is connected to the base 29 of a second transistor 30 of moderate power PNP type.

The second transistor 30 has a grounded collector 31, the emitter 32 being connected through a silicon rectifier 33 to the base 34 of a power transistor 35.

The power transistor 35 has a grounded collector 36, and the emitter 37 thereof is connected to the primary winding 24 of the transformer 25 for feedback. A resistor 39 interconnects the base 34 and emitter 37. A zener diode 38 provides protection to the third transistor by limiting voltage surges from the ignition coil during

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discharge by maintaining the voltage at the emitter 31 within a safe level.

Amplified current passes through the output coil 41, the primary winding thereof 40 being provided with a ballast resistor 43, and subsequently connected to the positive side of the battery system. The secondary winding 44 carries the ignition voltage as is well known in the art.

Resistors 45 and 46 are connected in series with the battery source (normally 12 volts) at 47. At 48, the same are connected to the junction of the zener diode 38, the emitter 37 of the transistor 35, the secondary return 49 of the secondary winding 44, and the resistor 39.

Lead 50 connects the junction 52 of resistors 45 and 46 and the secondary winding of the transformer 25. Lead 51 connects to junction 52 and to the coil 17, as well as to the base of transistor 20. Junction 52 provides a variable voltage to the transistors 20 and 30 for purposes of control, whereby the circuit is stabilized over the useful range of revolutions per minute of the engine. For example, when the engine is turning over very slowly, as at starting, the stabilizing voltage is divided by the action of transformer or ignition coil 41, and the control voltage is lowered. This permits the transistor 20 and 30 to function at lower levels.

By comparison, when the revolutions per minute are relatively high, for example 600 or more, the control voltage is higher and the transistors 20 and 30 are operating at relatively higher level operation.

During operation, as the pole pieces 44 pass the coils 16 and 17, an alternate current voltage is produced and added by the coils. This voltage triggers the first transistor 20 into conduction, and thereby allows the pulse to be inducted into the transformer 25 which then amplifies the pulse and triggers the second transistor 30 into conduction. A pulse is created each time the magnets pass the coils, and no current from the battery will flow unless the pulse is generated by the system. This follows from the fact that the positive portion of the pulse adds to the reverse bias provided by the battery voltage source through the coils 16 and 17.

The amplified pulse is then fed to the silicon rectifier 33, and a bias voltage proportional to the amplified pulse is developed and fed to the third transistor 35 which then passes current through the ignition coil. Due to the presence of the diode 33, only negative pulses are passed to reflect triggering action.

It will be observed that both negative and positive pulses are used for transformer multiplication, and by the presence of the diode, only the useful half passed through to the third transistor. The amplifier is thus selective in nature, and this fact makes possible direct coupling in the absence of condensers.

In contrast to existing transistor ignition systems, the transistors 20, 30 and 35, and diode 33 serve only the purpose of shaping generated pulses, as contrasted with the existing techniques of using transistors as oscillators which are triggered by the generated pulse from the ignition system. Thus, on a comparable basis, there is virtually no current drain during periods of non-conductivity.

It is to be observed that the primary winding of the ignition coil 41 does not saturate between pulses, as is the case with ordinary ignition systems, as the only current it receives is the amplified pulses from the emitter of transistor 35. Thus, the efficiency of the coil is improved, and a higher turn ratio between primary and secondary windings may be used. In addition, since the transistors are operating at a relatively low duty cycle, they run at substantially cooler temperatures, with correspondingly improved useful lives.

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I wish it to be understood that I do not consider the invention limited to the precise details of structure shown and set forth in this specification, for obvious modifications will occur to those skilled in the art to which the invention pertains.

I claim:

In a transistorized ignition, first and second signal pick-up elements connected in series, distributor shaft driving means operating said signal pick-up elements, a first transistor receiving the output of said signal pick-up elements, a second transistor, transformer means interconnecting said first and second transistors, a third transistor, silicon diode rectifier means interconnecting said second and third transistors, said third transistor being connected to the primary winding of an ignition coil; 15 feed back means interconnected the secondary winding

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of said ignition coil with said transformer and said pick-up elements for regulating the operating level of said first and second transistors, and zener diode means regulating the safe operating voltage of said third transistors.

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