

Capacitor Discharge Ignition

ELECTRONIC IGNITION SYSTEM WILL PROLONG LIFE OF POINTS AND PLUGS ON OLDER CARS AND INSURE EASIER COLD STARTS

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While we all recognize the desirability of a 100% stock vehicle, an electronic ignition can greatly ease the problems of starting an older vehicle as well as prolonging the life of the points and plugs (which are sometimes hard to get). The capacitor discharge ignition system described in this article can be installed on any vehicle with a 6V coil/breaker point ignition system; it cannot be used with a magneto. The ignition system should be mounted in a relatively cool location away from the battery - under the dash is ideal. It should be installed in such a way that when it is removed, the car is again stock. This allows using the ignition system for regular driving while removing it for club events or judging where authenticity is important.

A capacitive discharge (CD) ignition consists of three main elements: an oscillator and transformer for generating high voltage, a capacitor for storing the energy, and a silicon controlled rectifier (SCR) for discharging the energy into the coil. Because the ignition energy is generated electronically, the points will last almost forever (the rubbing block eventually wears out), and cold starting is much easier.

Circuit Description

Figure 1 shows the schematic for a negative ground ignition. Q1, Q2, and the transformer form a free running oscillator which generates a high voltage at the transformer secondary. This voltage is rectified by the diode bridge (D1-D4) and applied to the energy storage capacitor. The low side of the capacitor is grounded through the coil primary winding. R3 provides a leakage path to safely discharge the capacitor when power is removed.

Q3, R5, R6, and the 6.1 uf capacitor are a one shot circuit to generate short trigger pulses for the SCR. A conventional SCR trigger circuit with a coupling capacitor will not work due to the low voltage available when cranking the starter motor. When the points first open, the gate of the SCR is raised to 6V through R5, because Q3 is off. When the 0.1uf capacitor charges above 0.7 V, Q3 turns on, thus removing the SCR gate voltage.

R4, D5, D6, and the 0.01uf capacitor provide transient damping to protect the SCR. The SCR itself is just a silicon switch which grounds one side of the energy storage capacitor when it is triggered.

This allows the capacitor to discharge through the coil primary. When fully discharged, current through the SCR changes direction due to the "flywheel" effect of the coil inductance. This turns the SCR off, and allows the remaining energy in the coil to be restored to the capacitor.

Figure 2 shows the changes needed to Figure 1 to build a positive ground system. This involves PNP transistors in the oscillator and a simple inverter to drive the SCR trigger circuit. Six volt power for the inverter is tapped off the oscillator at the transformer primary.

Construction

Mount the large components (T1, Q1, Q2, SCR) to heavy aluminum for heat sinking and structural support. The remainder of the circuit is built on 0.1 inch perforated glass/epoxy board. The particular physical layout chosen is not critical and should be selected to simplify the particular installation. If the circuit is to be mounted under the hood, or in any other unprotected area, be sure to enclose the components to prevent problems with moisture. If radio interference is encountered once the circuit is built, standard suppression techniques such as a 0.25uf bypass capacitor from the input to ground will prove effective.

This project is obviously not one for someone who has never soldered before, however, there are few parts, layout is not critical, and checkout is simple, so anyone who can read the schematic should have no problems.

Testing

1. Connect the circuit to 6V power, and verify that 100-300 VDC is present at the output of the bridge. The system should put out a high pitched whine as soon as power is connected. If nothing happens, disconnect the diode bridge and try again. This will isolate the problem to the oscillator or bridge.

2. When power is present at the bridge output, connect the circuit to a spare ignition coil, and ground the points lead. Apply power. When the lead is opened, there should be a real solid spark from the coil.

(Text continued on page 10)

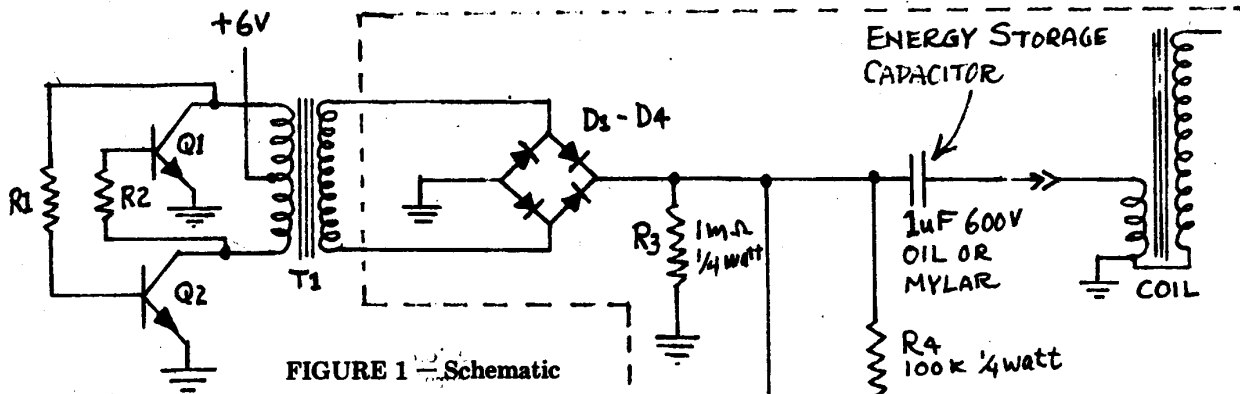


FIGURE 1 - Schematic

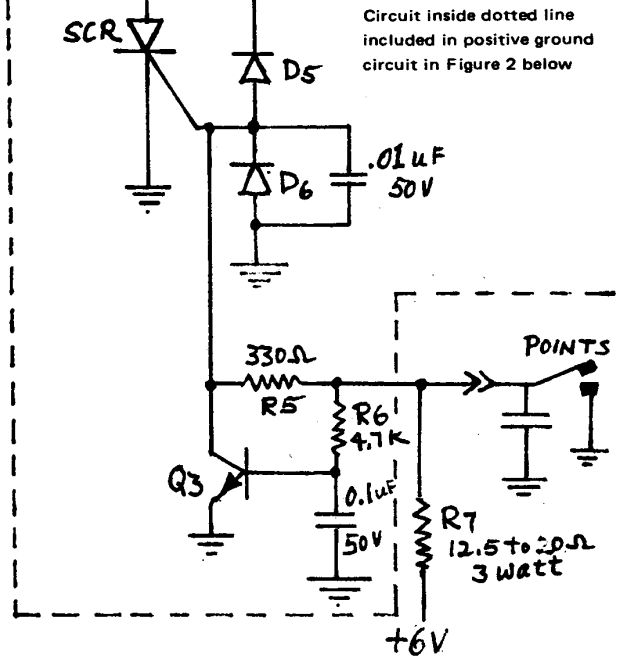
Circuit inside dotted line included in positive ground circuit in Figure 2 below

PARTS LIST - NEGATIVE GROUND CIRCUIT

- Q1, Q2 2N3055, 2N3716 or equivalent
- SCR 2N4444
- Q3 2N2222
- D1-D6 1N4008
- R1, R2 50 to 100 ohm, 1 watt
- R3 1 megohm, 1/4 watt
- R4 100 Kohm, 1/4 watt
- R5 330 ohm, 1/4 watt
- R6 4.7 Kohm, 1/4 watt
- R7 12.5 to 20 ohm, 3 watt
- 1 uF oil or mylar 600 V capacitor
- 0.01 uF 50V disc ceramic capacitor
- 0.1 uF 50 V disc ceramic capacitor
- T1 See text - 6V center tapped pri., 115V secondary

FOR POSITIVE GROUND CIRCUIT [See Figure 2]

- Q1, Q2 HEP S5002, 2N3715, or equivalent
- All other parts same as negative ground, but add following:
- Q4 2N2222
- D7, D8 1N4000 (1N4008 will work too)
- 1uF 50 V electrolytic capacitor
- R9, R10 4.7 Kohm, 1/4 watt
- R11 100 ohms



+6V CIRCUIT PER FIG 1

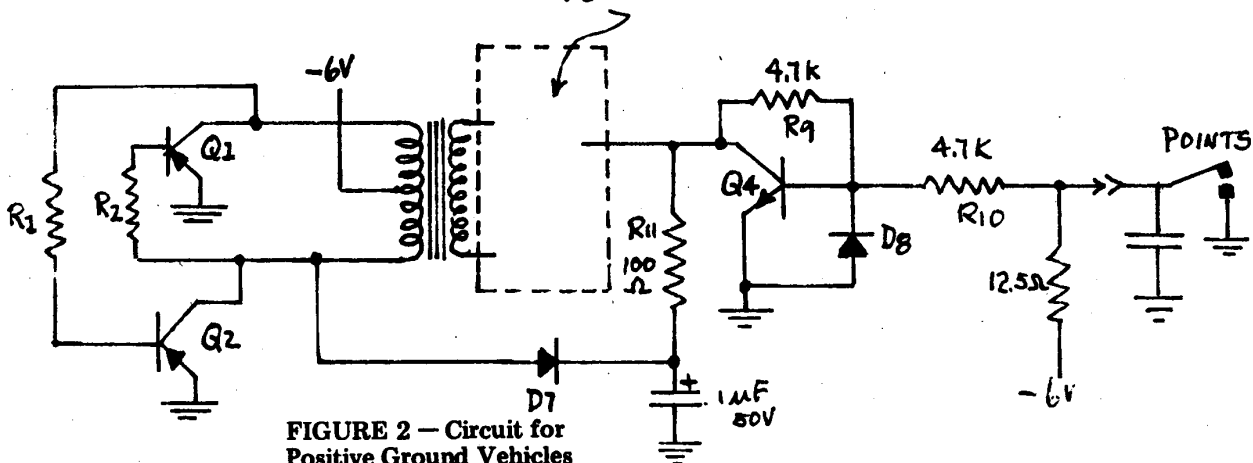


FIGURE 2 - Circuit for Positive Ground Vehicles

If not, verify that there is + (or -) 6V at the point lead when the lead is not grounded. If there is, and there is no spark, remove the SCR, apply power and momentarily short R3. If this does not cause a spark, the energy storage capacitor is connected improperly or is defective. If there is a spark, the problem is in the SCR or trigger circuits.

3. Put it in the car and start it up. If you installed a bypass switch (see below), test the switch at this time.

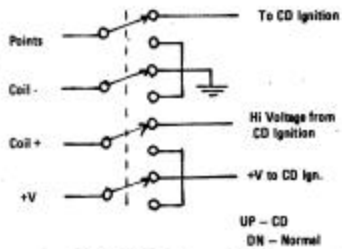


FIGURE 3 - Bypass Switch

Figure 3 shows how to connect a 4PDT switch so that the ignition can be easily switched between CD and regular ignition. I recommend this switch because many tune-up procedures require the normal ignition, and a quick-change capability is often handy. If the switch has a center "Off" position, this provides an extra level of theft protection by turning the whole ignition system off.

Getting The Parts

All parts values in this circuit are non critical ,so long as somewhat close (plus or minus 20%) to the recommended value, and so long as voltage and current ratings are adequate. Since the oscillator output has significant high voltage spikes in it, all components should be able to stand 2 to 3 times the normal working voltage.

The transformer may be any filament transformer with a 6V center tapped secondary and a 115 volt primary, so long as the current rating is adequate. A minimum 6V current is 5 amps, 10 amp rating is better. If you live in an area where there are electronic surplus stores, look for a 400Hz ;A transformer. Since these parts won't work on house current (60Hz) they are usually very cheap. Also, being designed, for higher frequency, they have less iron and. thus are smaller and lighter.

Hints

1. Be sure to check the point gap every 50,000 miles or so, since the rubbing block will eventually wear down.

2.] Oil the point pivot and distributor cam whenever you change oil in the car.

3. Check the spark plug wires. They are often bad on old cars.

4. While the circuit will work on 12V with no changes, I recommend that you buy a DELTA MK10B for 12V negative ground applications. They are available as - kits, or used at swap meets, and are both good and reliable.