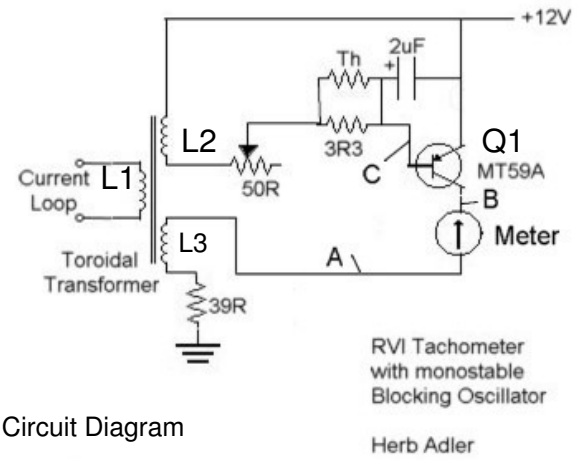
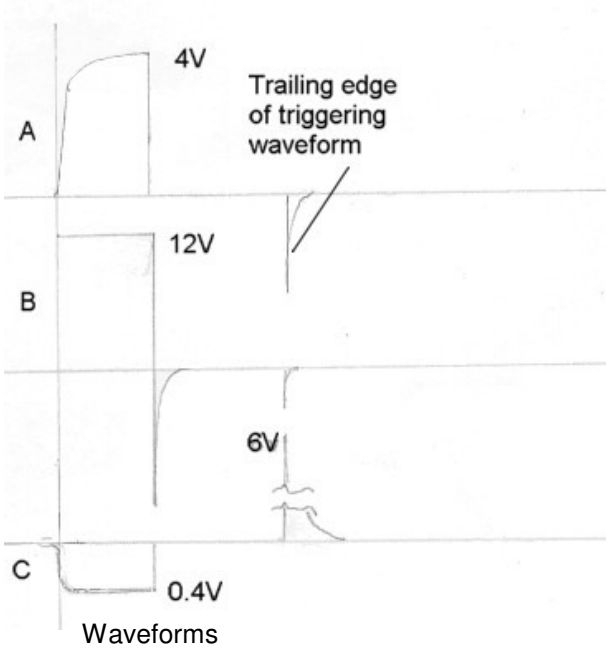
DESCRIPTION OF THE FUNCTIONING OF AN RVI 2430/00 NEGATIVE GROUND TACHOMETER
By Herb Adler

I recently had a need to check on the operation of one of these tachos, and luckily I had one disembowelled on the bench. This type of tacho has the internal toroidal transformer as the trigger sensor. Below are a picture of the circuit board, the circuit diagram and waveforms.



Circuit Diagram

CIRCUIT BOARD



Waveforms

Function.

The circuit is what is called a monostable blocking oscillator. What this means is that there is only one stable state, no pulse, and until a trigger occurs the transistor Q1 is blocked from turning ON.

This transistor, Q1, acts as a switch, i.e. it is either ON or OFF, as can be seen at waveform B, where Q1 turns ON and the voltage goes to 12V and then it turns OFF and the voltage goes to 0V.

L1,2 &3 are windings on a toroidal (circular) transformer, the plastic encased red thing with the white wire wrapped a couple of times around it.

L1 is the current sensing / triggering winding, the heavy white wire, that has the ignition coil current passing through it.

When the points close and current flows through the ignition coil, and L1, then a voltage is induced in L2 & 3.

The L2 voltage is the control voltage for Q1, turning it ON, with a voltage, as shown in waveform C.

Whilst this C voltage is present Q1 is ON. With Q1 ON current flows through the meter, giving a deflection / reading, and repetitive pulses are averaged by the mechanical inertia of the meter, which gives a "steady" reading, proportional to the engine revs.

As current through a coil cannot change instantaneously there is a gradual build up of current and thus voltage, in L3, as shown by waveform A, creating an increasing magnetic field. Because there is a changing magnetic field, due to the increasing current, coil L2 has a current / voltage induced in it, which keeps Q1 turned ON.

When the transformer's core saturates, i.e. any more current will not produce any change in magnetic field, the voltage induced in L2 stops, and Q1 turns OFF. This action makes the transformer the main timing element.

The energy stored in the core of the transformer is released as the big spike at the end of the pulse, as shown in waveform B.

The 3R3 ohm resistor and the thermistor (temperature sensitive resistor) Th, are a temperature compensation network, to minimise the effects of temperature on the operation.

The 2uF capacitor, I think, should absorb the 6V spike, seen well after the completion of the pulse cycle, and is the end of current flowing into the ignition coil, i.e. when the points open. The reason this 6V pulse is there, in my opinion, is that the capacitor, in my unit, is 30 plus years old and has ceased functioning. Removing it from the circuit made absolutely no difference, a test done for other reasons.

The variable resistor of 50R ohms, is there to allow calibration of the readout to the engine revs, and it does this as the pulse width is determined by the relationship of the inductance of the transformer divided by the circuit resistance. A wider pulse gives a higher reading, as do more pulses, at higher revs.

Following are comments by Tom Hayden on this type of tacho.

1) 1) Add notation of GRN (bottom of L2), and RED (top of L2) WHT (Top of L3) and BLU (bottom of L3)
2) 2) Note that some models have 70 ohm meter and some have 10 ohm meter.
3) 3) Note that some have 3.3 ohm (Orn Orn bands) and some are 2.2 ohm (red red bands)
4) 4) The thermistor in parallel with the 2.2 ohm resistor is unmarked, but measurements seem to show it to be 8 or 10 ohms. It's not very critical and is probably there to compensate for the tempco of resistance of the copper coil (about 1.2 Ohm) which makes up a small part of the L/R time constant for the pulse. 10 Ohm thermistors are fairly available.
5) 5) The transistor is a PNP Germanium type. Original specs are unknown, but a NTE 158 seems a good choice for replacement. Available from NTE Electronics.
6) 6) There appears to be enough adjustment using the 50 ohms adjustable resistor to calibrate the tach for a V6. There MAY be enough adjustment to calibrate for a V8, but it is near the full end of the adjustment. If it cannot be adjusted far enough for a V8 then add a 270 Ohm resistor between the 50 Ohm adjustable and the green marked toroid wire. It should be pretty easy to disconnect that one wire on the left side of the toroid where it connects to the pin on the adjustable resistor, insert one end of a ¼ w 270 ohm resistor into the pin on the adjustable resistor and reconnect the wire from the toroid to the free end of the 270 Ohm resistor. This should allow adjustment for a V8. Take care as the toroid wire is very fine and fragile.

The NTE 158 was suggested to me several years ago as replacements for the 2 transistors used in the earlier monostable mulitvibrator type tach. There are a slightly different case style (TO-1)than theTO-5 or TO-39 type used in these blocking oscillator designs, but I think they are a good choice for either style tach. See this table of PNP- Ge types. :
http://www.nteinc.com/Web_pgs/Germanium.html

I think the NTE 158 is a good choice based on Voltage rating , current rating , Power, and Gain (Hfe)

Here's a ref to TOM's write up available on the Sunbeam site for the earlier type tachs
http://www.sunbeamalpine.org/downloads/alpine_tach_repair_rev5.pdf