ignition timing stroboscope

There are several ways of adjusting the ignition timing of a car engine. One of the quickest and best is to use a stroboscope. The stroboscope timing aid described in this article is a self-contained unit for easy adjustment of the car's ignition.
It can also be used for running a fluorescent lamp off the car battery and with a few modifications it will operate as an electronic ıasher for photographic use.

The equipment differs from most commercially available stroboscopes in that it has its own high tension power supply. There is no need to interfere with the car's existing high tension wiring, except for the link to the ignition system required for triggering the flash. The unit only draws an extremely small amount of energy from the power intended for the spark.
'Simplicity' was the catch word maintained during the design of the circuit. The critical component in the unit is formed by a transformer having a centre-tapped secondary (2 x 6 V) and a 220 . . . 245 V primary. For those who remember the 'good old days' of valves: a heater transformer.
The secondary winding is used in a balanced oscillator with T1, T2 as active elements. The transformer characteristics along with the resistors in the circuit determine the frequency the unit will oscillate at. In this case it will be about 100 Hz.

The transformer primary (which is used as the secondary in this unit) will supply about 325 V (AC) which results in approximately 450 V (DC) after rectification (off load). With an 8 mA load, the voltage drops to about 300 V. The DC voltage is used to power the strobe light. The current for the fluorescent lamp comes direct from the transformer winding.
A small readily available 8 W fluorescent lamp is used with this unit. This will slightly overload the circuit, causing saturation of the transformer core. This in turn leads to an increase of the oscillator frequency which improves the lighting efficiency of the fluorescent lamp. Admittedly, the lamp will not emit its normal amount of light, but it should prove to be a suitable and economical battery-powered camping light. There is little risk of the car battery running down in the course of the evening, since the current demand does not exceed 750 mA.

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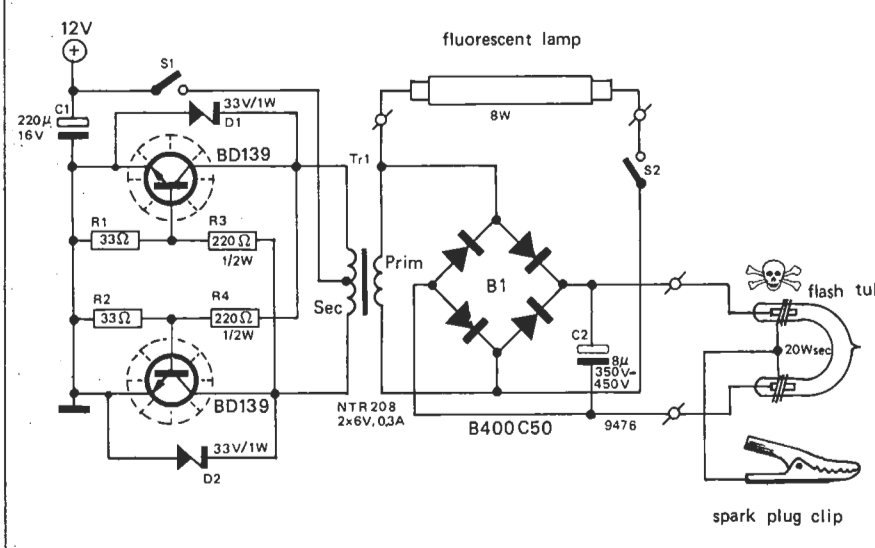


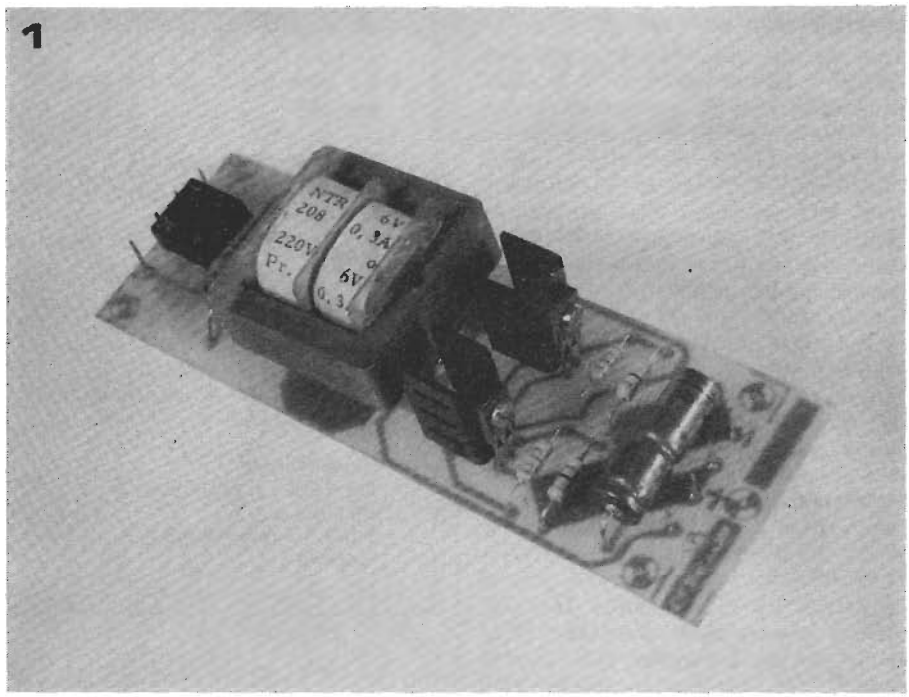
The unit can also be used as a photographer's electronic flash. However, several circuit changes will be necessary. Capacitor C2 must be increased to at least 250 μF (an electronic flash capacitor) and the trigger pulse must be applied via a pulse transformer actuated by t' flash contacts on the camera.

Stroboscope

The diagram of figure 1 shows that only a small capacitor is connected across the flash tube when the device is used as a stroboscope. At a working voltage of 300 to 400 volts, the energy stored will be approximately 0.5 Ws. This energy is sufficient to produce a flash which is visible for about 50 cm (20 inches), depending of course on the ambient lighting conditions. On the other hand, the energy is not so high as to require a particular type of flash tube; any commercially available type capable of handling 20 Ws can be used.
Since the ignition voltage of the flash tube is rather high it can be connected permanently across the capacitor without risk of spontaneous discharge. The tube must then be triggered in such a way that the flashes are synchronised to the ignition timing. It is standard practice to trigger a flash tube via a pulse transformer producing pulses of some 10 or 20 kV. However. since the pulses at the spark plug are already at this voltage, there is no need for such a transformer in this case. The trigger pulses can be derived straight from the spa lug electrode. This can be done by ig a well insulated wire of sufficient length fitted with an adequately insulated alligator clip.

Using the unit

The timing reference is usually the firing of the spark plug in the number 1 cylinder.
As the flash is triggered at the instant the plug fires, the engine is illuminated at the same moment. The flash should make the rotating parts of the motor seem stationary. Somewhere on the engine there are special timing marks, usually one on the flywheel or a pulley on the crankshaft, and the other on the block.
When the unit has been correctly hooked up to the engine (plus and minus to the car battery and the trigger wire to the correct plug) these marks will both appear stationary. The timing adjustment is carried out by rotating the entire distributor housing until the marks are correctly aligned.
It is best to consult the car service manual or other service notes. They should contain the location of the timing marks and the correct alignment pos n of the marks. There may be oth oints to be noted, for instance, the vacuum advance and centrifugal advance may have to be disabled before timing can be carried out. A good motto is: 'If in doubt, don't; contact your garage or the AA or RAC for further information'.



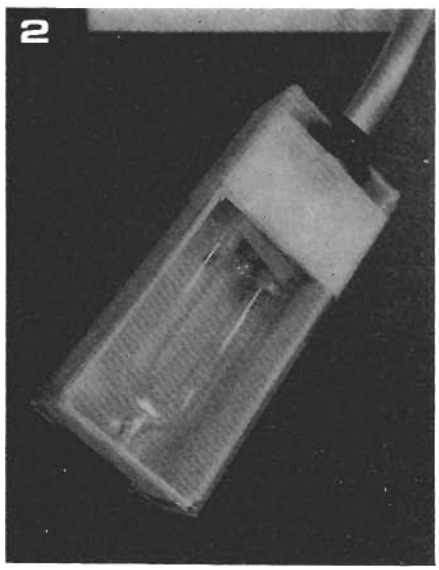
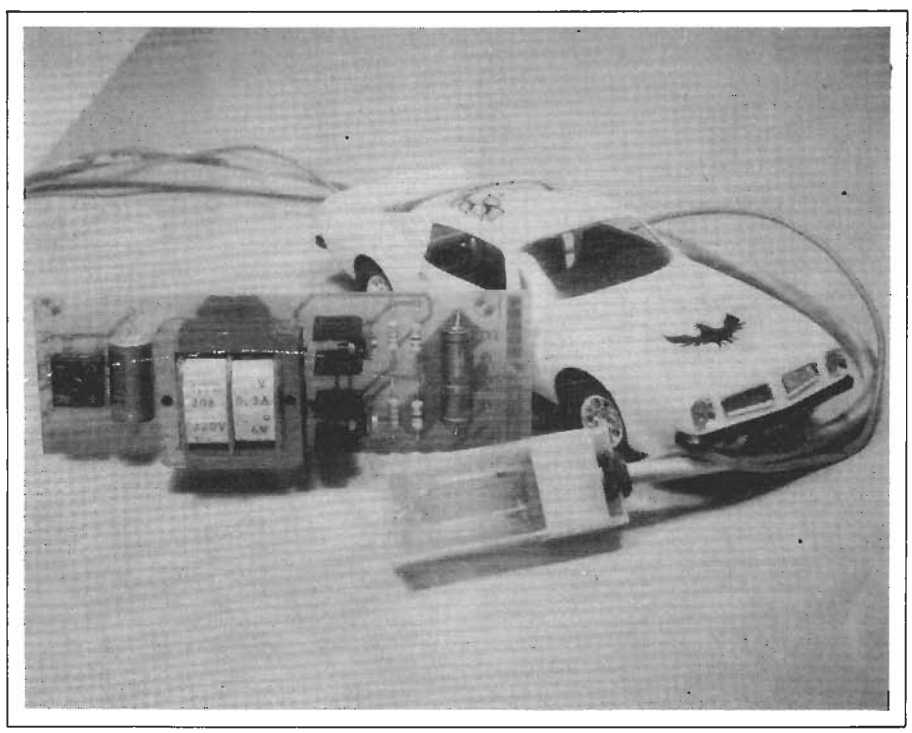


Photo 1. The unit can be quite compact. Bear in mind that good insulation is essential: the high voltages in the circuit can be lethal!

Photo 2. Prototype flasher unit. Nearly any flash tube can be used.

Figure 1. Complete circuit diagram.



Construction

The actual construction, although simple, must be carried out with care. All components except the flash tube and the fluorescent lamp are mounted on one printed circuit board, which should be mounted in an insulated case. Bear in mind that the voltage generated will rise to about 350 V and could become dangerous in the circumstances under which the equipment is being used!

It is a good idea to mount the flash tube in a separate shell (well insulated!) as it is rather awkward to 'aim' a box containing all the electronics . . . . A reflector mounted in the shell will improve the brightness of the flash.

Photograph 2 shows the U-shaped flash tube fitted in its small case. It also shows how the triggering cable is arranged: the wire is wound around both ends of the flash tube. The high tension pulses from the spark plug ionise the gas inside the tube causing the gas to become conductive, initiating the flash. The prototype unit used a U-shaped flash tube, but practically any tube, whatever the shape and size, will be suitable.

Parts list:

Resistors:
R1,R4 = 33 Ω
R3,R4 = 220 Ω, 1/2 W

Capacitors:
C1 = 220 μ/16 V
C2 = 8 μ/350 V

Semiconductors:
T1,T2 = BD 139, 2N4923
D1,D2 = 33 V/1 W zener diode
B1 = bridge rectifier B400 C50

Miscellaneous:
Tr1 = 220 . . . 245 V prim. 2 x 6 V, 0.3 A sec.
S1,S2 = on/off switch.
Flash tube.

Figure 2. Component layout and printed circuit board for the complete circuit.

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