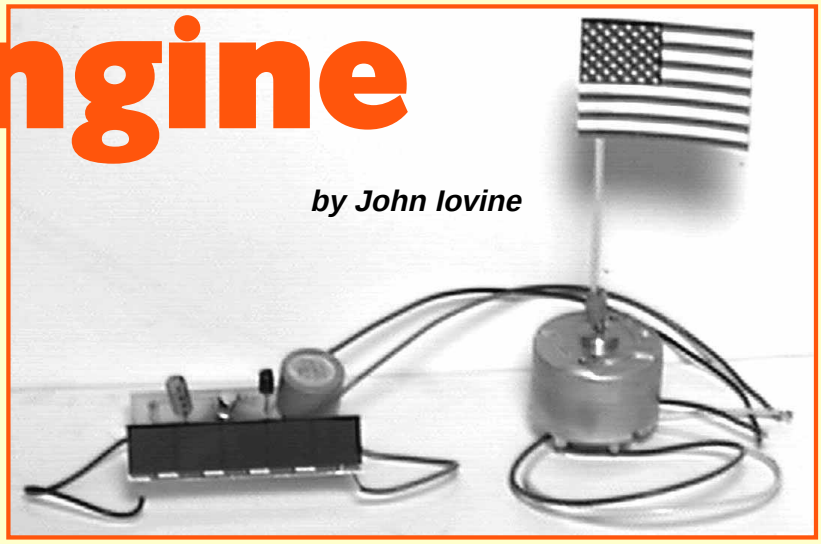
Solar Engine

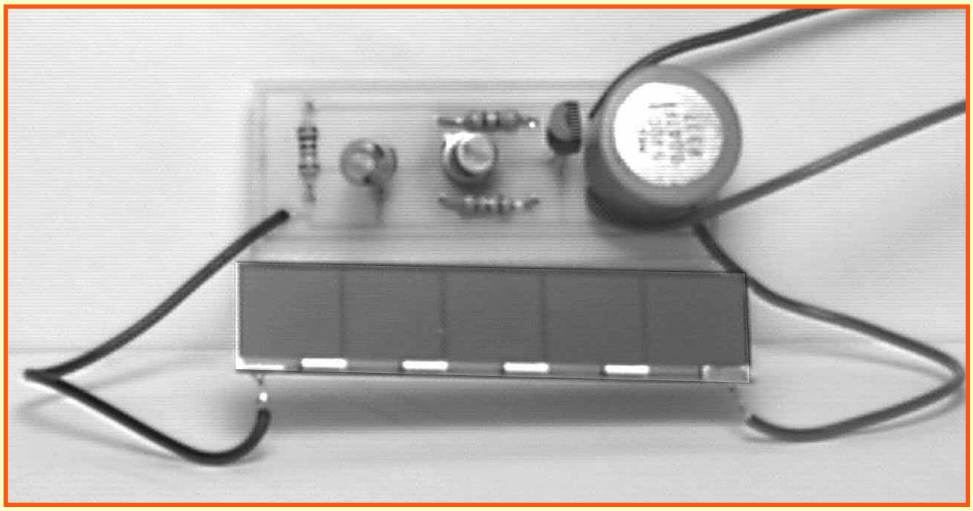


by John Iovine

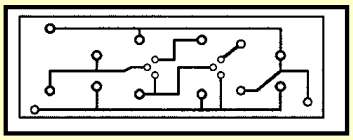
The solar engine is commonly used as an onboard power plant for BEAM type robots, sometimes called *living robots*. The circuit is simple in function. The main components are a solar cell, main capacitor, and a slow oscillating or trigger circuit. The solar cell charges the capacitor until a predetermined voltage is reached where the trigger circuit dumps the stored electrical power from the main capacitor through the main load (usually a high-efficiency motor). The cycle then repeats.

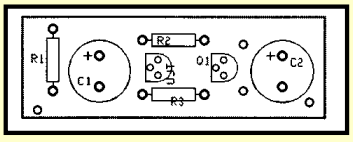
The inspiration for this solar engine came originally from Dave Hrynkiw from Canada, who uses a similar design to power a solar ball robot. I liked the electrical function so much that I decided to design my own solar engine. In doing so, I was able to create a new and improved circuit that surpasses the efficiency of the original design by about 100%.

Figure 1 is the schematic for the solar engine. Here's how it works: The solar cell charges the main 47000 uF capacitor. As the capacitor charges, voltage level of the circuit increases. The UJT begins oscillating and sending a trigger pulse to the SCR. When the circuit voltage has risen to about two volts from the main capacitor, the trigger pulse is sufficient to turn on the SCR. When the SCR turns on, all the stored power in the main capacitor is dumped through the high-efficiency (HE) motor. The motor spins momentarily as the capacitor discharges, then stops. The cycle repeats.



The solar engine circuit is simple and non-critical. It may be constructed using point-to-point wiring on a prototyping breadboard. A PCB pattern is also included for those who want a neat looking project.





High-Efficiency Motor

Not all electrical motors are high-efficiency (HE). For instance, the small electrical motors sold at your local Radio Shack are low-efficiency type. There is a simple way to determine if a motor is an HE type. Spin the rotor of the motor. If it spins smoothly, and continues to spin momentarily when it's released, it's probably an HE type. If, when you spin the rotor, it feels clunky or there is resistance, it probably is a low-efficiency type.

Caveats

The solar cell used in this circuit is high voltage, high efficiency. Typically, solar cells supply approximately .5 volts at various currents, depending upon the size of the cell. The solar cell used in this circuit is rated at 1.5 volts, but I've seen it charge a capacitor up to 2.5 volts.

I'm sure some people planning to build this circuit are already thinking about adding a few more solar cells to speed charging. While one can stack low-voltage solar cells in series to reach a usable (2-2.5 volts) voltage, one should not add solar cells to increase the current. There's a reason for this: In order for the circuit to recycle, the current through the SCR must stop (or at least be very minimal), for the SCR to close. If there is too much current supplied by the solar cell(s), the SCR will stay turned on. If this happens, the circuit will stop cycling.

The solar cell used in the circuit is balanced for proper operation.

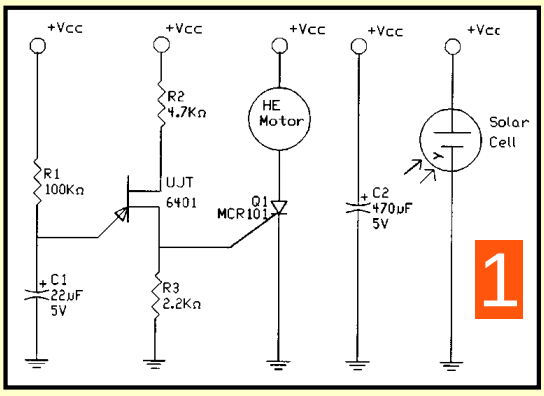
One component you may want to change is the main capacitor. You can use one of the super caps available to store more electrical power. Be aware that when using these capacitors it will take that much longer to cycle.

Uses

The circuit may be used in many novel and innovative ways. It may be used as an on-board power plant for a solar racer, to supply power to a HE motor for robotic locomotion, audio graffiti, flashing LEDs, or as the demo circuit pictured here does — spinning an American Flag.

The attractiveness of the circuit is that it operates perpetually, or at least until one of the components breaks, which means it should operate for years. **NV**

Note - This article was reduced to fit on an 8 1/2 X 11 page. The PBC pattern to the left must be enlarged to 125% to be full size.



Parts List

(1) - UJT6401
(1) - SCR MCR101
(1) - 22 uF Cap
(1) - 47000 uF Cap
(1) - HE Motor
(1) - Solar Cell
(1) - PCB
R1 - 100K 1/4 watt
R2 - 4.7K 1/4 watt
R3 - 2.2K 1/4 watt

Kit containing all the above parts $19.95 + shipping

Available from:

Images Company
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