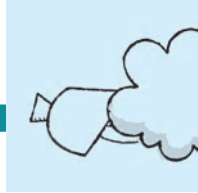
Pummer, Dude!

Part robotic plant life, part techno-sculpture, these desktop toys are easy and fun to make.

By Gareth Branwyn

Photography by Zach DeBord/M27.com



IN MAKE VOLUME 06, I WROTE ABOUT BEAM, a branch of robotics built on low-end, mainly analog electronics that is inspired by biology. I described how to build two types of bots in the BEAM taxonomy: Solarrollers and Symets. One of the more obscure members of the BEAM family tree is the Sitter, an immobile robot with few or no moving parts.

One of my favorite types of Sitters is the Pummer, a nocturnal, robotic plant that soaks up the sun during the day; stores that energy in batteries or capacitors; and then, when it senses darkness, feeds power to a light which pulses, or "pumms," away in the dark. Since the electronics are simple and minimal, you can have fun with the design of your Pummer, creating a swanky piece of high-tech art that will intrigue everyone who sees it adorning your geekosphere.

How a Pummer Works

In "A Beginner's Guide to BEAM" (*MAKE, Volume 06, page 54*), we talked about different types of Solarengines (SE), which are simple power circuits for actuating miniature robots. We mentioned the nocturnal type of Solarengine. This is the variety of SE used in many Pummers. All SE circuits work in much the same way: the solar cell captures light energy, converts it to electrical energy, and sends it to storage, either in capacitors or rechargeable batteries. When a trigger value is reached, the stored energy gets sent off to do some sort of work. In a voltage-triggered SE, the trigger is a set voltage ceiling. In a nocturnal SE, the trigger is a threshold value of light.

Looking at the circuit diagram on the following page, you might be asking yourself: where is the sensor that tells the Pummer that it's lights out and time to get with the pummin'? Ingeniously, the solar cell and the circuit itself serve this purpose.

During the day, when light hits the cell and the cell is sending juice to storage, the diode in the circuit keeps the enable line set to high. When the level of light/current reaching the cell/circuit falls below a certain value (as set by the value of the parallel resistor), the enable goes low, triggering the discharge cycle and the pumming of the LED(s). The diode, being a sort of one-way valve in a circuit, prevents the current from flowing back into the charging part of the circuit; it has no place else to go but along the discharge path.

Pummer Circuits

There are a number of different Pummer circuits you can use, from simple ones that power a single LED, to more sophisticated ones designed to maximize power collecting and discharging, and ones that can power multiple LEDs. The one shown here, used in the Solarbotics Bicore Experimenters BCP Applications Project (see makezine.com/08/pummer), balances simplicity with circuit efficiency and bang-for-buck; i.e., it makes a pretty damn cool Pummer without too many building headaches.

This nocturnal SE circuit makes use of another hallmark BEAM circuit, the bicore, which is the basic "neuron" of BEAM "intelligence" (*see MAKE, Volume 06, page 54 and page 58*). Here, the two-state oscillator is used to create the flashing/pumming behavior. The C1 and C2 caps are used to set the blink/pause rates, and C3 handles the "decay" rate of the pumms. You can play around with these rates by trying different capacitor values on a breadboard.

Other Pummer circuits, including those that can handle multiple LEDs, can be found on Solarbotics.net, in */library/circuits*. Costa Rica BEAM (costaricabeam.solarbotics.net) has a fairly thorough library of schematics for Pummers, including a circuit for making a Type 1 Solarengine (which uses a 1381 voltage trigger) into a darkness-activated power circuit.

Pummer Designs

One of the cooler aspects of a Pummer is that, because it's a Sitter and has no moving parts and no concerns over weight, etc., the design and aesthetics of the robot can take center stage. You can build Pummers to look any way you want. A lot of builders, inspired by the idea of Pummers being a sort of robotic plant life, put the LED(s) on a long stalk or on multiple stalks. But Pummers have also been built in the shape of modern sculptures, hexagons, triangles, cubes, even a dragon with solar

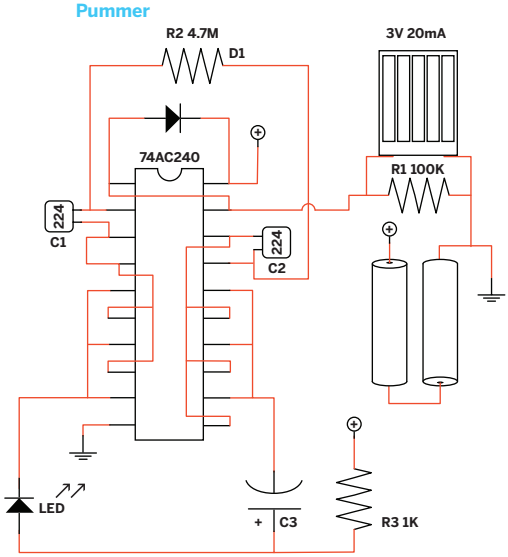
MATERIALS

To build this Pummer circuit, you'll need:

Solar cell that can deliver 3V at 20mA
(I recommend the SCC2433a from Solarbotics)
74AC240 Octal Inverting Buffer IC
AAA NiCad batteries (2) or you can use 10F "gold" capacitors (2)
0.22µF capacitors (2) often marked with "224" on the cap
1000µF capacitor or 3300µF for a longer fade-away
1kΩ resistor
4.7MΩ resistor
LED any color, high-intensity LED recommended
Diode A low-voltage type, such as the 1N5818 Schottky or a germanium diode, is best, but a silicon one works too.

Zach DeBord's collection of Pummers made from paper clips, guitar strings, rubber bands, heat-shrink tubing, and a dash of imagination.

Single-LED High-Efficiency Pummer



cells on the wings and glowing LED eyes. Really, your imagination and building skills are the only limitations.

A large majority of Pummers are built using paperclips as the main building component. Zach DeBord, a BEAM builder from Chicago (whose Pummers are pictured here) writes: "Buy a pack of jumbo and regular sized paper clips. For the $2 you spend, you'll be able to build a whole fleet of robots. I almost exclusively use paper clips and guitar strings for my creations."

Other common structural components are rubber bands and heat-shrink tubing. "An assortment pack of heat shrink (available at RadioShack and other places) goes a long way," says DeBord. "Not only are your bots more interesting looking, but you can use tubing in key places to reinforce weak joints."

For more Pummer resources visit makezine.com/08/pummer.

Gareth Branwyn writes about the intersection of technology and culture for *Wired* and other publications, and is a member of MAKE's Advisory Board. He is also "Cyborg-in-Chief" of Streettech.com.