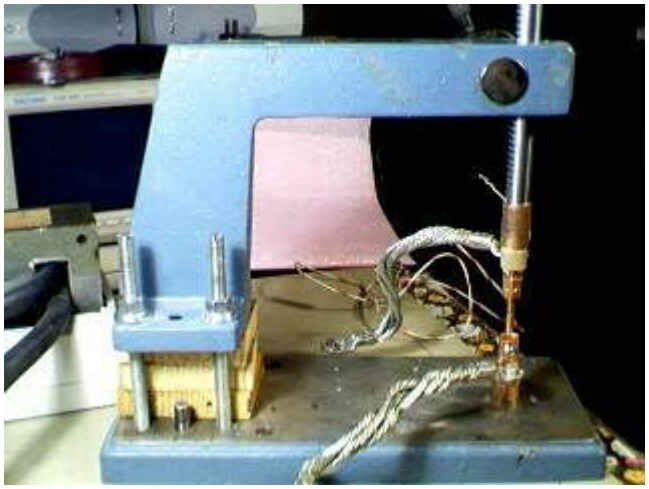
SPOT WELDER

I needed to rebuild some laptop battery packs.
Soldering wasn't working for several reasons:
Soldering is bad for batteries.
There's no room for the solder joints.

Spot welding seemed the way to go.

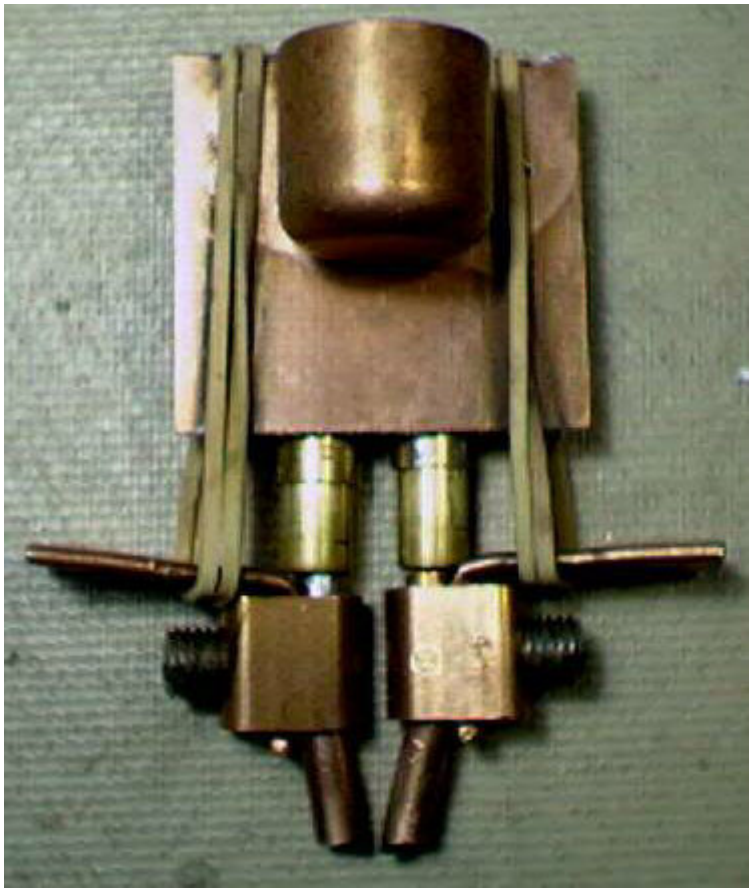
I wanted to design something that could be built without special tools. I started with a small arbor press and added some wood blocks to increase the clearance. It would have been just as easy to make it from an old drill press. Most of the pieces are made from copper wire and 1/2" copper pipe fittings. I got all the hardware from Home Depot and the local hobby shop.



This is the opposed welding head. The electrodes are #4 copper wire. The top section is a 1/2" copper pipe coupler with a wooden insert drilled to accept the wire. There's a plastic insulator inside the coupler to isolate the wire. The bottom section is a pipe cap drilled to accept the wire. A short piece of 1/2" pipe slides into the hole in the base. The bottom electrode is flat. The top is slightly domed.

The parallel gap head is made from #6 copper wire. Parts are soldered to a chunk of ECB material. Each electrode mount is made from concentric pieces of brass tubing with a spring inside. The copper wire is soldered into the inside tube. The end of the wire is filed down to 0.050" at the contact point. The black marks on the tubing mark the proper spring compression. A micro switch to trigger the weld would be a better idea, but I don't plan to use it enough to warrant the complexity. The rubber bands keep it from falling apart.

A copper pipe cap is soldered to the backside. This mates with the ram on the arbor press. The drill press version would use a smaller rod soldered to the backside and chucked in the drill.



The power source is a microwave oven transformer built into an old UPS case. Cut off the secondary, remove the magnetic shunts and wind two turns of 2/0 welding cable for the secondary.

Driving the transformer requires some care. To prevent core saturation effects, I used a 240V 40A solid state relay that switches on zero crossings. Don't forget the surge supressor on the transformer to keep it from zapping the relay. A foot switch triggers a one shot that synchronizes with the line. Changing the width of the one shot varies the number of cycles permitted to pass through the transformer. This unit allows 1-16 cycles. 4-8 cycles seems to be the range where good things happen, depending on the

material thickness.

I experimented with a variac on the input side to vary the current. There seemed to be no advantage.

The controller is implemented in a GAL20V8, so a circuit diagram wouldn't be helpful.

The most important thing seems to be to keep the resistances in the secondary circuit very low. I measured .37 mOhm in the secondary winding and another .28 mOhm in the flexible wire to the head. The resistance in the head is swamped by the wire resistances. The mechanical assemblies are soldered copper and brass, but all the current goes through clamped joints.

Another critical factor is pressure. The electrode tips are small and it takes little force to produce great PSI at the contact point. I wasted a lot of time using way too much pressure. I finally settled on about 8 pounds total force for the two contacts of the parallel gap head.

This is a VERY low duty factor welder. Everything past the 2/0 wire gets too hot to touch after a few dozen shots.

Welds battery tabs just fine.