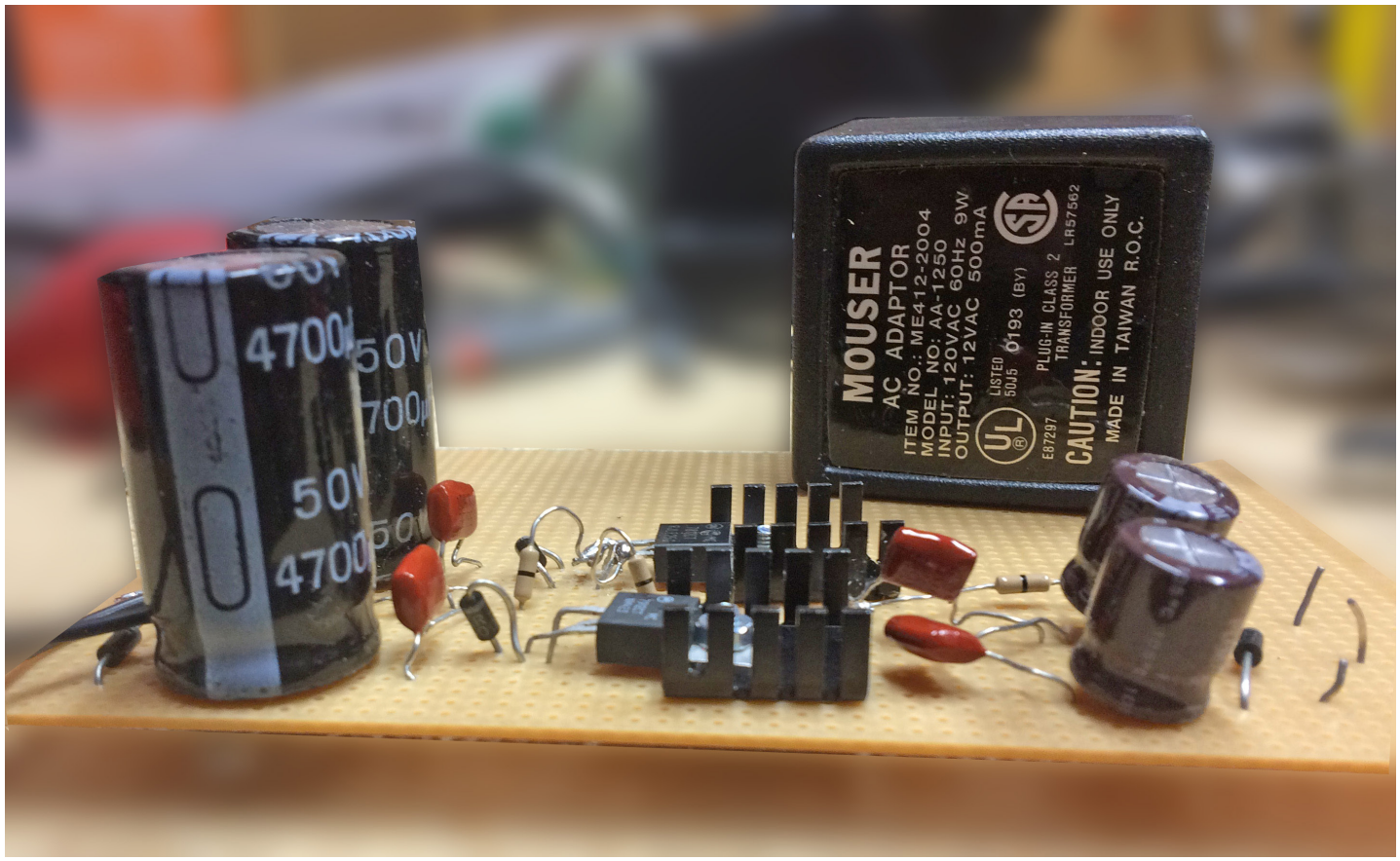
STRINGED THINGS

Building a bi-polar power supply



I took a break from the phase shifter rejuvenation project to have a go at building a simple bi-polar power supply. The basis for the project was this web page: http://sound.westhost.com/project05.htm.

It includes background information on the power supply as well as the schematic. All of the parts came from Jameco except for the wall transformer. It was an old Mouser 12 VAC transformer.

This power supply wouldn't be as dangerous as some other power supply projects I've built. This project runs off of a 12VAC wall transformer. The wall transformer drops the voltage down to 12 volts AC before it arrives at the circuit board.

Back in the day, I built three power supplies in which the transformer was part of the circuit. This meant that the 110-volt current went into the enclosure before it was connected to a transformer mounted either in the case or on the circuit board. I never suffered a shock, but I'm not sure my nerves could handle it now.

Anyway, this power supply is supposed to deliver 12 volts of regulated power to whatever device is connected to it. I could've built it as a 15-volt supply, but I had a 12VAC wall transformer on hand. I figured I'd save the expense of buying another wall transformer.

Op-amps, which are the basis for many audio circuits, require a bi-polar power supply. On many electronic devices that take a DC input, there's a section of the circuit that splits the current into a bi-polar output, but also cuts the voltage in half. The project I wanted to build would produce 12 volts of DC power, both positive and negative..

So, what's the difference between AC (alternating current) and DC (direct current)?

This is what an MIT web page says (http://engineering.mit.edu/ask/what's-difference-between-ac-and-dc):

"AC and DC are different types of voltage or current used for the conduction and transmission of electrical energy."

"Electrical current is the flow of charged particles, or specifically in the case of AC and DC, the flow of electrons. According to Karl K. Berggren, professor of electrical engineering at MIT, the fundamental difference between AC and DC is the direction of flow. DC is constant and moves in one direction."

OK, enough for today's electronics theory lesson.

The reason for building it, besides having another building adventure, was to provide power for two studio effects I recently unearthed. The devices are a couple of old Paia Electronics studio devices that ran on bi-polar power. The power supply that I built for them more than 20 years ago has been lost to history. I probably threw it out during a move.

The schematic is fairly simple. I decided to build it on non-conducting perf board. Non-conducting perf board does not have solder pads. The non-conducting nature of the perf board would lessen the possibly of short circuits. I later would find that I could build the power supply on one half of it and save the other half – maybe for another power supply?

The plan was to run the wires of the components through the holes and connect the wires together in accordance with the schematic. It would not be pretty, but I figured it would work.

I started from the left side of the schematic, where the wires from the wall wart connected to the circuit.

Please note that this circuit requires a transformer that outputs AC current, not DC current. If you power your pedals with a wall wart, it likely produces nine volts of direct current. This circuit calls for a transformer that outputs 12VAC, not 12VDC.

Some effects do run on 12VAC, though. I have an old ART Effects Command Center multi-effects board that runs off of AC. The ART Tube MP pre-amp requires AC input.

So, off I went. In went the diodes, then the (relatively) huge 4700uf capacitors. I went overboard by buying 50-volt caps when 35-volt or even 25-volt caps probably would've sufficed.

Bad weather actually helped this project. My workshop is in a shed that has no insulation and only portable heaters for heat. When I wanted to start the project, it was too cold to work in the workshop for any length of time. So, I brought in the components and the perf board to my house. I started running the wires and exploring different ways of connecting the components.

The placement of the voltage regulators was the biggest challenge. I wanted to place them so the circuit would take up only half of the perf board (longways). My parts layout generally followed the layout of the schematic. I couldn't do that with the voltage regulators. I also had to leave room for the heat sinks.

When the weather improved, I went into the shed workshop and fired up the soldering iron. The commentary on the project suggests that heat sinks might not be necessary, but I went ahead and put them in as a precaution. The two regulators, 7815 (positive) and 7915 (negative) have different pinouts. I made a document on the computer that showed both regulators and their pinouts. The regulators and heat sinks were attached to the perf board with nuts and bolts. I tried to carefully bend the pinouts so they would go into the holes of the perf board. One of the pinouts didn't cooperate, so I had to solder a component to it above the perf board instead of below it.

I was being careful to solder the diodes and the .1uf capacitors in place. I checked and re-checked the placement, polarity, and connections. To make one connection, I soldered a piece of stranded wire between two points on the underside of the perf board.

Honestly, an electronics engineer would cringe at my layout. It wasn't neat, not all that well planned, but nonetheless functional.

I finished the connections of the components. Now, it was time to troubleshoot before applying power. I re-checked and re-checked it with the multi-meter set for audible continuity check. There was a bad connection between the last ground component and the wire to which a device would be attached. A touch of solder fixed that.

Finally, time came to power it up. The electrolytic capacitors were of some concern. If one does not get the polarity correct, they can explode – literally. Those big 4700uf capacitors could do some damage if they blew up. So, I double and triple-checked the wiring of the capacitors.

Silly as it sounds, I put on a face shield before applying the power. I figured I couldn't be too careful. I soldered the AC wall transformer leads to the appropriate points on the perf board. I plugged in the wall transformer and waited.

Nothing blew up, so I took off the face shield. I set the digital multi-meter to check DC voltage. The circuit showed 12 volts on both positive and negative outputs. Success! Honestly, it was one of the rare instances when one of my projects worked on the first attempt.

So, now I have my bi-polar power supply. I ordered extra components in case I ruined one. I have enough electrolytic capacitors to do another supply, plus the remaining perf board. Maybe a 15-volt supply is next up!