Part 5, Attachment 3. <u>Tidying Up and Closing the Case</u>

Wall of Sound.ca Tubelab DIY EL84 Amp

Tools Required:

-Screw drivers

-Various pliers

-Electrical tape

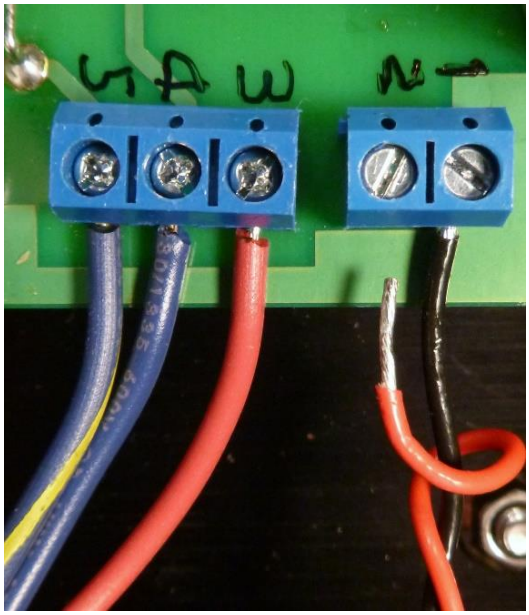
-Sanding block or file

-Round file or Dremel tool

Builders using non-Hammond output transformers start reading here.

Builders using Hammond OPTs should read this as well for information purposes.

If you recall back in Part 4, Attachment 2, two **red** wires, one each at connector points **2** and **10**, were <u>not</u> connected to their terminal blocks. See below.



These two wires, one for each channel, complete the negative feedback loop from the output transformers back to the input tube of the amplifier. Negative feedback helps reduce distortion and makes an amplifier more linear. Negative feedback has "negative" connotations to some and if overdone can make an amplifier measure better, but sound worse than an amplifier with a small amount of feedback.

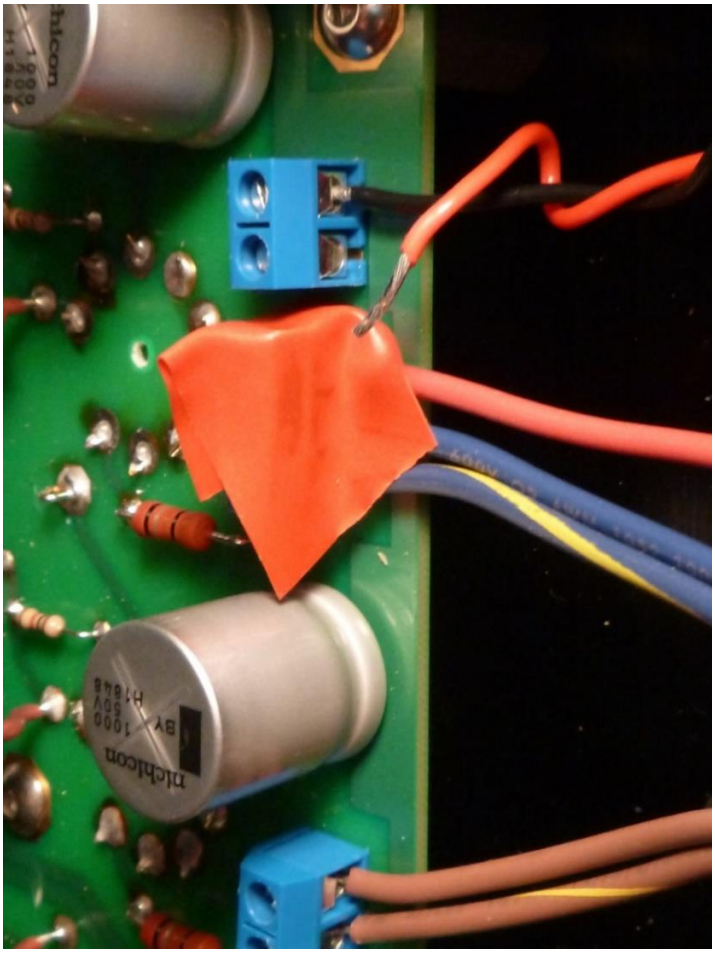
The Tubelab SPP uses a relatively small amount of feedback but it needs to be applied in the correct polarity.

What do I mean by *polarity?* Without getting too technical we want the feedback signal to improve the amplifier. The wrong polarity will make its performance worse and in extreme cases can turn an amplifier into a howling, screeching generator of noise. A PA system or a guitar-amp combination that squeals and howls is an example of positive *acoustic* feedback. Used by the likes of Jimi Hendrix it's a creative tool, not so much in a home stereo amplifier. The type of feedback we will be using in the amp is *electrical* feedback. Electrical feedback applied incorrectly can cause howling and squealing in an amplifier.

None of this is meant to scare the novice. It's an easy test to perform and a quick fix to correct. I did this with the old Heathkit trannies in the prototype and with the Hammonds in the patron's amp.

Power the amplifier down and wait a minute or two for the high voltage to dissipate.

The feedback connection at connector point **2** is right beside **300 volts DC** at connector point **3**. Yikes. Put a piece of electrical tape over connector **3**, see below.



Turn the amplifier on (speakers still connected) and give it a minute or two to warm up.

Grasp the insulation on the loose **red** wire intended for terminal **2** with a pair of needle-nose pliers.

Touch the bare end to terminal **2**.

If a squeal squawk or any untoward noise is heard from the speakers you have a little work to do. Power down the amplifier and give it a minute or two until the power dissipates. Proceed to *Remedial Action* below.

If no untoward noise is heard you're in with a chance that everything is OK so proceed as follows:

-Start some music playing from your source.

-Grasp the **red** wire again and touch it to terminal **2**.

-The sound level should **drop** slightly in the channel you are testing (the other channel should remain the same) and if it does you are good to go. I found it helpful to turn the speaker of the non-tested channel away from me in order to more clearly hear the volume drop of the tested channel.

- Check the other channel at connector **10** but chances are if the first channel was OK this one should be too.

-If the sound level **doesn't** drop but increases slightly you have work to do. See below.

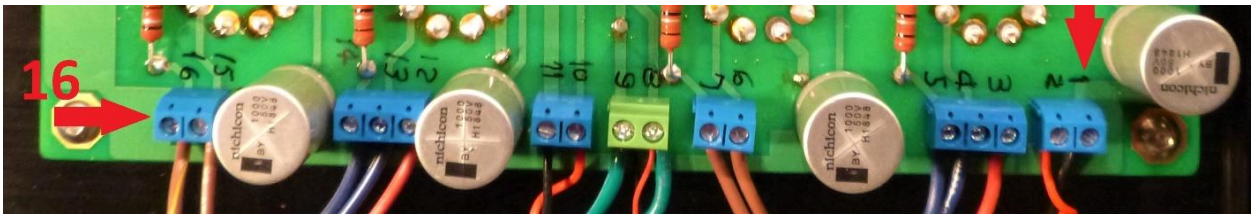
-If the sound level drops turn the amplifier off, wait a minute or two then insert the **red** wires into their respective terminals and tighten the screws to secure them.

-Skip the next section.

Remedial action for amplifiers that require modification to correct feedback application:

This isn't as onerous as it sounds, just slightly tedious and involves swapping around the transformer primary wires.

Refer to Part 4, Attachment 2 and the picture below.



If you are <u>not</u> using Hammond transformers chances are good that the wire colour coding will be different. Go to the Hammond website and the site for the transformer you are using. Comparing the connection diagrams will give a good idea how to proceed.

Remove the **blue** wire from terminal **4** and the **brown** wire from terminal **6** and swap positions.

Remove the **blue-yellow stripe** wire from terminal **5** and the **brown with yellow stripe** wire from terminal **7** and swap positions.

Remove the **blue** wire from terminal **13** and the **brown** wire from terminal **15** and swap positions.

Remove the **blue-yellow stripe** wire from terminal **14** and the **brown with yellow stripe** wire from terminal **16** and swap positions.

Power up the amplifier as before.

Touch the **red** wires to their terminal.

If you had feedback before it should be gone now.

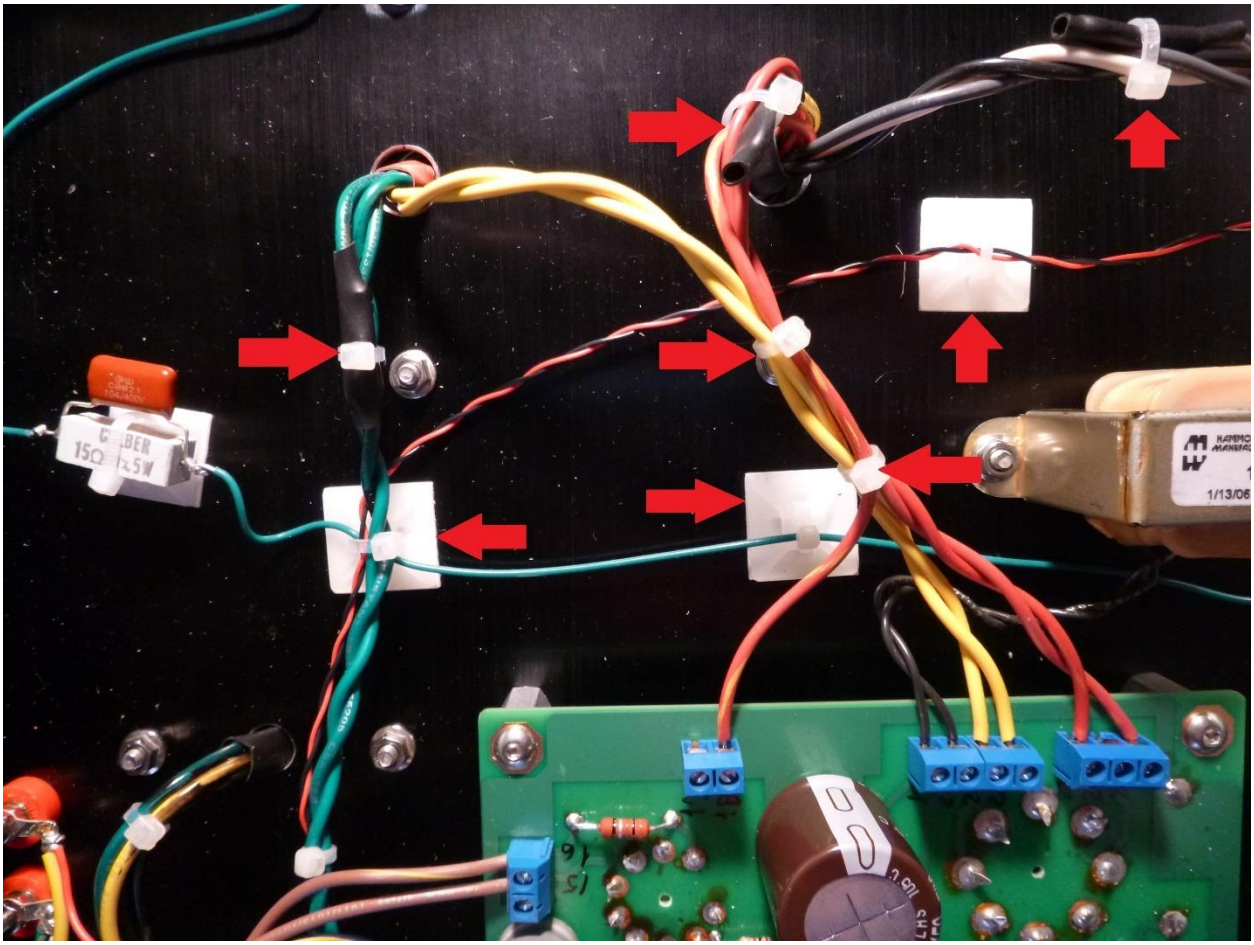
Set some music playing through the amp and touching the **red** wires to their terminals should result in a lowering of the music volume.

Assuming all is well, power down the amp and wait a minute or two.

Insert the **red** wires into their respective terminal blocks and tighten the screws.

Proceed with tidying up below.

Final Electrical Assembly and Tidying up:

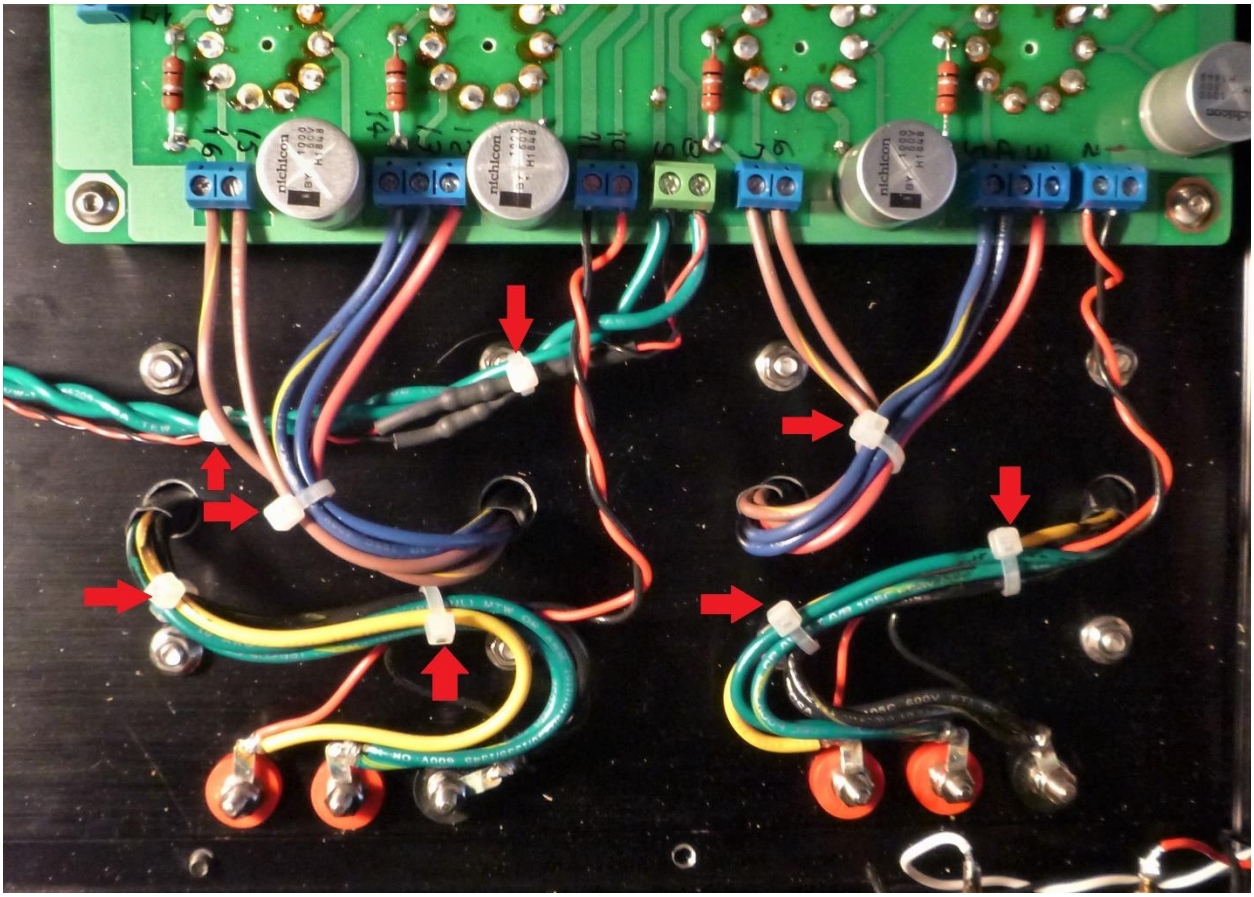


Apply a few cable tie mounts to the bottom side of the top panel. Clean the area first with an alcohol dampened wipe.

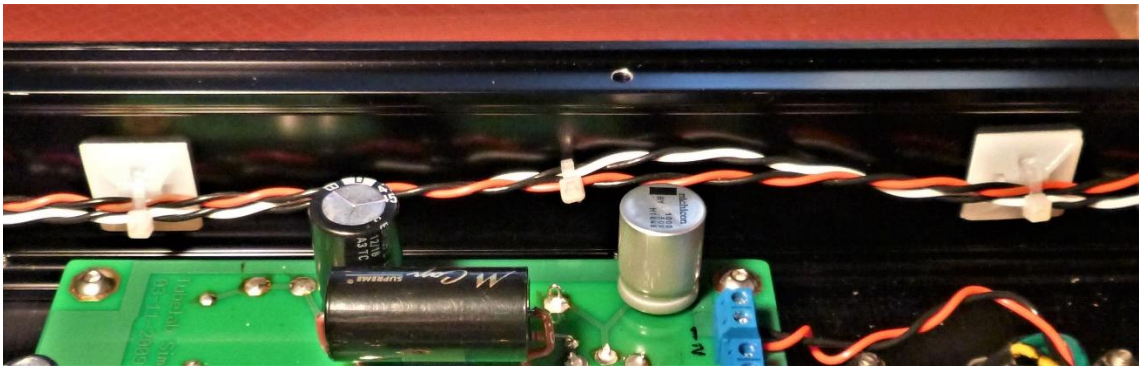
Restrain the wiring with zip ties.

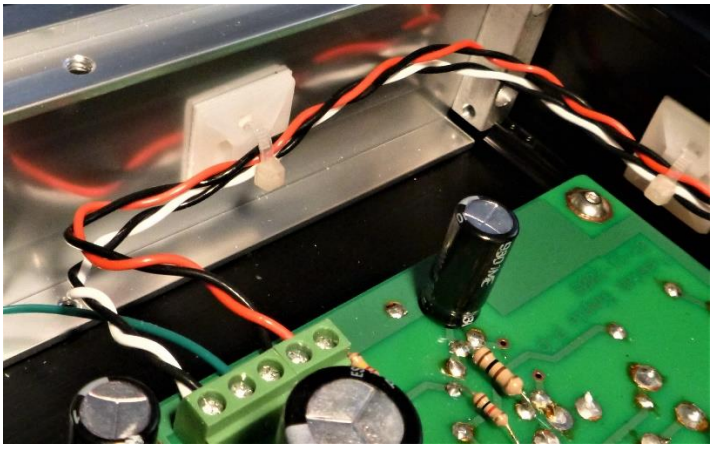
Add some zip ties to the power transformer leads and to the loose ends of the unused transformer wires.

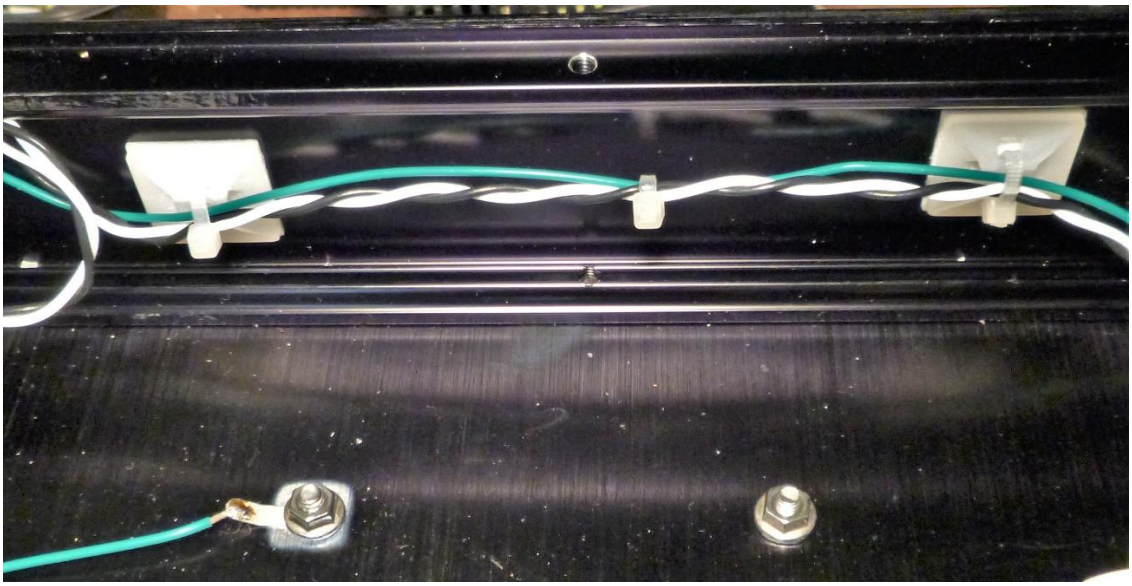
Do yourself a favour and cut the unused ends of the zip ties flush with the “knuckle” of the tie. Left long the cut end is sharp.



Put a few zip ties on the output transformer leads, the filament supply and LED wiring.







Add some more cable tie bases to the side and front panels, wiping first with alcohol.

Secure with zip ties as shown above.

Bottom Panel Assembly:

If you've come this far pictures shouldn't be necessary.

Wipe the bottom panel and the rubber feet with alcohol.

Assemble the screws up through the feet, put a little nail polish on the foot and screw as seen above.

Insert these through the holes in the bottom plate, assemble a nut and tighten.

Assemble the bottom panel to the amplifier with the pattern of drilled ventilation holes closest to the circuit board.

Assemble screws to the panel.

Flip the amplifier over on to its feet.

Five of the seven grommets used to finish off the holes in the top panel need to be modified.

These can be filed or sanded. If using a powered disk sander, material will be removed very quickly so exercise caution.

I've specified 8 of the smaller ones in the parts list so if one is spoiled there will be a spare or two.

Start by removing a small amount of material then test fit the grommets. Remove more material as required.

The large one for the rectifier tube and a smaller on for the adjacent 12AT7 will need some attention.

Two small ones for the closely spaced EL84s will need a bit of material removed.

One small one will need a bit of a radius removed to clear a screw head. Use a round file or Dremel tool. Stick the grommets in place with a bit of black silicone seal or 5-minute epoxy if desired.

Lessons learned: The tube holes in the top plate are a bit sloppy despite my best efforts. In future I think I'll drill holes about 1/8" smaller, counting on spending an hour or two with a Dremel tool to get a just-right fit.

Label the back if you wish.

That’s it, we’re done! Connect up your amp and play some music.

I’ve discovered it takes about 50 hours of running before new components start to sound decent, often 100 or more before they really “settle in”.

After a month or so of use I like to re-tighten all of the screws of the terminal connectors. It’s also a good time to measure cathode the voltage on each of the EL84 tube to check on their health.

Check the cathode voltage every 6 months or so to determine how the tubes are aging. Typically, the cathode voltage will drop as the tubes age.

I’ll review the sound quality (SQ) of the patron’s amp in Part 6. I’ll also have one last attachment describing the procedure for those wanting to try the EL84s in pentode and/or triode mode.