

A 6sn7 version of the Grounded Grid

Having built the Grounded Grid in kit form, I was thinking about building another "tweakable" Grid from scratch, so that I could mess around with the circuit a bit more. Eventually I decided that I might as well use a different tube, and see how it compared sound-wise. Here's my progress to date on a 6sn7 version of the Grid.

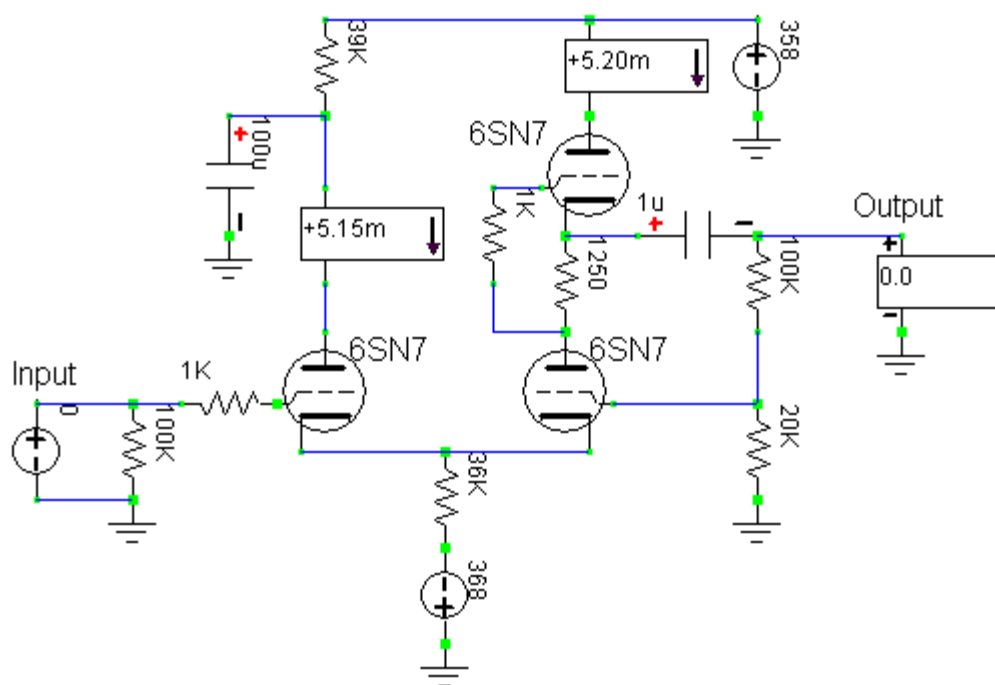
Note: this circuit is based on Bruce Rozenblit's Grounded Grid preamp circuit. It can therefore be used for non-commercial use only.

Audio circuit

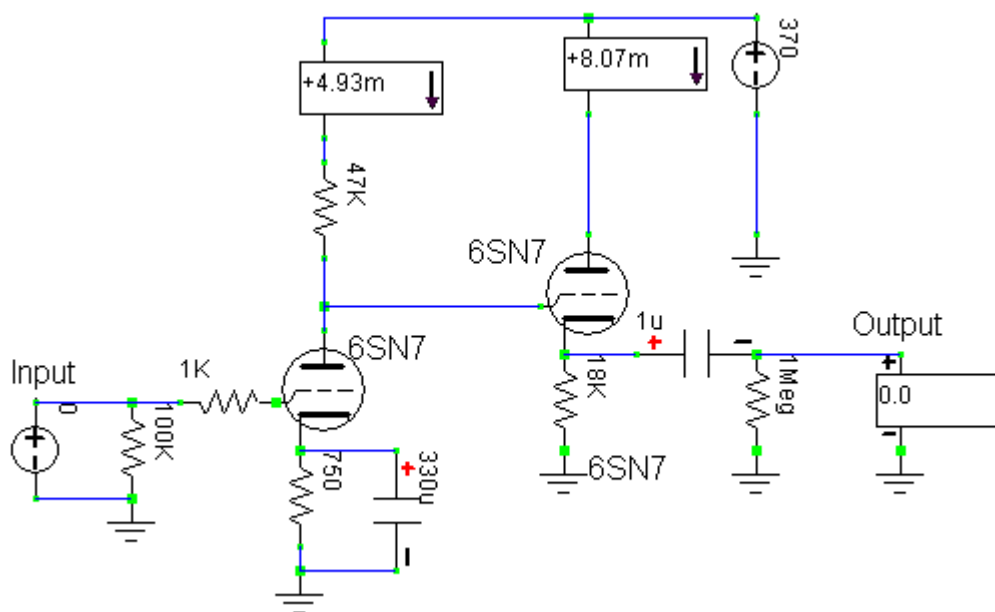
I simply adjusted the Grid circuit as published in Rozenblit's book Audio Reality for the 6SN7. I started with the operating points recommended (more or less) by the TubeCAD program from www.glass-ware.com. This meant 10 mA plate current and 150 V on the plate of the input cathode follower and the grounded grid triode. Check the **plate curves** on the Triode Electronics site -- it's hard to see how you could get more linear than that! I used a supply voltage of 350V, since this seemed like a good healthy voltage for a 6SN7 totem-pole type stage. The negative rail was the same.

After looking at the circuit for a while and playing around with the power supply, I realized that 10mA per tube might be a little much. For example, the resistor in the tail of the two lower tubes would be dissipating eight watts! So I modeled the 6SN7 line stage circuit published in Issue 11 of Vacuum Tube Valley. This preamp uses 5 mA on the gain stage and 8 mA on the output cathode follower. So I reduced the plate current to 5 mA in the Grid circuit. This also made the power supply slightly easier to draw up.

(Note on the circuits: the boxes with arrows in them are just "ammeters" indicating the current flowing in the circuit. The circle on the input is the signal source needed by the simulator, the rectangle at the output is the "voltmeter.")



6SN7 version of the Grid



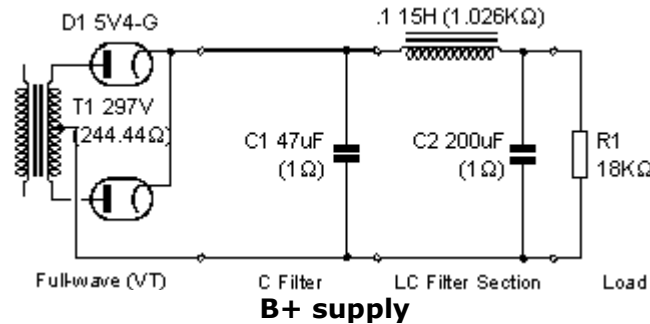
VTV line stage

B+ supply

Two channels draw a total of 20 mA from the supply (as opposed to 8 mA in the Grounded Grid). I didn't really fancy trying to use Zener regulators, so I just used simple CLC filters instead. I chose a Hammond 270BX, which is rated at 275-0-275 V @ 50 mA, 5V @ 2A, and 6.3V @ 2A. Since I had a 5V winding, I decided to use a

tube rectifier, might as well make the preamp look cool...

The chokes are Hammond 155J. I used only one per rail -- initially I used two per rail, in a CLCLC configuration, but decided that probably isn't really needed. Note that the transformer says 297 volts -- this is the no-load voltage, the transformer is spec'ed at 275 under full load.



This supply gives 358 V, with a 120 Hz ripple of about 1.2 mV peak-to-peak. That's just under 0.5 mV rms, or -66 dB relative to 1 V. The input cathode follower has additional filtering, plus a PSRR of maybe 20 or 30 dB. I have a suspicion that the PSRR of the output stage should be fairly good as well, because of the negative rail. Oh, well, I will see when I build it! If this is not low enough, a cascaded LC filter will drop the noise into the uV range.

A 5Y3G can also be used. It gives a B+ of 337 V. The 5Y3G may in fact be preferable as it is directly heated and therefore warms up faster. (Why am I thinking this? Because the negative rail comes up immediately, it seems like it might be better if the positive rail came up as fast as possible. If the tube warms up and there is no positive rail, then the grid is positive with respect to the cathode and excessive grid current might flow - ?) With 337 volts on the positive rail, the plate voltages on the two lower tubes drop from 157 V down to 136 V, but the plate current remains at 5.2 mA.

The negative supply rail circuit is identical, but uses diodes and is of course flipped over. It gives -368 V.

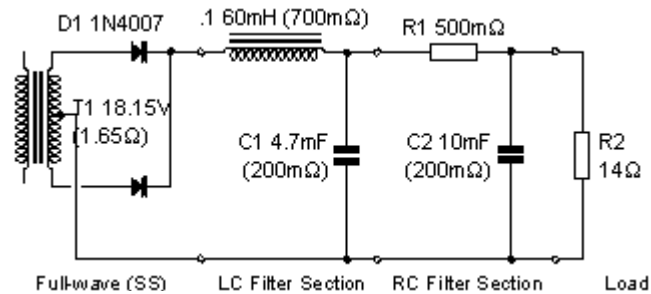
Filament supply

The Grid as published uses a 12V regulator for the heater supply. With 6SN7's, you need 1.8A at 6.3V; if you use 12SN7's you need 0.9A at 12.6V. This is still twice what the standard Grid uses.

I decided to give the regulator a miss, I don't think it's really needed anyway. I played around with a few supplies, only one of which really makes any sense given that I already have a transformer with a 6V winding...

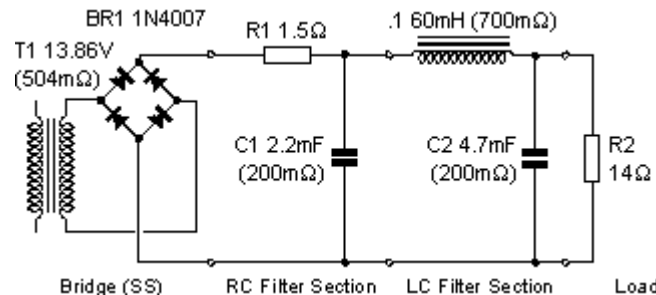
First off, a choke-input supply. I love choke-input supplies, the reduced peak current compared to capacitor-input filters makes a lot of sense. This one uses a Hammond 159ZC choke, which I just happen to have a few spare of. It's sort of beefy and inconvenient for a preamp power supply, but anyway... The transformer

is 33 V center-tapped @ 1A, Hammond 166J33. The second RC section is mainly there to drop a little voltage, as otherwise it's a wee bit high.



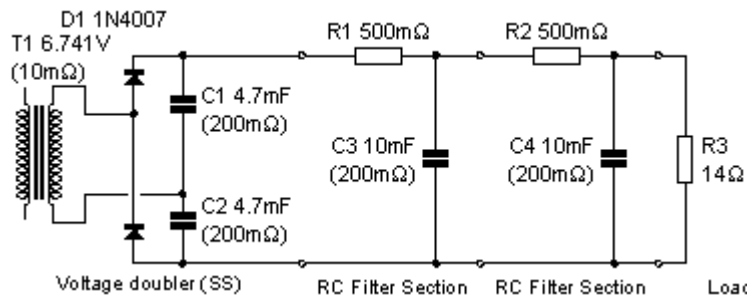
Choke-input filament supply: 12.5 V, 34 mV p-p ripple, 1.1 A peak current through the diodes

I then thought about using a 12V transformer, since I have a Hammond 167L12 rated 2.5A @ 12.6V. This supply uses a CLC filter, and loses some volts with a dropping resistor prior to the first capacitor:



Capacitor-input filament supply: 12.6 V, 13 mV p-p ripple, 3 A peak through the bridge

Finally it dawned on me that it would make most sense to use the 6.3V winding that I already have in the 270BX. So I came up with this voltage doubler supply. Since I'm losing the filament transformer, I may as well lose the choke while I'm at it and try and get the whole thing into one box. I'm not sure I really like this supply, but we'll see, it will certainly be smaller than the other two.



RC-filtered filament supply: 12.5 V with 46 mV p-p ripple, 6.5 A peak through the diodes

I think it may be possible to reduce the peak current by inserting a resistor between the transformer and the capacitors, but I can't model it in the Duncan

Amps PSU Designer program.

With any of the above supplies, it should probably be biased up to about 100V. The 6SN7 has a maximum heater-cathode rating of 200V, so purely in that regard we could either ground it or bias it up. Grounding might be less noisy, I will have to try both.

Layout and construction notes

OK, this is as far as I have got! I have a small chassis I was going to build another Grid in, but I don't think I can squeeze this version onto it. Hm... Hammond have 12 x 10 x 2 chassis, maybe I better get me one of those...

Tubeaholic.com is hosted on the ass-kicking Westside Platform.