



## VALVE JUNIOR UPGRADE KIT INSTALLATION INSTRUCTIONS

### HOW TO USE THESE INSTRUCTIONS

This kit is not for beginners! It is assumed you have a thorough working knowledge of vacuum tube electronics. It is also assumed you know and practice the appropriate safety precautions. If these 2 sentences don't describe you, do not attempt these modifications or use this kit. Instead, return it to us for a full refund.

**YOU MUST AGREE TO THE TERMS DESCRIBED IN THE **DISCLAIMER** SECTION OF THIS DOCUMENT BEFORE USING THIS KIT**

These instructions are divided into six sections. The first, **GETTING STARTED**, contains useful information about tech support, etc. This section also includes a parts list for the kit and a discussion of the Valve Junior schematic.

The **DISCLAIMER** section is filled with stuff to keep you, and/or your family if you should die, from suing me.

The next section, **GENERAL ENHANCEMENTS**, discusses changes that should be made to every Valve Junior amplifier to improve its performance with regard to noise, hum, and tube life. The following two sections are intended to address the specific goals of each customer.

**TONE ENHANCEMENTS** discusses how to use this kit to improve the overall tone of the amp and coax smoother overdrive from it. You may want to perform all or some of these modifications depending upon the sound you are seeking

**GAIN ENHANCEMENTS** details how to make small, incremental gain increases that can bump the overall gain structure of the amp a little or a lot. Use this information and group of parts to make your VJ grind a little more or scream like a [insert favorite screaming thing here]...

You will not use all of the parts included in the kit. There are several extra parts that offer flexibility in tone shaping and gain adjustment since no two players are looking for exactly the same thing. We recommend trying these mods one at a time and listening to the results before proceeding with the next one. You may find you only need to perform a couple of them to get your amp sounding its best according to your personal application. Use the parts you need and don't worry about the ones you don't. I always have stuff left over when I work on my car anyway. It's all good.

Finally, **SCHEMATICS** includes the stock Valve Junior schematic along with a couple of modded ones to get you started.

## GETTING STARTED

### TECHNICAL SUPPORT

Technical support is included in the price of the kit and is available at the s2 Amps Tech Support forum: <http://www.s2amps.com/forum.html>. If you can't get your question answered there, you can send an email to [info@s2amps.com](mailto:info@s2amps.com).

There is a photo essay covering some of these modifications to a head version of the Valve Junior amp here: <http://s2amps.phanfare.com/album/91114>. The essay depicts several of the mods listed below in the same order they appear in this document.

### BASIC KIT CONTENTS

ITEM	DESCRIPTION	VALUE	QUANTITY
1	Metal Film Resistor	10K ½W	1
2	Metal Film Resistor	1M ½W	1
3	Carbon Film Resistor	820R ½W	2
4	Carbon Film Resistor	680R 1W	1
5	Carbon Film Resistor	100R ½W	2
6	Carbon Film Resistor	100K ½W	1
7	Metal Oxide Resistor	270R 2W	1
8	Metal Oxide Resistor	20R 25W	1
9	Potentiometer	1M-A	1
10	Potentiometer	500K-A	1
11	Polyester Film Capacitor	.022µF 630V	2
12	Polyester Film Capacitor	.001µF 630V	1
13	Silver Mica Capacitor	47pF 500V	1
14	Silver Mica Capacitor	470-500pF 500V	1
15	Electrolytic Capacitor	120µF 450V	1
16	Electrolytic Capacitor	2.2µF 25V	2
17	Electrolytic Capacitor	1µF 25V	1
18	Electrolytic Capacitor	100-470µF 25V	1
19	Ultra Fast Diode	UF4007	4
20	Nylon Jack	NA	3
21	Mini Toggle Switch	NA	1
22	Shielded Wire	22AWG	1
23	Teflon Wire	20AWG	1
24	Spade Connector	20AWG	3
25	Screws & Nuts	#4	2

### PLUS KIT CONTENTS

ITEM	DESCRIPTION	VALUE	QUANTITY
1	Basic Kit	NA	1
2	Output Transformer	8W 60mA	1

## SCHEMATIC DISCUSSION

This section includes a discussion of each part in the schematic. This information will be useful to you in helping predict what effect changing values will have on the overall circuit. The discussion begins with the input jack and follows the circuit rather than following the enumeration of the various parts.

PART	NAME	DESCRIPTION
J1	Input Jack	Some VJ combo amps have a metal input jack that is grounded to both the chassis and the circuit board. This creates a ground loop, which can inject 60Hz hum into the signal path. Replacing this jack with the included plastic input jack will break the ground loop and prevent the hum.
R2	Grid Resistor	This 68K resistor is commonly located on the other side of R1, where it interacts with the Miller capacitance of the tube grid to reduce or eliminate radio frequency interference (RFI). Its location before R1 creates a voltage divider with R1 that causes a 50% loss of input signal as if you had plugged into a LO input jack. This little amp probably doesn't need a grid resistor at R2, so you can elect to jumper it with a wire. Or, replace it with the included 10K resistor if you should have problems with RFI.
R1	Pull Down Resistor	The purpose of this resistor is to reference the tube grid to ground, which sets the initial impedance of the circuit. This is normally 1M, so the stock 68K is a little odd. Epiphone engineers undoubtedly chose 68K because of the value and location of R2, which causes the aforementioned loss of signal. Changing this resistor to 1M will significantly increase the amp's overall gain and improve its signal to noise ratio. In fact, this may be all the gain increase you need.
V1a	First Preamp Triode	Here, the first half of the 12AX7 amplifies the input signal for the first time. The amplification factor is about 20 times the input signal.
R3	Plate Resistor	The plate resistor drops the voltage and limits the current to the anode of the first triode of the 12AX7. Its value is 100K, which is very common. This resistor interacts with the cathode resistor (R8) to set the operating point of the tube. There is no need to change this resistor unless you want to increase the gain of the 1 <sup>st</sup> triode, in which case you can change it to 220K and also change R8 to 1.5K. This combination extracts the most gain you can possibly get from a single triode of a 12AX7. But there are plenty of other (and better) places to adjust the gain in this circuit.
R8	Cathode Resistor	The cathode resistor interacts with the plate resistor to set how much current the triode can draw or the bias of the triode. Lower values allow the triode to draw more current and bias the triode warmer. Higher values have the opposite effect. It is generally accepted that warmly biased 12AX7s sound smoother and warmer. Changing R8 from a relatively high 2.2K to a relatively low 820R will help this triode sound its best.
C4	Cathode Capacitor	A cathode capacitor functions to increase the gain of a triode by letting certain frequencies pass unattenuated. C4 interacts with R8 to control frequency response of the first gain stage as it pertains to bass. Generally speaking, lower values of C4 will result in higher -3dB low frequency roll off points, or less bass. The value of this cap can be adjusted up or down to tweak the bass response of the triode. It is customary to select the resistor for its bias properties, then calculate a capacitor value to set the -3dB point of the triode. A cathode cap is optional. If you want the triode to run full range and don't want the gain boost benefits, it can be omitted from a circuit. The stock VJ uses a 22μF cap, which is basically full range with all cathode resistors. You can reduce this value to 2.2μF or 1μF to roll off some bass for a tighter response or remove the capacitor from the board if you want to reduce the amp's gain.

C1	Coupling Capacitor	Also called a blocking cap, C1 blocks the DC voltage introduced into the plate by R3 from passing to other parts of the circuit. This cap only lets the AC component through, which is the amplified signal. It can also be used to adjust bass frequency response by blocking frequencies below a certain threshold. The VJ's use of a .022 $\mu$ F cap here is pretty standard, but you can replace it with a larger cap (.047 $\mu$ F or .1 $\mu$ F) for more bass response, or a smaller cap (.01 $\mu$ F or .0047 $\mu$ F) for a tighter bottom.
R6	Attenuating Resistor	R6 and R7 create another voltage divider which reduces the signal by 50%. These resistors are not necessary, strictly speaking, but their presence is not all bad. They help limit the amount of signal going into the second triode of the preamp tube to help keep it from overdriving. This gives the amp some clean headroom and emphasizes power tube overdrive over preamp tube overdrive. If you want maximum overdrive from your VJ, jumper R6 with a wire and remove R7. You can also take advantage of R6 to adjust treble and midrange presence of the circuit by bypassing it with a capacitor. This will also increase gain for the affected frequencies.
R7	Attenuating Resistor	See R6 above. This resistor can be removed from the board if you want a substantial gain increase in the circuit.
VR1	Volume Potentiometer	The stock 1M pot lets the signal pass almost unattenuated when it is fully clockwise. If you want to decrease the signal by bleeding some of it to ground, you can replace VR1 with a 500K pot. You might want to do this if you have increased gain elsewhere in the circuit and have found it to be too much.
V1b	Second Preamp Triode	This triode amplifies the signal a second time before passing it into the power tube. It is also responsible for overdrive in the preamp. The amplification factor for the second triode is also about 20 times the input signal.
R4	Plate Resistor	See R3 above.
R9	Cathode Resistor	This triode differs from V1a in that it can be overdriven by V1a, yielding preamp distortion. To maximize preamp overdrive in your amp, replace this resistor with an 820R or even a 680R. Lower values of this resistor overdrive more easily and yield a warmer, smoother tone. Higher values like the stock 2.2K can still bias this stage to be overdriven, but the stage will overdrive later and the tone will lean toward edgy or grainy or buzzy distortion. Using a 1.5K resistor is a good compromise, which is why this value is so prevalent in Fender amps.
C3	Cathode Capacitor	See C4 above.
C2	Coupling Capacitor	See C1 above.
R5	Grid Leak Resistor	This resistor references the power tube to ground and can serve to adjust how much signal is applied to its grid. Lower values for R5 bleed more signal to ground and higher values send a stronger signal into the grid. If you want to maximize power tube overdrive, you can increase this value. If you lean toward more headroom, you can decrease this value. For most purposes, the stock 220K value is fine for this circuit and does not require adjustment.
R15	Grid Resistor	This resistor helps prevent parasitic oscillations and undesirable noise in the power section of the amp. The stock 1.5K value is typical, so this resistor can be left alone.
V2	Power Pentode	The power tube amplifies the signal going into the output transformer.

R14	Cathode Resistor	The cathode resistor for the power tube interacts with the plate voltage to set the bias of the tube. The stock 220R is a little low, which means the tube is biased too hot. Higher values for R14 result in colder bias. This resistor should be replaced with a 250R or 270R 2W resistor to bias the tube more reasonably, which improves its tone and increases its life.
C5	Cathode Capacitor	This capacitor is necessary to stabilize cathode biased power tubes. Higher values have more of a stabilizing effect than lower values. The stock 22 $\mu$ F cap is low compared to most modern circuits, but is very common in vintage circuits—especially tweed amps. It can be replaced with any value up to 2200 $\mu$ F. Higher values result in a stiffer power amp and can make an amp respond similarly to a fixed bias power amp. Common values range from 50 $\mu$ F to 470 $\mu$ F. This cap also has an effect on frequency response, and some people feel higher values contribute more bass to a circuit. This is likely only because of the stiffening effect, because even a 10 $\mu$ F cap is full-range when combined with a typical cathode resistor. This means any cap at or above 10 $\mu$ F is full-range and contributes nothing to the theoretical frequency response of the amp, but higher values can contribute to the stability, and therefore stiffness, of the power amp.
T2	Output Transformer	The output transformer matches the impedance of the power tube to the impedance of the speaker. Its size and construction contribute to the overall frequency response and tone of the amp as much as tubes do. The stock OT is on the small side and can be replaced with a larger unit for better bass response and clearer tone. Additionally, the stock OT has a primary impedance of 7.5K Ohms, whereas the ideal for an EL84 is 5.2K Ohms. A Hammond replacement OT has a bass response of 75Hz and allows for a nearly ideal 5K primary impedance.
J2	Speaker Jack	This jack can be either plastic or metal, but it should be grounded to the chassis in either case to reduce hum.
T1	Power Transformer	The power transformer converts the incoming wall voltage (120VAC 60Hz in the USA) to higher and lower voltages used by the tubes. In this case, the PT provides 250VAC for high voltage applications and 6.3VAC for the low voltage filament supply.
BR1	Bridge Rectifier	The rectifier converts the 250VAC power supply exiting the PT to DC (about 355VDC in this application). It is made up of 4 diodes in full-wave bridge formation, which is a kind of rectifier used with transformers which do not have a center tap. The stock rectifier network uses 1N4007 diodes, which are notorious for introducing switching noise into a circuit unless they are shunted with capacitors. Either bypassing each diode with a .01 $\mu$ F 630V capacitor or replacing them with ultra fast UF4007 diodes will solve this problem.
C6	Filter Capacitor	Filter caps convert the rippled DC exiting the rectifier into smooth DC and they store charge. The more capacitance a filter cap has, the smoother the treated DC will be and the more charge it can store. Smoother DC translates to a quieter circuit in the 120Hz range. The amount of stored charge relates to how much power is available to the circuit when it is needed to reproduce bass notes. More charge equals more punch. The first filter cap supplies the output transformer and power tube plate. The VJ uses a 22 $\mu$ F first filter cap, which is pretty standard for amps with tube rectifiers, but low for Solid State rectified circuits like this one. You can decrease 120Hz hum in the amp by increasing the size of the first filter cap to 100 $\mu$ F or more.
R12	Dropping Resistor	A dropping resistor provides separation between the filter caps and reduces the voltage between power supply nodes. This is important, because each filter cap needs to function independently of the others without bleeding from one node into another, which would inject noise into the circuit. Also, different parts of the circuit need lower operating voltages than others. For example, power tube plates should be fed the highest voltage. Power tube screens require less voltage than plates for

optimal performance and tube life. Preamp tubes run on much less voltage than power tubes, so the power supply voltage must be dropped significantly to protect them from damage. Dropping resistors serve to isolate each power supply node and drop the voltage appropriately for each node's application.

C7	Filter Capacitor	The second filter cap supplies the power tube's screen. The stock 22 $\mu$ F value is typical and there is no need to change it.
R13	Dropping Resistor	See R12 above.
C8	Filter Capacitor	The third filter cap supplies the preamp tube. The stock 22 $\mu$ F value is typical and there is no need to change it.
R10	Balance Resistor	Some power transformers do not provide a center tap for the filament supply—they are less expensive to make this way. A side effect of this lack of balance for the supply can be 60Hz hum if one side of a tube filament has a higher or lower resistance than the other. A 100R resistor on each side of the filament supply to ground serves as a virtual center tap and cancels the hum by balancing the two halves of the supply. An alternative is to heat the filaments with DC power, which is the method used in the VJ head.
R11	Balance Resistor	See R10 above.

## **DISCLAIMER**

VACUUM TUBE PRODUCTS SUCH AS GUITAR AMPS, PREAMPS, AND PEDALS CONTAIN POTENTIALLY **HARMFUL OR LETHAL HIGH VOLTAGE** ELECTRICITY. A SHOCK DELIVERED BY A TUBE CIRCUIT CAN **STOP YOUR HEART AND KILL YOU.**

IF YOU ARE NOT QUALIFIED TO WORK WITH HIGH VOLTAGE ELECTRONICS, PLEASE SEEK HELP FROM A QUALIFIED ENGINEER OR TECHNICIAN.

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## GENERAL ENHANCEMENTS

The Valve Junior is a pretty good sounding amp the way it is. But there are a few quick things you can do to make it sound better, run quieter and cooler, and increase the life of the power tube.

### TUBES AND SPEAKERS

The quickest and easiest mods you can perform are to change the tubes and speaker. Most current production amps ship with Sovtek tubes. Why? Because they are extremely durable and tend to withstand the rigors of shipping. Manufacturers don't want support calls about "broken" amps that turn out to be bad tubes, so they ship their amps with the most durable tubes they can find.

Upgrading your tubes is inexpensive (there are only 2 of them for cryin' out loud) and easy and makes a huge difference in tone. A simple amp with only 2 tubes gives you the rare ability to really hear the differences between different brands and types of tubes with distinct clarity.

The speaker that ships with the VJ is pretty anemic. It is made to be cheap to produce, having the quality of its sound as a secondary concern. Weber VST makes several 8" speakers which will dramatically improve the tone of your VJ combo. I personally like the 8F125, which has a huge magnet, is very loud for its size, and has great bass response. There are probably other great 8" speakers out there, so feel free to experiment. I've also heard of people squeezing 10" speakers into the combo, but I haven't witnessed it.

### SECOND THINGS FIRST

Be sure to check the voltage of all the filter caps and make sure they all read below 12VDC before performing any repairs, upgrades, or modifications inside the amp. Your Valve Junior has potentially FATAL voltages inside.

**IF YOU DO NOT KNOW HOW TO SAFELY CHECK AND DISCHARGE  
HIGH VOLTAGE FILTER CAPS, DO NOT USE THIS KIT AND  
DO NOT OPEN YOUR AMP!**

**SEND THE KIT BACK TO US FOR A FULL REFUND INSTEAD OF  
RISKING INJURY, PROPERTY DAMAGE, AND/OR DEATH.**

### DROP THE VOLTAGE

The *RCA Tube Receiving Manual RC-30* lists the normal operating plate voltage for an EL84 in Class A single-ended mode at 250VDC. My sample had a plate voltage of 335VDC, which appears to be way too high. In reality, you can almost always run power tubes with much higher than their rated voltages, but it is true that lower voltages result in a smoother, "brownier" sound and greatly extended tube life. You can bring the plate voltage down to about 300VDC by installing the included 20R 20W power resistor between the IEC mains input socket and one of the primaries of the power transformer. Reducing the voltage here will not introduce any unwanted sag into the circuit.

1. The 20R 20W resistor has 2 holes for mounting it to the chassis. Drill 2 matching holes in the chassis and screw the resistor to the chassis using the included #4 machine screws and nuts
2. Disconnect one of the mains wires from the IEC socket, strip it, and solder it to one side of the resistor

3. It is prudent to cover the exposed wire / solder joint with heat shrink or electrical tape
4. Run a new wire from the other side of the resistor to the IEC socket. You can either solder the wire directly to the socket or use one of the included spade connectors

### COOL THE BIAS

Replace the stock bias resistor with a new resistor included in the kit to cool the EL84's bias. This is a slight adjustment which sets the bias to true Class A performance instead of over-the-top, kill-your-power-tube Class A+. Your EL84 will sound a little clearer and last a lot longer with this mod. It will also run cooler and will likely extend the life of the PCB where the tube socket is mounted.

You may not need to do this mod if you did the voltage reduction mod above. If you have the capability to measure the bias, check it before you do this mod. If not, go ahead and do it to be on the safe side.

5. Use the included 250R 2W resistor to replace R14. This is the bias resistor. The stock resistor is 220R

### SHORE UP THE POWER SUPPLY

This is especially important if you have the combo version. The head version is already pretty well-filtered and does not necessarily need this mod (but it won't hurt either).

Change the first filter capacitor in the power supply to quiet things down. Replacing the stock 22 $\mu$ F cap in the first position with the included 120 $\mu$ F cap reduces 120Hz hum that creeps from the power supply into the signal path. Single-ended amps do not have the hum canceling properties inherent to push-pull amps, so they need a little extra help in this area. This mod will also smooth the amp's tone, add a little more punch to its response, and make the bottom end a little more solid. If you have the combo version, it may be easier to solder the replacement cap to the original cap in parallel without removing it, giving you a total of 142 $\mu$ F at this position.

6. Use the included 120 $\mu$ F 450V capacitor to replace or parallel C6

### CLEAN UP THE RECTIFIER

The Valve Junior curiously uses 1N4007 diodes in its rectifier without the usual snubbing caps that dampen switching noise. You can kill the switching noise by either adding the caps or replacing the diodes with UF4007 units, which are ultra fast equivalents to 1N4007s. It is easier and cheaper to replace the diodes, so that is the approach we will take here.

7. Remove the stock diodes and replace them with the included UF4007 diodes
8. Be sure to observe the polarity of the diodes

### ISOLATE THE INPUT JACK

Some VJ combos have a metal input jack that grounds to the chassis in addition to the circuit board and creates a ground loop, which results in 60Hz hum. If your amp has a plastic input jack, skip this mod.

You can also take this opportunity to replace the jack's wire with the included shielded wire if desired, but it may not make much difference for such a short run. The head version already has shielded wire.

Use the included nylon jack to replace the stock input jack. For this operation, you may need to enlarge the input jack's hole to fit the new nylon jack. You can do this with a drill bit, a Unibit, or a round file. Some VJs have a hole that is already large enough, so try to fit the jack in the existing hole before enlarging it.

9. Unscrew the existing jack
10. Unsolder the wire leading from the old jack to the circuit board at the board (optional if you want to replace it with shielded wire)
11. Enlarge the hole if necessary
12. Install the new jack in the chassis
13. Solder the shielded wire to the board in place of the old wire
14. Solder the shielded wire to the jack

## KILL THAT HEATER HUM

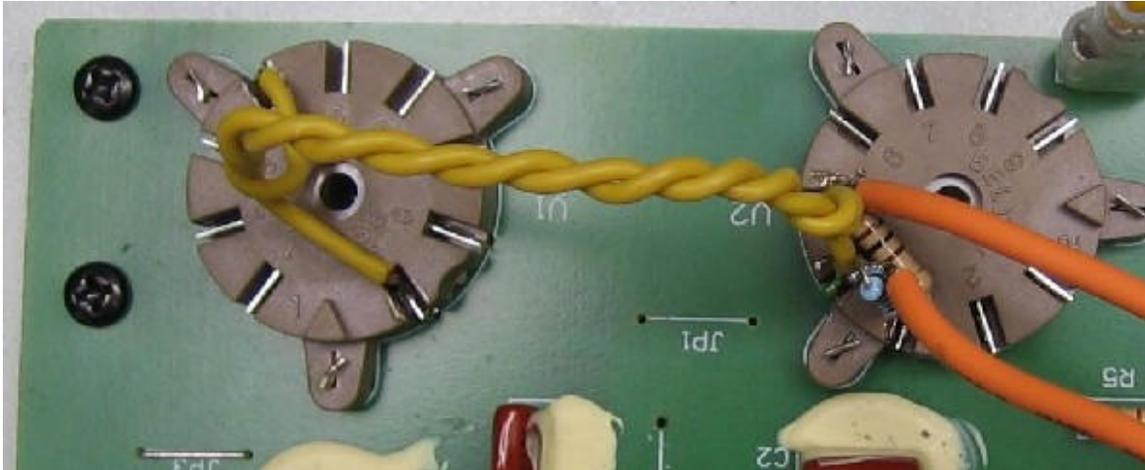
The heater supply in some VJ combo amps is AC powered. If you have the head version or your combo amp happens to have DC heaters, ignore this mod as your heaters are already quiet. If you have AC heaters, you need to move the heater supply off the circuit board to prevent it from injecting 60Hz hum into the signal path. It is not necessary to convert your heaters to DC. AC heaters can be just as quiet as DC if the wiring is done correctly. The problem here is not the AC heaters themselves, but the fact that the AC traces are running too close to other traces conducting the signal path on the circuit board. Moving them off the board solves this problem.

This is a somewhat tedious operation. Since my amp has DC heaters and is already quiet, I didn't do this mod and therefore don't have any photos of my own. Help can be found here however (scroll down near the bottom of the web page):

<http://users.telenet.be/svokke/valve%20junior%20mods.htm>

This is how to do it:

15. Find the heater wires coming from the transformer and unplug them from the board. They are orange in my amp
16. Cut the spade connectors off the wires and strip them. Twist them tightly and make sure they will reach the EL84 tube socket
17. Twist about 5 inches of the included hookup wire together
18. On the 12AX7, solder one wire to pin 4 and one wire to pin 9. You don't need to jumper pins 4 and 5, as they are already jumped with a PCB trace
19. On the EL84, solder the two included 100R resistors together to pin 3. It may help to twist them together before soldering them to the pin
20. You are now going to solder the PT's heater wires, the 12AX7's heater wires, and the unsoldered end of each 100R resistor to the EL84 socket. One set goes to pin 4 and one set goes to pin 5. It isn't easy to do, but there is enough room to do it
21. The finished product will look something like the following photo (borrowed from the above noted web site with permission), except the orange wires should be tightly twisted:



### ADD AN 8 OHM SPEAKER JACK

Valve Junior combos have a single 4 Ohm speaker jack in the back. These amps sound amazing through extension cabinets like a 1x12 or 2x12, but the 4 Ohm impedance limits your options as to what you can plug into. You can add another speaker jack by using the extra tap on the output transformer (the unconnected red wire) or you can add both 8 Ohm and 16 Ohm speaker jacks if you upgrade the output transformer.

Use the included nylon jacks to add one or two speaker jacks. For this operation, you need to drill a hole or two in the back of the chassis.

22. Locate the extra real estate on the back of the chassis
23. Drill 1 or 2 holes next to the existing speaker jack depending upon your OT situation
24. Install the included jack(s) in the new hole(s)
25. If you are upgrading the OT, install it now (see OT instructions)
26. Solder the new jack(s) to the OT secondary leads

### TONE ENHANCEMENTS

There are several things you can do to improve the overall tone of the Valve Junior. This section includes some easy mods to help the amp sound its best and help you zero in on that monster tone in your head.

If you plan to upgrade the output transformer, do it first. You will want to assess the tone enhancements in context with the new OT to prevent yourself from having to go back and adjust things again after replacing the OT. The replacement OT dramatically improves the frequency response of the amp.

### UPGRADE THE OUTPUT TRANSFORMER

Many of the less-expensive amps available today ship with inferior output transformers. These are designed to be cheap to make and sound quality takes a back seat in many cases. Inexplicably, the Valve Junior OT is wound with a 7.5K primary, when the ideal primary for an EL84 in SE mode is 5.2K.

Fortunately, there are several good options in aftermarket transformers which can dramatically improve the sound of a Valve Junior. The Plus Kit includes a Hammond 125CSE, which is twice the mass of the stock OT and can be wired for an almost-ideal 5K primary impedance.

This isn't the easiest mod, but it has a huge impact on tone. The aforementioned photo essay has some good pictures, which should make this operation easier.

27. Unscrew the speaker jacks from the chassis and flip the speaker jack PCB over to expose the solder points for the secondary leads
28. Unsolder each of the secondary leads from the speaker jack PCB and remove the wires
29. Remove the OT primaries from the circuit board by carefully unplugging them
30. Cut any wire ties as necessary
31. Unscrew the OT and remove it from the chassis
32. Place the new OT on the chassis and line up the chassis hole nearest the edge of the chassis with one of the OT holes
33. Mark and drill a hole for the other mounting hole on the OT
34. Feed the OT leads through the rubber grommet and screw the new OT to the chassis using the hardware from the old OT
35. Crimp the included spade connectors onto the blue and brown wires
36. Plug the **blue** wire into the connector nearest the power tube
37. Plug the **brown** wire into the connector nearest the power supply
38. Solder the **black** wire to the ground or common hole on the speaker jack PCB
39. Solder the **green** wire to the 4 Ohm hole on the PCB
40. Solder the **yellow** wire to the 8 Ohm hole on the PCB
41. Solder the **white** wire to the 16 Ohm hole on the PCB
42. Insulate the **orange** wire with heat shrink or electrical tape and tie it up out of the way
43. If you have a combo and choose not to add extra speaker jacks, insulate and tie up the **yellow** and **white** wires instead of soldering them
44. Tidy up the wiring with the included wire ties
45. Sell the old OT on eBay for big \$\$

#### UPGRADE THE TONE CAPS

The VJ comes with very inexpensive polypropylene tone caps. You can improve the tone of the amp by replacing C1 and C2 with high quality metallized polyester film caps. This mod doesn't make a huge difference, but it is worth doing while you have the opportunity.

46. Use the included .022 $\mu$ F Mallory 150 caps to replace C1 and C2

#### WARMER = BETTER

The cathode resistors on the first and second triodes are too large and cause the VJ to sound slightly gritty or grainy. You can fix this by biasing the tube warmer using the included 820 Ohm resistors. This mod also gives you creamier overdrive when the second triode saturates.

47. Use the included 820R resistors to replace R8 and R9

If you want to extract the most amount of crunch from the preamp, use the 680R resistor instead of the 820R to replace R9 on the second triode.

## BRIGHTEN THINGS UP

Some players complain the VJ is overly dark—especially with humbuckers. I'm not one of them, but there are such people. I swear. There are two ways to make the amp brighter. The first is to add a bright cap to the volume control. This mod adds chime/shimmer to the very top of your sound, but doesn't change the mids or bass. To add chime to the amp do this:

48. Solder the 47pF cap across the right and middle lugs of the volume pot (you will want to replace the volume pot first as described below)

If you are less interested in chime and want to increase the amp's overall midrange and treble presence skip the previous step and bypass R6 with a 500pF or a .001 $\mu$ F cap (or a .0022 $\mu$ F or a .0047 $\mu$ F or a .01 $\mu$ F or a .022 $\mu$ F (you get the idea)). Bigger caps let more bass through. You might want to start with the 500pF cap and move up or down to taste.

R6 plus R7 form a voltage divider that reduces the signal going into the volume pot by 50% (more on that in Gain Enhancements a little later). Bypassing it with a cap allows midrange and treble frequencies to pass without being attenuated, but the muddier frequencies (lower mids and bass) are still rolled off. If the 500pF attenuates too much bass, try the .001 $\mu$ F cap. You can also use the 47pF cap if you just want a little more high end chime and don't like bright caps on volume controls.

This mod also increases gain, and can increase it quite a lot if you use a larger cap. You can use the included mini toggle switch to make this "bright cap" switchable.

49. Bypass R6 with one of the included caps
50. If you have the head version, you will need to solder the cap leads to the exposed resistor leads on the top of the board
51. If you have the combo version, there may be an unused space on the board next to R6 that is waiting for the new cap

If you like things really bright, do both mods and see if you like the results. Both are very easy to undo if things turn out too bright.

## TIGHTEN THE BASS

You may want to adjust the presence of the lower bass frequencies if you feel the amp sounds muddy or farty. You can do this by adjusting the cathode bypass caps on the preamp tube. These are C3 and C4 on the schematic. You can tighten up the amp's bottom end by first replacing C4 with one of the included 2.2 $\mu$ F caps. If that isn't enough, replace C3 with the other 2.2 $\mu$ F cap. This will set the -3dB point for each triode to 133Hz instead of 13Hz. If that still isn't enough, you can set the -3dB point of the first triode to 293Hz by using a 1 $\mu$ F cap. These frequencies assume you have already changed R8 and R9 to 820 Ohms.

52. Replace C3 with a 1 $\mu$ F or 2.2 $\mu$ F 25V cap
53. Replace C4 with a 2.2 $\mu$ F 25V cap

## REPLACE THE VOLUME POT

The stock volume pot in the VJ is silly. Your kit includes a larger (better, quieter) pot. Two actually. Use the 1M pot for more gain or the 500K pot for less.

54. Use one of the included pots to replace VR1
55. Cut the volume pot plug right up against the plug itself
56. Strip the 3 wires on the plug
57. Solder the **black** wire to the left lug of the new pot
58. Solder the **red** wire to the middle lug of the new pot
59. Solder the **white** wire to the right lug of the new pot

## STIFFEN THE BIAS

You can stiffen the bias of the amp and make it act more like a fixed bias circuit by changing the EL84's cathode cap from 22 $\mu$ F to something bigger like the included 470 $\mu$ F cap. Up to 2200 $\mu$ F is acceptable if you really want to go wild with it. This mod gives the amp the gift of punch.

60. Replace C5 with the included 470 $\mu$ F 25V cap

## **GAIN ENHANCEMENTS**

Each of the following mods increases the VJ's gain structure in different ways. Some of the mods have more impact than others. Some result in more preamp tube overdrive, others increase power tube overdrive, and some increase both. Keep in mind that making changes to increase gain early in a circuit have more impact than doing it later because the boost is amplified by each subsequent gain stage.

### **MAKE THE LO INPUT A HI INPUT**

It is my personal opinion this mod should be done to every VJ. I think Gibson / Epiphone intentionally crippled the VJ to make their more expensive offerings more attractive to buyers.

Much like in cheap effects pedals, a certain resistor—commonly called a pull-down or grid leak resistor—is sucking your guitar's tone as soon as it enters the amp. This is R1 on the schematic. You need a grid leak resistor to reference the signal to ground to set the impedance for the tube grid, but for some reason, the VJ uses a 68K resistor, which is a very low value for this position in the circuit (normally 1M). That value, when used in conjunction with odd position of R2 before the grid leak instead of after it, creates a voltage divider that dumps half your guitar's signal to ground like plugging into a LO input on an old Fender amp. Doing this at the very beginning of the circuit lowers your signal to noise ratio in addition to dramatically lowering the overall signal traversing the entire circuit. Exchanging the 68K resistor with a 1M resistor solves this problem.

R2 is called a grid resistor or a grid stopper. Its purpose is to interact with the Miller capacitance of the tube's grid to eliminate radio frequency interference (RFI) from radio and television stations. In an amp with shielded wire and a fairly low impedance, this resistor may not be necessary or may be reduced from 68K to 10K. Removing or reducing this resistor improves the touch sensitivity of the amp.

You might be surprised at how much the amp will open up with this mod alone since it happens at the very beginning of the signal chain and its boost is amplified by 3 subsequent gain stages (both triodes of the 12AX7 and the EL84). This may be the only gain adjustment you need to make.

61. Replace R2 with the included 10K resistor or a jumper wire
62. Replace R1 with the included 1M resistor

### **ADJUST THE ATTENUATOR NETWORK**

This mod adds a LOT of gain to the circuit. Resistors R6 and R7 make a voltage divider that attenuates 50% of your signal before it reaches the volume control. It doesn't make much sense to amplify your guitar signal through the first triode of the preamp tube only to dump half of the result immediately unless you are trying to maximize clean headroom.

You may have bypassed R6 with a 47pf, 500pF or .001 $\mu$ F (or bigger) capacitor in a previous step to add some midrange and treble presence to the amp. If you did that mod and are happy with the sound, ignore R6 (you already have a good gain boost by doing that) and just look at R7, which is an optional mod to bump gain very slightly. R7 doesn't need to be there, but its presence doesn't hurt anything.

If you didn't add that cap or you didn't like the sound of that mod, you can take R6 and R7 out of the circuit for a huge boost in gain. This mod increases both preamp tube and power tube overdrive for some serious scariness.

63. Remove R6 and replace it with a jumper wire
64. Remove R7 from the board (optional)

#### ADJUST THE EL84 GRID LEAK

Resistor R5 on the schematic dumps some signal to ground before feeding the power tube in addition to setting the input impedance of the EL84 grid (much like R1 does for the first triode). You can increase power tube overdrive by increasing this resistor up to 1M or decrease it by reducing the value down to something like 56K. Any value between 33K and 1M is okay here.

65. Replace R5 with a higher value resistor (>220K) for more power tube overdrive or a lower value (<220K) for less power tube overdrive

#### GAIN REDUCTION

No idea why you might want to do this, but there are several places in this circuit where you can reduce its gain. You can remove R8 and/or R9 from the board to reduce the gain factor of one or both triodes of the 12AX7. You can reduce VR1 from 1M to 500K or 250K. You can reduce R1 to 47K. You can reduce R7 to 470K, 220K, or 100K. You can reduce R5 to 100K, 68K, 56K, 47K, or 33K. [Not all of these values are included in the kit.]

Interestingly, you can increase the gain and decrease it in different parts of the circuit to emphasize preamp tube overdrive, power tube overdrive, or both. Feel free to experiment.

#### SCHEMATICS

##### STOCK SCHEMATIC

The first schematic is the stock combo amp before any mods have been made. I have not drawn one for the head, which is slightly different, because the signal paths are identical between the 2 amps. The differences are in the power supply and preamp filaments. The power supply has an extra filter cap, and the preamp had DC filaments.

##### MODDED SCHEMATIC

The second schematic represents a modest improvement in gain and tone. It features all of the general enhancements plus the upgraded OT. There is also a very slight boost in gain from the adjustment of R1 and R2. Finally, the bottom is tightened up by adjusting C4.

This schematic shows the changes made to the gallery amp. It is a very good starting point for most mods. Of course, your mileage may vary.

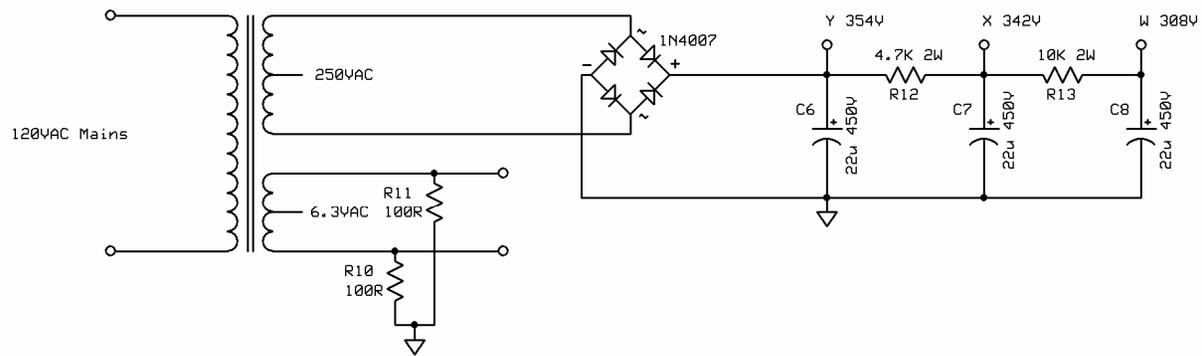
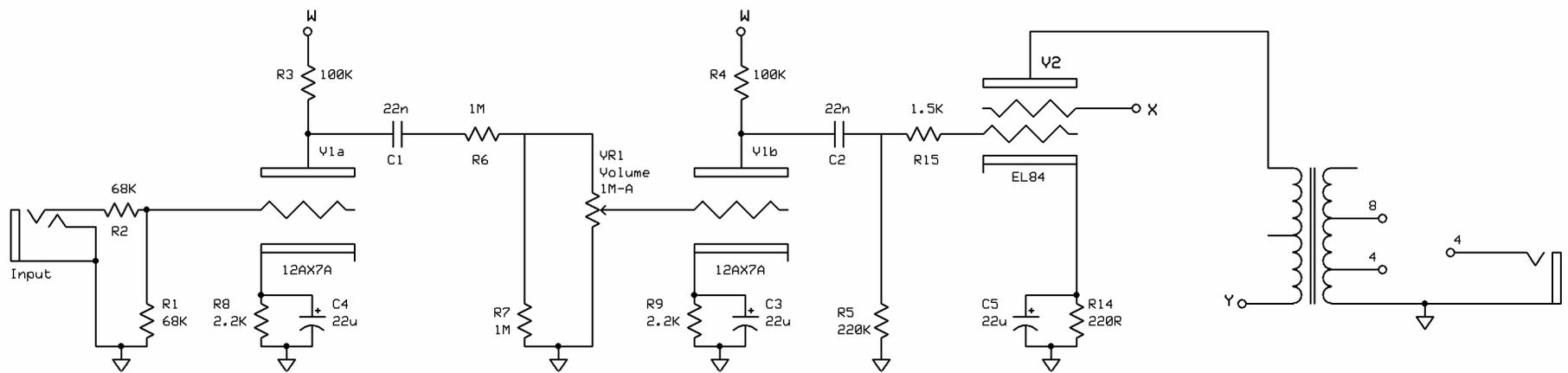
##### MY SCHEMATIC

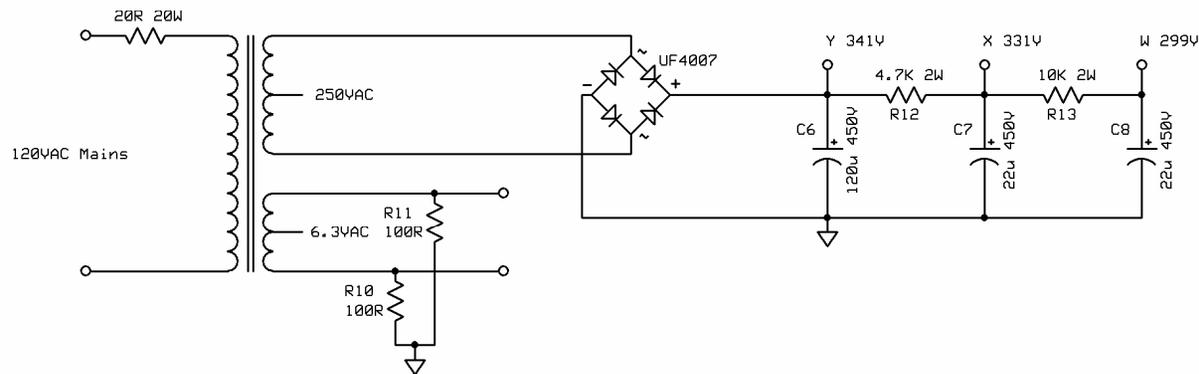
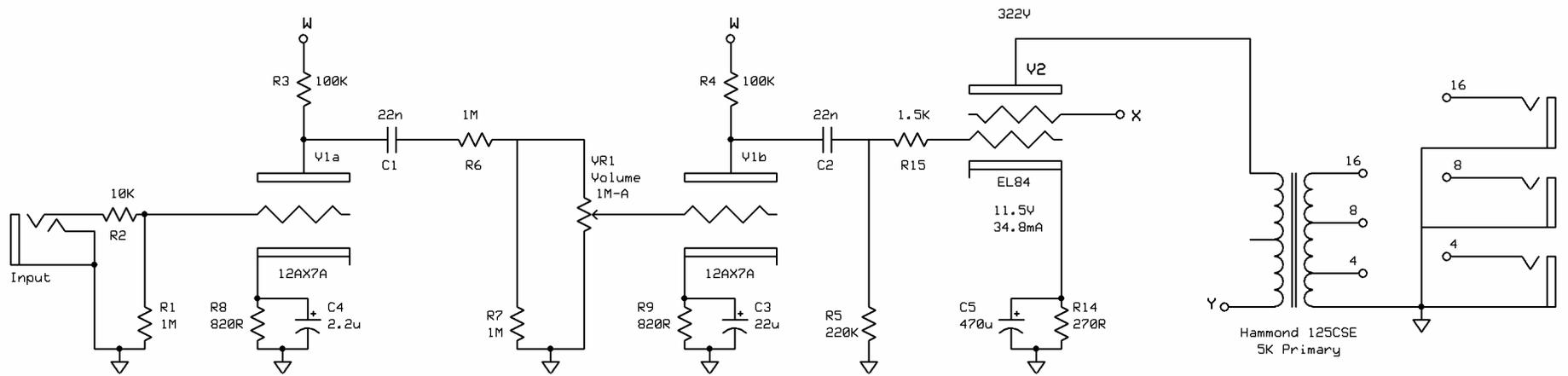
This is my personal VJ head. It is identical to the modded schematic except for the addition of a .0022uF cap across R6 and the volume pot, which is 500K instead of 1M. It has a great blues tone with a nice chime provided by the bright cap that melts away into grind as you turn up the volume knob. I didn't

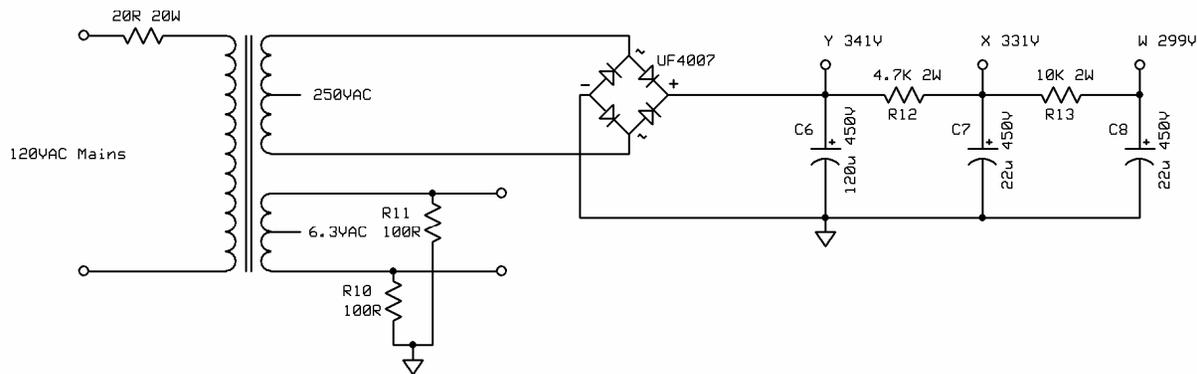
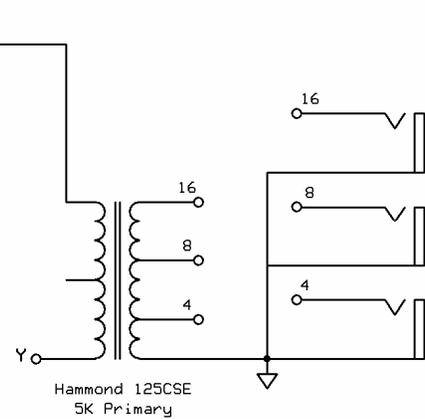
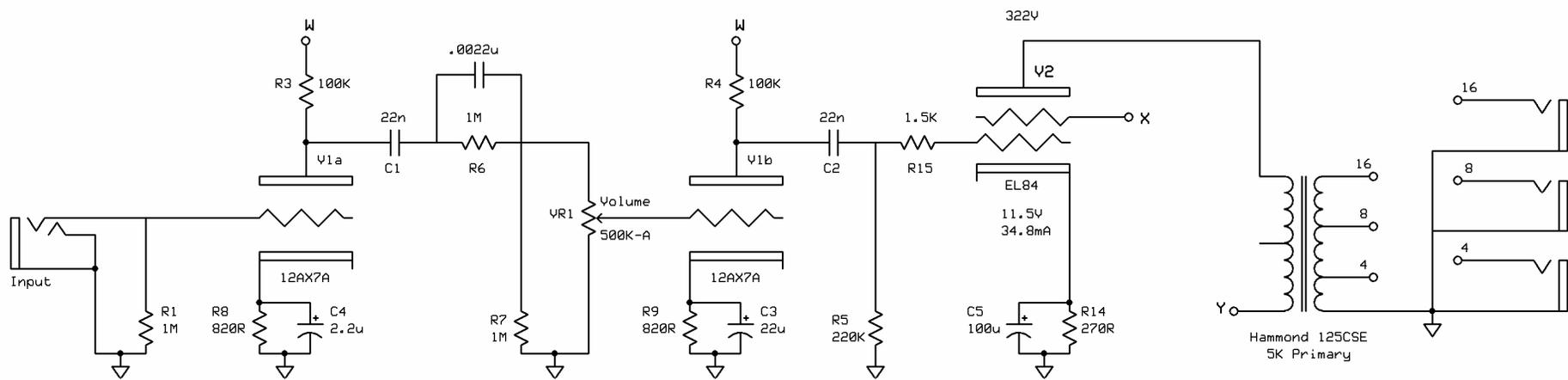
want to go too far over the top with this amp. The goal was a sort of SRV tone with a Strat and ZZ Top and AC/DC sounds with a Les Paul. It has a little less gain because of the 500K pot.

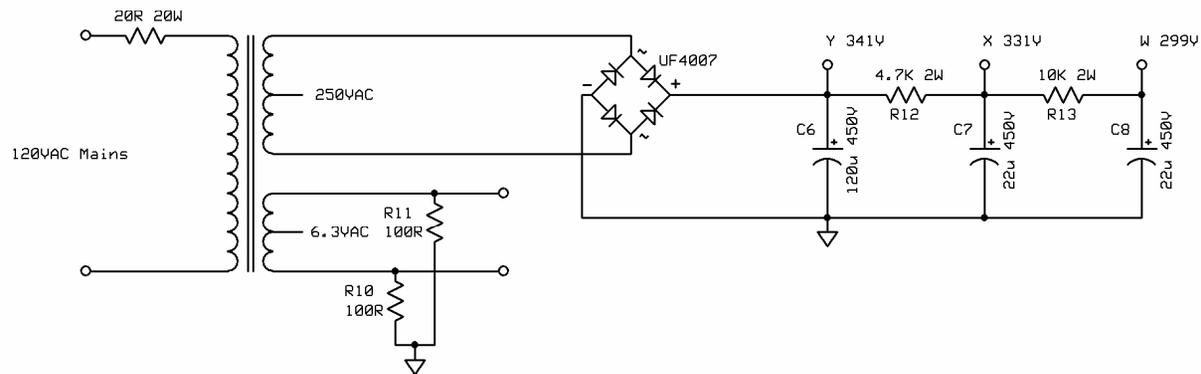
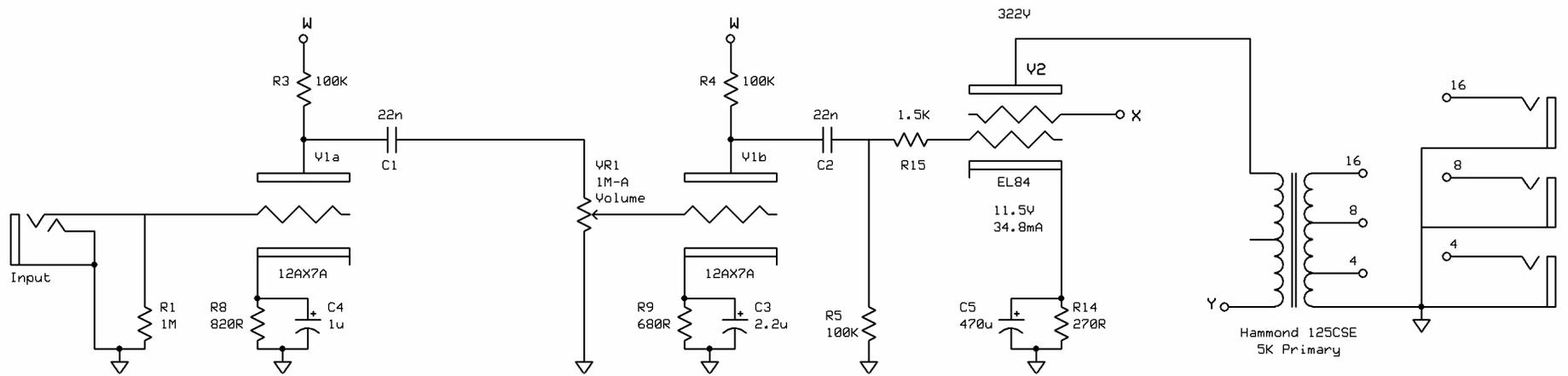
#### INSANE SCHEMATIC

The last schematic is a high-gain fire breather. It has almost no clean headroom and coaxes a lot of overdrive from both the second triode of the 12AX7 and the EL84, so you get a good mix of preamp tube and power tube overdrive. The EL84 breaks up first, followed quickly by the 12AX7.









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## Valve Junior Combo - Insane

Steven Scott

Rev 1.0

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