

Music Angel 845

The modding of a SET-A amp

This is another modification of the Chinese tube-amp.

I believe that the MA 845 is a great opportunity, to obtain a real good sounding SET-A amp and I invite you, after you read the precautions on electrical safety, to follow this mod.

By Barbara E. Gerhold, *TUBECLINIC* Linz/Austria

<http://www.tubeclinic.com>

Current updates:

January 2013: Connecting to the idea of Mr. van Hall, I designed a Gyrator circuit, intended to substitute the choke needed in the B1+ supply. The results obtained by this modification are so fine, that there is no more need for heavy resistor chain between B+ and B1+. Please see in behind and also the extra PDF about this theme.

May 2010: Again some eMails from other Audio aficionados made me revising this article. Especially an idea of Mr. van Hall should be incorporated. His idea points at the B+ supply for the front end tubes (6SN7). I wish to thank Mr. van Hall for his good idea!

March 2009: This is a revised version of the former article, situated at the "Lampizator" website of Mr. Lukasz Fikus, where some FAQs of you readers are obtained. Also my eMail changed – please see in the back of the text!

Please read the precautions on electrical safety

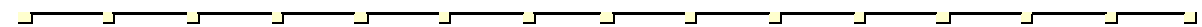
(printed in RED in the behind of this text)

in the entire first!

Please also **be aware**, that:

- On your workbench you have a tube amp with nearly 1000V supply voltage! This voltage is more than dangerous for life!
- Supply caps will store lethal energy for more than fifteen minutes!
- You have not got so much room in the housing to apply the needed parts - mentioned in this text - so you have to plan the mod carefully!
- You should be skilled in doing tube amp work. This project is strictly no thing for beginners!
- I shall accept no liability whatsoever – implied or not implied - resulting from usage of this modification!

If only one of the above points says **NO**, please do not try and let the rework do a person you rely to and who has the skill and ability to do it!



At my website you can find a schematic of the final modification (V4.3a). Pls. download it and print it before starting to think about any modifications!

Please have a look at it first. I also recommend to change the B1+ supply, according to this latest review (Ver. 3), as well as to change the connection of the heaters of tubes V1 and V2 according the above mentioned schematic V4.3a.

Now some explaining words on the HOW and WHY:

Soundstage:

I tried the version of the SRPP input stage using both 6SL7GT and 6SN7GT and found out, that I could not find a totally stable operation with this connection. At least after some hours, the operating point always settled to another value.

Sound was also not according to my opinion. It was clear but not really musical, no blooming and sparkling at all.

So I changed to a series connection of V1 using a 6SN7GT.

All four pre-tubes in my mod are new 6SN7GT from Sovtek. They have a grand sound with much detail - very, very better than the original Chinese tubes - although they need some more time for breaking-in.

Note – be aware:

I made not so good experiences with NOS tubes from the fifties!!! All these tubes showed rather microphonic behavior and seemed not to be "that new". Some of them - bought via ebay USA - definitely not were new!

Today there are no (really new) NOS 845 tubes on the market, so stay away from fakes and burnt-out items. In this case, the Chinese "Shuguang" brand is the best I could get.

If you already own NOS 845 tubes (like a reader "from the wireless division" wrote) they could be a big improvement.

Pls. note: This configuration is not suited for the Metal Plate 845 tube, having only 70W of power. It is only suited only for the standard 100W version of the 845.

The advantages of the series connection are:

- Heater induced hum is cancelled out because both stages operate exactly the same way and they are phase inverted.
- There are no heater problems with the upper tube half of the SRPP (heater to cathode voltage in a 6SN7GT must be <200VDC).
- The series connection shows no cancelation of even order harmonics (esp. k_2), other than in the SRPP. So the sound will stay pure and sweet as well.

The sound of the series connection is full of details, very colorful and the operating point is absolutely stable (at least for the last months). I put current-feedback (CFB) resistors (2k7) into the ground wires for to lower the total amplification factor of both V1.1 and V1.2. This makes also the sound more accurate and much better 3D-imaging, thus not touching the typical SET sound performance!! You could experiment in the range of 1k5 to 3k3, depending on the input sensitivity you wanted to realize.

Driver tube V2 (6SN7GT) is connected with both systems in parallel, as a hard-coupled cathode-follower directly to the anode of V1.2. This understands, it is only matching the impedance to very low levels. This circuitry cannot do anything good or bad to the sound, it changes only output impedance as seen by the 845. All the signal amplification is done by V1.

Idling currents and operating points:

V1.1 and V1.2 are idling at exactly the same 3.55mA.

V2 is idling at about 10.5mA.

V2 shows a maximum undistorted sine wave output swing of about 100Vrms (280Vpp). More than you need for the 845 to fire its grid!

BIAS circuitry:

I changed the BIAS resistor at the grid of the 845 tube from former 2 x 68k/0.5W-coal in series to a 220k/2W-metal film to get a better noise figure.

Note: Some readers sent me eMails, considering this value: 150k/2W - metal film might give a bit brighter sound. I did not try until now, but you could try by yourself.

Components:

I put out all 0.5W/5%-coal resistors and substituted them by 0.6W/1%-metal film (VISHAY). The 2W/1%-metal film resistors are also from VISHAY. 10W and 5W resistors are wire wound (DALE) and selected to achieve reliable and stable operating points.

I also found out, that 0.47 μ F/500VDC WIMA MKP capacitors ahead V1.1 and V1.2 have the best sounding capabilities I could get. *You could use other caps of good quality too, but then you had to experiment on your own. MKP-X2 of 275VAC have a real good reputation too, mostly being better than special types recommended for Audio!*

Maybe some further improvement could be made by paralleling some mica-caps ... I don't really know by now, but maybe I shall try later on.

The coupling capacitor ahead the grid of V3 (845) is at its best as a mix of 3 pieces (all in parallel):

- 1 x 0.47 μ F/275VAC/2000VDC X2 Siemens or similar (a RFI product, optimized for AC)
- 1 x 0.33 μ F/1000VDC PME RIFA (Swedish product; was originally in, sounds fine, but is too small)
- 1 x 0.22 μ F/1250VDC FKP WIMA (a pulse-current proof version of MKP).

I received many questions about this cap-mix:

It is composed in a way that the benefits of each type are brought together to make one ideal sounding cap. Please do not change this mix! Brands are not so important, but keep the types and values and always use good make! I suggested WIMA in some places, because they are the Real McCoy - caps in Europe at an affordable price.

I used the 0.22 μ F/1250VDC FKP WIMA also as decoupling caps for all DC-supply voltages in parallel to the electrolytic caps. They improve micro dynamics in sound a lot!

The sound is also improved (but only a bit!) by the 1k/0.6W-metalfilm resistors in front of each triode grid. It makes the sound a bit more sparkling. Solder them as close as possible to the lugs of the tube-sockets!



The DC supply board:

A separate supply B1+ (420VDC) for the input and driver stage was omitted in my amp in the delivered condition. This supply was originally gathered from the B+ rail (920VDC) and was lowered via 3 pieces of 33k/2W resistors in series. They would have smoked away, if I left them in their place! My total idle current in the pre-stages is around 18mA per channel, so I settled to the above mentioned (→ *components*) wire wounds. I used {15k/10W + 10k/10W + 3k3/5W} to lower the 920V to about 430V.

Ver. 2 - NOTE:

Last eMail-responds say that in the moment MA845 are delivered, which again have a separated B1+ supply. In this case you should use this separate supply instead of a resistor chain!!!

AGAIN – Ver. 3 - NOTE:

Mr. van Hall pointed out, that the B1+ supply could also be gathered from the center point of the B+ voltage-doublers supply (point between the two caps 120µF/475V in series => half voltage of B+ => +460VDC).

The try-out showed that this connection works well. During turn-on you might attend some rumbling, but really soon it will show a stable operation. A series resistor from this point to the original B1+ point is necessary. In my case it was a value of 1k8/5W. You should keep the value of B1+ as close as possible to +430VDC. Maybe some other value is suitable within your amp, so you had to try by your own. Also the ripple increases by this connection. If it shows too big for your ears, you also might insert a small choke.

Another essential requirement will be that you switch the choke of the B+ supply from the negative (grounded) path to the positive (hot) path of the supply. In my case this was not difficult, but please -> have a look at your amp before making changes! Take a measurement of the leakage resistance of both wires of the choke against iron core and mounting bracket before switching on. If there is any leakage, it will mean a short against ground!

The reason for this adoption is, to omit the real heavy power resistor chain for lowering B+ (920VDC) to B1+ (+430VDC). This is a big improvement from a view of energy saving, but I had to say, that the Audio performance was not increased. Only the heat from the resistors stayed away. Because hum increased, I kept with the former configuration; anyhow ... My horn-speakers have a sensitivity of 108dB SPL, so any additional hum is no good.

A separate schematic is attached to this chapter, showing the modded Ver. 3-power supply.

Ver. 4 - NOTE:

I wanted to improve the hum situation beyond the otherwise splendid idea of Mr. van Hall, and so I designed a dual Gyrator stage, which is intended to substitute the choke in the above mentioned schematic. The results are much better than from using an iron choke. So I wanted to encourage you to have a look at a separate article I wrote about this theme. You can find it here at my website.



Please note, that all these schematics only show the situation in my special amp. There are many variations of this amp in the marketplace, so you should thoroughly check your own situation before changing any connections!

Precautions on electrical safety:

1. As you can easily figure out, these above mentioned three wire wound resistors show a heater power of about 9W per channel! In my amp, I had to distance the bottom steel-sheet 10mm (4/10") from the enclosure,
 - to get enough cooling air into the enclosure and
 - because the distance between B+ (920VDC) on the supply PCB and the enclosure was too small.
2. Worst of all, the enclosure of the amp had no earth wire connection in the delivered condition! This had to be repaired in the entire first! Be aware – B+ is nearly 1000VDC!!!
3. Please have a look at the punched holes in the bottom steel-sheet. There are maybe some splints left in the holes (my amp had them!) that could make a short from ground/earth to supply voltage!
4. Please have a look at the 4 diodes of both of the B+ supplies, before switching-on the amp!!!
5. When I switched on the amp for the first time, a diode of the voltage-doublers (for B+) smoked away, taking the lower electrolytic cap (150µF/450V) with it.
6. I changed all 4 diodes from 1N4007 (1A/1000V !!!) to UF5408 (4A, 1000V) and reset all 4 caps to 120µF/475V.
7. You could also use diodes 1N5408 (4A/1000V) instead of UF5408.

After all mods:

- Input sensitivity is now about 1,5Vrms (+6dBm) for full output. I put out the selector switch and the volume pot, because I am using the Angel only as a power amp behind a preamp of my own construction.
- Hum and noise are no matter at all, even connected to my horn-speakers of 108dB SPL (1W, 1m) sensitivity.

Three listening tips:

- You should always use high sensitivity speakers (e.g. horn speakers) when playing music through sophisticated SETs. Only such speakers are able of performing all the dynamics and details, coming from your vinyl. Speakers of more than 95dB SPL are fine - the more the better! The more the sensitivity is, the better will be the resolution – or - be the ability, to make sound from the tiniest signal parts! **This amp is not well suited for small speaker boxes with low sensitivity and therefore low resolution! You then should use an amp with higher wattage!**


- You should always compare your listening at home to live performances, played by acoustic instruments, you already heard and remember well. This is the only way to improve your music gear.
- CDs do not have such a rich and defined sound, compared to what a SET (connected to a horn-speaker) is able to bring out, so please always use vinyl, when checking-out gear performance!

What was the sound before modding:

- The sound was already clear but had lack of details. Bass was strong, cloudy and somewhat too booming. Female voices and brass had a nasal touch and were not so real right, anyhow.
- Dynamics were huge, but not realistic for my ears. All seemed to be too big, compared to a similar live performance.
- I had the feeling, that the sound was harsh in some places, especially when listening to jazz recordings of smaller bands.
- All in all, it seemed to me, the electronics did not have so much control of the sound.

My view of the new sound after modding:

- The sound is really very bright, clear and full of details. It is also very colorful, especially in view of female voices, brass, woodwinds and string arrangements. Grand pianos show their characteristic sound, you can easily distinguish the several brands.
- The bass section is powerful and undistorted - that means you can follow bass lines with ease. The big bass tone in the beginning of Richard Strauss's "Also sprach Zarathustra" stands markedly in the room. Bass drums come with a mighty kick (for example try Charly Antolini's "Knock out" from the Jeton direct cut LP).
- The imaging is outstanding, after I put in the above mentioned current-feedback resistors to the first and second stage (V1.1 and V1.2). Brass sections can be easily divided into the several playing instruments and also choirs can be heard as each voices instead the sum of them (for example try a good US-made Big-Band recording of the late sixties).
- I did not make use of any capacitive paralleling of cathode resistors, because I feel, that it makes the sound somewhat cloudy and dull in the bass and lower midrange (maybe an immeasurable phase-distortion problem or a problem with settling time of big electrolytic caps in general).


I hope this description of my mod is something helpful to you - and – please ignore my bad English ...

If you have further questions, please give me a return:

Mailto: support@tubeclinic.com .

Ver. 2: Notes and additions to the former article (Ver. 1) were marked green!

Ver. 3: Notes and additions to the former articles (Ver. 1, Ver. 2) were marked violet!

Ver. 4: Notes and additions to the former articles (Ver. 1, Ver. 2, Ver. 3) were marked blue!

