The Class-A Amplifier Site
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A Dutch journey in JLH-land

A tribute to the JLH 10-15 Watt Class-A amplifier

By: Rudy van Stratum, Dutch audio-hobbyist

Why this article?

Simple: Geoff Moss asked me to write this article. And if that's not enough, I want to convince you that building a JLH is a wise thing to do. During the last few months, Geoff and I seemed to have a continuous hotline of e-mails about the progress I made in building a (second) JLH. Because I think we made some steps forward and gained some new insights, we decided we'd better share these thoughts with you as potential new constructors.

How I met the JLH

The first time I came across the JLH amplifiers was in 1997. A friend of mine sent me the 1996 article that appeared in Electronics World. I was immediately intrigued by the man and his ideas. To be honest I have not experienced much enthusiasm for any transistor amplifier since I discovered good tube amplification. The only transistor amplifier I have used every now and then during the last 10 years or so was the famous Hiraga 20 Watt amplifier (I have built several of these amplifiers, in a number of variants and settings). In my humble opinion, this is one of the best simple transistor amplifiers available to the diy public, up to this very moment. Before that I enjoyed many fine hours with the now obsolete Musical Fidelity A1 budget amplifier. Nevertheless, the story of the JLH inspired me to take another leap at transistors. I'm not a great fan of complexity and regulation, so I chose the original 1969 design, as shown in figure 1 of the 1996 article. This was even simpler than the Hiraga. Component selection did not seem very critical. Most of the components needed I had somewhere lying around the house. It took me several days and the first prototype (not yet in a neat enclosure) was playing before me. Finally, I built the prototype in true Hiraga-style. Here are some features:

- A monstrous power supply, 3 big 40,000uF/75V Sprague capacitors per channel.
- 35 Ampere bridge rectifiers, a transformer of around 200 VA per channel, double mono construction.
- Passive power supply that gave me around 44 Volts of DC voltage. I set the thing at an idle current of 1.5 Ampere, so in effect I already had a 15 Watter from the start.
- I used Motorola transistors everywhere, 2N3906, 2N1711 and 2N3055s.
- Beyschlag 1 Watt resistors everywhere (I was very pleased with these resistors in my earlier designs, comparable with Holco's which are far more expensive).
- Philips capacitors everywhere else, except at the output, where I in the end used a Roederstein 4700 uF/63V type.
- An input C4 of 1.3 uF, 100 Volt, of American make (I once got 25 of these capacitors from a friend of mine), polyester type, very musical.

First results with the JLH-69

My first JLH worked right from the start, no hum whatsoever, no hiss, no problems, just music. Before I forget: I introduced one 'new' thing into the design. I put a 0.33 ohm/5 Watt resistor in the line from the collector of Tr2 to the Vc. I did this to have an easy way of measuring the idle current through the power resistors. Later, when everything worked properly, I could easily bypass this resistor with a few inches of thick wire. Actually, I never bothered to bypass this resistor, so I always listened with this power resistor in place. I fine-tuned the amplifier by trying at least a dozen output capacitors. Every capacitor sounded different and the one that really made the amplifier sing was the Roederstein (other capacitors made the amplifier sound more 'mundane', more clinical, more sterile). I changed the transformer a few times for other types, and here also differences in sound quality could clearly be heard.

From the beginning it was clear to me that this was a very special amplifier indeed. In some respects it gave me more pleasure than did the Hiraga. This amplifier did not sound like a transistor amplifier at all, it sounded so round and full and gave an immense depth into the music. Amazing. The amplifier gave a somewhat coloured overall view I guess, like many fine-sounding tube-amplifiers of the 1960s. I missed some speed and texture in the high frequencies. The low frequencies came out too dark and not so 'quick' and up-tempo. Think of the loudness controls of yesteryear.

Good but not perfect

My JLH did not sound perfect. The Hiraga was a more neutral and more transparent performer. I started to wonder how the amplifier would sound without the output capacitor, because this was the most obvious candidate for the few shortcomings of the JLH. I wondered how the 1996 version would sound to my ears. In the article the author did not take a lot of trouble to persuade the builder to go for the newer version. Actually, he did not hear any significant differences between the '69 and '96 versions, good is good. I acquired the newer version of the JLH on loan from a friend. As I expected, it did not sound as good as my old version. My friend had built the amplifier from a Hart Electronics kit. Maybe (now this is what I think) there was still one remaining error in the design, as pointed out by Geoff on this site (the incorrect connection of the feedback capacitor to the -ve supply rail). Indeed a fairly loud hum was clearly audible.

So in 1999 I started to think about building the old JLH anew, with a symmetrical power supply. Why change something more than is strictly necessary? If the old design could sound that good, there clearly is not much wrong with the design itself. Therefore, in building my second JLH, I insisted on using exactly the same components where possible. Refer to figure 2 in the 'Design Notes' article for the circuit used. When I first switched on this prototype (now it really was a prototype, I did not know if and how it would work) there was a terrible hum. More seriously, after switch-on I got more than 10 Volts DC for a few moments on my speaker. I've got myself a big DC offset problem here. After consulting several friends at the time, no one could see a solution, so away went the thing into a box.

When Geoff Moss entered the game

Then a few months back I discovered the DIYaudio site and I posted my problem of 2 years back on the forum. Geoff is a regular visitor to the forum and within 24 hours there was a

solution to my problem: insert one resistor and the hum should be gone. Geoff gave me some extra advice, remove the 0.33 ohm resistor and change the polarity of the feedback capacitor.

Ok, now for the first time I had a properly working amplifier, new-old style. The DC offset swing was minimized within reasonable margins (it stays within 0.5 Volts during one second, you can hear the woofer give a very soft thud sound). First conclusion: clarity and focus and speed are much better than the old JLH. Very good.

The 1969 dual-supply JLH: an evaluation of its sound

After a few weeks (and comparing it many times with the Hiraga), I came to the conclusion that the sound missed some of the old warmth and body. Just a logical consequence or could this be 'solved'? Now a painstaking inspection of all components and several experiments followed.

As mentioned before, the Geoff's advice was also to cut out the 0.33 ohm power resistor. This sounded logical, it had no use after all. It took me several weeks to find out that the sound of the amplifier changed just because of this removal of the resistor. We both have no clue why this is so. Geoff made several computer simulations and concluded that it did not seem to matter whether the resistor was in or out (there was virtually no difference in the simulated distortion figures, the square wave performance or the bandwidth). Okay, then I prefer having it in, and my advice to you builders is to try it for yourself. Without this resistor, the newer design sounded more clinical than my old version. The transparency was all right though. With the resistor in place the sound becomes more relaxed, everything is smoother than before. Now, when I place the original Roederstein capacitors between the amp and the speakers (just for an experiment) I have my original sound back (and I checked it by making comparisons between the two amplifiers). Taking away or bypassing the Roederstein (do this only with the newer version!!) shows clear gains in transparency and detail richness. No doubt about that. The output capacitor introduces some colouration of the sound, it is a very nice and pleasant kind of distortion that is introduced here though, not bad at all.

Furthermore there was a slight gain in quality to be had by bringing the bootstrap and feedback capacitors (referring to figure 2 on the Design Notes page, C2 and C3) to a higher value of 470 mF/63V (this is a departure from my old JLH).

Now 4 years after first meeting the JLH I have a version that really shines. I think it flows more organically than the Hiraga, but the Hiraga still has the edge in a number of other areas. I dare not say which amplifier is the best in the long term. Both amplifiers stay way ahead of any transistor competition that I know of.

How does the JLH compare to a good tube amplifier?

As a postscript, let me say something about the statement that the JLH equals a good tube amplifier (and, as a bonus, for a tenth of the price of a good tube amplifier). Well, this certainly is not so. I have made many tube amplifiers in my life that, without any doubt on my side, bettered both the JLH and the Hiraga in almost all respects (of course these are subjective statements, it can not be demonstrated by hard figures). Also, and meant as a warning, it should be clear that I have also heard a good number of tube amplifiers that could not match the quality of either the JLH or the Hiraga. Recently I built a very simple EL84 push-pull amplifier (see www.hifi.nl) using old transformers from a Bocama/Lafayette

LA-224B amplifier of the 1960s. I used no overall feedback, set the EL84's in triode-mode and used a paraphase phase-splitter. This baby tube amp didn't cost me as much as the JLH (in terms of components). And sorry folks: everyone in my place prefers the tube amp. You really have to bring in a normal commercial transistor amplifier to be able to hear the special qualities of the JLH again.

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