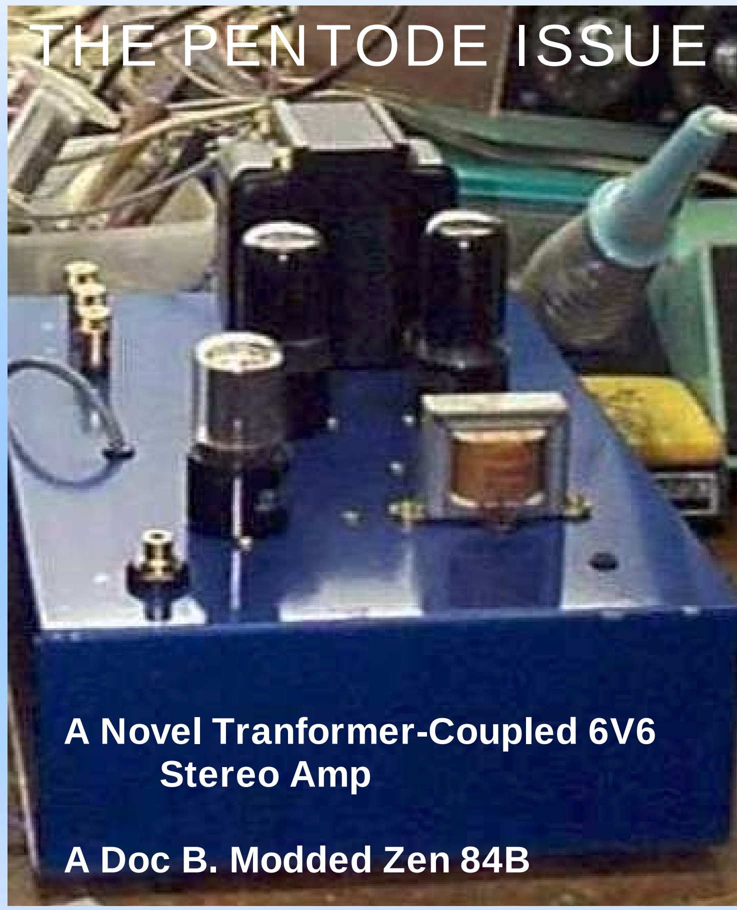
VALVE

the magazine of astounding sound



Twelve Ways to Parafeed

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volume 6 number 5 1999

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P.O. Box 2786
Poulsbo, WA 98370
by phone: 360-697-1936
business hours: 9-4:30 PST, Mon -Fri
technical queries: Thurs. 12-4:30 PST
fax: 360-697-3348
e-mail - bottlehead@bottlehead.com

Editorial and Advertising Inquiry
1428 Roberts Ave.
Nashville, TN 37206
by Email: brad_brooks@hotmail.com
by Phone: 615-228-2792, evenings CST
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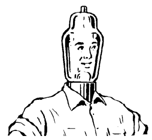

editor's thing

Season's Greetings!

I am really excited by the opportunity to edit my favorite audio eXperimenter's and DIY magazine. Under Doc's guidance, VALVE has developed into a valuable resource for audio eXperimenters and Hi-fi enthusiasts around the world. As the new editor, I am excited by the challenge of continuing to offer exciting technical features.

VALVE will continue as a tube enthusiasts, experimenters and DIY journal, just like when it started back in 1994. It has been a formula for success since the beginning, so why change now? You can see for your self—the VALVE CD-ROM Archives are now available. Was VALVE ahead of it's time? Maybe. I think that it was innovative even in it's humble beginnings as a simple club newsletter— get the back issues and check it out.

Look forward to a few small changes. Beginning January we will be publishing VALVE quarterly. We will also be revamping the VALVE web page, and we will be posting additional goodies there in-between issues.

I will be eXperimenting with various formats to enable you to use this document easier. PDF format is great, and we will continue to distribute VALVE in PDF format. I will be looking at ways to make it work even better as a screen document, so it is easier to read at work (on breaks only!) Do not have your BAN up and running yet (Bathroom Area Network)? So print it out. That way you can read it on the bus, or while waiting in the car at the mall while your "dear heart" shops. Either on screen, or as a printed document, your choice. We will constantly be tweaking.

We will be searching out more advertisers of DIY kits and parts to include in VALVE. Our ad costs are reasonable, heck, they are dirt cheap! Look forward to new sponsors in the coming issues.

Thanks to everyone for your patience while we produced this latest issue. Please drop me a line now and again with feedback on how we are doing.

Thanks to Dan, Eileen, Paul, Dave, John T., John C., Mikey, Eric, and all others who have contributed thus far to make VALVE what it is. They have set the bar high. I thank Dan for the opportunity to continue his fine work. Happy New Year everyone, and *Don't let the blue smoke out!*

Without further adieu, we bring you:

THE PENTODE ISSUE

On the cover:

Cameron Etezadi's 6V6 amplifier. Read more about how he designed and constructed this screamin' blue amp and power supply.

Keep those equipment Glam shots coming!

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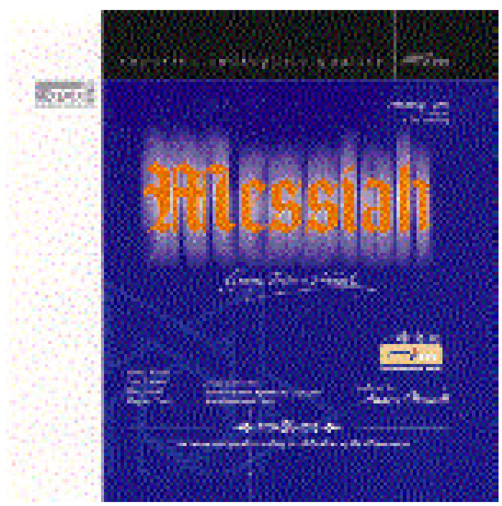

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#189 16149 Redmond Way
Redmond, WA 98052

http://www.fimpression.com

Tel: 425-868-5326
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A NOVEL TRANSFORMER-COUPLED 6V6 STEREO AMPLIFIER

by Cameron Etezadi

ABSTRACT

Certain types of music or certain types of speakers require more power to drive them to acceptable volume levels than a relatively inexpensive DHT or other SE configuration can produce. The inexpensive solution to this issue is construction of a push-pull amplifier, with the resultant change in sonic character such a topology brings. This article details the construction of an inexpensive and effective push-pull amplifier, offering excellent sound at increased power levels. Some interesting design tricks are employed; these may be successfully utilized in other single ended or push-pull designs. The result is an amplifier with an almost flat frequency response from approximately 18 Hz all the way to 24 kHz, 0.58% THD at 1 W, and no shortage of detail or bass, yet with a total finished cost of less than $600, well within the budget of the average do-it-yourself builder.

INTRODUCTION

When the Whammodyne! speakers were first published in VALVE, a copy quickly became my main reference pair of speakers. They offer remarkable efficiency, extreme detail, and have a reasonable frequency response. These speakers were bi-amplified with identical pairs of homemade 6GW8/ECL86 single ended amplifiers, using parts scavenged from old phonograph amplifiers generously provided by both my mother and George Wright. This setup worked well for a while, but the strained three watts per channel provided just could not handle the heavier passages of more modern, contemporary music, nor could the meager power supplies and output transformers keep up with the dynamics of the more refined classical or jazz pieces. Given these shortcomings and a slim budget to spend on audio equipment, the design of a cheap, yet reliable and high fidelity push-pull amplifier was sought that could remedy this situation. The limitations and drawbacks of push-pull designs are obvious, yet the more reasonable prices of the output transformers, coupled with the higher power levels available from such configurations make it the logical choice, if the price to performance point for this project was to have been reached.

DESIGN CRITERIA AND GOALS

This amplifier had only two major goals; these seem to be the common goals of all VALVE projects: good sound and a price as low as possible.

With these two goals in mind, the search began for parts to use. One of the easiest ways to bring the price of any project under control is to scrounge. The Puyallup, Washington hamfest was a great help here; for those in the eastern part of the country, a spring trip to the Dayton Hamvention would be in order every year. A suitable old TV transformer and a heavy duty military surplus choke inductor of 5H at 300 mA were found, each for $5. Several chassis were either bartered for or purchased on the surplus market for under $10 each. Inexpensive NOS tubes were also procured for $1 each or less. Once the junk box was reasonably stocked, the amplifier layout could begin.

First, to keep cost at a minimum, two power supplies would be impossible. Each would require a chassis, a large heavy transformer, and a matching choke. Finding more than one transformer of a matching pair was not possible. That meant the stereo supply had to be shared between the two audio channels. Monoblock amplifiers provide better sound quality, though, as the two audio channels do not couple to each other through the power supply. To ensure adequate decoupling in the single supply, the power supply for this amplifier is regulated, with each channel being routed through a separate series pass element and utilizing an independent voltage error amplifier. Adding additional regulator parts is cheaper than adding another transformer and choke, unless one happens to have a matched set of two in his junk box. Furthermore, there are additional benefits in a regulated supply, specifically in the area of supply impedance, which make it worth considering. A regulated supply will also help remove a few extra decibels of hum from the circuit, leaving more headroom for the music. Hum was a major problem in the supplies of the 6GW8 amplifiers, and great pains were taken to eliminate it from this amplifier.

The only downside to a regulated supply is a lack of the sonic effects of “tube rectifier sag” upon the circuit. This effect is often desirable, and many of the projects presented in VALVE are often the subject of rectifier swap tweaks to change their sonic signature. However, the intent of the project is to hear the amplifier, and not to listen to the power supply for the circuit.

Scavenging my inventory for suitable tubes to use in this project, valves were chosen that were either in current production, large surplus supply, or easily replaced with solid state components, should the need arise. Also, the search was limited to the use of octal based tubes, exclusively. Most of the pentodes and tetrodes and beam power tubes that are suitable for audio output are based in an octal fashion. Excellent preamplifier tubes are also available in this size. Keeping the size uniform throughout the project permits a single size of socket, a single size set of hardware, and a single hole saw to bore the chassis out, thus saving several dollars overall. The 6V6 tube was picked for audio output. This tube was common in early guitar amplifiers, but was largely replaced with the larger 6L6, EL34, or 6550. Few guitar amplifiers past the late 50’s or early 60’s were designed with this tube. It retained some popularity in hi-fi circuits, but almost always ended up playing second fiddle to larger, more powerful tetrodes and beam power tubes. The 6V6 is rated for more than 14 watts in push-pull, fixed bias operation, which is more than enough to drive the Whammodynes!, and should certainly suffice for the much less efficient speaker projects that are planned.

For output, the first choice was to try a pair of Brooklyn B-15 transformers, which looked like a good, cheap way of getting the sound from the tubes to the speakers. The circuit needed an ultralinear output configuration to reduce the distortion in the amplfier and to simplify the output tube hookup. After some consultation, MagneQuest would not build the B-15 with ultralinear taps. Instead, one of the first production pairs of MagneQuest MQ-565 output transformers was obtained. They are at about the same cost and offer great performance for not a whole lot of money.

Ease of use of the amplifier was also important, so a cathode-bias arrangement for the 6V6 tubes is employed. Re-biasing the tubes with each tube swap was not an appealing thought. Also, fixed bias causes even more complexity in the power supply, as a bias supply must then be derived.

In the driver for a push-pull amplifier, some method of phase inversion must take place, as the signals applied to the grids of the output tubes must be 180 degrees out of phase. Various schemes for phase inversion have been developed, both active and passive. The active methods all suffer from a voltage gain of less than unity, since they employ some form of cathode follower output, unless an additional gain stage is employed. That additional gain stage is usually an RC coupled amplifier, although it may be direct coupled. The major disadvantage of this arrangement is the need to balance the phase inverter carefully. Another possibility exists for doing the same task – a transformer coupled stage. Antique Electronic Supply makes a PT-157 nickel core interstage transformer specifically for driving push-pull grids from single ended output stages. Transformers are remarkably easy to use and need no balancing. The tradeoff is limited bandwidth, as well as saturation of the nickel core if it is overloaded with DC current. The bandwidth limit cannot be circumvented, but the DC saturation can be prevented by not placing any DC on the primary leads of the transformer. Thinking back to basic electronics, just about any inductance can be replaced with an active load. Most octal triodes are dual triode units, and hence provide can have one triode used as an active element for loading the lower, voltage amplifier stage properly. Here, a mu-follower configuration provides the proper loading for the 6SN7 tube chosen to be the voltage amplifier. The output of this stage is then transformer coupled (with a DC blocking capacitor in series with the primary lead of the interstage) to the grids of the second stage.

The PT-157 has been explored previously in VALVE articles. It is a cheap part (at under $13 each) yet sounds surprisingly good. Placing it on an oscilloscope and subjecting it to a square wave, however, is a little bit disappointing – there is a lot of overshoot on the rising edge of the peak, and the frequency response is very clearly frequency limited, even in the audio range. However, it can be significantly improved by loading the output down with resistors. Subjectively, the transformer sounds great and the nickel core is really fast when listening to complex passages. With the cost coupled with reasonable performance, at least subjectively, this part looked like an ideal choice.

Now that the amplifiers' tubes were selected, and a rough idea of operating points located, the design of the power supply could be completed. Given the heavy choke, large power transformer, and the complexity of the additional regulation circuitry, the power supply was built on its own separate chassis. This arrangement permits later substitution of either amplifiers or power supplies, should the need arise. It also allows further physical separation of all the units to reduce magnetic coupling between transformers wherever possible. Lastly, it allows a much smaller chassis for the whole unit, which means already owned chassis units could be used.

For the heater supply, there were two choices – AC or DC. DC won out easily. In an amplifier like this one, there is hardly a good reason not to use a DC supply here. The parts count is small and it squeezes a few extra decibels of hum out of the amplifier. It provides a low voltage to drive any solid state components on outboard amplifiers, and is so easy to provide with the three terminal regulators that are available. Here, the circuit uses the LM338, which is a five amp, three terminal adjustable regulator, to provide this voltage. With a large 10 gauge steel chassis, heat sinking this part was not an difficult task.

For the B+ power supply, the circuit was originally designed using the high gain 6SL7 dual triode in a cascode configuration as an error amplifier for each half of the 6080 series pass regulator tube (a 6AS7G would also work here.) The reference voltage was supplied from a 0D3/VR150. It could just as easily have come from a zener or string of zeners, but the beautiful purple glow of a VR tube is not to be missed. Zeners are also noisy, but they do yield a much more stable reference voltage than a gas tube. However, after building a copy of this circuit, the cascode error amplifier could not be stabilized enough to keep the circuit from self-oscillation when the output voltage was lowered to an operating point usable with the 6V6 tubes. As a result, the circuit was switched to a variant of the regulated power supply available in the “GE Essential Characteristics” book (see references at the end.) The gist of that circuit is almost identical to the one previously used, except that the relatively complex cascode error amplifiers are replaced with much simpler pentode based (6SJ7) ones. Working the numbers through, after the fact, for the old and new circuits revealed operating points that were “impossible” for the old circuit and flawless, safe operating points in the new. Power supply design, even in the case of a regulated linear supply, can be tricky, and unlike much audio design, where trial and error based on reasonable assumptions will often work, there is simply no escape from pushing the pencil across the page.

Lastly, the HV supply rectification is done by high voltage, high current silicon diodes. With a regulator in the circuit, one is simply not going to hear a sonic signature of a vacuum regulator. Save a couple of dollars and the space on the chassis and go with solid state. Increased reliability and lifespan of the solid state components, plus a lower voltage drop across the rectifier comes as a bonus. A well designed regulator does not permit the voltage to vary much from the designed value; it also serves to control much of the ripple. Ergo, the surplus voltage afforded by the solid state diodes is useful in providing overhead for the regulation drop. The variance in output voltage as a function of current, or “sag” that is inherent in a tube regulator, would be masked by the series pass element and error amplifier, unless this circuit was malfunctioning. In fact, load regulation in this supply is on the order of 3VDC over the design range of output current, and ripple should be less than 5mV, if good construction practice is followed. For smoothing prior to the regulator, an LC filter configuration provides a peak DC of 90% of the transformer’s AC voltage; a CLC configuration would yield a peak of 140%, instead. The regulator will make up for the slightly lower ripple reduction from the filter with one less half-section.

THE POWER SUPPLY CIRCUIT

Figure 1 shows the power supply unit. The important bits of this circuit will be discussed by subcomponent. The circuit itself was built with point to point wiring for the HV supply and on perfboard for the heater supply. Scraps of perfboard were used for the voltage divisor network on the HV supply feedback loop, however, to facilitate mounting of small PCB-style ½ W trimmers.

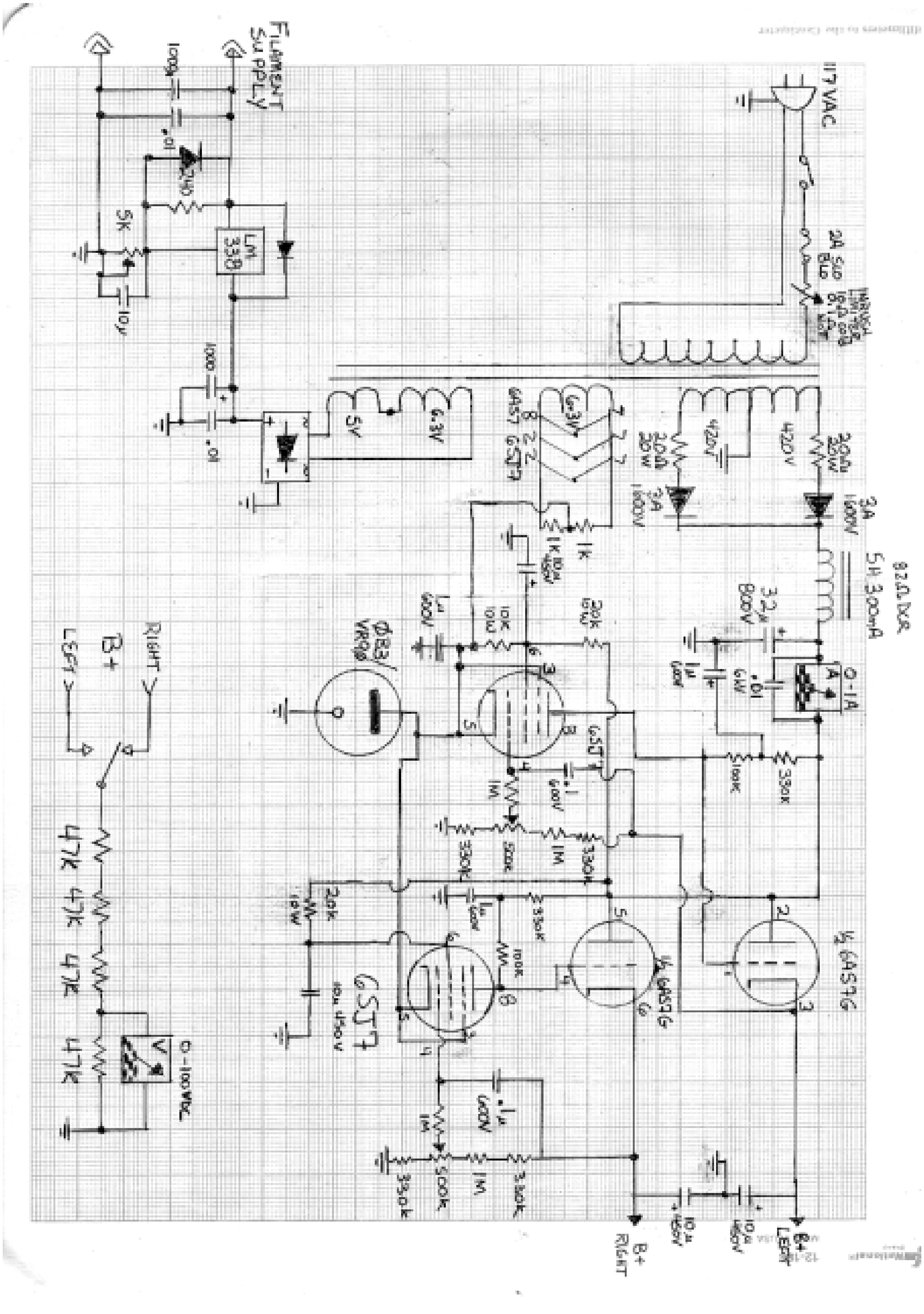

Figure 1 – Dual channel regulated B+ supply, 200V – 400V @ 125 mA/channel, with single 6.3 VDC @ 5A heater supply

The simplest and easiest part to start with is the DC heater supply section, which is in the upper left hand corner of the diagram.

The DC heater supply is filtered and regulated. The LM338 is a three terminal adjustable regulator housed in a TO-3 package. The third terminal is the case itself, and it is the "adjust out" line, so mounting this part must isolate its body from the chassis. Mica washers and TO-3 mounting kits are fine, but be sure to heat sink everything well and use silicone grease. The part is capable of five amps of current, but will generate quite a bit of heat. Forced air is not necessary, but stuffing this part inside the chassis would be a bad idea. This is also not a low-dropout regulator, so if you have the five volt winding on the transformer, or can squeeze more than the requisite 6.3 VAC out of a filament winding, it will appreciate the extra overhead. It is a linear regulator, however, so this will burn off as heat.

The extra capacitor across the adjustment potentiometer serves to reduce ripple, and is not required, but given the price-for-performance improvement for a 15 cent item, include it. The two additional diodes (1N4001 or something similar) serve to protect the regulator from the discharge path of the hefty (1000 microfarad) capacitor on the output filter side and the much smaller ripple-reducer capacitor. The 0.01 microfarad ceramic capacitors are a design habit. They may be left out if so desired. There is no proof that they make a difference one way or the other, but my drawer is full of them, so they get used a lot as extra bypass capacitors. By not using these parts, there is a risk of blowing out the regulator under certain power-down scenarios. The regulator is not a cheap part (about $10) and sometimes hard to come by. A simple CRC filter could be used, instead, but would be a bit noisier than the regulated supply here, yet would still offer a major improvement from AC heaters.

On the high voltage side of the supply, there are a couple of interesting pieces. Most of this circuit comes almost directly from the General Electric Essential Characteristics guide, which most tube enthusiasts should have as part of their reference library.

The input to the power transformer has a thermistor current limiting device in series with the primary of the power transformer. This part is available from Mouser and is 10 ohms cold, 0.1 ohms hot. It will limit the inrush current nicely, and prevent turn-on surges. A major problem with the initial power supply design was blowing fuses prior to insertion of this part. Part of that problem stemmed from the initial CLC filter design, which basically presents a dead short to ground for the first half-cycle of the AC waveform, until some charge has built up. Needless to say, some sort of current limiting is good here. Note that the audio tubes will *never* have high voltage applied before they have warmed up, because the output voltage is dependant on the regulator's conduction, and the 6080 is a slow tube to warm up. Also, the LM338 has current foldback, so input surges are limited to the heaters of the audio power supply automatically, regardless of whether the thermistor is there or not.

On the secondary side of the power transformer, there are small resistors in series with the rectifier diodes. These help to quiet the spikes in the transformer. Before inserting them on a hint from George Wright, the power supply diodes would routinely fail in a catastrophic and often spectacular manner. The transformer in this project was designed for an old tube television set, and as such, is more of a match for a tube rectifier. Solid state rectification really needs these resistors to be happy.

The regulator feedback mechanism is pretty self-explanatory. Matching resistors or tight tolerance items are unnecessary, although use metal film resistors wherever possible in power circuits. They retain their value over time, unlike carbon composition resistors, and are thus better suited to the strain and demand of power supplies. Remember, also, to watch the voltage breakdown ratings of whatever resistors used in the project, as the raw voltage in this supply is around 400 volts, more than many resistors can handle.

There absolutely *must* be a separate filament supply for the power supply tubes. This supply ***has to be floated*** above ground; failure to do this simple action will exceed the cathode-heater breakdown voltages for many of the tubes in this supply, and will lead to undesirable quantities of smoke being emitted from the device. Two 1K resistors, as shown, coupled to the 150V reference source provided by the VR tube will more than suffice. In addition, a small capacitor across the VR tube will shunt some of the high-frequency noise inherent in these tubes to ground. Keep it less than 0.1 microfarad, or this type of tube is prone to oscillation.

The output capacitors on the power supply (after the cathodes of the 6080, in the lower right portion of the schematic) are simply electrolytics, of about 10 or 20 microfarads at 450V. Use a much higher rating here than the supply is worth, as the supply voltage is variable, and component tolerances, settings, and errors in the first pass at building this supply may result in voltage higher than a “marginal” 350V capacitor could handle safely. Also, the cost difference is almost insignificant between the two. It is a small price for a little safety. Do not waste expensive polypropylene capacitors prior to the regulator – an audible difference will not be heard.

The meters in this project are surplus, PM-89 style, and are easily obtained from Antique Electronic Supply or from All Electronics Corporation. They are wildly inaccurate, but give a nice ballpark reading to ensure everything is healthy. An AC ammeter would also be nice on the input side of the transformer, and might be a nice replacement for the DC one. The DC ammeter reads >1A all the time, which, according to a Fluke multimeter, is off by a factor of ten! The voltmeter is within about 10% of the actual value. Higher quality meters would be a nice investment, or that part of the circuit could be left out all together, as it is essentially set-and-forget. The meters mostly serve to point out the tube age in the power supply. As the 6080 ages, it will likely cause the output voltage to drop, and that should signal replacement. Do not use these meters for actual adjustment of working voltages – set those with a high quality DMM.

On the voltmeter – 400VDC units are difficult to come by. Here a 100VDC unit is employed and the faceplate remarked by scanning and editing it, then cutting out a high-quality laser printout, and pasting it on with 3M spray adhesive. If the voltage divider is used to provide a sample voltage for this meter, it becomes more critical to match the 47k voltage divider resistors to avoid introducing more inaccuracies in the measurement; close matching will keep the errors to a minimum. Use high quality resistors if any accuracy is to be expected.

On layout, be careful to space the 6080 (or 6AS7G) well away from other components in an area of the chassis where good air circulation can be obtained. This tube gets quite warm and needs to remain relatively cool.

All the output voltages and grounds are run to Jones style jacks on the rear panel. Use six-pin jacks, wired with the center two pins as ground, and ensure that, while the plugs are polarized, excessive force in inserting them the wrong way would not produce high voltage on the heater line, nor the converse. This actually makes it reasonably safe to plug and unplug these items while "live"; at the least, it is not much more hazardous than standard mains plugs on the wall.

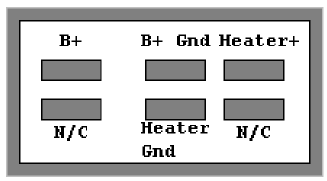

Figure 2 - Jones socket wiring (top view)

The power input jack to this unit is a standard three-prong unit (IEC), but features an inline RFI/EMI suppressor. These units are available surplus for as little as $1.50, and are a worthwhile upgrade for any and all equipment featuring this style of connector.

THE AUDIO AMPLIFIER CIRCUIT

The audio amplifier circuit is fairly straightforward for a transformer-coupled amplifier. The schematic appears on the next page (figure 3).

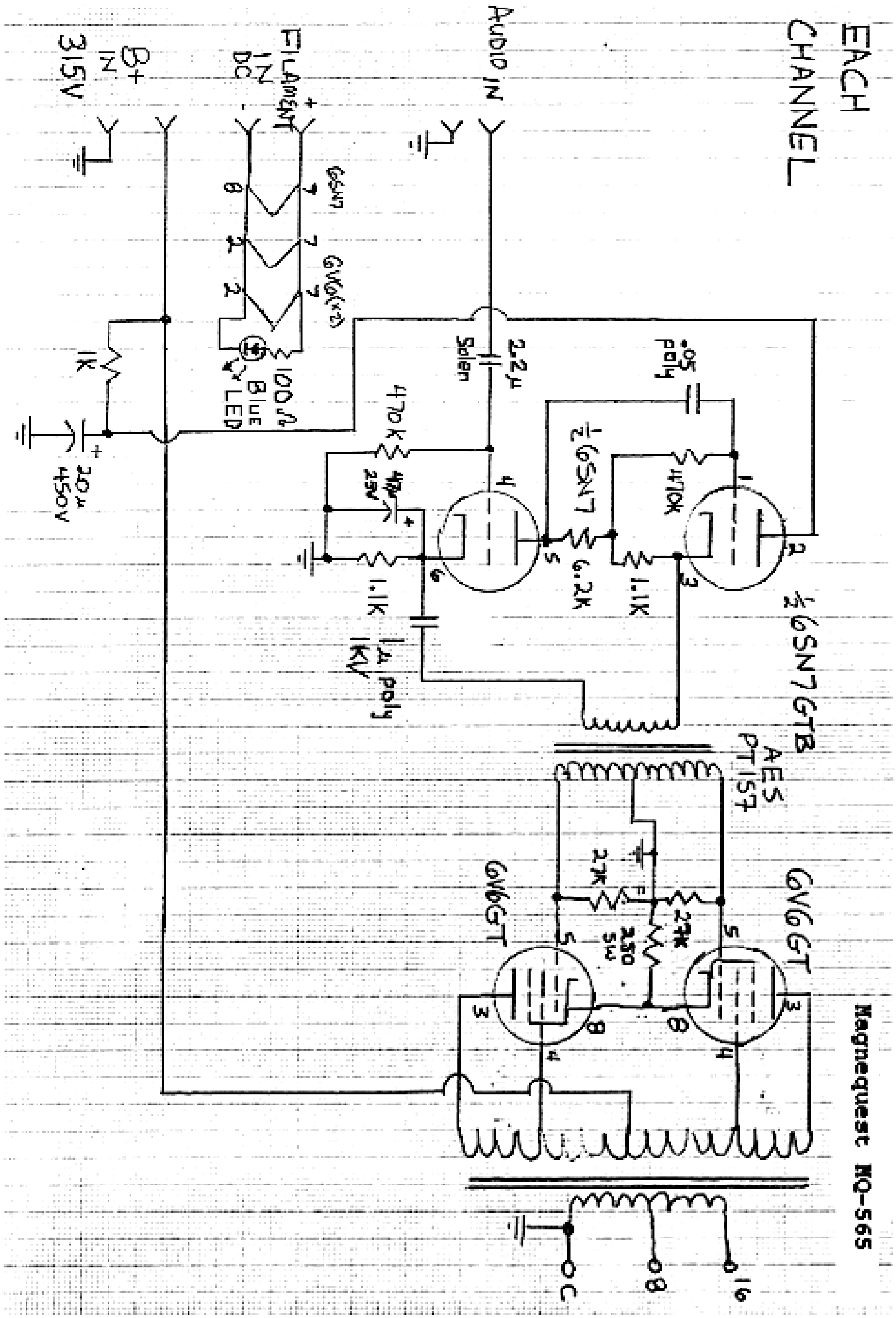

Figure 3 -Transformer coupled audio amplifier

Each amplifier connects through a private “umbilical” cord terminated in a six-pin Jones plug that mates with the jacks on the main unit. Each Jones plug is wired identically, as illustrated in figure 2, so that the side of the power supply used is irrelevant. The jacks on the power supply only bring out one B+ channel to each socket, and it is a different one between left and right sides. The umbilical cords feature snap-on ferrite core chokes obtained from All Electronics Corporation, as an added reduction measure against any high frequency noise that might have been introduced in the cable run. The cable itself is also shielded four-conductor Belden wire, with the shield grounded only to the power supply chassis ground bus.

Note that the heater supply is completely isolated from the ground of this unit. This reduces hum; the filament supply is referenced to ground in the power supply -- connecting it here to the chassis would only cause a ground loop. This setup also allows the use of an AC heater, should a low cost power supply be built, instead. However, the “on” lamp, a blue LED, is fragile, and should be either eliminated or diode-protected (another 1N4001 in series would do) in this case. Note, too, that substituting another color of LED for the blue would require changing the dropping resistor value, as blue LEDs have extremely high voltage drops across them.

As far as the audio circuit is concerned, the number one noise elimination step to be taken is the utilization of a star ground in the construction of this unit. This technique should be a standard construction practice, anyway. Pick a good, centrally located point and solder the ground to the chassis, if it is possible. If the chassis is aluminum, use the mounting screws of the terminal strips to make the connection.

Starting at the output end of the amplifier, the tubes’ operating point is set by the cathode bias resistor. Here, it is a 280 ohm cement unit. The operating point that should be aimed for is approximately –20V of grid bias at 315VDC B+. The 280 ohm cement resistor has to supply the current for both output tubes. The maximum output current is about 100mA, combined, at peak AF input voltage (for the pair of tubes). This gives a grid bias of about –28 volts, a bit high. However, normal drive on these tubes uses much less current, and the more reasonable zero-signal usage of 70mA across two tubes combined leads to about –20 volts on the grids. This value is not terribly critical, and is worth experimenting with. Note that a very large bypass capacitor could be used here – on the order of 4700 microfarads at the appropriate voltage. This value would serve to maintain that 20 volt bias during high power transients. A large value is necessary to prevent the time constant of the cathode resistor-capacitor circuit from delaying the transient response. Individual resistors, which would be a good upgrade and reduce the need for a matched pair of tubes, would be of a much higher value and could benefit from bypassing by smaller electrolytics. If the cathode resistors are split, these capacitors become necessary to prevent the introduction of negative current feedback, which would reduce output impedance and increase drive requirements. Alternatively, connect the two cathodes together with a non-polar electrolytic.

The 27K resistors on the secondary of the interstage coupling transformer serve to load the secondary down, as well as to load the grids of the 6V6 tubes. These resistors improve the sound of this transformer as well as its frequency response.

The most complex part of this entire amplifier is the input stage. S.E.X. amp kit builders might recognize the mu-follower configuration used here. In the case of this amplifier, not only does give increased linearity of the lower stage from the active loading of the upper stage, but the nickel core interstage now no longer needs to carry DC, as it would if it were to provide the load for the plate. Honestly, the nickel interstage simply lacks the impedance to be used well as a direct load of a voltage gain stage.

The following bit of theory, paraphrased from Paul Joppa, allows effective design the input stage:

Good operating points for this configuration have $E_b/I_b = 4 * r_p$ or potentially more. Since the interstage transformer's impedance is fairly low, this should be kept fairly low.

r_p for a 6SN7 is about 7700 ohms, so an operating point of about 150V at 5mA, per triode section is about right. Remember that they are stacked one above the other, for a total drop of about 300 volts.

With cathode bias, one figures that:

$$0.7 * E_b / mu$$

should provide the bias voltage. Mu is 20 for this tube, so, plugging in from above yields 5.25V of bias. With ohm's law, that gives the cathode resistors as:

$$R = E/I = 5.25V / 0.005A$$

or 1050 ohms. 1.1K is a standard value that is close enough in a 5% tolerance.

For a mu-follower, figure on about a 20% drop at E_b across the current sensing resistor. So, the plate resistor for the lower tube, which is really the current sensing resistor, should have, from ohm's law again, a value of:

$$(0.2)(150V) / (0.005A)$$

or 6000 ohms. 6.2K is again a close enough standard value to use here without worrying.

An arbitrarily picked value of 470K provides a nice grid resistance. It is possible to go as high as 1M here, but consider the input impedance of the amplifier when choosing this value.

The grid coupling capacitor should then be chosen based on this value. Paul's formula lists 30000/R, where R is 470K, or about 0.06 microfarads here. Just use 0.05, which is close enough. The input capacitor was initially the same, although it was later replaced it with a much nicer Solen 2.2 microfarad unit left over from the Whammodyne! construction.

Lastly, the DC blocking, or coupling capacitor should be as large as possible to allow the bass to really play though. At a bare minimum, it should have enough reactance to match the transformer inductance at the load impedance, which, for the transformer used, is about 6 kohms, as shown with the load. This translates into about 30H, or 6 kohms at 32Hz. So, the coupling capacitor should be:

$$C = 1 / (2 * pi * f * X)$$

where f is the frequency and X is the reactance. Using the supplied numbers, this works out to 0.82 microfarads. 1 microfarad should be fine, and, finding a great surplus deal on 1 microfarad, 1 kilovolt polypropylene units, this was exactly what went into the amplifier. Note that this value must be rated for the full power supply voltage, at least, just to be safe.

PERFORMANCE DATA

The most important characteristic of any amplifier naturally is how it sounds. Before heading into the subjective listening tests and commentary, here is some real performance data on the frequency response and the spectral output of this amplifier. Measurements were obtained through a HP 35665A Dynamic Signal Analyzer, courtesy of Dave Dintenfass.

IInput (V)	Output (V)	THD %	2nd harm (dB)	3rd harm (dB)	4th harm (dB)	5th harm (dB)	Pwr out (W)
0.1	1.3	0.17%	-58.4	-59.5			0.21125
0.22	2.83	0.58%	-57	-45	-71.3	-72.4	1.0011125
0.283	3.6	1.07%	-52	-39.6	-72.5	-66.8	1.62
0.5	5.9	4.38%	-50.7	-27.2	-67.6	-58.9	4.35125
1	9	14.80%	-35.8	-16.9	-56.3	-37.2	10.125

Table 1 – Performance data, 1kHz sine wave input, 8 ohm resistive load

Table 1, above, presents the data that was taken in regards to the harmonics and distortion of the amplifier. Performance is excellent at low power levels, but degrades somewhat at higher levels. However, performance is still acceptable for the normal listening range. Here are three possible tweaks to lower the THD at higher power levels. First, the cathode bias resistor of the 6V6 should be lowered slightly, to raise the grid voltage, relative to zero volts (bring it from a full-signal –29V to closer to that magical –19V.) Second, this test used NOS Ken-Rad tubes. There was only one pair of Ken-Rads (the other channel sports RCAs), and they are not matched. Close AC and DC matching, especially in this common cathode resistor case, will improve performance somewhat. Lastly, at high power levels, the circuit may exceed what the tiny nickel interstage can handle. A heftier transformer here would drive up cost, but improve fidelity quite a bit. On the other hand, Whammodynes!, with just one *good* watt of power, perform fantastically, as long as the transients are handled gracefully. The recovery of cathode bias certainly affords that luxury.

The harmonic data is certainly more telling in graphic form, and Figures 4 and 5 illustrate clearly the relative dominance of the odd order harmonics, as is characteristic of a push-pull amplifier. Note, however, that the even order harmonics are not particularly heavily suppressed – a result that is surprising, unless one refers to my earlier comment about not matching the tubes well. A non-balanced match actually *benefits* in this situation, as the even order harmonics are quite pleasing musically.

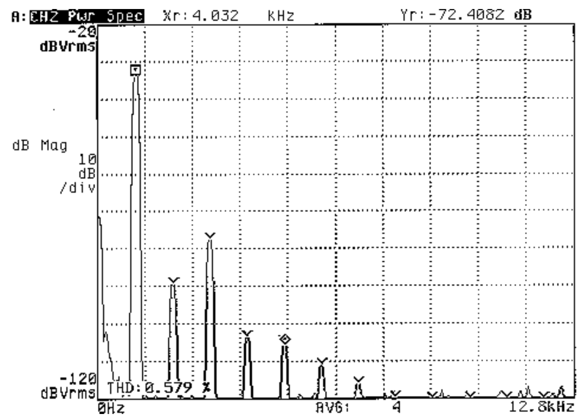

Figure 4 - 1 Watt Spectral Output,

1kHz Sine Input

In the ten watt version, above, it is clear that the amp is beginning to distort, and the numeric data shows clearly that the third harmonic is only about 17dB down from the fundamental.

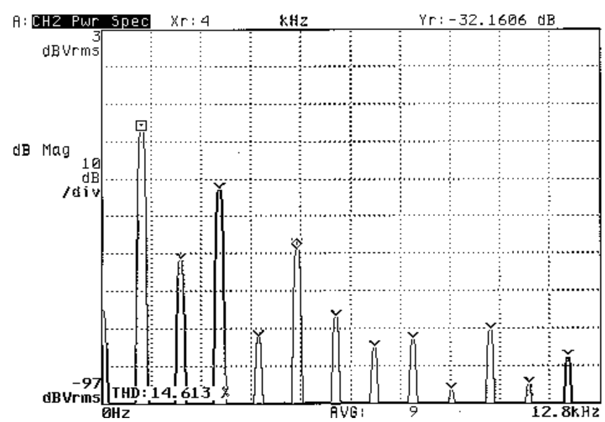

Figure 5 - 10 Watt Spectral Output,

1kHz Sine Input

Frequency response is excellent for this amplifier, which is a tribute to the output transformers used. The frequency response of these transformers is actually given by the manufacturer at full rated power, not the low power levels that may other companies use. As a result, the graph of frequency response is identical for all the power levels tried. Just one plot which is representative is included.

Figure 6, below, shows the transformer's –3dB points are 17.8 Hz, as well as 25.0 kHz, more than adequate for all listening, and certainly more than adequate for Whammodynes! (good, unfortunately, only to about 30 Hz).

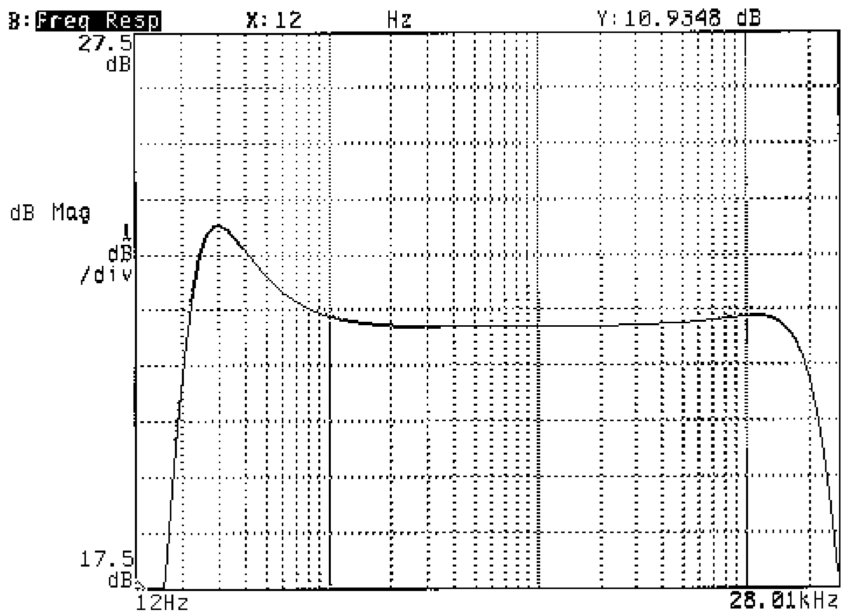

Figure 6 - Frequency sweep, 2 Watts output power

The scale of Figure 5 is 1 dB per vertical division, so the spike at 30 Hz is not as dramatic as it appears on the graph – only about 2 dB above baseline, and it is centered exactly at 30 Hz.

The –1dB points for this amplifier occur at 20.1 Hz and 20.4 kHz, which are effectively the upper and lower edges of what is considered to be the full audible spectrum. Obviously, this statement is not the exact truth, but most speakers fall into this range, anyway.

The damping factor for this amplifier is 0.38, which is a little lower than might be expected. This value could be increased with some negative feedback, or, alternatively, speakers that work well with low damping could be used instead. This low number is indicative that this amp functions more as a current source than a voltage source, and as a result, with the proper speakers, can have quite low loudspeaker distortion.

Subjective Performance

The amp itself has replaced a bi-amplified single-ended setup and is now the main listening reference. Construction on the unit finished in April, and it has been listened to extensively and burned it in for quite a few hours ever since. The system setup used is either a turntable (a mish-mash of homemade upgrades to a cheap table, always in progress) or a Marantz CD-67, feeding a Carver Silver One Reference Preamplifier (a prototype), into these amplifiers, and out to the SuperWhammodynes!. The system is fast, responsive, and does not lack the bass punch that push-pull configurations often seem to suffer from. Highs seem to be a little bit suppressed. At the last meeting, Dan agreed, noting that the signature of the regulator tube was evident in the audio, perhaps contributing to that sound and feeling.

The amplifier was also tested as a subwoofer amplifier when paired up with a set of horns in the Electronic Tonalities workshop. It performed admirably, bringing out a nice, full bottom end and having plenty of power to spare driving the 96dB subwoofers against a 100dB+ horn system. In addition, it was auditioned alone through a two-driver + tweeter vented box, using MCM’s heavier 5-inch aluminum drivers and the Whammodyne! tweeter. The performance was similar to that of the Whammodynes! at home, it and really shone nicely.

Tips, Tweaks, and Upgrades

There are quite a few areas of this amplifier that could be upgraded or improved upon. For those building the setup, or inspired to build pieces of it (since its design is so modular), here are some suggestions:

- ✓ Upgrade the interstage transformer. This piece is likely the first and foremost limiting component in the entire amplifier signal chain, and more metal is almost surely equivalent to better sound and power handling.

- ✓ Install separate cathode resistors for the finals. Wirewound adjustable potentiometers might even be better, here. Bypass them with polypropylene or electrolytic capacitors if so desired. This eliminates the need for DC balanced tubes to be used as finals, although AC balancing may or may not be something to play with.

- ✓ Remove that input capacitor from the grid of the lower half of the mu-follower. One less component in the signal chain is always better. Be careful, though, to only use gear that is safe to couple this way.

- ✓ Adjust the connection of the primary of the interstage transformer. There are *eight* possible configurations for this transformer's hookup. Each of the following has two locations in the circuit:

    - o DC blocking capacitor may be as shown, *or* it may be placed at the "high" side of the transformer, prior to the audio signal passing through the core.

    - o The "high" side of the transformer may be connected either to pin 3 of the 6SN7GTB, for cathode-follower, low-impedance drive, *or* to pin 5, for high-impedance drive.

    - o The "low" side of the transformer may be returned either to the cathode of the lower half of the 6SN7GTB (pin 6, as shown), which provides a minimal amount of feedback to the circuit, *or* simply connected directly to ground.

  Each of these permutations will make a difference in the quality of the audio from this amplifier, and moving this part around is one of the most interesting experiments to undertake.

- ✓ Employ a global feedback loop from the output of the transformer to the cathode of the mu-follower. Either voltage or current feedback could be used to further reduce distortion, at the expense of changing the frequency response of the circuit. This change may or may not be advantageous, given that the low-power distortion of this amplifier is very low.

- ✓ Replace the 6SN7GTB tubes with 6SL7GT tubes. The operating parameters of these two tubes are different, but they will actually use the same component values to achieve good operating points. The 6SL7 will provide somewhat more gain than the 6SN7 used here, but the circuit should perform just as well. Again, it is a matter of individual listening preferences. The 6SN7 is usually preferred in listening tests, however. Miniature dual triode tubes could be used as well in the same configuration, provided the operating points are recalculated.

- ✓ Replace the hefty tube-regulated power supply with a solid state equivalent. There is little question that tubes look impressive glowing on the stereo rack. However, the reality is that the supply electronics could be shrunk to a much smaller package through the use of high-voltage Darlington pass transistors, op-amp dc error amplifiers, and the like. The hefty choke might not even be necessary – a CRC filter and good solid state regulation should do just as well (is this heresy in VALVE?) *(Nope. Ed)* If there is interest, write to the e-mail address below, and discuss some solid-state, high-voltage supplies built and used. The look of the tubes, especially the 0B3/VR90, and the ease of visually checking that the regulator is operating right are both advantages of tube-regulated supplies. However, the size of the power supply is quite unwieldy, except as compared with some of Dan's wild amplifiers.

- ✓ Replace the LM338 with a smaller regulator and a pass transistor. More parts, yet easier and cheaper replacement. One could even use a three terminal regulator and two forward diode drops in the ground lead to achieve about 6.3 VDC. LM7805 IC chips, even the five-amp versions, are significantly cheaper than the LM338 used here.

- ✓ Replace the meters' voltage divider chain with a single resistor and a meter rated full voltage, if more accurate readings are desired. Ensure the resistor has a breakdown voltage rating capable of handling the power supply maximum output voltage.

- ✓ Polypropylene output capacitors on the output of the series pass elements of the power supply, as well as on the decoupling resistor in the amplifiers themselves would be a nice upgrade and may make a minor sonic difference.

- ✓ A triode-pentode switch could be installed in the amplifiers. Use a 100 ohm, five watt resistor between the plate and the screen if this option is installed. The sound should change quite nicely. A small, 0.01 microfarad capacitor between screen and ground could be installed here, as well.

ACKNOWLEDGEMENTS

Much deserved thanks and a show of appreciation go to Dave Dintenfass, Paul Joppa, George Wright, and Dan Schmalle for parts, theory, feedback, and analysis throughout the construction of this amplifier and power supply. Without their help, it would not have been possible.

CONCLUSIONS

This amplifier plays everything from classic jazz albums and great symphonic performances to modern alternative rock. With such a selection, it is hard to find an amplifier set up that can deliver in all cases, and it may make sense to keep several sets handy for different types of music. However, this particular 6V6 amplifier works amazingly well, and seems to be a very acceptable and pleasing compromise.

As always, comments, questions, and suggestions may be delivered to ce001@hotmail.com.

REFERENCES

My father was an electrical engineer and went to college in the late 50's and early 60's. Most of his engineering textbooks have been more than valuable in designing vacuum tube circuits. The following books might prove useful to those designing similar systems:

Gottlieb, Irving M. Regulated Power Supplies.U 4th ed. New York: TAB Books, 1992.

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Kempton, R. G., et al. Essential Characteristics. 10th ed. General Electric Co., 1963.

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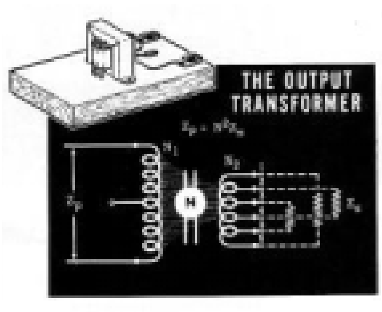
Brainiac's



Heavy Metal

An occasional review of some nifty chunk of iron (usually cheap!)

by Paul Joppa

Today's Topic: *Ugly Ears (don't ask!) - an interstage transformer*

This unit is available for $13.95 from Antique Electronics, and is one of the small class of cheap interstage units available. There are several in the $10 to $20 range, made for old radios usually. Nothing fancy, but their small size makes for low leakage inductance even without interleaving and they can sometimes be used with decent results. They are usually designed for SE drive of push-pull output tubes, but this one offers either push-pull or single-ended drive. Generally they are not optimum for single-ended output. In my experience these transformers are often very inaccurate in their specifications; they should be measured before a circuit is designed around them. This one is attractive because it has very good high frequency extension and will handle substantial DC current, though it is quite demanding in drive requirements. It is in a U-channel frame, with a lamination stack of 1.875 by 1.5 by 0.625 inch and mounting holes about 2.375 inches apart (when they're not all bent to heck! … don't ask). It weighs 8 oz. on my kitchen scale.

This particular unit was given to me by Reid Welch; it's the same one that appears in his Glass Audio article of several years ago. I've since given it to Tim Lollar who is building an experimental P-P 6B4G amplifier. Jerry Cottingham has discovered that if you carefully remove the paper wrapping and expose the secondary wires, the center tap can be separated so that the two secondaries are accessible. This would permit separate bias voltages in push-pull, for instance. I have not tried this, so caveat emptor!

All the data below is for single-ended drive, ignoring the primary center tap.

Low frequency data:

Turns ratio:	1CT:1.5CT; specified for 7k CT:15.8k CT impedance
Primary:	230+248 ohm DC
Secondary:	402+306 ohm DC
DC current:	Inductance with 12v/60Hz excitation is 7.9H at 0 mA, falling to 4H at approx. 90 mA. I would rate it at 45 mA, where inductance is 6.8H
Peak output:	58v + 58v at 40 Hz.

High frequency data (resistance for best available square wave at 5 kHz):

push-pull: with a 7k source and 15k + 15k loads, it looks adequate, though there's still 1.5 cycles of ringing around 60kHz - but the bass will be worthless, maybe -3 dB at 150 Hz (I didn't even bother to measure it). With a 1700 ohm source, loads of 5k + 5k are needed to get a nice square wave. There's only a tiny amount, about 1%, of high-Q ringing at around 250kHz. In this case, bass goes down to 70Hz at -1dB, 30Hz at -3dB. The highs extend to -1dB at 45 and 60kHz, -3dB at 75 and 87kHz. By far the best high end of the cheap units I've measured!

single-ended: You can't stop the ringing at all. The best compromise was with a source impedance of 700 and a load of 14k, but it still rings for 4 cycles at around 70kHz. Very similar results are obtained at 1700 ohms source and 20k load. The ringing is a little lower in level but lasts a bit longer if you reverse the primary leads and load the secondary with 5k (source 1700) but that's a pretty heavy load for little benefit. Still, it does provide -1dB at 16kHz and -3dB at 40kHz.

This is pretty good performance, if you can adequately drive it - say, with a type 45 or a 2A3 tube! More seriously, some of the television vertical output tubes like a 6EM7, 6DN7, or 6CK4 might work well here, or maybe a triode-wired EL84. In a single stage, possibly a 5842/417A or a 7788 (triode-connected) might work. It could, just barely, drive a pair of 2A3's in push-pull to 40 Hz if the driver uses the full 45mADC capability. A 5842 at the "book" value of 150v and 26mA will run out of steam at 33 + 33 volts peak output at 40 Hz or 58 + 58 volts at 70 Hz due to the low primary inductance.

Hurry! This offer must end December 31st, 1999!

Hurry! This offer must end December 31st, 1999!

Z-glow? ParaZen?

A Doc B. Modded Zen 84B

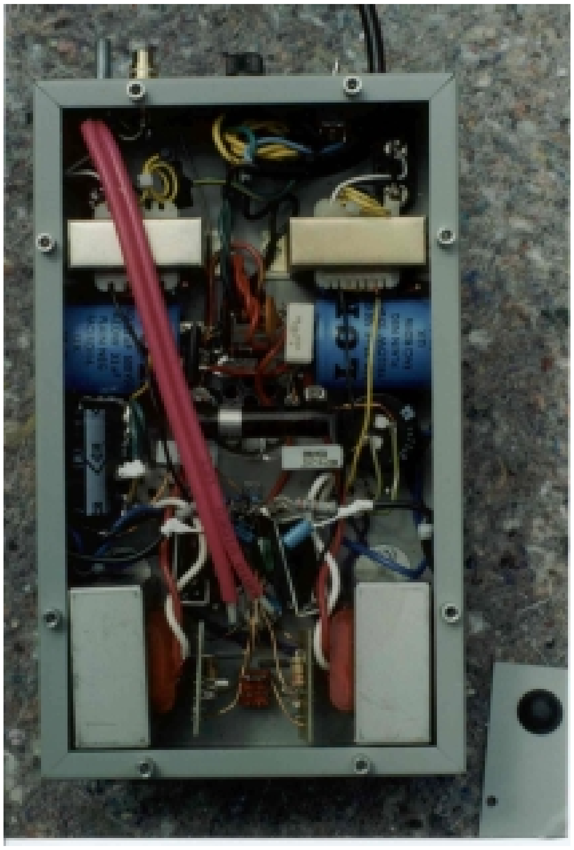
By Doc Bottlehead

Intro by Brad Brooks

Who else would you expect to take a perfectly great little SE pentode amplifier, and soup it up by parafeeding it? Don't put anything past old Doc B. This will teach a guy about leaving anything on Doc's workbench unattended!

Why did he do it? Well, a number of readers asked him to—Doc aims to please.

From deep within Doc's newly remodeled dungeon, this editor obtained the following drawings and photos. What's this all about anyway?



Check out these mods:

- C4S constant current source in the driver stage
- Parallel-fed output stage
- Reworked the ground buss to a single grounding point at the input jack
- Power transformer was isolated from the chassis and the core was grounded at the input jack.
- Tube rectifier out, ultrafast soft-start diode rectifiers in.
- Diode reverse recovery spike filtering.
- Schottky Diodes in heater supply!

Doc uses the existing output tranny primaries as the parallel-feed plate choke. The secondary windings are connected as a sort of regenerative feedback loop.

In addition, the driver tube plate is loaded up with a C4S constant current source. Not only a current source, this little board helps the 6N1P dual-triode driver operate at close to the theoretical operating points, as it sees effectively a very high plate resistance. Another benefit of using these cool C4S boards is that they further isolate the driver from power supply noise.

With additional components added to the chassis, Doc helped the thermodynamic issues by creating a “heat drain” where the rectifier tube used to be. This, and spacing the base plate out with some hardware helps cool the innards.

Man, I can only imagine how much of Doc’s knuckle skin was left inside these little cuties...

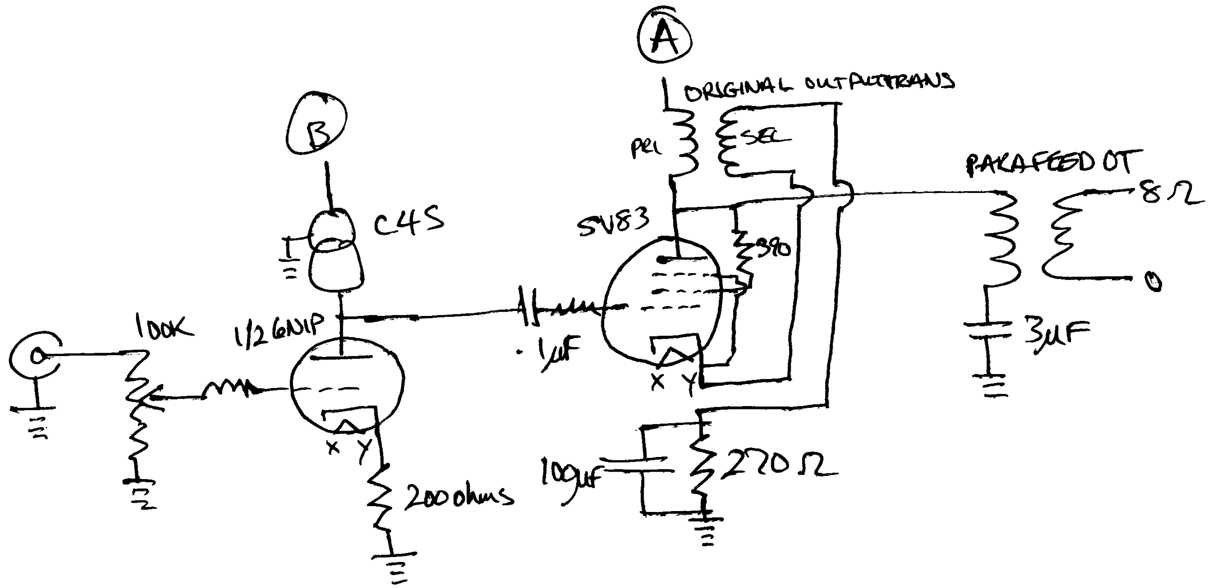
How does it all sound? Try it and see! Be sure to send us the results of your hot-rodded gear.

These measurements were made after modifications were completed:

- Power - 2.29 watts RMS ~ 10%THD 1KHz 8 Ohm non-inductive
- Hum & Noise < 20mV

Tube operating points	
6N1P	200V Plate
	10mA
	-2V Grid
SV83	300V Plate
	38mA
	-10.3 Grid

DOC B. MODDED ZEN 84B © 1999
AMP - ONE CHANNEL



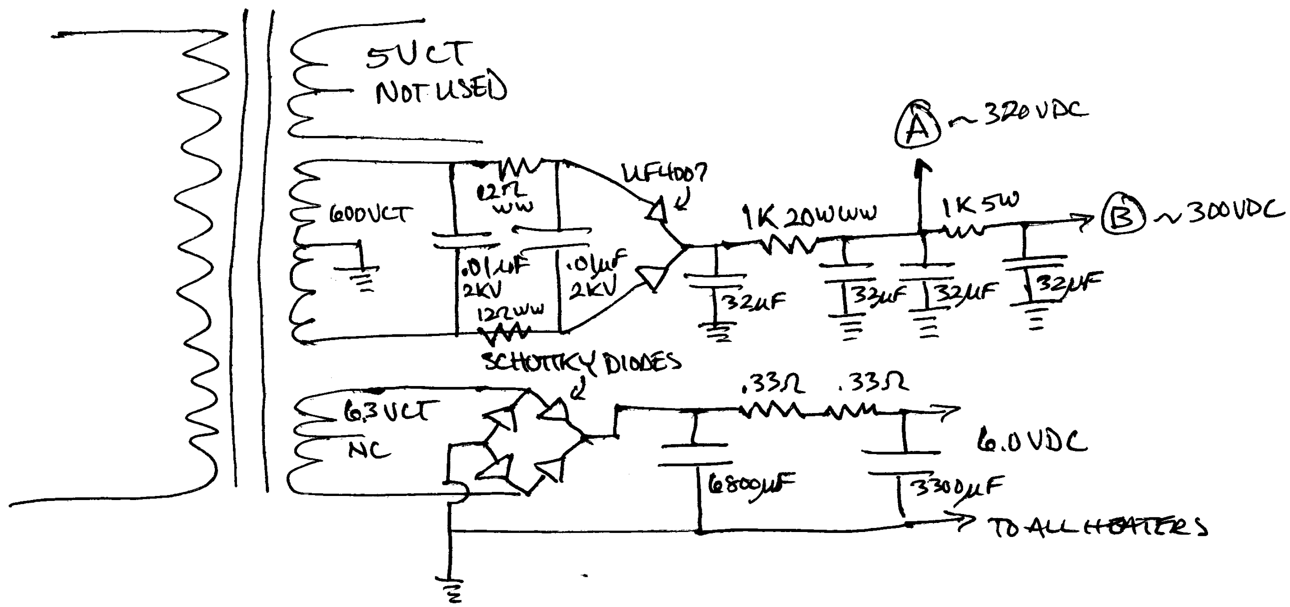
- GROUND BUSS REWORKED TO SINGLE CHASSIS GROUND AT INPUT GROUND
- POWER TRANS ISOLATED AND CORE GROUNDED AT INPUT GROUND
- 5Y3 SOCKET AND CHASSIS BOTTOM MODDED FOR INCREASED COOLING

POWER - 2.29 WATTS RMS ~10% THD
1KHZ
8 ohm
noninductive

HUM + NOISE < 20mV

OP POINTS
6N1P 200 Vplate
10 mA
-2V grid
5V83 300 Vplate
38 mA
-10.3 Vgrid

DOC B. MODDED ZEN 84B © 1999
POWER SUPPLY



TWELVE WAYS TO PARAFEED

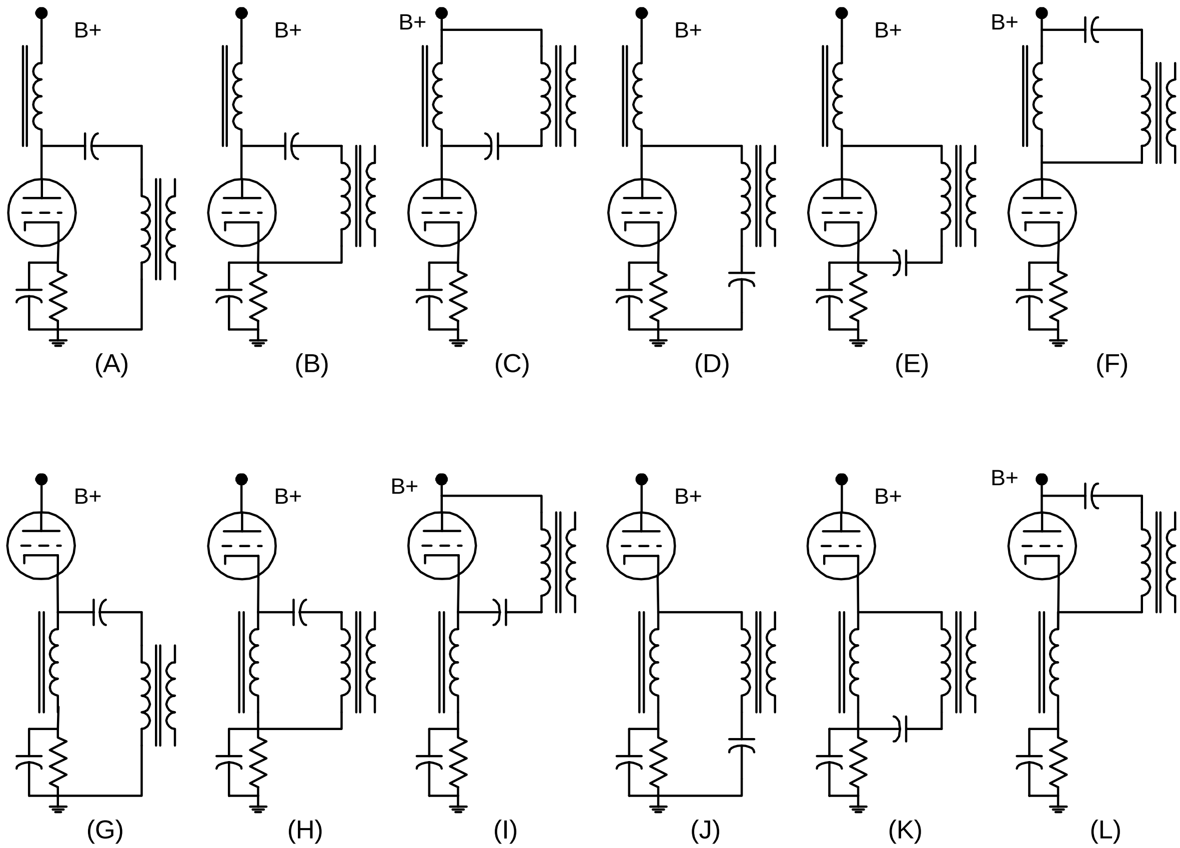
By Paul Joppa

A recent thread on the Bottlehead forum asked about using parafeed with a cathode follower output tube (*a 6V6. ed*). The attempt to describe the circuit failed, partly because words are a poor substitute for a picture, but also because there's lots of ways to connect a parafeed output. In fact, there's six ways to do it for a regular anode load, and another six for cathode followers - a total of twelve ways!

Figure 1 shows the twelve connections. How does one choose between them? Here are some considerations:

1. DC voltage at the transformer primary. This is an important consideration when using transformers that are not rated for high voltages, such as line output transformers and multifilar wound interstage transformers. The primary may be grounded (safest), at cathode potential (reasonable if the cathode is close to ground, but DC coupled amps may have high cathode voltages), or at plate or supply voltage (needs a transformer rated for high voltage).
2. DC voltage across the coupling capacitor. At audio frequencies, this is the capacitor voltage. At low frequencies however, some signal voltage may appear across the capacitor in addition to the DC voltage. The best way to estimate this is to simulate the circuit; however a reasonable estimate is that the signal voltage peak is no more than the B+ voltage. The cap should be rated for the sum of signal plus DC voltages.
3. In some connections the signal loop is confined to the tube, cap, and transformer. Others may include the power supply or the cathode bypass caps, or both. Incidentally, if the loop does not include the cathode bypass cap, that cap can often be eliminated.
4. Some configurations are said to just sound better, for reasons more subtle than the obvious circuit topology. This is a matter of experience, and our experience with parafeed is still limited, so listening to it yourself is still the most reliable approach.
5. In the cathode-follower circuits (G) through (L), the bias resistor and bypass cap can be eliminated by choosing the choke DC resistance to be the right value to set the bias. In all cases, a fixed-bias arrangement can be used, eliminating the cathode resistor and cap.
6. Generally, the plate or cathode loading choke can be replaced with a current source provided it has enough voltage compliance.

Figure 1. Twelve Ways to Parafeed.



Circuit	Primary DC voltage	Capacitor DC voltage	Signal loop includes:	Comment
A	Ground	B+	cathode bypass	safest
B	Cathode	B+, minus cathode		
C	B+	Low	power supply and cathode bypass	
D	B+	B+	cathode bypass	said to sound good
E	B+	B+, minus cathode		said to sound good
F	B+	Low	power supply and cathode bypass	
G	Ground	Cathode	power supply	safest
H	Cathode	Low	power supply and cathode bypass	
I	B+	B+, minus cathode		
J	Cathode	Cathode	power supply	
K	Cathode	Small	power supply and cathode bypass	
L	Cathode	B+, minus cathode		

What I Wish I Had Known About Dual Volume Controls Before I Purchased...

By Tom McDonald

Over the last twenty years, every pre-amp or integrated amp that I had ever used had a single volume control and a separate balance control. I was familiar with this system and did not want to change. But some stereo equipment uses dual volume controls, one for each channel, and does not have a balance control.

I finally purchased the Foreplay pre-amp kit with its dual volume controls. I thought I would hate this system, but I loved it, for the most basic of ergonomic reasons. So what are ergonomics?

Ergonomics, as defined by the latest Webster Dictionary, is: "An applied science concerned with designing and arranging things so that people and things interact most efficiently and safely - called also human engineering."

The rest of this article hopes to communicate the point that the ergonomics of dual volume controls seems more normal, organic, natural, logical, and human. What follows is an industrial engineering type discussion of volume control ergonomics. It is a kind of discussion that many people might not have read before. I started ergonomic studies when I was a computer programmer who wanted to create programs that were simple to use.

Ergonomics of Dual Volume Controls

The words "control" and "knob" designate the same control element, they are used interchangeably below.

If we dissect the logic of the volume changing process, we find that with dual volume controls the volume is raised by turning clockwise with two hands, one hand on each control knob, or alternating between the knobs with a single hand.

If the left ear hears too much loudness (compared to the right ear), the left arm and hand respond by turning back counterclockwise. Left side is always left side, right side is always right side, a clockwise turn always raises volume, a counterclockwise turn always lowers volume. The mind only has to think which side of the body to respond with. The arms and hands and ears function normally responding to their own side of the body. This is classic, simple ergonomics.

Ergonomics of Stereo Volume Control and Balance Control

But with a single stereo (dual channel) volume control and a separate balance control, the operator many times is trying to turn in opposite directions and thus can be confused.

As the operator raises both channel's volume with a single volume control, by turning it clockwise, if the left ear hears too little volume (compared to the right ear) then he/she must turn the balance control counterclockwise toward the left channel to raise the left side volume. The normal clockwise rotational direction to raise the volume has been reversed to a counterclockwise direction by the balance control.

The ergonomic problems here are that the arms/hands must respond in two different directions for the same function of raising volume. Clockwise for the volume control and counterclockwise for the balance control.

Reversing the scenario, if the right ear hears too little volume (when the left ear hears correct volume level) then the balance control is turned clockwise which is the opposite of the left-ear-too-quiet scenario. So the balance control causes confusion by operating in different directions depending on which ear has the too-little-volume problem.

In addition, as the balance control raises one side's volume, the volume of the other side is lowered even if the operator doesn't want to lower it. Usually this means that the operator responds by raising or lowering the overall volume higher and then adjusting the balance again to get the channels balanced at the new higher volume level. A complex adjustment cycling problem begins caused by the sometimes-clockwise sometimes-counter-clockwise operation of the balance control and the subsequent need to readjust the volume control.

So dual volume controls are simpler to use mentally, although they sometimes require more physical effort, since you must always turn two controls to raise or lower the overall volume level. Once a balance control is set you may only have to use only one control, the volume knob, to change the overall volume level. Some sound systems need a different balance control setting for low, mid, and high volume levels due to speaker performance changes at different volume levels. In such cases the stereo volume control and separate balance control also require the adjustment of two knobs as does dual separate volume controls. So the work level in this case is similar.

Probably the simplest mental/ physical process instructions for using the stereo volume control and balance control combination is as follows:

1) Turn up the volume knob while listening for the loudest channel. (I think that it is easier to detect which channel is loudest than which channel is quietest.)
2) Turn the balance knob to "send" the extra volume away from the loudest speaker.
3) Raise or lower volume and adjust the "send" until the overall volume level is reached and each ear hears the same volume level.

A Verses B Channel Comparisons

Another advantage for dual volume controls is the ability to attach different speakers to each channel and then easily do a speaker A verses speaker B type sound comparison. Each speaker has its own identity in a separate volume knob. This system also helps compare component changes in one channel verses the other channel. This may not sound like much of a help but in truth it is much less work than with a volume control and balance control.

With a stereo volume control and a separate balance control the operator must mentally calculate by first viewing the stereo volume knob's position then looking to the balance knob to see if the channel in question is raised or lowered by the balance knob position. When your mind is already busy checking speaker room position, looking for reflective surfaces that may be affecting the sound, and considering the circuit and/or part change that you made, the added need to "calculate" the true volume level by looking at two knobs is an irritation; it is also easy to forget to do.

But with dual volume knobs, that is a single knob for each channel, a single look is all that is needed to know a channel's true volume level

Ergonomic Summary

I must admit the points made above are subtle, but subtleties are what high-end audio and ergonomics are all about. After adding up many fine points a general bias is produced of either overall simple or overall complex operation. Even though ergonomic considerations vary it can be generalized that the-simplest-is-the-best for most people. Obviously, ergonomic discussions can continue ad nauseam based on the needs, likes, and dislikes of the operator.

Overall I've found that dual volume controls are not much of a hindrance and are actually a significant convenience in many situations.

Bottlehead Reports

This month we feature reports from the Valve group in Washington state, and the Tennessee Tube Enthusiasts. Rumor has it that there have been a couple of meets in Vancouver, British Columbia—perhaps we will be able to include a report from them in future columns. Also, check out the report from the Boston area group on the www.enjoythemusic.com web site. Sounds like a lot of cool fun...You got something going on? Send me your reports and photos—Brad.

Valve Meeting, October 1999. Acoustical Magic -- Kirkland, Washington.

Quest, our reporter in the field, reports:

“Here's a brief report on Last Sunday's VALVE meeting @ Acoustical Magic (N. Kirkland)

“Last Sunday the weather was cool but sunny. As usual I was wearing my smile on my face an joy in my heart to attend Doc's VALVE meeting at Acoustical Magic.

“Being the first to arrive there (aside from A.M.'s Gil and Dorothy (*Dorothy Harwood, owner)* who were there to open up the shop at 11:00am) I swiftly introduced myself and took a short break in their largest showroom, listening to their demo gear with my own software. Shortly afterwards Doc showed up in his little pickup truck with a blue tarp over some "secret" stuff . Underneath was Doc's newly made Straight 8 with blackish "fakestone" speckled finishing on it. According to Doc he had these speakers finished last night and it hasn't been completely "run in" yet. He was confident that the sound will get better as the days went by...and I believed him. Along with his gizmos, tools, Foreplay and ParaGlows he also bought a pair of KR 2A3 along to play with.

“John "Smoothplate" Tucker came along with his Sovtek 6B4G version of ParaGlow and his usual "bag of tricks": his own power supply, DAC, preamp, wiring, etc...”

[Quest reports that typical Valve meeting activities went on: Coffee drinking, swapping around various combos of DIY gear and listening to your favorite tunes.]

Quest continues…”Among us sat a sneaky little guy that didn't introduce himself until the midst of the listening session... Guess who? It's Vinylly! He silently brought over his Thailand-made all chromed 300B SET amp to audition: This baby consists of single 300B per channel, driven by 6SN7s and some small MT tubes (ECG6189W you say??). We played some Jazz vocals and it struck me with the sound that is typical with 300Bs: smooth, non-fatiguing soundstage with a strong authoritative sense in vocal presentation -- female vocals came out effortlessly with the finesse that is known mainly to DHT Single-Ended configuration.

“Halfway into our fun-filling sessions came Hopper accompanied by Doc with 2 white boxes of unknown content, mumbled something like "...quick! stick'em in while they are still warm!!" " What was that?" I wondered. As soon as Hopper pulled out a tube for that box and proclaimed "...VV....2A3." Did I ever noticed that, and everybody was stunned just by the looks of it! Physically speaking those VV 2A3 looks more like a VV-52 to us. The glass envelope is twice the height of the typical ST tube and it's one and a half time bigger too. Of course the contents inside is proportionally bigger as well. Doc swiftly pulled out his KRs and put in those big Muthas. Wow! exclaimed Richard: "....these 2A3 sounded very good indeed!"…

[I am excited myself to hear these 2A3s as well…there seems to be no lack of good new 2A3s out there for every budget…]

“Thanks to Acoustical Magic for their place and various treats, Doc and Smoothplate's various gears, Vinylly for his super 300B SET (boy that baby sure is heavy!!). Best of all, Kudos to Hopper for his VV 2A3. Those tubes are a blast!!

“We had so much fun that afternoon. I always leave Seattle with a smile of content in my face :^>”

Tennessee Tube Enthusiasts, October 1999. Phil Sieg’s house. Knoxville, Tennessee.

Phil’s got the scoop:

“Well, it's really the Tennessee Tube Two right now. Brad Brooks drove over to knoxpatch this weekend with his stock Foreplay and ParaSEX. We listened to the T-1s for a while with the modified Atmas driving full range - the baseball playoffs are interfering with finishing the 45s - so Brad could get a feel for the "sound" of the system.

Then we plugged in the Foreplay

and ParaSEX monoblocks. Everything else stayed the same. First, 5 parafed Watts will drive the T-1s full range with relative ease. There was less extension and air on top, but the tonal quality of the midrange was right there. Lester's clarinet and Roy's trumpet (Laughin' to Keep from Cryin') had authority and body, and that "bright" Eldridge sound came across faithfully. Bass was not as deep as with the Atmas, but it was taut and well-controlled. Duke's piano (This One's for Blanton) didn't have quite the sonorous body as it did with the Atmas, but the attack and decay of the notes was all there. Same with Ray Brown's plucked bass.

So what does $500 worth of electronics driving a pair of $13K speakers prove? First and foremost is that circuit topology is by far and away the most important factor in design of an amplification stage. Tube rollin' and boutique parts will only get you so far if the topo is screwed up. Second, there's a whole lot of pricey gear out there that would slink off, head hung in shame, when compared to this little combo.

Did they best the Atmas? Well, no (and I think Brad agrees). But the Atmas are an exceptional pair of amps. However, my sonic memory tells me that the combo is every bit as good where it counts as my old ARC VT-150SEs (and I cringe inwardly as I think about the price tag on those).

[Phil and his wife Tina took me out to a well known pub in Knoxville near the college. Never have I ever seen so many people wearing orange, the team colors of UT, and it wasn't even game day! Man, this town sure loves it's football…]

Brad took some pictures, including one of my work-in-progress 45s, which will eventually show up in VALVE. And he shared his thoughts about what was next for his Foreplay/ParaSEX combo, but I'll let him talk about that. We talked about other designs (we have a shared interest in the KR PX-25 and talked about building ParaGlows that could accommodate a 2A3 and the PX-25). And we discussed how we can grow the Tennessee Tube Two. He going to try to set up something at Nicholson's Hi-Fi in Nashville soon. Then maybe something in East Tennessee again before Christmas. All-in-all, a very good day with good ideas for the future. Anyone in the area reading this who would like to participate, please e-mail."

[Sorry bottleheads, no pictures of the meet this time, but I promise to put them in the next issue.]

Valve Meeting, November 1999. Rancho Tonalities -- Poulsbo Washington.

Our tireless reporter Quest sends this report:

"This time instead of driving to Rancho Tonalities alone by myself I dragged TonyD. along with me. We managed to hit the Edmonds ferry terminal for the 10:50am ferry and arrived around 11:45am, and before I reached into that evil Dungeon door I was so familiar with I heard some laughs and music pouring out from the basement....It wasn't until I walked down the stairs that I realized that there was a huge gathering this time.

"Eager to introduce myself I waded through the crowd and talked to many other guys on the show: Paul Joppa, Cameron, Doc, Tim, "Willy the squid" Tony , Ed, John, Tony Glynn(Yes! Tony Glynn of Lowther America was here!!),Aaron and many others around. Looking straight down the end of the basement I saw the already broken-in straight-8. It sounded way smoother than our first encounterings in Acoustical Magic. Tony immediately pointed out that the sound is much more coherent than what he thought it would be, and the bass? plenty for all of us. We sat down while guys took turns sitting on the "golden" spot. From a distance I saw Doc's B-Glow playing with John's eX-ception and his own DAC + a Marantz CDP(?) playing music. This time we opt for mostly vocal stuff: Ella Fitzgerald, my little favourite Charlie Hayden, etc. The sound was nothing short of stunning as I would say…"

[Quest describes the goings-on that are typical of a Valve meeting: Laughing, playing music, laughing, swapping out the latest DIY wonders, listening to music. And, as usual at a Valve meeting, a little surprise…]

"While 1/2 of the audionuts stucked to their chair on Doc's basement, others secretly "sneaked" upstairs to take a look at Doc's secret weapon: the Beveredge speaker system. This odd looking speaker comes as 2 planar structure and 2 "coffee-table" like subwoofer. According to Doc the array of ribbons on the planar structure plays down to 80Hz before the subwoofer takes over. With built-in amp (some sort of

SEPP using 36KD6?) on each planar structure base all we could see is the RCA interconnect wirings and that's all. When Doc played some music through the system it sounded stunning! A full-range system that has the power to rock the house and and clarity is everything you'll always wanted, and more.....

“We hanged around Doc's upper level as the rest of the people carefully sneaked into the basement: Lehman(?), a friend of Wendell in Japan showed up for a bit of fun, and so did Jay. They played Ry Cooder and V.M. Bhatt's "A Meeting by the River" with steel guitar and sitar and the sound was just marvelous: Ry's steel guitar has all the body and weight that is appropriate to the soundstage, without being overly "dry" nor "shrill" and definitely not edgy at all. With V.M.'s complement into the sonic picture everything was just perfect. (If it's because I have to drive home later that day I would have ask doc fo a glass of wine :^>

“Queen Eileen was kind enough to prepare some "num-nums" for us (big applause for Eileen!!!) and brought home a big pot of Starbucks coffee. While the folks upstairs chomping down the dip and the spread we talked about many other things in the audio industry, people and dogs (Doc just brought home a big dog ...it is a blend between boarder-collie and ???)

[Pony, Perhaps?]

“Later with Tony Glynn and a few others in the kitchen area some of us went down to the basement afterwards and discovered that the crowd now played Charlie Hunter and Leon Parker's Duo, with Aaron sitting in the "golden chair" quietly listening to the tone and the color produced by the audio picture. Lehman (sorry bud for I might have spelled your name wrong) started talking about his recent problem with the hum from his SE-1. Eager to jump into the bunch I followed him and John Tucker to Lehman's bug (yes! a classical 1974 bug!) , picked up his amp and later John took off the bottom plate and took a quick look into it. He advised Lehman to have his amp reworked and instead of using 6SN7 try something else .....

“As dusk came little by little some of us left Rancho Tonalities and went home. Instead of intensive audio session this meeting was sort of casual gathering in nature: warm, friendly folks such as Ed. John Tucker, "Willy the Squid's warm smile, Richard and many others make us feel like one big family. (TonyD: are you coming next time :-)

“Kudos to Doc and many other favourite guest like Tony Glynn, Paul Joppa and John Tucker, Cameron and Richard, Jay and TonyD., Tim and Ed, "Willy da Squid" and Lehman (I hope your hum problem will be over soon).

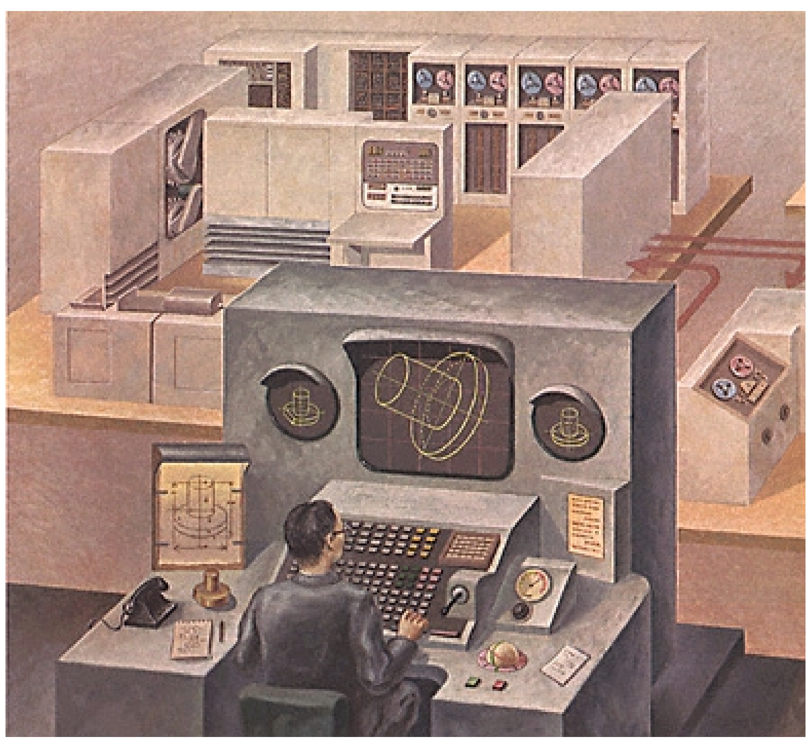
“Also a big thanks to Queen Eileen's dip and other snacks!

Take care!”

Well, that’s all of the club reports and going’s on for this issue. I look forward to future reports, with photos of all of the fine projects and smiling faces enjoying everyone’s company and the cool music. Send them to me via my e-mail:

brad_brooks@hotmail.com

Until next issue...



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