

VALVE

VINTAGE AUDIO LISTENERS AND VALVE ENTHUSIASTS

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picking a good mod project

we close in on the elusive 3C33

Klipsch has a museum!

upcoming meetings

July 9, 1995
preamps, preamps -
bring your favorite!
at Classic Audio, Seattle

August 6, 1995
TBA

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VALVE

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Editor and Publisher:

Dan Schmalte

Our mailing address is :

VALVE

1127 N.W. Brite Star Lane

Poulsbo, WA 98370

By Phone: 360-697-1936

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editor's thing

This is the time of year that makes every club administrator cringe --- dues month for active members!

Yup, it's time for your thirty-five bucks. The coffer has been empty for several months, so swift execution of those checks would be greatly appreciated. You folks with subscriptions need not worry, your money isn't due until your 12 issues are delivered.

I hope anyone with doubts about renewing will pause to reflect on the cool stuff they heard, the neat deals they worked with fellow members, the access they had to schematics for their pet project, and the new audio friends made through the past 18 or so months. I for one have found it much easier to find just the right tube, or someone with the knowledge I need to get a project going. I know this club is more expensive than the other local clubs, but I think you get twice the bang for your buck too.

We are already nearly as big as the other audio club after only a year and a half, and many of our members joined in spite of already belonging to the antique radio club.

Our membership isn't composed of lurkers, either. Look at the last issue, we're all building, listening, designing, and thinking for ourselves, not just spoon feeding what the industry tells us. That's what makes this all so much fun. We know there's no absolutes when it comes to audio quality, and we're all willing to experiment with different sounds and types of equipment, often finding some little known, 'worthless' piece to be a diamond in the rough.

Hell, I've even got a list of great old solid state equipment running in my head these days!

Keep the smoke in another year,

DAN

Klipsch museum

Got a call this month from Tim Hunter at Klipsch. Among his other duties there, he is the curator of their museum. Yup, thats right, a museum full of cool old speaks and stuff.

Tim says that most of the equipment on display is commercial type items from Klipsch, Altec, WE, etc. He was very excited to have recently acquired some nice vintage British speakers and related equipment, including a Voight corner horn, an exceedingly rare piece in this country.

He also has all sorts of interesting letters and other documentation on file, including much correspondence between Paul Klipsch and many of audio's early heroes.

I will be sending Tim complementary copies of VALVE with the hopes that he might supply us with an occasional picture or audition report. He welcomes members to contact him ahead of time if they are planning a visit to the Arkansas area and would like to see the museum. He can be reached at:

Klipsch
PO Box 688
Hope, Arkansas
71802

audio power 100W class A

Got a call from Gil the day after our meeting. He wanted me to come to Nuts and talk to a couple of gentlemen who were demonstrating a new tube amp.

I arrived a while later to meet Jim Maxwell and Bob Bottman of Olympia, partners in a venture called Audio Power.

They had with them two prototype amplifiers. One was a 100wpc class A pentode output amp using 6550s, regulated screens, pentode drivers, and a HUGE power supply. The power supply was about the size of entire Conrad Johnson 70wpc amp we auditioned at the meeting, and the amps were each the size of MarkIII's. Several cables connect the PS to the various connectors located on the amp chassis, which consisted of a hamertone top plate set into a wood base.

The amps made plenty of loud, and sounded pretty good. Remember, I'm a dyed in the wool triode goof, so they were probably really excellent.

They are planning a \$5000 price tag. I presume that the production unit will use something besides the Radio Shack wire and binding posts found on the prototype. Jim said they are getting custom transformers wound similar to Triads, to replace the Hammond used on the prototype.

They want to come demo these amps for us some time. Cool!

administrative junk

Thanks to those of you who sent money for back issues. As I said in the last issue, it may be a little while before we get them out. Eileen will be putting this project together later this month.

Hey, I'm running out of ideas for meetings! HELPI! Can we have a meeting at your place? Can you bring something to demo? CALL ME!

We also need more articles like the great bunch we got last month. I print 'em as I get 'em so the news is fresh. This means I need you to write that article this week, not in a couple months. Remember, the alternative is reading twelve pages of my nonsense. We need record history/reviews, vintage speaker reviews, tweaks, construction articles, well, you get the idea.

systems that surprise me

I have taken flak for saying that I wasn't sent into audioerotic release by an audition of the Marantz 7&8 vintage holy trinkets, even before I published this month's impression. Honestly, some of you guys need to take up a second hobby to keep you from getting so revved up. Here's some more thoughts to raise your blood pressure.

I stopped by Stan's the other day, and was knocked out by the sound when I walked in the garage. What was playing? A pair of QUAD's. Sure, that makes sense, I love 'em. But get this, They were being driven by a SOLID STATE AMPI Dasrite, Bowie, a Pioneer Series 20 class A amp and matching preamp. Now I've listened to three different pairs of QUADs in four different venues, with QUAD tube amps, Mark III's, Ampex tube amps, Stereo 70's, my 6080 SE amp, my SE 10 amp and my Triophoni amps. This was with tube preamps, solid state preamps, no preamps, good CDs, Japanese LPs, etc., etc. But this Pioneer made me shut up and listen. Now don't give me some crap about the signal source, because it was a just OK Pioneer solid state FM tuner, and the sound was still marvelous. I mean, I've always liked QUADs, but this is the first time I've been prompted to maybe even want a pair. Apparently the Pioneer amp was claimed to be very tolerant of capacitive loads when it came out, and that is why it works so well with the ELS's. I'm not trying to shove any philosophy down your throat here (except have FUN), I'm just saying that it pays to keep an open mind. You may get a nice surprise now and then.

what's brewin'?

Surprised myself again the other day when I set my JBL LE175, padded down 3dB, on top of my Stretchom, sans crossover. The system is kinda honky at moderate to high volume, but a frequency response curve plotted with the HP 35665A and a Radio Shack level meter came out really smooth from 40Hz up to 8 kHz, where it rolled off gently. I may play with that ol' bass horn some more. It tested pretty smooth from 40 to 400 Hz. I always dreamed of building the "horn loaded Heil" from Speaker Builder to put on top.

Myron finished his latest version of the Loesch style W-4's. This time he used premium components and an impeccable construction technique, using perfboard cut to cover the entire underside of the chassis. The perfboard has terminal posts riveted to it, and components were layed out on paper to determine their location. The final result is so neat and organized that it looks better than many commercial products. Will try to get pictures and a description of Myron's technique in a future issue.

Mike went and spent some dough on Magnequest 030's and Chinese 300B's for his SE amps that used to sport 6B4G's and 025's. Says he likes the increased power and cleaner highs. Now he likes his LP's better than his CD's.

FLASH - just got a bizzare pair of amps from George, who will be joining our ranks soon. These things are carillon amps, the amps they use to broadcast the church tower carillon sound from the organ of a church. Class B push pull 805 transmitting triodes and Kenyon iron. Estimating 300 watts output. Four 17"X13" chassis, with blowers to cool the output tubes! Thought I'd found the perfect Magnepan amps, but alas, the outputs are a weird 45 ohms. I guess I'll have to build some speakers with six 8 ohm drivers in series. Bet that will play loud enough.

Rick's fantasy

May's meeting was a new twist for us, that of watching the birth of an entirely new system.

Rick had spent several months putting together the following:

Altec 24Ω drivers and 300 Hz horns

Altec 515s in A7 cabinets, heavily braced and filled with pour foam

Audio Concepts subwoofers

Craftsman 500s, modified to triode mode 807's for the tweets

Heathkit W-5s (the subject of last month's mod article) for the woofs

Harmon Kardon Citation 12 for the sub
Luxman active tube crossover

Lafayette 600 preamp

Thorens TD124II with SME arm and Stanton 681 cartridge

Technics CD

I arrived early for the setup and coffee making duty, and found, naturally, that Rick had been up most of the night listening to all his CD's on the new system.

After coffee was started I pulled out my trusty BSR (ADC) EQ-3000 spectrum analyzer and tweaked around with the crossover levels. As usual, this gave a rough starting point for several hours of everyone trying their own version of 'real sound'.

We started with CD's as the turntable hadn't been set up yet. With Kai's help setting up the cartridge we were ready to run, or so we thought, but the Ttable hadn't been used for a while and ran about half speed!

Mike Lee had stopped by, as about 1/3 of the equipment had been purchased from him and he was curious to see how it went together.

When I came out of the kitchen from making yet another pot of coffee, Mike was chief surgeon at the dining table, with about four others in attendance as

he carefully extracted parts to be cleaned and lubed. About an hour later the ttable was running perfectly, and once situated on the mantle away from floor vibration, put on a very nice audition. Check out last month's Hi-Fi World for an article on how much better a TD124 is than a Garrard 301. I love my current Denon, but listening to the 124 made me wish I hadn't sold mine to Dave!

I suspect the KT-600 has something to do with the nice phono sound too.

As for the rest of the system:

- I thought the crossover was a very neat piece. It has plug in modules which allow you to set various crossover ranges for each band.

- the subwoofers were a very nice addition to the 515's. The added extension was tight, adding foundation to the presentation, and very obvious on some organ music. This is a smart addition to an A7 system, and the Citation 12 proved its reputation for great bass.

- The A7's sounded quite similar to Eric's stock system to me. I'm sure there would be differences in a side by side, but I didn't notice anything stupendously different than my impressions of the stock A7's. Eric's woofers had been reconed and took some time to break in and give decent bass. Rick's 515's were brand new and may need some break in as well.

My only gripe about A7's is the honk near the cutoff frequency. I tried raising the crossover frequency to about 1080 Hz and got a few people to agree with me that it sounded better, but a little later folks said "change it back", to about 500Hz, I believe.

-the typical horn high frequency rolloff is nice, smoothing CD's and emphasizing midrange. At a good distance from the system (Rick's living room is pretty big) imaging was quite nice.

Thanks again, Rick for your hospitality!

rare birds

Listening impressions of some collectible equipment.

Warning: This article contains opinions. If you are offended by people expressing their thoughts, you may wish to skip to the next page.

There, I hope that helps keep anyone from getting to upset, because I'm going to be honest about what I thought of some very highly touted equipment.

Two weeks ago I had the opportunity to audition a Marantz 7 preamp and 8 power amp which were consigned to me.

Both pieces were in excellent electronic shape and very good to excellent cosmetic shape. The preamp had been checked out and a new filter cap installed by Audio Classics, the guys in New York who sell all the Mac stuff for huge prices. Both units had been freshly retubed with ARS tubes, and were driven daily by their owner, a high end audio dealer. The output tubes in the amp appeared to be relabeled GE 6CA7s, but I won't commit to that.

So I got the stuff home and listened to it. I used the Magnepans so as not to taint my impression with my yet to be debugged Both Ways speaks. Sources were a Kenwood L-07T tuner, a cheap Technics CD, and a Thorens TD160 with Grado MC+ moving coil, all of which I have listened to extensively. Impressions were compared against the same system amped with my Triophoni amps.

The overall impression was nice. Not cosmic, not The Best, just nice. I liked the preamp quite a bit. It worked nicely with the phonograph, and took the edge off the CDs. It's certainly a pretty piece of gear, and the controls have a nice feel to them.

The amp was nice and detailed and seemed to put out more than 35 watts

per. But it was really bright. I mean *really*. That real pentodey, slightly irritating sound like a Citation II has. I will certainly agree with anyone who says that the tubes could have produced some of this edge, but it was too edgy to be only the tubes. The midrange just wasn't there enough between the bass and the highs.

If I had to compare, I would say that the overall sound was similar to a PAS/Stereo 70 setup, with more extension on both the high and low ends.

I've been told that the major difference between a model 8 and an 8B is the output transformers. I would be curious to hear if the 8B sounds a bit warmer.

Now one thing you don't want to do is change anything on one of these Marantz tube deals, because you devalue it like crazy. That is unfortunate, because I opened the preamp and found a zillion stripier caps. I bet a recap would make some nice changes to the level of detail and clarity, but I for one am not flush enough to buy one to satisfy my urge to hack!

The next treat was a Scott LK-150. Steve B., owner of one of the biggest radio collections in the area, found one at a swap meet and called me for advice on getting it running. Turned out only a couple of caps were bad. After getting a good jolt from an exposed floating ground, Steve got the thing running.

I stopped by to hear a couple days later. It sounded OK on his Bozaks, typical bassy Scott sound, only bigger, and looked very cool, with polished champagne anodized chassis, dual 5AR4s and coke bottle 6550s. But I'm not running out to buy one. Why did they use those puny 7199s?

So anyway, don't feel like you'll never reach Nirvana because you haven't spent hundreds on any of these pieces. They sound very nice, but there are definitely other things out there that sound as good, if not better.

nuts about tubes

Last Saturday's meeting was a chance to see how our pet projects fit into the current high end scheme of things.

Bill Benson, Jim Lee, and Gil Loring at Nuts About HiFi in Silverdale were kind enough to loan us the use of their entire store for a three hour free for all, wherein those attending brought in their favorite amps for a quick frequency response check, courtesy of yours truly, Dave's HP 35665A Dynamic Signal Analyzer (thanks again Dave) and a Deskjet, and then plugged into some awesome gear for a listen.

We got to use the way cool \$20,000 Krell CD player, a really nice Conrad Johnson tube preamp, and Wilson Watt/Puppies, for auditions, switching to an Audible Illusions preamp brought by Jon when we went for vinyl.

We had Myron's new Loesch triode mod W-4's, Doug's mintoid Mac MC225, his immaculate Stereo 70, Mike's SE amps, the monoblocks now sporting Chinese 300B's, My 6080 SE integrated amp, Stan's cool old Sansui 6V6 monoblock, Paul's Heathkit monoblock 6BQ5 amp (A-18?), Jerry's Scott 208, and Rick's restored CitationII.

I must admit that my frequency response tests were offered primarily to protect Bill's expensive gear. I really didn't think there would be much variation besides some slight rolloffs of highs and lows and such. Wow, was I wrong!

Myron's amps tested very nice, with the top and bottom rolloff you might expect from a zero feedback design. Mike's amps with Magnequest iron showed similar response curves which were perfectly smooth. Those are great transients.

Then things got interesting. Doug's Mac had a super flat curve, which goes with its very neutral sound. But his 70, along with Stan's Sansui and Paul's Heathkit, all exhibited peaks as high as 4 dB at around 5 to 9 Hz.

Folks guessed that this was a feedback induced oscillation.

Jerry's 208 had a nice rolloff designed in at 20Hz, which showed up clearly, and, interestingly, quite an upward swing from 10 kHz up to 20 kHz, the limit of our sweeps.

Rick's Citation II got one quick sweep before overheating the too small load resistor I brought, and it showed quite a peak, maybe 1 or 2 dB at about 8 kHz. I always thought those Citations sounded too bright!

We managed to listen to Myron's amps, my 6080 amp, Mike's 300B amps, Doug's Mac, and Rick's Citation before the night was up, and all performed quite nicely, thank you. I'm not sure I could pick a favorite. I liked the triode amps, but I've gotten oversensitive to the slightly loose bass of zero feedback amps these days, and I think the Watt/Puppies may have presented kind of a tough load to the little amps. The Mac and Citation did well on the bass, with the Citation being able to crank pretty loud! The 6080 amp sounded good, but I never played it loud.

I asked for Rick to put in the Citation last because it was the closest thing we had to the 70 wpc Conrad Johnson amp Bill has started carrying. I heard this amp on the Watt/Puppies and loved it. We played a track from my Dorian CD of the Jongen Organ Symphony on the Citation/Watt setup. Then I did something totally unfair. We played the same CD with the Conrad Johnson playing the big X-1 Grand Slams. Wow.

The Conrad Johnson is a great amp. It ran the X-1's with aplomb. The soundstage was about 110' wide!

After experiencing some disappointment with the Cary and Sonic Frontiers products sent for audition last month, my faith has been renewed that there are manufacturers out there who can combine the best of the old and new and really put out a great sounding, modern tube product. Thanks you Nuts guys!

dinkin'around

tech tips and other unsolicited advice

My experience this month with a Marantz amp and preamp gets my head spinning about the idea of paying a ton of money for something that you don't dare service for fear of terminating its investment potential. Alas, I will never make a fortune by selling off my collection of rare audio wonders, untouched by human hands. If I buy 'em, I just gotta play with 'em.

Witness here then a few suggestions for pieces to buy for hacking purposes, that is, stuff that isn't worth too much, but has lots of potential (kinda like me):

Dynaco

Anything but the super rare Mark VI is fair game for hacking. Stereo 70's are a great amp to learn about tubes on, and there isn't a simpler preamp around than a PAS. If you feel adventurous, an FM-3 might be a good first tuner hack. Although people try to get a bit of a high price for them, I think Mark III's are a legitimate hack candidate too. There's still plenty around, and there's definitely more good music to be gotten out of a pair of III's than from a 70.

H.H. Scott

If you don't insist on separate components, Scott integrated amps are another plentiful source of audio potential. The 222 and 299 both use 6BQ5/7189 family tubes which are relatively cheap and plentiful, while the later 299 variants and the kit sibling LK-72 use the now extinct 7591. I think this is just fine, as the 222/299 is a much cleaner, open sounding amp, while 7591 amps sounds a little grundgy and bass heavy to me. Integrated amps are a little more intimidating as a first project, due to space limitations, and the added complexity of having to redo a preamp and amp at the

same time. On the other hand, you know your amp and preamp will work together very nicely, and interconnects won't be a problem!

Scott separates don't particularly strike me as great mod material, but I guess one could play with a 350B tuner, as they are fairly common. The LC -21 preamp is a very nice unit, but I'm not sure they are common enough to hack up, and Scott power amps are really hard to find.

Fisher

The best candidates for heavy mods from Fisher would have to be the receivers. The best receiver is the 500-C. The only problem is those stupid 7591s.

I haven't tried it yet, but I suspect the KM-60 tuner would be lots of fun to hack. It seems to have the right stuff, and they aren't worth much. I even thought about combining parts from two to get an extra tuned RF stage and more IF stages, ala FM-1000.

As with Scott, the separates are getting a little too rare to hack up. The integrats tend to use wierd output tubes like the receivers, so they may not be a good choice for hacking either.

Eico

The HF-20 gets cut up a lot here in the northwest. As a mono integrated amp, it's not very desirable, folks say the iron is very nice, and you can still find them pretty cheap.

The HF-81 is another nice 6BQ5 type integrated amp that would make a good project. The bigger Eico integrats use rare tubes like 7591s and 7247s so they could be tough to play with.

Only a total idiot would do a major mod to an HF-60, and other big Eico power amps should probably be treated the same way. Just restore them nicely and enjoy.

Heathkit

Heathkits are close to Dynas for hackability. The best amp candidates are the W-4 and W-5. Both are plentiful, roomy, and well endowed with good iron. The Heathkit WA-P series preamps are considered worthless by most collectors as they need external power, but if you really want to play, they might be a good starting point. It's probably not a good idea to hack up an XO-1 crossover. These are getting pretty collectible.

W-1's, 2's and 3's are probably better left stock, as they are going up in value, too. Don't even think of wrecking a W-6!

Harmon Kardon

The Citation II amp is a true collector's item these days, which is too bad, 'cause I'd like to try a triode input/driver stage. The Citation I preamp is cheap because it's so complicated that people are scared of them. It's actually a very nice preamp, and can be selectively restored in the circuits which are normally active (a lot of stuff, like the tone control, is switched out of the circuit and thus does not affect sound unless switched in). The Citation III-X is my choice for a great sounding tuner that's not so collectible as to be untouchable. Citation IV's and V's are kinda scarce too, but it would probably be better to hack these than I's and II's. Some say the IV sounds better than a I.

An HK-250 might make a good mod project, as might some of the integrated stuff, but watch out for wierd tubes.

As usual, don't take any of this too seriously. If your HF-60 uses 300B's, cool, I'd like to hear it! If you think a Stereo 70 is perfect in stock form, enjoy.

However, if you turned your Marantz 9's into plant stands, don't call us, we'll call you.

vacuum tube valley

Just received the premier issue of Vacuum Tube Valley, the quarterly publication by the company of the same name. This is the venture put together by Charlie Kittleson, John Atwood, Eric Barbour and Norman Braithwaite.

Charlie promised it would be a very high quality publication, and it is, very nicely screened photos and quality paper.

The content is pretty well rounded, including historical articles on the early days of hi fi, an illustrated history of Dynaco's tube line, the basics of tube testing, industry gossip, and, most interesting to me, a neat article on various 12AX7 types and their relative performance.

I noticed in this article that Telefunken smooth plates and late 80's Sylvania 5751's scored pretty high and close together in terms of low distortion and microphonics. This article once again proves that these types of figures are an excellent starting point for picking good tube types, and seemed to explain why each of several different NOS 5751's sounded consistently cleaner than several near new (very high transconductance, similar to the 5751's) smooth plates, when placed in the line stage of my SE 6080 amp. Why they both sounded hugely better than a Sovtek 7025 seems to be demonstrated in the tables pretty clearly, as the Sovtek was near the bottom of the low distortion and microphonics piles.

I hope that the VTV crew continues to put out tube articles of this comprehensive style. They have definitely come up with something not in other publications which really serves the DIYer.

Call or FAX 408-733-6146 for subscription info. Subs are \$25 per year for four issues.

(OK Charlie, there's your plug. How about one for VALVE in your next issue?)

letters

At the last meeting Paul and I got talking about the 3C33 tube again. I had mentioned the article in May 1951 Radio & Television News in which a load impedance of 2800Ω is suggested for a 40 watt PP output at 500VDC B+. Because of this, I suggested to Paul that two 1600 Ω primary SE transformers from One Electron might work with the 3C33, creating a single tube stereo SE output similar to my World Audio 6080SE amp.

Here's his further thoughts on the topic:

Dan-

After looking at the problem more carefully, I'm afraid I gave you some wrong information at the last meeting, when we discussed single ended amplifiers based on the 3C33 twin triode. Here's the corrected version of my simplified graphical approach to find the operating conditions. This method can work even when you have plate curves (my article was for when there are no curves, just the handbook values of plate resistance, etc.)

First, find the point on the plate curves where the plate dissipation limit intersects the zero grid bias characteristic. For the 3C33 using the curves in the April 1995 VALVE newsletter this is 150 volts and 200 mA. A good operating point would be twice that voltage and half the current (300 volts, 100mA). The typical load impedance is then 0.74Xvolts/amps, or around 2200 Ω .

I also tried my formula from the article, using a plate resistance of 1200 Ω at 100 mA which I got by fitting a tangent to the -20v grid bias line. This gave an operating point of 440 volts and 68 mA, load impedance 4800 Ω . The large difference comes about because of the tube's nonlinearities - for a perfectly linear tube

there should be no difference. The high degree of nonlinearity suggests that the only way to get realistic numbers is to draw some load lines on the plate characteristics. I tried this and got the following results:

At 300 volts / 95 mA (-20 volt bias)

Load	Power	Distortion
1k	5.5W	14%
2k	5.4W	8.4%
3k	4.8W	3%
5k	4.0W	2%

At 360 volts / 83 mA (-25 volt bias)

Load	Power	Distortion
2k	7.6W	20%
3k	6.5W	14%
4k	6.0W	9%
5k	5.6W	5%

Of course the numbers are pretty crude, depending on how well I can read the curves, but the trend is clear. This tube really wants high load impedances to keep the distortion down, and raising the plate voltage just drives you into an even less linear region.

Actually Paul, I read in an old RCA catalog the max plate dissipation for one side of the 3C33 is 15W, not 30. μ is 11 per plate (easy drive). Using a good operating point of 220V and 68mA (-15V bias), I get 2400 Ω for a typical load impedance, 7.48 watts output. Hey, that sounds like a Superman 2A3. Using a plate resistance of 808 Ω at the zero bias point, which I get from 110V/.136A, optimum load resistance would be 1616 Ω based on $R_L=2R_p$. We have also moved over to an area on the graph where the plate curves are evenly spaced, so distortion may drop quite a bit. As my college prof's used to say when they got lazy, "I leave the distortion calculations as an exercise for the reader".

I _____, being a dyed in the wool, gonzo bottlehead, do hereby reup.

That is to say, I rejoin for the following reasons:

- ___ - I have a bet that Dan won't ever finish those wierd styrofoam speakers, and I want to collect on it.
- ___ - I heard that there would be a containerload of Marantz 9's for sale at the next meeting for \$5/lb.
- ___ - The rest of you chuckleheads don't know spit, and I'm coming back to educate you
- ___ - I need a copy of the 1963 Kenner Close'nPlay factory service manual, cheap

I have enclosed one of the following:

A check for \$35.00 made out to VALVE

The keys and pink slip to my Dino 246

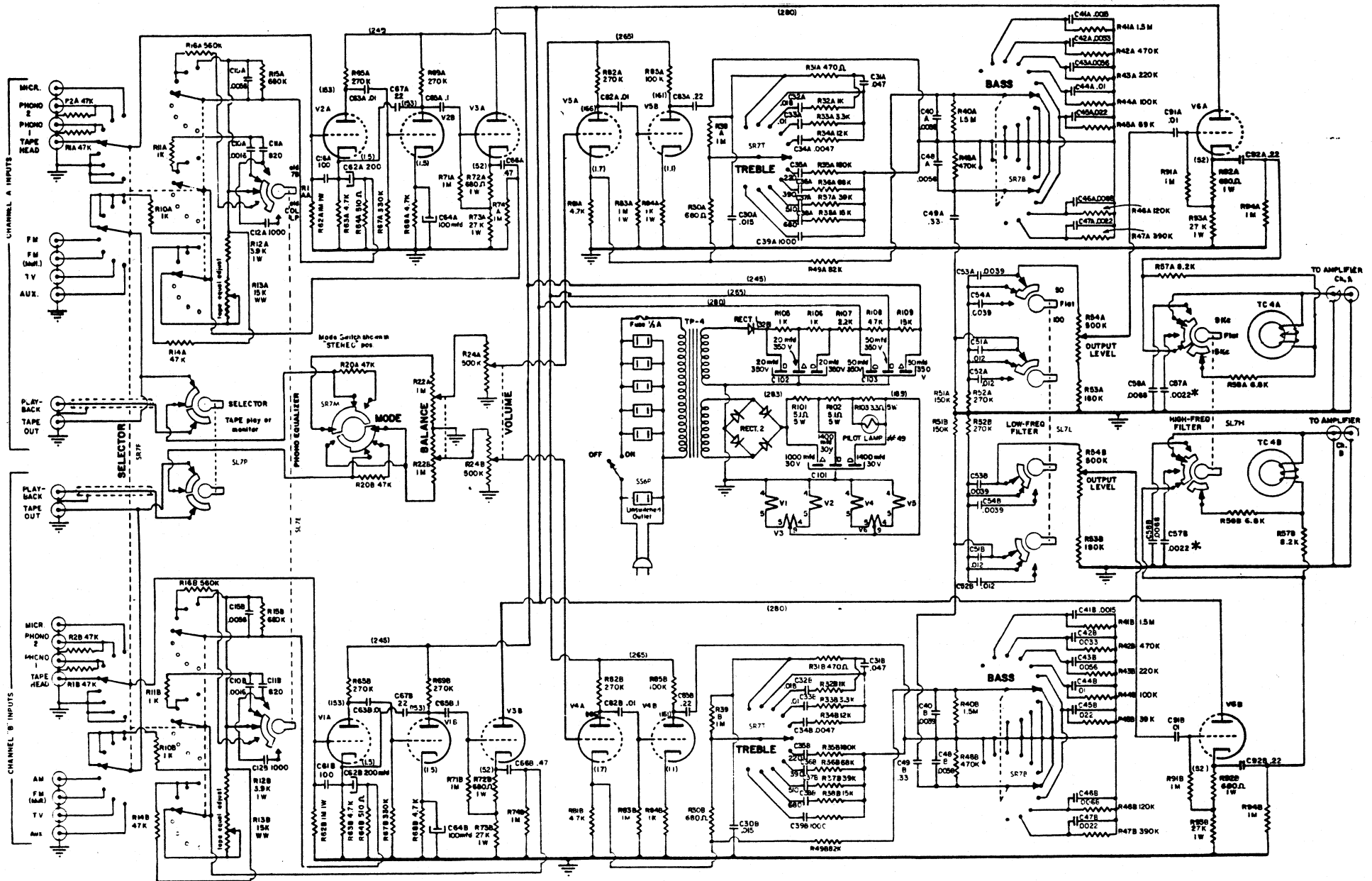
24 NOS WE 300B's

Here's my current address and phone numbers:

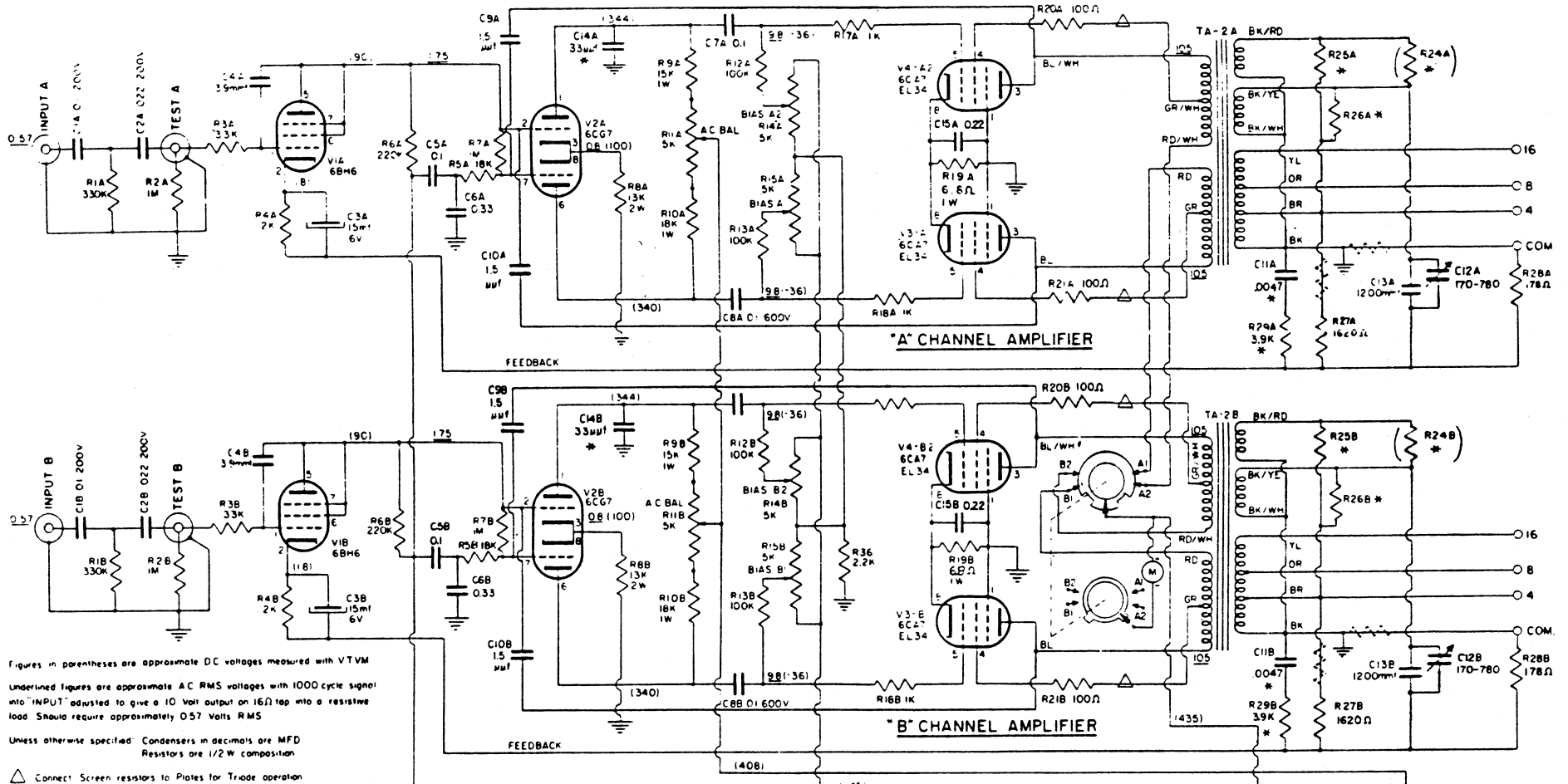
Mail this testimonial with your check to:

VALVE, 1127 NW Brite Star Ln, Poulsbo, WA 98370-8241

marantz 7C



marantz 8B



Figures in parentheses are approximate DC voltages measured with VTVM
 Underlined figures are approximate A C RMS voltages with 1000 cycle signal into INPUT adjusted to give a 10 Volt output on 16Ω tap into a resistive load. Should require approximately 0.57 Volts RMS

Unless otherwise specified: Condensers in decimals are MFD
 Resistors are 1/2 W composition

△ Connect Screen resistors to Plates for Trade operation

Insert Resistors for lower Damping Factors

K = 1,000
 M = 1,000,000

* These components are selected to obtain optimum operation with particular output transformers

