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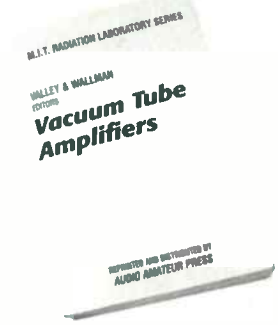

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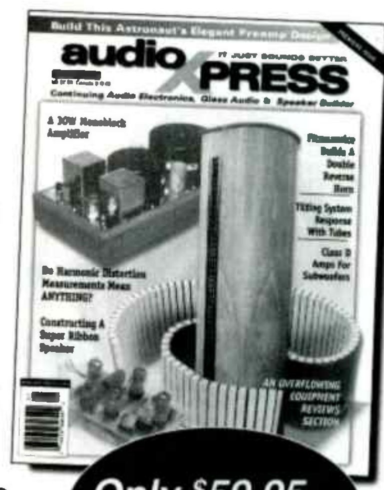

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KIT & COMPONENT NEWS

STEPPED ATTENUATORS

DIYers interested in our attenuator feature in the August issue DIY section might like to know that there's a commercial alternative available from Goldpoint, of Sunnyvale, California (www.goldpt.com). They are "affordable, precision level controls for high quality audio and general instrumentation applications. These compact 24 position Series, Ladder, and Shunt designs out perform pots by offering lower noise and better channel-to-channel signal level tracking" Arn Roatcap tells us.

The Mini-V series type, Mini-L ladder type and Mini-H shunt type units come in 1 to 12 channels, fully assembled or as easy to finish kits. Mini-V stocked values include: 10K, 25K, 50K, 100K, and 250K. Blank switches, (with printed circuit boards attached), are also available for user customizable controls.

Only 1.25" tall by 1.65" wide! Other features include precision Swiss made switch components, smooth turning torque, and hard-gold plated switch contacts with low contact bounce (no "pops or clicks").

The Mini-V and H types are priced at $143 (£90) and the more complex but theoretically ideal Mini-L at $239 (£150). Phone 408 737 3920 (USA) or e-mail arn@goldpt.com.

DUTCH TRIODES

Anyone interested in the secrets of the output transformer might well take a look at this little known site http://www.triodes.nl/. Based in Holland it has Tribute, Bartolucci and Amplimo output transformers for sale, via mail order of course. Interestingly, it also publishes a picture sequence showing how an output transformer is wound and potted. Well, perhaps on reflection this isn't quite the most exciting picture sequence you will ever encounter, but it does give some idea of how it is done.

GREENWELD CATALOGUE

Here's an interesting catalogue for home constructors, with a range of products for the dedicated DIYer - plus any budding small ones in the family. The Greenweld catalogue has a wide range of kits and bits, electronic and mechanical, from simple rubber-band driven model aeroplanes through to valve radio kits, as well as solid-state ones of course. These are the simple things that can make childhood fun - and they don't cost a lot.

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Class & Power

Building upon experience, World Audio Design comes up with a valve amplifier that combines real class with a good output power. Here is a high quality, purist design with all-valve power supply, that can drive modern loudspeakers with a clean 40W of power. Nick Lucas explains and Andy Grove designs.

Our KiT88 integrated amplifier was very popular. Using KT88 beam-tetrode valves to deliver 40W per channel, it sold strongly; there are hundreds of them dotted about the world. Unlike other manufacturers who might let a product live for years, we have a Supplement and hungry readers to feed! So our commercial dynamic is a little different. At World Audio Design we come up with new and progressive designs frequently. On average, a kit will only have a life of around 2 years. Work on KiT6550 described here was started many months ago and you will notice similarities to our recent KiT34 amplifier; both are devised around the same circuit. Andy Grove, will be discussing the ins and outs of the circuit design later. In a nutshell, where KiT34 used inexpensive EL34 pentodes, this kit uses higher quality 6550 beam tetrodes. They give more power and better sound quality, but at greater expense.

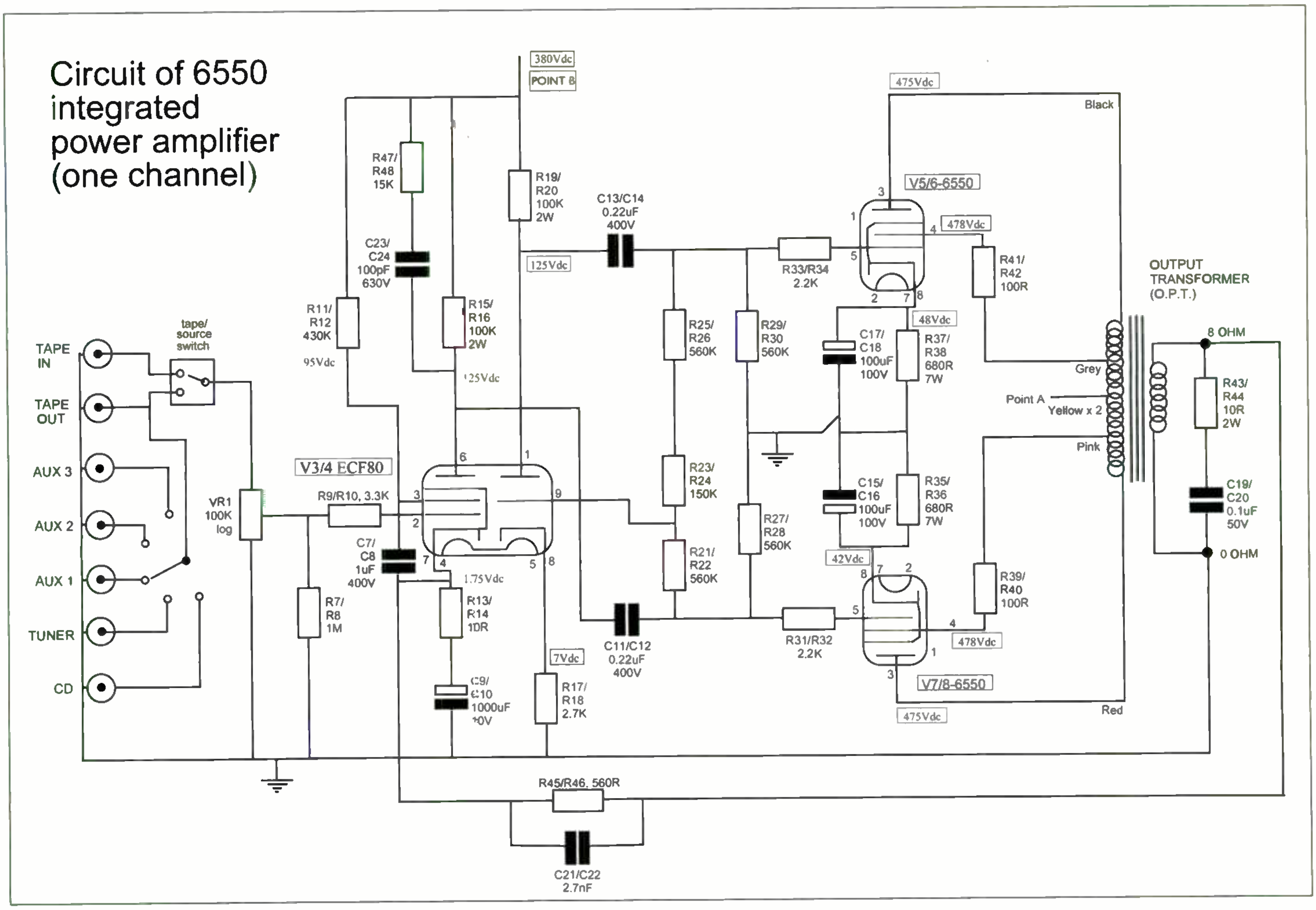
There are many key features to this new amplifier. The power supply employs valve rectification, using two impressive looking and rugged Russian 5U4s diodes. It has a 1.5H 350mA choke in a classic 'pi filter' smoothing network to suppress both hum and noise. The gives an extremely quiet H.T. line and a low noise figure of -90dB on the speaker outputs – there's no hum here!

Valve rectification also offers bonuses in the sonic signature of an amplifier, compared to the more popular solid-state circuits. You get tighter, cleaner bass and superb overall dynamics. We are not just trying to recreate an Old World replica here, as some cynics seem to think. Sound quality is our primary interest, not nostalgia. Valve rectifiers do sound better, that's why we use them.

Old-school hobbyists will appreciate our use of tag boards in the kit for KiT6550. Printed circuit boards are good and make building easier, but for a couple of hours extra work soldering in hard wired links (equivalent to the PCB tracks) you will reap the sonic benefits. Basically, good wire sounds better than a thin slice of copper PCB track. Tag boards also make component changes and repair a good deal easier.

The output transformers, available in 4 and 8 ohm versions, are of the ultra-linear variety. This gives a lower distortion figure when compared to the normal anode(1) - centre tap - anode(2) type transformer.

The KiT6550 integrated valve amplifier is of our signature construction, with a black powder coat finished 2mm mild steel chassis, 6mm anodized aluminium front plate, and custom made knobs controlling the volume and input selection. All three exposed E/I transformers are topped with chrome plated caps. To top it all off we have a perforated cage that covers the whole chassis for safety.



Circuit of 6550 integrated power amplifier (one channel)

This is an optional extra and is easily removable by loosening four M3 screws, two each side.

KiT6550 uses the pentode/triode ECF80 that is an excellent input/phase-splitter tube. We fit two Svetlana 6550Cs beam tetrodes in push-pull configuration per channel in the output stage. They work with auto-bias so re-biasing is unnecessary if a tube is replaced.

Mains power enters via an IEC socket on the rear panel, the on-off switch being located on the back left corner of the chassis to avoid having mains current running through the amplifier. It minimises hum.

The amplifier accepts five line level inputs, controlled by a rotary selector switch, and it has a tape in/out, controlled by the tape/source switch. All phono sockets are of the insulated gold plated variety. The speakers get their juice via 4mm gold plated speaker sockets at the rear of the amplifier. KiT6550 provides 40Watts into an 8 ohm load - ample for the hungriest of speakers. Input sensitivity is 500mV.

OUTPUT TUBE VERSATILITY

Output tube versatility is worth discussing here, because it is a significant issue in a valve amplifier, if not a commonly discussed one for political/commercial reasons, as well as lack of experience.

With KiT88 we used Tesla KT88 tubes. They are good sounding tubes but I found the failure rate to be a little too high for my liking. There were a few complaints of flashover on the screen grid, causing the 100ohm resistor that feeds the screen to fry. I know of other amp companies who are experiencing this problem too.

I must point out at this stage that tube failure rates are dependent upon tube testing before they get to the customer. It seems to me currently produced tubes leave the factories of Eastern Europe after limited testing, often set by agreement between the distributor and the factory. The distributor can demand a certain specification of tube, but he will be paying extra if it is high.

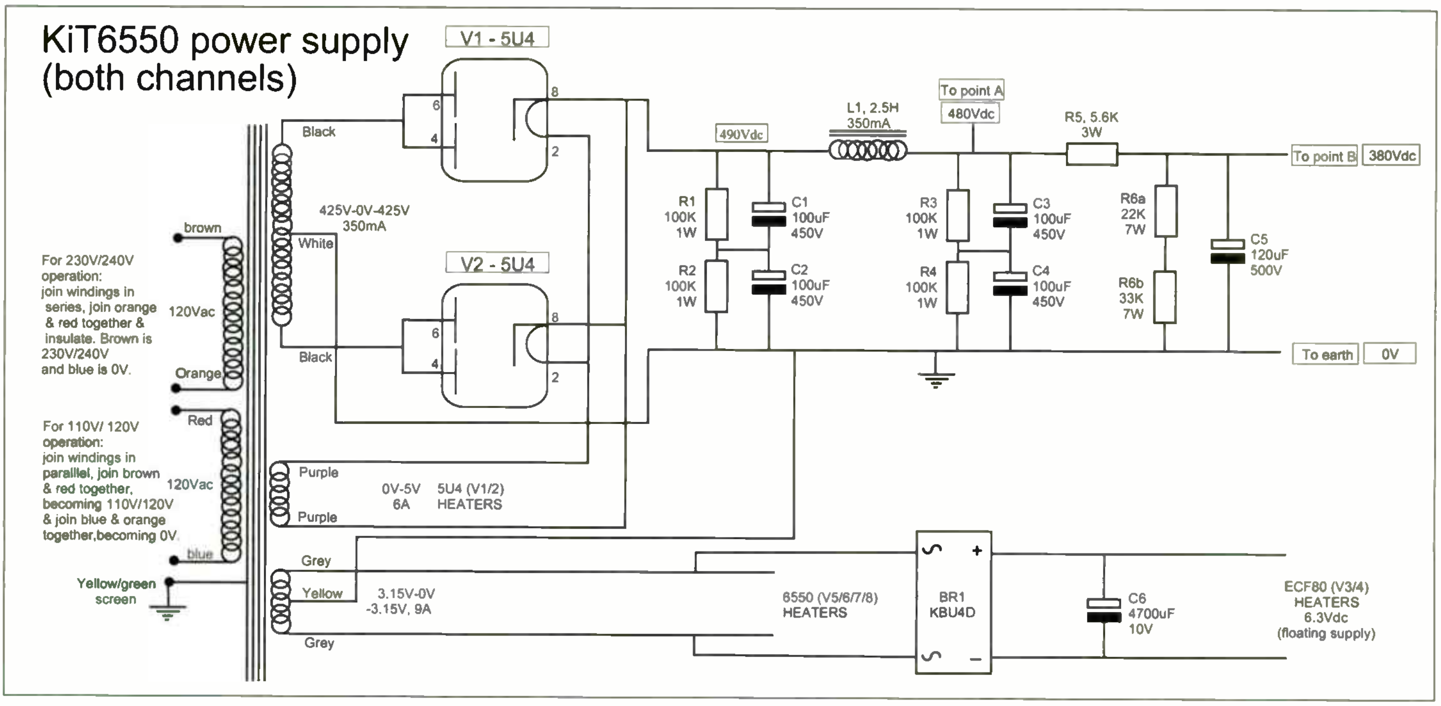
Tubes arrive in the UK through numerous distributors, Edicron, Chelmer, Billington and Watford Valves to name a few. From here it is the decision of the distributor as to whether they test the tubes before shipping out. Edicron, our main supplier, carry out a batch test, i.e. they will test 1 out of 20. This is the arrangement I have with them and we get a good price which reflects in the price you see. Watford valves on the other hand go to great lengths when it comes to valve testing. They test all the tubes that come in and match them into pairs/quads/sextets etc. Obviously, you will pay a bit extra for this service.

In hindsight, we probably had a bit too much faith in what Tesla were shipping out and it would have been worth paying that little bit extra to get them 100% tested. Next time you buy some valves it may be worth checking the seller's testing procedure. As a result of our experiences I will be checking all power tubes in situ, actually working in an amplifier for 1 hour continuous play before dispatch. This way the constructor is less likely to be troubled by a defective valve.

The KT88 tube is British in origin and has been very popular ever since it first appeared in April 1957 from GEC. The 6550 tube was released in December 1954 from Tung Sol in the good old USA. This obviously inspired GEC to create the KT88. Evidence for this is within the 1957 GEC valve manual where the KT88 is quoted as equivalent to the American type 6550.

We have chosen the 6550 tube purely because our favourite, from the numerous KT88 and 6550 variants on the market today, is the Svetlana 6550C. You may like to refer to a past article in DIY supplement No 56 that details a head-to-head of different makes of these tubes.

There are plenty of 6550s around from all the UK distributors. They sell at a reasonable price and it is too good a tube to ignore. There are plenty of other tubes to choose



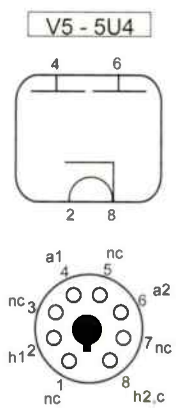
from too. This month's issue of Audio Express, an American DIY publication, sees the release of the Electro-Harmonix 6550EH tube that has a huge 42W maximum anode dissipation, website www.ehx.com. Also, there is a review of Sovtek's 6550WE tube. Svetlana have recently released their KT88. Americans are fond of the 6550 and the KT88 has a good reputation too, so there is some demand.

With our selected output tube, the 6550C, we first had the cathode resistor set at 470ohms 7watt. This gave rise to a whopping output of 46 watts into an 8 ohm load. A few calculations showed us that the actual combined screen grid and anode dissipation was 38W - a trifle too high. The 6550C is rated at 35W.

Increasing the cathode resistor to 560R reduced the dissipation to 34.5W, giving 44W output in 8 ohms. I was still a bit sceptical about running the output tubes so close to their limit. Whilst enjoying the amp at home late one night (perks of the job), I did the darkness test - lights off and nose up to the valves! On two of the 6550Cs I noticed tiny hot spots, visible as small orange/red dots on the anode. This is a tell tale sign the tube is being pushed too hard.

Further investigation - a couple of phone calls and some e-mails later, I was reassured of the quality of Svetlana's 6550C but had it confirmed that my earlier wish to drop the dissipation was wise! Putting a 680R 7W resistor in the cathode gave a combined dissipation of 31watts and no hot spots. I would like to thank Derek from Watford Valves and Richard Maile from www.worldaudiodesign.co.uk Bulletin Board Society for their help here. So, as you can see, our KiT6550 is very flexible. You can use 6550s or KT88s. You can drive your output tubes as hard as you like by altering the value of the cathode resistor, although a little maths is required. **NL**

Valve pin layout



Views are from underneath valve or valve holder
h1, h2 = heater a1, a2 = anode c = cathode nc = no connection

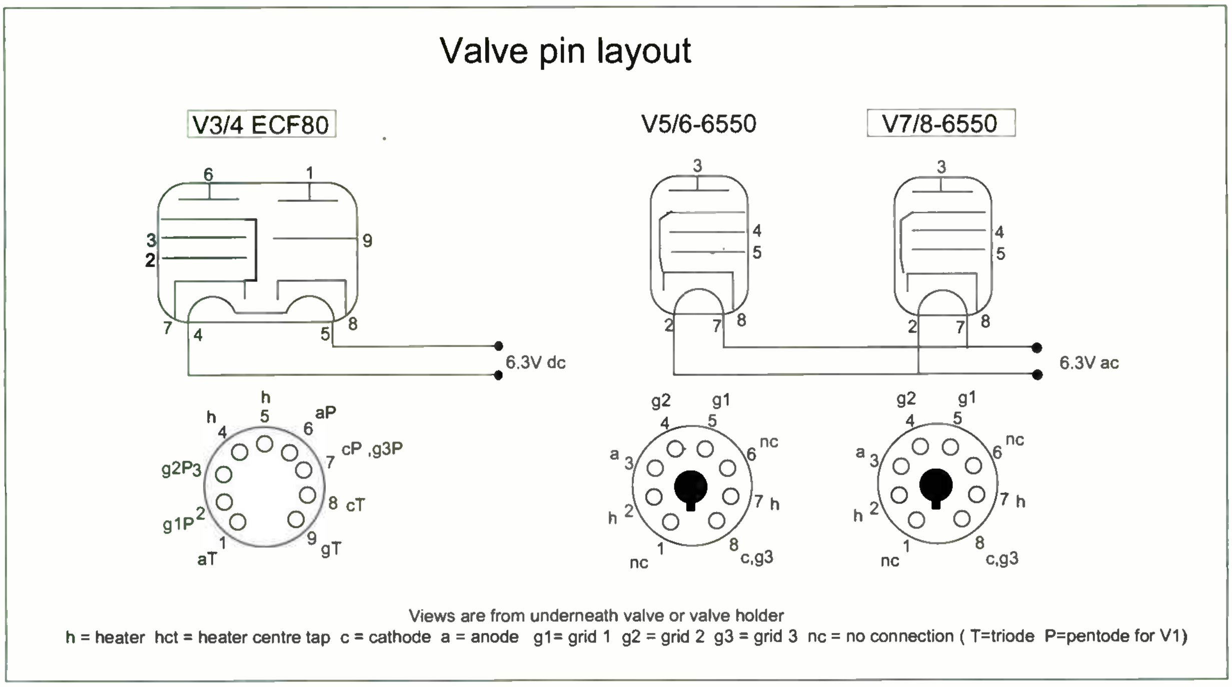
MEASURED PERFORMANCE

using Svetlana 6550C tubes

Power	40W
Frequency response (3dB)	15Hz – 60kHz
Sensitivity	500mV
Distortion (1W)	0.08%
Noise	-90dB

Part II of this feature will appear in DIY Supplement No. 61, banded to the November 2001 issue of Hi-Fi World magazine. This will detail the following:

Release of the KaT6550, the power amplifier version of the KiT6550.
Sound quality of both the KiT6550 and KaT6550
More about the kits and their construction.



KiT6550 circuit description by designer Andy Grove

This amplifier is very similar in design to our recent EL34 kit, but here we are using the American designed 6550 valve. As Nick Lucas explains separately, the Svetlana factory in Russia manufactures the version we have used here.

The 6550 is very similar to the KT88, perhaps with a slightly lesser specification and reputation. Tung-Sol, a company that produced some of the finest ever valves, produced the original design. The 6550 is a beam tetrode (or beam power valve) like the 6L6, KT66, KT88 and so on. These valves were specifically developed for audio use as they generate predominantly second harmonic distortion like the triode, but have efficiency equal to, if not greater than the pentode.

The vast majority of high power American amplifiers have used the 6550; manufacturers like Audio Research, Macintosh and Conrad-Johnson help keep the 6550's reputation alive. The 6550 is also widely used in musical instrument amplifiers, like the hugely powerful Mesa-Boogie bass amps. It has a crisp, clean sound similar to the KT88, with plenty of bass grip and power. In our design we are feeding the 6550s with Russian 5U4 rectifier valves for the last word in refinement.

Once again the input valve is the ECF80, a really sweet little valve. With a triode and a pentode in one envelope, it was originally conceived for use in radio receivers and televisions. The triode would be used as an oscillator and the pentode as the mixer in a superhet circuit. Here though, we are using the pentode to provide the necessary gain in one stage and the triode as a phase inverter. The circuit is set up as a self-balancing 'paraphase' phase-splitter.

There is a step network across the anode load of the pentode that reduces gain at HF. It ensures stability with a capacitive load, which interacts with the leakage inductance of the output transformer.

Feedback is taken to the cathode of the pentode stage in the usual way, with C21/C22 cleaning up the square wave.

The screen bypass capacitor is taken to the cathode of the pentode rather than to ground. Taking this component to ground introduces an unwanted feedback loop. As usual we have a network in the pentode cathode which effectively increases feedback at LF. This might seem to be heading for LF instability but the reverse is true, due to phase shift heading in the correct direction.

The bridge in the grid circuit of the 6550s is the paraphase network for the phase splitter.

The 6550s are operated purely in cathode bias mode. This limits the steady state power output but has some advantages. Their recovery after overload is cleaner than with fixed bias and of course the DC feedback minimises differences in the valve's parameters.

The dynamic power output of this stage will be greater than the specified 40W, which is measured steady state. With a dynamic signal there is too little time for charge to build in the cathode capacitors. This could be one reason why cathode bias amps sound louder than their equivalently rated fixed bias cousins. I also suspect that faster recovery from overload is also responsible to some extent.

The screen grids are taken to Ultra Linear taps on the output transformer. As I have explained before, U.L. causes the valves to move towards partial triode operation. If the screen is connected to the anode we have full triode operation, when the screens are at fixed H.T. potential we have pentode (or tetrode) operation. With U.L. the screens receive a proportion of the anode's A.C. signal superimposed upon the fixed H.T. - hence partial triode operation. The efficiency of the setup is still far greater than triode connection.

The output transformer's secondary winding has a zobel network connected across it to ensure stability into inductive loads at high frequencies, and the feedback loop comes directly from the secondary.

The power supply is a heavy duty affair with two 5U4 rectifiers. Each 5U4 is connected as a single diode and then the two diodes are operated as a biphase full wave rectifier system. The input of the pi filter is two 100uF capacitors in series to provide 50uF at 900V, then we have a rectifier choke and two 100uF in series again. There is a little network to provide the filtered HT for the input stage. Here a potential divider is used to ensure that the surge voltage at switch on does not exceed the surge rating of the 500V capacitor (550V surge). The heaters use Nick's proprietary AC/DC circuit that seems to be very effective in practice, keeping heater induced hum to a minimum.

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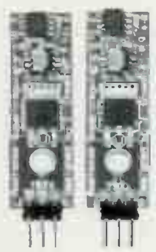

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Part no	Description	L x C mm	Price
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CPW150N	Ansar 150nF 630V	32 x 7 5	2 00
CPW220N	Ansar 220nF 630V	32 x 9 0	2 00
CPW330N	Ansar 330nF 400V	32 x 8 0	2 00
CPW470N	Ansar 470nF 400V	32 x 9 0	2 00
CPW680N	Ansar 680nF 400V	32 x 10 5	2 00
CPW1U0	Ansar 1uF 400V	32 x 12.5	2 00
CPW1U5	Ansar 1 5uF 400V	32 x 14.7	2 00
CPW2U2	Ansar 2 2uF 400V	4[illegible] x 14.8	2 50
CPW3U3	Ansar 3 3uF 400V	4[illegible] x 17.6	3 00
CPW4U7	Ansar 4 7uF 400V	4[illegible] x 20 7	3 00
CPW6U8	Ansar 6 8uF 400V	4[illegible] x 22 8	3.50
CPW8U0	Ansar 8uF 400V	4[illegible] x 26 5	4 00
CPW10U	Ansar 10uF 400V	4[illegible] x 29 5	4 00
CPW15U	Ansar 15uF 400V	5[illegible] x 34 1	6 00
CPW22U	Ansar 22uF 400V	5[illegible] x 39 3	7 50
CPW25U	Ansar 25uF 400V	5[illegible] X 42 0	7 50
CPW30U	Ansar 30uF 400V	5[illegible] x 44 7	9 00
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CPW60U	Ansar 60uF 400V	8[illegible] x 51 7	13 00
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CPW80U	Ansar 80uF 400V	8[illegible] x 56 8	[illegible]8 00
CPW100U	Ansar 100uF 400V	1[illegible]5 x 55	20 00
CPW125U	Ansar 125uF 400V	1[illegible]5 x 61	26 00

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Part no	Description L x D mm		Price
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CPW3232	Propyl 32+32 400V	115 x 61	30 00

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Blue coated Film & Foil. Epoxy coated, low inductance metal foil & film. Supremely stable. Tolerance 1%

Part no	Description	Price
CPP47P	Propax 47pF 630V	0 40
CPP100P	Propax 100pF 630V	0 40
CPP150P	Propax 150pF 630V	0 40
CPP220P	Propax 220pF 630V	0 40
CPP330P	Propax 330pF 630V	0 40
CPP470P	Propax 470pF 630V	0 40
CPP680P	Propax 680pF 630V	0 40
CPP1N0	Propax 1nF 400V	0 40
CPP1N5	Propax 1 5nF 250V	0 50
CPP2N2	Propax 2 2nF 250V	0 50
CPP3N3	Propax 3 3nF 250V	0 50
CPP4N7	Propax 4 7nF 160V	0 50
CPP6N8	Propax 6 8nF 160V	0 50
CPP10N	Propax 10nF 63V	0 60
CPP22N	Propax 22nF 63V	0 70
CPP33N	Propax 33nF 63V	1.00
CPP47N	Propax 47nF 63V	1 50

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Part no	Description	Price
1Y50	Lo Imp Hi Temp 1uF 50V	0 30
2U2Y50	Lo Imp Hi Temp 2 2uF 50V	0.30
4U7Y100	Lo Imp Hi Temp 4 7uF 100V	0 30
10Y63	Lo Imp Hi Temp 10uF 63V	0 30
22Y63	Lo Imp Hi Temp 22uF 63V	0 30
47Y63	Lo Imp Hi Temp 47uF 63V	0 40
100Y63	Lo Imp Hi Temp 100uF 63V	0 60
220Y50	Lo Imp Hi Temp 220uF 63V	0 80
470Y63	Lo Imp Hi Temp 470uF 63V	1 50
1000Y35	Lo Imp Hi Temp 1000uF 35V	1 50
2200Y50	Lo Imp Hi Temp 2200uF 50V	2 50
4700Y25	Lo Imp Hi Temp 4700uF 25V	2 50

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22000+100	22000uF 100V	30 00

Alcap Bipolar Electrolytics

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Primarily for use in speaker crossovers

Part no	Description	Price
CAB1	Alcap 1uF	0 40
CAB2U2	Alcap 2 2 uF	0 40
CAB3U3	Alcap 3 3uF	0 40
CAB4	Alcap 4uF	0 40
CAB5	Alcap 5uF	0 40
CAB6U8	Alcap 6.8uF	0 50
CAB8	Alcap 8uF	0 50
CAB10	Alcap 10uF	0 50
CAB16	Alcap 16uF	0 80
CAB20	Alcap 20uF	0 80
CAB25	Alcap 25uF	0 80
CAB35	Alcap 35uF	0 80
CAB50	Alcap 50uF	1 00
CAB60	Alcap 60uF	1 00
CAB[illegible]	Alcap 80uF	[illegible] 00
CAB100	Alcap 100uF	1 50

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P22	220µH 0 15Ω 48x19mm	£2 50
P33	330µH 0 2Ω 8x19mm	£3 00
P47	470µH 0 25Ω 50x19mm	£3 50
P68	680µH 0 35Ω 59x19mm	£4 50
P100	1mH 0 4Ω 59x19mm	£5.50
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F330	3 3mH 0 2Ω	330W	65x39mm	£9 50
F470	4 7mH 0 25Ω	140W	65x30mm	£11 00
F680	6 8mH 0 35Ω	120W	65x39mm	£12 00
F1000	10mH 0 45Ω	100W	65x39mm	£13 50

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Part No	Description	Price
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6550C	BEAM PENTODE	£26 00
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6SN7GT	TRIODE	£4.50
6V6GT	TETRODE	£4 50
E88CC	RUGGED DOUBLE TRIODE	£11 00
ECC81	DOUBLE TRIODE	£5 00
ECC82	DOUBLE TRIODE	£5 00
ECC83	DOUBLE TRIODE	£5 00
ECL82	TRIODE PENTODE	£4 00
ECL86	TRIODE PENTODE	£4.00
EF86	LOW NOISE PENTODE	£10.00
EL34	PENTODE	£8 50
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KT66III	BEAM TETRODE	£25.00
KT88	BEAM TETRODE	£20 00

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Part No	Description	Price
B9AC	B9A VALVE HOLDER CERAMIC	£1 50
B9AG	B9 VALVE HOLDER PORCELAIN PLUS GOLD PLATED PINS	£3 00
OCTC	OCTAL VALVE HOLDER CERAMIC	£2 00
OCTG	OCTAL VALVE HOLDER PORCELAIN PLUS GOLD PLATED PINS	£4 00

Please call for valve holder not listed

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KIT 6550 PARTS LIST

RESISTORS

R1/R2/R3/R4	100K, 1W
R5	5.6K, 3W
R6a	22K, 7W
R6b	33K, 7W
R7/R8	1M, 0.5W
R9/R10	3.3K, 0.5W
R11/R12	430K, 0.5W
R13/R14	10R, 0.5W
R15/R16	100K, 2W
R17/R18	2.7K, 0.5W
R19/R20	100K, 2W
R21/R22	560K, 0.5W
R23/R24	150K, 0.5W
R25/R26	560K, 0.5W
R27/R28	560K, 0.5W
R29/R30	560K, 0.5W
R31/R32	2.2K, 0.5W
R33/R34	2.2K, 0.5W
R35/R36	680R, 7W
R37/R38	680R, 7W
R39/R40	100R, 1W
R41/R42	100R, 1W
R43/R44	10R, 2W
R45/R46	560R, 0.5W
R47/R48	15K, 0.5W
VR1	100K dual log potentiometer

CAPACITORS, RECTIFIER

C1/C2/C3/C4	100uF, 450V
C5	120uF, 500V
C6	4700uF, 10V
C7/C8	1uF, 400V
C9/C10	1000uF, 10V
C11/C12	0.22uF, 400V
C13/C14	0.22uF, 400V
C15/C16	100uF, 100V
C17/C18	100uF, 100V
C19/C20	0.1uF, 50V
C21/C22	2.7nF, 63V
C23/C24	100pF, 630V
BR1	KBU4D

VALVES & BASES

V1/V2	5U4 (Russian)
V3/V4	ECF80 (European)
V5/V6/V7/V8	550C (Svetlana)

B9A chassis mount x 2
Octal chassis mount x 6

TRANSFORMERS

Mains x 1
Primary 0V -110V/120V - 230V/240V,
Secondary 365V - 0V - 365V. 300mA,
0V - 5V, 6A & 3.15V - 0V - 3.15V, 7.5A
Choke x 1 - 2.5 Henry, 350mA

Output x 2 - Primary 4.5K, 14% ultra-linear taps, Secondary 8ohm or 4ohm(optional)

CHASSIS

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6mm thick anodised front plate x 1
34mm diameter chrome knobs x 2
chrome finished transformer caps for mains & outputs x 3

HARDWARE

2 pole/6 position selector switch x 1
tape/source switch x 1
IEC socket & power switch combined x 1
1.6A slow blow fuse x 1
gold plated insulated red phono sockets x 7
gold plated black insulated phono sockets x 7
earth post x 1
gold plated banana speaker posts x 2 pairs
M3 x 25mm stand offs x 6
M4 x 12 hex. bolts x 4
M4 x 12 screws x 2
M4 nut x 6
M3 x 12 screws x 30
M3 nut x 22
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IEC mains lead x 1
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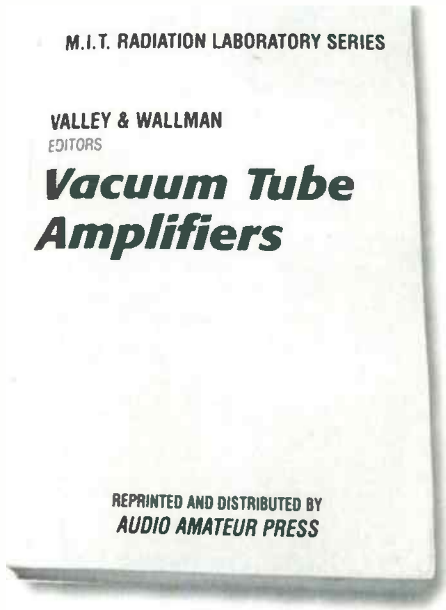
Book Review

Andy Grove looks at a U.S. classic reference work, Vacuum Tube Amplifiers, on valves and radar, from the Massachusetts Institute of Technology. A must for dedicated valve engineers!



This is a well known reference electronic text book and forms one of a series of twenty eight volumes produced by the Massachusetts Institute of Technology (M.I.T) - in particular that university's Radiation Laboratory. Most of the books in the series deal with microwaves and RADAR, which at the time were of utmost importance to the allied war effort.
During WW2 the Radiation Laboratory was established to research RADAR and communications technology together with colleagues in the U.K. and other allied countries. The vast amount of knowledge accrued was later collated and published as the book series. This is volume 18 of the series and is assembled from pieces by ten authors. Warning! Stop here if you are terrified by mathematics, this book at a first glance looks like it contains a million squashed flies.

Chapter One is entitled Linear Circuit Analysis and Transient Response, by Richard Q Twiss. It concerns the mathematical methods used in finding the response of a network to a stimulus, introducing the Laplace transform as the primary method. This chapter is necessarily very mathematical.

Chapter Two covers High Fidelity Pulse Amplifiers, authored by Robert M Walker and Henry Wallman. The term "high fidelity" in the title is it's most literal sense. The chapter deals with the accurate amplification of pulses, where rise time, overshoot, undershoot and sag are of prime importance. These circuits have found great application in oscilloscope design.

Chapter Three also covers pulse amplification - Pulse Amplifiers of Large Dynamic Range, by Harry J Lipkin. The title says it all really. Multivibrator output stages make an appearance here, and the subject of microphony is also covered.

Chapters Four, Five, Six and Seven cover the design of tuned high frequency amplifiers. These chapters are very comprehensive, and contain a lot of theory and mathematics. Subjects covered include stagger tuned circuits, high frequency feedback amplifiers and bandpass amplifiers, amongst a whole lot more. The amount of information contained in these chapters really deserves a review of it's own, but as this is primarily an audio magazine it isn't possible. If you are an R.F. designer the book is worth buying just for that information.

Chapter Eight is entitled Amplifier Measurement and Testing, by Yardley Beers and Eric Durand. It is quite short.

Chapter Nine may could well be the most interesting from an audio design standpoint. Low Frequency Amplifiers with Stabilized Gain discusses the design requirements for L.F (in this context meaning those which are not R.F.). And the author completes his task admirably. Of course gain stabilisation requires the use of feedback of one or other type. The author first introduces the reader to the different ways of applying feedback, gives these a theoretical treatment and then progresses to the problems of stability. He then goes on to analyse the design of each stage within an amplifier. The resultant formulae are extremely useful for operating condition and gain calculations. The final section of the chapter deals with compensation networks to avoid instability and is once again excellent.

Chapter Ten is Low Frequency Feedback amplifiers, by Harold Fleisher. This chapter is mainly a discussion of frequency selective amplifiers and their feedback loops. But interestingly some of the amplifiers use a cascode of two triodes, with one grid as the signal input and the other as the feedback input.

Chapter eleven covers Direct Coupled amplifiers, by John W Gray. This chapter is interesting in both an electronic sense but also in a historical sense. Here we see servo amplifiers for control purposes and amplifiers for analogue computers as well as amplifiers for instrumentation.

The final chapters cover noise and amplifier sensitivity and dynamic range. Just about every aspect of these subjects is covered. This is a very comprehensive section.

This book is an absolute classic. I have an original copy and I always have it to hand. It is the culmination of work of many of the top electronic engineers, mathematicians and scientists of the day trying to stay ahead of a very clever and determined enemy. And from this standpoint it is worth buying for historical interest, let alone it's knowledge content.

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D.I.Y. LETTERS

Agony about attenuators and interest in subwoofers, our letters are about the unusual things in hi-fidelity, those mysteries that don't get talked about anywhere else.

PLAYING WITH STRINGS

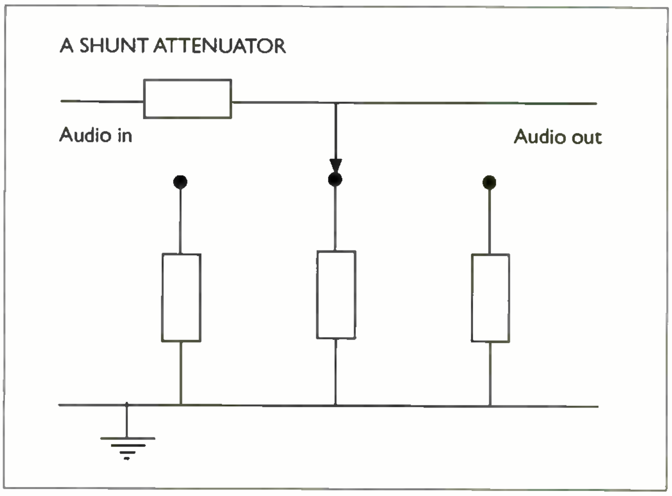
I read with interest your articles on stepped attenuators in the latest issue, as I've been toying with the idea of building one for some time now. Last Sunday, as luck would have it, I came across a pair of rather tasty-looking switches at a local radio rally, which I thought would be ideal for the job. They are 30-way, make-before-break 2 wafer affairs, as were used, I am told, by AVO in some of their test equipment.

So far so good, but there is a snag: the wiper positioning wheel has only 10 notches, thereby making it into only a 10-way switch. No doubt 30-notch wheels can be fitted in its place, but I doubt if I will ever find one. I did contemplate filing the extra notches myself, but I don't think I could do it with sufficient precision. What I have decided to do, therefore, is to remove the sprung lever altogether, allowing the wiper to move freely rather than in discrete steps. The problem is, of course, that the wiper can now maintain contact with two adjacent pins. To my way of thinking (and I could well be wrong here - please advise), this still permits the use of a string type arrangement, but rules out the shunt idea, because two adjacent resistors would end up in parallel, and you would get an increase of volume between individual pins.

Andy Grove didn't go into too much detail in his description of the ladder arrangement, but I get the feeling it could be used to some advantage in my particular situation, because the paralleling of the adjacent resistor pairs would produce intermediate values, in effect adding more steps and making for finer control. Again, I am slightly out of my depth here as I am making the assumption that the sum of the values in each of the resistor pairs is the same. Having two switches, I could then use one per channel, thereby getting a balance control into the bargain !

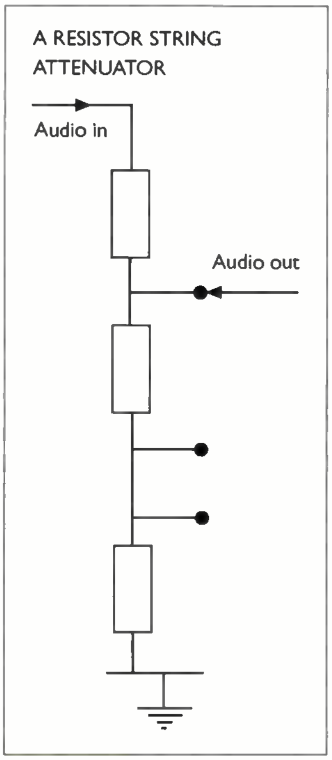
I didn't understand Andy's saying that you could join together the tops the resistors - wouldn't it put them all in parallel ? Or am I missing the point altogether?

Your comments and any help would be much appreciated.
regards,
Z. Hauptman



A resistor string would work in these circumstances and would be worth trying. As a resistor in the chain gets shorted by the make-before-break contacts the input impedance will dip a little. If the source impedance is low, which it is likely to be these days, this will have no effect. If it is high then volume will dip a little also.

With the shunt arrangement volume will dip significantly every time the shunt resistors are paralleled, since this lowers their value, as well as input impedance.



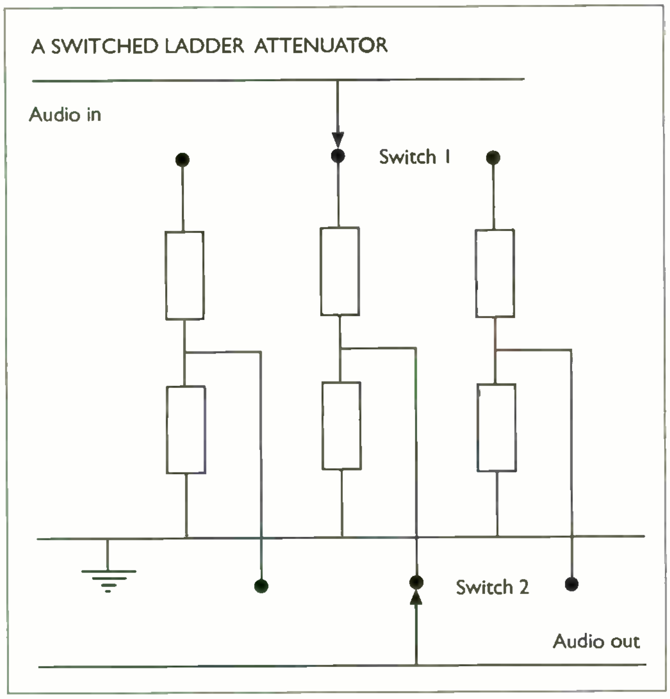
If you can get two wafers you could try the most complex potential divider (ladder) arrangement. Here volume will stay steady, but input impedance will approximately halve. With a low source impedance this may not be noticeable as a change in volume.

Why not get a range of inexpensive carbon resistors and try out a dummy assembly? You can use an ohmmeter on the input if you do not want to calculate the values. Since most sources are a few hundred ohms, you only need maintain 5kohms or so minimum to not notice volume changes. See also our news this month and the internet site www.goldpt.com, where such attenuators are discussed. **NK**

SHALLOW GRADIENTS ?

I would be very grateful for some objective advice. My system is as follows: Musical Fidelity Nu Vista M3 amp; Linn Mimik CD player; Quad ESL 63s

I have put a deposit down on the Nu Vista CD player because I felt an up-grade was in order having recently bought the M3. As for my speakers - I love them. However, I was always aware of the 'debate' about lack of bass frequency, and that 'gradients' are recommended. But I only got really interested when I hooked up a Paradigm PDR 10 sub. that I use in a separate *(hugely inferior) system in another room for movies. It surprised me quite how much bass I was missing (and more important how much I liked it there, albeit quite 'boomy'). So my quest*



now is to do something about it. I have done some Internet research and whilst the gradients seem to be the only dedicated subs for the 63s.

Criticisms I have read are as follows:

a) you need a separate amplifier, so are better off with a REL

b) The Gradient crossover is junk (replace with a Bryston cross over).

c) Gradient is not a 'sub' woofer anyway (I confess I am not sure what is meant by this).

d) the Gradients do not in any event go down to low enough frequencies.

e) it is all is a compromise: a REL will only augment, but not increase the Quads dynamic range and therefore keep its inherent limitations.

This is a minefield for me. Please offer some advice!

Yours,

Rick Scannell

Gradients might not be the best thing going when it comes to extending ESL-63 bass, but they are reasonably cost effective. It is a good point that a REL, with built-in amplifier, is arguably a simpler solution. REL subwoofers are well engineered and have a 100Hz high-pass filter to which a Quad can be attached. Filtering out high level bass signals from the Quads does allow them to go louder at higher frequencies. Since there is much more acoustic power going into the room the overall system (i.e. Quads + REL) goes much louder too, so this is an effective solution. It is best to go for the simpler RELs with smaller cones, since they will match best subjectively.

However, on this point it isn't easy to get a dipole – the Quad ESL-63 - to match a monopole bass like the REL, or any other closed-box system. Their radiation pattern and energy distribution into the room is totally different at the crossover frequency of 100Hz. The Quad radiates front and rear; the REL front only. There will always be a subjective disparity. That is one reason I chose (many moons ago) to match the ESL-63 with the unique Celestion SL6000 dipole subwoofers (see below).

On the matter of whether a Gradient is a subwoofer, it might not go as low as a REL, which hits 10Hz, but it does give the Quads useful extra bass, so this is a somewhat academic argument in my view. Also, very low bass tends to hang around (long decay time) and make a system seem "slow" to some, so beware of another subjective trade off here. If you want fast, punchy bass it's wisest to go down to 40Hz and no more; if you want earthquakes then 10Hz is more like it. Perhaps RELs should come with a remote control where you can switch from Fast Rock to Deep Earthquake mode, according to mood, music and whether your neighbours are in at the time. By this I mean all your neighbours – along the entire street. **NK**■

GOING NUTS

I have been going nuts trying to track down an article about modifying the Celestion 6000 crossover to improve its interface with Quads. I bought the 2/96 magazine with an article that refers to it but contains only partial details. I believe the original article was in the 12/95 issue but I have been unable to find it in any library in USA. Is it possible to get the article, or schematic, or back issue?

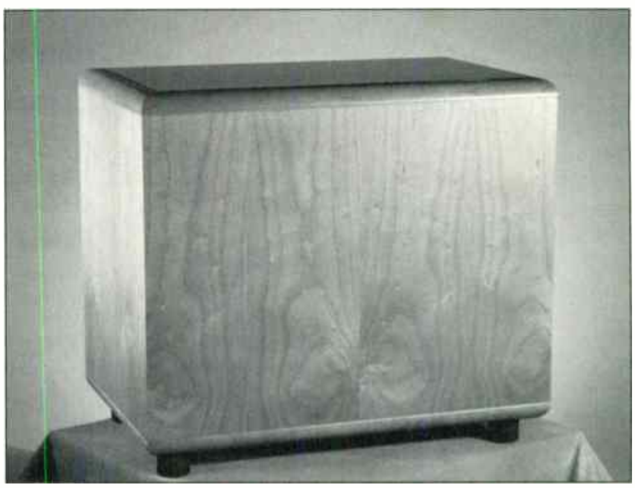
I would appreciate any help because I have been frustrated by the Celestion Crossover for some time now.

Thanks for your time

Ken Gates

This Supplement is out of print and sold out many years ago because of interest in this crossover. We are going to put the info up in PDF archival form on the site soon though. (a PDF can handle text and diagrams without taking up too much web space/download time). So for readers who might be interested, it is coming!

The crossover was meant to overcome the quite obvious limitations of the one Celestion supplied at the time. It does so effectively too, speeding up its sound whilst cutting out the ridiculously low frequencies below 10Hz the Celestions would otherwise try to reproduce. **NK**■



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