

Hi-Fi WORLD SUPPLEMENT

FEBRUARY 1994



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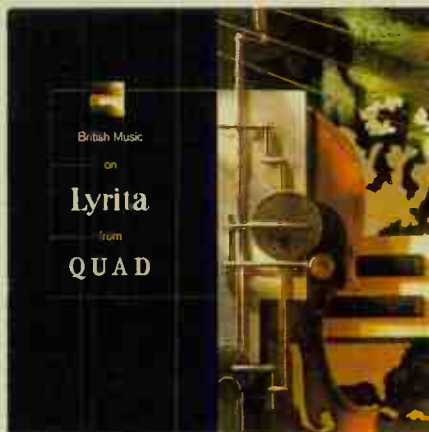
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UNWRAPPING A QUAD 66 SYSTEM

Eric Braithwaite reviews a complete system from Quad. The system pictured here shows the Professional version of the ESL-63 loudspeaker and the 306 power amplifier.



It may seem odd to begin a review of Quad's '66' system with an ode in praise of packaging, but I don't think I've had so much pleasure unwrapping anything since I took the ribbon of my first Easter egg. Quad's gear was beautifully wrapped. As always, the manuals are

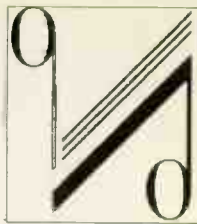
equally beautifully designed and printed, which adds to the pleasure.

This present was a complete '6' series set up: 66 pre-amplifier, 66FM tuner, 67 CD player, 606 power amplifier and ESL-63 loudspeakers. All (apart from the speakers, of course) entirely remote-

controlled from that wonderfully elegant coffee-table remote control. ESL-63s were supplied, but I used my own pair (just serviced and checked against Quad's own reference) the spare room already being full to the gills with boxes.

Unfortunately, while the Accessories

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Both Bartlett's stores are able to demonstrate the full range of Quad electronics. The London store is also able to demonstrate the ESL 63 electronic loudspeaker along with the Gradient SW63 subwoofer. The Gradient SW 57 is also available for demonstration although a few days notice is required. Demonstrations on any of the above loudspeakers & subwoofer combinations can be carried out at Bartlett's Woking store although seven days notice is required.

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music made live...

music made live...

boxes disgorged plenty
and enough mains cat-
components to power
to each other, there
be for

of interconnect
bles to allow the four
r and supply signals
was no IEC cable to
he whole caboodle into
s, will, however, make up

components, excepting
have already been
World, it's worth re-
single item has much more
/off switch and a display
both lines - though part of
glossy black flash on the
CD player turns out to be the drawer
Open/Close button which is not
duplicated on the remote. All
programming is done from this control,
whether it's setting volume level, balance,
Quad's unique 'Tit' and 'Bass Step' tone
functions, persuading the tuner to
memorise its nineteen station pre-sets or
re-arranging the tracks on a CD. As I've
said before, one of its prime virtues is that
it's powerful enough to function even on
top of the set-up, or pointed in the
opposite direction to the receptors, which
always startles visitors. It can also be
powered direct from the pre-amp tuner
or CD player if the battery runs out. The
various buttons are dual-purpose to cut
down the clutter, using 'Search' to scan
the airwaves is logical, but pressing the
'Track' buttons to select FM presets is a
little unfamiliar at first.

Being a devout hater of
'Up/Down' push buttons on
tactile grounds and equally of
motorised volume controls,
it's a pleasure to have
continually-rotatable knobs on
the remote for volume and
balance and to see only an
oval orange segmented display
on the pre-amp to show the
volume level. Undemeath this
is an equally effective
segmented display to indicate
balance left and right, while
sources selected are back-lit
legends and there are
graphical representations of
the tone filter, treble/bass
'slope' and bass-step tone
control options.

All these will be familiar to
Quad users of old, but less so
to those used to simpler 'cut
and boost' arrangements.
They allow for a subtle re-
equalisation of those
recordings with an unusual
tonal balance either from the
mono days or when the
balance engineers for one
reason or another would have
had 'could try harder' on their end-of-
term report.

Having recently discovered that the
retail price of the now superseded 40511
power amp was £405.20 (!) I now scour
Quad manuals for subtle jokes. In the
supplementary sheet to the pre-amp's
manual, which explains that the
microprocessor software has been

updated to Version 1.04, I read that three
quick presses on the relevant source-select
button followed by one long one on 'Stand-
by' will memorise tone settings for that
source. 'Da-da-da-dum' explains the
manual. Ah. So the software has really been
updated to Beethoven, Version 5.0, then?

Those wanting the full works on the
606, the 66FM and 67CD, assessed as
individual items, should go to their back
copies of Hi-Fi World, or ring the
Circulation Department. Quad's Crystal-
based 67CD is one I - and others - rate
very highly. At it's best, it is a crisp,
detailed, well-defined player, with only a
degree of 'looseness' in the bass to qualify
otherwise unreserved approval. Similarly,
the 66FM tuner gives away little against
the top-rank, being less clinically detailed
than the Audiolab 8000T perhaps, but
gaining in real musicality and involvement.
It entranced me for a whole afternoon of
early music on Radio3 and a couple of
long nights of GLR's rock programming.

Alas, since I last had one for review,
unpleasant compression has
become even more
rife. The Quad

hi-fi tuner, it won't be the fault of the hi-fi
industry or the 66FM, but the
broadcasters.

The ESL-63s need no introduction.
'Reference class monitors' says it all. They
have defined 'pin-point imaging' and
accurate tonality in loudspeakers for a
dozen years. Though they are fussy about
room-placement to reproduce point-
source imagery with the precision they are
capable of, and lack the bass power of
moving-coil designs, their mid-band clarity,
purity and transparency are unparalleled,
even at nearly two-and-a-half grand. Fed
power - I've used them with top-class
200-watters - they will also rock, despite a
common belief to the contrary.

In absolute terms, the pre-amplifier is
less satisfying - there is an odd sensation
of the sum being less than the individual
parts. In some ways, the 66 exerts a
beneficial influence; Jamiroquai, for
example, sounding more like a dance-
band than a collection of synthesisers,
especially in the notoriously fake violin
area which is so often infuriatingly



synthetic. In classical pieces as
well as rock, partnered with the
63s, there was a feeling of
restraint - a slightly velvet-gloved
punch, a somewhat too-sweet
top-end. Yet the whole system
pulled off that rare trick of
invisibly playing music so that
one listened to the artist -
whether Claudio Arrau or The
Cure - without either forcing
itself on the listener's attention,
or reminding you that there
were electronic circuits in the
way. Too often, I find myself
saying "Ah, I haven't heard that
so clearly before; that's the
power-amplifier (or the
speaker)." But that is listening to
hi-fi, not music.

Music, consummately, is what
the Quad system is for. To
temper the reservations, I have
heard the 66 preamp and 606
power amp drive Spendor
LS3/5as with real dynamic verve
and less of the slight veiling -
and less of the slight veiling -
compared, it should be said to what I've
been listening to for the last few months,
all of it costing far more - than came
through the 63s. Add the touch-button
remote control, and you have a system of
great refinement and of acknowledged
accuracy, yet without the sort of hair shirt
speciality that so often marks out top
flight hi-fi systems ●

66FM, though a little more forgiving than
the old FM4, is still so ruthless a monitor
of the airwaves that I found most of the
eighteen stations I programmed in damn
near unlistenable. Widespread computer
programming by the number of beats per
minute - even on Classic FM! - makes it
worse. If this last decade of the the
twentieth century sees the demise of the

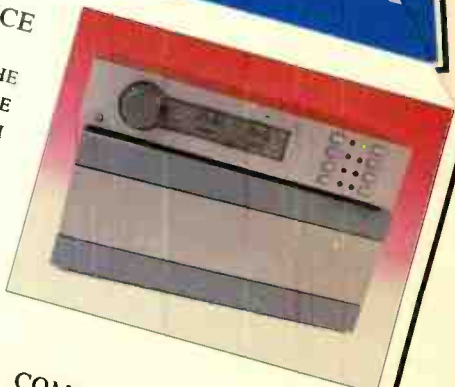
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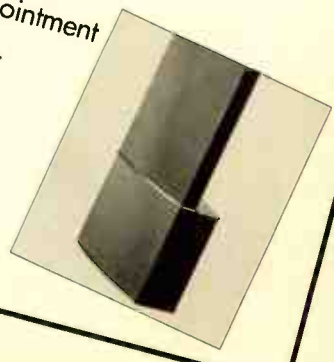
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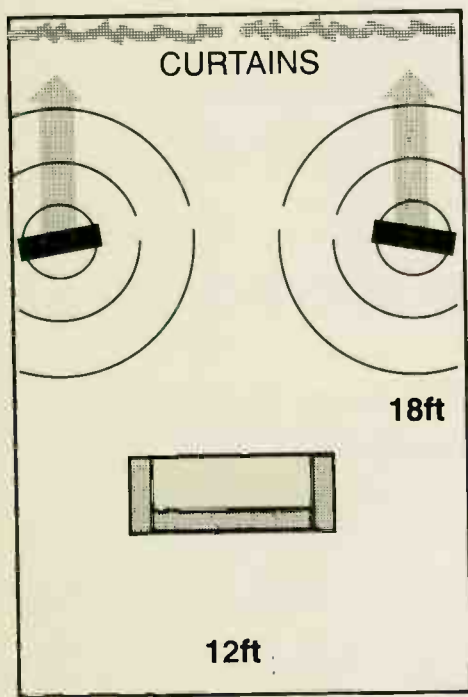
SING ELECTROSTATICS

Noel Keywood, who has used Quad ESL-63s in many rooms and systems, explains how to get the best from them.

Quad electrostatic loudspeakers have a reputation for being difficult to use. It isn't entirely undeserved, but most of the problems are easily overcome.

First, let's look at the most obvious difficulty - size. Being a panel 26in wide and 37in high, the speaker is wide. The base isn't very deep, but because the panel radiates from the rear as well as the front, it cannot be stood against an end wall. However, this speaker can be put against side walls and in some rooms this positioning turns out to be fairly convenient.

Rear radiation from the panel is something of a problem, since it is unwanted. Ideally, the '63 needs a fairly large room (18ft x 12ft minimum) to blend in visually and to 'lose' rear output down the length of the room behind the speaker (see diagram). The common rule-of-thumb is to operate the speaker one-third the way up the length. In a room 18ft long, this would put the speaker 6ft or so in front of the end wall.



The Quads need space behind them and, preferably, soft furnishings to help absorb rear radiation. They can be stood against side walls though, which can be convenient.

Heavy curtains and furnishings behind the speaker absorb rear radiation. I hang double-curtains of heavy carpet felt roughly 4in behind the speaker to do this job, but its effectiveness is limited at low frequencies. There are various ingenious ways to absorb the rear sound, but do not consider using a closed box.

Another feature of the ESL-63 worth knowing is that the front mesh protection grille beams sound downwards toward the carpet. The usual solution to this is to raise the speaker up by about 8in or so and tilt it backward, something both Stand and Deliver (not now manufactured) and Quad recommended GFD speaker stands achieve. Doing so will make the electrostatics sound brighter and clearer. Ideally, any stand that lifts the speaker should have a solid front so as to extend the baffle right down to the floor to improve bass. A chipboard, MDF or plywood stand can be made to raise the speaker, tilt it back and support rear sound absorption curtains.

The other big difficulty is price, but ESL-63s can be picked up second-hand. Expect to pay around £750-£1000 a pair. Whilst the original electrostatic would arc when over-driven, perforating the drive film, the ESL-63 has elaborate protection circuits and it is a reasonably safe second-hand purchase. All the same, Quad recommend you check for noise (crackling or popping) when switched on, but not playing music. A slight rustling, especially on damp days, is to be expected. Then play music and ensure they sound OK.

Early models had a crude compressor circuit to prevent music over-driving the speaker, plus a crowbar to short the driving amplifier if things got too bad; later models have a special fuse and crowbar, plus diode protection, which affects the sound less at high volumes. Otherwise, the speaker



has changed little since its introduction in 1983.

The most common form of damage to the ESL-63, Quad told us, is burnt out protection circuits, probably because sensitivity is low at 83dB (our measured value) and people tend to over-drive them to get volume. Quad, however, will fit the latest protection circuits to a pair of speakers for around £100, so getting such damage repaired is not too expensive. Anyone experienced can get a renewal kit from Quad and do it themselves. Overseas readers may be interested in this option, since it allows an upgrade of Quads to meet the latest spec.

Amplifier power requirements are specified by Quad as 50watts minimum and 55V peak (190watts into 8ohms) maximum. Quad recommend their 306 (50watts) amplifier for small-ish rooms up to about 18ft long, and their 606 (140watts) for larger rooms. Our view, from long experience, is that amplifiers of 40-80watts are most sensible for the ESL-63s.

What amplifiers work best? Apart from Quad's own, which have suitable protection circuits, high quality solid-state amplifiers from DPA, Sugden, Rose, Michell and John Shearne we find work well. It's wisest to audition an amplifier in conjunction with the speaker before buying. And be very careful of valve amplifiers - some do not like the speaker we have found, possibly because of incipient instability; the EAR834 is a good match we can vouch for though, as is our own 300B amplifier.

The Quad is a difficult load, as our analysis shows. Below 15Hz it drops to

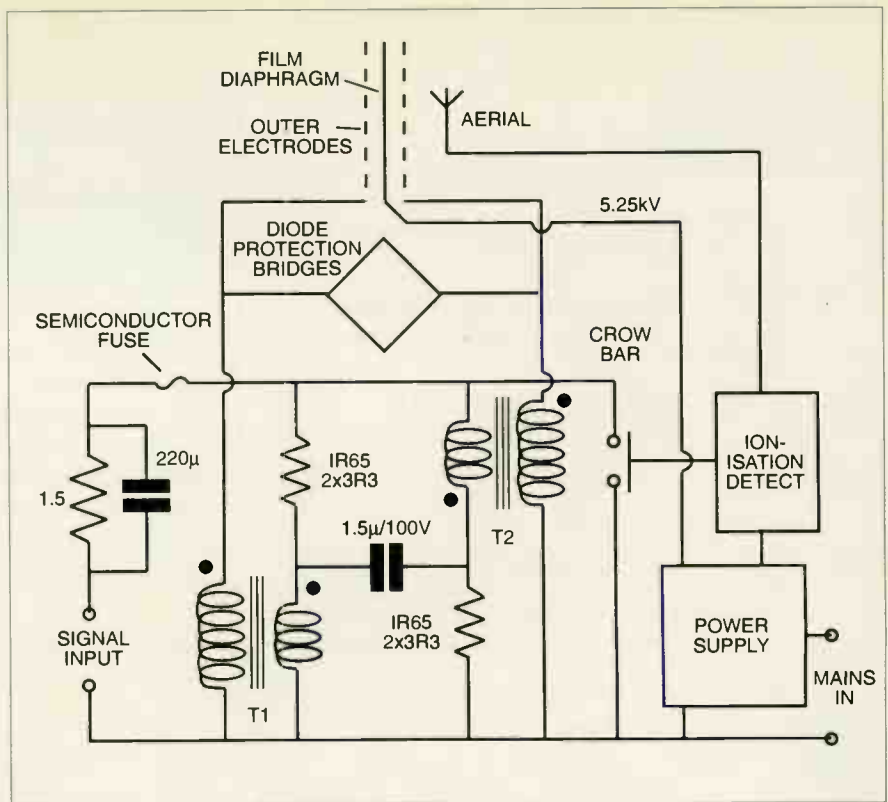
2.7ohms, which will draw power if LP warp signals are fed to it. There's a bass resonance at 60Hz and a treble resonance at 20kHz, both of which produce significant reactive swings. The high frequency resonance presents 1.6µF of capacitance at 20kHz, which may well upset amps of marginal stability. I strongly suspect this is the reason some not-too-clever valve amps have problems, but in truth well designed valve amps can handle this sort of load.

A good cable we'd recommend is Ortofon SPK300 at £7.50/metre. Or you can choose Quad's own simple copper cable, QLSCF2 at £3.50/metre. Don't forget that the speakers need a mains supply too.

Although it is possible in some set-ups to hear Quads delivering powerful bass, which is always quite a surprise, in general they give a somewhat mellifluous sound at low frequencies, lacking deep bass or real punch. Consequently, subwoofers are a topic very much on the agenda amongst Quad users. I have used Celestion SL6000 subwoofers (expensive, large and heavy, not now manufactured), but their crossover doesn't integrate the Quads in well, since the speakers start to roll-off below 250Hz, but the crossover brings the Celestions in at 100Hz, leaving quite obviously divorced sounding bass. Better alternatives are now available.

A surprisingly effective one is the REL Stadium powered subwoofer. It must be carefully tuned in to match, using its frequency and level controls, to avoid boomy bass, but it can deliver very deep bass and the Quads seemingly go much louder with it. This can only be a psycho-acoustic effect, because the REL does not remove bass from the feed to the speaker, unlike the Celestion and Gradient subwoofers. Quads with a REL put up a good challenge to ordinary loudspeakers in terms of power and dynamics, even if their combined cost does go beyond £2000.

Finally, there is the Gradient SW-63 subwoofer that matches in well and gives excellent results. By removing the need to reproduce deep bass from the Quads, it allows them to go louder. The price is £1650 and they can be auditioned at Quad dealers. We review these separately of page 15 of this supplement ●



Amplifiers must drive two step-up transformers that provide a high voltage push-pull audio signal to the fixed electrodes. On early models a compressor circuit acted in the primary circuit to limit the audio voltage reaching the plates. Current models, after Serial No 29000, possess a network of diode bridges that clip the high voltage audio signal in the secondary circuit. An upgrade kit is available from Quad.

The diagram also shows how the film is polarised to 5.25kV from an internal power supply and that an ionisation sensing aerial causes the crowbar to operate, blowing the semiconductor fuse, if arcing from severe over-drive occurs.

QUAD STANDS

Stand and Deliver - an open frame stand that raises the speaker by around 8in and tilts it backward. Gives a clearer sound, without losing too much bass, but not now in manufacture.

Arcici - Not now available in the U.K. Raises the speaker high, but does not tilt it. Good for stripped down Quads, but gives light bass.

GFD - Tilts the speaker back and possesses castors for ease of movement, but does not raise it. Recommended by Quad. G.F.Deane, Moorlands Garage, Chorley Old Road, Horwich, Bolton BL6 6BB Tel: 0204-843382.

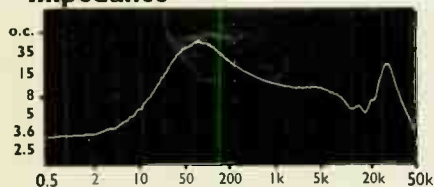
SUBWOOFERS

Gradient SW63 - Sits underneath the Quad, acting as a stand. Needs a separate stereo amplifier for bass drive. See our review on p15. Available from Quad Electroacoustics Ltd, Huntingdon, Cambs PE18 7DB. Tel: 0480-52561 Fax: 0480-413403. Price £1650/pair

Celestion SL-6000 - Not designed for the Quad and does not match perfectly with standard crossover, but has bass of unlimited depth. Discontinued, but may be available second hand. Celestion International, Ipswich IP3 8JP. Tel: 0473-723131. Price was £1800

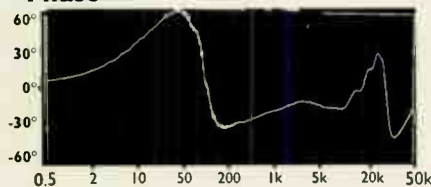
REL Strata £495, Stadium £795, Stentor £1495, Studio £2995. Powered mono subwoofers. We have tested the Stadium, which possesses its own 100watt amplifier and low-pass frequency/level controls for tuning in. Powerful and deep bass; an impressive performance. Harman UK, Unit 2, Rowley Lane, Borehamwood WD6 5PZ. Tel: 081-207-5050.

Impedance



The impedance dips to 2.7ohms below 15Hz and there are two resonances which introduce reactance. At 20kHz the speaker acts as a 1.6µF capacitor, which can upset amplifiers having a limited stability margin.

Phase



Two resonances are revealed by the phase plot above, one at 70Hz and another at 20kHz. The speaker is reactive around these frequencies.

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REVIVING THE QUAD 22/11 VALVE AMPLIFIER.

Designed by the founder of QUAD, Peter Walker, the 22/11 offers an attractive alternative to modern amplifiers, says Haden Boardman.



The Acoustical Manufacturing Company Q.U.A.D. II (Quality Unit Amplifier Domestic Mk II) is possibly the best known and loved 'classic' hi-fi amplifier in Britain. With around 120,000 units sold, they are also reasonably common.

Introduced in 1954 with the matching 'QCII' pre-amplifier, it was an instant hit and remained basically unchanged throughout 15 years of production.

When stereo records and equipment started to creep on to the scene, the QUAD 22 control unit became available. This has about the most comprehensive set of controls imaginable but by modern standards, the pre-amp is not quite up to the mark. It is a little too flexible, possessing input matching 'pods' on the rear for a wide range of the different playback characteristics, all of which tend to dull the overall sound. On the plus side, this must be the first stereo pre-amp to have defeatable tone controls.

Another negative aspect of the 22 is that it scavenges power from just one 11 power amp., compromising the balance. To make matters worse, all of the tuner's H.T. rails are switched on and off from the pre-amp also. As the entire ensemble is powered from just one poor old Q11 power amp, it tends to fry the mains transformer.

A Quad II is rated at 15 watts output for an input of 1.4 volts. This makes the QUAD a pretty insensitive power amplifier by the standards of today. If you intend to use a more modern pre-amp bear this in mind; unity gain cathode followers and passive pre-amps are totally out. Also if you like to disturb the

neighbours, high sensitivity loudspeakers are the order of the day.

Sonically, the QUAD II is a peach. Warm, lush and extremely romantic. It suits Mozart more than Mahler, flatters 'Fitzgerald over 'Franklin. For some it can sound too soft, with not enough fire in the performance.

Technically, it's a very interesting amplifier. It was one of the first to use a version of the so called 'Ultra Linear' output stage. Mr Walker's circuit differed from Hafler & Keros circuit by connecting the cathodes of the output valves to the output transformer, instead of the screen grid; it also predated Hafler & Keros. If you want more on what P.J.W. describes as 'Super Ultra Linear' read the article he wrote with D.T.N. Williamson in the September 1952 'Wireless World'.

One other unusual detail is that this is only a two stage amplifier. Two EF86 pentodes act as both an efficient phase splitter and driver, supplying the two KT66 tetrodes with the appropriate signal. Most circuits of the day used three stages, the famous Williamson four. Overall negative feedback is quite low compared with any other design from the period, and the circuit very neat and simple.

On the service side, all electrical parts are still available from QUAD's world leading service department. How many companies will even look at products they started to make nearly 40 years ago - and do it for pin money prices as well. No one can even approach QUAD for the quality of back up service.

If buying a set, look very carefully at the under side. Check that the mains transformer has not melted all over the inside. Don't worry about a tiny bit of wax, that's quite normal. But too much

could in the long term spell trouble. All of the passive components are pretty cheap. The handful of components that usually give trouble are the coupling capacitors (C2 & C3 - 1µF/350vdc), the cathode resistor bypass capacitor (C5, 25µF/50vdc) and the anode resistors of the EF86's go high value with age (R5 & R6, 180kΩ).

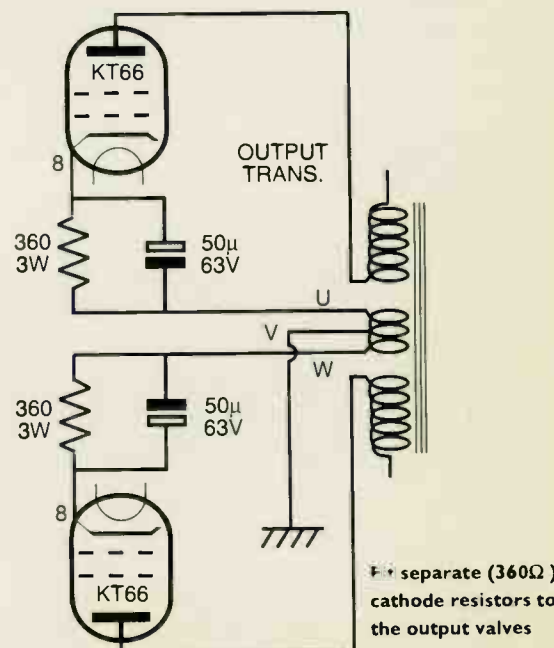
Needless to say, you must avoid 'modified' Q11s like the plague. A handful of companies in the past have persuaded people to fit voltage doubler power supplies, EL34 output pentodes, anything they can do to boost the power output.

I'm afraid it's all a load of cobblers. Watch these vandals, Mr Walker knows best. QUAD II's were designed for 15 watts output - not fifty.

The only tiny hole I can pick in a QUAD II is the fact that P.J.W. chose to use a common cathode resistor of 180Ω for the output valves.

This allows a slightly 'leaky' output valve to 'turn off' the other good valve; it was very difficult to get wirewound resistors of high tolerance in the 1950s. The voltages on the cathodes must be as close as possible for perfect push-pull operation. These days, of course, you can get high tolerance wire wounds and for increased reliability, without changing the sound quality, try fitting individual 360Ω cathode resistors (see circuit). It's the only mod you should ever consider executing on a Q11. Happy listening ●

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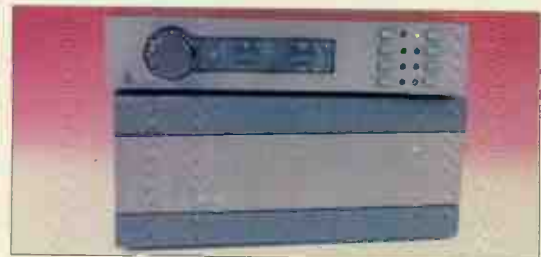
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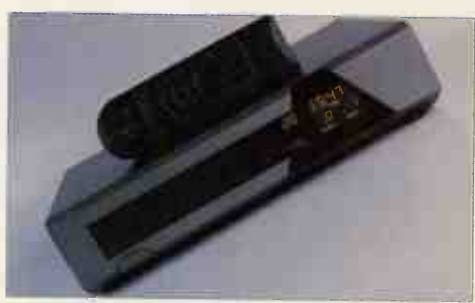
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Adding a Gradient to a Quad isn't roadmenders' slang for building a slope into the quadrangle of an Oxford college. It's all about supplementing what is often considered to be the somewhat sparse bass from a pair of Quad electrostatics - in this case the ESL-63s. As it happens, adding a pair of Gradient subwoofers from Finland also helps those owners who feel their ESL's are vertically challenged. Including the spikes, the whole will stand another eighteen inches tall. Each is parked neatly below the ESL's own base - no garage-type re-engineering required, only an Allen key to lock them together.

The result is certainly imposing and a pleasant aesthetic match, since the front grille is curved to follow the shape of the '63 and covered with cloth to suit. They look as though they were made for each other: hardly surprising, since, as Alice would say, they were. Originally, I believe, conceived by Quad's Finnish distributor, they saw the light of an English day rather than that of an Arctic Circle night about three Penta Shows ago, powered by a Quad 306 power amplifier. It's worth bearing in mind that adding the Gradients to your listening pleasure involves a trifling additional expense: one power amplifier for the Quads themselves plus another for the subwoofers. In an all-Quad system, the 306 is certainly cost-effective.

Since the Gradients are supplied with an active crossover, some experimentation is possible to create a preferred sound balance. Since electrostatics are also notoriously fussy about room positioning, prospective owners should be warned that immediate results aren't on the menu. Setting up the Quad/Gradient combination is very much a matter of tasting and testing. That, and twiddling the level control while switching the midrange position on the crossover unit can occupy many a happy hour. It's just like the old days, when electronics and speakers had a wider range of - and often touchy - temperaments.

I eventually left the mid-range switch at 'Off', finding the alternatives too coarse. Both tended to limit the ESL's normally smooth and wrinkle-free midrange, either in dynamic range or by taking images a fraction too far back. Very subtle, but still too noticeable for my liking. Luka Bloom's voice on his *Riverside*, for example, had a grainy edge that overlaid that Kerrygold Irish lilt.

Finding the best average position for the subwoofer level was trickier. Too far

one way and the double bass in REM's *Automatic for the People* boomed; too far the other and the fetching deeper resonance of acoustic instruments on this and other albums the Gradients produced was diminished. Life is full of compromises.

With an effective compromise reached eventually, it was a salutary discovery that the Gradients are about bass enhancement more than bass addition. They won't turn Ragga freaks on by transforming ESLs into electrostatic Cerwin Vegas or PA horns. Speaking of horns, the Gradients do add that extra

deep rasp to brass which makes a symphonic recording more of a real, live, experience. Belatedly celebrating the anniversary of Tchaikovsky's death with an 1812 overture (well, it was a good excuse!), selective twiddling with the level setting markedly increased the cannon's bore and gunpowder consumption, with a very satisfying thunder - and response from the neighbours! And equally gratifying, but less appealing to the destructive child in me, a real blare of brass.

At times, the Gradients hardly appear



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Eric Braithwaite and Dominic Baker - both ESL-63 users - listen to the Gradient SW-63 dipole sub-woofers designed specifically for this loudspeaker



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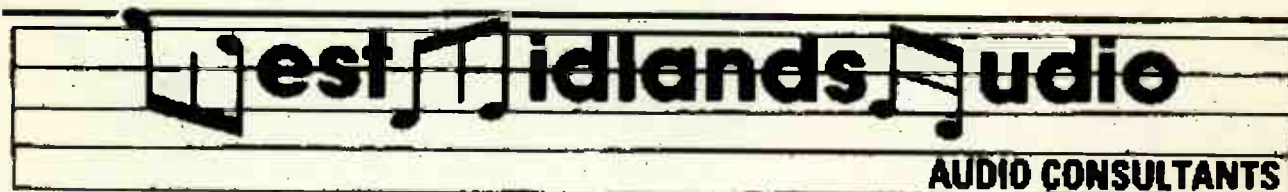


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to be in circuit at all, though there is always a subliminal awareness of them underpinning the structure of the music. Joe Lovang's saxophone on *What We Do* from the John Scofield Quartet, for example, sounded that much larger than on sub-wooferless ESLs. In an odd way, however, bass guitar notes failed to achieve a similar increase in body-size: the timing of rapid plucked notes less precise or distinct. While double basses accompanying jazz musicians bloomed, they also sounded a trifle lax. Whether other amplification (that used for this test was DPA Digital) would tighten up the subwoofer's timing is a moot point. While the bass in Jim Lampi's 'TV Weather' rumbled along the floorboards, the notes also had a tendency to roll into each other. There was no mistaking the sheer weight, however.

Like the ESLs themselves, the Gradients are best at the subtler aspects of bass reproduction rather than gross exaggeration. Stadium Rock PAs they are not, though a good bash does not frighten them. Quad owners who are nervous about sudden shut-downs after winding the volume control a touch too far will also welcome the relief they provide to the ESLs, allowing them a slightly easier ride and to go a notch or three louder, through that splendid articulate midrange and image-pinpointing treble.

Not quite as supremely articulate or transparent as the Quads themselves - it would be an awful lot to expect from an add-on unit using moving-coil drivers - the Gradients do add a good dollop of grunge, grind and stomach-wall wobbling. Good for those of us who occasionally long for a more downright visceral

experience to add to the infinite, perhaps more intellectual, sonic delights of the ESL-63.

Dominic Baker says

I have been using Quad ESL-63s for nearly a year now - and a very enlightening experience it has been, too. The pair I use are stripped down to their 'cling-film' dust covers, on stands that lift the centres to ear level and have thick carpet felt draped behind to absorb backward-firing treble energy. They are positioned so that their outside edges touch the side walls, which effectively act as an extended baffle.

Used like this I hear an uncoloured, lifelike sound with an image you can walk into - and plenty enough bass power to fill a room. Though a little bloom in the bass can be heard, using a dry-sounding Deltec 505 power amplifier prevents any exaggeration in this area. They sound simply superb, so any sub-woofer intended to go with them has to be of equal quality.

I have spent a long time experimenting with subwoofers for the '63s. They have included SL6000s with a special crossover developed by Noel some years ago, a REL Stadium - now used to great effect by Richard Kelly with a pair of the original ESLs - and now the Gradient SW-63s. The SL6000s and special crossover were superb, but take hours of careful positioning to match them to a room. The Gradients suffer from a similar problem. Until you get them working with the room, usually involving swinging them through 90 degrees, they sound like four cheap bass drivers mounted on a piece of wood.

When they work with the room though, the bass becomes as clean and free from colouration as the 63s are themselves.

There is one other factor involved: the active crossover. The one supplied with the Gradient uses a cheap plug-in-wall power supply and general purpose op-amps for the filtering. For what amounts to a £4500 loudspeaker system, plus the extra power amplifier, I would expect something a little more sophisticated. The idea of squeezing the signal from several grands' worth of front-end through op-amps costing little more than £1 each, and then back out to be listened to through the most revealing loudspeaker I have ever heard doesn't appeal. It adds a coarseness to the midband and doesn't do a particularly good job of integrating the 63s with the subwoofers.

For these reasons I wouldn't sacrifice my Quad set-up for the Gradient approach. In many ways, I feel the REL integrates better and it has the advantage of being self-powered and insensitive to placement. If all you are after is a little bass reinforcement, my advice would be to go for the REL - it has a lovely rich quality and it really plays a tune well. If you want deep dipole bass, the Gradients are excellent 'speakers, but the crossover could be better and to integrate them into the room properly, the 'speakers must often face outward, meaning the 63s won't then sit neatly on top - that's a problem with dipoles. ●

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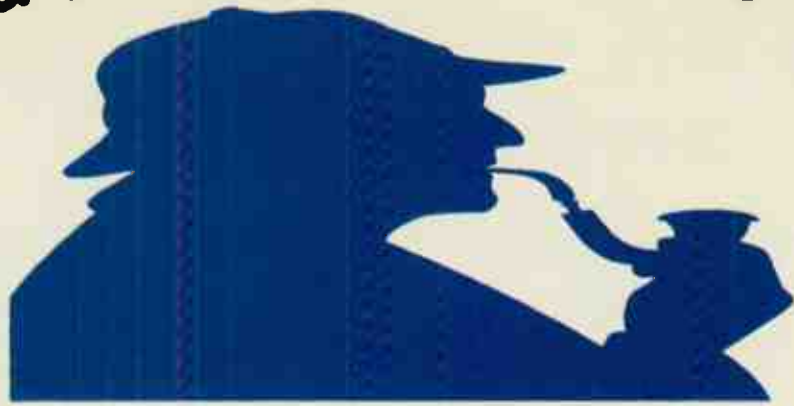
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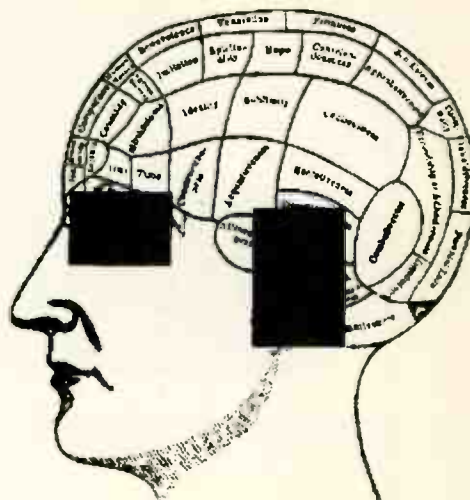
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BRITISH MUSIC ON LYRITA FROM QUAD

By Eric Braithwaite

Richard Itter, Lyrita's retiring owner and sole motivating force has built a reputation for recordings of sonic excellence that has made vinyl examples highly collectable. Concentrating on under-played and seldom-recorded British repertoire, Decca's most famous and respected team - Kenneth Wilkinson and James Locke - established the Lyrita 'sound'. Though Itter's label was late coming to CD, the house-style has remained constant for over thirty years.

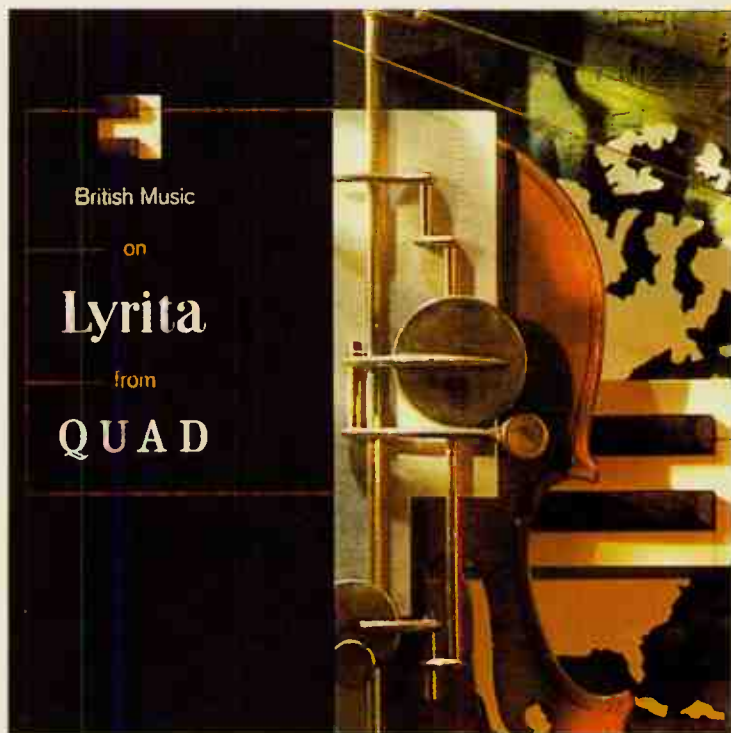
The Quad connection arises from Itter using Quad Electrostatics - stacked Quads, no less - and electronics in his music room. It led to a long association, culminating in Quad being given the run of past and current recordings to choose from thirty-five years of Lyrita archives.

Now, the monitoring speakers are ESL-63s and the Quad connection will be strengthened with sponsorship of new Lyrita recordings, as well as early instruments on the Oxford Isis label and The Sixteen on Collins. "It continues the association we've started with the Isis label and The Sixteen," said Quad's Ross

Walker, "and we'd like to expand. Recordings for 1994 on Lyrita are not decided yet, but we'd like to do some complete works, including some so far unrecorded British compositions."

"I'd be quite interested in recording some new works," he added. They are most likely to stem from the traditionalist school rather than the minimalist - don't necessarily expect Fitkin or Martindale or other refugees from the Factory label. Thanks to this new association, it looks as though we shall soon be exploring some

fascinating repertoire that would otherwise have remained unheard and very likely unperformed ●



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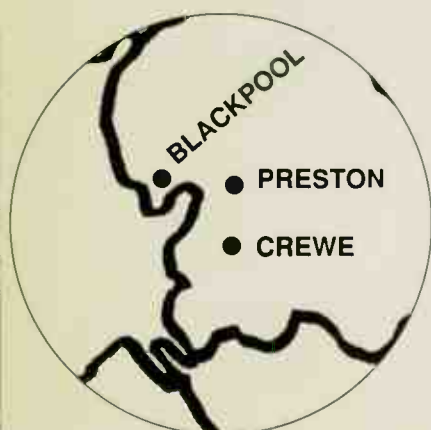
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In our experience owners of Quad ESL 63's are a devoted bunch and not easily parted from their speakers when looking for an upgrade path. If you like the sound they give where can you go for improvement? Up to now, apart from tinkering with your amplification, there hasn't been much on offer, but Gradient (the Finnish distributors for Quad) have come up with a subwoofer system to give the extra bass extension that many ESL 63 owners would regard as the only real shortcoming of the speaker. You don't have to take our word for it - come and listen for yourself. Full literature pack available on request.



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HI-FI NEWS - MARCH 1992 said in conclusion...

The Gradient woofer has not transformed the ESL 63 - rather it has released it from restrictions determined by a need to make the standard speaker a full-range device. With the SW63 the electrostatic blossoms into a true high end speaker of such integrity and ability that no sensible criticisms are worth voicing. This is a most graceful performer which again shows the fundamental quality of Peter Walker's marvellous creation. It comes strongly recommended.

I can think of no better upgrade path for a '63 owner with ambitions, while as an all-in-one purchase the high review rating equally applies.

TESTIMONIALS FROM SATISFIED OWNERS

Mr. Davidson of Co. Durham.

"It really is a delight to listen to this combination of ESL 63's and SW63's. The music seems to be more solid and I find the imaging properties of the Quads are enhanced. The extended bass is a boon when listening to large orchestral and organ works, yet the treble is clearer. Altogether a most successful marriage."

Mr. Tyler of Basingstoke.

"With the SW 63's raising the Quad ESL 63's some 15 inches from the floor, the effect is to create an excellent tonal balance with a truly authoritative firm bass combined with an opening up of the sound which is wholly beneficial... the results are really beyond criticism over a whole range of material."

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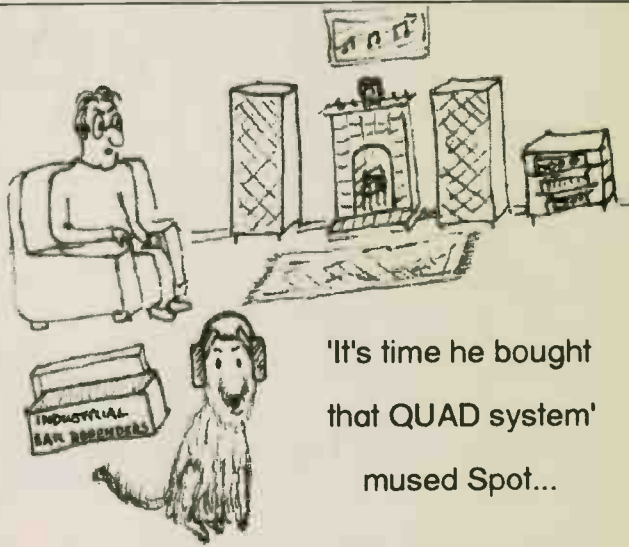
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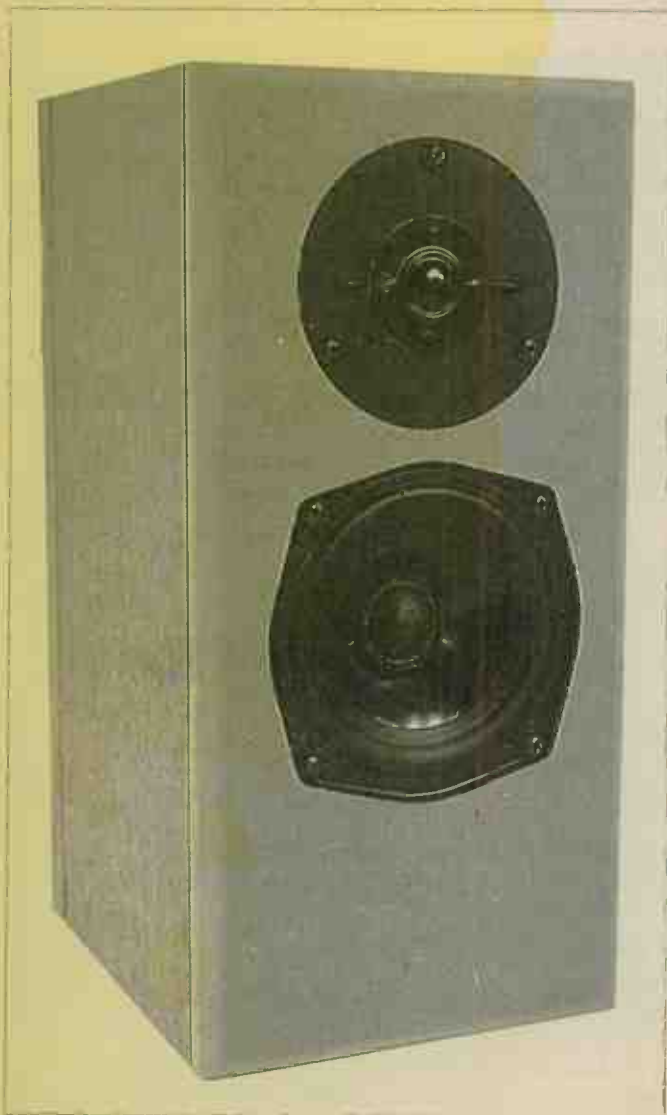
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BOOK REVIEWS

LETTERS AND Q&A

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D.I.Y. Supplement

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KIT NEWS

AUDIOPHILE CATALOGUE

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Waterside Mill,
Waterside,
Macclesfield,
Cheshire.
SK11 7HG
Tel: 0625 500507

AUDIOJUMBLE

The second Audiojumble, organised by John Howes, is due to take place on Sunday 17th July at the Royal Victoria Hall, Southborough, Tunbridge Wells, Kent. A wide range of vintage and modern hi-fi equipment will be on sale, so if you've always fancied restoring a piece of vintage esoterica, or even just browsing for interesting books and gadgets, pop along and have a look. Admission is £1, and if you're interested in taking a stall, the cost is £15. For all enquiries,

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MAPLIN STRIP OFF

The new CW33L wire stripper for Maplin Electronics is a compact and unique cable stripper capable of removing both the inner and outer insulations of round cables up to 8.5mm cross section. Ideal for the home constructor, or professional electrician, it costs just £6.75.

Maplin electronics are also keen to make themselves more available to the general public, opening new shops in Stoke-on-Trent and Dudley recently.

Maplin Electronics,
P. O. Box 3,
Rayleigh,
Essex.
SS6 8LR
Tel: 0702 554161

A CATALOGUE OF KITS

The Speaker Co. have just finished updating their kit loudspeaker and drive unit catalogue, bursting with lots of new products. New drive units include the massively engineered Precision Devices bass drivers, Audax HDA units, and automotive speakers from Altec and Macrom.

There are also several new kits on the way. First to arrive should be the DTM1, a 2-way desk top monitor using twin 5inch bass units and a soft dome tweeter, both supplied by Morel. The Speaker Co. are also working on a small horn loudspeaker, using a 6.5inch bass unit, possibly the Audax HDA unit, although this design is at a very early stage. Also due sometime in the future is The Speaker Co.'s first subwoofer, using the dual voice coil Volt DVC 250 bass unit.

Also in the new catalogue are Ansar Supersound polypropylene capacitors and

DIY Supplement. Tabular Rasa report an excellent response, so much so, that they have reduced the price even further, it's now down from £295 to £280!

Within the next month or so, they will also be importing the beautifully styled and built Burmester range of hi-fi equipment, and audio components from Inter Technik who produce a wide range of inductors, foil capacitors and transformers.

Tabular Rasa
136 Kilnwood,
High Wycombe.
HP14 4UR
Tel: 0494 565116

300B PRODUCTION DEVELOPMENT COMPLETED

And now some news from us. Frustrated potential customers champing at the bit worldwide will be delighted, even amazed, that we have finally completed development of our 300B 30watt/ch. amplifier. It is now going into production as a kit.

The delay has been caused by numerous factors, including Chinese valve unreliability, which triggered a power

supply re-design, an improvement of the input/driver stage to further reduce distortions and allow removal of tertiary feedback, improved driver transformers for wider bandwidth for substantial reduction of ringing, physical re-arrangement to lessen heat build up over extended periods.

And then there's been the subjective fine tuning, to select the capacitors, valves, and resistor makes/types and set values where possible (e.g. bypass caps).

The improvement in performance has been so great that 300B does not now need feedback of any sort, distortion has become so low. In other words, it has become an unusually linear amplifier -

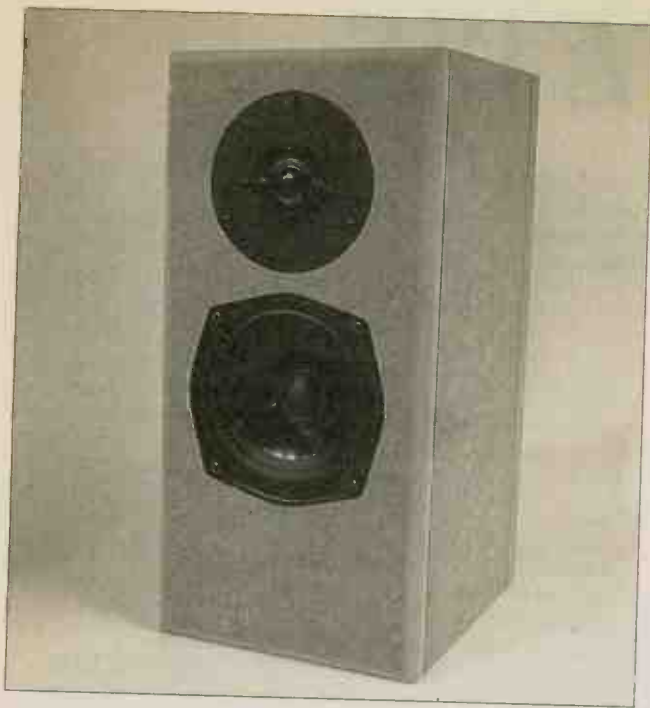
always the promise of the 300B valve, usually frustrated by transformer and/or circuit limitations. All the same, loop feedback can be applied by the flick of a switch; the amp. can be monoblocked as well to give around 60watts. We hope to be giving much more information on this project soon, which has become totally absorbing to us. **NK**



TABULAR RASA EXPAND

Tabular Rasa have been hard at work expanding and diversifying. They have just launched a range of loudspeaker stands to complement their loudspeaker kits, and equipment racks are to follow shortly.

Following the review of the floorstanding CT77s in our October '93



Building The 101 Monitor Loudspeaker

**Dominic Baker tackles a quality mini monitor
from The Speaker Co.**

The LS3/5a is a loudspeaker familiar to most audiophiles. Originally developed by the BBC in 1974, it is still going strong today, 20 years later. Nowadays though, there are several pretenders, following the

LS3/5a theme. Some use more modern drive units, up-rated crossovers and differently dimensioned boxes. The Speaker Co. have recently added their kit version to the market, based on the KEF 101 monitor, which, itself, was an LS3/5a pretender. They've added a little more volume to the box though, to get better

bass, and used very heavy 30mm MDF, for an uncoloured midband. The kit comes with high quality components throughout, including knurled gold plated terminals, Deflex damping pads, a pre-built KEF crossover and grilles. The instructions were clear and easy to follow, but this is a very simple kit to build anyway, so anyone who can use a soldering iron and drill should encounter few problems.

BUILDING THE KIT

Like the IPL S3 kit I built for the last supplement, The Speaker Co's 101 Monitor kit went together very easily. The wide rebated edges give plenty of room for the glue to be applied and should ensure that the box is airtight.

There is a little drilling to be done with this kit, to provide fixing holes for the drive units, input connector panel and grille fixings, but this only takes a few minutes and can be done with a small electric drill. Just small pilot holes are needed for the tweeter and input panel - self-tapping wood screws are used - but threaded 'T' nuts have to be hammered into the rear of the baffle for the bass unit.

The kit comes supplied with Deflex damping pads which replace the traditional carpet felt and long haired wool. It is best to cut the damping pad to size and glue it to the rear baffle before putting the cabinet together, it's much harder once the box has been built.

I glued the cabinets together, not forgetting to stick the pre-built KEF

crossover board to the bottom surface; it was a quick process. Excess glue can be smoothed away easily with a damp cloth and the cabinet then held firm with carpet

tape. Other wide tapes can be used, but carpet tape in particular has some stretch in it, which helps to pull the panels tightly together.

While the cabinets are drying the rest of the kit

can be prepared. The latest addition to the Deflex range are small circular damping pads that are fixed to the rear of the magnet assemblies. The idea is to reduce reflections off the hard surface of the magnets.

Once the cabinet glue has dried the tape can be removed and the terminal panel and drive units mounted. If you want to apply a painted or veneered finish it is best done at this stage, since drive units and paint don't mix.

A small hole has to be cut through the Deflex damping to

allow the wires from the crossover to be soldered to the terminal panel before it is screwed into place. The drive units are easily mounted, thanks to the 'T' nuts already in place, but care is needed in getting the wires the right way 'round.

The kits come complete with grilles which have to be assembled by the constructor. This is a relatively simple operation. The thin board which forms the crossover frame is placed over the cabinet, making sure it is straight. Four small (3mm) pilot holes are drilled through each corner of the grille frame and just into the surface of the cabinet. This ensures that the cups and studs that fix the grille in place will line up. The hole in the grille frame has to be widened out to 4.5mm and the one in the cabinet to 10mm to accept the fixings. The grille cloth can now be glued or stapled into place, finishing the loudspeaker.





The treble was quite sweet and avoided sharpness, even with Steve Earl's Copperhead Road which contains a lot of high frequency energy. It was a little bit relentless, smacking on the same note over and over again, but didn't disgrace itself. I did notice that there seemed to be a lack of really high treble, cymbals decayed a little too abruptly, but again this kept sharpness or grittiness at bay.

Basically, what you get with The Speaker Co's 101 Monitor is an LS3/5a with better bass, uncoloured midrange (thanks to the heavy cabinet and Deflex panels) and respected KEF drive unit engineering.

101 Monitor

£240

**The Speaker Company
Unit 9, Waterside Mill,
Waterside, Macclesfield,
Cheshire. SK11 7HG**

SOUND QUALITY

The 101 Monitor kit is basically an LS3/5a with a little more bottom-end welly, thanks to the increased volume of The Speaker Co's cabinet. It still doesn't have real deep bass, like any small speaker, but what's there is firm and punchy, adding speed and dynamics to the bottom end; I found there was little sign of one-note bass.

Overdriving them brings a crack from the bass unit as it hits its end stops. It sounds dramatic, but it is a deliberate design feature used to deter owners from overdriving, KEF told us some time ago.

Above the solid upper bass lies a soft midrange. It doesn't project as well as many more modern versions based on the LS3/5a theme do, but the heavy MDF cabinet ensures that it is not boxy. For example, John Lee Hooker didn't fill the room with quite the same larger-than-life image that some speakers produce, but his voice was clear and free from any artificial colouration contributed by the cabinet.



MEASURED PERFORMANCE

The frequency response of The Speaker Co. 101 monitor is, as you'd expect with the crossover being engineered by KEF, very smooth indeed. There is a little dip in the upper mid which explains the softness I heard, and a lift in the upper bass which will give the sound speed and punch. There isn't much low bass, but there's enough to give a balanced sound.

The impedance curve is very high indeed, giving an overall impedance of 171Ω. In consequence, the 101 monitors will not demand much current from an amplifier, but they aren't very sensitive either. Measured at 1m with a 2.5V pink noise audio band signal, it was a very low 81dB. This means that you'll need an amplifier that can supply a lot of volts, a good

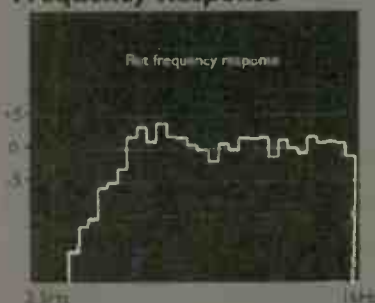
Japanese pre/power or finely integrated being best at this.

Overall, The Speaker Co's 101 monitor is a well engineered loudspeaker. The combination of high impedance and low sensitivity is a little inconvenient, but shouldn't cause any modern transistor amplifier problems. **DB**

Impedance



Frequency Response



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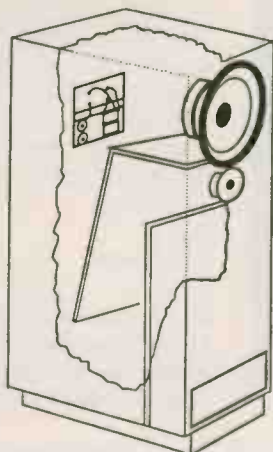
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211 Bedside Lamp

(for sweet dreams)

Building a kit valve amplifier isn't that easy. You need to be able to solder neatly, follow circuit diagrams and have a fairly good understanding of electronics in general. But that doesn't mean that you can't build something with a glowing valve in it - and perhaps do a little dreaming. Here is a simple ornament or lamp - albeit a dim one - made using the bright emitter 211/VT4C valve, found in exotic amplifiers such as the £43,000 Audionote Ongaku.

Our lamp is a bit more affordable than an Ongaku and the electronics knowledge required to build it is minimal, so almost anyone should be able to participate. The heaters of the 211 which give off the bright glow only need 10V, so a transformer is used to step-down the 240V mains voltage. But the 211 takes 3.25A of heater current, so a highly rated transformer must be used.

Most of the components needed came from Maplin, who produce an electronics mail order catalogue that can be found in W. H. Smith. The components for the lamp cost an affordable £15 or so and the 211 itself can be purchased from P.M. Components for £19.95, quite a lot for a light bulb, but then it'll last for many years and it's bit more unusual and

evocative.

To build the 211 ornament you will need some solder, a soldering iron and the components listed at the bottom of the page. There is a schematic diagram to help you build it, showing exactly where each wire goes. Remember, don't touch anything unless the mains switch is turned off and the plug has been pulled out of the socket.

BUILDING THE 211/VT4C LAMP

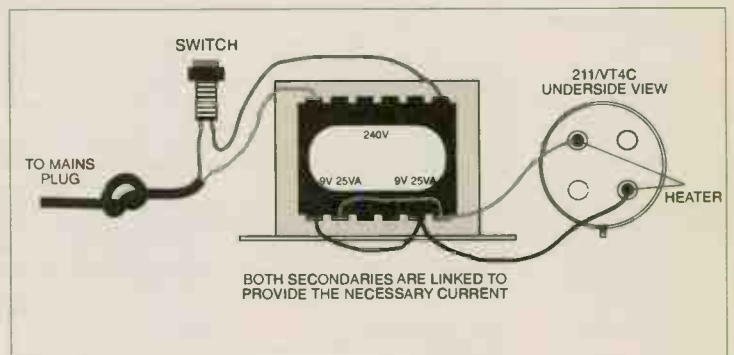
Start by mounting all of the hardware on the ABS box. A 48mm diameter hole needs to be cut for the 211 to drop through, into the capacitor clip. I did this by first drilling a small pilot hole and then widening it out with a fine blade in a jig-saw. By screwing the valve

into the capacitor clip, the fixing holes can be marked and drilled, and then the clip bolted in. The mounting hole for the switch can be drilled straight out using a 13mm bit, as can the one for the mains lead using a 5mm bit. The transformer is bolted to the bottom of the box, positioned to be half way between the valve base and the mains switch.

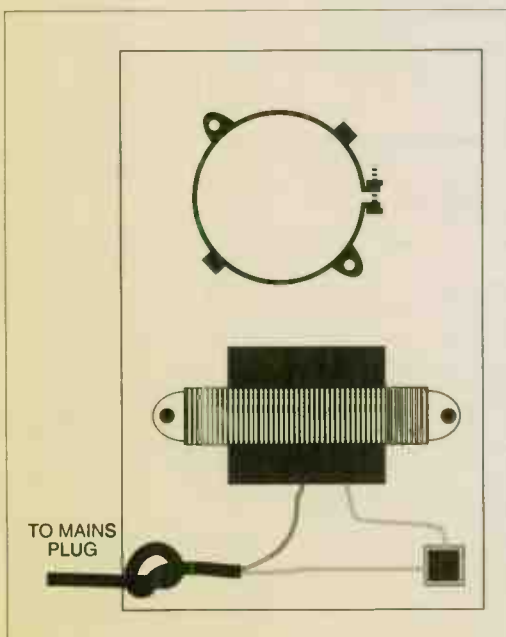
Once all the hardware has been fitted the components have to be soldered up. It is best to solder from the valve backwards, connecting the mains lead last. Solder two wires to the heater pins and then to the transformer as shown in the diagram. Wire the transformer to the switch and the mains, putting a knot in the mains lead to prevent it being pulled out of the box. Wire up a mains plug and then go back and check that



you've made all the connections correctly. If you're sure that all is O.K. plug in and turn on. Hopefully you will now be sitting in front of a glowing 211/VT4C valve - and it won't have cost you £43,000 ●



Wiring diagram



Layout

LIST OF COMPONENTS FOR 211 LAMP

MAPLIN 0702 554161		
DH30H	Transformer	£8.11
YW43W Red	Switch	75p
KC89W	ABS Box	£3.85
XR47B	2m Mains cable	2x20p
FW38R	4 Stick-on Feet	4x28p

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211/VT4C Valve	£19.50

PASSIVE PRE-AMP

A cable compensated passive-preamplifier designed and written by Richard Brice.



I first suggested the idea of a cable-compensated "passive preamplifier" in my column Recorded Message in the March 1994 issue of Hi-Fi World. Since then, judging from the number of telephone enquiries, I've come to realise that the project clearly appeals to many would-be constructors, having the particular merit that it is extremely simple to build.

The principle behind cable-compensation is not new, the concept is borrowed from its implementation in test equipment. For instance, the designers of oscilloscopes ameliorate the effects of high-frequency distortion due to the cable connecting the measuring probe to the oscilloscope display itself by using a cunning technique to make the cable "disappear" in electrical terms. Fig 1 illustrates the principle: V_{c1} is used to "tune-out" the effect of the cable.

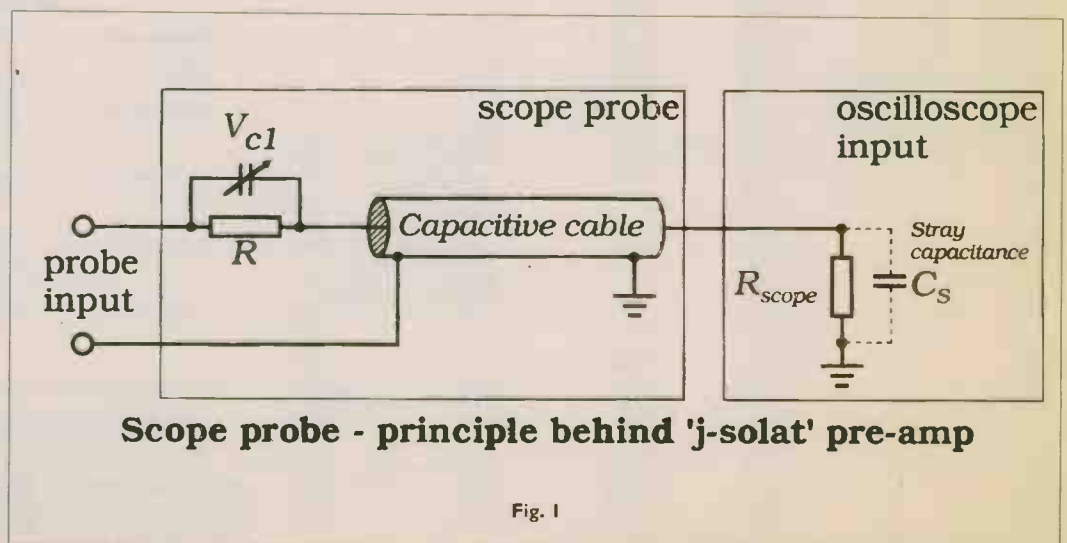
Unfortunately, the straightforward execution of the method illustrated in Fig. 1 applied to a passive pre-amp is hindered by several practical hurdles. It is for this reason that, when I first suggested the idea, I omitted component values. Neither due to deliberate obscuration

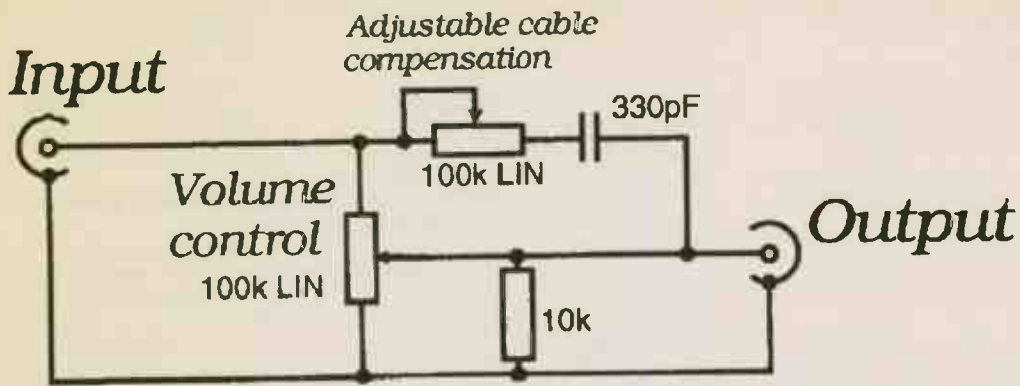
nor oversight, the problem with suggesting circuit values stems from the fact that the choice of exact values depends on knowing:

- 1) The output impedance of the source being fed to the control unit.
- 2) The resistance of the potentiometer.
- 3) The capacitance per unit length of the following cable.
- 4) The length of the following cable.
- 5) The input impedance of the power-amplifier.

6) The position of the volume control when listening at normal levels.

So many imponderables in fact, that it seemed to me the inclusion of some hastily-conceived circuit values could lead to some disappointing results should anyone wish to try the technique. The new design, shown in Fig. 2, eschews many of the disadvantages of the simple circuit suggested in my original article by including a continuously variable cable compensation control which allows the control unit to be "tweaked" to match the cable it is intended to be used with. A further refinement is the implementation of a quasi log-taper volume control achieved by means of a linear 100k Ω





'j-solat' cable compensated passive pre-amp

Fig. 2

control shunted with a 10kΩ fixed resistor across the wiper and earth. This circuit arrangement has the virtue that the output resistance remains more constant with respect to control position than is the case with a simple log control. (Be warned - the price you pay for this advantage is that the input impedance variation is normally larger!) The cable compensation control is designed to compensate for capacitive loads between 50pF and 500pF, which should allow adequate allowance for the majority of interconnects.

The cable-compensation control must act equally on both channels, so the control should be a linear dual ganged 100kΩ potentiometer. You can choose to

adjust the control in a number of different ways:

- 1) use test equipment - a scope or an AC voltmeter - to give the best frequency response.
- 2) by ear, or,
- 3) using the rubric shown in Fig. 3.

MEASUREMENTS

Measurements with and without cable compensation for a load of 500pF are given in Table 1. As you can see, the technique reduces frequency response

aberrations and (perhaps more importantly) reduces phase-shift, thus preserving the waveform of complex signals more faithfully.

Table 1. Results - with and without cable compensation.

Freq	Gain		Phase Shift	
	without	with	without	with
3kHz	-6dB	-6dB	3°	0°
6kHz	-6.1dB	-6dB	5°	2°
9kHz	-6.1dB	-6dB	9°	3°
15kHz	-6.3dB	-6dB	13°	5°
20kHz	-6.6dB	-5.9dB	19°	8°

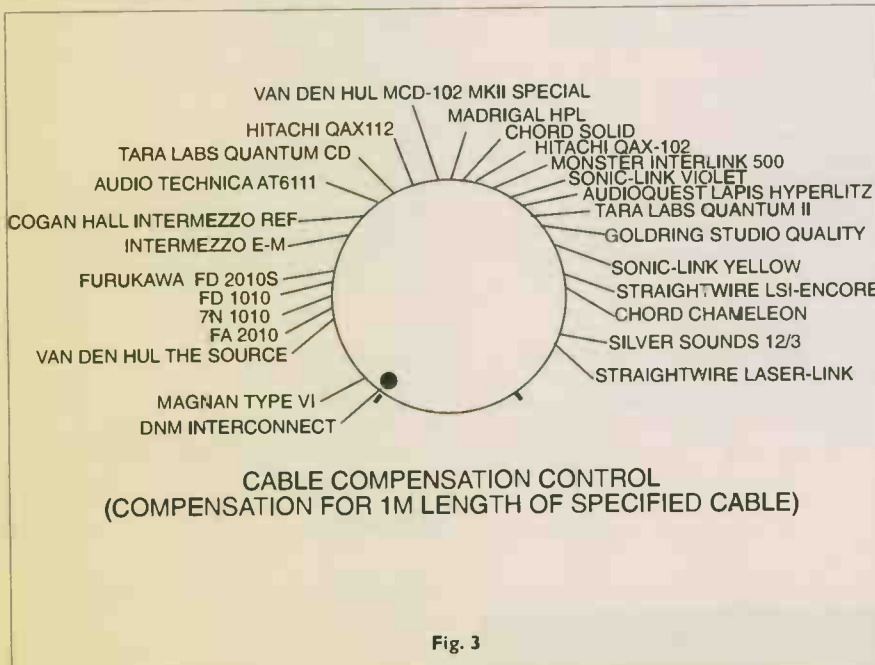


Fig. 3

In this diagram I have marked the positions best suited to compensate for a 1 metre length of various cables based on published data* on capacitance per unit length.

My prototype pre-amp is illustrated in the head shot. I named the unit the j-solat interconnect isolated control unit, the "j" refers to the engineer's term for the complex (eg. capacitive) part of the following circuit impedance which the cable compensation is intended to isolate. (isolate becomes j-solate becomes j-solat, oh well, it was fun at the time!)

Bored of the usual run-of-the-mill control knobs, I opted for my own design which I had turned at a local engineering works from a rod of Nickel Steel. Inspired by my favourite fashion designer, Jean-Paul Gaultier, the pre-amp inexplicably sounds its very best playing Madonna CDs!

References

- * Hi-Fi Choice Pocket Guide to Interconnect Cables 1992
Dennis Publishing.

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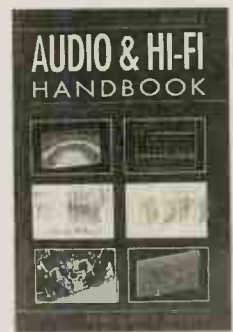
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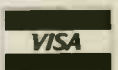
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Review

SPECTRA DYNAMICS DEFLEX

speaker damping pads

£8/£12

Jimmy Hughes sets to work on his Impulse H-1 speakers with a set of polymer panels designed to improve the sound by eliminating standing waves

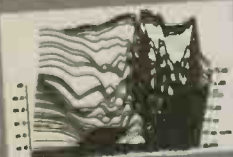


Four or five years ago I wrote an article describing the benefits to be had by removing the internal damping from loudspeakers. An undamped speaker typically has more life and impact than its damped counterpart. Undamped speakers sound more freely able to move air, giving a bigger sound even at lowish volume levels. In a word, the music breathes. Drawbacks? Well, undamped speakers can lack

tightness and control, and coloration levels may be higher too. So I was intrigued when a set of acoustic damping pads arrived from Spectra Dynamics. At first I intended to use them in a conventional damped speaker, but then decided to try them in my undamped Impulse H-1 horn speakers instead. Previously, I'd heard H-1s damped, and much preferred the undamped version. However, fitting Deflex panels seemed to give greater tightness and control, improved internal clarity, and

THE DESIGN BEHIND THE DEFLEX PANEL

Deflex panels are made from an advanced polymer on the basis of currying liquid. An excellent shock absorber, its surface resolution has been designed to eliminate standing waves. The panel's thick heavy construction makes it very good at damping resonances, and for this reason Spectra Dynamics recommend you remove unnecessary damping pads from inside the speaker where they are fitted. Three years were spent developing them, emphasising that Deflex panels are purpose-designed speaker fittings not a by-product of another industry. The panels can be cut to size using knives and then stuck in place using a glue such as Cypsel. If required, distributors The Speaker Company can supply panel adhesives.



Charts show the improved energy retention of enclosure with panels (shown) compared with undamped enclosure (top)

Panel size is 280x210mm, and maximum thickness 12mm falling to 5mm at the centre. Fitting should be straightforward, but not all speakers are suitable. For example, Linea Isobarika may benefit, but are extremely difficult to gain entry to because the drive units are usually sealed in place. It's difficult to decide beforehand whether Deflex panels are going to make an improvement. But you can gain an idea of the likely outcome by listening to the speaker with its damping before ordering. This allows you to hear any adverse effects produced by the existing damping, and also tells you how easy it is to gain access to the speaker's interior. Modify one speaker only, then (with damping removed) compare it to the other. If the damped speaker sounds muffled and 'slow' and you prefer the undamped one (even if initially it isn't quite right), a set of Deflex panels should work successfully giving the best of both options.

DATA

Price: £7.95 standard panels
£11.95 subwoofer panel
Size: 280x210mm
Thickness: Min (Centre) 5mm
Max (Edge) 12mm
Material: Advanced polymer
Colour: Charcoal grey

DESIGN

- ◆ Advanced Polymer damping panel
- ◆ Concentric surface relief to reduce standing waves

PERFORMANCE

- ◆ Gives tighter cleaner sound
- ◆ Improves bass definition
- ◆ Allows the sound to breathe

better pitch definition – all without deadening the sound in any way.

Because the Impulse H-1 has an open-backed midrange unit, accessible simply by removing the top cover, it was easy to fit and remove Deflex panels behind it for A/B comparisons. However, the benefits were so obvious that it was hardly necessary to compare back and forth.

I later tried four panels in the bass chamber and again heard big improvements in control, definition, and clarity. I especially liked the way Deflex treatment gives the benefits of damping with none of the drawbacks.

Each panel is fairly easy to fit – though much depends on the speaker being treated. In most cases you'd simply remove the bass driver, take out the speaker's internal wadding/damping, and fit the Deflex panel as required. Naturally such work invalidates the speaker manufacturer's guarantee, so only attempt the modification if you feel competent to do so.

■ Right of Reply: see page 59

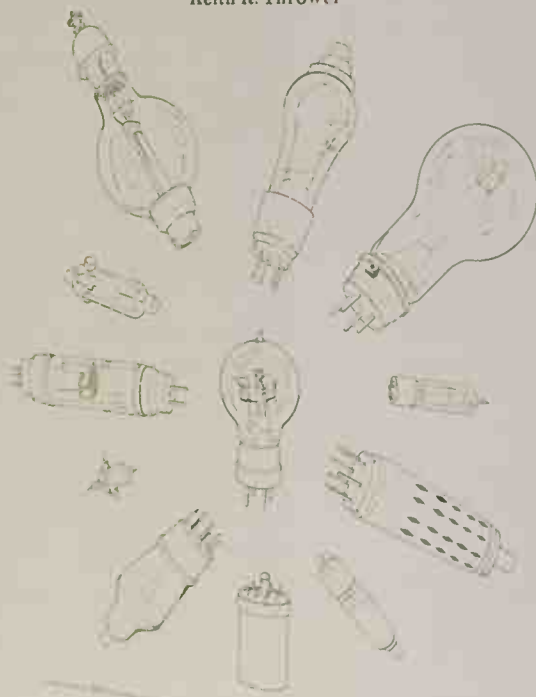
January 1994 AUDIOPHILE 35

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History of the British Radio Valve to 1940

Keith R. Thrower



HISTORY OF THE BRITISH RADIO VALVE TO 1940, by K. R. Thrower.

Reviewed by Noel Keywood.

What a delightfully obscure title, and how appropriate too, for this is an obscure book in lay terms, yet for valve-heads it will be required reading. As its name suggests, the book covers valves generally, rather than in a hi-fi context, which isn't surprising because hi-fi is a post-war notion which this book pre-dates. All the same, anyone with an interest in valve history will find the book impressively well researched and detailed; I personally found it fascinating.

The early history of the valve is covered in detail, revealing the difficulties Fleming and then Lee de Forest had in producing adequate vacuums and satisfactory electrodes at the turn of the century, as well as the difficulties they had in appreciating fully the mechanisms at

work in thermionic emission. For example, many scientists and engineers of the time thought that air was necessary for conduction. Although Langmuir of AT&T labs. in the USA realised a 'hard' vacuum was necessary, even the Americans had to import a special mercury pump from Germany to achieve it.

Both Alexander Fleming, who worked in London on the diode until 1906, and Lee de Forest who invented the three-electrode (triode) valve in 1905, saw them as rectifiers rather than as amplifiers. It was the laboratories and scientists of AT&T and General Electric in the USA who developed de Forest's 'Audion' valve into an amplifier for telephony. They paid de Forest no less than \$390,000 in all for his patents, a fantastic amount for the time.

Parallel developments in Germany are covered, including a fascinating comment that "Nemst, Lieben's teacher and friend, on numerous occasions observed the fidelity of amplification of Lieben's device". Made in 1906, this comment must surely be one of the first ever references to the notion of fidelity in amplification.

Keith Thrower's book is intensively researched from original research papers and records, copiously illustrated with pictures and diagrams, wide ranging in its coverage (American, British and German work is described) and possesses long lists of references and bibliographies. There's no doubt that he has put enormous effort into this book.

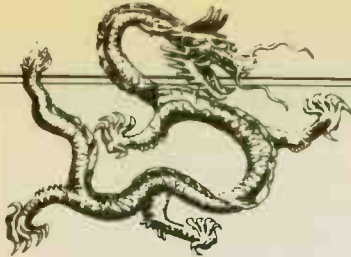
From early researches, the book moves on to cover development of the valve as an amplifier, from 1913 until 1940, mainly within the context of radio, but with good reference to audio amplification too. Surprisingly, as if all this was not enough, there's a comprehensive chapter on valve construction as well, covering materials, design rationales, problems and solutions. Plus a short history of British valve manufacturers.

If there's any criticism I could make of this book it is that it attempts too much, in the process losing the thread of the story of the valve's development, for example. But this is a very minor point in comparison to all that it achieves, and all that it offers.

The History of the British Radio Valve to 1940 is

an impressive work by an engineer quite obviously dedicated to his subject and determined to produce a valuable reference work. As far as I know, it is one of a kind. The book is not on general sale. I had to contact Keith Thrower, the author (and Research Director at Racal Radio), personally to get hold of a copy. So will you! Copies of this book can be obtained by sending a cheque for £10.25 to :

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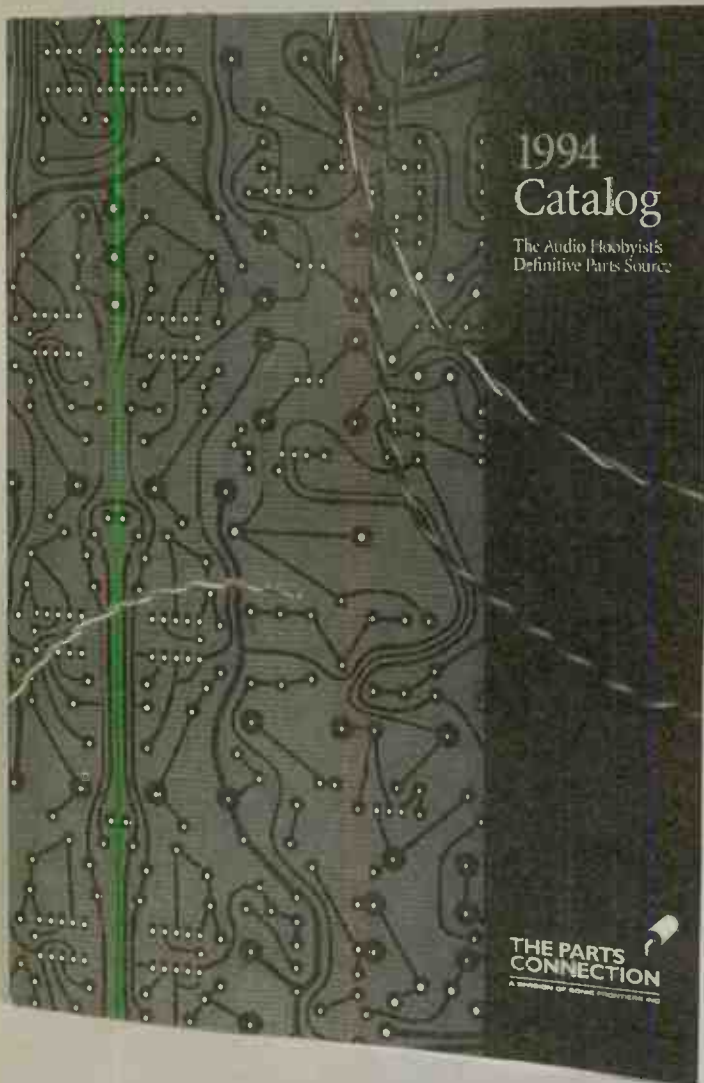
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EL509	TEONEX	5.50	2X2A	RCA	5.00	1625	RCA	6.50
EL519	TEONEX	5.50	3A/167M	ITT	10.00	5687WA	RCA	6.50
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THE PARTS CONNECTION CATALOGUE

Reviewed by Noel Keywood.

Per head of population, Canada supports a larger hi-fi market than Britain, I was once told. Looking at this highly specialised catalogue, I can believe it. What's more, Canadian enthusiasts seemed more turned onto super-esoterica ('real' hi-fi to some) than the British, if The Parts Connection, "A Division of Sonic Frontiers", is anything to go by.

In their own words, "The Parts Connection is a one-stop audiophile shop". And their definition of audiophile coincides precisely with ours: the catalogue has ranges of highly specialised capacitors, resistors, valve amplifier

output transformers, valves, volume controls, connectors, kits, tools, solder and many other items.

Where this catalogue differs from most is in the rarity and speciality of some of the items. For example, we were taken aback to see Teflon capacitors in stock. These are extremely difficult to manufacture, a capacitor supplier told us recently, so they are as rare as thermionic transistors. Mind you, the price of \$43 (U.S. Dollars; equivalent to £29 at the time of writing) for a 0.1µF reflects this. Teflon is said to be the best dielectric, however. Otherwise, film-and-foils with a polypropylene dielectric rate

highly, which The Parts Connection also stock. There are no Black Gates, but they do have Mallory electrolytics and at \$10.25 (£6.92) for a 100µF/450V (525V surge) they are competitively priced.

Resistors include Vishays and Holcos, but there are plenty of other makes too. Magnequest output transformers for single ended 300B amps and general purpose push-pull usage are stocked, but insufficient information is given to apply them optimally. Further info. would be needed.

Tested valves like Golden Aeros are listed, as are new old types. The Parts Connection also stock, to a limited degree, specialised solid state devices. This is an area that could beneficially be expanded I feel, because semiconductors could well benefit from greater specialisation of design toward audio usage, supportable by higher audiophile pricing. But then, that's for the chip fabricators to consider; operations like The Parts Connection might well stimulate this.

Canada? Yep. There is a lot of water between them and us, but they're fully geared for overseas orders, with answerphone and fax. First class air mail or UPS (C.O.D. if wanted) will keep UK-bound parcels dry and payment can be made by money orders (US dollars), bank transfer for large amounts, American Express, Visa and Mastercard. Delivery times are 7-10 days approx., but it's always best to check

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The 96page A4-size catalogue costs \$5, but offers a \$10 discount against the first order over \$100. Britain is 5 hours ahead, so 'phone 3pm-10pm to speak direct. At the time of writing exchange rate was \$US1.48=£1.

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BASS POWER!

Here are thirteen of the best known ten and twelve inch bass units, ranging from £30.50 to £185 each.

To measure the frequency response of the bass units, we used a huge baffle, achieved by mounting each driver in a doorway between two rooms. The frequency plots show how low bass will go naturally on such an open baffle, but bear in mind that with units that are amenable to the effect, bass will be extended down by the cabinet, eg. the Beyma reaches 72Hz on the open baffle, but 34Hz in a cabinet.

The high Q (0.37) bass units are best suited to sealed enclosures, and their bass response in a box will not go lower than on the open baffle. Lower Q units can be used in a reflex enclosure, where the bass response can be forced downwards by the port.

Other areas that are important to how the bass unit will perform are sensitivity and BL factor. Make sure that if you decide to use one of these bass units that it is sensitive enough to keep up with the

midrange and tweeter units you have chosen, else they'll have to be attenuated, which is a waste. The higher the BL factor is, the harder the bass unit will push outwards for a given input. So a high BL factor will give good clean bass, with low distortion.

A simple second order filter is all that you're likely to need to roll off the midrange from these units. Pick the frequency you want to use the bass unit up to, say 200Hz, and then use the impedance curve to give you a value for R. This value can then be inserted into the equations below to give a value for the inductor and capacitor.

Most of the units can be used right up to 1kHz, but some can be seen to break up lower down. This break-up can be clearly seen, and they should not be used above this point.

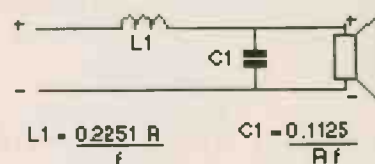
To see what they could actually do, I ran all of the units through a computer box designer. I fixed the volume at 100litres, about the size of a large floorstander. This

gives you an indication of how low the bass unit will go in a given box size, making comparison easier.

The bass units in this test are available from: The Speaker Co. Unit 9, Waterside Mill, Waterside, Macclesfield, Cheshire. Tel: 0625 500507

Richard Allan Audio Ltd, Bradford Rd, Gomersal, Cleckheaton, W. Yorks. Tel: 0274 869935

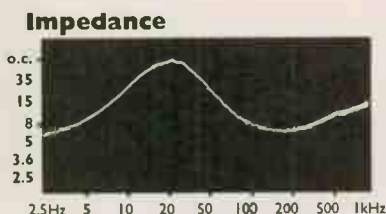
Beyma bass units available from: LMC, Unit 10, Acton Val Industrial Park, Cowley Rd, London. Tel: 081 743 4680



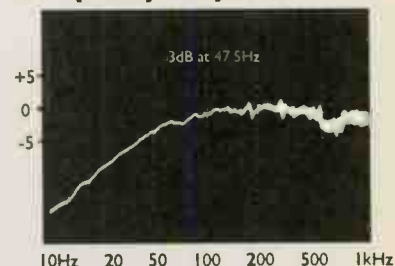
AUDAX HT240M0 £30.50



Audax's HT240M0 is a 10inch bass unit with an undoped paper cone. Sensitivity is high at 92dB, making it suitable for most midrange units and tweeters. It is best suited to reflex loaded enclosures, reaching 37Hz in a 100 litre box with an 80mm diameter, 71mm long port.

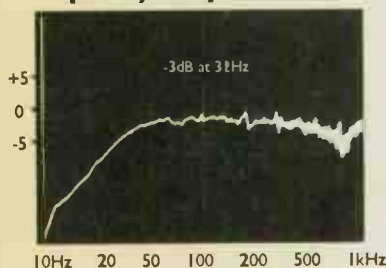


Frequency Response



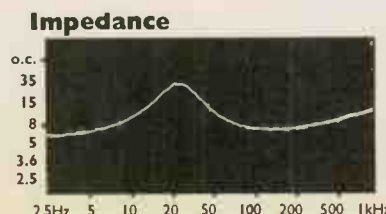
Fs	28Hz	Qms	1.78
Sensitivity	92dB	Qes	0.48
Power Handling	80W	Vas	0.21m3
Mms	0.024Kg	Re	6.3Ω
BL factor	7.4Tm	Sd	0.034m3
Qts	0.38	Baffle Cutout	222mm

Frequency Response



Fs	25Hz	Qms	2.5
Sensitivity	89dB	Qes	0.87
Power Handling	180W	Vas	0.178m3
Mms	0.028Kg	Re	6.4Ω
BL factor	5.9Tm	Sd	0.0324m3
Qts	0.65	Baffle Cutout	235mm

Morel's 10inch MW1075 damped polymer cone bass unit is best suited to sealed enclosures, reaching down to 34Hz in a 100 litre cabinet. It is only 89dB sensitive so efficient midrange units and tweeters will have to be attenuated to match.



MOREL MW1075 £52.89





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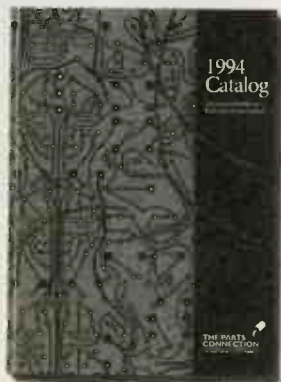
factory matched ATC drivers. Cabinet parts are machined from high grade MDF for easy assembly and consistent acoustic performance. ATC's MK I Tri-Amp Pack systems are available as an option if required.

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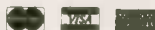


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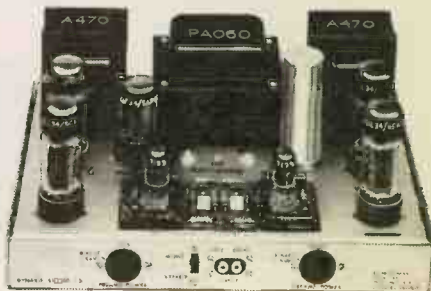


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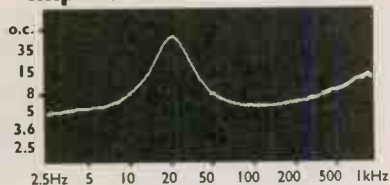
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MOREL MW1275 £69.33

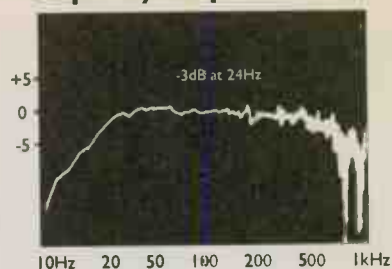


We quickly named this unit the frisby, it is lightweight and has a very small magnet. However it managed to get down to 30Hz in a 100 litre sealed box, which is very reasonable. Sensitivity of this 12inch DPC coned unit is high enough for use with the majority of mid and treble units.

Impedance

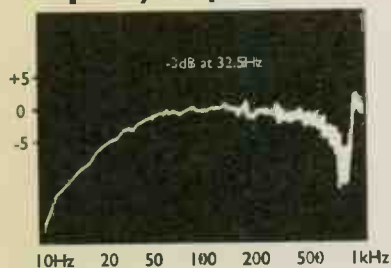


Frequency Response



Fs	22Hz	Qms	3.8
Sensitivity	90dB	Qes	1.0
Power Handling	250W	Vas	0.27m3
Mms	0.055Kg	Re	6.4Ω
BL factor	5.4Tm	Sd	0.0503m3
Qts	0.8	Baffle Cutout	266mm

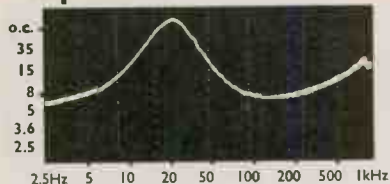
Frequency Response



Fs	25Hz	Qms	6
Sensitivity	87dB	Qes	0.39
Power Handling	100W	Vas	0.127m3
Mms	0.054Kg	Re	7.2Ω
BL factor	12.5Tm	Sd	0.0349m3
Qts	0.17	Baffle Cutout	template

An old favourite this one, I found the B139 worked best in a reflex enclosure reaching down to 30Hz in a 100 litre box with an 80mm, diameter by 120mm long port. Sensitivity is drastically low though, so most mid and treble units will have to be attenuated to match.

Impedance



KEF B139 £135

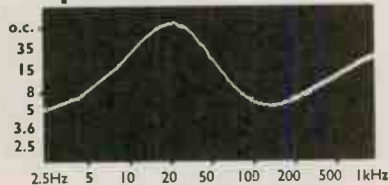


VOLT B250.8 £108

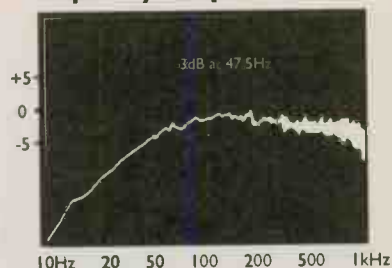


The VOLT B250.8 is massively built. A low Q makes it suitable for reflex enclosures and in a 100 litre box it reached down to an impressive 27Hz with an 80mm diameter, 166mm long port. The sensitivity is a little low, so partnering units may have to be attenuated.

Impedance

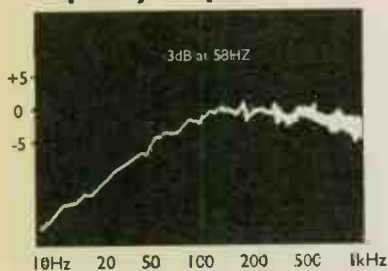


Frequency Response



Fs	24Hz	Qms	2
Sensitivity	89dB	Qes	0.35
Power Handling	150W	Vas	0.126m3
Mms	0.044Kg	Re	5.9Ω
BL factor	10.6Tm	Sd	0.0289m3
Qts	0.3	Baffle Cutout	253mm

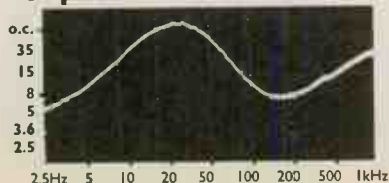
Frequency Response



Fs	25Hz	Qms	1.4
Sensitivity	90dB	Qes	0.25
Power Handling	250W	Vas	0.051m3
Mms	0.11Kg	Re	5.9Ω
BL factor	20.3Tm	Sd	0.03m3
Qts	0.21	Baffle Cutout	253mm

The even lower Q of the B2500.1 means that this unit gets down to 24Hz in a 100 litre reflex enclosure with an 80mm diameter, 181mm length port. It's sensitive enough to work with the majority of partnering units, and the high BL factor should ensure strong, clean bass.

Impedance



VOLT B2500.1 £185



WOOFERS TEST

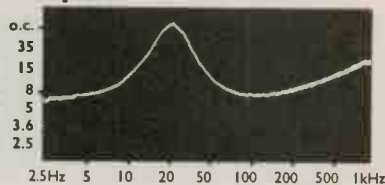
RCF L10/020

£32.05

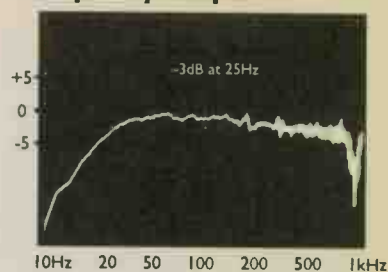


Even though the L10/020 has a high Q, I found lowest bass came from a reflex enclosure. In a 100 litre cabinet with an 80mm diameter, 163mm length port, it reached down to 27Hz. Sensitivity is very low though, most midrange units and tweeters will have to be attenuated.

Impedance

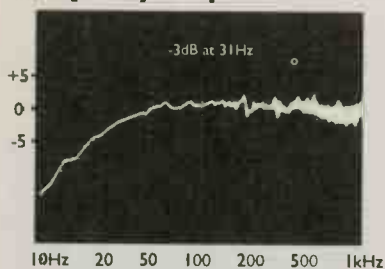


Frequency Response



Fs	30Hz	Qms	4
Sensitivity	87dB	Qes	0.8
Power Handling	70W	Vas	0.09m3
Mms	0.028Kg	Re	7.2Ω
BL factor	6Tm	Sd	0.0333m3
Qts	0.64	Baffle Cutout	235mm

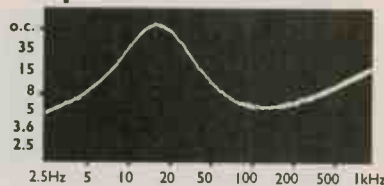
Frequency Response



Fs	20Hz	Qms	12
Sensitivity	90dB	Qes	0.35
Power Handling	100W	Vas	0.25m3
Mms	0.028Kg	Re	5Ω
BL factor	7.1Tm	Sd	0.0284m3
Qts	0.34	Baffle Cutout	231mm

The L10P10-1 has higher sensitivity than the L10/020, making it suitable for a wider range of partnering units. The soft fibrous cone should give a good sound, and bass went low, 29Hz in a 100 litre reflex enclosure - port 80mm diameter, 163mm long.

Impedance



RCF L10P10-1

£55.14



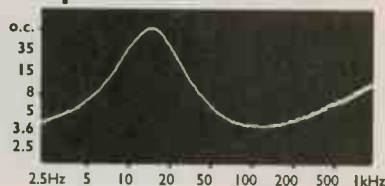
RCF L12P48

£87.89

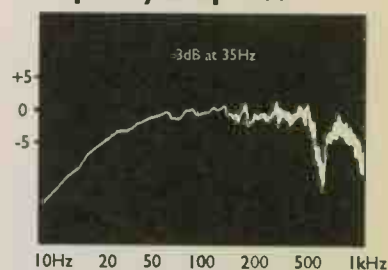


The 12inch RCF reached down to 28Hz in the 100 litre reflex loaded cabinet, with 80mm diameter, 202mm length port. Its sensitivity isn't very high, so partnering units will likely have to be attenuated. It is, however, a well made and powerful bass unit for the price.

Impedance

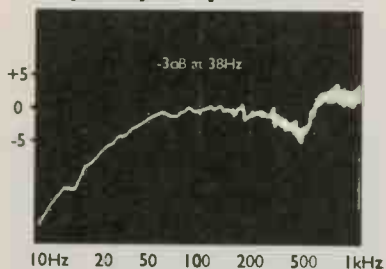


Frequency Response



Fs	19.5Hz	Qms	10
Sensitivity	89dB	Qes	0.44
Power Handling	150W	Vas	0.27m3
Mms	0.08Kg	Re	5Ω
BL factor	10.5Tm	Sd	0.0483m3
Qts	0.4	Baffle Cutout	226mm

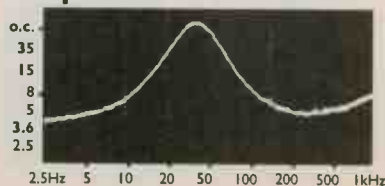
Frequency Response



Fs	26Hz	Qms	3.8
Sensitivity	91dB	Qes	0.24
Power Handling	100W	Vas	0.175m3
Mms	**Kg	Re	5.8Ω
BL factor	6Tm	Sd	0.035m3
Qts	0.23	Baffle Cutout	228mm

The SEAS 25F-EWRX is a good all rounder combining high sensitivity and power handling with a low Q, which will give deep bass. It reaches 35Hz in a 100 litre box, port being 80mm diameter, 71mm long and the doped paper cone should give a smooth sound.

Impedance



SEAS 25F-EWRX

£41.22

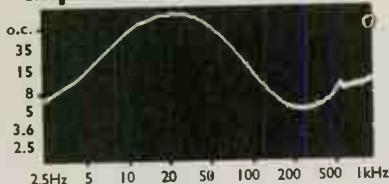


BEYMA 12B-100/R £157.69

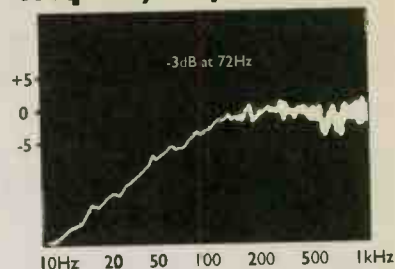


This beautifully built 12 inch paper cone unit has a lot going for it. High sensitivity and BL factor should give powerful clean and loud bass. The low Q also helps it to reach 34Hz in a 100 litre reflex enclosure tuned with an 80mm diameter, 85mm length port. Good, even at the price.

Impedance

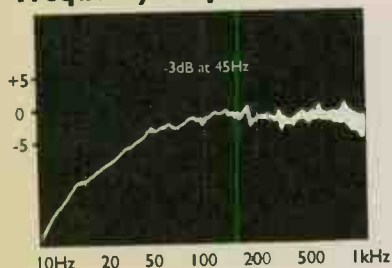


Frequency Response



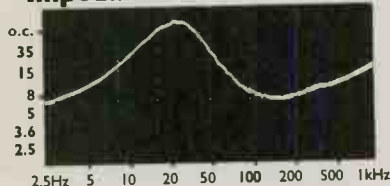
Fs	23Hz	Qms	6.42
Sensitivity	96dB	Qes	0.175
Power Handling	150W	Vas	0.275m ³
Mms	0.067Kg	Re	6.1Ω
BL factor	18.5Tm	Sd	0.053m ³
Qts	0.17	Baffle Cutout	286mm

Frequency Response



A 10inch polypropylene unit this one, and with reasonable BL factor and low Q. The B10CVH went down to 32Hz in a 100 litre reflex enclosure, port dimensions - 80mm diameter, 88mm long. Sensitivity is high enough to suit most midrange units and tweeters, and it is well priced.

Impedance



R. ALLAN B10CVH £52.83



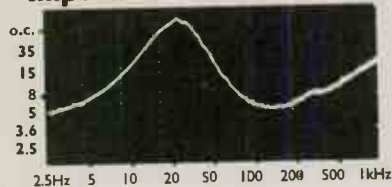
Fs	30Hz	Qrms	2.63
Sensitivity	90dB	Qes	0.31
Power Handling	100W	Vas	0.11m ³
Mms	0.0308Kg	Re	6.8Ω
BL factor	11.28Tm	Sd	0.03m ³
Qts	0.28	Baffle Cutout	232mm

R. ALLAN B12CVS £68.86

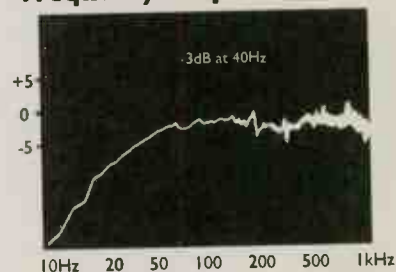


This 12inch Richard Allan polypropylene cone unit doesn't go as low in a 100 litre box as the 10inch, because of its higher Q. Ultimately it will, but in a much larger cabinet. With an 80mm diameter, 45mm length port the B12CVS got down to 45Hz. Better power handling though.

Impedance



Frequency Response



Fs	28Hz	Qms	4.97
Sensitivity	90dB	Qes	0.38
Power Handling	200W	Vas	0.33m ³
Mms	33.13Kg	Re	6.3Ω
BL factor	9.74Tm	Sd	0.05m ³
Qts	0.33	Baffle Cutout	273mm

CONCLUSION

The good all rounders are those with high enough sensitivity to match the majority of midrange and treble units, and good low bass performance from the 100litre cabinet. This includes: Audax's HT240M0, Morel's MW1275, VOLT's B2500.1. RCF's L10P10-1, SEAS's 25F-EWRX, Beyma's 12B-100/R and Richard Allan's B10CVH. All of these are above 90dB sensitivity and reach down below 40Hz, low enough to play bass fundamentals properly. The

others are either not sensitive enough for general use, or didn't get below 45Hz.

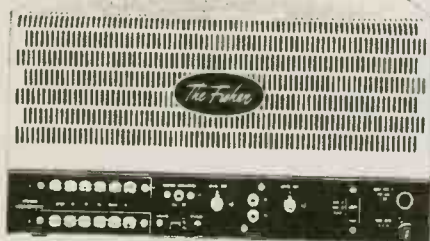
Of these seven, the Audax HT240M0, RCF's L10P10-1, SEAS's 25F-EWRX and Richard Allan's B10CVH stand out as being best value. The home constructor should not only find these affordable, but will get good deep bass and high sensitivity.

If money is no object, this leaves three, of which I must say the Morel

MW1275 looks the weakest. Its low BL factor and tiny magnet suggest bass quality and power handling will be suspect. The beautifully made and engineered Beyma 12B-100/R and VOLT 2500.1 are the most expensive in the group, but what you get is a combination of high sensitivity, low Q for good bass in a reasonably sized cabinet, and massive BL factor, which will ensure that bass is not only loud, but powerful and clean ●



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D.I.Y. Letters

10W CLASS A TRANSISTOR DESIGN

In the light of the recent introduction of kits for valve amps I feel it worth mentioning a transistor design for a 10 watt pure Class A design by J. Linsley-Hood that appeared in *Wireless World* (April 1969, October 1969 and December 1970). The latter two articles are relating to refinements. This amp was built on a single tri-pad board, with the output transistors on a suitable heat sink. In addition to the original design a choke smoothed power supply was used.

In use this amplifier feeds

LS3/5as and is open and punchy in sound with delicate music (e.g. Rory Block) and good vocal recordings, being so involving that I prefer its sound to some of the valve designs that have passed through my hands (perhaps this is just a personal choice). I do feel, however, that this amp provides a very affordable intro to Class A and would make a suitable kit.

As regards pre-amps, the one in use is also from *Wireless World*, this time a design by Doug Self published on October 1983. In place of the suggested NE5532/4

originally specified I have used OP275GP op amps from Analogue Devices which give a smoother and better controlled sound with improved bass (not volume, but quality). This pre amp has a very well designed phono stage, which seems to be a rarity these days.

Just a note on output power: 10 watts into LS3/5as is enough to fill a Victorian 2 up 2 down. So the amp should be adequate for most normal use.

The rest of the kit includes a Rega Planar 3, NAD 5420 and a tampered with geriatric

Pioneer tape deck.

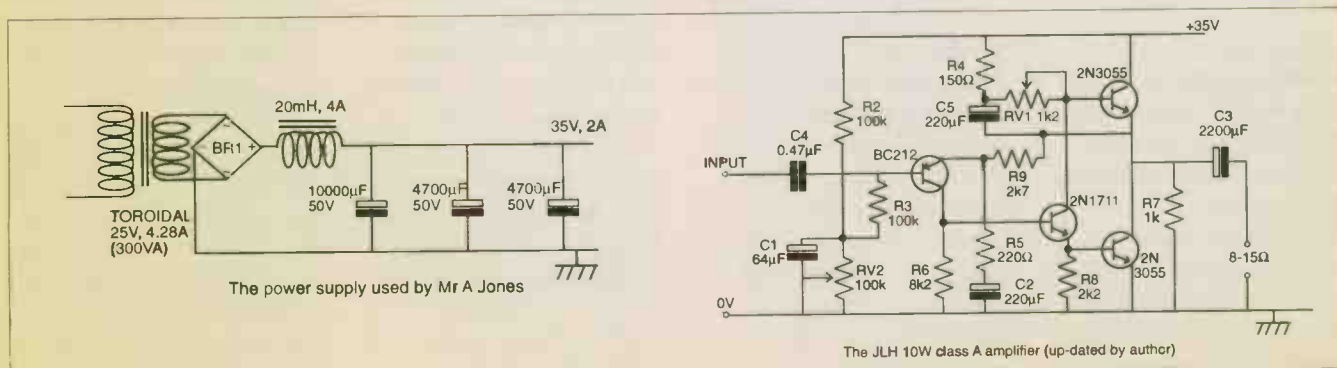
Keep up the good work with kits etc.

**A Jones
Southville,
Bristol.**

We are looking into designing a low powered transistor amplifier at the moment, although it will be some time before it appears in the magazine. What we hope to be able to do is offer a 10-15w single-ended or push-pull transistor design with very low, or preferably no feedback, at a reasonable cost. The components will almost certainly be cheap, but the mains transformer and heatsinks needed will account for most of the cost. However, at the moment we are up to our necks production engineering the other designs that we have published over the last year. So it will be towards the end of '94 at the earliest before such a design appears. **DB**

300B KIT QUERY

Your recent design and project for a 300B push-pull amplifier is very interesting. The design seems to have many excellent features and to offer the promise of very good sound quality. I am aware that any amplifier design is the outcome of a complex process of trade-offs and on the whole the 300B amplifier represents a well chosen combination of compromises. Even so there are perhaps a number of points where the design might perhaps be changed for the better or modified successfully. I would



Circuit reproduced with kind permission of J. Linsley-Hood

be interested to have your comments on the following points.

1. Firstly I do approve of the use of a interstage coupling transformer in the place of a phase-splitter arrangement. But what I do find somewhat surprising is the absence of any arrangement for balancing the output valves. Even very highly specified valves like the 300B can show power variations in the region of 7-10% when new and it would seem obviously desirable to include in the circuitry a means of balancing the output pair.

2. Secondly, I am wondering if consideration was given to the use of the Western Electric 310A valve for the voltage amplification stage. This valve was produced as a high gain voltage amplifier for driving the 300B and its use in your design would eliminate one of the two stages of voltage amplification. The elimination of a whole stage of amplification would seem an obvious benefit. I am aware that arguments are frequently advanced in favour of all-triode amplifiers but the 310A is a very special valve designed to give high gain while meeting the exacting Western Electric standards for low distortion.

3. I have acquired some Western Electric application notes for their amplifiers and theatre systems and I have been much impressed by the thoroughness and sophistication of their investigations into the problems of high fidelity sound in theatres. Some time ago I acquired a Western Electric 1086 amplifier. While

this had been converted in the 1960s from a 300B output stage to a 6L6 output stage, most of the original circuitry and components remained.

harmonics cannot manifest themselves in the primary of the output transformer where they meet out-of-phase and cancel, but commonly appear

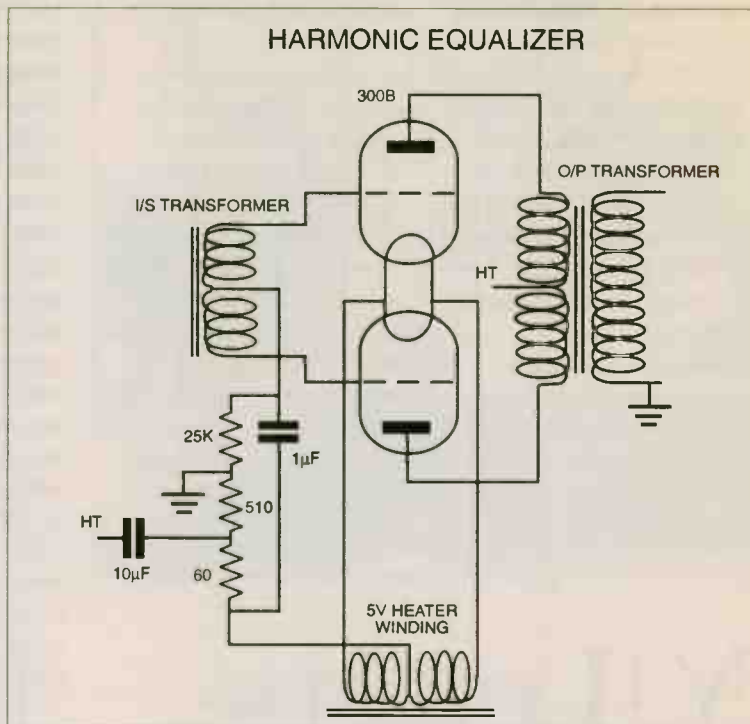
60ohms is a critical value. For other values the third harmonics generated in the valves would be either too weak to cancel the original harmonics or too strong and thus add to the distortion.

I have never seen another version of this unusual circuit and I can't find any mention of it in the Radiotron Designer's Handbook (Radio Designers Handbook in the UK). It is an interesting example of the Western Electric engineer's efforts to build low distortion amplifiers in the 1930s.

I would also like to take the opportunity to point out that polypropylene capacitors with working voltage ratings of 900V and values of 25, 32 and 50 μF are manufactured in Australia by Plessey Australia. These are high pulse grade capacitors intended for electric fence power pack applications and their high working voltage rating makes them eminently suitable for valve amplifier power supplies. They are also very cheap and I am a very satisfied user of them.

**John Rivers
Palmerston North,
New Zealand.**

Balancing the output valves only serves to eliminate low order harmonic content, which is subjectively not intrusive. With my modifications to the 300B amplifier driver stage (Ed. note: in development for production kit form, Andy Groves has altered and refined our 300B amplifier, but we have not published details yet) design distortion is in the region of 2% at max output without A.C. balancing and 0.2% with it, both with zero feedback. We carried out listening tests here and found that sonically the two performances were all but indistinguishable. The valves will be reasonably balanced in anode currents because of the cathode biasing (auto-bias) used.



The Harmonic Equalizer - a circuit for reducing odd order harmonic distortion

Included in the circuit was a curious arrangement of cathode resistors for the output stage. Recently I came across an article in the International Projectionist for December 1936 which gave an explanation for the arrangement. The Western Electric Company referred to the arrangement as a 'Harmonic Equaliser'. What follows is an abbreviated version of their description.

"The purpose of the 'Harmonic Equaliser' is to remove harmonic distortion without using feedback. While even order harmonic distortion is removed by the usual device of the push-pull output stage, third and other odd-order harmonics are removed by the action of the 'harmonic equaliser'. The 60ohm resistor and 16 μF capacitor are in series with the return from the centre tap of the primary of the output transformer to the filaments of the output tubes. The second and even order

as voltage in the return between the centre tap of that primary and the output valve filaments. They also appear in the space of the output valves themselves. The very low impedance of 60ohm in series with 16 μF prevents the even-order harmonics from developing any appreciably large voltage drop in the filament-to-primary-centre-tap lead, and thus concentrates them almost entirely in the space of the valves. But in the valves they react with the fundamental frequency to produce third- and other odd-order harmonics which are 180 degrees out-of-phase with the odd-order harmonics already present there."

The result is, according to Western Electric, that odd-order harmonics are cancelled in the valves themselves by the generation, within those valves, of the identical harmonic frequencies in reverse phase. Western Electric go on to say that the

The 310A pentode + 300B triode + 274B rectifier is the classic circuit used widely in Japan and France, but 310As are very rare and expensive. Using a single gain stage has both advantages and disadvantages, as one valve is asked to do the job of voltage amplification and driving the output stage. The 5687 valve now used to drive the 300Bs in the kit is just about the most linear valve available for this purpose, considerably more linear than a 310A.

The "Harmonic Equalizer" circuit is interesting, but it will have problems because of the valve variations you mentioned. Cancellation circuits like this need to be set up with accurate test gear and have a tendency to drift with time, hence the popularity of feedback which eliminates a lot of these problems. Western Electric used feedback, along with everybody else, to improve the figures of their amplifiers, but nowadays it tends to be used as a "magic bullet" to cover up terrible faults in the open loop performance.

Andy Groves

PENTODE AS TRIODE!

It is with great interest that I follow your DIY projects and I have some comments and suggestions which I hope will prove of interest to yourselves and to constructors.

I was never a fan of the original Mullard 5-20 and converting from pentode to triode input stage has been an acknowledged modification for many a year to the Mullard and other (i.e. Radford) designs. With the K588 I it is interesting to note that you have followed this path, which I am sure provides a worthwhile improvement. BUT why codge up a pentode to act as a triode? A strapped pentode never seems to perform like the genuine article, still being prone to parasitic oscillation, hence your grid stopper resistor.

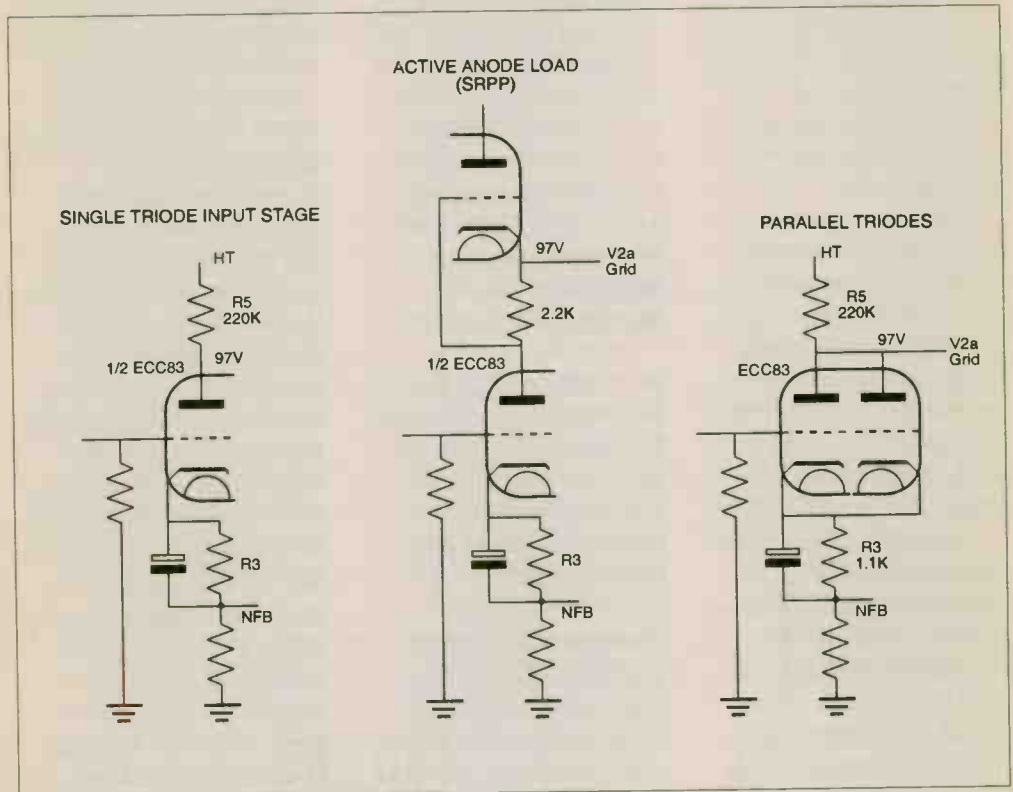
Good triodes are readily available, the ECC83 being a logical choice.

Your tagboard construction method is a good idea. It has an advantage in making experimentation and modification easy. One half of an ECC83 will work well if the anode load resistor R5 is increased to 220K and the HT voltage adjusted to maintain V2a grid at 97 volts. This leaves a spare triode unit which it seems a shame not to

forms a constant current source and uses only one resistor along with the triode. This resistor can be mounted directly on the valve holder and again this circuit can be incorporated with very little effort. These circuits are suggested for experiment and are shown on the enclosed sheet.

By providing mounting holes on the front panel and additional mounting holes on the rear panel the constructor

crosstalk figures, however it is plainly audible. This circuit is not as original as you seem to think, I have seen a cinema amp probably built around 1937-39 which employs the same circuit with octal valves in the driver, but not tertiary feedback. Apart from some minor differences to component values and, crucially, the quality of the transformers, the circuit is practically identical. This basic circuit was quite widely used



Three different input circuits that could be used on our K588 I amplifier.

use. The two triode units can be connected in parallel for lower impedance. If this is done R5 may stay at 110K but the bias resistor R3 will need to be half its present value, easily achieved by connecting another 2.2K resistor directly across the existing one. It is easy to give this a try by just re-wiring the valve holder and adding one resistor.

Alternatively the spare triode could be used as an active anode load which holds the promise of low distortion, low output impedance and high gain. I have found this arrangement to be highly satisfactory, as have some commercial amplifier producers. The top triode

would have the option of building in a volume control and, if required, an input selector with the necessary sockets, thus greatly adding to the versatility. Blanking plugs would deal with the holes for those who do not require them. Both K588 I and 300B could benefit from this.

The 300B circuit looks interesting. I do not like sharing double triodes between channels since my practical experience has shown that stereo presentation is always better when both channels are physically separate, not possible when sharing valve halves. This does not seem to be reflected in measured

and proved to be a consistent and highly reliable design. In the August supplement, under "Theory of Operation" Tim de Paravicini states that about 400 volts peak-to-peak is available from the driver transformer. This seems a little excessive for 300Bs but it should be just about right to drive a single 845 - now there's a thought!

In the 300B Part 2 article (October supplement, page 22) it is stated that transformer cores should be electrically isolated from the chassis. This is dangerous rubbish. Mains transformer primaries are generally wound on nearest the core, so clearly a fault here could result in the

core becoming live. With the core mounted so close to earthed metalwork, and exposed, the danger is obvious.

The situation with output transformers can be even worse, since the full H.T. voltage could appear on the core. The very idea makes me shudder. It is usual when designing signal transformers to assume that the core will be earthed and transformer capacitances are usually calculated making this assumption. To float the core will change these capacitances and the transformer may not perform as intended. Safety must be our first priority and all exposed metalwork must be earthed.

I feel that you must have misinterpreted the function of the fibre washers which is to prevent the bolts from acting as shorted turns, lowering inductance and causing losses. They should isolate only the ends of the bolts and not the whole core; this is the true function of the washers.

How about making your transformers available separately, rather than in sets? Should I decide, say, to scratch build K5881, for instance, I already have mains transformers and chokes which would be suitable, so only output iron would be required. Likewise, should I decide to substitute an 845 single-end stage for your 300B push-pull as suggested earlier, then the mains and output transformers would not be required. There are a number of circuits from Japanese constructor magazines which call for a driver transformer for which yours would be quite suitable. There could be a healthy demand for these since driver transformers are difficult to obtain.

Where can we get to hear these designs? Your magazine, along with others, quite rightly advises readers to audition equipment before buying, but this is an obvious difficulty with DIY. I know you exhibited at the Penta show

but that's only once a year and 180 miles away from here. Show demonstrations can only give one a general impression anyway.

I am tempted by the high definition design recently published, but I have doubts. This is not a complicated project and I am confident that I can build it to plan and that it would perform as you intended. What deters me is that I might not like it. After all, loudspeakers remain very much a matter of taste. Surely I am not alone in this? It is a stumbling block to DIY and building without audition makes even less sense than buying without audition except to the inveterate experimenter. Can anything be done about this?

David Dick
Stockport,
Cheshire.

PS: Golden Dragon valves that I have used sound great when they are new but they just don't last. My letter of complaint to P.M. Components did not even elicit a reply!

Andy Groves says:

The EF86 is an excellent valve, triode or pentode connected. It is very linear and has low noise, low microphony, internal screening and a spiral wound heater to cut down on hum. For these reasons Noel chose to use it when he originally designed the K5881. The grid stopper on the input is essential, and should be present no matter what type of input valve is used. The fact that the input on K5881 is a triode connected pentode makes no difference and I would say that you have been lucky not to experience tweeter vaporizing parasitics yet, especially when you get a bad earth or faulty input connector.

Your ECC83 modifications are worth a try for experimenters, but I would like to point out that the SRPP circuit is not quite

the cure-all it seems. Firstly, problems occur when the cathode of the load valve is elevated above the heater by more than a few volts. This usually shows itself by valves becoming severely microphonic after a few weeks (or even days) of use, so the heater winding must be biased up from ground by +45 to +55 volts D.C. Secondly the linearity of this type of circuit is dubious. If the transfer function of the combination is plotted, it is S shaped like a pentode and weird kinks show up near the A.C. zero crossing point unless care is taken when setting quiescent currents and operating voltages.

The load valve in the standard SRPP circuit does not function as a constant current source because there is not enough feedback associated with its cathode resistor. As you have drawn it, the bottom valve thinks the top valve is a non-linear impedance of around 300kΩ.

Transformers should not be considered in the same way as other passive components. When Tim or I design a transformer, it is specially constructed to perform at its best in a particular circuit. The 300B driver transformer is intended to be used as a phase splitter and driver and would not be suitable for driving a single-ended 845; a bi-filar single-ended transformer with something like a 5687 or 6BX7 valve should be used to drive the 845.

The design is original in that it is not a data sheet clone, which unfortunately many commercially available amplifiers, valve and solid state, are. This type of topology has been around for a long time, so has using canvas and oil paints, but that doesn't mean that all oil paintings are re-hashes of older works.

The core of the transformer should be electrically earthed as you say, but it needs to be lifted off of

the chassis otherwise large eddy currents are set up in the chassis causing the transformer to heat up. **AG**

On the safety front, I had a discussion with Tim about core isolation and he pointed out that transformer bobbins are heat resistant and flash tested to over 3000V and that there comes a time that you have to trust to the properties of insulators or, for example, ordinary electrical cabling could be considered an unacceptable hazard. In his view, it was unnecessary to put in a special earth, but it can be done by using an earth wire between chassis and core. However, the laminations should not, for magnetic reasons, touch the chassis, as Andy explains. The output transformers can be electrically earthed in the same manner if desired.

Study the original manufacturers descriptions and then note that K5881 is quieter (hiss) than most solid state amplifiers available today and you'll understand why I used the EF86 instead of an ECC83.

Both Tim de Paravicini and Andy Groves are experienced transformer designers and, I'm learning, the driver transformer is the most difficult transformer of all to make work well, even though it is technically the most elegant solution to phase-splitting and driving. Tim insisted his be potted by himself alone, in a specially made can of one-eighth inch thick mild steel, with ball bearings in the potting compound to prevent people hacksawing the thing open. Andy spends hours musing over cross coupling arrangements and ways of lessening and neutralising capacitances to smoothly extend bandwidth whilst retaining high frequency balance (he also spends of fortune on getting prototypes built!). It's a dark art, but a fascinating one. **NK**

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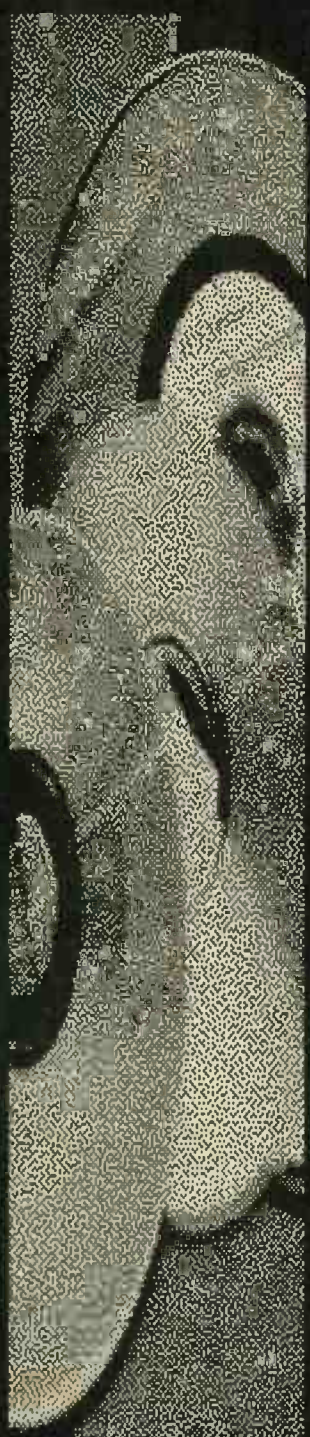
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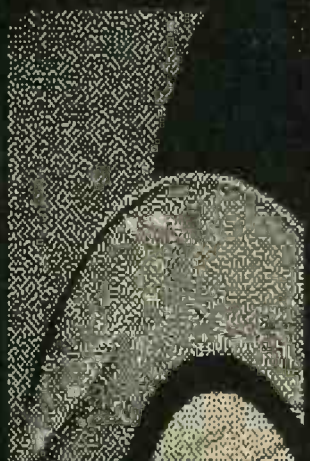
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