Hi-Fi WORLD

NO.28 APRIL 1997 SUPPLEMENT

BOOK REVIEWS:
ELECTRONICS MADE SIMPLE
by Ian Sinclair

TWEAKING KLP1 WITH SPECIAL COMPONENTS

FILTER DESIGN
by Steve Winder

KLS9 - BUILD A SUPERB HIGH TECHNOLOGY SPEAKER

FREE D.I.Y. SUPPLEMENT No. 28

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D.I.Y.

Supplement

Contents

KIT NEWS

SVETLANA'S NEW BABY

The American component manufacturer Svetlana has just announced the introduction of its Russian manufactured EF86/6267 small signal pentode valve. Svetlana claim the valve benefits from low noise and microphony thus making it ideal for use in the first gain stage of phono or microphone

pre-amps. Other advantages are a high voltage gain in pentode mode and low distortion in both pentode and triode operation. The EF86 is also improved from earlier versions by having higher structural rigidity which aids performance.

Svetlana Electron Devices
8200 South Memorial Parkway,
Huntsville, AL35802
USA
Tel: (205) 239-6900

SOCKETS GALORE

Billington Export, the valve suppliers, have now introduced a new range of sockets, which have previously been about as easy to get hold of as hens' teeth. The sockets now in production cover 4-pin types, including the £3.60 B4 (for use with DA42, PX25 and U14, this socket is a copy of a World War Two military design), the £15 L4 (designed on a 1920s' pattern for use with the DA100) and the £37.50 USL4 (for the huge 212 and 4212e.)

For £3.60 you can make the B5, a British 5-pin type for use with MH4 and ML4 , your own. There's also the £11.70 PO5, another 5-pin socket with a continental-type side spigot known as the G5K. To end our list we have the £13.50 E2e continental 9-pin socket for use with E2e and F2e valves.

Billington Export Ltd
1E Gillmans Trading Estate,
Billingshurst,
West Sussex RH14 9EZ
Tel: 01403 784961

FALCON GET ACTIVE

Falcon Acoustics of Norwich have just released a third edition of their book entitled Active Loudspeaker Crossover Filters and Sub bass. All you maths experts out there will be glad to know that it now contains even more formulae for infinite baffle and reflex designs. The complete set of equations used for calculating fourth-order coupled-cavity designs is also included. Price for this thirty-two page booklet is a modest £1.50 plus an A5 stamped addressed envelope.

Falcon Acoustics Ltd
Tabor House,
Norwich Road,
Mulbarton,
Norfolk NR14 8JT
Tel: 01508 578272

AUDIOCOM'S RANGE GROWS

Audiocom, the specialist component suppliers, are pleased to announce the new MIT Multicap RTX polystyrene and PPFX polypropylene capacitors. MIT uses a patented process which winds the capacitors co-axially rather than in a single winding. So the Multicap is not a single capacitor of 1000+ turns but ten smaller value, high-speed capacitors all wound in parallel to make up the total value.

Danish Audio Connect attenuators are now on sale as well. These use low-noise, non-inductive, metal film surface mount resistor networks to give a signal path claimed to be five times shorter than conventional designs.

Audiocom
2 Swallow Tree Gardens,
Saundersfoot,
Pembrokeshire,
SA69 9DE
Tel: 01834 814036

PRESTIGIOUS WILMSLOW

Wilmslow Audio aim for the stars with their new top of the range 'speaker, the £2200 Prestige. This three-way 'speaker was designed by Wilmslow's director Shaun Williams and combines high performance drive units from ATC, Scan Speak and Volt. Wilmslow claim the combination of Scan Speak's Revelator tweeter and ATC's SM75-150s midrange gives the Prestige a high level of clarity and detail. The three drive units are linked via a high quality passive crossover which utilises polypropylene capacitors and air-core inductors.

Wilmslow Audio
50 Main Street,
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Leicester LE9 6RD
Tel: 01455 286603

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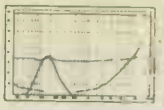

As Featured In the Hi-Fi World DIY Supplement No,s 22 & 23 (June, August 1996). Still available to Hi-Fi World readers at the Reduced price :- £89-00 Inc Plus £5-00 P&P

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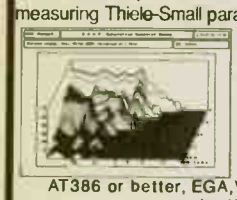

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KLS9 LOUDSPEAKER

Noel Keywood designs and builds a high-technology, but inexpensive two-way floorstanding loudspeaker that gives real bass.

Up to now, our loudspeakers have been a little different from the norm but this design, KLS9, deliberately uses a conventional format: it's a two-way floorstander.

There are two reasons for this. Everyone wants to know how to design a loudspeaker and a two-way is an easy place to start. KLS9 is something of a design exercise.

Secondly, by using high-quality drive units and not skimping on the cabinet size-wise, it is relatively easy to produce a budget design that is easy to build but offers superb performance.

CHOOSING THE DRIVE UNITS

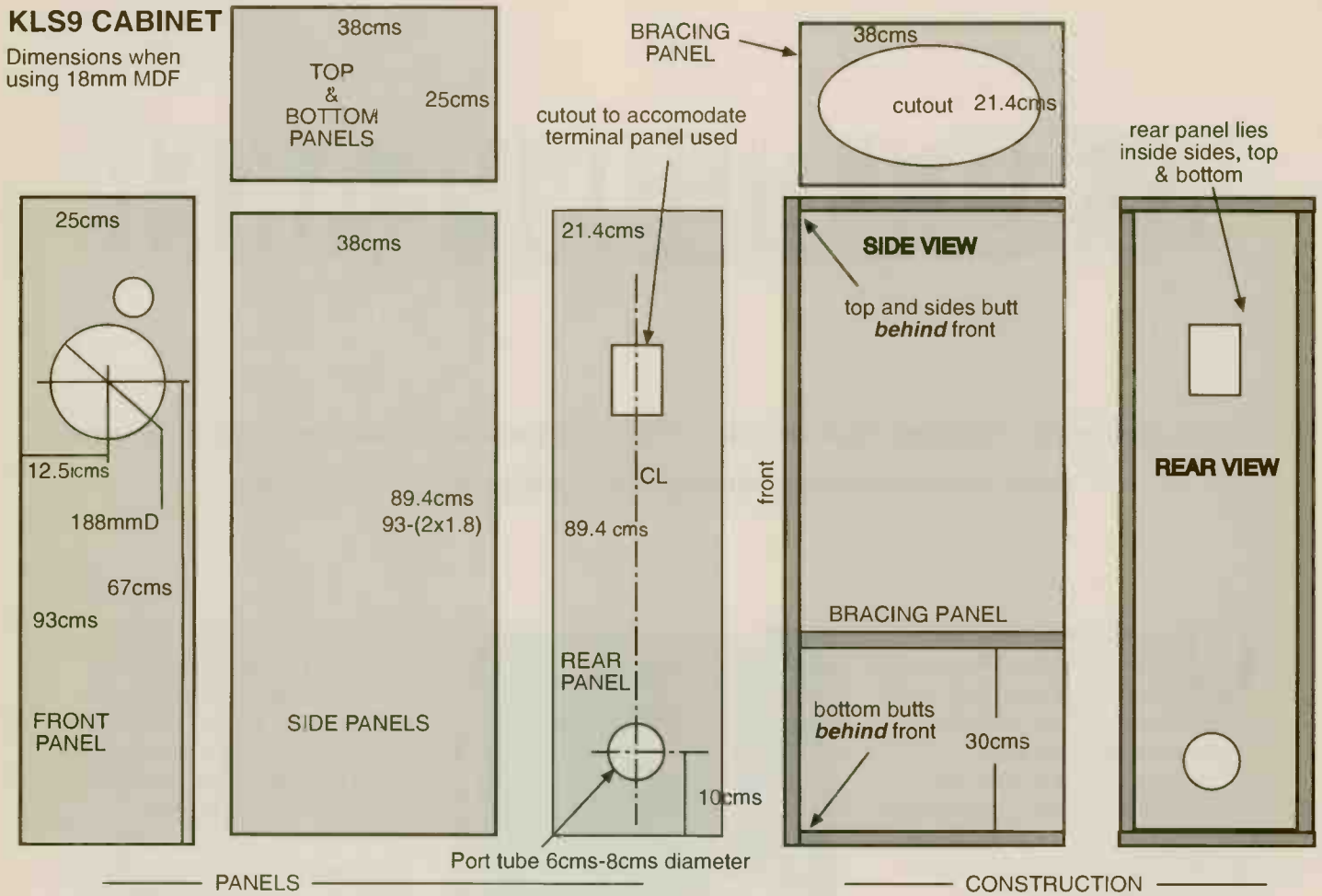
In a two-way 'speaker, the bass unit must cover a wide frequency range, from the lower limit set by the box, all the way up to meet the tweeter, at around 3kHz. Because this covers not only the bass region but the midband too, it is called a bass/midrange driver. It's asking a lot of any unit to work over such a range and in practice, most bass/midrange drivers get a bit rough in the crossover region, from 2kHz-4kHz. Using a small cone minimises this problem, but the drive unit then has to work hard moving air to produce bass. Bass distortion rises and low-frequency power handling deteriorates.

To achieve reasonable power handling as well as deeper bass with more punch, an 8in cone is needed. This is the most popular choice amongst manufacturers and it was my choice for KLS9. To maintain quality above 2kHz, I chose to use a High Definition Aerogel (HDA) cone driver from Audax, the HM210ZO. This is one of their most advanced designs.

HDA is a composite material comprising Kevlar and Carbon fibres, aligned along the polymer chain of an acrylic gel. The cones are actually baked hard, although they retain a peculiar slight stickiness on their front surface. HDA is extremely light, yet rigid, with optimised internal damping. Audax fit the unit with an edge-wound voice coil of flat copper wire, mounted on a heat-resistant Kapton former, and the whole assembly is supported by a rigid, cast Mazak chassis, not a cheap pressed steel affair.

Modern synthetic cones are more consistent in their properties than paper types, giving a clean sound even at high volume. Paper 'breaks up' badly, sounding sharp and coarse. By the way, the instrument that puts most harmonics into the break-up region of a bass/midrange cone is the violin, which is why violin sounds so different between 'speakers.

The tweeter I chose to use was the well tried and tested Audax TWO25MO. This uses a fabric dome for good sound quality (I would not use a metal dome by the way; they are too hard and clattery). It comes down far enough to meet the bass/midrange unit at around 3kHz and has sufficient sensitivity to match. It is also very



PANELS — CONSTRUCTION

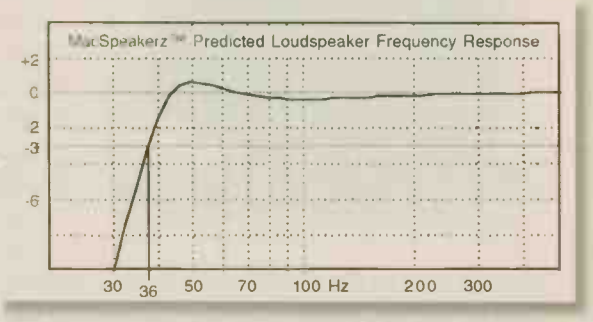
reasonably priced.

THE CABINET

Not unsurprisingly, when the Thiele-Small parameters of the HM210ZO are plugged into a computer programme to calculate box volume, the optimum figure turns out to be the size of a conventional floorstander. That's because nowadays, drive unit manufacturers tailor parameters to produce a drive unit optimised for a real-life cabinet. The HM210ZO suits a medium-to-large ported cabinet.

From experience we have found it best to go for a high-pass response that produces a little bass peaking around the 30Hz-60Hz region. This gives real weight to bass, which most listeners prefer. With the HM210ZO, using a box volume of 2.6cu ft (0.075 cubic metres), bass reaches down to 36Hz (-3dB), which is low. You will find that our cabinet is 0.072 cubic metres volume in fact, but internal sound absorbent makes the cabinet appear bigger as far as the drive unit is concerned.

Generally speaking, the larger the cabinet the better - up to a limit. If you make the cabinet for this driver any larger than 2.6cu ft in volume, it will start to peak up in the bass, sounding boomy and one-note. What I have done is to choose the highest volume figure possible, consistent with flat response, meaning +1dB of peaking at 40Hz. This gives low box Q, good damping and a relatively clean step response, suggesting solid sounding bass with weight but little overhang. Practice bore out theory; KLS9 delivers very deep, tight bass - it can really thunder. Conveniently, for this volume of cabinet, dimensions can be set to give a large but not monstrous floorstander, measuring 93cms high, 25cms across the front panel and 38cms deep.



Computer predicted response of the HM210ZO drive unit in a 2.6 cu ft enclosure. Output rises by +1dB or so around 50Hz, then falls away at 24dB/octave. This is a classic reflex, high-pass box response, with a -3dB frequency of 36Hz in this case.

However, cabinet volume can be reduced, by up to 50%, for those who might want a smaller 'speaker or lighter bass. The best approach here is to knock up a pair of experimental cabinets of 2.6cu ft volume and then slowly reduce the volume with bricks until you get the bass quality you are after. The bass drivers can be removed to get the bricks in, or the rear panels if they

are screwed in place.

CROSSOVER

Analysis of the HM210ZO's frequency response by our B&K measuring microphone and Hewlett Packard 3561A FFT spectrum analyser showed it rolls off above 3kHz and, as expected from an optimally damped and consistent synthetic material, doesn't break up badly at high frequencies. It looked suitable for a slow-ish roll-off Butterworth (or thereabouts, damping-wise) second-order filter response, but in the end I found a first-order (-6dB/octave) low-pass filter was sufficient, as it should be with a good driver. The 1.2mH inductor has a ferrite core, which allows a low DCR of 0.65Ω to be achieved, maximising sensitivity and leaving driver/box Q unaffected.

The high-pass section for the tweeter was engineered to make it flat in response terms and a good phase match with the bass/midrange unit. The first-order low-pass filter combines with the HM210ZO in a complex fashion, because the drive unit itself rolls off above 3kHz. Also, the drive units are horizontally displaced by 30mm, which amounts to 90degrees of phase shift at 3kHz. Experiment showed that best phase matching was obtained with a first-order filter feeding the tweeter, making the crossover network very simple. I usually expect to use second or third-order networks for the tweeter, but the slow roll-off of the HM210ZO allows the tweeter to be rolled in high up the audio band, keeping low frequency energy out, and with this arrangement the phase matching proved excellent.

First-order filters don't provide much flexibility in the all-important response tweaking department but in this design it didn't matter. Frequency response was as I prefer it, with a slow downward trend, no crossover suckout or dip around 3kHz at all, and no phase errors in this region to put in an off-axis suckout or dip. Keeping the midrange flat ensures good detailing and vocal projection without having to resort to any artificiality, like brightness.

Talking of which, a tweeter should never be allowed to peak. The TWO25MO's response is tailored by the series high-pass capacitor so it exhibits a) no peaking and b) it rolls off slowly toward 20kHz. This ensures there's no sting in the treble. Another subjective disaster is to allow treble output to rise toward 20kHz, giving painfully incisive treble.

In the end, KLS9 turned out to need a minimal crossover, much simpler than any of our earlier designs. That makes it even easier to build, of course, and less expensive too.

I expected fairly benign load characteristics as a result of this simplicity and wasn't surprised to see a gently undulating impedance curve, as our analysis shows. This means there's little reactance in the load, always a good thing, since energy storage is kept to a minimum. The curve sits high up, meaning overall impedance is high, because of the HM210ZO's intrinsic 6.3Ω DC resistance, which sets minimum impedance.

Overall impedance measured 12Ω, meaning the 'speaker draws little current, so it will not stress amplifiers. When impedance is high, sensitivity usually suffers. In this case, it turned out to be a respectable 88dB SPL (Sound Pressure Level) from one nominal watt of input (2.84V), so amplifiers of 30-80watts are suitable, according to room size.

BUILDING KLS9

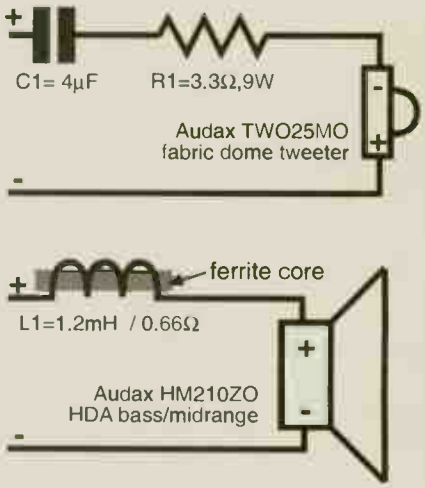
The cabinets should be built from 18mm MDF according to our cutting plan. The most important parameter is cabinet volume, but it is not so crucial that dimensions must be exact. Glue the cabinet with Evode Resin W or similar. It can be screwed as well, if desired - use coarse-thread screws made for MDF. Note that we put in a bracing panel, with a cut-out in it, two-thirds of the way down. This is to brace the side panels and avoid boxiness.

The assembly sequence is -

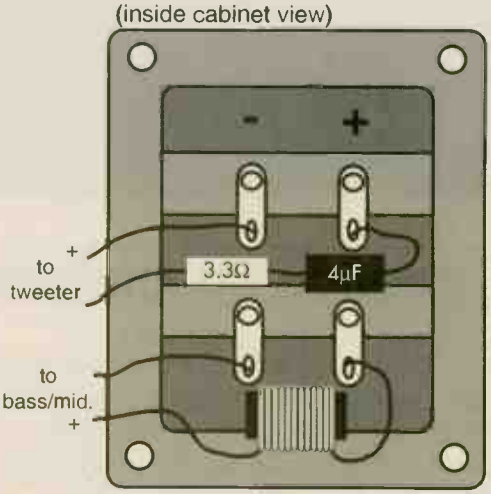
1) Glue top, bottom and side panels together, then screw/pin on the front panel to hold them in shape whilst the glue dries. Do not fix the rear panel.

2) Glue and screw the internal bracing

KLS9 CROSSOVER



INPUT TERMINAL PANEL
(inside cabinet view)



(on drive units, +ve is narrow terminal)

ANOTHER BIG HIT!

Following in the path of the original and extremely well received Assemblage DAC-1, the DAC-2 appears to be another big hit with customers and reviewers alike. The DAC-2 builds on the strengths of the original DAC-1, with its dual Burr-Brown PCM 1702 20 bit DACs, Crystal CS8412 input receiver, toroidal power transformer and Analog Devices based output stage, but adds HDCD capability with the PMD-100 digital filter chip, an extra co-ax digital input on a BNC jack, a phase invert switch, three more power supply regulation stages with greatly increased power supply capacitance, and improved parts quality in the analog output stage. The best news is that all these improvements come with a very small price, the DAC-2 digital processor kit is **$499.00 U.S.!** Of course, the DAC-2 also comes with our 30 day satisfaction guarantee, two year limited warranty, AND our assembly guarantee, (If you can't get it to work, we will!).

For those of you with the upgrade bug, we also have a **parts upgrade kit** available for the DAC-2. This kit includes Caddock resistors and MultiCap capacitors for the analog output stage, Kimber silver and Illuminati hook-up wire, EAR and Soundcoat isolation and damping materials, Linear Technology voltage regulators, and more parts that make a significant improvement in the performance of the stock DAC-2. The parts upgrade kit is available at a special package price of $149.00, which makes it even more good news!

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panel into place.
3) Cut driver cut-outs on front panel.

4) Glue damping pads of heavy, natural fibre carpet felt onto every internal panel. An alternative is the bituminous felt used to damp car panels.

5) Cut terminal panel and port cut-outs on rear panel. Fix port into hole and glue in place.

6) Screw and glue rear panel into place.

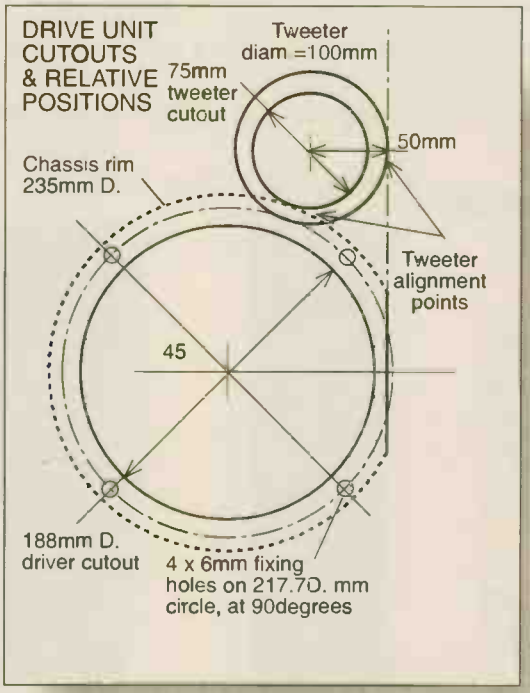
The cabinet can be accessed internally through the bass/midrange cut-out on the front and the terminal panel cut-out at rear. Internal damping wool can be put in through the front opening.

7) Solder wires onto drive units and lead them out through the terminal panel cut-out when screwing drivers into place.
* Note polarity - the narrow pin on both drive units is positive (+, marked red on woofer). Also, the tweeter has reversed phase, so connect +ve from the crossover to the tweeter's -ve (wide) terminal. *

8) Solder crossover components onto terminal panel. Connect drivers to crossover then screw the terminal panel into place.

We placed the terminal panel right behind the bass/midrange unit so we could fix it using nuts and bolts, if need be. A 7mm recess had to be routed out for the chassis front face, leaving 11mm for screw thread. We were worried they might not hold after repeated use, but they proved OK in practice.

The inside view of the cabinet shows the bracing panel and damping pads. The cutout size is not critical, but should be big.



CABINET PROPORTIONS

The cabinet was proportioned so that a point midway between the bass/midrange and the tweeter would be 2ft 6in from the floor - ear-height in a normal seat.

The front was deliberately kept narrow, for best imaging. Wide-fronted loudspeakers image messily, so beware if you are thinking of altering this dimension. You will notice that the cabinets are 'handed' by offsetting the tweeter, so there are right and left-hand 'speakers. This places the tweeter asymmetrically, dispersing phase and diffraction effects, and it reduces the path length to the cabinet's inside face, pushing effects up-band. Bear this in mind when cutting the front panels, since they must be different. The tweeter sits closest to the inside panel of the 'speaker, when viewed from the front as a stereo pair.

We used a router to inset the chassis of the bass/midrange unit, making for a flush baffle in order to minimise destructive reflections. The tweeter has been mounted over the edge of the bass/midrange chassis, to get it as close as possible; it is one wavelength away at 3kHz. I did not want this distance to be exceeded, since I rate good imaging very highly. For this reason, all the cabinet front edges were routed to have a smooth radius on them, to avoid edge-diffraction. This makes the cabinet difficult to veneer, so we applied Unibond as a sealant and then eggshell black paint.

The crossover is so simple it can be soldered directly onto the input terminal panel. Glue the crossover components on with a hot-melt glue gun or, better, drill the panel and bolt on two three-way tag strips. The capacitor, inductor and resistor can then be soldered on. Keep the inductor and capacitor apart and at mutual right angles to minimise inductive coupling ('cos a capacitor is a coil of foil with inductance).

We suggest you use Solen audio quality polypropylene capacitors. The inductor is ferrite cored for lowest DCR, measuring 0.65Ω. These properties must be replicated, or performance will change. The resistor will not get hot; make it 5W-9W. We used a high temperature wirewound, but really this resistor is best made up from 1W carbon film types, because of their neutral sound.
The terminal panel we show is a bi-wire type and the 'speaker is bi-wireable of course.

Because the panel is positioned directly behind the bass/midrange unit, a

pad of carpet felt should be placed over it to eliminate reflections from the rear of the bass/midrange driver.

The reflex port itself is not too critical. To keep distortion down, it must be made fairly large. Our port was made 8cms in diameter and 4cms deep. You might like to try experimenting with these dimensions. The port is placed close to the floor on the rear baffle. Since it works low, around 35Hz, it is close enough to the main driver to avoid phase problems, so positioning is not too critical.

Ideally, the base should have floor spikes fitted. The cabinet side panels could well be braced further by a 1in dowel or similar, because this 'speaker produces a lot of bass energy.

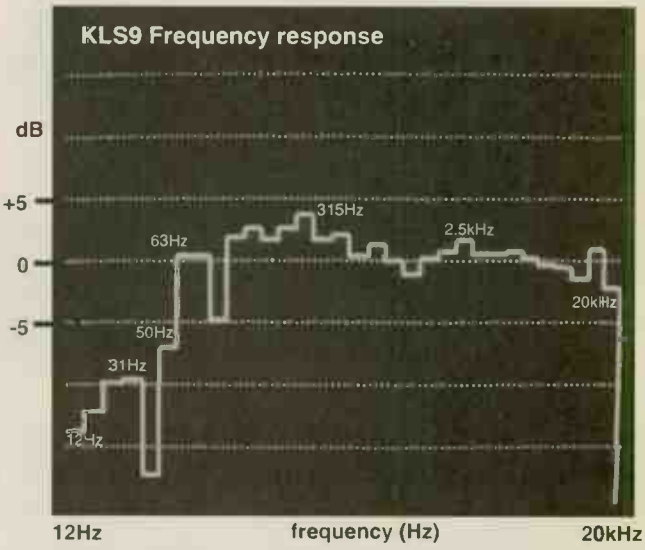
And finally, to the matter of internal damping. Regular readers will know we recommend long-haired wool. It must be teased out and should be supported internally on threads to prevent settling over time. The bracing panel is useful for this purpose. Put an open gauze over it and wool on top, as well as in the bottom chamber. Don't over-stuff the 'speaker or it will sound lifeless and the port will not work properly. Reflex cabinets must not be too heavily damped for this reason. The amount of damping used is a matter for experiment, being sufficient to suppress cabinet boom but not enough to create a 'dead' sound.

Most people like to finish their cabinets with a good veneer. To retain bevelled edges, I suggest hardwood or stained softwood 1/4 rounds are routed into the edges. Veneer up to these edgings. Bear in mind that all around the tweeter, up to 12in away, there should be no protuberances, especially ridges. The surface acoustic wave it produces must not be obstructed, nor should it be caused to diffract off sharp surface discontinuities. Attention to detail here, together with good drive units, narrow front baffle and accurate phase matching between drivers yields very sharp, clean-edged images, plus well embodied cymbals made of solid metal, rather than the sort of mellifluous representation that arises as a result of phase errors and anomalies.

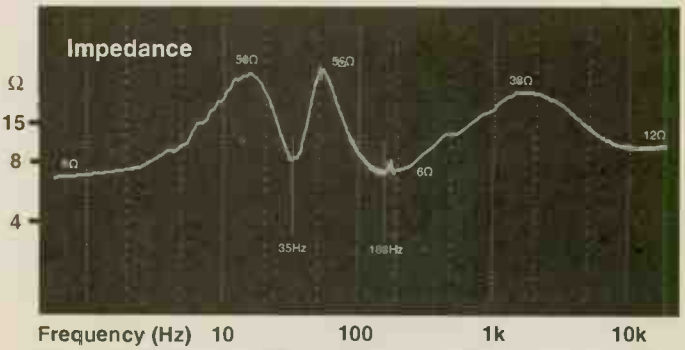
The cost of these 'speakers is low relative to the specification. The Audax drive units total £150, wood around £30, terminals, wool, components, wire, ports, etc, around £70 (for two 'speakers). That's £230 in all. For this you get a high technology loudspeaker with superbly even and well damped bass that goes very low. It also has a clean, clear mid-band and is easy to drive. Have fun!

COMPONENT LIST (per loudspeaker)

L1	1.2mH, 0.65Ω, ferrite cored
C1	4μF, 50V wkg. min. Solen
R1	3.3Ω resistor, 5W min.
Input	bi-wire input terminal panel
Component mounting	3-way tagstrips
Damping	long haired wool
Panel damping	carpet felt
Wood glue	Evode Resin W
Panel damping glue	Evostick
Wood	18mm MDF
Wire	silver plated copper, single strand
Port	7cm-8cm diameter, 4cms long



Output is strong down to 50Hz in our room. The response characteristic falls slowly and smoothly toward high frequencies, by about 3dB overall. This is deliberate, to ensure the 'speaker sounds smooth but full bodied in its rendition.



Overall impedance measured 12Ω, with a pink noise test using an rms reading meter. The twin peaks are typical of a reflex, where the port resonates out of phase against the box, at 36Hz here. Above 200Hz impedance rises smoothly, due to voice coil inductance, then levels out as the tweeter comes in. KLS9 is an easy load for an amplifier, drawing little current and possessing little reactance.

KLS9 KIT

Two kits of parts are available for this loudspeaker:

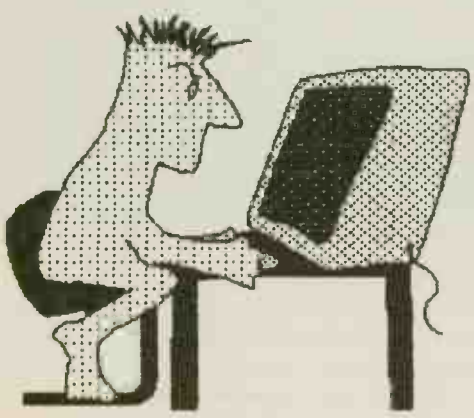
1) Drive units only, comprising two HMO210ZO and two TWO25MO **£150 + £10p&p UK**

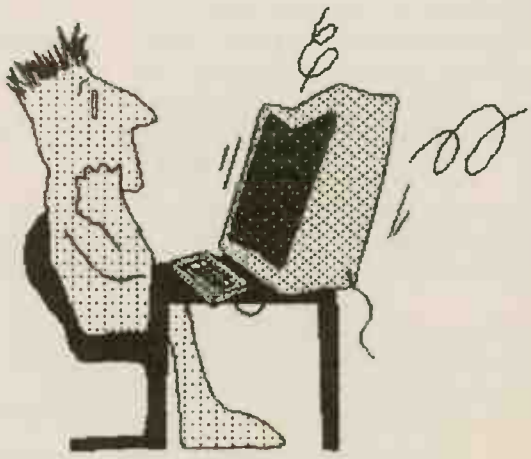
2) Drive units and hardware. Contents as above, plus Long Haired wool, bi-wire gold plated input terminals, crossover components, adjustable ports, silver plated wire and floor spikes **£220 + £10p&p UK**

SEE PAGE 77 FOR ORDER FORM

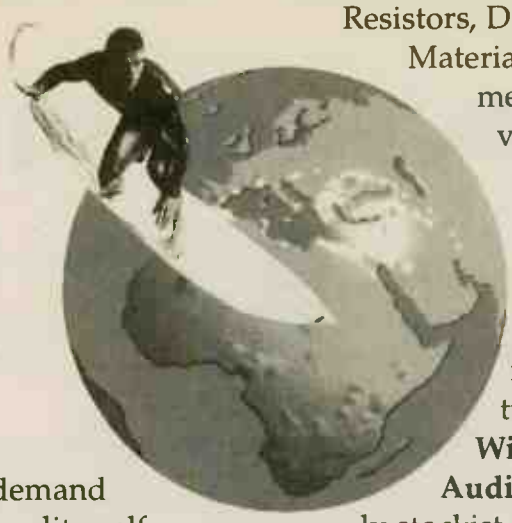
Everybody's gone surfing.....

Wilmslow Audio have decided to take the plunge and dive head first into the exciting world of computerisation and electronic mail. Yes, those two grumpy old fossils Terry and Shaun have thrown off their seventies flares, discarded their Gary Glitter EPs, and staggered into the nineties by hooking up to the Internet. Mind you I am not sure if Terry totally understands this new vehicle as upon hearing that they were to surf the net he rushed out and bought stacks of Beach Boy CDs and a pair of bermuda shorts !! **Wilmslow's** decision to get involved with the net was prompted by a number of factors, not least of which was that their export business is expanding at a great pace,





with orders and enquiries arriving daily from all corners of the globe. This week alone has seen numerous orders dispatched to places as far flung as America, Australia, Russia and Weston-super-Mare ! In fact demand for their high quality self assembly kits is so great in Russia that **Wilmslow Audio** have just appointed their own Russia agent, Vladimir Fichtchouk as the sole exclusive dealer for their products in the CIS (Community of Independent States) who will promote and stock all of **Wilmslow's** loudspeakers in both kit and fully finished forms. This is the first of many such appointments planned by **Wilmslow Audio** in order to broaden their sales base. They are currently negotiating with probable agents in America and Malaysia where demand for their products is growing rapidly, watch this space for future announcements on their progress. The demand for **Wilmslow's** vast range of high end products is growing all the time, yet a lot of customers still only identify **Wilmslow** with self assembly kits and are unaware of the incredible range of goods available. Their stocklist consists of Cables, Capacitors, Connectors, Inductors, Resistors, Damping Materials, not to mention the vast array of replacement drive units on offer from the worlds leading manufacturers.



Wilmslow Audio are currently stockist of drive units manufactured by:

One of the biggest advantages of the Internet to **Wilmslow Audio** will be the ability to show their catalogue to a world-wide audience. **Wilmslow** currently send out via the Post Office between 100- 200 free catalogues every week, which obviously is very time consuming, not to mention costly. In the future customers will be able to access this information without leaving the comfort of their own laptop !

Modern technology already plays a large part in the **Wilmslow Audio** set-up with their computerised crossover design service, production of technical drawings, catalogues and mail lists but the addition of the Internet and a web site can only enhance their already excellent service and pledge to their customers to provide **"Quality sound to rival the best."**

Everybody's gone surfing ...

So off they go, surfboard and keyboard in hand, ready to put their toes in the water and surf that net.
For more information regarding **Wilmslow Audio** or to receive your free catalogue. contact them at

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Feature

TWEAKING KLP1

Continuing our journey of discovery in the world of esoteric components, we take a listen to a tweaked-up version of our KLP1 line-level pre-amp.

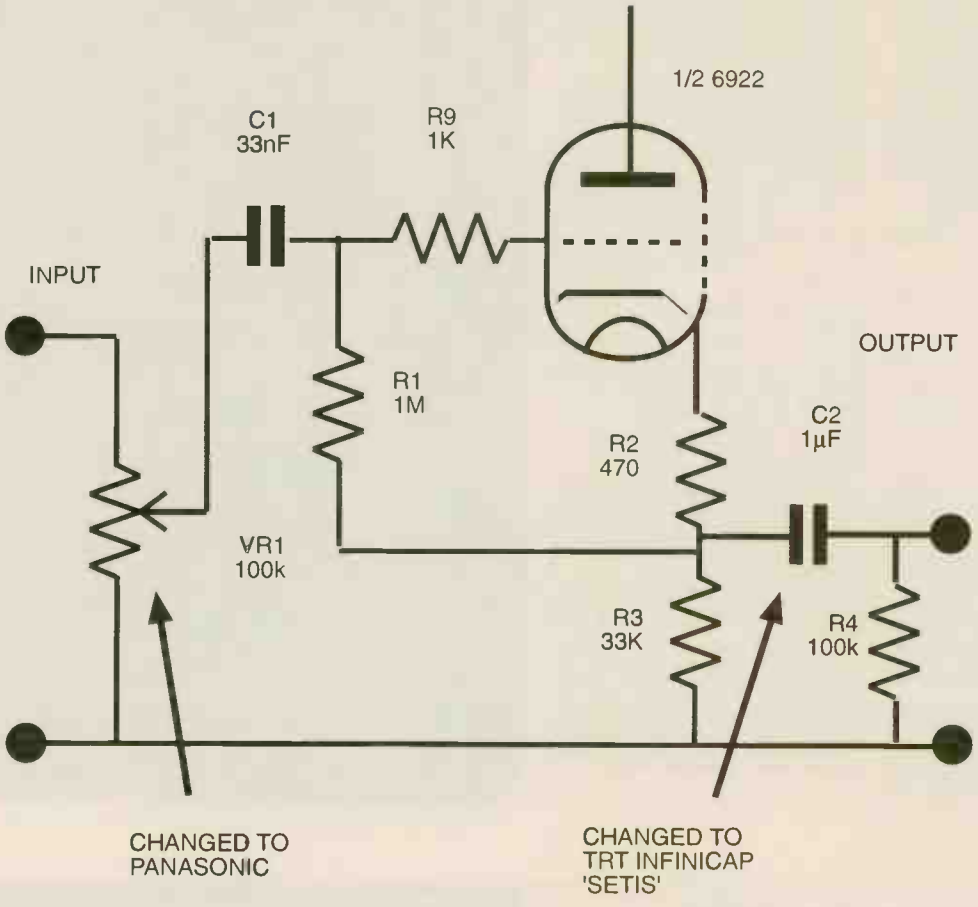
In our DIY supplement of February 1997 we reviewed the effect upon sound quality of various esoteric components. We chose a selection of high quality components to give our K588I MkII 20W Class A power amp. a bit of a treat. The results really were a bit of an ear-opener, with a couple of Black Gate capacitors from Japan and four paper-in-oil caps from Sweden transforming the amp's sound, producing a much more open, solid and realistic rendition. Impressed by this, we decided to track down some more components for souping up our KLP1 pre-amplifier.

KLP1 is basically a line drive stage, in that it has no voltage gain but can supply the current necessary for driving long runs of cable between pre and power amplifiers. It uses a simple but elegant cathode follower circuit to give a clean, clear sound.

With such a simple circuit, components have a large impact on sound quality. One component in particular is critical as far as pre-amplifiers go - the volume control (potentiometer). Most commercial pre-amplifiers fit cheap pots. that cost typically 20p-50p apiece. They have a characteristically hard, flat sound that lacks life and colour. At the other end of the scale are the no-holds-barred pots from companies like Penny and Giles, which can cost more than £200.

One alternative to the normal style of volume potentiometer is something called a switched attenuator. This uses a multi-pole rotary switch (usually of a minimum of 12 poles, like Maplin's FF73Q) with resistors soldered across its terminals. These work in a similar manner to standard pots, but don't have infinite resolution - i.e., they don't change volume smoothly but in discrete steps.

Even a stepped attenuator built from cheap carbon film resistors sounds better than a cheap pot., displaying a cleaner, more detailed and colourful sound. And for a cost of about £1.50 per channel, they won't break the bank. Of course, you don't have to stick with



carbon resistors that cost a few pennies or so each - Holco or Vishay resistors can also be used to construct a very high quality attenuator. We hope to bring you more information on attenuators in a forthcoming supplement.

Also having a large effect on sound quality are the output capacitors, in KLP1's case 1µF. In February, we got to grips with a number of capacitors, Hovland Musicaps, Jensen paper-in-oils and TRT Wondercaps. We got on well with the latter, and decided to try out some of their new SETI caps, so named for their single-ended triode amp sonic signature.

PANASONIC POTENTIOMETER (£64.30)

Before I'd even made it back to the sofa after slipping Magnificat's Europe, The Golden Age Vol 1, into the drawer of our Audiolab transport, the improvements were obvious. For a start, there was a much larger amount of subtle detail coming out of the Sextets, the acoustic of St Jude's On The Hill sounding a lot more solid and realistic.

The voices of individual choristers also became weightier and more substantial. This was because KLP1 was now painting from a broader tonal palette, this performance benefiting from greater colour and tonal resolution. This made the task of listening in on separate voices in the choir easier, and following the music was more enjoyable.

As the tracks rolled by, I found myself becoming increasingly aware of how much larger the sound stage and how much clearer the images were through the Panasonic pot. While the Alps Blue Velvet fitted as standard to KLP1 is an audiophile pot in its own right, presenting an open window for music to flow through, the Panasonic took the window and opened it even further.

Music was more relaxing to listen to because it had much more room to breathe, filling out and swelling into the room. Especially impressive was the extra stage depth the sound had, almost literally adding another dimension to music.

Coming back down to earth after the ethereal Magnificat, I indulged in a little Spice Girls. OK, the production on this CD might be more processed than your average cheese in a plastic tub, but the Panasonic was obviously still working, letting through detail its less expensive counterpart had either glossed over or missed. Percussion in particular showed greater insight, coming across as crisper, better focused and more incisive. Bass did similarly well, drum machine rhythms now heavier and more dynamic, sounding less 'sludgy' thanks to improved detailing. More of the funk and timing was also getting through, songs sounding catchier and more toe-tapping as a result.

Piano, whether Classical or Jazz, was a lot more convincing with the Panasonic in place, thanks to its ability

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The Riverside 4040 is our integrated amplifier. It features dual mono construction and has five line level inputs and both 4Ω and 8Ω outputs. The output stage is configured in the classic McIntosh connection, which gives stable, wide-band operation even with difficult loudspeaker loads. The stainless steel chassis and transformer cover are hand polished to a mirror finish, and come with a semi-matt black valve cover. 4xEL34, 4xECC83, 2xECC82. A full description, including circuit diagram, is given in the 4040 reference manual, £6.50. Kit £780, fully assembled £995.

Technical specification: dual mono construction, 40W/channel, 12Hz to 25kHz power bandwidth, distortion <0.1%, five line level inputs, tape output, 230/240V mains input.

Stereo amplifier circuit board : board only £49.50; component pack (including valve bases), add £63; populated board £125; full valve set, add £45. Power supply board : board only £20.50; component pack, add £44; populated board £66. Input board : board only £15.50; component pack, add £16; populated board £33.

The output transformers are configured for the McIntosh connection and have excellent low frequency response and a primary reflected impedance of 3800Ω. Full connection instructions provided. Price £70. The mains transformer is wound for dual mono construction, as this gives superior isolation between channels which sharpens imaging and eliminates inter-channel ground loops in the amplifier. Primary 0-230-240V. Secondaries 2x295V@0.25A (0.4A int.), 2x70V@30mA, 2x6.3V@5A. Price £60. Other primary voltages can be supplied to special order. Data sheets giving connection diagrams, specifications, as well as circuits for using each transformer, £2.50 each

The chassis, comprising main chassis and transformer cover, is hand polished, welded 1/16" stainless steel - NC machine tooled for a perfect fit and clean finish. Each kit also includes a mesh valve cover and baseplate, finished in semi matt black. Price £310. Also available in mild steel finished in black, £195. For those who wish to use one of these high quality chassis for their own projects, details of the chassis are given in the 4040 reference manual, £6.50.

Connector kit: twelve gold plated phono connectors, two sets of loudspeaker terminals, an IEC mains socket with integral fuse and switch, and an IEC mains lead with fitted 13A plug. £51.50. Cable kit: all cables required for the 4040, £6.

The Riverside P2 phono preamplifier is designed to partner the Riverside 4040 for those who enjoy the vinyl sound. Equalization is provided for moving magnet output to line level. The P2 features a high accuracy feedback RIAA equalization circuit, ensuring a natural tonality, a regulated high voltage supply per channel and cathode follower outputs. 3xECC83, 1xECC81, 2xECF80. Full details and circuit diagram in the P2 reference manual, £6.50. Kit £225, fully assembled £275.

Technical specification: 47kΩ input impedance, 1kΩ impedance output for driving long interconnects.

Stereo circuit board: board only £25; component pack, add £37.50; populated board £70; full valve set £20.

The mains transformer is wound for dual mono construction and is toroidal for low leakage flux. Primary 0-230-240V. Secondaries 2x295V@20mA, 2x6.3V@0.45A, 16V@1A. Price £30. Other primary voltages can be supplied to special order. These transformers are also suitable for power supplies in preamplifiers and other line level valve circuits - see data sheet for details, £ 2.50.

The chassis (main chassis and transformer cover) is made from mild steel. Each kit comes complete with a mesh valve cover and baseplate, finished in black. Price £110. For those who wish to use a high quality chassis for their own projects, details of the chassis are given in the P2 manual, £6.50.

Connector kit: four gold plated phono connectors, IEC mains socket with integral fuse and switch, and IEC mains lead with fitted 13 A plug, £15.

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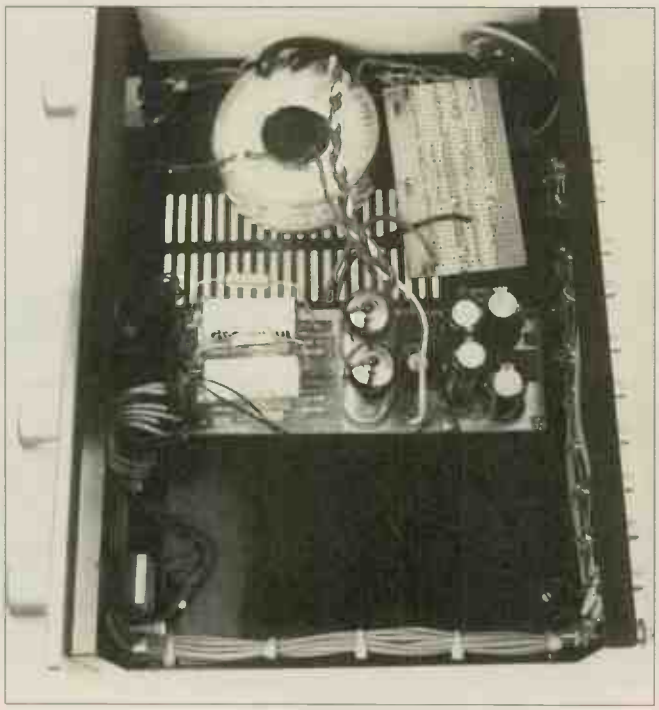
to resolve fine tonal gradations. Orchestral images were more clearly marked out as well, and more substantial than they had been through the Alps. Instead of images being slightly two-dimensional, like cut-outs glued onto a background, they were more strongly three-dimensional in character and set in a larger sound stage.

TRT INFINICAP SETI, 1µF 425V (£16 each)

TRT supply some hints on using the SETIs. One of these is that the capacitor's body shouldn't be mounted against a PCB but should be about a quarter-inch in the air. They also recommend that the left side of the printed label be considered the + end and take the incoming signal. As you can see from the picture, we adhered to both of these hints. Each SETI comes with a small 0.01µF film-&-foil bypass capacitor, which costs an additional £9. I listened to this composite arrangement of two caps.



Early impressions of the SETIs suggested they had struck pay dirt in a manner similar to the Panasonic potentiometer - basically, more of everything.

Tapping toes to the rhythmic strains of Dave Brubeck's Time Out CD I homed in on the immortal 'Take 5', which is a particularly telling track as far as sound staging is concerned. The piano which normally sits out at stage right images flatter through the standard KLP1 - it's as though you can hear around the image, but the image itself is thin. With the SETIs in place, the piano became truly three-dimensional, finishing off the process the Panasonic pot had started. It also had a rich resonance to it, vibrant and closer in colour to a real piano.

Saxophone was depicted with the same colour and smoothness, all the inflections in the playing completing their journey from the CD to my eardrums. The cymbals which run throughout this number can quite often sound slightly monotonal and splashy - these traits disappeared totally with the SETIs, cymbals sounding clean, natural and very well defined, as well as packing a surprising dynamic punch.

It was that sax which held my attention though. It had a rich, dark reedy texture that was almost impossible not to be drawn in by. Apparently these caps were named SETI because they have a sonic signature similar to that of a good single-ended triode amp, and on the basis of that sax, this is actually no idle marketing boast.

While the Spice Girls are probably not every valve-head's idea of a good listen, after a bit of the SETI treatment they certainly merit a bit more attention. The Wondercaps helped tighten up the bass, adding speed and 'oomph'. This didn't amount to the almost steroid-loaded bass of the paper-in-oil caps in our February supplement - they went lower and sounded faster and more impressive.

Instead the SETIs were enticingly smooth but very well controlled in the lower registers. And they had a midrange clarity that produced a surprising additional breadth to vocals, especially on harmonies, which opened right up.

Lest you get the impression that the SETIs are capacitor perfection unalloyed, one drawback was a very slight hardness across the top of the midrange, although this was more obvious on certain kinds of music, Oumou Sangare's Moussolou, for instance, where plucked strings and vocals were slightly harder than normal.

The real acid test is, as ever, orchestral strings. A recording of Mahler's Traume for violin and orchestra lacked a little of its customary sweetness, solo violin not quite as smooth as I've heard it before. It sounded slightly 'loud', a characteristic upshot of midrange hardness. While this wasn't a big problem, I had been hoping for something slightly closer to the supremely smooth and relaxed presentation of a really good single-ended triode amp. In spite of this, the SETIs sounded very different from the foil and film polypropylenes we listened to in the February supplement, lacking their upper midrange glassiness and possessing a more truly transparent, colourful timbral range.

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ELECTRONICS MADE SIMPLE

By Ian Sinclair

Reviewed by Noel Keywood.

Can he do it? Write a book on electronics that makes the subject simple to understand? If so, then there's no shortage of demand I'd say, from the volume of requests we get for such a book. But such books are rare nowadays. There are some difficulties. Experts tend to lapse into familiar jargon and confuse readers by failing to explain the prior knowledge and assumptions their explanations are based upon. Novices understand what needs to be explained, but can make a dog's dinner out of doing so. The question is, where does author Ian Sinclair stand between these poles?

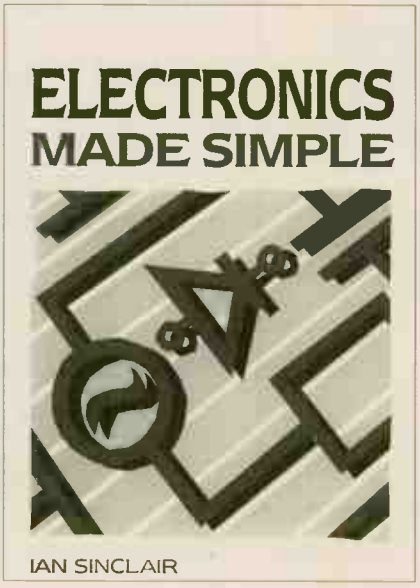
Basic electronic theory is fascinating, but it isn't easily simplified without running into descriptions of arguable accuracy. I started off in my teens reading water analogies to describe the flow of electricity, but they've since fallen from favour, which is a pity.

In the first chapters of this book, concerned with basics, we hear about "waves of current" and "waves of voltage", and the fact that current is 90 degrees out of phase with voltage.

"Waves of voltage" seems an unfortunate way of describing electromotive force. This is where I prefer the water analogy of applied pressure driving a current - think of it as the pressure needed to drive a water current. And then there's the delightful analogy of waves at sea, an example that clearly illustrates how wave movement can be divorced from water movement - an important distinction. Such matters are not covered in Electronics Made Simple, which is a shame.

You cannot say much of use with regard to capacitors without raising the issue of phase. And, quite simply, this soon becomes a difficult topic beyond the full and fluent comprehension of many engineers. On this topic I've always admired M. G. Scroggie's exact explanations.

Current flow into a capacitor is a function of the rate of change of voltage applied to the capacitor. Starting offrom this point we can easily understand, using everyday logic, the apparently peculiar conclusion that charge current into a capacitor is greatest when voltage is zero. Such explanations are missing from this book. It skims through basic theory at a high rate, having dispensed with component behaviour by the end of Chapter Two (of thirteen). We do get an explanation of preferred values and other often confusing issues, like diode polarity, but even the diode diagram lacks +ve and -ve symbols.



One reason basic theory has been given limited attention is because the author seeks to cover a lot of ground - what the book gains in ease of comprehension it loses in thoroughness. Negative feedback works "provided the phase of the feedback signal remains at 180 degrees" we are told. This isn't a very useful definition because at spectrum extremes circuit reactance will cause the output to change phase progressively relative to the input, and feedback remains negative providing the output is more than 90 degrees out of phase with the input.

What is lost in detail though is made up for in breadth of coverage. There is a small chapter on block and circuit diagrams, not a topic commonly given special treatment. It's a pity that the 1930s' layout diagram shown is dismissed quickly as "useful only if you are using components that correspond to the shapes shown".

This sort of diagramming is explicit and extremely valuable, being demanded by DIY novices. It requires a lot of drawing work and computer drawing packages aren't so much help here, which is why such diagrams have virtually fallen out of use.

Basic circuit theory is left behind at the end of Chapter Five, with a few circuit symbols as a parting gesture. The book then moves on to How a Radio Works and continues with Disc and Tape Recording as well as TV and Radar. Digital signals are introduced in Chapter Nine, together with conversion processes to and from analogue.

The delights of AND/OR gates and logic circuits come next. Here the book moves back into basic theory, albeit the world of digital this time. I fancy that Ian Sinclair is happier with digital signals, because the coverage is good enough to get a novice started. I remembered a comment made to me recently by Ken Ishiwata: "You can teach an analogue engineer digital, but you cannot teach a digital engineer analogue".

This book does a good enough job with digital, moving on to cover Counting and Correcting, where there's useful detail. Then there come Microprocessors, Calculators and Computers. If, like us at Hi-Fi World, you too often come up against the shenanigans of the Memory Heap, the problems of the PRAM and crashing caused by dodgy Directories, then you may well find this book useful in its explanations of basics.

The final chapter quickly covers the oscilloscope, modem and Compact Disc players.

Electronics Made Simple is something of a mixed bag. It offers a quick introduction to a wide range of subjects and breadth is its strength. And while its presentation of analogue electronics may not be perfect, its £13 price looks like good value next to other pricier alternatives.

Electronics Made Simple

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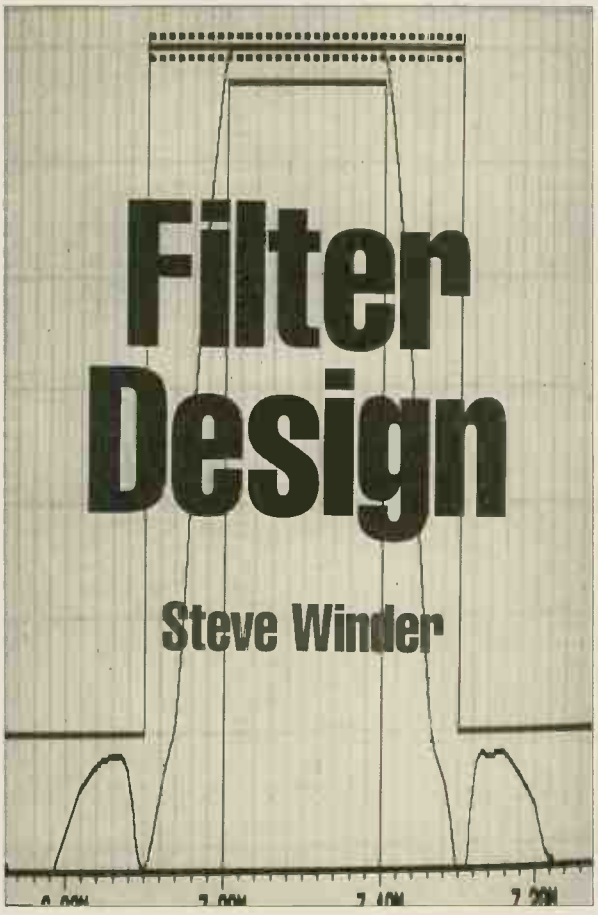
FILTER DESIGN

by Steve Winder

Reviewed by Noel Keywood.

Filters are a perplexing subject, one that faces every DIYer. I was arguing last night about the darn things, over a pint or two. The discussion was about the phase characteristics of the various alignments and their impact upon loudspeaker crossover design. I bet that rings a bell with a lot of you, and doubtless you might be hoping that 'Filter Design' by Steve Winder is your salvation.



Unfortunately, it isn't. It says nothing about the problems of handling power, which in turn affects DC resistance, which alters electrical damping. Nor does it say anything about trying to make sense out of filters when the load is all over the place, rather than being a normalised resistor. Which is to start to put this book into context.

As author Steve Winder would immediately protest, I'm sure, Filter Design is not meant to cover such applications, even though Butterworth, Chebyshev, Linkwitz-Reilly (not mentioned in this book), et al., get a very comprehensive airing in the loudspeaker field.

No, Filter Design is strictly for electrical engineers who work with defined sources, defined loads and what have you. It is meant for those very fluent with maths, since there are plenty of sinh and cosh functions to cope with. There's not a single diagram to elucidate the pass-band shapes of Chebyshev, Butterworth and other such filters. This is a dry book, very much intended for those who want the theory more than anything else. It is really for engineers who already have a good grasp of filter theory but want to take the subject further.

A chapter on poles, zeroes and network theory brings in some useful and potentially powerful concepts related to understanding the convolution of impulses from one domain to the other, under the influence of various filters. I'm not sure the explanations are the most accessible I've ever seen and I have to say that this book is likely to be a bit abstruse even to practising amplifier designers, at least the ones I have met. Winder gives normalisations and scaling factors, popular for fast filter design work, if made less accessible than in the Active Filter Cookbook, to take an example.

Where Winder's book scores is in its coverage of more complex filter types, but where it fails again is in its absence of pass-band diagrams. There are some fascinating animals to be found, such as the first order all-pass mentioned in a chapter on all-pass filters for phase shifting work and more sophisticated variants of it. I'm reminded of the time I wanted to design an MPX filter and ended up making a constant-K m-derived type from a lab handbook, which gave great results. Which is to say that you never know when you might want to design a weird filter. When such impulses arise, if you'll pardon the pun, then this book may well prove invaluable. But I have to note that it is more concerned with theory than practice and, alas, it doesn't hold easily understood magic solutions for audio DIYers. Professional engineers are the target market.

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D.I.Y. Letters

THE ELUSIVE KT61

I have a Leak TL10 amp with KT61 output stage. The KT61s are long gone and I've never seen mention of them in Hi-Fi World or anywhere else current come to that. Consequently, I would like to know where they can be obtained, if there is a direct equivalent or if it is feasible to substitute KT66s (which I have) with an adjustment of cathode bias resistor. What should the new bias value be set to?

I am also currently building a valve pre-amp based on a shunt regulated push-pull circuit published a while ago in Elektor magazine (see attached circuit diagram). I was interested to see your SRPP mod to the K5881 amp and your comment that the Japanese swear by this configuration. Why is it so little used or mentioned in the UK when it seems to have many worthy attributes?

As it stands, the circuit has a gain of 66dB which should be enough for a high output cartridge with a sensitive power amp input. Given your comments on the superiority of the ECC82/6922 and 6SN7/6SL7 valves over ECC81, 2 and 3, I would like to substitute these where appropriate in this SRPP circuit. Which valve combination do you think would give the best noise performance and sound quality? How do I calculate the new operating conditions and component values?

Finally, what about a design for a solid-state, sine wave power supply for Garrard and Thorens decks (or would that be treading on too many toes?) and a valve-based electronic crossover.

Matt Rowland
Plumstead,
London.

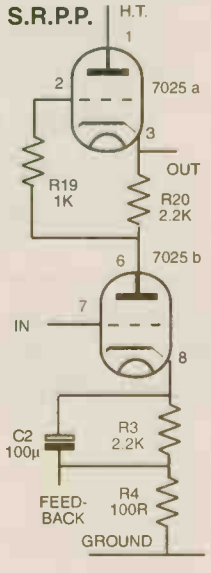
The KT61 is a unique valve. It has very high sensitivity which makes the driver circuitry easier to design. Replacing it with another valve will effect the amp's sound - the KT66 is a much larger valve and it has very different characteristics.

I think that you may be able to get some KT61s from either PM Components or Billington Export, both of which advertise in the supplement. The EL33 is an equivalent, but again your amp will sound different.

The SRPP is a handy circuit, and it's used in quite a lot of Japanese designs because of its advantages. If the output is taken from the cathode of the upper valve then you get a lower output impedance because it works part way towards being a cathode follower. Also, the active load part can be made to present a very high impedance to the lower section, especially in the so-called mu follower which is a development of the SRPP.

I think that SRPP isn't used by many British manufacturers because, quite frankly, a lot of them don't know what it is! The circuit is used by some UK companies such as Woodside and Audio Innovations.

Generally you can easily



substitute a 6SN7 for an ECC82 with little or no modification, and a 6SL7 can be used in place of an ECC83, but has lower gain. These valves are 6.3V-only heaters and have octal bases so you can't just plug them in. It goes without saying that the 6SN7 and 6SL7 would benefit from having the circuit optimised for them.

Another great sub for the ECC83 is the 5751. It's pin compatible and sounds great, although the gain is slightly lower.

You will probably find that the time constants for the RIAA EQ in the pre-amp rely partly on the impedances of the valves present, so it may not be possible to make any substitutions. I would recommend that you build the circuit as it is and then try fiddling with it! **AG**

Checking with PM Components (01474 560521) revealed the fact that they do indeed have some GEC KT61s at £37.50 per matched pair. There aren't too many in stock though, so it might be a good idea to lay your hands on a set fairly swiftly.

If you can't get the KT61s, then as you say, EL33s are a near equivalent. Another valve worth checking, according to Billington Export, is Mazda's 6P25, which cost £14.25 each plus VAT. This is another near equivalent. Happy hunting! **JM**

FUN

It is great fun to read about tube amplification in your magazine. I am one of the tube converts, having constructed a zero-feedback power amplifier based on a pair of EL34s in triode mode, along with several line stages. The result: it's a pity that I had to be forty years old before I discovered how much superior this technique is.

May I add something? I wish to comment on your advice to Mr Phil Tolcher from Southampton, in the October issue.

I constructed a line level pre-amp as well, which also uses an ECC82, fronted by an SRPP stage (from Glass Audio), followed by the usual

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MARK LEVINSON

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amplifying stage, first in a cathode follower topology and then with both halves of the double triode in parallel. The last sounded best.

Your statement in the April 1995 issue that the 6SN7 is superior to the ECC82 encouraged me to make some swaps. The reasons you mentioned were also given in several articles in Glass Audio.

I swapped the ECC82 for a 12SX7GT, which is about the same valve as the 12SN7, which is the same as the 6SN7, apart from the heater tension. I obtained these tubes in Holland for less than £2. The brand is RCA and the sockets of the tube tell me they date from March 1939 to October 1948.

I chose to heat these tubes with AC. Because my transformer delivered 6.3 volts, I bought a simple PCB-mounting transformer with two 6 volt windings and one 2 volt winding, which gives AC voltages between 4 and 14 volts. I use the two 6 volt windings in series, with a high wattage drop resistor, to obtain 12.4 volts AC. Both sides are connected by a 470ohm resistor to ground. This works fine, is simple to construct, if space allows, and works absolutely hum-free.

This solution has allowed me to discover that both your magazine and Glass Audio are correct. This tube does sound better in every way. As far as your remark that the number of brands is limited, I would say: fine for me! As long as RCA tubes are available for silly prices, one can easily stock up as I did. So I can only encourage Mr Tolcher to swap in old 12SN7 tubes and heat them with 12.6 volts AC. He will be amazed! I plan to swap the ECC82 which works as a cathode phase splitter in my power amplifier for a 6SN7 in the same configuration. Then I can use higher voltages, and - importantly - more current.

Another tip for Mr Tolcher. Get rid of those electrolytic capacitors in the high tension supply of your amp. Just use very little capacity in polypropylene. I used two 47uF from Solen with a choke between, and just 15uF in the driver stage. The difference is even bigger than swapping to a 6SN7.

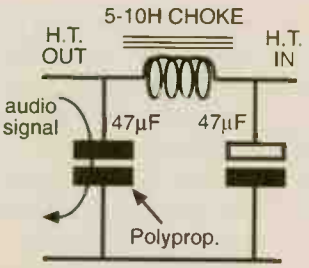
Finally, can you give me the address of a reputable firm, preferably in the South of England, which can align my tuner? I have already replaced the valves, the coupling caps, the AC cable, the output cables, and a few electrolytic capacitors and three resistors, which were out of tolerance. A good sounding tuner is getting better! DC voltages are spot-on throughout.

Jan Willem van Wijngaarden
Utrecht,
Holland.

The π filter commonly found in valve amp power supplies offers good suppression of hum, pulses the transformer lightly when re-charging and, when a 5-10H choke is used, can be configured with 47μF capacitors. Then you have the option of choosing higher quality electrolytics, or film capacitors like polyprops. The one on the amplifier side effectively holds the H.T. rail to ground with respect to a.c., carrying output signal current. It has a crucial role and affects sound quality significantly. We suggest you make it polypropylene or possibly a special electrolytic like an Elna Cerafine.

Or you could make the amp side a polyprop. and the power supply side an electrolytic. You might also experiment with decreasing the input capacitor, since this moves the supply toward a 'choke-input' type in topology, which has a very smooth current draw.

Graham Tricker of GT Audio is the man to speak to about tuners. Tel: 01895-833099. **NK**



PENTODE PASSION

I have been wondering about the performance of EL34s connected as pentodes for some time. After reading your article about the K5881 amplifier it seemed a good idea to do something about it.

The EL34s live in a Mullard 5-20 amplifier with a solid-state power supply and they are strapped as triodes with a 100ohm resistor. The HT supply is 426V and the output transformer impedance is 7000ohm.

Mullard's excellent amplifier book gives performance curves for EL34s strapped as triodes and in ultra-linear mode but not for pentode operation. Please could you fill the gap and let me know if it is possible to use the EL34 connected under the above conditions and what the grid and cathode resistors should be.

When I built the power amp I had to construct a pre-amp to go with it and decided on a passive amp incorporating an RIAA module based on a simplified version of your circuit of April/May 1994.

My next project is to include a unity gain line driver for all inputs so I can move the power amp nearer to the 'speakers and out of the way of my cat.

A. Proctor
Scunthorpe.

If your amp is a Mullard 5-20 type then the output stage should be ultra-linear. You can easily experiment by moving the screen grid connection from the transformer tap (ultra-linear) to the HT (pentode operation) and to each valve's respective anode (triode operation) to see what happens. Keep the 100ohm resistors between the screens and whatever you connect them to.

Don't sine-wave test the amp at full power in pentode mode - the screen grid may dissipate a lot of power and fail. Music, however, should be OK. **AG**

Because degenerative feedback (triode operation) gives more linear behaviour and lower generator impedance, it is usually compared to circuit feedback, as provided by ultra-linear connection. Going to pentode mode will give more gain, but also more distortion, usually with strong odd-order components I find from experience. The debate that raged for so long was whether it was best to use pentodes for gain, and then linearise the shebang with loop feedback, or to use the humble triode and not bother. As feedback became better understood, after the war, circuits became increasingly complex and, I suspect, engineers wanted to believe they were better for

it. So we ended up with pentode output stages and looped feedback. If you remove the feedback, as I have done when experimenting with pentodes, they are unpleasantly non-linear.

Funnily enough, I know two valve engineers who prefer the sound odd-order distortion brings to a valve amp. It does not add roughness or coarseness, but it sharpens the sound up, until it becomes glassy hard (6-10% or so).

All of which is to say that you may well prefer the sound of pentodes unleashed, or you may not, but I can assure you that triode and/or ultra-linear operation is most truthful. **NK**

LONG TAILS

I was interested to read about the improvements to your K5881 amplifier. I would like to make some non-critical observations on these modifications based on my own experience with SRPP stages, as my company has been using SRPP stages in our pre-amplifiers for over ten years.

I suspect that one of the main contributors to your improvement is, in fact, the effect of the new stage on the long tailed pair phase inverter. This well known phase inverter suffers from a problem with an output imbalance at high frequencies. This is due to the Miller effect feedback rolling off the bandwidth of the first stage which is operating in a common cathode mode but not affecting the grounded grid second stage which has a much wider bandwidth.

Dr. A. R. Bailey published an article in Wireless World, September 1962, on this problem. In the article, Dr. Bailey proposed a modified version of the long tailed pair using a triode/pentode valve with the pentode as the first stage of the phase inverter. Radford Audio used this system in all their power amplifiers from that time onwards.

When Woodside first produced amplifiers under the Radford name, we continued to use this system but we were finding large sonic differences between batches of valves, so we decided to find an alternative.

The other way to reduce the Miller effect was to drive the phase inverter from a low impedance source. We experimented with DC coupled cathode followers between the first stage and the phase inverter. This worked OK but was rather untidy. Then we realised that we had the answer in our pre-amplifier designs with the SRPP stage.

This stage has a very low source impedance due to the extremely high internal negative feedback around the upper triode section. On open loop measurements with this system we found that we were achieving a very similar wide bandwidth balance to that achieved with the Bailey phase inverter.

I have not had the opportunity to measure the open loop response of your amplifier in its two different guises but as I said at the beginning of this letter, I think that this phenomenon could be a contributing factor to your sonic improvements.

I hope that these observations may be of interest to you and your readers.

John Widgery
Woodside Sound Engineering,
Whitland,
Wales.

New Phase-Splitter

By A. R. BAILEY*, M.Sc.(Eng.), A.M.I.E.E.

* Bradford Institute of Technology.

This, I believe, is correct. The cathode coupled phase splitter is a two-stage device. The first section has its grid driven by the input stage while the second section is driven by the cathode of the first.

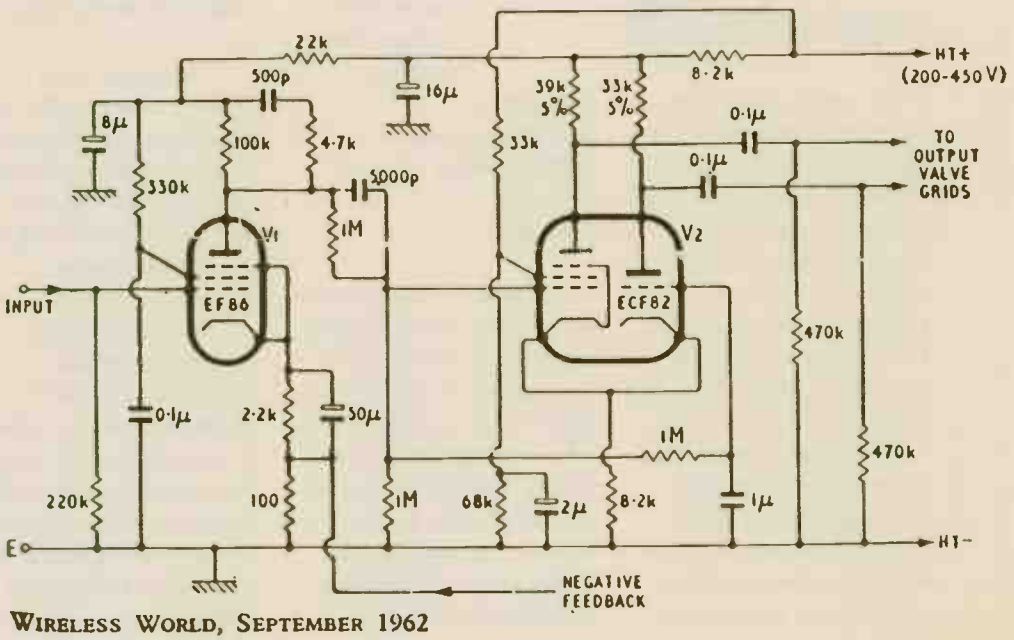
The ECC83 has quite a low grid-to-anode capacitance but its gain is high, so the Miller effect amplifies this capacitance, loading down the output of the input stage at high frequencies. The first and second sections of the phase splitter are coupled together so the roll-off effect should affect both sections together - otherwise, the HF distortion of the amp would rise disproportionately, which it doesn't (the distortion does rise because of the falling open loop gain though).

If either the Miller effect could be reduced or the output impedance of the driver stage lowered, then this problem could be alleviated. Using a pentode for the first section of the phase splitter works. Or using cascodes for the two sections also eliminates the Miller effect.

The SRPP drives the Miller capacitance and thereby improves the HF distortion and stability, which probably accounts for the sonic improvements. **AG**

SCRAPPING GARRARDS

Reading your excellent magazine has brought me some consternation over the now-exalted status of the Garrard 301/401 turntables. I say consternation because, as the Plant & Equipment officer for a large Govt department, I authorized the scrapping of literally dozens of them. To make amends I have now



WIRELESS WORLD, SEPTEMBER 1962

rescued one (purchase price fifty pounds) along with an SME 3012 arm and two Goldring cartridges. I will restore the unit but am having considerable trouble designing a suitable plinth. Available information merely suggests it should be as heavy as possible but finer points, such as coupling the plinth and motor unit to its best advantage, isolating the tonearm and attempting to route vibration where they will do least harm is unavailable.

My current thoughts centre around an elegant wooden surround and a bag of concrete. I would also like to use a 'historical' cartridge which is nevertheless capable of modern standards of reproduction or as close to as possible. In short, although rebuilding an old turntable, I'd like it to sound as good as my Heybrook TT2 with matching Heybrook arm (the one made by Alphason) and van Den Hul modified Grado cartridge - no doubt a tall order!

Any suggestions, or better still, a design as a DIY project?

Hal Littlewood
Queensland,
Australia.

Garrards gone to scrap? My heart bleeds! Oh well, at least you've managed to save one from potential oblivion. As you say, the best plinth for a Garrard is a heavy one, although there are several ways to go about this.

One, suggested by Haden Boardman of Audio Classics (01942 257525) is to use a large piece of thick MDF to mount the motor unit and arm on. The MDF then sits on an open Target wall shelf. Apparently, the Garrard motor transmits most of its vibration in a horizontal plane, so minimising this can mean opting for a plinth which is wide but relatively thin. The only problem with this line of attack is that all the electrical innards dangle out in the open, ready to fry anyone unaware of the fact that they are carrying 240V mains.

A more standard plinth would be something similar to what you suggest with a wooden surround and a bag of concrete. If you could cast your own plinth from concrete. leaving the smallest possible airspaces inside the plinth itself (to reduce the chance of motor vibrations setting air pockets resonating), you'd probably be quite close to the ideal plinth.

Mounting the tonearm on a separate arm board would not only give you a certain flexibility in terms of which arms you might choose to fit but also help isolate the arm. The armboard could either be bolted to the plinth using serrated washers or mounted on something like RMS Carbon Fibre Isolators (£12 for three from Audiophile International). Experimentation, as always, is the way to go.

Unfortunately, most 'historical' cartridges had a habit of gouging their way through record collections at a fairly alarming rate of knots. Shures have always been renowned for not doing this, and their M75, M95 and V15 are pretty good, although most budget modern cartridges will still sound better. **JM**

The Garrard 401 has a large squirrel cage motor, seen at left here, suspended by springs. This turntable needs a solid plinth.

INTERCONNECTED

In the exotic world of expensive, esoteric interconnects, there seems to be a black sheep! The hi-fi magazines pay religious attention to the merits/demerits of cables that join CD players to amplifiers, but little mention, if any, is given to the connection of CD Transport to outboard DAC. These components are tested in reviews with no reference to this vital link that has a massive affect on the sound.

Some manufacturers of CD separates e.g. Teac, do not supply a connecting cable with their own CD transport/DAC combinations - their T1/D-T1 for example, that I own. The other conundrum that faces the prospective purchaser of a CD transport/DAC connector is the ubiquitous optical link.

The optical connection has been rubbished unanimously by the Hi-Fi press who all appear to favour the co-axial connection. Fighting against this tide is Kimber/Russ Andrews who states in his catalogue that the optical connection should be used - with Kimber fibre-optic cable - in preference to any coaxial connection. Could you please shed some light on this, and recommend a good connection between the above combination.

Roger Staton
Burntwood,
Staffs.

Writing about cables has become, for people like me, a high-risk activity. I tend to receive a lot of hate e-mail from the 'no cable can possibly sound different to any other' school the minute I stick my head over the parapet. So far as digital connectors go, by and large, I'm one of that school.

But. Mostly, a good shielded 75Ω cable (like aerial down-lead, preferably the type with a closely woven outer screening braid) works pretty well. I also use Audioquest Video Z, though my preferred cable is one filched from a professional video company. They need 75Ω co-ax cable which will carry MHz signals well beyond the audio band, and it does seem to make a noticeable improvement, though theoretically it shouldn't. Because electrical connection avoids the use of optical transmitters and receivers, it is preferred by theorists. It cannot isolate earths, however, the benefit of optical cabling.

As for optical, the technical advantages should

make it ideal. After all, the signal is light, not an electrical one (in common parlance, that is), so not subject to any dirtying by electro-magnetic interference and transit jitter. Unfortunately, subjectively it seldom performs as satisfactorily, nearly always sounding somehow less lively and dynamically weaker. Suspicion falls upon the optical transmitters and receivers used, of which there are two types: cheap and expensive. Needless to say, it is the cheap ones used in most hi-fi, especially from the East, and they sound mellifluous, a bit like the free interconnect you get with much hi-fi. I expect my hair to gain another parting as I stick my head over the sandbags.

A great many claims are made for a great many cables. They should, on the whole, be treated with the same scepticism as those made for ostrich farming or Albanian savings banks. If a cable has a 'massive' effect on the sound, then the most likely explanation is that a combination of its impedance and capacitance is in fact acting as a tone control or filter. It ought not to.

Pick a figure beyond which you do not want to go and be aware you may not find any difference between a digital interconnect for a tenner and one for two hundred. If you firmly believe, on hearing one of the latter, that it's better, well, you'll feel satisfied, and who can argue with that. Or vice versa, of course, except the one who's dissatisfied will be the dealer or manufacturer who thereby loses a sizeable mark-up. Remember, the customer is always right and the dealer and manufacturer are out to make a profit. Thus, EB, who is not now likely to receive any free samples of pricey cables. **EB**

If you fancy trying your hand at a little DIY digital cable construction, Maplin sell Low Loss Satellite Cable which should work well. Type CT125, order code XS46A, uses a solid copper conductor, separated by a 5-celled polyethylene insulator from the double shielding provided by a copper/mylar foil and copper braiding. And at 94p/m, it won't break the bank either. Maplin also do gold-plated phono plugs suitable for thick cables (7.8mm diameter in CT125's case) - order code JU08J and JU09K, with red and white identification bands respectively. **JM**

Low Loss Satellite Cable CT125

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Nominal impedance:	75Ω
Attenuation per 100m:	4.9dB at 100MHz
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Order Code		Type	Price each
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PB59P	E10	LL Sat Cable 100m	£52.99

SOURCE: MAPLIN CATALOGUE

GETTING IMPEDANCE TAPED

I have a very "puritan" amplifier set-up, comprising a passive pre-amp with four inputs and a series stepped attenuator volume control (the attenuator supplied as a kit by The Parts Connection in Canada). This feeds your K5881 (original design). I deliberately avoided a tape monitor connection as I thought this would introduce at least one extra switch in the signal path. Instead, whenever I want to make a recording, I climb behind the stereo, work out which lead I have to connect to the tape input and swap everything round. All very hi-fi, but not particularly convenient.

Having relented due to the almost total lack of vinyl in my area, I have recently bought a CD player and I need to modify the pre-amp to fit an extra line-in. While I am doing this, I thought I would also fit a tape monitor.

Being a mere mechanical engineer I will risk ridicule and ask what is possibly a naive question: I am not sure exactly how I should arrange a tape monitor connection in a passive pre-amp. If the input from (say) the CD player is connected to both the tape line-in and the power amp input, will the combined input impedance be too low and affect the CD player output stage?

If the input impedance is not relevant, presumably all I have to do is permanently connect the pre-amp outlet to the tape line-in. I would of course need to isolate the tape line-in when playing tapes, to avoid a feedback loop.

In case it is relevant, the other components in my system are a Rega Planar 3 with Ortofon MC10 super, a Creek CAS4140(?) tuner, a kit (solid state) phono pre-amp, a Sony Walkman-Pro cassette recorder and a pair of home-made, floor-standing transmission line 'speakers.
John Strachan
Cambridge.

Your electrical engineering seems fine to me. K5881 had a very high input impedance of 100k so it can easily be paralleled with a tape input, since if the tape input has low impedance K5881 has relatively little influence. CD outputs invariably comprise op. amp line drive stages which can drive down to 100Ω or less. Such a stage will have no trouble driving down to 1kΩ, usually taken as a low load. So you will not have a problem here.**NK**

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