fifteen-bit valve performance

Richard Brice modifies a pair of Leak TL25 Plus valve amplifiers

Two Leak TL25 Plus monoblock valve power amplifiers have been languishing in an upstairs cupboard in my home since they were retired from the hi-fi system several years ago. Recently, I thought I would try them as monitoring amplifiers in the small recording facility which we have built up and expanded since I started getting work as a record producer. The studio is MIDI based, which means a lot of the music goes straight onto the digital master tape and we get really clean recordings with very low levels of distortion and noise. Obviously any monitoring system must match the level of performance from the recording equipment.

I dusted off the TL25's, plugged them in, fed Compact Disc and Digital Audio Tape sources to them via a passive preamp. and waited for that valve sound to wash over me. I was horrified! One channel hummed loudly; that was easily cured, one of the output tubes had gone soft. But the noise level wasn't hiss, it was the sound of tearing calico! I checked all the voltages to see if any of the D.C. blocking capacitors needed replacing. They didn't.

Rather than put them back in the cupboard, I decided to see if anything could be done to this thirty-year-old design to improve matters. The modifications I came up with may be of interest to anyone owning an old Leak amplifier. The electrical work is very simple and the main design change can easily be undone to allow comparisons.

Modification

Part of the problem with the TL25 Plus is its high input sensitivity. It is not ideally partnered by most modern pre-amplifiers. It is both noisy itself and will exaggerate any noise on the input signal. Attenuating the input is a cludge since you then amplify the noise in the attenuator as well!

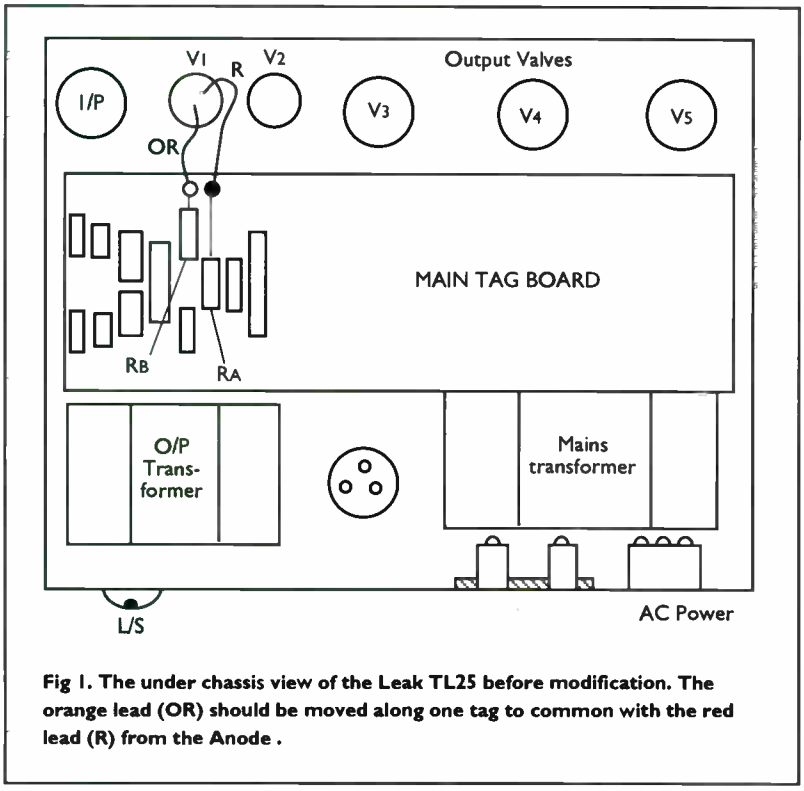


Fig 1. The under chassis view of the Leak TL25 before modification. The orange lead (OR) should be moved along one tag to common with the red lead (R) from the Anode .

The inherent noise of any tube power amplifier is primarily generated by the first valve stage, in this case, the EF86 pentode and its anode load and screen feed resistors. The TL25's were designed using cheap and nasty carbon composition types for these critical components, so the first job was to replace R_A and R_B (Fig.1) with 1/4W metal film types. The low-noise resistors improved matters but the sensitivity was still too high. Pentode valves, like the EF86, have high gain but are much noisier than triodes. Fortunately any pentode may be operated as a triode by connecting the screen grid to the anode and by happy coincidence what was needed was less noise and more gain. That is what is shown in Fig 2b where the input valve is shown changed to operate as a triode.

Buying new output valves as matched pairs, a service offered by good retailers, improved matters further by reducing hum.

Sound Quality

The audible benefit of the modification is obvious. Listening to our DAT master tapes and Classical CDs, I can hear the hiss from the microphone pre-amps before the music starts. The signal comes, as it were, 'out of silence'. This is essential for a monitoring amp. in order to judge where to edit track beginnings and ends. Hum could still be lessened. A good performance can only be secured by careful matching of output valves and I worry what effect valve ageing might have. I feel Leak cut corners on the power supply design for this amplifier; the High Tension line is smoothed with an RC network rather than the 'Rolls Royce' solution of a large and expensive smoothing choke - and it shows! However, the amplifier is linear and being a Class A design the power supply unit noise shouldn't be modulated by the music signal, as happens on a poorly designed Class AB transistor amplifier.

The audible implications of the raised output impedance that results from the conversion of the first valve from pentode to triode will depend on the design of the loudspeakers being driven. It's difficult to generalize, but as a rule any loudspeaker with a tendency to bass overhang will not be improved by driving it from a valve amplifier. Fortunately our nearfield monitors are reasonably bright so the TL25's may just warm them up a bit. In every other respect the sound quality is unchanged or improved by the modification.

Conclusion

Modified, the Leaks are 'digital compatible', turning in a measured 15 bit noise performance, level frequency response, good reactive load

handling and low harmonic distortion. The loudspeaker damping factor is poor but in listening tests this didn't seem to be a problem.

There's something about valves, something musical and aesthetic. A friend of mine used the studio the other day to check some backing tracks. She pointed to the TL25's glowing on their shelf and said, 'Is that a sculpture?' I like to think of an audio system as a meeting of art and technology and if your power amps get mistaken for objets-d'art then you're half way there already! ●

Measured Performance

Changing the forward gain of any amplifier should not be undertaken lightly or wantonly. To check the performance of the modified TL25 Plus, I ran a series of checks on the modified amplifiers on the test bench:

Modified Performance Specification

Output Power, 1kHz sine-wave input, clipping starts just greater than 17v r.m.s. (24.6dBv): 28.9 Watts into 10ohms.

Noise (unweighted)
-58dBV, predominantly 100Hz power supply noise.

Noise (100Hz notched out) -65dBv.

Dynamic Range (unweighted)
83dB, approx. 14 bit
(100Hz notch)
90dB, approx. 15 bit

Frequency Response at 1 Watt
+/-0.5dB, 20Hz - 20,000Hz
-3dB, 40kHz
at 5 Watts
-3dB, 20kHz

Distortion (1kHz, 5 Watts)
approx 0.1%, predominantly third harmonic

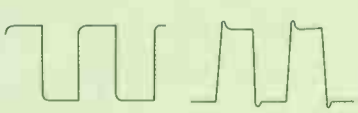
Sensitivity
1.1v r.m.s. for full output.

Output Impedance (80Hz, 5 Watts)
1.5 ohm
Damping Factor 5.33

Squarewave Response (3kHz, 5 Watts)
No overshoot or ringing.

Reactive Load Handling

1kHz into 10 ohms and 10 ohms in parallel with 32uF:



5kHz into 10 ohms and 10 ohms in parallel with 3.3uF

No sign of instability observed.

Very Low Frequency Response
20Hz, 5 Watts

Test Results

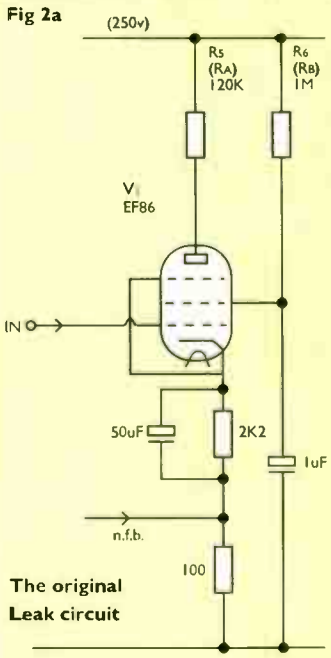
The modified amplifiers deliver a very healthy 33.9 Watts into 8 ohms, revealing that the 'Plus' is a well deserved epithet. Frequency response is good too: within half a dB from 20Hz to 20kHz at 1 Watt output. Noise (unweighted) measures about 83dB below maximum output which is equivalent to a correctly dithered 14 bit dynamic range. The major noise component is at 100Hz and is due to a less than perfect power-supply design. If the hum is filtered out, the noise is -90dB below full output; equivalent to a theoretical 15 bit performance.

The lowering of the loop gain has had a number of effects. One is to increase distortion. This is pretty insignificant since the inherent (open-loop) distortion of the amplifier is well below one percent at normal operating levels. The second effect is to increase the stability margin of the amplifier when feeding into reactive loads (like a real loudspeaker) and will result in a smooth, coherent performance when feeding difficult loudspeakers. I have found insufficient stability margin to be a common cause of the nasal, congested midrange sound that some amplifiers possess.

The third consequence of lowering the forward gain is to raise the output impedance. The measured value is 1.5 ohms at 80 Hz at a medium power output. For a 1960's valve amplifier this is a good figure but poor by modern standards. The loudspeaker's bass resonance is better damped with the first valve operated as a pentode.

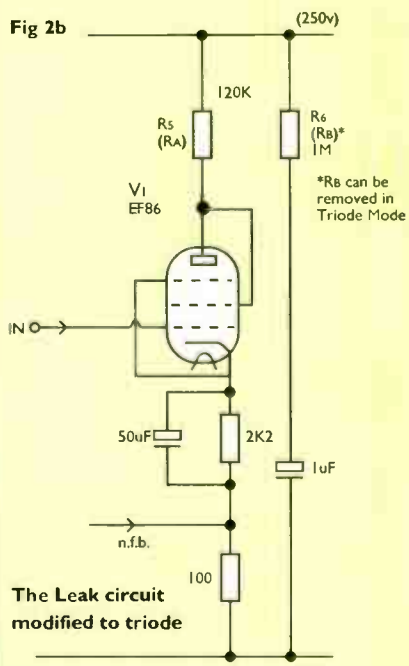
Sensitivity is reduced to 1.1v r.m.s. for full output. This is correct for most modern pre-amplifiers and is ideally suited to a CD source with a passive pre-amp. My studio 0VU line-up level is -10dBV or 316mV r.m.s. Full output is achieved when input signal level is +11dB above 0VU, an ideal figure.

Fig 2a



The original Leak circuit

Fig 2b



The Leak circuit modified to triode

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: VC1 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.

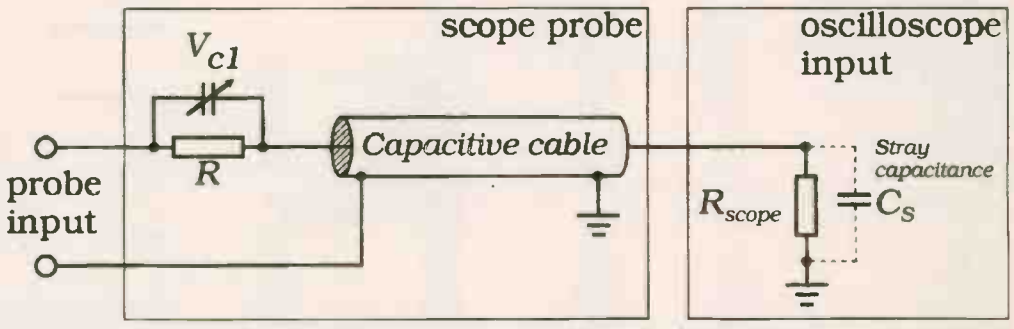
3) The capacitance per unit length of the following cable.

4) The length of the following cable.

5) The input impedance of the power-amplifier.

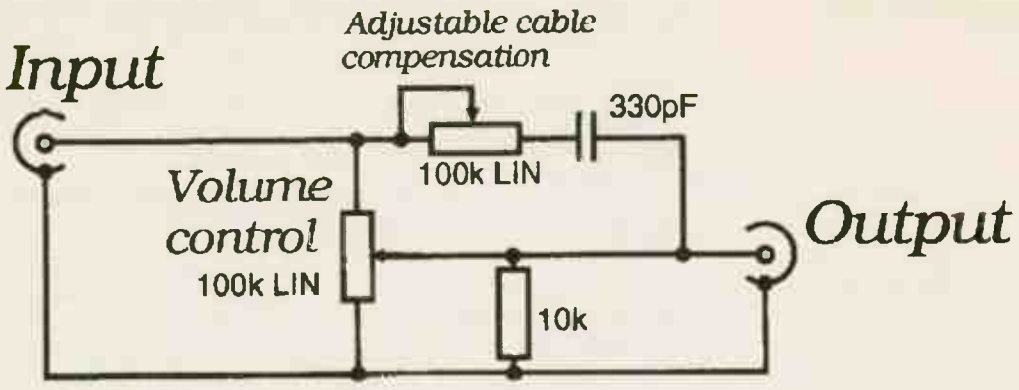
6) The position of the volume control when listening at normal levels.

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 100kΩ



Scope probe - principle behind 'j-solat' pre-amp

Fig. 1



'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 rubic 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°

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!

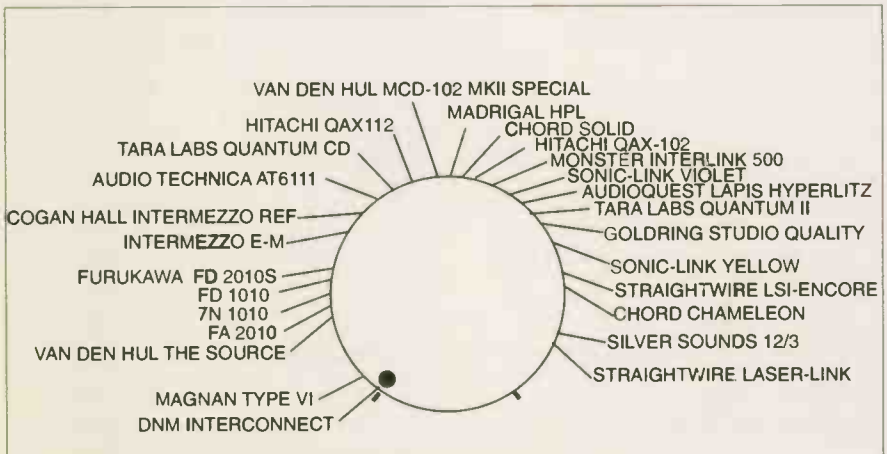


Fig. 3

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!)

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References

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

recorded message

Left by Richard Brice

If I told you I had an idea for an upgrade which would revitalise your entire record and CD collection, would you be interested? If I told you that this upgrade would alert you to previously hidden subtle shades of orchestral colour and detail so that you would notice small string figurations and nuances of woodwind writing which you had previously missed, might you be prepared to dig deep into your pockets to buy it? Furthermore, if I told you that my suggested upgrade can be bought gradually - a few pounds at a time, would you believe me? Well I believe there is such an upgrade. It works just as well with a top-end, Class A, triode-valve, mortgage-busting system as with a more modest set-up. It's called 'following the musical score'. Already I sense your questions and protestations!

"That's not for the likes of me, that's for the likes of a Mackerras, a Solti, a Levine"

I hear you say. No, that's not true. There's a world of difference between following a score and reading a score. Conductors read scores and that requires a knowledge of harmony, rhythm and counterpoint and orchestration as well as the history of music. Following a score is much easier. Anyone can do it with little more than a memory of secondary-school music. Following a score only requires being a spectator, not a sportsman. For instance, I can follow and enjoy a game of world-class cricket but I couldn't play in it - I couldn't even commentate on it, but it's not a closed book to me. So it is with following an orchestral score. Sure, you'll need to know a few of the rules, but you can pick those up as you go along and there are plenty of good, popular books on basic music theory.

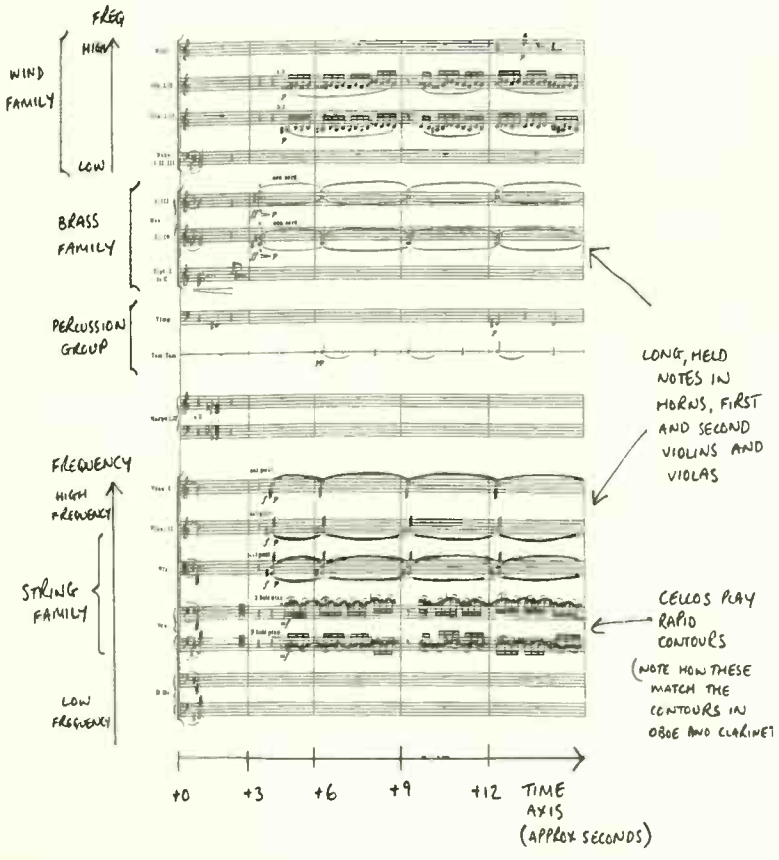
In fact, anyone who can understand a graph can understand enough to follow written music. For all its funny squiggles and Italian terms, music is a straightforward, graphic description of frequency against time. Time is on the X-axis (horizontal), and is regularly divided into convenient units called bars. Following good mathematical convention, time flows from the left-hand side of the page to the right hand side of the page. Frequency - on the Y axis (vertical) - is similarly divided into specific pitches denoted by five lines and the gaps between the lines.

Because piccolos play very high notes and double-basses play very low notes its necessary to slightly complicate the graph by a system of clefs which denote over which pitches the five lines and spaces range but the basic idea is simple. Things are also slightly obscured by the fact that music editors insist on denoting each of the instruments by their Italian names. Figure 1 shows a page from Bela Bartok's Concerto for Orchestra which I've marked-up to remove some of the obscuration. I hope this will help get you started.

The excerpt is from the third movement Elegia. The movement is mostly in 3/4, or waltz, time and is marked "Andante, non troppo" which means at a moderate pace. A few things to look out for are the instruction by the violin and viola parts to play "sul pont". This is short for sul ponticello which means to bow the string near the bridge. This sets the string into a complex motion with lots of high, odd harmonics. It produces a thin, metallic sound. (Sul ponticello is the no-feedback pentode sound of string playing!). Also notice how the horns are told to play "con sord", meaning with mutes. This produces a soft, distant bell-like quality. Do you really think you could have heard all that without looking at the score?

"OK, so how do I get hold of orchestral scores?"

I'm very lucky, I grew up in a musical home with a sister who became a music teacher so we always had music about the place. But it isn't difficult to get hold of. Most good music shops have a good selection of the Eulenburg Miniature Scores and/or the Hawkes Pocket Scores. They're not exactly cheap - the pocket score of a



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big symphony will cost about £10 - but these editions represent the best value. And there's a cheaper option still. My upgrade is available on a free home-trial basis because most public libraries have a selection of scores. So, if you want to dabble, that's the best place to start.

"Doesn't all this score-following distract from the act of listening?"

I believe the answer is no, not unless you have exceptional powers of auditory concentration. Psychologists know humans receive 80 percent of our sensory input from our eyes - that doesn't leave much for the ears alone. Add to that worries of the office, fatigue, next-door's television and upgrade-itis and I'm sure you'll know how easy it is for the mind to wander when listening to the hi-fi. Following a score helps concentrate the mind on listening.

"All this sounds like so much musical snobbery"

I'm not being a snob. There is, of course, a very good place for music as an aid to woolgathering. It's nonsense to suggest as some superior people do that not a single note should pass you by without the full force of your mind being brought to bear on it. Music is so rich an artform, and so important to our lives, because it fulfils such a myriad of roles. It functions as both a pleasant anodyne and as a stimulant - an opiate and an amphetamine. Perhaps (you play your games and I'll play mine) even as an aphrodisiac. But then you don't always have to follow the score, only do it on those occasions when you want to concentrate on the music.

"So, how and where do I start?"

Buy or borrow the score of one of your favourite CDs. Start by simply following the contours of the melody with the contours of the notes on the page. The golden rule always is to remember what you're doing is for enjoyment. Nothing kills enthusiasm like a sense of failure. If you get lost - and you will get lost - don't worry about it. Go on a few pages and pick it up when the music catches you up. Failing that, skip the CD player back! Above all, don't get disheartened; like anything that's worth achieving, score-following is worth a little work and disappointment. I've written in these pages before about the perils and rewards of home-built hi-fi. By comparison, the perils of disappointment of a few skirmishes with printed music pale into insignificance. By comparison, the rewards may be much greater! ●

recorded message

Left by Richard Brice

One of the compensations of maturity is that it enables one to cast away guilt. As a hi-fi enthusiast I used to be riddled with angst - but no more! Though I still find the arguments for and against valves or silver-wire or absolute-phase secretly fascinating, I was frightened in the past of committing that most terrible of drawing-room crimes: being boring about the hi-fi. And that was simply the tip of the iceberg. I was racked with fears that ran deep. Fears I know others share. Just talk to the owner of an extravagant display of audiophile quality equipment and watch how they shift nervously from foot to foot explaining - almost apologetically - that it is only a means to an end. It is, they'll explain, the music which really interests them. Is it not odd that we should we feel the need to justify our obsession?

I shared too, the nagging doubt that I spent too much time fiddling with the hi-fi and not enough listening to the music. But a few years ago I got interested in flying light aeroplanes and, as anybody who has ever done any flying will tell you, as a pastime absolutely nothing comes close to flying for the amount of time spent doing something other than pursuing the purpose of the hobby.

Orgy of Indulgence

At least fifty percent of the time spent at a flying club consists of peering out at dismal, foggy airfields drinking cups of revolting coffee. Ninety per cent of the rest of the time is spent standing in the blistering cold checking, mending, waiting and watching other people flying aeroplanes. Add preparing Flight Plans, Load Sheets and other paperwork and only about two percent of the time spent anywhere near aeroplanes is actually spent flying them. By comparison hi-fi as a hobby is an orgy of indulgence.

I suffered too the commonplace anguish that I spent too much money on audio equipment. But, I argued, other people spend greater sums of money on their cars and decorating and furnishing their homes so there was nothing uniquely extravagant about spending my money on hi-fi equipment.

And then came the blinding realisation that I was simply weighed down by a twentieth-century, northern-European puritanism. The end need not always justify the means. Historically, people have sought to surround the act of making music with the best acoustic, the best craftsmen and couched the process in opulent surroundings.

Audiophile hi-fi equipment is the modern manifestation of this old, and noble, tradition. What is wrong with enriching our lives with objects which both serve a purpose and - by virtue of the care and skill with which they have been crafted - are an end in themselves?

All ceilings need to be painted. But if Pope Sixtus IV had put up with a coat of distemper we shouldn't have Michelangelo's Sistine Chapel ceiling. The Ponte Vecchio in Florence is only a bridge with shops on. I suppose it could have been constructed out of bricks and girders and look like Blackfriars railway bridge. It would serve the purpose just the same, but the world would be a poorer place for it. To argue always for bland utilitarianism is to argue there should be no interiors by Robert Adam, no carving by Grinling Gibbons, no architecture by Vanbrugh, no cars by Ferrari, no fabrics by Zandra Rhodes, no fashion by Chanel. We should have drunk all the vintage claret, swopped our Parkers for Biros and let Rolex go into liquidation.

I'm sure God hears the petitions of a sinner rising from the vaulted halls of an English cathedral no more and no less than he hears the prayer of a starving man in a shanty town. Extravagant opulence doesn't hold any absolute value but which of the two men would you rather be? Come to think of it, if it were not for extravagance in human affairs I doubt we should ever have stood up. Extravagance is everywhere in the world where people have thought to themselves, "Let's fashion this a little better than it needs to be fashioned - let's make this pleasing to look at, uplifting whilst serving its purpose."

It's craft, not art, that enriches the material lives of ordinary people. I don't own even a minor masterpiece of the quattrocento and I confidently expect that I never shall but I can own well crafted things for my home. I've learned to stop being priggish about the minor extravagances of hi-fi. In my own mind I'm sure that there is more to do with a delight in extravagance behind the use of precious metals in hi-fi than there is to do with electrical conductivity.

Extravanagce Factor

It is because this 'extravagance factor' is eradicated in double-blind listening tests that subjects in these trials fail to detect differences between pieces of equipment which they can distinguish when they know which amplifier combination or CD player is playing. Which magazine recently ran a report on CD players which concluded that, without knowing which player was in operation, there was no discernible difference in the sound quality between players in any price band. But with an experience as emotive as listening to music, it really is nonsense to ignore the peripheral psychological effects of where, when and how the music is being produced.

The anguish I associated with hi-fi was born of the mistaken belief that it is a profanity; a material obsession riding on the back of music which is unworldly and spiritual. I now know this is nonsense. Music is physical. It is a rich, wonderful, intense sensory experience which triggers deep psychological associations. It's 'aural sex' if you like! The time, the place and the extravagant paraphernalia of the production of music go hand in hand with its inherent capacity to move and inspire. Monteverdi sounds its best in Venice, Mozart in Salzburg or Vienna, English cathedral music needs to be heard as it disperses amongst groined vaults.

Listening to hi-fi at home, different values obtain. It is one of the great delusions of hi-fi that it can ever aim to recreate the concert hall in one's own home. The experience of listening to music at home will always be very different to the experience when listening in a concert hall, but the same rules apply. All that a hi-fi ever needs to justify its existence is that it enhances and complements our pleasure. If, as in my case, that means serried ranks of glowing valves - so be it. The only necessary truth in the 'fidelity' of high-fidelity is the truth that is beauty, the beauty that is truth.

So I have cast away my guilt, remembering that if everything in the world were judged purely for its utility - how well it served its purpose - there would be no music to put through our hi-fi's circuits. For what could be a more pointless, extravagant folly than a group of grown up people banging drums, blowing down coiled-up brass piping and scraping horse hair across stretched catgut ●

recorded message

Left by Richard Brice

Today brethren, dark clouds are a'loomin' on the horizon. For I am aware that I have already failed in my attempts to dissuade some of you from endeavouring to construct your own valve power amplifiers (see this column September '92). Now I hear that there are amongst you good, hum-fearing people, some who have strayed so far into the swamp of confusion and idolatry that you are considering constructing your own pre-amplifiers.

Once again, I say to you brothers and sisters: don't do it. Valves are the serpents of hi-fi - luring we innocent hi-fi victims with their warm, cherry-red charms only to dash us to pieces with their lethal high voltages, troublesome base connections, cost and tinnitus-like microphony. Steel yourself against this temptation. Join AA (Analogues Anonymous). Sign the tube pledge. Once you let this awful vacuum into your life, you will be changed. Look at brother Noel and brother Alan.

On The Bottle

I have to tell you, I myself fell. And only near-bankruptcy raised me up. I have known earthly rapture. I have sat in the listening-seat of iniquity. I have heard the music of men and believed it was the music of angels. I was ensnared. I thought I had glimpsed heaven but the heaven I had glimpsed was the heaven of a bottle - a line of bottles glowing red with a sheen of blue. And those bottles carried me away from the world I had known to a realm of appalling dissipation. In the blindness of my idolatry, I danced fearful pagan rites with Nijinsky, I took the A-Train, I heard Salieri's pulse quicken, I heard Puccini's stop. A curtain was not so much lifted as rent in twain and I became blind to the pleas of multinational advertising, blind to the heroism of efficacy and mass-production. Blinded to that most profound of truths brethren: that things always get better.

I want you always to remember, chil'n, that in our lives two forces are wrestling for us; valves and semiconductors. For a time it looked like old valves was a'winning. Then it seemed as if transistors was a'gettin the upper hand. To and fro they fought. History has put valves from their seats, and exalted them of low degree. Solid-state has filled the hungry with good things. . .

But the rich it has sent empty away? So, Fig. 1 shows a design for a vinyl disc pre-amplifier that I designed and which ran in my system for some years during the apogee of my idolatry (here endeth the first lesson).

I hope the circuit will be of interest because it is a slightly unusual. There is no overall negative feedback, passive RIAA equalisation and it employs a cascode input stage.

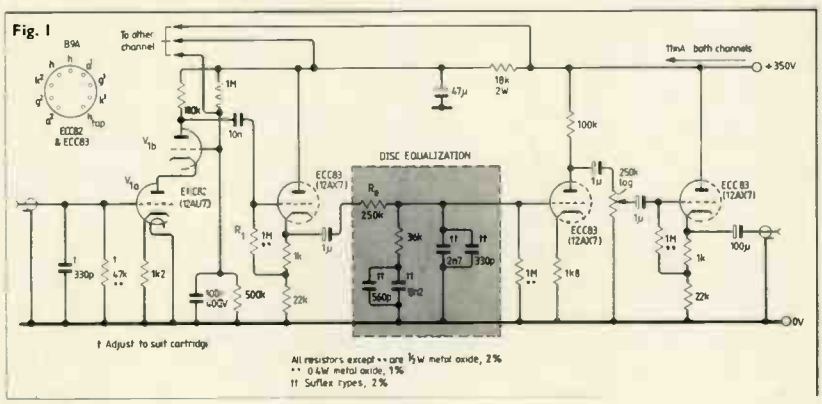
In transistor equipment, the problem with passive equalisation is the risk of overloading the first (necessarily high-gain) stage due to high level treble signals. With valves this does not present a problem because of the enormous headroom when using a power-supply of several hundred volts.

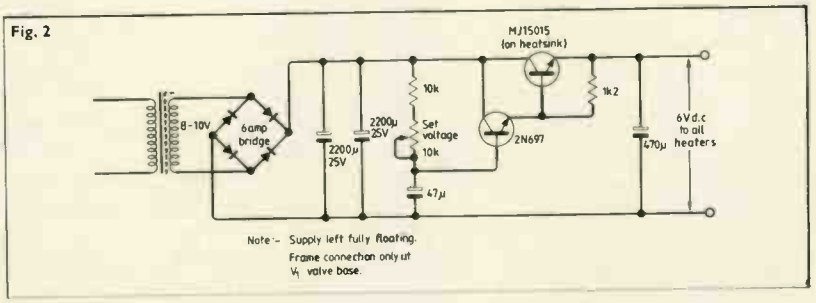
The usual choice for a high-gain valve stage is a pentode, but these valves generate more shot noise than triodes because of the action of the cathode current as it splits between the anode and screen. Instead I used a cascode circuit. Like so many other valve circuits this has its origins in radio. Its characteristics are such that the total stage noise is substantially that of triode V1a. But the gain is roughly the product of the anode load of V1b and the working mutual conductance of V1a. In other words it works like a pentode but with lower noise!

The RIAA equalisation is shown in a dotted box. This is to dissassociate myself from this section of the circuit. If you have your own ideas about RIAA eq. then you can substitute your own solution for mine!

On a general note, I disagree with those who say there is no place for valves in low level circuitry. Well-designed valve circuitry can give superlative results. Hum can sometimes be a problem. In this design I left nothing to chance and powered the valve heaters from a dc regulated power supply (Fig. 2). The h.t. was also shunt-stabilised using cold-cathode glow-discharge tubes which look great! The power supplies were built on a separate chassis. The more common ECC83 valve would be suitable as the first stage cascode valve except that the ECC82 is more robust in construction and therefore less microphonic. I have found, from bitter experience, that there is no alternative but to select low-noise valves individually for the first stage valve.

I must stress that, like my September column, this is not a constructional article. My intention is to both warn and tempt. My own ideas and mistakes are presented as grist to that most enjoyable of design phases: The Armchair Phase. And to hell with the warnings - welcome to thermionic Heaven! ●





Figs 1 and 2 are reproduced by kind permission of Electronics and Wireless World.

recorded message

Left by Richard Brice

I think we've let hi-fi get too house trained. Modern designers have laboured to ensure what was wild has become tame, as surely as we have bred curious wolves to become our domestic dogs. What is a house but a temple to our art? Somewhere to put the family, somewhere to sleep, an address to put on forms. What's carpet there for but to be burnt with red-hot KT66's swopped in haste? Hi-fi just isn't the same without having to make a few sacrifices, like a peaceful marriage, a livable sitting-room and a friendly relationship with the neighbours.

For a hi-fi system to be really moving it has to be big and it has to be frightening, by which I mean it has to be virtually unusable by everybody else but you. A barely tamed beast and you its keeper, a relationship of cautious and brooding respect. For instance, the amplifier has to come in at least three bits: a pre-amp, a pre-amp power supply (a real flourish that), and a power amplifier - and preferably two of those, with valves in them and no covers so casual admirers leave skin on the output tubes if they dare touch them.

These and a thousand other idiosyncrasies retain the hi-fi as a personal domain, a private joy. As far as I'm concerned, the ergonomicists just haven't seen the point. Not for me track skipping, repeat playing, bottom-fattening remote volume controls. I liked it difficult. I liked the wires and the fragility of an engineering system which felt like it had to be treated like an atomic-reactor control system even though all it was doing was playing a record!

Now it's all got too uniform. Playing a Compact Disc is indistinguishable from using the microwave except that the microwave hasn't a remote control unit - next to the mobile phone, the most undesirable flotsam of our consumer society. What can you do with this handy gadget? By means of one hundred and twenty cryptic button pushes, I can play all the tracks on a C.D. in reverse order or all the even numbers first and then all the odd numbers. Do you have any idea how long is spent in production meetings deciding the order of tracks on a disc? Producers, artists, record company people lose sleep deciding in what order to put the songs so that we, with our handy remote controls, can shuffle all around again.

Nowhere has the emasculation of hi-fi been more painfully felt than in the decline of the large loudspeaker enclosure, because of the loss of true bass that this has brought about. And by true bass, I mean sub 50Hz, not sub 250Hz. Before the sad days, when loudspeakers which might easily have passed for civil engineering constructions were hunted to destruction by a callous desire to adorn our homes with television, a concrete transmission-line or acoustic labyrinth enclosure was the badge of a true hi-fi nut. And, in my book, a large loudspeaker system is still the insignia by which an enthusiast of reproduced sound shows his (or her) true metal. Whilst I can appreciate the fine stereo image of a small pair of loudspeakers on good stands, nothing at all affects me as deeply as a big pair of boxed moving-coil loudspeakers. If you visit a home where two scale-models of tower blocks worthy of Le Corbusier adorn an otherwise genteel living room, you instantly know that you are in the presence of a soul in love.

It's very common nowadays to speak of a system in terms of "information retrieval", the system's ability, or lack of it, to tease out all of the audible data from a recording. Almost exclusively this term seems to be applied to high-frequency extension. But consider for a moment that a small enclosure may have a bass roll-off at around 100Hz, a frequency three octaves above the lowest audible frequency. If that isn't throwing information away, I don't know what is. By way of demonstration, a loudspeaker which attenuated the treble by the same amount would roll-off at 1kHz!

"Ah," I hear you say, "I listen to almost nothing but string quartets and house vibrating bass notes have no part in that music." True, there is much music of very great beauty that does not require thunderous low-frequencies but, unless you can say you never listen to music without bass drum, harp, organ or piano - all of which have fundamental notes below 50Hz, it's a bit like arguing that because you watch a lot of old black and white films there is no point in owning a colour television. (Incidentally, it's still possible to "hear" the lowest note on a piano if it is reproduced over small loudspeakers because the upper harmonics or partials extend well into the loudspeaker's range even though the fundamental frequency is missing. What is produced though, is a sound of very different timbre indeed to the original sound.)

None of this would be so worrying, were it not for the fact that the ubiquity of little speakers has resulted in an increasing tendency for recordings to be produced which "punch up the bass" in the lower-middle frequency band in order to give the record "slam" when played over typical loudspeakers. As marketing plays an ever stronger role in the record business, it is becoming more and more common to mix exclusively on small "near-field" monitors in order to ensure the record sounds good on average systems.

For this reason, most kick-drums are regularly equalised in the mix-down with several dB of bass-boost around the 80Hz mark to add "punch and drive" to the bass drum part. Tricks like this which are regularly employed to boost the perceived bottom-end in cars, ghetto blasters and midi-systems tend to tip the sound produced by big loudspeakers over the edge - from powerful and exciting to ponderous and bass heavy.

How many times have you heard bass-light loudspeakers being described as having "articulate bass" and loudspeakers with an extended and accurate LF performance as sounding "ponderous" and "one-note"? I've heard the effect myself many times and, on several occasions, I could definitely ascribe the effect to heavy handed upper-bass, lower-mid boost on the recording itself. The neglect of true bass on modern recordings was nicely summed up by Paul White, the producer/engineer and editor of "Home and Studio Recording" recently, when he said in the magazine, "In pop music, it's pretty safe to say that we don't have to worry about much going on below 50Hz."

It's sad that these practices of deliberate tonal distortion coincide with our best chance yet to appreciate real bass. For the first time in the history of recorded sound in the home we have, with C.D, a medium which can accurately reproduce right down into the the gut-rattling, infra-bass frequency band. It's time to throw off the chimera of civilisation and rediscover hi-fi's wild, deep roots. Time to rid ourselves of the limits imposed by the tawdry 1970's bookshelf loudspeaker and rekindle interest in hi-fi's forgotten octaves. Time to let recording engineers know that if they let something happen "down there" someone's going to hear it and like it.

The new interest in subwoofers is to be applauded; here perhaps is a way forward to real bass without upsetting the domestic situation too much. One thing is certain. Only when we rediscover these lost octaves can we dispense with our domestic dog and enjoy the electronic wolf - wild but exciting ●

recorded message

Left by Richard Brice

The launch of the Thorn EMI Sensaura surround-sound system raised wry smiles in the offices of Select Systems, since we have been marketing a similar system for some years now. It is based on the same principles as Sensaura, but does not use a dummy head. Almost the moment that EMI's press releases hit the streets, our fax machine started spewing paper and it hasn't stopped since. The messages come from amazed customers, puzzled agents and indignant artistes, and every fax finishes with the same question: isn't this what you guys have been doing for two years? The truth is, yes!

Not that I'm complaining, the enthusiasm has which greeted Sensaura will help raise public awareness of three-dimensional stereo systems (i.e. surround sound from two loudspeakers) and, I believe, because such systems represent the most exciting development in sound recording since the invention of stereo, there is room for all of us at the new frontier.

Like Sensaura, our own OM 3D system, which I initiated, works with any standard two-loudspeaker system, so no extra equipment is required by the end-user. The system uses psychoacoustic cues to position sounds within a 360 degree arc anywhere about the listening position, as shown in Fig.1. The system has been successfully used on CDs, tapes, and radio broadcasts, and has been employed by musicians and engineers to enhance musical styles as diverse as experimental jazz, and children's educational tapes!

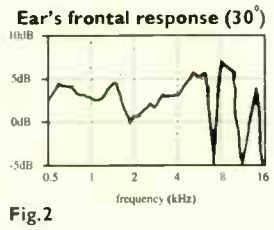


Fig.2

Like Sensaura and Roland's RSS system, OM 3D uses left-right channel time delays to make low frequency sounds appear to come from beyond the boundary of the loudspeakers. For example, on one of our experimental demo CDs we created a 3D storm sound-effect with a roll of thunder which appears directly behind you. It's enough to make you turn around when you hear it, yet there's no loudspeaker there - it's all a psychoacoustic 'illusion'. OM 3D can place sounds behind listeners; we wonder whether this is possible with Sensaura.

In fact, low-frequency 3D stereo is relatively easy to create. It's at high frequencies that a 3D system has to be really clever, because the ear and brain determine acoustic directions at high frequencies by analysing the tonal spectrum of a sound as it enters the auditory canal. The brain is able to do this incredible real-time processing because the external ear has an incredibly non-linear frequency response (if Noel or Dominic measured an amplifier with a response like the ear, you would hear the howls of derision in Knightsbridge!).

What's more amazing still is that the frequency response of the ear is different for every position about the head, due to the multiple reflections from the pinnae (the pinnae are the bits of skin and cartilage we hang our sunglasses on). Fig.2 shows a typical frequency response of the external ear at one position around the head. Our own OM 3D system mimics these complex frequency response changes using electronic filters.

The practical realisation of 3D system is an achievement for any company. Thorn EMI have apparently spent three years developing their Sensaura system and I believe Roland's Japanese engineers spent at least that much time developing the RSS system.

We openly demonstrated our system to EMI in June of this year. Like Sensaura, our OM system was developed in the UK. I studied human perceptual psychology at Bradford University (home of Professor Bailey, transmission lines and long haired wool!). Strong on audiology, my studies at Bradford stimulated me to develop this form of surround sound when I left.

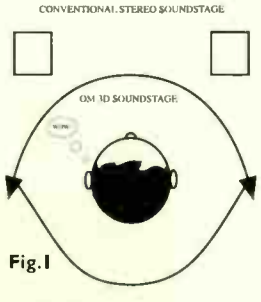


Fig.1

The final OM 3D system represents the culmination of many thousands of hours of carefully prepared listening tests and electronic development by a team at Select Systems. My columns in Hi-Fi World and Francinstein, the stereo enhancer, both exploit knowledge gathered from this research.

As a member of the team which developed the OM system, I was invited by the Institute of Sound and Vibration Research at Southampton University to deliver a seminar on our system earlier this year. I was pleased when the demonstration worked so well in a lecture theatre not noted for its acoustics!

So whilst this form of surround sound is relatively new, Sensaura is not unique. That doesn't mean it won't become hugely popular of course; if we believed otherwise, then OM 3D would not have been developed. However, whilst our system costs around £1,800, Roland's costs around £18,000! What E.M.I. hope to charge studios we have yet to learn. That is likely to affect its popularity. Whoever comes to dominate in this field though, it does look like the technology is here to stay, because it is so consumer friendly ●

EXAMPLES OF RECORDINGS MADE USING THE OM 3D SYSTEM

Roy Ayers, Hot, Jazz House Records; JHR021, JHMC021, JHCD021 - watch out for super-wide synth stabs on track 6.

Ian Shaw, Ghostsongs, Jazz House Records; JHR025, JHMC025, JHCD025 - general stereo enhancement.

Keith Tippett, The Dartington Concert, EG Records; EEG2106-2 all formats.

Village People (DMC/Brian Butler remix). YMCA; forthcoming.

Brian May, Live at the Brixton Academy, video album and CD released Feb '94 - note £D guitar work on Love of My Life.

Jim Lampi, TV Weather, Zok Records no LP, no Cassette; ZCD001 - rear panned percussion in The River and rear power chords in TV Weather.

Big Audio Dynamite - forthcoming album, all formats.

Simon Boswell, Second Best - staring John Hurt (film soundtrack).

Nursery Rhymes and Lullabies, CYP Ltd no LP; PT246, CD246 - general stereo enhancement.

A Traditional Christmas, CYP Ltd no LP; PT251D, CD251 - stereo enhancement and rear panned sound effects.

Vlad Nastas, Funk Guitar Sample CD, Time and Space 442870681.

J. Gross, Let's Do it Together (3D Club Mix) Rec002 (12 inch 45RPM).

recorded message

Left by Richard Brice

Surely the most charismatic tycoon since the age of Henry Ford and Howard Hughes, Richard Branson has a way of changing the face of businesses he espouses. He challenged the patriarchy of the major record companies, then the hegemony of the major airlines and won in both instances. Now this capitalist swash-buckler has left a glove in Auntie's face with a challenge to the BBC's dominion of the airwaves. The launch of Virgin's new radio station Virgin 1215 is just the beginning, it heralds a Branson-style campaign for an overhaul of radio frequency allocations.

Unfair

Branson believes the present system of allocation is unfair meaning, as it does, that his own new station is confined to broadcasting on the medium-wave band in AM because of the BBC's virtual monopoly of the national VHF FM channels. (The only exception being Classic FM.) Branson has said that he is prepared to wage a "sustained campaign for fair allocation of frequencies". His widely publicised, dotty suggestion that Radio 4 could swap its national VHF channels with his national MF network, though no doubt a carefully crafted publicity stunt, obeys a widely accepted and apparently faultless logic. The argument runs that since Radio 4 is almost exclusively a speech-based service, which does not require good audio quality, it would be suited to an AM service. Whereas Virgin 1215's classic rock programme would benefit from the better audio quality afforded by FM transmission.

Not surprisingly, the BBC don't agree with him and are set to defend vigorously any attempt to wrest away any of their precious VHF wavelengths. Branson, who cannot seriously believe that the BBC will ever surrender its VHF Radio 4 service, has cleverly provoked the debate of whether it is desirable that the BBC controls 70% of the available VHF frequency allocations. My own view is that it is not, and that we shall see a carve-up of the FM band in the next few years.

But the scope of this debate should be widened still more. There should be a complete government-led review, not only of our present use of the VHF waveband but, of our use of the medium-wave band as well. Branson's dissatisfaction with his frequency allocation reveals the way in which medium-wave has been allowed to become regarded as radio's stagnant backwater. And not surprisingly either, since most of the receivable signals on the MW band sound as if they have been recorded on a telephone answering machine!

The shame is, there is no necessity for this, it is due to a combination of disinterest, prejudice and self-fulfilling pessimism. AM radio in America sounds just fine - and most stations broadcast in stereo! When I was at the National Association of Broadcasters in Las Vegas in April I listened to an experimental stereo AM test transmission on medium-wave and was invited, along with other visitors, to compare the result with an FM broadcast signal. It was very hard to tell the difference. It is true that the situation in the USA is different because the medium-wave band is less congested and is controlled by one authority. Nevertheless, the system proved that there is nothing inevitably "lo-fi" about AM broadcasting.

The demonstration reminded me of some experiments I performed some years ago, in the days when Radio 3 were transmitting on Virgin's new frequency of 1215kHz. The main purpose of my experimental work was to see if I could improve the quality of AM long-wave and medium wave reception by experimenting with different types of receiver design. I started by generally improving detection linearity and local oscillator purity in a superhet design and then moved on to other types of receiver; the homodyne, the direct conversion set and the TRF.

All my work proved interesting. Certainly I convinced myself that the superheterodyne receiver is no longer a suitable design in today's overcrowded waveband - especially at night since it is more prone than other types to adjacent channel interference and whistles unless exceptional care is taken with local oscillator and mixer circuits. But with each small improvement I made I became increasingly convinced that the broadcast signal itself was of appallingly low-quality. In the end I set up my own low-power medium-wave radio station at about 1300 kHz where I re-broadcast a received FM mono Radio 3 signal using a high-quality AM modulator and r. f. signal generator. My own "Radio 3" was now right next door to the BBC signal at 1215kHz so I could easily tune and re-tune between the two.

The comparison proved very interesting. The BBC's signal was heavily compressed and very highly modulated causing distortion in all but the very best demodulation circuitry. Furthermore, compared with my own signal, the BBC's broadcast was response tailored with excessive bass and presence-band boost and very severe h.f. roll-off. Further research uncovered that this was not due to any fault in the BBC's equipment. Rather it was their policy:

*"Another operational measure being adopted by a number of broadcasters, including the BBC, is the limitation of the modulation frequency bandwidth of m.f. and l.f. transmissions. The principle of this is that the sidebands corresponding to modulation frequencies above about 5kHz are so heavily attenuated in present-day receivers that they do not contribute significantly to the quality of the received programme. . . . . The preferred BBC practice is to equip transmitters with low-pass filters at the modulation input that have a slightly rising response between 1kHz and 4.5kHz and then a fairly rapid cut above 5kHz. This has been found to give a modest benefit in adjacent-channel interference with no perceptible degradation of sound quality on average receivers."

You can bet that those filters are still there at the transmitters, across the output of Mr Branson's digital quality, computer-controlled radio station. In audio quality terms, they make a mockery of the signal even before it's left the transmitter mast. The BBC's intentions are laudable enough but the whole practice revolves around the interpretation of the phrase "average receivers". What incentive have manufacturers to improve receiver design if the transmitted signal is engineered around battery operated portables with 3 inch loudspeakers and about 5% crossover distortion due to underbiased output stages.

I wish Richard Branson luck in his campaign for fair frequency allocations but I hope in the resulting shake-up of radio broadcasting is an enlightened review of the old AM wavebands. There is no technical reason why medium-wave stations should not be able to provide listenable, medium-quality stereo radio. MF even has some propagation advantages over VHF broadcasting, meaning that it is more easily received on portables and cars at and near ground level which is, after all, where most people drive their cars and listen to their radios! In the meantime Virgin might consider investing some money in electronics research and development to improve AM transmission quality and receiver design ●

** The Future of Medium and Long Wave broadcasting J.G. Spencer (BBC Research Department) Wireless World August 1974*

recorded message

Left by Richard Brice

The fashion of minimalism in audio electronics might be neatly summarised as the principle of seeking to ensure the precious audio signal passes through as few electronic stages as possible on its journey from the microphone to the loudspeaker. Since every electronic circuit must inescapably introduce distortions of one sort or another, the aim is laudable enough and is a view with which I have a great deal of sympathy. Nevertheless, in the field of professional audio, it is often the case that, of necessity, there is a long and circuitous route from microphone signal to final master tape, where minimalism must take a metaphorical back-seat.

An example of this is a recording I made a couple of years ago as a result of a commission to produce a dance piece for children for the Rainforest Foundation. The recording involved spoken word, a children's choir, sound effects and backing involving a standard rock-band plus, amongst other things, pan pipe samples and Spanish guitar. The piece, Hey Bulldozer is based on a two-bar musical quote (and I mean a quote, not a sample!) from the fade out of Hey Bulldog by The Beatles. This two-bar ostinato underpins the whole thing whilst other ostinato phrases build up on top, first four-bar, then eight-bar and finally sixteen-bar.

The problem was, none of the pieces' component parts - the choir, the band, the narrators etc. - seemed to be able to be at the same place at the same time! Genuine sound effects were promised from South America, but these arrived only just in time for the final mix and then on a standard analogue cassette. The narration excerpts and pieces of choral annunciation were recorded in a dance studio in central London (complete with a very live acoustic and traffic noise) and arrived on un-edited quarter inch analogue tape recorded at 15 inches per second. The skeleton of the backing tracks were prepared as MIDI tracks and therefore existed only on floppy discs and the choir were rehearsed and waiting somewhere in deepest Surrey. It began to look as if personally lying in front of the bulldozers might be a simpler way of saving the rainforest!

Once the realisation set in that the whole project would have to be put together "collage" style, the first step involved making a gash mix from the original MIDI files and dubbing this onto a multi-track tape as a working cue track. The multi-track was then loaded into the back of the car along with an array of microphones, mixer, power amps and fold-back speakers, then driven down to the choir. The children recorded several different "takes" whilst listening to the backing via several fold-back loudspeakers carefully set so that they were loud enough to be heard, but not so loud as to cause too much "spill" of this signal onto the final choir microphone signals.

Back at another recording studio a week later, after the final tweaks to the MIDI sequencer data and samples were finished, the complete vocal track was formed by selecting the best bits from the various "takes". The narrated speech and choral speaking excerpts were then carefully edited and "topped and tailed" using a trusty razor-blade and splicing block (yes, some of us can still do this) and spun-in to a track on the multi-track by hand. The two acoustic guitar tracks were then added, then the electric guitar track and then a backwards electric guitar which involved turning the multi-track tape over on the deck and having the guitarist play along to the other tracks running backwards - something you can do only with an analogue multi-track machine.

After that, all that was left was to add the sound effects, which involved a combination of real jungle sounds (from cassette - arrrgh!) and library FX. Oh, and the mix down: sixteen tracks of MIDI, four guitars, four stereo-pairs of choirs, two of narration, four of sound effects. Not having the budget for a studio with fader automation, it took me six goes, but I got it in the end.

It still intrigues me when I listen to the finished song that the children who say, "Leave the forest alone" and the children who sing, "Don't let them bulldoze the rainforest away", immediately afterwards are not only different children, but were recorded twenty miles and a month apart. It's a tribute to modern parametric equalisers, noise gates and digital reverberation equipment that the choir, recorded direct to master tape with spaced omni microphones in stereo, doesn't sound too different from the chorus who were recorded in a noisy London location in mono onto analogue quarter-inch tape with different microphones.

So there we are. The whole track turned out to be about as minimalist as a Midi-System, but I believe - in this case - the end justified the means. Despite its tortured genesis, I am really proud of this track. It starts with an eerie prediction from an Indian chief which still sends a shiver down my back.

There is so much smoke, all the animals are being killed, the rivers too. My spirit is warning me that when the forest is all destroyed there will be no shade, there will be very strong winds, the sun will get very hot and it will be difficult to breathe. Then everybody will die, not just the Indians - everybody will die. I am warning you - leave the forest alone.

Hey Bulldozer received several performances during the summer of 1991 and has been performed several times since in different versions. Sadly, since then, the destruction of the rainforest has continued apace ●

recorded message

Left by Richard Brice

The domination of the chart scene by dance music has had one profound effect on popular music today, that is the death of the Lyric - indeed the threatened death of the popular song form itself. Put in this way, I believe we ought to regard dance as a "pure music" form - more akin to classical music than to the aural song tradition which has formed the basis of all folk, rock and pop music until now.

A very different kettle-of-fish it is to the tradition of the song, which reaches back to the pre-literate past. (Of course, rap music represents an important exception, but in rap, the message - albeit often distastefully xenophobic and misogynous - is of such overriding importance that this type of music is a form of poetry and not a musical form at all.)

To me, this emergence of a pure, popular musical form is both a good thing and a bad:

Good, because the exploration of pure sound is very far from the meretricious experimentation which it is sometimes accused of being (why shouldn't musicians blend sounds in a manner to delight our sense of hearing in the same way a cook might explore different ingredients to delight our sense of taste?)

Bad, because it cuts us off from the vital tradition of the finely crafted three minute song. Put another way; where are the "our songs" of the future?

I don't suppose anyone can know exactly when the song-form first developed, but it was an invention every bit as important as the wheel (although, come to think of it, where would Bruce Springsteen be without both inventions?).

The first songs I remember were folk-tunes which we learned at school. And it's odd, how thirty years later I discover that I learned highly sanitised versions of these most early songs. For instance although I remember singing, She Moved Through the Fair, I don't remember singing the final verse:

I dreamt it last night that my young love came in,
So softly she entered, her feet made no din,

She came close beside me, and this she did say,
"it will not be long, love, till our wedding day."

With the inclusion of this last verse, the perfect blend of everything a good song should be, it becomes. It's delightful, humorous in a way that is delicately self-mocking, erotic, but not licentious. These attributes are what attracts me to what I consider to be the great period of song writing, the nineteen-twenties, thirties and forties. Whether it's Jerome Kern's and Dorothy Fields' A Fine Romance or Cole Porter's:

There's no love song finer
But how strange, the change
From major to minor
Everytime we say goodbye.

The delicate double rhymes and the musical prosody to mimic the words "major to minor" shows a creative deftness which is quite wonderful.

Which brings me to Gershwin and Gershwin, and my "desert island" lyric:

In time the Rockies may crumble Gibraltar may tumble,
They're only made of clay
But our love is here to stay.

A characteristic of these lyrics, typical of the words of the popular song during the twenties, thirties and forties, is their air of urbane detachment. I'm not for a minute suggesting that the art of great Lyric writing is dead - far from it. However, the modern songwriter just has to be so-o-o serious!

The boy child is locked in the fisherman's yard
There's a bloodless moon where the oceans die
A shoal of nightstars hang fire in the nets
And the chaos of cages where the crayfish lie.

It's brilliant but, blimey Sting, it's grim stuff - Samuel Taylor Coleridge on 48 track digital. Neither is the eloquent romantic dead either, at least whilst we still have Annie Lennox:

Stay by me
And make the moment last
Please take these lips
Even if I have been kissed
A million times
And I don't care if there is no tomorrow
When I could die here in your arms

But it is very earnest. Of course, teeny-pop still provides a lightweight alternative. The New Kids on the Block might have "acronymically" become the tough NKOTB, but the songs haven't.

And Take That, even the titles: Babe, A Million Love Songs. Let's face it, they don't auger well for the following Lyric. And when you listen to the Lyric, well your pessimism's not disappointed!

And a cab combs the snake trying to rake in that last night's fare and a solitary sailor who spends the facts of his life like small change on strangers pauses inside peekhole park for a welcome 25 cents and the last bent buff from a package of Kent's as he dreams of the waitress with Maxwell House eyes and marmalade thighs with scrambled yellow hair and a rhinestone studded monarch he says "Irene" as she wipes a wisp of dishwater blonde from her eyes and the Texaco bacon burns on a steel belted attendant with a ringing valve special crying "fill her up and check that oil you know it could be the distributor and it could be your coil".

Is it any wonder, when Lyrics have reached this sophisticated synthesis of James Joyce and Raymond Chandler, there's perhaps nowhere left to go.

Conceivably, that's why dance music has emerged as a strong force. Not so much a denial of the lyric as a reaction against a kind of brick wall brought about by the polarization of the contemporary lyric between the high-brow existentialist's creation of meaning and the puerile. Perhaps rock has finally hit the same crisis which has hit all the arts in the 20th century, the "Where do we go now?" crisis ●

recorded message

Left by Richard Brice

When I was at college, a friend of mine owned a Michell GyroDec. What a wonderful, extravagant flourish of design these machines represent. Although it has a conventional platter, the record appears to be supported on top of half-a-dozen whirling weights. The eye can hardly fail to be enchanted by gyrating chrome whilst the ears are delighted by the music from the record.

As if this display was not enough, my friend's listening was preceded by a precisely observed ritual because he had discovered hi-fi during the period when playing records wet was in vogue. Once a record has been played wet, due to the wet dust-sludge forming a kind of emery paper in the groove when dry, the record must always afterwards be played wet unless it is very carefully cleaned. My friend, unable to afford having all his records cleaned, continued to play them wet.

So, before an LP was played, a few drops of distilled water were dropped from a pipette onto the surface. Due to the rotation of the record, they formed a neat spiral of menisci and a modified "Dust-Bug" brush swept the surface of the disc breaking up the little droplets of water to form a surface film.

It was as fascinating and intricate a ritual as a Japanese tea ceremony. He owned the best hi-fi that I had heard but there was more to it than that. The method and protocol, the pageant of the extravagant and hypnotic design of the record deck, all added to the occasion and - where music is concerned - occasion is the key word.

"Some 300 years ago," wrote Arthur Jacobs at the end of his *A Short History of Western Music*, "music was composed for the specific musical occasion; now the musical occasion is ubiquitous, wherever there is a record player radio or jukebox... It is a situation of both peril and promise." The perils seem more acute today than they have ever been before.

One is due to digital audio's very indestructibility. This was brought home to me recently when I overheard a comment two friends talking in Our Price and one turned to the other and said, "The great thing about CD is, because they don't wear out, you don't feel guilty if you leave the room when they're playing." Is it good for music - good for us - that we own hours of untaintable, immutable music? Does it not encourage us to not bother to listen to it properly? In the good old days of records, the sound - in a sadly literal sense - was torn from the groove. As you played them, they wore out. But far from detracting from my listening pleasure, I believe in a curious, subconscious way it may have enhanced it. It made listening an occasion, special in the way that every instant of great music is special because it is transient and fleeting.

An LP record is not inorganic. An LP scratches and wounds; treat it badly and it dies. Old, worn records are like old friends, maddening but ultimately more lovable for their faults. Moreover LP's benefited from one's own kindness. The more attention you lavished upon them, the more pleasure they returned. By comparison CD's are not just the ever-young Peter Pans of my music collection. They remind me more of the little boy in the film "The Tin Drum" who wilfully and infuriatingly refuses to grow up.

Another peril is the result of the characteristic complexity of digital audio. People have "lost connection" with the designers. Writing before the dawn of CD, Evan Eisenburg, the music columnist of the American magazine, *The Nation* wrote about the special nature of music on records:

"Instruments which are bitches to play, from which drawing a single clean note is like pulling a tooth, afford the keenest joy of all when played well; every note of the oboe, violin and French Horn seems to recall the ordeal of its production and rejoice in its escape. When such hard-won beauty runs the further obstacle course of vinyl and diamond and reaches our ears in one piece, our delight is that much greater."

Eisenburg argued that because, like a musician, a record player wrings beauty from an uncooperative medium, "the art of 'phonography' is music multiplied by itself." Music produced from arcane, drab digital integrated circuits can never tangibly reveal the "ordeal of its production". Clever digital audio may be, but the artifice is beyond drawing-room comprehension. Consequently, the digital age has deprived us of the age of whimsy and of delightful design for its own sake.

It's a depressing characteristic of the new digital age that it will ultimately deprive hi-fi buffs of the domestic listening occasion as we knew it, the special hi-fi pageant. An occasion that was, in its way, as special as going to a concert. And yet I am optimistic. Recorded music, though it pales in comparison with computers, antibiotics and atomic energy, is one of the Wonders of the Twentieth Century. It touches most people's lives everyday and probably for the better. In Arthur Jacobs' terms, the promise of recorded music in our century has far outweighed the perils and I believe it will continue to do so. Eighty years ago musicians feared recorded music would drive people from the concert halls. It didn't. Maybe because it wasn't good enough - but I doubt it. It's because music is about communication. And not in the dry engineering sense - people communication. Whether it's Hendrix, Du Pre, Lennon or Glenn Gould at one end of the recording chain, if we're moved to anger, laughter or sadness at the other, more has travelled in the wires and semiconductor junctions and is contained in the grooves or CD bits than just signals; as much as a great work of literature is more than a pint of ink on a few hundred sheets of paper. But the comparison with a work of literature reveals what I believe to be the overriding peril of our digital age: a belief that we do not have time. Whether or not we fall prey to this peril is entirely up to us. Music fares badly in our hurried lives because it is so easy for it to fade to a background accompaniment to other more pressing tasks. At least the written word forces your attention. For instance, you can't, unless you have a brain very different from mine, decide to read *Martin Chuzzlewit* and make a meal or a telephone call at the same time.

The anger of Hendrix and Beethoven, the wry humour of Haydn and Dylan, the cool headed precision of Bach and Reich all sit in my CD cabinet, waiting for me to listen to them. I can choose to pay them the attention they deserve or I can leave the room and - like the couple in Our Price - feel no guilt.

Thinking back to my college days and listening to records on my friend's wonderful system complete with record-cleaning ceremony, the lesson I have learned is that the more ubiquitous hi-fi sound becomes, the more rather than less we must use our ears and minds to appreciate it. The more convenient it becomes to store and play recorded music, the more careful we must be not to undervalue it ●

recorded message

Left by Richard Brice

I know what I am about to say amounts to a heresy in some people's minds but I'm going to say it anyway. There's nothing inherently wrong with tone controls. I had to swallow hard before I said it. Now I'd better justify myself.

I've gradually come around to this opinion because of the tricks I have to play on my hi-fi (which has no tone controls) in order to get the tonal modifications I occasionally want. For instance, in the process of my work as a producer I get sent a number of cassette tapes to listen to. I accept that cassette is not the "highest of fi" but nevertheless its ubiquity means that I (and a great many other people) listen to good deal of music from it. For a hundred reasons many of the tapes I listen to are downright dull. Sometimes they have not been recorded "hot" enough so there's inadequate level on tape and what little treble there is, is swamped in noise. Often the azimuth of the recording head was radically different to my playback head and that really mutilates the top-end. I've adjusted my playback-head azimuth to the IEC reference tape but it really is not practical or desirable to readjust this for every tape I listen to.

So what do I do? What I suspect everybody else does: I switch off the Dolby decoder and revel in the treble. I end up with reproduction with heavily compressed high frequencies and about 40dB signal to noise ratio. It sounds like American A.M. radio. Depending on the tonal balance without Dolby, I then mess with the 120us/70us equalisation switch. In other words I end up with a grotesque approximation to a flat frequency response by inappropriate means. How much better it would be if I had a tone control which would provide a temporary brightening of the sound.

When I was a boy, my grandmother had a large valve radio in her kitchen which had a volume control and a knob marked "mellow" in the fully anti-clockwise position and "bright" in the fully clockwise position. That radio must have been thirty years old thirty years ago. I find it hard to accept that in the intervening sixty years, we have not had time to develop a tone control circuit which doesn't mutilate musicality and still copes with lousy cassette tapes.

Other more prestigious media can occasionally do with a little "tweaking" too. Maybe you're luckier than me, but I have many vinyl records where the tonal balance is capricious. Yes, even the occasional Compact Disc has a tonal balance which is obviously downright wrong.

There are two tenets to the purist's argument against tone controls:

1) Less is always more; all circuitry, no matter how good, will always corrupt and veil the sound to some extent.

2) The music is what counts, so we shouldn't fiddle with the sound of a record or C.D. since this might be an incorrect and ill-informed judgement.

There is a great deal of merit in botn these arguments. At worst, tone controls can be awful. They can add noise and, certainly in the early days of transistor amplifiers, they often produced plenty of distortion in the boost regime. Perhaps the worst incarnation of the tone control was the dreaded "loudness" button.

I once worked on a recording session where the studio was temporarily relying on a domestic hi-fi amplifier for monitoring because the professional amplifiers had gone to be fixed. No matter what the engineer did, the mix sounded dreadful. I took a DAT copy home to listen to. Far from the flabby, sloppy bass that seemed to beset everything in the studio, there was hardly any bass at all when I listened at home.

Investigation unearthed the fact that the temporary hi-fi amplifier had a "loudness" button and this had been accidentally switched on during the session. The whole session had to be junked. In my opinion there ought to be an article in the Charter of Rome forbidding the inclusion and use of this hateful feature.

One really mustn't, however, write off all tone controls because of poor examples from the past. It is possible to engineer good controls with useful and musical response modifications. After all, virtually everything we hear on record has passed through equalisation tone-controls in the recording studio of such devastating audio power it would make a hi-fi designer's eyes water. The golden rule, as far as domestic controls are concerned, is that the extent of the spectral manipulation must always be modest and appropriate. Many of the cheap "treble" and "bass" controls of the past (and sadly of the present) have vicious levels of cut and boost and characteristics that are not suited to modern response errors.

The purist's second argument, that it is the music that counts - not features or the whim of the listener - is much harder to fault. Few would dispute that it is a hi-fi's job to reproduce as cleanly, faithfully and transparently as possible the music recorded on the disc. My defence here is to say, "Yes, but that music is captured in a recording process. This is distributed via a production process, which, like everything else, is prone to engineering failure, subjective judgement and poor software duplication." If you care about music and you own a favourite tape, record or C.D. by a singer you admire, singing songs you love but the tonal balance of the performance is shrill, woolly, or bass thin, and that detracts ultimately from the performance, then I think you have the right to turn the treble or bass up or down to suit. And you have a right to expect that engineers can provide you with controls that will do it without introducing perceptible noise or distortion.

The sad fact is that tone controls will always be standard on cheap and cheerful equipment where features matter, where it's least likely they will be well designed, and consequently where the potential customer will be least able to adjust them to give genuinely musical results. On the other hand, they are increasingly lacking in equipment where there is an adequate budget to ensure their correct circuit implementation and where their inclusion would be of most benefit because the listener is able to judge the sound quality accurately.

Don't you think there's some inverted snobbery going on here? If I was to produce an audiophile pre-amp, do you think it would be taken seriously if it had tone controls on it - no matter how well engineered? I don't - and that has to be more to do with marketing fashion than engineering.

For as long as people hold onto treasured record and tape collections that sound like they have been recorded through a sock, or mastered on speakers borrowed from the dog-track, there will be a need for tone controls for some of the people, some of the time. It's true that a collector of well-recorded C.D.'s with very little in the way of rogue recordings from the past, owning a well set-up system, has little use for tone controls. A minimalist pre-amplifier will suit this paragon of purity down to the ground. But I suspect there are lots of people like me, who want to listen to the best of their music collection as cleanly as they possibly can, but who also want to listen to the not-so-good as well as it is reasonably possible to hear it.

Tone controls have got lumped in with L.E.D. power meters as a gimmick and they're not. Designed and used intelligently, with discretion and with a provision to by-pass without disrupting overall phase coherence, tone-controls can provide the listener with a means of enjoying that tip-top software without sacrificing audiophile status. Extracting musical merit and providing enjoyment from all forms of electronic and mechanical recording is what hi-fi in the home is all about. Anything that provides or increases that enjoyment, or unlocks that merit, has got to be a good thing ●

recorded message

Left by Richard Brice

Make the whole thing sound bigger, more exciting," said the client to the recording engineer. With a wry smile the engineer thought how sad it was that this customer asked for the excitement to be generated during the mix-down rather than asking for it from the musicians and vocalists. In response he patched in an audio exciter which works by deliberately adding controlled amounts of harmonic distortion to the signal. It can be used to add life, but can sound harsh and strident if over-used. It also tends to exaggerate noise. So he patched in a single-ended stereo noise reducer after the exciter.

"Yes, that's better, there's more air around the vocal but it still needs more balls," said the client.

"How much more LF equalisation can this guy, let alone my monitoring system, stand?" thought the engineer. He could already feel a gentle breeze from the main monitors on his face with each kick-drum beat. But he added a few dB extra bass boost on one of the drum channels and the client beamed.

"Good - but do something about that snare, it sounds boxy. It needs to sound big - like the mix."

The engineer reached for the computer mouse, selected a few different snare samples and tried each one in turn. The client liked SNAR4 the best, especially once the engineer added a little more reverb. Now the only trouble was that the track seemed to drag slightly during the chorus so they tried advancing the drum samples with respect to the beat during this section. That did it, the track was beginning to come together.

"I love the piano sound you've got in the intro," said the client. The engineer glanced at the small package of electronics that produced such a beautiful 'authentic' piano sound and remembered the days when he first set up his studio and the hassle with moving in the very expensive overstrung upright. The piano was still there but he had neglected it and it was now unusably out of tune.

"I agree, those guys sure have the edge when it comes to piano synthesis," said the engineer.

"Can you compress the whole mix a bit more - it needs to sound seamless, closely integrated - like it's knit together?" asked the customer. The engineer obliged and the client stopped talking. The engineer thought that was a good sign, anticipated the end of the track and drew back the main faders to simulate the final fade.

"That's great!" said the client. "I only wish the track started with a chorus rather than a verse. Could we edit it?"

They mixed the track and loaded the song onto the computer editing system. Employing a 'cut and paste' technique like a typist using a word processor first they tried a chorus to start, followed by a verse then another chorus followed by the 16-bar sax break, then another chorus. Finally they arrived at the best medley of sections.

"I'm not sure if we'll get much radio play but the hook falls at the end of the chorus and the radio stations won't play more than three minutes," explained the client. The engineer tidied up some biscuit wrappers and drank a Coke whilst the computer sat quietly doing the huge number of calculations necessary to time-compress the audio data by five per cent without altering the music's pitch.

When the session ended, the engineer took a cassette copy of the mix home to see what it sounded like on his home hi-fi system. It sounded worse than he could possibly have feared. The top-end was brash and shrill, the whole mix was over-compressed and the bottom end was unbearably dominating. Furthermore there was a poor edit where the level dipped slightly. He hadn't noticed these problems in the studio and he hoped now that the client wouldn't either. He comforted himself that the mix was the way the client had wanted it and he would never have been able to offer the opportunity of rearranging the whole song at such a late stage and in so little time without the use of MIDI and the hard-disk editing system. Nevertheless it hurt professionally that his hi-fi system had revealed faults in his studio set-up.

Then with a dawning apprehension, in his mind he compared his home system, with its carefully selected components and directional interconnects, to his studio installation. He thought of his old, oxidized patch bay, of the distortion-producing exciter and transient-clipping noise gate. He began to wonder why he unwittingly trusted the studio's tawdry cables plucked hastily from the cable rack when he had spent careful hours selecting one pair of leads for his home system. He reflected on the hard-disk editor squashing the audio into a convenient three minute package and of the sonic carnage that must inevitably result from such manipulations. His mind flashed to the piano module, sampler and drum-machine, silent electronic boxes with no more real sound than the speakers used to give them voice.

And then the truth began to dawn upon him. As the years had progressed he had forgotten to regard the original signal from the microphones as something precious to be cherished and preserved and treated with respect. He had become a skilled artisan in a complex, electronic workshop producing tape as its final product. In a way he had neglected his audience too, so that they had become in his mind a market to be serviced with glossy well-packaged audio product. Worst of all, his factory was now producing shoddy goods. With the zeal of a man who has seen the light, he leapt from the chair to get the phone book. "I'll get that piano tuned tomorrow," he thought.

The purpose of my caution-ary tale is to demonstrate how our fictional engineer was seduced by the flexibility and power of the signal processing available to him in a modern recording studio only to be caught out by his home hi-fi. In a home system a CD player's signal may pass through one, maybe two, operational amplifiers on its way to the power amplifier. In comparison, the audio signal path in a modern recording studio will certainly pass through patch bays and tie lines and effects units, noise reducers and audio sweeteners. The sounds themselves may never have existed because they were digitally generated in the first place.

It's possible to argue that the more power to manipulate and change, distort and re-arrange the better. But power, as the saying goes, has a nasty habit of corrupting. The absolute power afforded to today's musician and engineer to control, manipulate and even generate sound is having the effect of corrupting absolutely every sound that is captured on modern records. The age of what I can only describe as 'audio Cubism' is nearly upon us when nothing we hear will be as it really is. And as a hi-fi enthusiast I am saddened by it. For when, and if, it finally comes, it will be impossible for us to say whether our hi-fi systems are producing lifelike results or not ●

recorded message

Left by Richard Brice

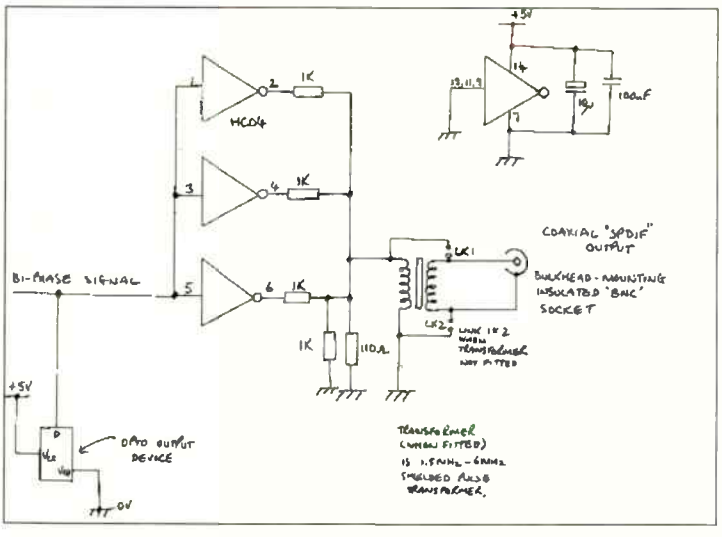
In very many ways an optical link appears to be the ideal solution for joining two pieces of digital audio equipment together. Obviously a link which has no electrical contact cannot introduce ground-loop interconnection problems, short-circuits or crosstalk. Also, because the bandwidth of an optical link is so high, it would appear from a superficial inspection that an optical link would provide the very fastest (and therefore "cleanest") signal path possible and that it would introduce the least distortion into the digital audio waveform.

No doubt these considerations account for the adoption of the optical digital interface being included on many pieces of consumer digital audio equipment in favour of the apparently simpler coaxial electrical interface. (My own DAT recorder and CD player included!)

Yet all is not right with the consumer optical digital audio interface, the TOSLink" style link popular in consumer equipment is widely regarded as sounding a little less crisp than its coaxial, electrical counterpart. There are a number of possible reasons for this. They all concern the limited bandwidth of any cheap optical interface: In the first place the speed of the link is compromised by the relatively slow light emitting diode transmitter and photo-transistor receiver housed within the connector shells.

Secondly, cheap optical fibres, which allow the optical signal more than one direct path between receiver and transmitter (the correct term is multimodes), cause a "smearing" of the digital audio pulses in the time-domain resulting in an effect known as modal dispersion. Such smearing of the digital audio data can cause a degree of timing instability in the positions of the data transitions (jitter) and this can effect sound quality. One can conclude that a cheap optical interface may actually provide a poorer transmission channel than its simpler electrical brother.

The only advantage such a link can have over its coaxial counterpart is its freedom from ground-path induced interference signals such as hum and r.f. noise. Yet at digital audio frequencies such ground isolation, if it is indeed necessary, is probably much better bought with a transformer. But strict adherence to the IEC 958 Type 2 interface standard for the electrical coaxial link on domestic equipment requires the use of a transformer on the transmitting end in any case!



Sad indeed then is the man who like me had a CD and DAT player with digital outputs on optical connectors only. Sad enough to set about considering how it might be possible to modify my optical outputs to provide 75Ω coaxial outputs. Fortunately, the job is not as difficult as it seems because the signal which drives the "TOSLink" optical transmitter is exactly the same data-format, bit-for-bit, as that which needs to appear on the coaxial socket (ie. AES/EBU two channel serial digital audio bitstream with consumer use of channel status bits). The optical transmitters fitted to domestic equipment are driven by a TTL signal adhering to this data format. Suitably buffered and attenuated this TTL signal can be used to drive a coaxial socket on a suitably drilled and modified back panel. The complete modification I devised is shown in Fig. 1. I opted to leave the optical output connected.

The circuit features a cunning use of the cheap and easily available high-speed CMOS hex invertor package HC04. I opted not to use a transformer since I have not experienced any ground-loop problems with modern double-insulated, mains-powered, digital audio equipment. Once there was a time when every hi-fi magazine you picked up contained a forlorn enquiry on the letters page from some enthusiast asking how was it possible to reduce hum from a turntable or tape source. Indeed this was a very real problem in days when nearly all hi-fi equipment was earthed.

However with the widespread adoption of Class 2, double-insulated equipment, earth-loops have all but vanished - or should I say all been silenced? (To digress a little, I have to say that the adoption of double-insulated equipment for audio use is, in my view, one of the greatest steps forward in the last twenty years of the manufacture of hi-fi equipment and it both baffles and irritates me to see how some "audiophile" manufacturers are returning to earthed-frame construction for their equipment.)

Fortunately, transformer coupling which is my favoured (though expensive) approach to solving grounding problems in analogue audio is also available as a palliative in digital links and it is very much less expensive and bulky when implemented in a digital audio circuit. Nevertheless digital audio transformers aren't perfect and introduce group-delay distortions which are the corollary of modal dispersion in fibre-optic links so I decided not to use one.

The complete modification (which represents about a days work) result is an electrical interface on a insulated bulkhead style BNC socket next door to the optical output with a signal as clean as any I have ever seen on a coax interface. Indeed the signal proved to be so good it was used as a reference source when developing an outboard DAC. I have now completed this modification on a number of CD players and in every case it brings with it a worthwhile increase in sound quality.

The modification should prove relatively easy for anyone handy with a soldering iron and bold enough to delve into the guts of their hi-fi equipment. Do remember to earth the unused inputs of the HC04 package, failure to do this will lead to increased jitter. Remember too, never work on any equipment unless it is fully isolated from mains voltages and that any modifications may affect your warranty ●

recorded message

Left by Richard Brice

Every now and again, a truly innovative idea surfaces in the world of recording. I was recently privileged to witness a demonstration of such an idea when some revolutionary loudspeakers were being tested during a Classical recording session in London. Dubbed the 'Hautparleur Numerique', the 'Digital Loudspeaker' is the brain-child of Dr. Pierre Gavan who works and studies at IRCAM, the electronics and musical research institute housed in the Pompidou Centre in Paris. Gavan's breakthrough is the practical realisation of a truly digital transducer and it may represent as great an advance as the invention of digital audio tape itself.

Ever since the widespread adoption of digital audio in recording sessions twelve years ago there has existed a nagging worry in engineers' minds. It is this: how does he or she know what is actually being recorded onto tape? After all, the engineer can only listen to an analogue conversion of the digital signal and is therefore limited, as you or I are in our own homes, by the standard of the digital-to-analogue convertor.

Obscuring The Signal

In fact, it is true to say that the engineer risks making more judgements about the standard of the conversion than about the positioning and performance of the microphones! And the digital-to-analogue convertor is just part of the problem because the audible signature of every power amplifier and conventional loudspeaker all contribute to the obscuration of the original digital signal.

By contrast, Dr Gavan's invention promises a completely digital signal route from the analogue-to-digital converters following the microphone amplifiers to the loudspeaker diaphragm. In fact beyond, because Pierre Gavan's loudspeaker converts digital signals directly to acoustic energy. I was able to speak to the loudspeaker's mercurial designer during a break in the recording session.

"In order to fully appreciate this approach," he explained, "it's first necessary to recap a little on the theory behind digital audio. Remember that a digital audio signal has two characteristics which separate it from an analogue signal. First, it is a sampled signal. Second, it is a quantised signal. In other words, instead of a continuous electrical waveform, it is a time-discrete sequence of binary numbers. How many numbers is a constant source of debate within the audio industry, but in practice the signal is usually divided into two raised to the power sixteen - hence the term sixteen bit. Sixteen bit allows for 65536 different levels."

"Inside the digital-to-analogue converter, the electronics tries to create these sixty-five thousand different levels from the sixteen bit binary number it receives via its digital input. But this is a very hard thing to do. Instead, inside the Hautparleur Numerique is a set of amplifiers and loudspeakers each scaled in binary sequence. Each digit of the final digital signal drives an amplifier and loudspeaker cone directly." So the most significant amplifier/loudspeaker pair is formed from a hundred watt amplifier and a 25 centimetre bass loudspeaker, the next most significant digit triggers a fifty watt amplifier and a 25 centimetre cone and so on until we reach the least significant digit which triggers a 12 mW amplifier driving a 2.5 centimetre soft-domed tweeter. In each case the loudspeaker is either driven hard in or hard out, just like the binary signal itself so there can be no distortion. This experimental version is fourteen bit but it can easily be extended to twenty bit and beyond as digital recording technology gets better."

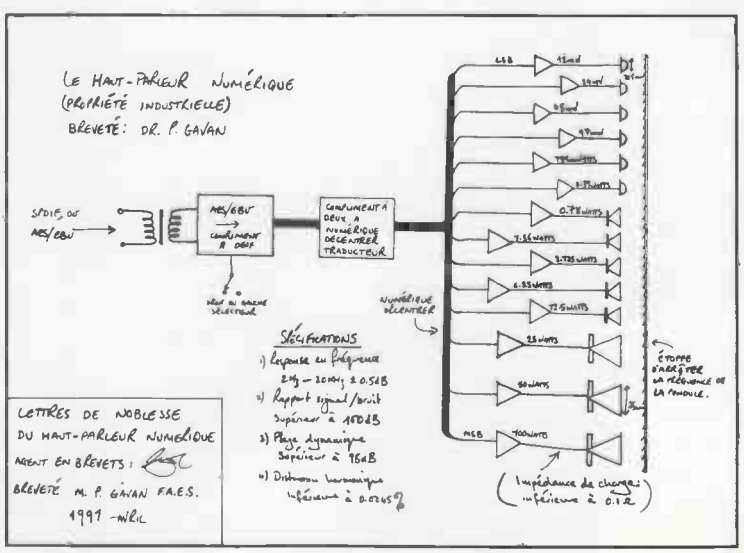
Like most great inventions one is struck by its underlying simplicity, fourteen loudspeakers each handling just one bit of the digital signal and responding by moving simply in or out. A distortionless, entirely digital transducer. Fig. 1 is the diagram accompanying Dr Gavan's French patent application. Note the acoustically treated material in front of the cones, which is used to filter acoustic energy at the digital worddock frequency of 44.1kHz. The diagram also illustrates the AES/EBU digital interface receiver and the serial complement-to-parallel offset binary converter box. All the electronics was designed and built for IRCAM by the electronics department at Lyons University.

Unfortunately, time at recording sessions is always limited, so a prolonged listening test was impossible. Nevertheless, the sound quality was remarkably clean and detailed. Despite the French government's generosity to blue-sky research, like all such groups IRCAM are always pressed for funds and are anxious to licence the commercial manufacture of Dr. Gavan's loudspeakers. Pierre Gavan himself is convinced that, with a modest investment, it would be possible to produce a domestic version of the loudspeaker economically. As the IRCAM press release points out:

"Although the loudspeakers are themselves complicated, they dispense with the need for power amplifiers and a digital-to-analogue converter. In the home, all that would be needed is the CD player and the loudspeakers!" ●

Fig. 1 ▶

Block diagram illustrating the 'Hautparleur Numerique' from the French patent application..



recorded message

Left by Richard Brice

I hope you'll forgive me from straying this month from the world of recording and studio technology, the usual remit of my column, to the world of music. It seems to me that, as a nation, we do not appreciate our artists and composers as much as we should. We freely laud our sportsmen and women, our explorers, our actors and actresses, our television personalities even our politicians (once they are no longer in office anyway).

But, considerable though the achievements of our footballers, racing car drivers, pole pedestrians and Oscar winners are, there is a peculiar (to use George Meredith's phrase) "disrelish of brainstuff" in our treatment of our thinkers, over the treatment of our doers. All the more important then, when an appeal like the one launched this year by the Elgar Foundation, acts to preserve a part of our national musical heritage and to bring us closer to the life and works of one of Britain's greatest composers.

My interest in Elgar (and perhaps more importantly in Elgar's music) was recently rekindled when I attended a concert of his oratorio, The Apostles performed by the London Gala Orchestra and Ashtead Choral Society with Helen Pritchard, David Johnston, Laurence Whitehead, Caroline Stormer, Graham Titus and Martin Robson as soloists all under the baton of Arthur Diamond. Performances of this huge work are relatively rare and there only exists two recordings of the work: EMI's reissue on CD of Boult's 1973/74 Kingsway hall recording with the London Philharmonic and Hickox with the LSO on Chandos.

Sadly The Apostles has never achieved the impact or reputation of The Dream of Gerontius and it seems unlikely that this situation will improve much as The Apostles slips from the repertoire - aided and abetted by Novello who have taken the work out of print! From the performance I heard last Saturday, that certainly seems to be something of a shame. I would be lying to you if I said I spent two and a half hours in rapt attention because the work does flag a bit in the middle. But the setting of the Beatitudes and Peter's Denial and the last few pages of the work must rank amongst the finest Elgar ever wrote. Especially the last crescendo comprising; the huge orchestra, full chorus, semi-chorus and four of the six soloists. This builds into a "wall of sound" stretching from the earthly soloists to the heavenly semi-chorus. No less remarkable is Elgar's modern treatment of his subject matter. This is a very human work. Jesus is not central to the piece. Instead the composer explores, with very un-Victorian sensitivity, the flawed characters of the prostitute Mary Magdalene and the disillusioned revolutionary Judas.

Mary Magdalene:

Have pity upon me because I have sinned before Thee.
My tears run down like a river day and night.
Whatsoever mine eyes desired I kept not from them.
I withheld not my heart from any joy.....

Hide not thy face from me: put not Thy servant away in anger.

Judas: (following Jesus' exhortation, "Blessed are the poor in spirit for theirs is the kingdom of heaven.")

He poureth contempt upon princes.....
The poor is hated even of his own neighbour, the rich hath many friends.

And when Judas hears the people call for Jesus' execution,

Mine end is come - the measure of my covetousness.
Over me is spread an heavy night,
Yet am I unto myself more grievous than the darkness.

The Apostles is a piece that should not be allowed to suffer neglect - and neither should its creator. The concert performance was complemented by an exhibition mounted by the Elgar Foundation who have launched an appeal for £1M to enable it to provide a visitors centre at Elgar's birthplace in Worcestershire. Couched in the countryside that inspired so much of his music, the cottage at Broadheath where Elgar was born has been maintained as a memorial to the composer since the establishment of the Elgar Birthplace Trust in 1936, two years after his death.

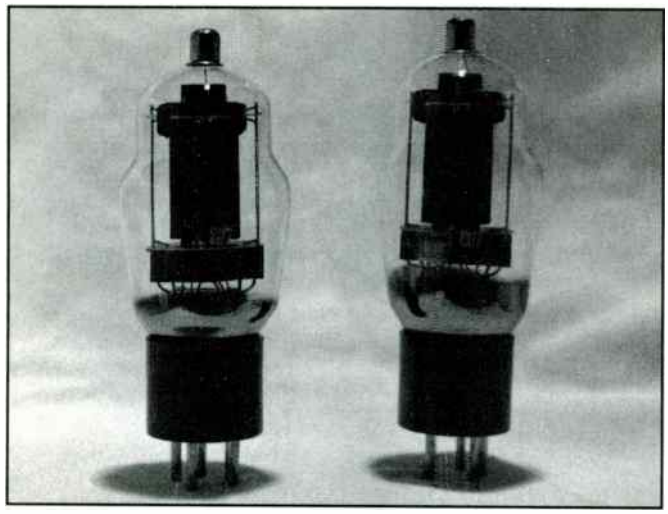
The appeal is aimed at providing a proposed new building close to the cottage and for the conversion of an existing building into an Elgar library where the composer's manuscripts can be preserved and safeguarded under proper conditions. Thankfully the proposed Elgar Centre is intended to blend in with the character of the surrounding countryside and is designed by the architects Firmstone and Co.

The centre will include, not only an Exhibition Hall, the Library and Archive Room, but also a large room for audio-visual educational presentations and for live music events. The new building is intended to release the original cottage from the many roles it is presently required to house and for which it is unsuited. The new centre, if it is built, will enable scholars and lovers of Elgar's music from all over the world to appreciate further the life and work of one of Britain's no - hold it, the world's great composers.

Of course, there is an argument which says, "What's the point of preserving a great persons birthplace? Does it illuminate the visitor by showing the room in which the master worked/ate/slept? Is it not simply a curiosity?" I do not subscribe to this argument. I assiduously visited Mozart's birthplace in Salzburg and enjoyed every moment of it, despite the fact that Mozart hated Salzburg. I visited Leonardo's birthplace north of Vinci, Thomas Hardy's, Shakespeare's and a host of others. And I did it because there's a special fascination in visiting the houses where the famous were not famous - where the great and the good were little and indifferent. It is in the houses where the great and the famous were born that each of us is reminded of our own vanity and humility. It is there that we find the mighty were made low.

If you don't know The Apostles, try to get hold of a copy on CD - both recordings are passionate accounts of the work. If you would like to contribute to the Elgar Birthplace Appeal, write to:

The Hon. Treasurer
Elgar Birthplace Appeal
c/o KPMG Peat Marwick
Peat House
2 Cornwall Street
Birmingham B3 2DL ●



A representation of the author

recorded message

Left by Richard Brice

It's often said good movies are made in the cutting-room, not on the set. If you've ever watched a movie or video edit you'll know what a difference the director and editor make as they painstakingly piece together the finished article shot by shot. Mistakes, poor lighting and sloppy acting are edited out and consigned to the cutting-room floor.

Unfortunately, this practice has lead to a belief in all sectors of the entertainment industry that performances can be fixed "post-production". Recorded music is no exception. It's a chastening thought to know that a classical Compact Disc may contain up to eight hundred edits. That's an edit about every five seconds!

There are several reasons for this state of affairs: Firstly, that it is possible at all. With the advent of digital recording and editing it's now feasible to stitch together one hundred 'takes' and seamlessly assemble them as an apparently complete musical performance. This has led to musicians, knowing the technical team can 'fix it in the edit' arriving at the recording session under-rehearsed. Also, record reviewers, who have criticised recordings with comments like "It's a pity about the sour oboe tone in bar 65 of the scherzo", have made record companies loath to release recordings with even slight flaws.

But, what price Beethoven in the age of digital editing? Is it any wonder that, time after time, music lovers cherish 30 year old analogue performances over their modern digital counterparts. At least the conductor knew, when he put down his baton 30 years ago, what the recording would sound like! Digital editing is doing for classical music recording what MIDI did for pop. The flawless, glossy and gutless is replacing the coherent, possibly blemished but sometimes inspired performance.

There is an energy - a vitality - well rehearsed live performances possess that a musical patchwork, no matter how beautifully or sensitively constructed, can never match. Nobody wants to hear dud notes, but a woodwind melody going slightly sharp at the climax of a musical phrase isn't a mistake, it's a natural part of a musical performance. The energy and fragility - it's human!

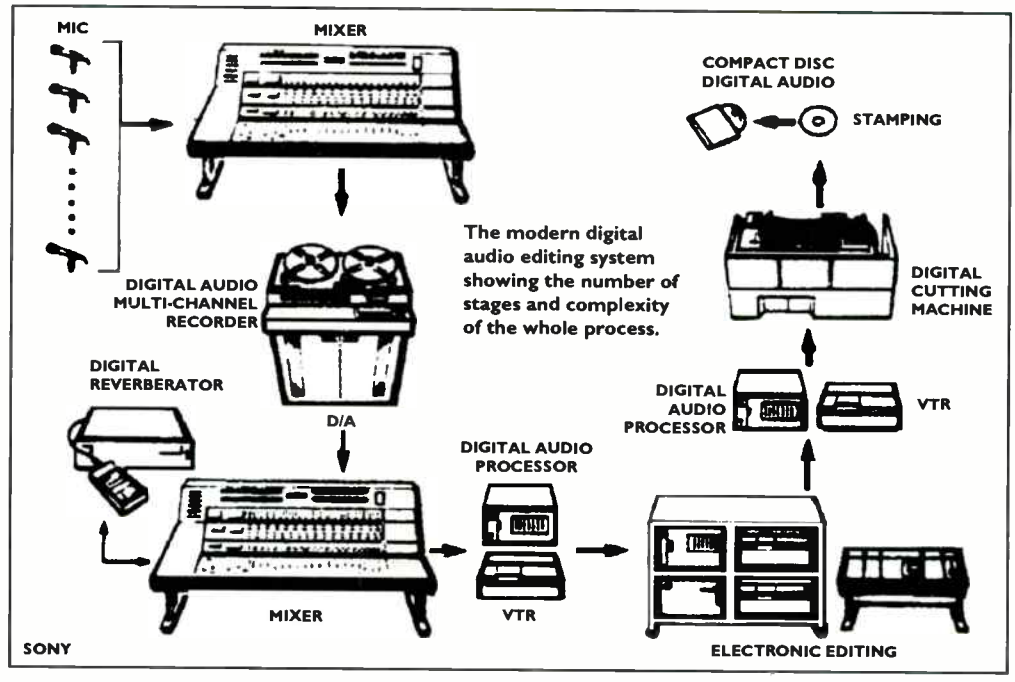
In pop and rock recording there is the beginning of a swing back to recording live. I know from rock recording sessions using MIDI sequencers in the past, that it was all too easy to fall into the trap of recording a sloppy keyboard part and then spending hours fiddling about with the technology, trying to fix bad timings and tunings. An attitude built up which was: "the technology is here to fix this and we'll do anything to avoid rehearsing and re-recording that piano part!!"

The trouble is, the technology gradually erodes the necessity and the inclination to put in a decent performance. This leaves the real job of shaping the music to the people with their fingers on the computer mouse, rather than on the musical instruments.

I know it's one of the great patterns of history that technology replaces skill. I, for one, cannot remember the last time I had to fashion flint-tips for my spears or harvest my own wheat! But, at least with the necessities of life, they just need to be there, such is the nature of their importance. The arts are rather different, they're not a necessity. Take the "art" out of food production and you may take away an indefinable something, but not its innate value. Take the "art" away from music and you're left with a kind of industrial by-product, completely negating its raison de' être.

Of course, it's not as bad as that yet. There's plenty of skill left. Audiences still go to live performances and that has ensured good orchestras and fine conductors. But digital recording is breeding new skills: fine editors and fine producers and fine MIDI programmers too!

It's not that the skills have evaporated from the production of recorded music but that the important skills have changed. I wonder how long it will take before the record buying public cotton on. Will we walk into "Our Price" in five years time and see Beethoven Piano Concerto No.5 with credits for producer and editor on the front and a small credit on the back page of the pamphlet for conductor, orchestra and soloist? ●



The modern digital audio editing system showing the number of stages and complexity of the whole process.

recorded message

Left by Richard Brice

Purists can argue until the cows come home but good neighbourliness and family life forces some of us to listen to music on headphones. For all their disadvantages of paradoxical stereo imaging - causing a miniature drummer to appear to play a miniature drum set somewhere in the region of the pituitary gland - headphones have distinct advantages. The most obvious is that it is possible to listen at realistic listening levels without inflicting one's own taste for loud music on anyone else. The second, is that they represent fantastic value.

For under fifty pounds it's possible to buy headphones which possess frequency response and distortion characteristics the equal of loudspeakers many, times their price. Why? Well, because, in a nutshell, they have to move far less air. (They also require far less electricity to do it, but I'll come to that in a minute.)

The characteristics of low harmonic distortion and linear frequency response at high listening levels lend headphones their oft-quoted virtue of clarity. I know one very respected classical recording engineer and producer who prefers to judge the nuances of different performances through headphones rather than via loudspeakers. When open-style, high-velocity headphones first appeared ten years ago, I found them a revelation. When I'm working on my own I use trusty, high-velocity Sennheisers. I've loved these 'phones ever since the type HD40; the HD320 and HD530 II are worthy successors. They're light, comfortable and are also supplied with very long leads - other manufacturers please note! I can work for hours on end and not even know I'm wearing them - a far cry from the old closed-back type which made me feel like I was wearing a Mickey Mouse dressing-up kit.

Unfortunately, for headphone listening, a high-quality, dedicated amplifier is indispensable too. Just such an amplifier is the subject of this month's column.

Integrated amplifiers which provide headphone output rarely have a dedicated headphone stage. Instead, they have a 'potted-down' version of the signal fed to the loudspeakers. Better are the dedicated headphone stages installed in CD players, cassette players and other separates. Yet the quality of these stages is very far from consistent and most, if not all, produce plenty of what used to be called 'listener fatigue'. I suspect this derives from the fact that the majority of headphone amplifiers are Class B in origin. In portable equipment, like a personal stereo, such a circuit topology is obviously imperative in order to keep current consumption to a minimum.and battery life to a maximum But the slight disadvantage of increased heat dissipation in a fixed, mains-powered separate is harder to justify.

Provided power consumption is not uppermost in the designer's mind, the choice of Class B operation for a headphone amplifier is particularly unsuitable. The reason is that the maximum voltage swing required to produce a very loud noise from most lower impedance headphones is only about 6 volts peak to peak. The crossover region (about 1.5 volts) thus represents about 25% of the total transfer characteristic of the amplifier. In other words, most musical information - except the very occasional transient - will occupy the region of the amplifier least able to produce signal without distortion. For comparison, a power amplifier designed to drive a loudspeaker will have a cross-over region which represents only perhaps 1% or 2% of its available output swing, so only very low-level signals will find themselves in the amplifier's 'twilight zone'.

If single-ended, class A amplification represents the zenith of purist amplification, what better place to try it than a headphone amplifier where the power output required to drive a pair of headphones is only about 100mW and the precious low-level signals are minute indeed. Fig 1 shows my own design. I have listened to this circuit for many hundreds of hours and its recovery of low-level detail is superb, it plays loud and fast and is very reliable and virtually noiseless.

The circuit itself is made up of a voltage amplifier stage (TL072 op-amp) and class A emitter-follower output circuits. Negative feedback is only used in the voltage amplifying stage and no overall feedback is employed. Each output device 'sits' in about 40mA of current. The power transistors run appreciably warm but do not require heatsinks. Best results are obtained if the bias is individually trimmed for each transistor (resulting from variations in ß) as shown in the diagram. A cunning feature of the circuit is that either channel is strung respectively between the positive and negative supply - this ensures that low-frequency transients (which usually occur centre-image) do not cause unnecessary currents in the signal ground. The other, incidental, advantage to building the headphone amplifier described here is that you will be able to tell your hi-fi buff friends you have installed single-ended, Class A, no-feedback amplification and can still afford clothes for the children ●

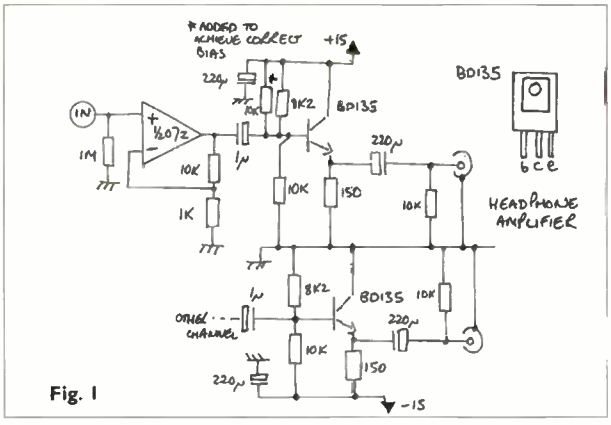


Fig. 1