THE HISTORY OF HI-FI 1978~2008

This article has a strange story behind it. While we were compiling the magazine, a strange box turned up out of the blue on Ron Harris's desk. It contained this report. The box disintegrated shortly afterwards, leaving nothing for analysis.
As the subject covered is *exactly* that which Ron Harris was working on at the time, we can only wonder at the origin of the work. The historical tone points to someone somewhen deciding to help us out with our predictions . . .

It is clear, in retrospect, how audio technology came to be in such a confused state in the later half of the 1970s. Having only recently progressed from such techniques as thermionic emission amplification and rubber band driven turntables (literally!) and having perfected neither, the industry was hardly in a condition to handle the newer and more promising ideas beginning to make themselves heard.

A classic case of nerves set in.

Things were a little better in the semiconductor field. VFETs were only introduced into the market in 1977, until which time bipolar transistors with all their inherent linearity and harmonic problems were universally employed. Perhaps it was the dissatisfaction felt with this device which caused the widespread vacillation that gripped the field at this time.

The Great Diversion

Early in 1976 the hi-fi press began to crystalise the feeling that 'things could be better', but in the most extraordinary, and to us, unbelievable manner. The forerunner of the transistor amplification circuit had been the thermionic or valve amplifier. Instead of controlling carrier movement within a doped semiconductor substance, these devices operated by modulation and retardation of electrons released from a heated electrode within an evacuated glass envelope.

Essentially the concept was a linear one, whilst transistors at that time were not. It was noted by such enthusiasts who had run both systems that the newer semiconductor amplifiers added an unpleasant 'edge' or harshness to the sound when compared to their predecessors. Not unnaturally two schools of thought drew themselves up, almost overnight.

The first stated flatly that valves were superior - and that was that. Transistors were 'edgy', 'harsh' and 'unmusical'. Bring back the 'good old days' (groan) of the 50s and 60s etc, etc.

Facing them were arranged the advocates of the new technology. Valves generated more distortion, more heat, required HT, deteriorated with age very rapidly and were generally to be ridiculed. Transistors gave a clean analytical sound much more faithful to the original (undefined but still held inviolate) and rightly replaced the outmoded valves.

At the outbreak of this polarisation, there were very few left in the middle to attempt to explain the phenomenon in a scientific manner. Both camps rapidly began producing evidence to support their own beliefs. Magazines began to take sides. One particularly infamous publication, seeking to bolster its failing circulation in the face of a congested marketplace, took up a decidely radical stance and was responsible for a good deal of the resulting escalation of the arguments.

Amid the effects of the debate, the cause began to get lost. Transistor technology was flawed - that much was recognised - but valves were beginning to gain acceptance as the answer to that flaw. Instead of harking back to the basic non-linearity of the amplification element itself, and attempting to correct this, it seemed for a depressingly long while as though valves would sweep back in, cheered

on by the press, and set back sound reproduction technology twenty years or more.

Economic Pressure Begins To Tell

Thankfully the battle was a protracted one. As in all extended conflicts, eventually it is economics which decide the issue. While it is undoubtedly true that valve design had not fully exploited the potential of the single carrier device, being abandoned too quickly in the face of an apparent overwhelming semiconductor superiority, and that early bipolar power amplifiers were wont to exhibit a particularly nasty sound spectrum, the big industry money had gone into transistor designs.

The initial changeover coincided with the advent of the consumer society in the widest sense. Hi-fi equipment began to appear in more and more homes, and the industry grew rapidly. Expansion continued unabated until the world-wide economic depression of the early seventies.

By this time however the die was cast and the framework of the new giant corporations, mainly Japanese, and their 'feeder' firms producing specialist items (i.e. the British loudspeaker industry), was firmly set.

So when the public began to apparently reject transistor designs, reaction was not slow in coming. Within a year most big companies had a valve amplifier on the market – at a price. Valves were considered as a fanatic's tool, and as such were available only in small numbers at high prices.

At the same time however the massive investments in semiconductor production had to be protected. With the power of the Yen behind it research at last began to identify and eradicate the faults of transistor amplifiers.

Meanwhile, back in print, some publishers were beginning to give space to freelancers who were coming up with ideas of their own. Microphony was belatedly identified as the cause of a supposed 'ambience' possessed by valve amps. This effect is a modulation of the election beam within the glass envelope by the action of sound waves striking that envelope. The valve acts like a microphone. Playing an uncased valve amp (as most of them were) in the same room as the loudspeakers gave an effect rather like turning up the reverberation control on modern signal processors. Pleasant, but highly disposable!

British firms acted totally in character. Small specialist concerns began to market the first truly acceptable semiconductor amplifiers. (Firms like Lecson, Naim and Quad began their climb to ascendancy here.) Close behind came the Japanese with all the speed and industry indiginous to that nation; they produced a whole new generation of 'soft sound' hi-fi tailored to the ears of their predominantly western market.

Valve amplifiers settled into a niche, a minority taste to be catered for a huge profit, and gradually faded away again never to reappear. By 1980 they had vanished completely. ▷

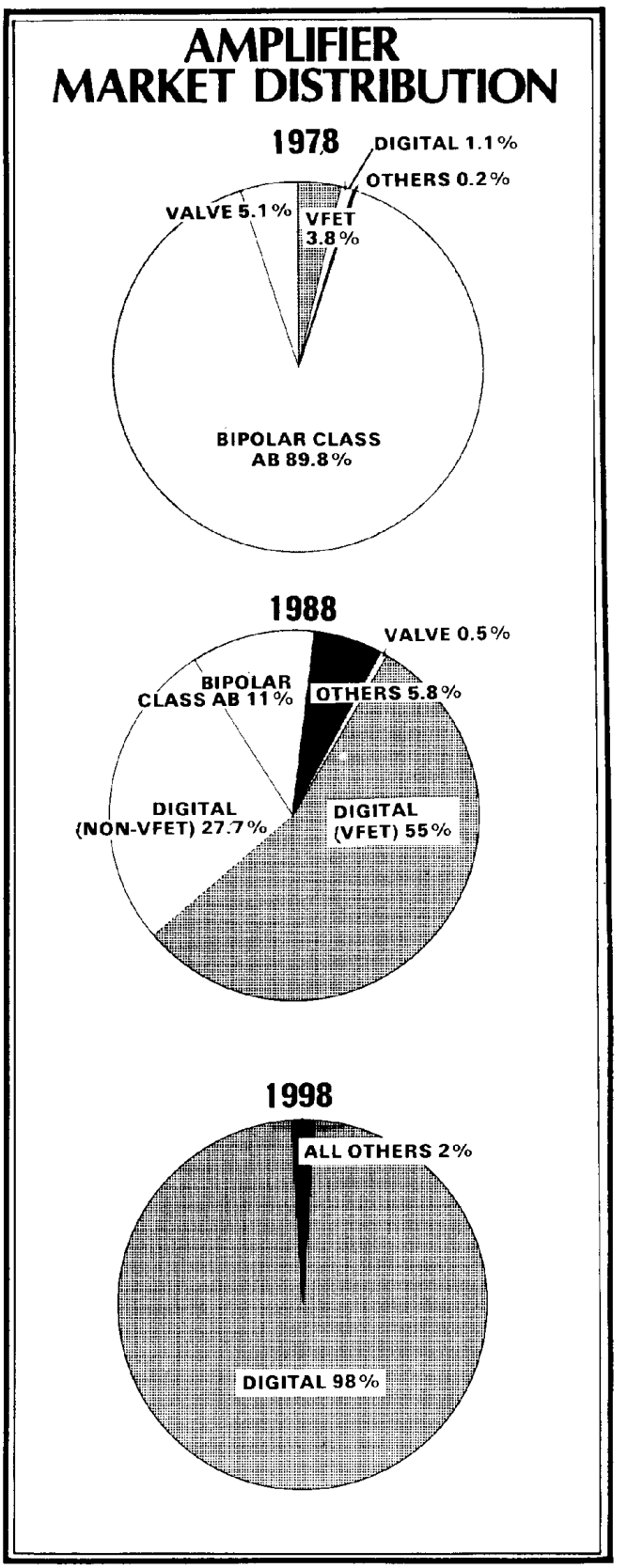

Fig 1: — the three diagrams show how the share of the amplifier market has been divided over the years. 1978 still shows the dominance of the early class AB hybrid design. Just ten years later, however, digital amps are accounting for a total of 77.7% of the total. 1998's figures require no comment!

Investment had been protected, and sound technology advanced. A luckily advantageous outcome from a most embarrassing incident. Progress could now be made.

Other Results Of Valve Resurgence

A furore of such magnitude could not help but have consequences far beyond the primary engagement. At about the same time as semiconductors came under attack, belt driven turntables were at last being replaced. Direct-drive units began to replace them at the top end of the market, and to seep downward into the mass sales area.

This 'watering-down' of a basically sound but expensive technique led to some degradation of performance at first, with the result that it was possible for the inherently inferior belt-drive units to outperform similarily priced direct drive devices.

Suddenly turntables too were in the great 'musicality' debate. Just as transistors suffered for their birth pains, direct drive had to pay for its early mis-application. Belt-drive was hailed as the ultimate manner of spinning discs. Such terms as 'information loss' 'hunting' and of course 'un-musical' were applied to direct drive turntables.

Once more the camps drew up, only this time they had somewhere to go! Belt-drive was a natural bedfellow for valve amplifiers, and the new sorely pressed direct drive fell gratefully in with the amplifier technocrats.

Mercifully this alteration was not to last long. Moderation has apparently been learned by now and opinion, divided though it was, never became so fiercely intransigent over the subject. Faults were recognised on both sides, and work progressed smoothly to correct them. Belt-drive reached its zenith with the Linn Sondek and Planar 3 designs, and once direct drive design surpassed these, belts began to fade from the hi-fi horizons.

Other smaller ressurections occurred elsewhere in audio. Moving coil cartridges, unjustly abandoned due to low output and tracking problems began to receive attention once more, and were developed considerably. Amplifiers began to incorporate circuitry to facilitate their usage just as the more advanced designs dispensed with the necessity!

Loudspeakers remained strangely untouched by the blight, national tastes continued to dominate with the British once more convincing the world that *theirs* was somehow more tasteful than anyone else's with a resultant domination of the market. The incredible Quad elec-

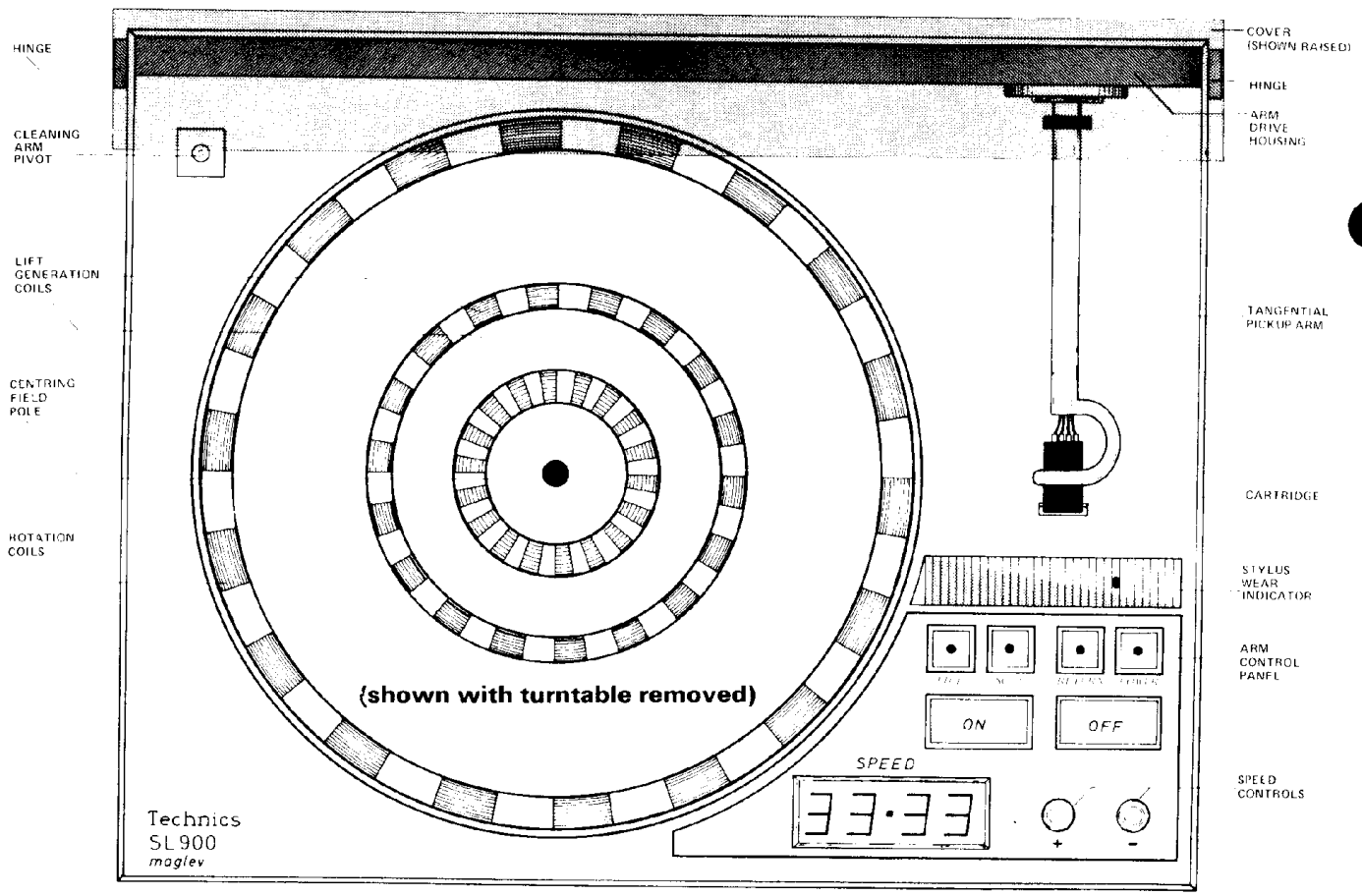

Fig 2: Above — The first truly modern turntable design, Technics famous SL 900 unit. Launched in 1979 it swept the field in a way no other model has done before or since. Early versions suffered from field problems, but these were eliminated very rapidly, and the benefits of a turntable with the platter and arm as the only moving parts were quickly realised by both competitors and the public. All present day manufacturers producing magnetic levitation turntables do so under license from Technics.

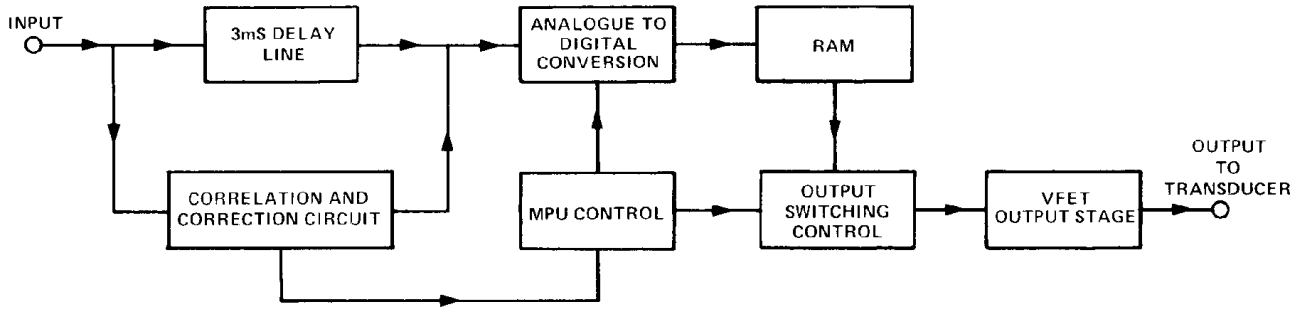

Fig 3: Block diagram of the early digital power amplifier circuits. Opinions at the time differed on the length of delay line used, and on the required sampling rate. The basic premise, however, was not questioned until 1986 with the advent of Pioneer TSA 5190 unit. (Full details Viewdata Listing Elec 177/H).

trostatic design was still largely unsurpassed twenty years after its introduction.

Dawn Of The New Technology

Nineteen seventy-eight saw perhaps the most rapid progression of any one year in the period. This was when VFET amplifiers, led by Sony and Yamaha, moved to take a much larger segment of the market. This was when several companies simultaneously launched the new direct drive machines which rapidly settled that particular debate.

The research financed by the giants mentioned previously advanced digital sound processing seriously for the first time, but foundered initially due to the failings of signal processing generally. It was not until late 1978 that MPUs were first employed to control the A to D conversions and the output switching functions.

Soon afterwards someone somewhere put a very fast MPU controlled processor on the same breadboard with an output stage of VFET power types, and modern amplification was born.

Signals presented to the input where shunted around a 3 ms delay line, and correlated to eliminate noise. From here the signal was digitalised at the fast (for the time) sampling rate of 100 MHz and used to control the 'power-switch' output stage of VFET devices.

(The reader is referred to his data terminal for a more detailed discussion of amplifier types. Historical tapes will have to be accessed for treatment of types previous to H. As this is a general survey details would be inappropriate here.)

Amplifier design wavered back and forth for a while as each failing of the bipolar circuits was indentified and dealt with. Lecson's was the first commercial design to acknowledge the importance of the rectifing metal-semiconductor junction in low level control circuits. Their solution was to employ FETs wherever possible in the signal path instead of switches. Naim simply left out as many switches (and hence facilities) as possible!

By the time charge contoured semiconductor material with its programmable carrier distribution in the surface layers appeared in the eighties, audio processing was almost entirely digital and so this solution was never seriously adopted.

Turntable design was reasonably static through 1978, refinements occupied most companies for a long while, and the first mag-lev design did not appear until well into 1979. This was the Technics SL900 which can still be found in modified form today.

Radially mounted drive elements in both the base and the table are used with a cycling drive signal to rotate the platter at the required speed. Control is achieved electronically by a sampling technique, and the high mass provides a good deal of smoothing. Isolation from external disturbance is of course very good.

The SL900 was also the first unit to employ a fixed height radial tracking arm, also mag-lev controlled, driven by pulses derived from the turntable drive circuitry for synchronisation. All in all quite a revolution for its time.

Conclusion

Thus audio technology emerged into the mid-eighties with a sound and undisputed base despite the dangerous turbulance of the late seventies. Loudspeaker development was thus able to bring about the startling advances of 1986 unhindered. Had the diversions of 1975-1978 gone much further however it is doubtful in the extreme whether we could now look back so smugly from our present day state of the art.

One is tempted to conjecture whether in a century or so a report such as this may be written in exactly these tones concerning our present day technology. □

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Our thanks also to the staff of IBM and ICL for their help in accessing the historical data necessary for this report. Without their programming skill the task would have been far more onerous.