

A bull's-eye for DARTS

Exclusive news of a revolutionary digital speaker system that could herald the end of hi-fi as we know it

Loudspeaker manufacturers across the world have been stunned by the surprise announcement and demonstration of the world's first 'Digital Loudspeaker'. Dubbed DARTS (Digital Action Reaction Transmission Speaker) by its Osaka-based manufacturer, Nippon Electric and Bearing Co. (NEBCO), the first model was demonstrated to a selected number of journalists earlier this year under conditions of great secrecy.

The background to this amazing development can be found in the ever accelerating movement towards digital electronics in the audio industry. Many recording and broadcast studios (including the BBC) are already re-equipping with digital mixing desks. The amplified output of the microphones is converted into digitally encoded pulses which can then be modified easily to alter the level, frequency response (tone) etc, often under the control of a minicomputer. Usually, the resulting output is converted back to an analogue form for recording onto a conventional multi-track recorder, but some studios are already using digital recorders (EMI, Nippon Columbia) or sending the output down landlines in a digital form (BBC).

The main advantage of such technology is that at any point in the chain techniques exist to correct any errors that accumulate, with the result that noise and distortion become things of the past. A number of companies have produced excellent records by conversion of their digitally encoded recordings to an analogue form.

However, despite the excellent quality of these pressings, it's a compromise that sacrifices quality for compatibility with existing record playing equipment. The future lies with production of digitally encoded discs using either the Philips/Magnavox system or the similar Sony system. Laboratory discs already exist that have been digitally encoded from microphone output to disc, and their freedom from noise, distortion, wow and rumble is absolutely staggering. But at present the output from the laser-scanned discs is converted back into a low level analogue form to feed to conventional amplifiers. Such amplifiers are essential to drive the conventional loudspeaker which must be driven by a high-level analogue signal. Thus the loudspeaker has been the major stumbling block to any further progress in the digital chain.

The remarkable DARTS system completely does away with the need for a conventional amplifier with all its problems. The stream of pulses from the disc-player is decoded by a mass of high-speed logic circuitry under the overall

control of the ubiquitous microprocessor. Two outputs are generated, one equivalent to the level of the signal and the other equivalent to the time-character (eg frequency) of the original signal.

The loudspeaker itself is extremely unusual, although in appearance it looks like a large electrostatic panel. It is the result of many years of research involving leading Japanese experts in the fields of metallurgy, mechanical engineering, acoustics and computer science. It is composed of a matrix of miniature 'air pistons' meshed together in a honeycomb pattern. Although the matrix is arranged as a conventional X-Y chessboard system, the drive units themselves are arranged in a helix. Thus the centre driver will always be operated while those at the outer perimeter will only operate occasionally. For a low-level high frequency note, the centre driver will be operating, for a medium level note perhaps the centre third of drivers, and for a very loud note perhaps all the drivers. This arrangement is alleged to give an excellent 'wave front' to the resulting sound. Each driver is complete in itself but can only radiate a tiny amount of acoustic power. For this reason, other drive units are activated in succession as the level increases. On the prototype DARTS, a total of 16,625 drivers are arranged, giving a usable dynamic range

of 80dB — compatible with envisaged digital disc systems and well in advance of the current systems. Maximum Sound Pressure Level is a daunting 124dB and this (for reasons apparent later) is undistorted. There is in fact no distortion or clipping — the speaker just reaches a certain level and then stops getting any louder.

The individual 'air-pistons' of the DARTS matrix are the key to the whole system. They each consist of a thin hexagonal piece of Beryllium carried on a miniature high-speed solenoid of the type used in large computer printers. On receiving an impulse from the control circuitry, the piston is moved forward and in doing so pushes forward a 'lump' of air. At any one time, half of the 'air pistons' are IN and the other half are OUT. Once a piston has moved, it is registered by the computer as now being in the reverse position and being ready for further movement instructions. It is apparent, therefore, that increases in sound level are achieved by operating successively more pistons simultaneously. Low frequency waveforms, as they last for an appreciable time, are generated by activating batteries of pistons in succession. Thus the waveform is composed of horizontal levels (representing amplitude — each extra piston being a one-step increase in level) and vertical slices, each representing a period

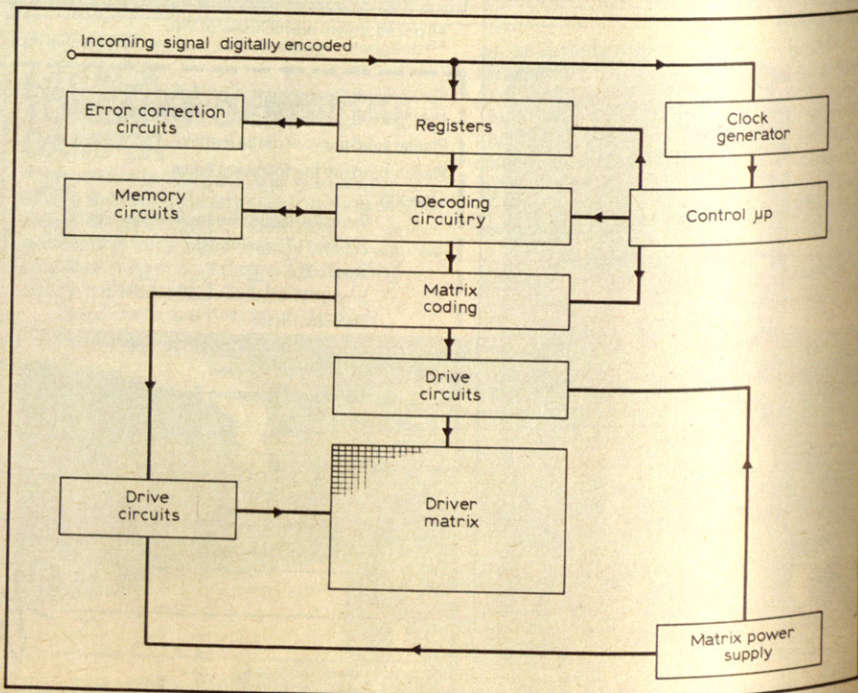


Fig. 1 'DARTS' system diagram

time during which a fresh battery of pistons must move. Eventually, all the pistons will be in the OUT (or IN) position and no further output is possible until the waveform reverses polarity.

It is this that determines the low-frequency response of the DARTS system. To prevent the possibility of a bass note just stopping in mid-stream, a clever automatic computation has been evolved. The incoming digital signal is subject to a delay before it is converted into sound energy. 'pre-listen' evaluation of the incoming signal is performed by the computer which quickly calculates the piston line-up needed to reproduce a particular piece of the signal. If the requirement is beyond what will be available, the computer reduces the level of the signal until it suits the number of available pistons. Such excellent management of the system allows the DARTS system to give its optimum performance at all times.

This digital loudspeaker is inherently free of any distortion or non-linearity as all movement of air is very much a switching action. In fact measurements, as well as theoretical computations, have indicated that the dominant audible distortion is caused by the non-linearity of the air itself, in acting as a transmission medium. As no component of the 'speaker' is actually vibrating, there is no danger of resonances and consequent colourations. Although the sound is emitted as a number of air pulses or plasmas, these quickly integrate to form a coherent wavefront (as described conventionally). The moving part of the piston is so light that the DARTS response goes up to super-sonic frequencies as well as achieving a superb transient response. As described before, this loudspeaker cannot clip or bottom and so never emits any audible signs of distress. Indeed, the engineers responsible believe that performance is close to ideal although research continues in two main areas: (i) Directional characteristics. (ii) Replacing the 'solenoids' with a much cheaper energiser.

The complete DARTS system consists of three modules: the driver panel itself, the power-supply (the equivalent of the power amp) and the decoder module. The latter is relatively inexpensive, being built around a low-cost microprocessor. At present, the major costs are centred around the drive panels, but work is in hand to significantly reduce their cost. In fact, a range of units is planned, down to a small bookshelf unit in the £450 bracket. It is expected that these production units will appear under one of the major Japanese brand names.

So much for the theory, but what of the results? Well, hold on to your seats for their subjective performance defies description. NEBCO set up a demonstration using specially produced digital discs replayed on a Sony disc player. There was no noise, no distortion, no colouration, wow or rumble, and apparently unlimited reserves of volume. The result could not be compared to anything heard previously: it was just so real. One particularly revealing passage was a street 'atmosphere' recording. Reproduced at a sensible level, the effect was as though someone had opened a window out onto the street.

So when can you hear DARTS? Well, although some demonstrations may be made at international conventions and exhibitions, full production is two or three years away to tie in with the timetable for digital disc manufacture.

Just where does this leave the world's specialist audiophiles? Well, they are now up a creek without a paddle. In a few years' time, their turntables, arms, cartridges, amplifiers and loudspeakers will be inadequate to meet the new standards.

DARTS may be heralding the opening of a new age for audio enthusiasts, but at what cost? Must our industry head for oblivion like the wool industry before it, or can they produce their own DARTS? Time, alas, is not on our side.

OLAF PIROL

An ode to Ella

TV viewers and magazine readers will have noticed that the 80s have started with a new advertising campaign for tape firm Memorex, in which not a single glass is shattered. Feeling that this event was too significant to pass unnoticed we tracked down the famous poet of Greek Street in a nearby pub and commissioned him to write us an epitaph:

So, Miz Ella Fitzgerald
it is finally farewell
from Mister Memorex.
Goblets the world over
may now
sleep easy in their beds.
Which is really just
as well
Because shattering a
glass
With a sledgehammer sound
tells you as much about
tape
as kicking an advertising
manager in the groin tells
you
about shoe leather
(EJ Thribb (17))

Audio-Technica hit by OEM selling

Audio-Technica are the latest cartridge manufacturers to be plagued by the direct-selling to the UK public of a product which should only appear here as an OEM component on other companies' turntables.

Cartridge in question is the AT 12E, and its unwelcome direct-sale appearance in certain UK outlets is the result of the auctioning-off of an OEM batch supplied to a turntable manufacturer who subsequently went bust.

Audio-Technica's original sale took place several years ago, so naturally the company are unwilling to accept responsibility for products whose present condition is unknown. As a result, they've been forced to withdraw any guarantee or warranty on AT 12Es supplied in any non-standard Audio-Technica packaging.

Sansui cut costs of mini-speakers

Sansui have lopped 15 per cent off the price of a pair of their two-way, paperback book-size J11 mini-speakers. The move has been partly prompted by the consumer interest shown in the product so far, and partly by a desire to foster even more interest in the future. The retail price per pair is now down to around £92 from the previous £108.

Full details from: Sansui Audio Europe NV, Unit 10A, Lyon Industrial Estate, Rockware Avenue, Greenford, Middlesex UB6 0AA (Tel: 01-575 1133).

London guide

Just a quick reminder that next month's HFP will be accompanied by the free official guide to the Spring High Fidelity 80 show which will be staged at London's Cunard Hotel on April 23 to 27.

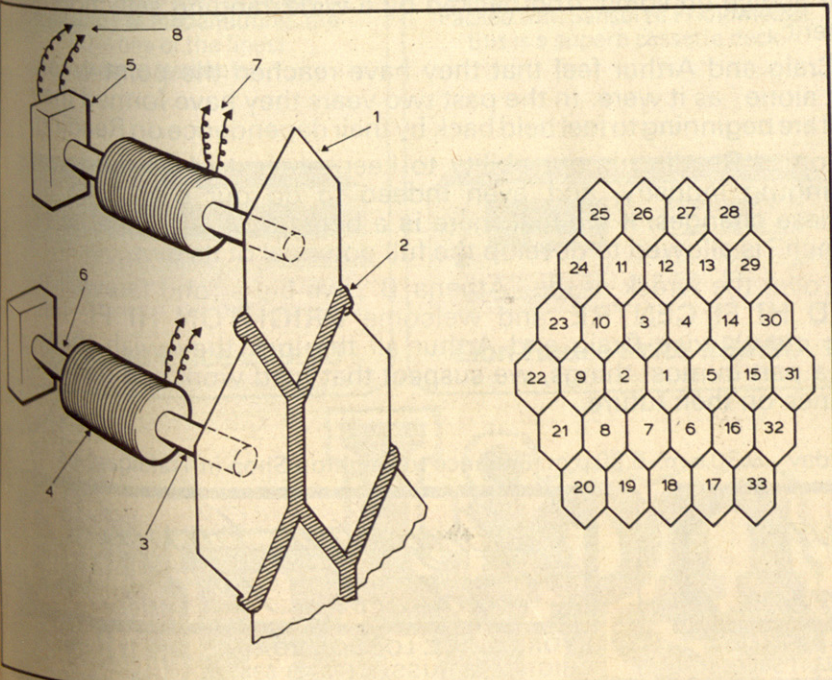


Fig. 2 Extracts from the 'DARTS' patent specification