

Stereo

PRESTIGE & IMAGE



Scoop !
Leedh C
le Concept
Speaker

Installation
exemplaire
Par Jean Hiraga



BANCS D'ESSAIS

ACCUPHASE C-2410 / A-35 • ATOLL DA
CYRUS 6 XP • DAVIS ACOUSTICS Mon
EXPOSURE MCX • KTR LAB Evolution 5725
LEEDH Concept Speaker C • MC INTOSH MP
NEOD 37" • ROTEL RB-1082 • SPEND

Mc Intosh MPC 1
le secteur dép



L 14379 - 42 - F: 5,00 €



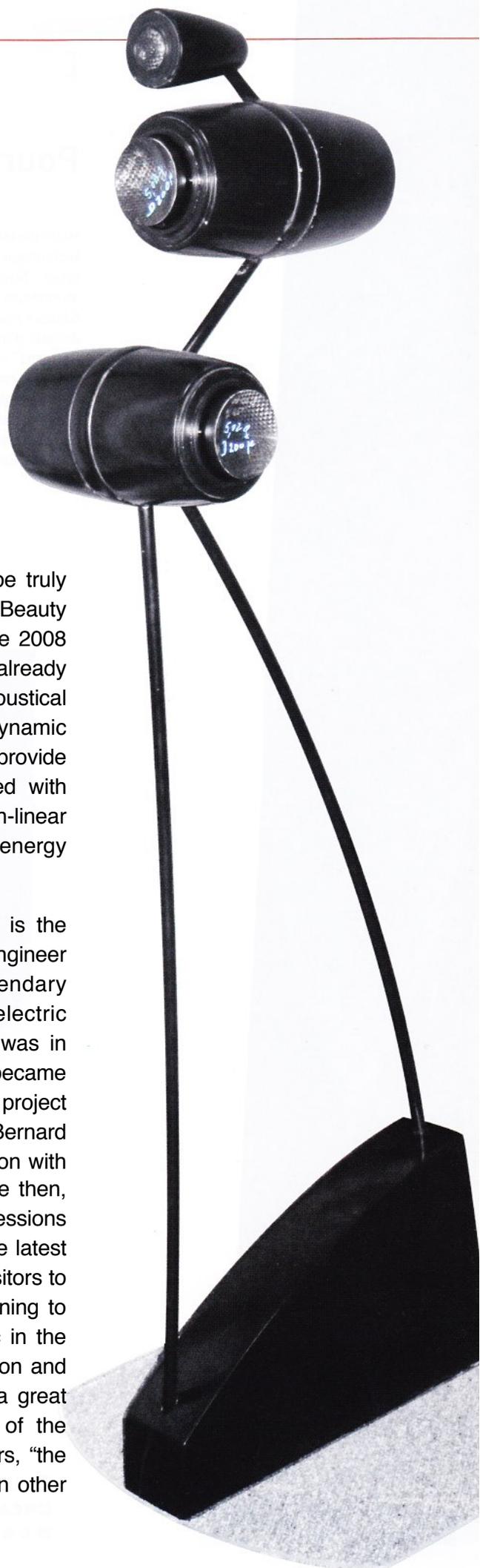
LEEDH

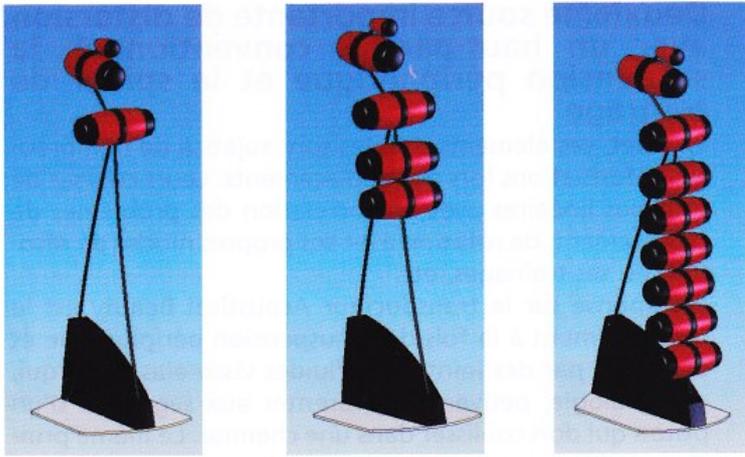
CONCEPT SPEAKER

Here is a preview of the LEEDH Model C, the first in a range made up of models D and E (which are coming out next year). The definition of the C, D and E range is based on English musical notation - C (do), D (re), E (me). *today the range is called C, E and G (the perfect harmony)*

We consider the Leedh Model C concept speaker to be truly revolutionary as it incorporates the new Acoustical Beauty electrodynamic high definition loudspeakers. In our June 2008 edition (number 25), in the news section, we have already described the main technological features of an Acoustical Beauty high definition loudspeaker. These electrodynamic loudspeakers were truly created from scratch in order to provide a technical response to the main problems associated with conventional loudspeakers (cone, dome or flat) - non-linear distortion, resonances or break up modes, slow energy dispersion, oversize, need for total mechanical reliability.

Readers will remember that this really brave initiative is the work of M. Gilles Milot, a pioneering French acoustics engineer who created, among other things, the now legendary Perspective speaker system, Leedh, the piezo electric membrane speaker and who for more than 15 years was in charge of the Harman Group's Audax laboratory, who became interested in a revolutionary electrodynamic transducer project being developed in le Mans, as early as 2004, by M. Bernard Richoux in the Incubateur Emergence and in collaboration with M. Guy Lemarquand from the University of Maine. Since then, Gilles Milot has organised some memorable listening sessions with the prototype system using these transducers at the latest Hi-Fi Show in the Hotel de Sevres (see report no.39). Visitors to the Salon were able to appreciate for themselves, listening to the Leedh Model C Concept Speaker, a new aesthetic in the field of sound, stripped of the usual mechanical coloration and any kind of distortion, resulting in the reproduction of a great tonal precision completely removed from the source of the sound. Or in a phrase commonly used by hi-fi observers, "the best sound system is one which cannot be heard," or in other words, one which does not announce its presence ...





The LEEDH speaker series using the Acoustical Beauty loudspeakers, will be fully modular: the basic model C Speaker on the left picture can be upgraded to E Speaker (center), with 2 additional woofer modules, both C and E speaker can be upgraded to G Speaker (right) which has 6 woofer modules more than C speaker.

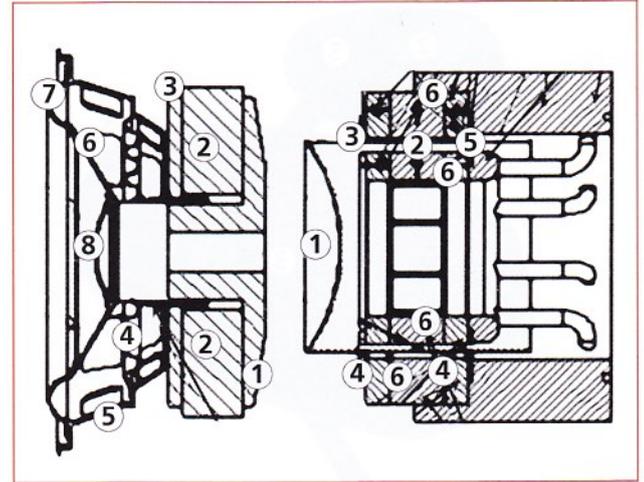
... through the inclusion of mechanical interference detail as well as the removal of primordial musical parameters.

This was also an opportunity to note the progress of Acoustical Beauty transducers towards covering the entire audible spectrum, with a specific module for low sounds with paired transducers working in push-push each with a load of only 0,28l, a medium module with an identical volume facing the listener and including internally another mute annular diaphragm transducer working in phased contrast to produce, without adding mass and making it incompatible with domestic use, a stable mechanical framework, and finally a tweeter also using the principle of the iron-free magnetic circuit manufactured using neodymium/iron/boron materials.

Back to the basics of electromagnetic loudspeakers, re-evaluating how an acoustic system should fit into the home

First of all, one of the main causes of interference phenomena in a conventional loudspeaker resides in the configuration of the electrodynamic motor with a magnetic ring, often made of ceramic material, sandwiched between soft iron magnetic poles creating problems of non-linearity (coil movement not in a linear magnetic field in the air gap, causing nearly 90% distortion) with phenomena due to eddy currents, hysteresis and flux modulation. This problem has been solved in the Acoustical Beauty transducer (see picture for technology) by adopting a magnetic circuit using no soft iron polar parts, with concentric axial rings made directly from neodymium/iron/boron, giving a constant field on the mobile coil's mechanical excursions capable of reaching $\pm 7\text{mm}$ and with distortion on these excursions not exceeding 10% as opposed to 90% in a traditional transducer. Effectively, problems with Eddy currents, hysteresis with variations in the value of self-inductance, flux modulation are all eliminated.

A view on the technology



Above the comparison between the conventional electro-dynamic speaker (left side) and its structure with the magnet system, basket and moving parts: 1 - T-yoke in soft iron, 2 - ferrite magnet ring, 3 - pole plate (soft iron), 4 spider, 5 - basket, 6 - membrane, 7 - surround, 8 - dust dome

and of the new HD speaker concept of Acoustical beauty (right side): 1 - concave carbon dome of 54mm diameter and 120 μm thickness, 2 - windings of voice coil, 3 - the long voice coil former, 4 ferrite magnet ring, 5 - ferro-fluid ring, 6 - axial magnet rings of Neodymium-Iron-Boor



Detailed view of the different modules of the Concept speaker model C:

1 - Tweeter with carbon dome, 25mm diameter, 2 - Low-midrange module with (3) the carbon dome of 54mm diameter, on the opposite (back) side a inaudible ring transducer just to eliminate the mechanical vibrations, 4 - Woofer module with two transducers working in push-push and mounted in 90° angle to the listening axis

A view on the technology

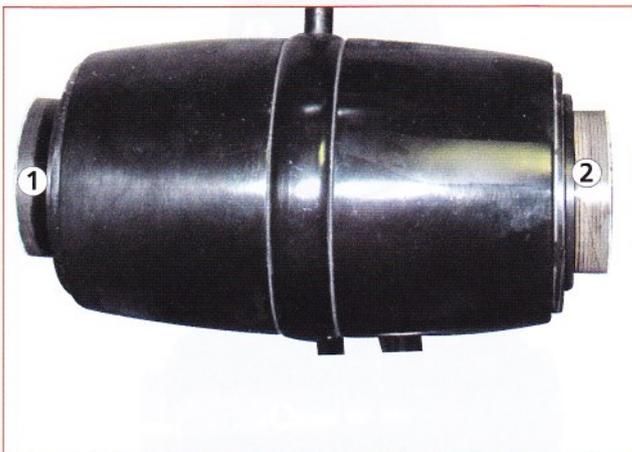


Detailed view of the tweeter and low midrange modules:

1 - carbon dome of 120 μ m thickness, 25mm diameter, with (2) its circular surround 3 - invisible the magnet structure made of a machined block of Neodymium-Iron-Boor rings. This tweeter reproduces the frequency range above 7kHz.

Below the low-midrange module with (1) the carbon dome of 54mm diameter, fixed on the long voice coil former (2) made from carbon of 70 μ m thickness with invisible the ferro-fluid ring replacing the traditional suspension parts., also invisible the magnet structure made of a machined block of Neodymium-Iron-Boor rings of 600g

3 - the injection molded shell made of epoxy-ceramic composite with a back volume (charge) of only 0,28 liters
4- on the opposite (back) side a inaudible ring transducer with identical parts as the front speaker except the missing dome, just to eliminate the mechanical vibrations.



Detailed view of the woofer module:

1 and 2 - the carbon domes and carbon voice coil formers working in push-push mode, and the same magnet structure and epoxy-ceramic shell as the low-midrange above provide a symmetric double back volume of 2x0,28 liter. The new principle to eliminate the elastic suspension enables an excursion of 27mm. With the new magnet structure without soft iron pole pieces all innovating elements together results in a tremendous reduction of distortions, knowing that without charge (free air the woofer has 0 Hz resonance frequency).

Second major cause of distortion in a conventional speaker – the peripheral suspension (surround) and the centring spider

These flexible parts are indeed likely to be distorted in many ways in their movements. Their trajectories are not linear, and consequently there are problems of tilting, rotation with its own resonance modes, slow energy dispersion etc.

The solution in the Acoustical Beauty transducer is to replace both the peripheral suspension and spider with visco-elastic ferro-fluid seals which, by analogy, can be compared to the segments of a piston which has to slide into a liner. The principle involved in these seals is also to be found in very high-speed rotation bearings. Thanks to this process, the long mobile coil bracket remains perfectly centred on excursions of a total length of 2,7cm! The return is not due to the mechanical flexibility (flexing or extending) of a flexible material, but linked to the principle of air compression (acoustic suspension) with electromagnetic protection (in the event of over-excursion). Thanks to this new principle of suspension creating very large excursions, the designer has achieved a de-correlation between membrane diameter and excursion, leading to a new approach moving towards a reduction in the emission area and hence also in the load volume. Since the suspension has no mechanical force return, low resonance frequency is reduced to zero when the speaker is operating without acoustic load. Using air compression and expansion and in order to balance these various pressures, a network of internal tubes has been incorporated, with external evacuation.

A new principle of antagonistic forces to achieve a stable mechanical framework

For the medium module situated facing the listener, the designer became aware that the heavier the module was made, the more the dynamic improved and the transitory response became more direct and faster. However, the idea of transforming the transducer into an “anvil” did not fit in at all well with the objective of an aesthetically pared down system. The practical idea was to arrange symmetrically, opposite the medium one, another mute transducer based on the same principles - magnetic circuit, absence of suspension, and a diaphragm no longer in the shape of a dome but an annular crown functioning exactly in phased opposition with the inverse dome transmitting directly towards the front. In this way antagonistic internal forces cancel one another out and the front transducer has an absolute mechanical framework without the need for a heavy mass as with infinite inertia.

Ultra compact bass module

The bass module placed at 90° to the median axis (see image technology) is fitted with two Acoustical Beauty transducers placed at either end of the composite epoxy resin ceramic shell, transmitting in phase in line with a push-push principle. In this way we have two inverted 5.4cm diameter domes operating in phase and here fore in push-push with, in order to reproduce the 20Hz, a ± 7 mm linear

excursion giving a distortion rate of only 10 % (with a total load of only 0.28 l). If we compare this with a low excursion cone loudspeaker, this is the equivalent of a 17 cm emission area.

For this evolutionary speaker system, Leedh envisages the following range: Model C with 3 independent active transducers equivalent to a 17 cm (1 bass module with 2 x 5.4 cm + 1 medium 5.4 cm bass module with inverted dome + one 5.4 cm annular diaphragm mute transducer + 1 x 2.5 cm tweeter), model D with 7 active transducers (with 3 bass modules), equivalent in total to one 24 cm, Model E with 15 active transducers (7 bass modules, in other words a total with the medium equivalent to one 36 cm).

A filter which reduces phase rotation problems for an open, articulated bass

The filtering of these bass modules is carried out very gradually starting at 200 Hz at the rate of 1.5 dB per octave (avoiding sound blockages due to phase rotations). Given the very large excursion of bass module mobile parts, registers below 200 Hz are at 90° in relation to the listening point (no more Doppler effect) suppressing peer harmonic artefacts at 0°.

A tweeter with very low distortion

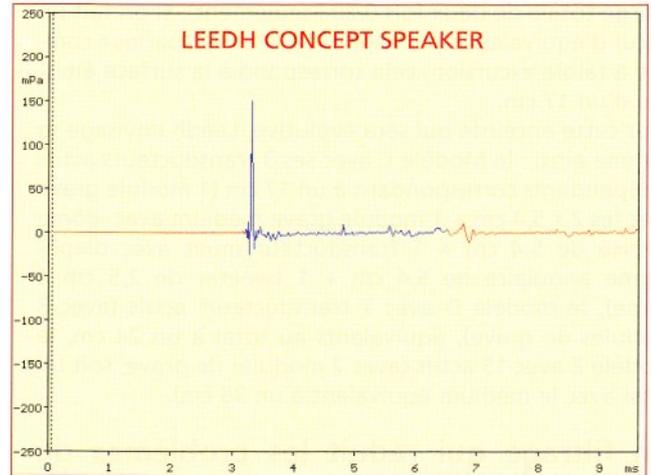
The tweeter has a 25 mm positive carbon dome. It uses the principle of the magnetic circuit directly manufactured using neodymium/iron/boron without any soft iron parts, for transcribing frequencies in excess of 7 kHz. Thus, between 600 Hz and 20 kHz, the phase curve is contained within $\pm 15^\circ$. Beyond 20 kHz, Leedh has allowed for a steep filter of 36 dB per octave with no phase rotation above 7 kHz and eliminating all digital processing residues, which is important when using with class D amplifiers.

The sum of these technologies is observable in measurements. So when 60 W are applied to this speaker system, above 600 Hz, total harmonic distortion is less than 0.02 %, identical to, in other words, or even less than, distortion values for numerous amplifiers.

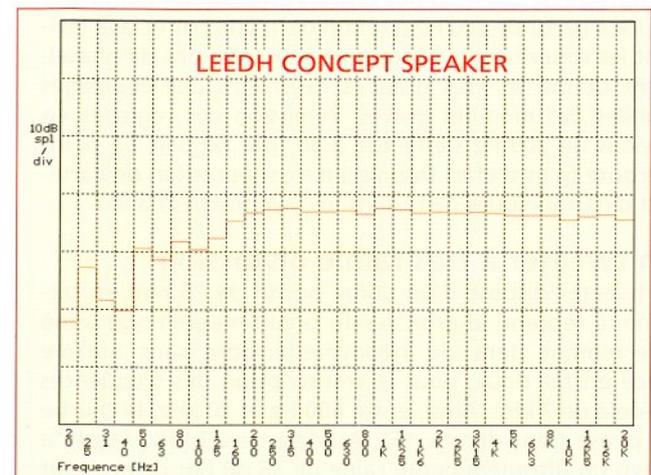
A system without baffles

The model C system will come with a heavy base, incorporating the filter components, plus a cavity filled with 5 kg of sand for total stability. The tube structure supports the bass modules (situated at 90° to the listening area), the medium bass module facing the listener and above the tweeter module slightly off centre to achieve good phase. The mechanics have been designed with great care in order to eliminate any interference from vibrations (no vibration can be felt when placing a hand on one of the modules while it is functioning). The transducers have absolutely no baffles, thus eliminating any risk of interfering reflections, with a guarantee of an ultra-stable stereophonic image.

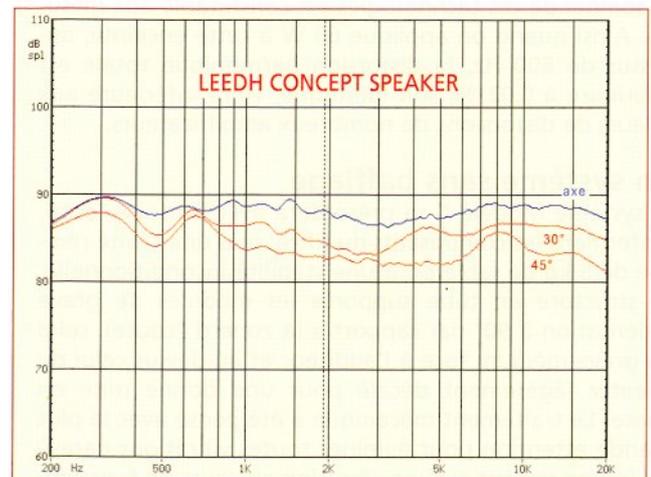
First measurement results from our lab



Impulse response, simply exceptional, ultra rapid build up of energy and fast dissipation after.



Response curve in axis with third octave of the prototype of concept speaker model C with only one woofer module, revealing the general linearity curves, very flat drop in low frequencies



Directivity curves at 0°, 30° and 45°, nothing to criticize, the curves make the very stable stereo image visible