WALSH PATENT PRODUCTS

MODEL	LIST (Each)
OHM A — Walnut	$1500
OHM A — Teak	$1600
OHM A — Rosewood	$1700
OHM F — Walnut	$ 525
OHM F — Teak	$ 625
OHM F — Rosewood	$ 725
OHM G — Walnut	$ 775 (pr.)

New Product — Ohm G

Although it is considerably smaller and less expensive than any previous Walsh speaker, the Ohm G represents in some ways a genuine advancement of the state of the art.

With a Walsh driver only 8 inches in diameter and 9 inches high, and with an air space of only 1.05 cubic feet under the titanium-and-aluminum cone, the speaker has an almost unbelievably smooth response from 32 Hz to beyond audibility.

What the smaller driver lacks in cone area and excursion capability is more than made up for by the extraordinarily sophisticated design of the enclosure. A 10-inch passive radiator, facing rearward in the normal position of the speaker, is used to reduce the excursion requirements of the abbreviated Walsh driver by about 60% as compared to an equivalent sealed system. At the system resonant frequency of 32 Hz only the passive radiator moves; maximum excursion of the driver is at 45 Hz. Above 64 Hz the contribution of the passive radiator becomes insignificant and the speaker begins to behave like a sealed Walsh system.

This particular bass-loading configuration is known as a fourth-order Butterworth filter and is characterized by perfectly flat output. The interference with coherent sound radiation below 64 Hz or so is of no real significance, since phase effects are inaudible in that range. On the other hand, the gain in efficiency over an equivalent acoustic-suspension design is at least 4 dB. The Ohm G can therefore be driven with medium-powered amplifiers, although its ultimate power-handling capability is extremely high — 300 watts rms maximum and 225 watts continuous.

Tests of phase coherence and transient response show an almost perfect square wave at 3,500 Hz! There could be no better proof of the validity of the Walsh principle.

241 TAAFFE PLACE, BROOKLYN, NEW YORK 11205 Ohm

C765-036

AUSTRALIAN HI-FI

STEREO BUYER'S GUIDE SPEAKERS No. 3

Complete guide to Speakers and what to look for when buying.

Reprinted With Permission From Stereo Buyer's Guide

Ohm F

Virtually every year a loudspeaker manufacturer claims some new discovery or development that will revolutionize the industry and set a new standard for all to be measured against. Some remain, most are forgotten.

Linear Sound Pty. Ltd. are ecstatic about the latest such development which is now available in Australia — the Ohm F coherent sound loudspeaker. And so fantastic is its approach to reproducing sound that it's worth skipping the usual layout of these Product Reports to explain the history and reason behind it, as provided by the manufacturer.

The Inventor

Lincoln Walsh (1903-1971) always had the highest professional standing, not only as an audio designer but also as an expert on high voltage power supplies, transformers and other technologies. Veteran audiophiles are still sentimental about the Brook all-triode amplifier, a Walsh design regarded as the state-of-the-art for a number of years after World War II.

Very few people understood, however, the crowning achievement of his life, the coherent-sound loudspeaker. Even some quite sophisticated engineers referred to it as merely an interesting development in metal-cone drivers. One reason for this general shortsightedness was that Lincoln Walsh's early demonstration models had certain characteristic anomalies in response, due to

unsolved problems in construction technique.

It remained for Ohm Acoustics Corp. to recognize the invention as an absolutely basic discovery, the Newton's apple of electro-acoustics, and start a collaboration with the inventor. In Lincoln Walsh's own words, everything he had learned in a lifetime of engineering practice fitted together in one fundamental insight.

The Concept

The briefest possible statement of the principle whose perception led to the eventual design of the Ohm F would be this:

A loudspeaker cone does not really behave, and cannot be made to behave, like a piston. It does behave and can be made to behave perfectly, like a wave transmission line.

Abruptly stated, this unorthodoxy may not reveal its full implications, which will be discussed below. It does, however, identify the invention as the first loudspeaker that does not even attempt to operate as a rigid piston, which has thus far been the engineer's conceptual model of the perfect speaker diaphragm. This model is now scrapped as illusory and replaced by an equally pure and far more attainable ideal; a conical surface that "ripples" in the organized and predictable manner of a wave transmission line.

The physical shape taken by the concept is, at the moment, that of a large electrodynamic driver, superficially resembling a woofer with an exaggeratedly deep cone, mounted face

down on top of a large enclosure, "wrong" side out and magnet up.

The woofer-like appearance tends to deceive the uninitiated; the speaker is actually very close to being the ultimate expression of the audiophile's 20 to 20,000Hz fantasy, rather than a low-frequency unit.

The proof of the concept is in the acoustic output. That turns out to be the same as would be produced by a cylinder pulsating radially, with every portion of its surface moving in simultaneously and out simultaneously, in perfect phase with the input audio signal. Such an acoustic output is called "coherent sound", since it is analogous to coherent light as produced by a laser.

In a listening environment having a floor and a ceiling, a pulsating cylinder is the logical evolution of a pulsating sphere, which is the more generalized textbook ideal of sound reproduction, regardless of the mechanism used.

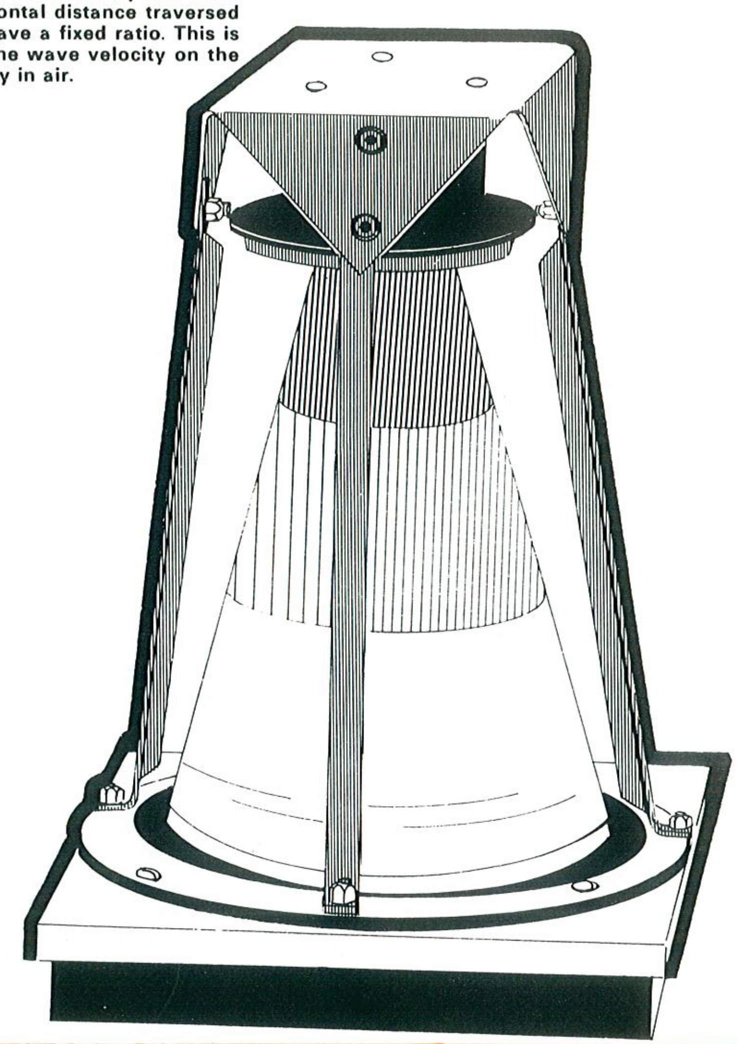


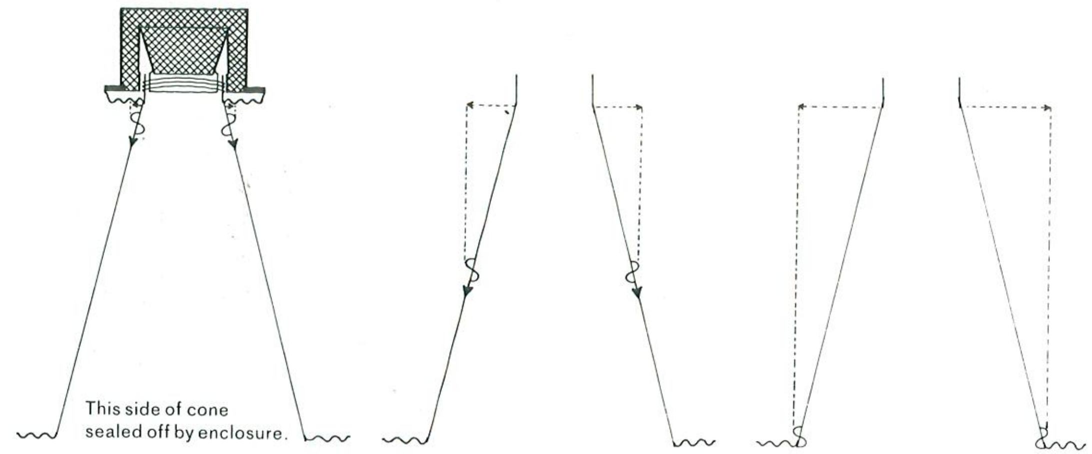
Fig. 1
Schematic diagram showing the operation of the Ohm F. The slant distance traversed by the wave on the cone and the horizontal distance traversed by the wave front in air have a fixed ratio. This is the same as the ratio of the wave velocity on the cone and the wave velocity in air.

How it works

The waves are generated at the apex of the cone by an electrodynamic transducer consisting of a very powerful Alnico V-7 magnet and an unusually sophisticated 3-inch voice coil. (It should be noted that, theoretically, any linear electromechanical conversion principle would do, but the moving coil is by far the most practical motor for the speaker.) This voice coil is made of edgewise-wound anodized aluminium ribbon and, while it handles large amounts of amplifier power with ease, has a mass (in the case of the Ohm F) of only 4 grams — about the same as the plastic membrane of a small electrostatic panel. The mass of the voice coil represents the total inertia of the moving system at the highest frequencies, in accordance with the mathematics of a cone acting as a wave transmission line.

The waves travel down the side of the cone to the surround, where they are absorbed. There is virtually no reflection back into the cone; the transmission line is properly terminated by various mechanical techniques, so that each impulse traverses the slant distance (in the Ohm F) of $12\frac{3}{8}$ inches from the apex to the surround essentially once only. In exactly the same amount of time, waves generated in the air at the apex travel horizontally a distance of $3\frac{1}{8}$ inches to a point directly above the surround. The geometry of the cone is calculated to maintain this exact relationship between the supersonic slant wave and the sonic horizontal wave.

By examining Fig. 1 it will be seen that, as the supersonic wave travels down the cone, all the horizontal waves produced in the air meet on the vertical dotted line standing on the surround. Thus a cylindrical wave front is generated, which has virtually no time or phase errors. It is a coherent wave front, which appears to be generated by a virtual pulsating diaphragm of cylindrical shape, standing on the surround of the actual transmission-line cone.



Performance Characteristics

If the construction of the transmission-line cone of the Ohm A or the Ohm F were mechanically perfect, in the same sense as, say, a perfectly balanced automobile wheel, the frequency response measured at any point within a doughnut-shaped space around the speaker would be ∓ 0 dB throughout the audio range. The speaker would also pass any kind of complex signal (pulses, square waves, etc.) inside certain frequency limits without the slightest visible deformation. But no automobile wheel is perfectly balanced and no Ohm transmission-line speaker made so far has a perfect cone.

Within the tolerances of high-precision manufacturing methods and the limitations of present-day materials, ideal performance is only closely approximated rather than fully realized. Because of the large area and unusual shape of the radiating surface, valid pressure amplitude measurements are extremely difficult to make; there are minute variations from point to point and no precedent techniques to fall back on.

It is possible to line up the measuring microphone in such a way that an almost ruler-flat response is obtained from about 450 to 23,000Hz on the Ohm A and from about

200 to 19,500Hz on the Ohm F. On the bottom end, the two speakers differ somewhat. The Ohm A shows a slight upward shelf that remains level down to almost 20Hz and can be taken out with the simplest passive equalization. (The response is then $\pm 2\frac{1}{2}$ dB from 23 to 23,000Hz!). The Ohm F is up 1 or 2 dB from 200Hz on down and begins to roll off very slightly at 50Hz, with good output down to 32Hz (unequalized). It is also possible to obtain deviations of $\pm$4dB on both speakers within their range, under the least favourable conditions of measurement.

These are, of course, steady-state measurements with single-frequency input signals; averaging or integrating techniques ("spectral energy profiles", $\frac{1}{3}$ octave-band pink noise, etc.) will result in considerably flatter readings. One must proceed with extreme caution when making comparisons with claims made for typical commercial speaker systems. The latter are based either on wishful thinking or on axial response only or, as is often the case, on a combination of both.

The Ohm A and the Ohm F will pass square waves with excellent retention of steep sides and level top, indicating substantially perfect phase and time characteristics throughout the audio spectrum. The dispersion of the speakers has already been discussed.

There is a price to pay for all this; the design is inherently inefficient, requiring a large power input to achieve a high sound pressure level. This is especially true of the Ohm A, which should ideally be driven with an amplifier capable of 350 watts (rms) per channel. The Ohm F is 6 or 7 dB more efficient, so that 50 or 60 watts per channel will be adequate, although up to 200 watts per channel can be recommended. Needless to say, the speakers will "speak" with a considerably lower input, but the awesome dynamics of which they are capable will not be fully appreciated without the reserve margin of the larger amplifiers. Nominal impedance of the Ohm A is 8 ohms; at no point across the audio range is the impedance lower than 6 ohms or higher than 12 ohms. For the Ohm F, these figures must be halved. In either case, the impedance is almost purely resistive.

Performance

Judging loudspeakers, no matter on what principle it has been designed, should always be on its sound quality and we are happy to report that the Ohm F system is amongst the very best we have heard.

The speaker deserves a very high output power amplifier and our Dynaco 60 watts pre/power amp setup was going at full power to drive the Ohm; we would have preferred another 60 to 100 watts extra.

Treble response is very clean; there is a total lack of distortion, although in comparison to our studio monitors there is some colouration, giving a steely sound.

Bass response is absolutely superb, very firm and it extends beautifully down to 30Hz before some doubling takes place.

Conclusion

An unusual and interesting design technique and we would have liked more time to enjoy them; at above $1000 per pair, the Ohm F loudspeakers will be outside the realms of many buyers. However, whether you can afford them or not, do try to listen — we think you'll be impressed.