JERN14 DS

A MINIATURE SPEAKER MADE OF CAST IRON? USE WITH TWO SUBWOOFERS TO ACHIEVE SOMETHING CLOSE TO THE STATE-OF-THE-ART

This extraordinary speaker is effectively the 'swan song' of engineer Ole Lund Christensen, who has spent his life in audio design and marketing (see Box). What appears superficially to be a simple compact two-way speaker turns out to be radical in a number of respects.

Cast Iron

The word 'jern' is Danish for 'iron', and refers to the cast iron enclosures that uniquely form the basis of this tiny but exceptionally heavy loudspeaker. It might seem somewhat unlikely at first sight, but cast iron actually has certain special properties that are particularly well suited to loudspeaker enclosures, including a density that's three times that of aluminium, plus some very effective self-damping due to a high content of carbon in graphite form. Indeed, the *JERN14 DS*' combination of 14kg mass with good self-damping means that cast iron could well be the ultimate material for loudspeaker enclosures, especially when cast as a single piece, as here, in an unquestionably strong as well as acoustically promising near-spherical shape. Incidentally, the company responsible for the casting work is Dansk Skalform A/S, which has an international reputation for top quality, and an enviable client list that includes companies like McLaren, Daimler, Porsche, Rolls Royce, Siemens, VW, Volvo etc.

The very tough and heavy speaker only encompasses a total air volume of 3.7 litres (0.13cu ft), which is certainly very small, and explains the need for subwoofers. Furthermore, the designer's intention is to mimic the motor industry's pattern of sharing a common platform for several models by building a 'family' of models based on the same enclosure, a prospect that is quite intriguing.

The Configuration

The original sealed-box speaker is the version that I've been trying. It has been deliberately aligned to operate alongside a specific REL *T/5i* subwoofer, so consequently it combines a decent sensitivity (c90dB/W) with an allegedly easy amplifier load (6.4ohms minimum). As a result the bass starts rolling off below around 120Hz, and the sealed enclosure ensures a predictable roll-off below this point. One (or more) subwoofer(s) are therefore an essential ingredient in creating a full range loudspeaker system, but that bald statement does tend to overlook at least two crucial factors.

One consequence is that the main driver here operates from around 120Hz all the way up to a 1st order crossover to the tweeter at a fairly high 4kHz, which is a much wider bandwidth than usual for what is effectively a three-way design. The other factor concerns the price. A pair of *JERN14*s costs £2,000, which is somewhat less than one might anticipate for a full range speaker of comparable high end quality. The subwoofers inevitably add to the cost, but the recommended REL *T/5i* (a sealed-box model) costs just £550, so a pair of these will bring the outlay to £3,100. Add in the extra cost of speaker stands and accessory bases and the total price comes to around £4,000, which still seems modest enough in today's marketplace.

Indeed, the whole concept of separating the bass enclosure from the main speaker seems to be relatively new and unexplored, though we did run a feature by Peter Truce called *The Road to Great Bass* a year ago (*HIFICRITIC Vol10 No1*). That feature anticipated just such an arrangement, referring to Dr. Floyd Toole's (1) book entitled *Sound Reproduction* as a major source of inspiration. I can even recall discussing the concept with Dr. Toole when we dined at a CEDIA convention in Brighton during the 1990s. However, the packages back then, as well as Peter Truce's much more recent version, were relatively complex affairs that incorporated quite elaborate bass equalisation, whereas a major strength of this *JERN*/REL combination is the essential simplicity of the package.

And the more one thinks about the combination of small satellite main speakers with multiple subwoofers, the more such an arrangement seems to make good sense. After all, the important stereo image information is always best handled by something small and artfully shaped (such as the *JERN 14 DS*), while the best way to supply bass in a room is arguably *via* several sources as widely distributed around the listening room as possible. The only question mark comes down to the power amplification, and whether splitting it up between the bass and the rest involves any significant compromise, which doesn't seem to be the case here.

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The Specifics

So much for the operating principle behind the combination, it's also necessary to include some constructional details, especially on the two-way *JERN14 DS*. The drive units are sourced from Scan-Speak and consist of a main driver with a glassfibre cone 95mm in diameter, crossing over to a 19mm fabric dome tweeter with a short horn that's very similar to the device that first made Scan-Speak's impressive reputation way back in the 1970s. The crossover network is quite deliberately as simple as possible, with just a single capacitor feeding the tweeter. The highish crossover point and gentle crossover rate means that it's important to sit with ears close to the main driver axis.

The enclosures themselves are sand-casted in a single piece, modified from the spherical ideal simply in order to accommodate a tweeter above the main driver. The internal face is covered in small dimples that should help diffuse reflections. An earlier version of *JERN* was reflex-loaded via a rear port, but this has been changed for the current sealed version, avoiding the port resonance.

The REL *T/5i* is a very compact sealed-box subwoofer, with a relatively small (8in) bass driver that points downwards towards the floor, driven by a 125W Class A/B amplifier with a linear supply. The total weight is a relatively modest 12kg, so Christensen has designed some cast iron bases to add 19kg of extra mass to improve its physical stability, especially when working hard. There are certainly many less costly subwoofers around, but the *T/5i* avoids the 'boom box' tendencies that plague the subwoofer genre by operating in a sealed-box rather than reflex mode.

Measurements

Measurement confirmed a smooth overall response from a pair of *JERN14 DR*s, either on their own or with low frequency assistance from a REL *T/5i* that was initially supplied with the *JERN*s. The combination of two *JERN*s with one (or more) subwoofer worked exceptionally well in balance terms, as the *JERN* has a generous sensitivity alongside a complete absence of LF peak or phase change (thanks to sealed-box loading), and rolls off below 100Hz at a totally predictable rate. While the in-room averaging remains good overall, room modes inevitably introduce some unevenness below 200Hz, above which output stays impressively flat (albeit with a mild tendency to emphasise 700Hz and 11kHz). ensitivity is around 90dB, and although I was unable to measure the impedance myself, the factory quotes a 6.4ohm minimum at 300Hz, and points out that the bass resonance here is at 100Hz.

Sound Quality

A pair of *JERN14 DR*s used alone already sounded rather promising, if distinctly bass-light. Adding a single REL *T/5i* subwoofer immediately transformed the combination into a full bandwidth sound that had some genuine high end pretensions, albeit with one major limitation. That was that the little REL *T/5i* had a tendency to overload even at quite modest levels. At Christensen's suggestion I contacted REL to try and borrow another *T/5i*, as adding a second identical subwoofer would add 3dB extra headroom, and would also help to spread the room modes over the listening area.

However, REL had completely sold out of *T/5i*s. Assuming that the *T/7i* would be a similar but rather larger version of the *T/5i*, I arranged to borrow one of those instead, but hadn't realised it was ABR-ported rather than a sealed-box design, so it didn't work as well in context. After waiting for the next delivery from a Chinese manufacturer, I eventually managed to borrow two *T/5i*s and started to use them, initially without the optional heavy bases which arrived a few days later.

Get the bass working well and this speaker system can deliver a genuinely top class sound at a relatively modest price. Indeed, the sheer coherence of a midrange driver that covers more than five octaves is itself impressive, and the observations that it is then combined with exceptionally low coloration and

very fine stereo imaging makes this a very difficult speaker to criticise.

Perhaps the most telling observation is that I began listening by simply installing the *JERN14 DR/T/5i* combo in front of the far more costly B&W *800 D3* speakers that I had been using previously. A few weeks later little has changed (apart from the subwoofery of course). I may now be using two *T/5i*s, but the two *JERN14 DR*s are in exactly the same place as before, and I'm still using them in exactly the same way for day-to-day listening, albeit at relatively modest listening levels. Inevitably the ultimate sound level available is somewhat limited, but that's a matter of personal taste. Those seriously interested in high level replay should maybe look elsewhere, but provided one is happy enough with 'normal' levels, this combination should be fine.

The real strength of this speaker lies in its five-octave overall midband coherence, which in some respects resembles the sound of a speaker system based on a solitary full range driver. However, it also successfully counters some of the traditional weaknesses of such designs, as it's significantly tidier in terms of both coloration and treble output, and also delivers absolutely outstanding stereo imaging in focus precision, both on- or off-axis.

Conclusions

While it's certainly true that this JERN 14 DS/REL T/5i combo falls a trifle short of the performance of the B&W 800 D3 that preceded it in the listening room, the performance gap between the two is much smaller than the price difference. The three factors that stand out are the wideband coherence of the bass/mid driver; the exceptionally low midband coloration; and the outstanding stereo imaging. I spent several weeks thoroughly enjoying listening to this combination, and certainly didn't detect any problems in supplying the bass separately from a couple of active subwoofers.

Ole Lund Christensen

Born in Copenhagen in 1953, Ole Lund Christensen began studying engineering at Denmark's Technical University in 1972, and a few years later, alongside Bo Christensen, he co-founded Audiophil to import hi-fi into Denmark, quickly picking up the substantial KEF loudspeaker brand.

He sold Audiophil on to Per Lundgreen, co-founded a Pro-audio import company, and in 1982 began manufacturing an *SLT 250* Pro-audio power amplifier that became a standard in most Danish recording studios and PA companies. In 1985-1987 he designed and supervised the turnkey construction of the PUK recording studio in Jutland. A major part of its control room was a 10,000W active four-way loudspeaker system and a unique room acoustic design that was co-developed with Poul Ladegaard from B&K.

Among many other top names, George Michael's *Faith* album, which stayed high in the US charts for the whole of 1988, was made there. A major part of the PUK design was superior sound insulation between the different rooms, which was done by floating the rooms on separate foundations, with Rockwool insulation. He has since built many rooms that integrate the loudspeakers into the room using similar design principles.

He began making hi-fi amplifiers in 1990, based on the professional power amplifiers, and in 1995 developed the *SiriuS D200*, the world first single-MOSFET 200W power amplifier. (All other 200W transistor power amplifiers had to use four or more output devices in parallel for the positive signal path, and four others for the negative signal path.)

Having sold the SiriuS name to a US satellite radio company, he founded GamuT to make similar amplifiers, but then sold the company in 2003. He custom-built listening rooms, amplifiers and loudspeakers for rich music lovers around the world, and then moved to Finland to develop many successful loudspeakers for Amphion, which were unusual in featuring large waveguides around the tweeters.

He's presented numerous papers to the AES (the Audio Engineering Society) and at the Munich Show, and has acted as consultant to a number of brands, including Parasound, Jeff Rowland and Avantgarde, plus others who prefer confidentiality. He's also spent a lot of time in India, giving lectures at AES meetings in Mumbai, and building an active-drive listening room for a private client. A recent UK project involved the system and acoustics of an English room: in *Meeting the Sonductor*, Steve Harris describes this in detail in *HIFICRITIC Vol8 No2*. However, his dream has always been to make high quality sound that's also genuinely affordable, and that is the reason behind his latest work on cast iron speakers and subwoofer integration.

(1) Dr Toole worked initially for the National Research Council of Canada, before moving on to head up Harman International's research department in California.

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