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A Low-Frequency Emphasis Non-occluding Hearing Aid

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> Mead Killion, Charles I. Berlin, and Linda Hood
> Hearing Instruments 35(8), 30-34, 1984.

SOMETHING ABOUT MEAD

This article, co-written with Charles Berlin and Linda Hood, takes a major leap into a realm where audiologists normally don't tread. It describes a prototype hearing aid with 75 mm of tubing, one acoustic damper, and 2 filter chambers placed in a behind-the-ear hearing aid shell. Of equal importance to the article's content is Mead's remarkable ability to "translate" complex engineering simulation analyses for the audiology public. (Incidentally, his co-author Charles (Chuck) Berlin also emulated this talent). Much of what I learned about the field of amplification in the 1980s and 1990s came from reading Mead's publications, sitting at conferences listening to him talk to other engineers, and trying to place phrases like "characteristic impedance" and "inertance" into my audiology training. But Mead was always able to explain (and frequently demonstrate) exactly what was meant. I still recall him holding up a hearing aid receiver connected to a small amplifier, with a number of different foot-long horns or other bizarre pieces of tubing, to demonstrate something that had only previously been gleaned by working through a page of algebra to solve an equation. Mead is the ultimate explainer and translator.

SUMMARY

In 1928, G.W. Stewart took out patent #1,692,317 that described acoustic wave filters and showed that, given sufficient acoustic mass, the 1000 Hz "tubing-related" resonance found in behind-the-ear hearing aids could be shifted down to the 500 Hz region. Using that, and his general acoustic knowledge, Mead and his colleagues constructed an acoustic network built into a behind-the-ear hearing aid shell with 75 mm of 1 mm inner diameter tubing, one 680 ohm damper, and 2 filter chambers such that there was indeed sufficient acoustic mass to shift the primary hearing aid acoustic coupling resonance down to 500 Hz. And despite the inherent low-frequency roll-off of sound energy with venting, he was still able to generate 30 dB of low-frequency gain (with sufficient output) in a non-occluding hearing aid (IROS fitting). This type of hearing aid was designed for those with low-frequency hearing loss but relatively good hearing above 1000 Hz. For the first time, low-frequency amplification could be obtained with a non-occluding fitting. This approach was the precursor to the KBASS earhook, which could be used with any power aid in a behind-the-ear configuration.

Annotated by: Marshall Chasin