



# Headphones

Are stereo headphones really stereo?

Graeme J Cohen AES June 17 2014



Sennheiser HD800



**Beyerdynamic T1**



Beyerdynamic T5p



Audeze LCD-3



Stax SR-009



Taket h2+



Fostex TH-900





Millett Hybrid  
Minimax  
Headphone Amplifier

HEADPHONES

MIN





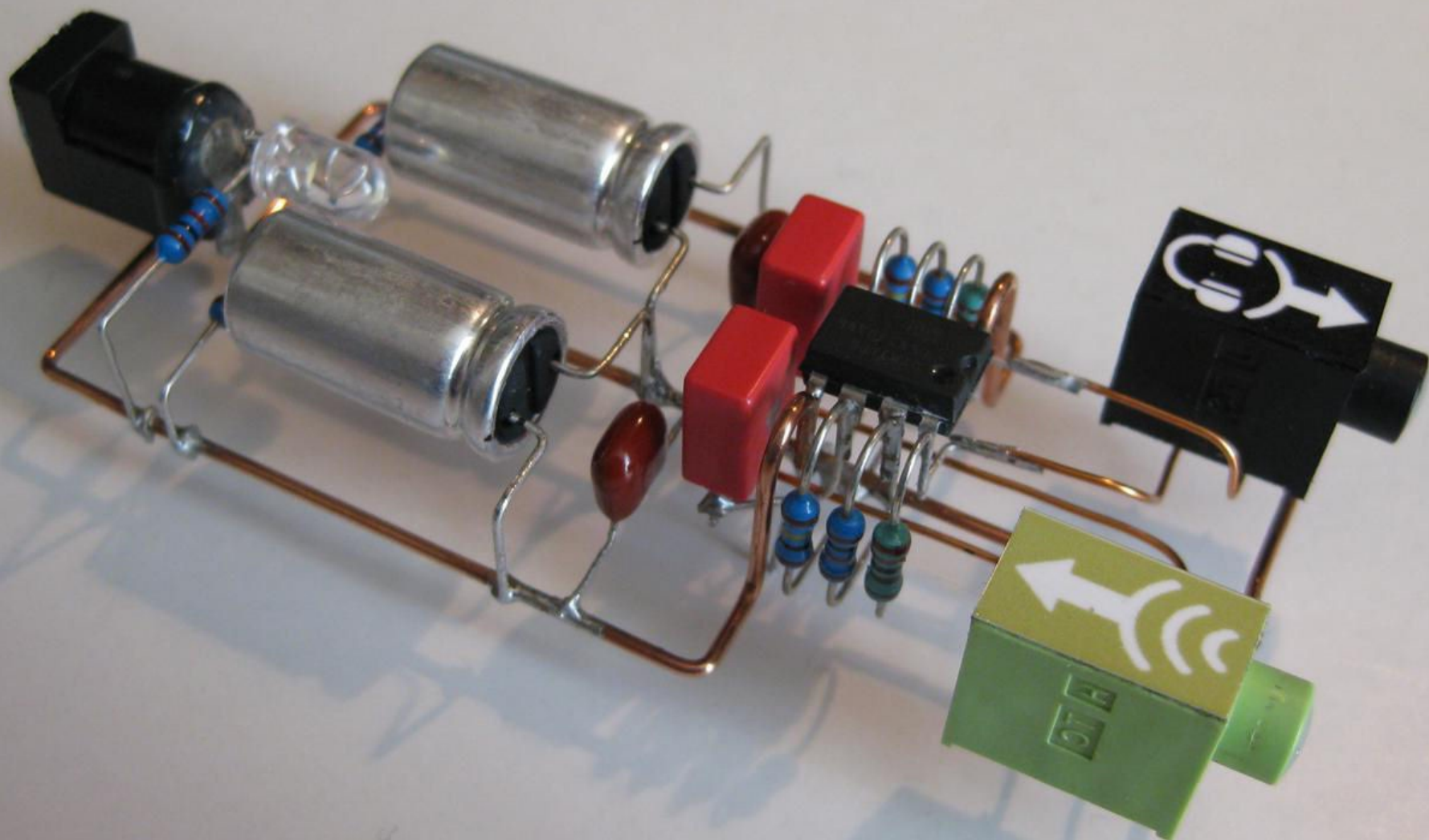
MP-301 Mk3



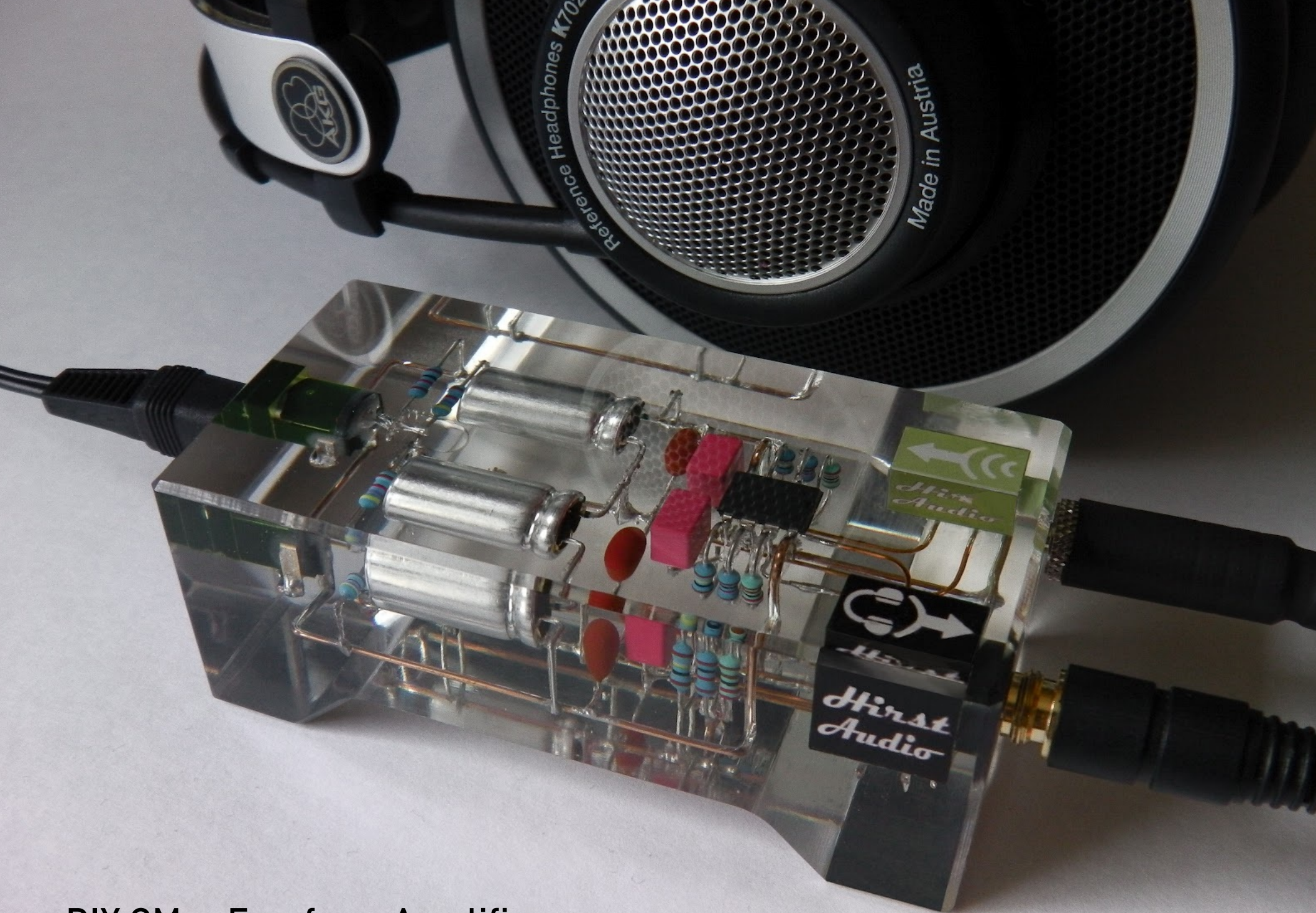
Decware Taboo MKIII



ALO Pan Am Amplifier and USB DAC



DIY CMoy Freeform Amplifier



DIY CMoy Freeform Amplifier

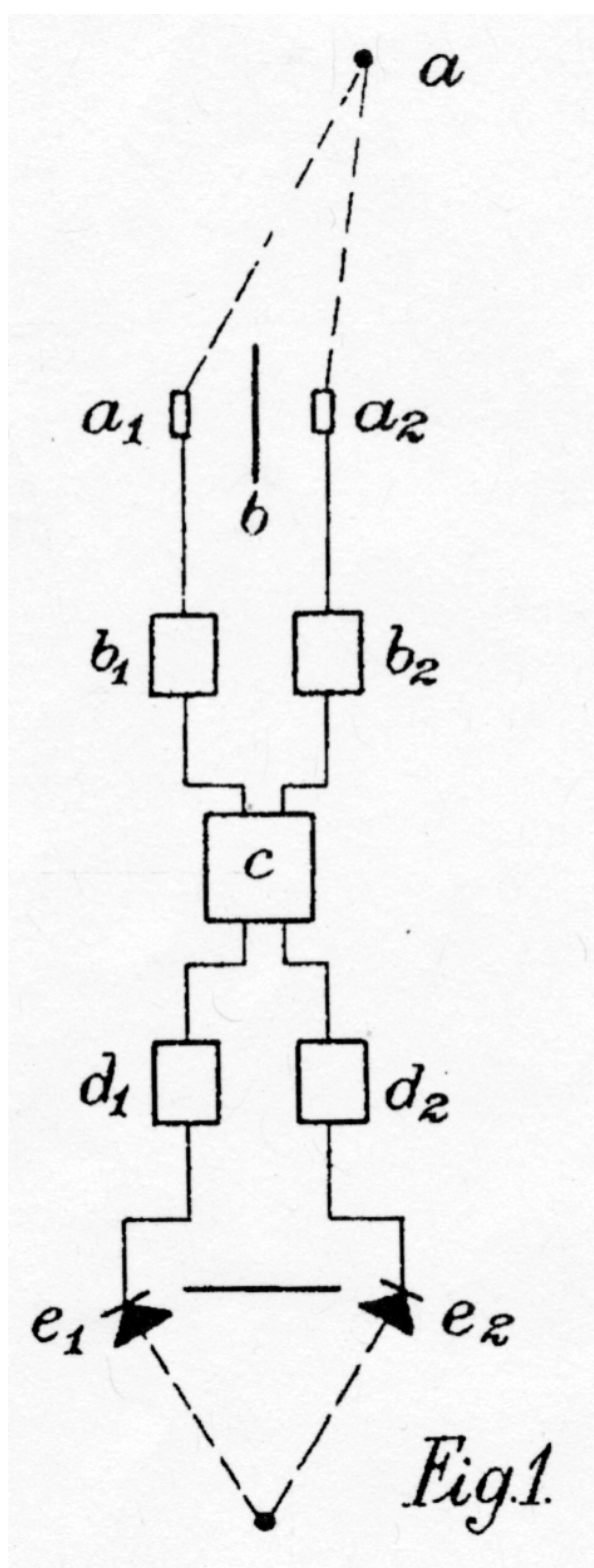


Sennheiser Orpheus

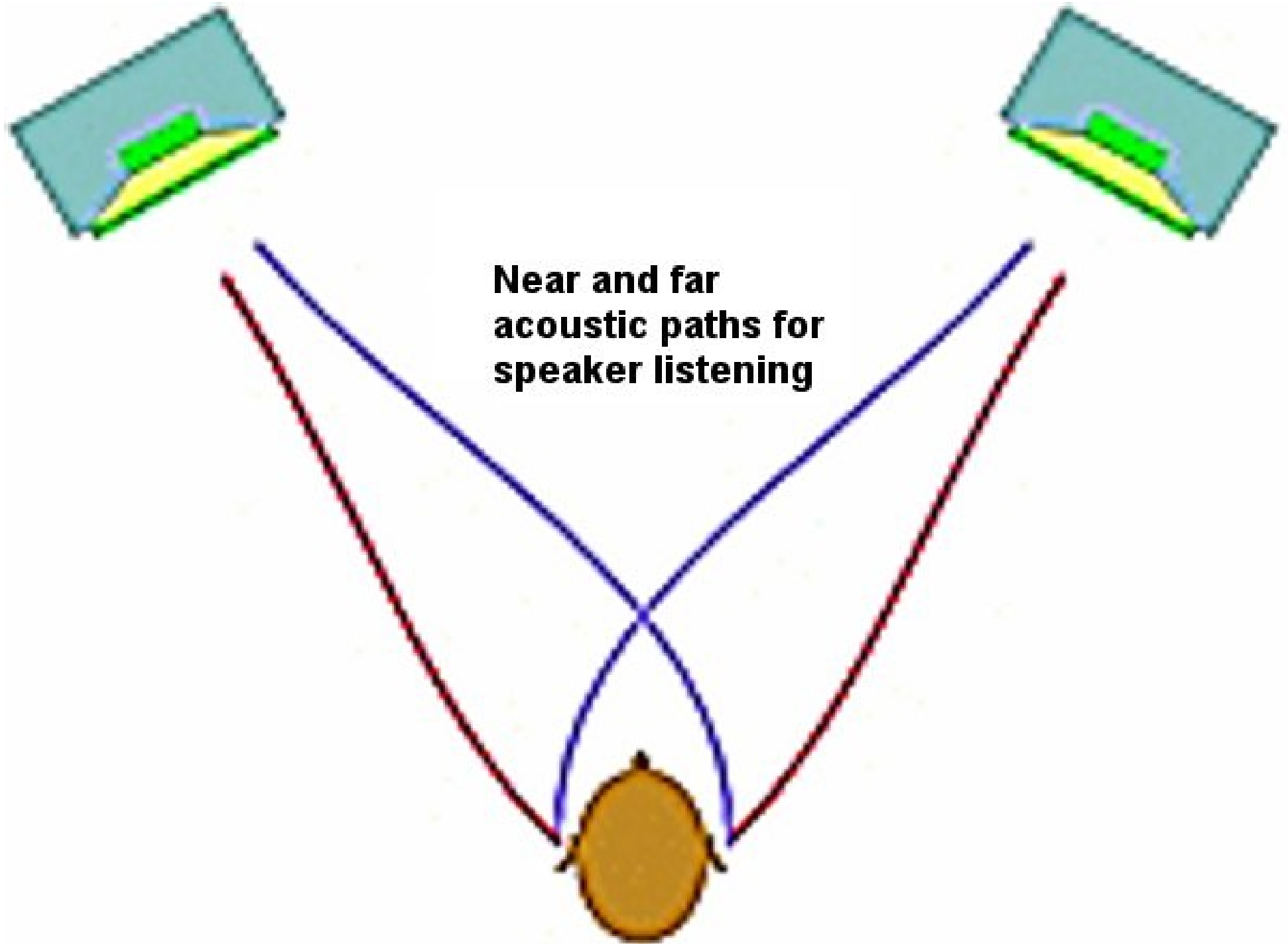


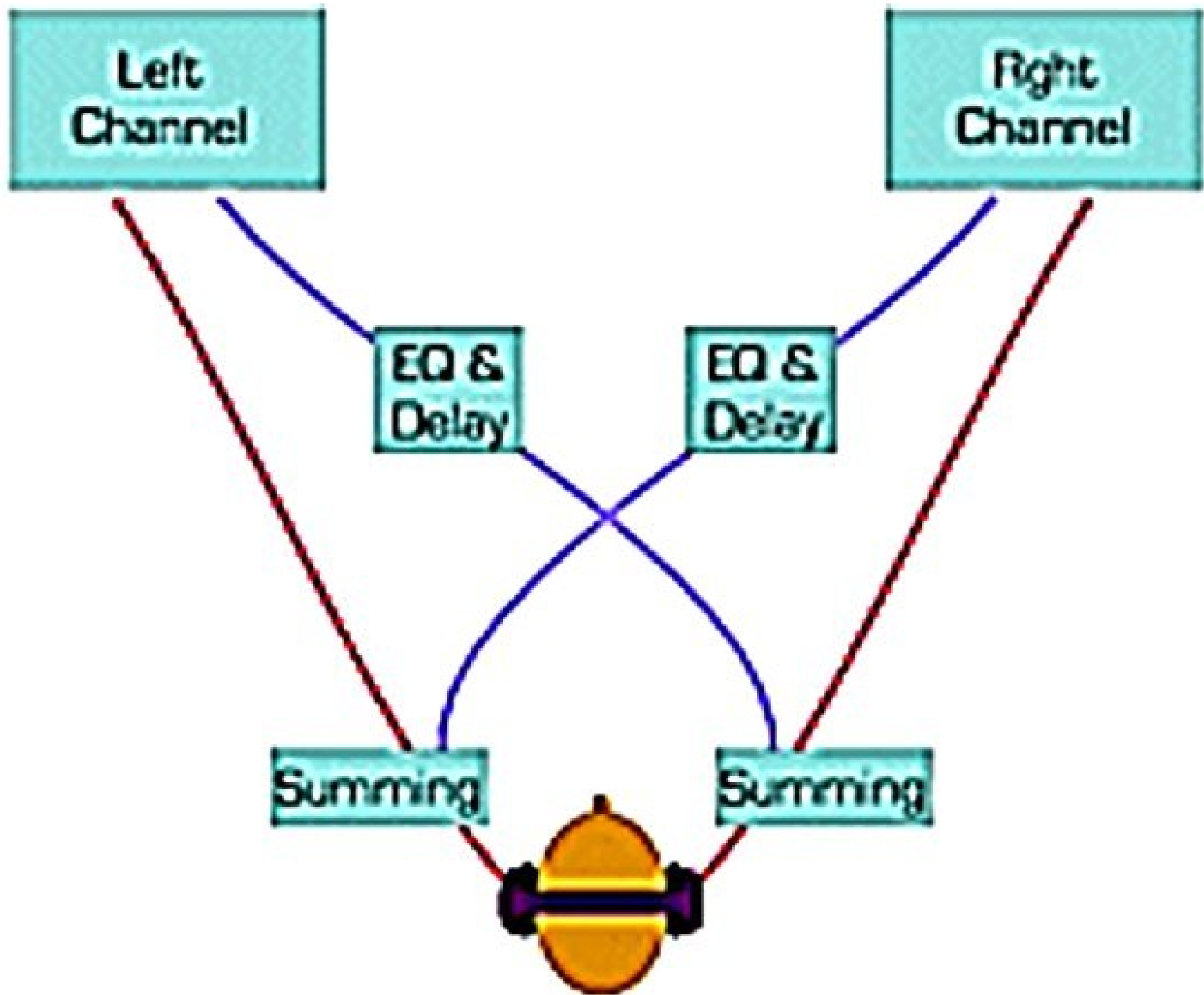
# Are stereo headphones really stereo?

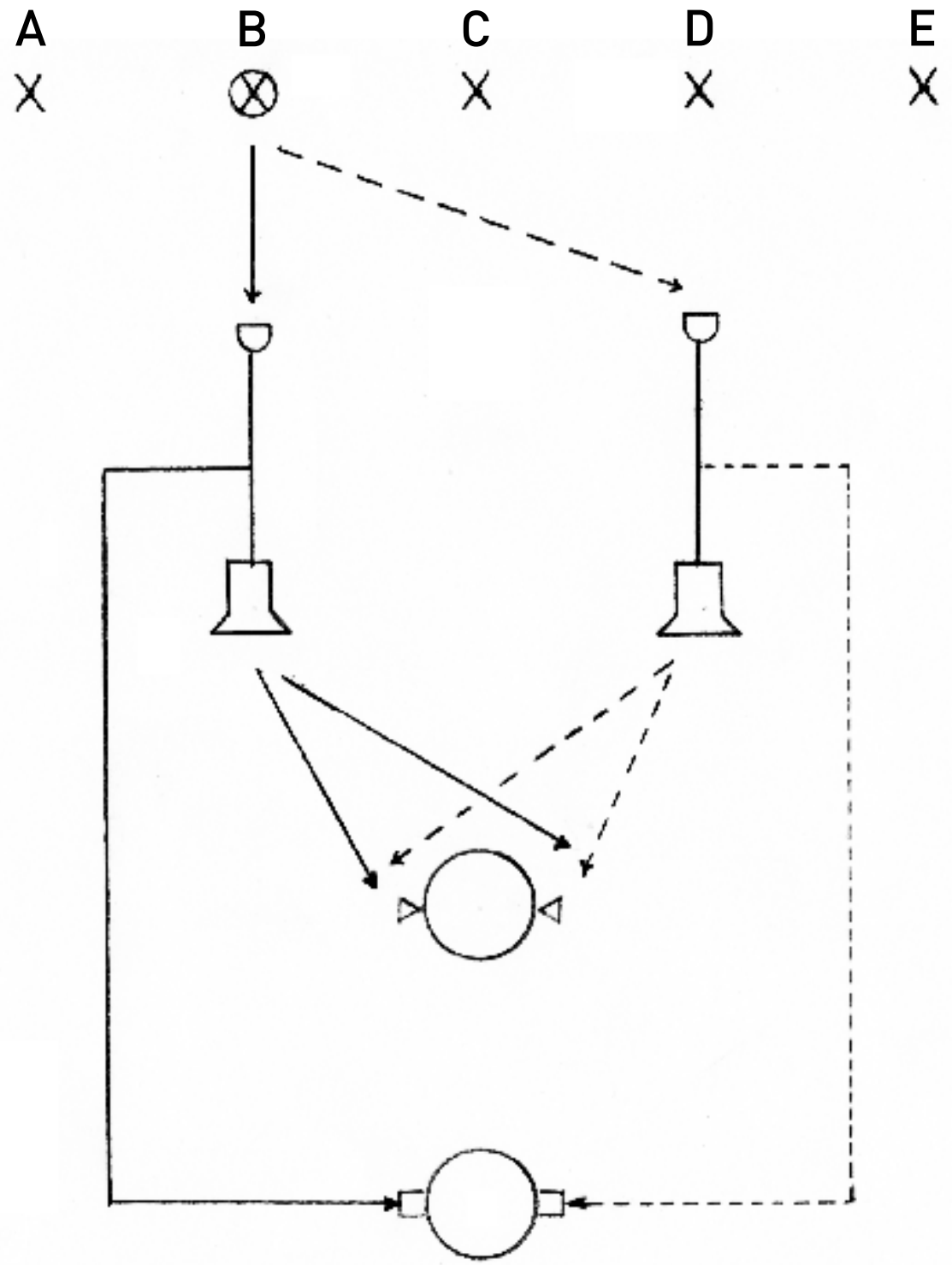
What is stereo?  
What is binaural?



From Blumlein's binaural patent 1931

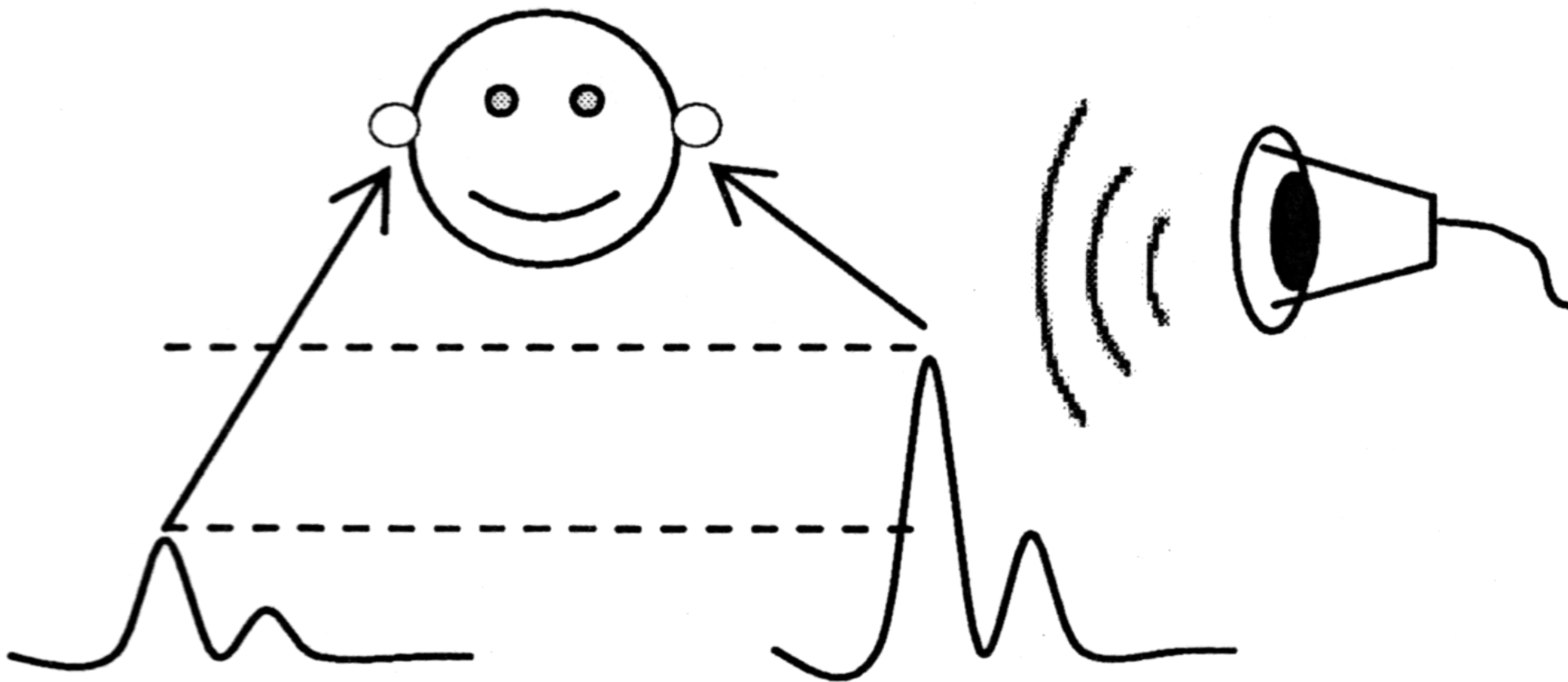






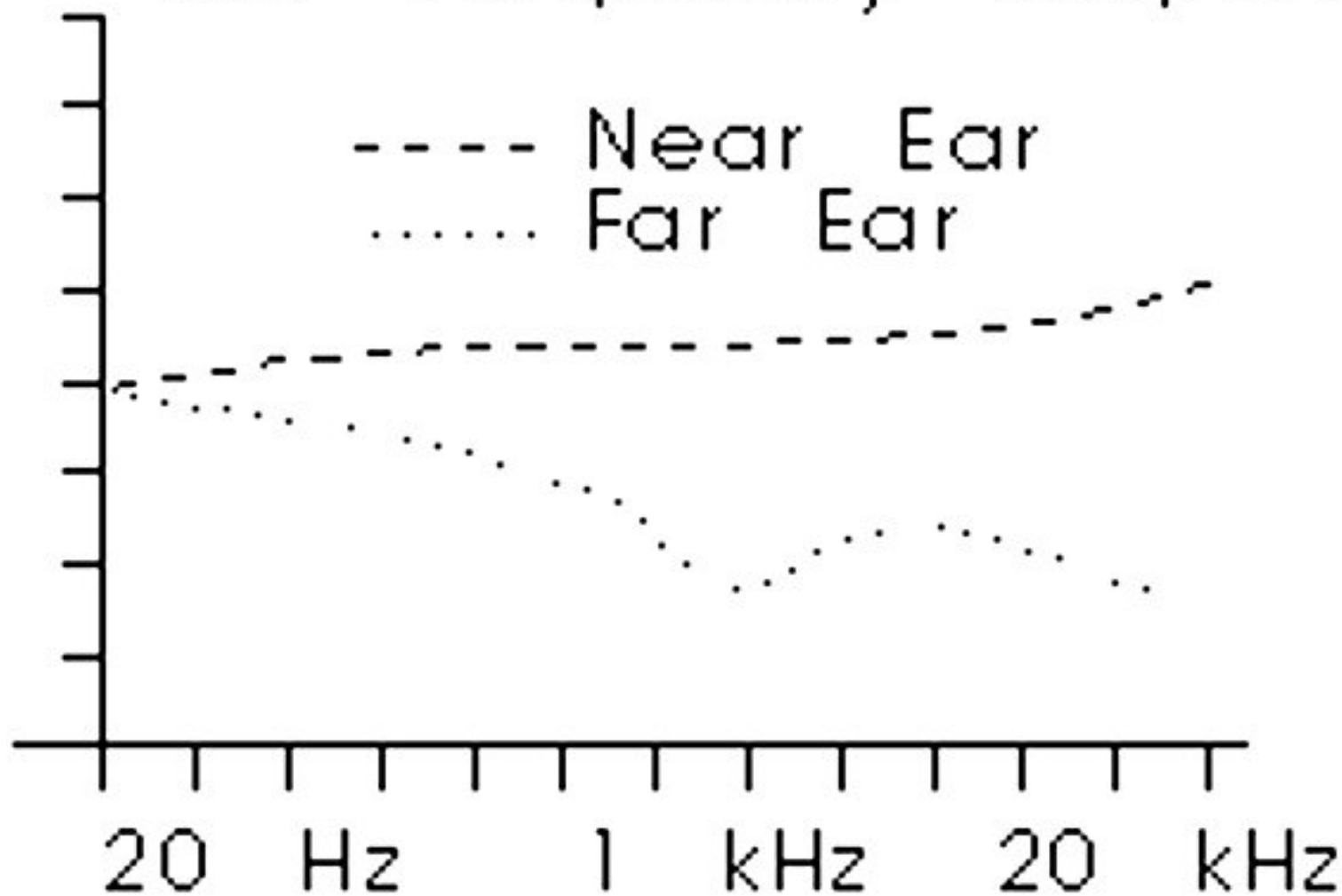
Listening to  
Loudspeakers  
Vs  
Headphones

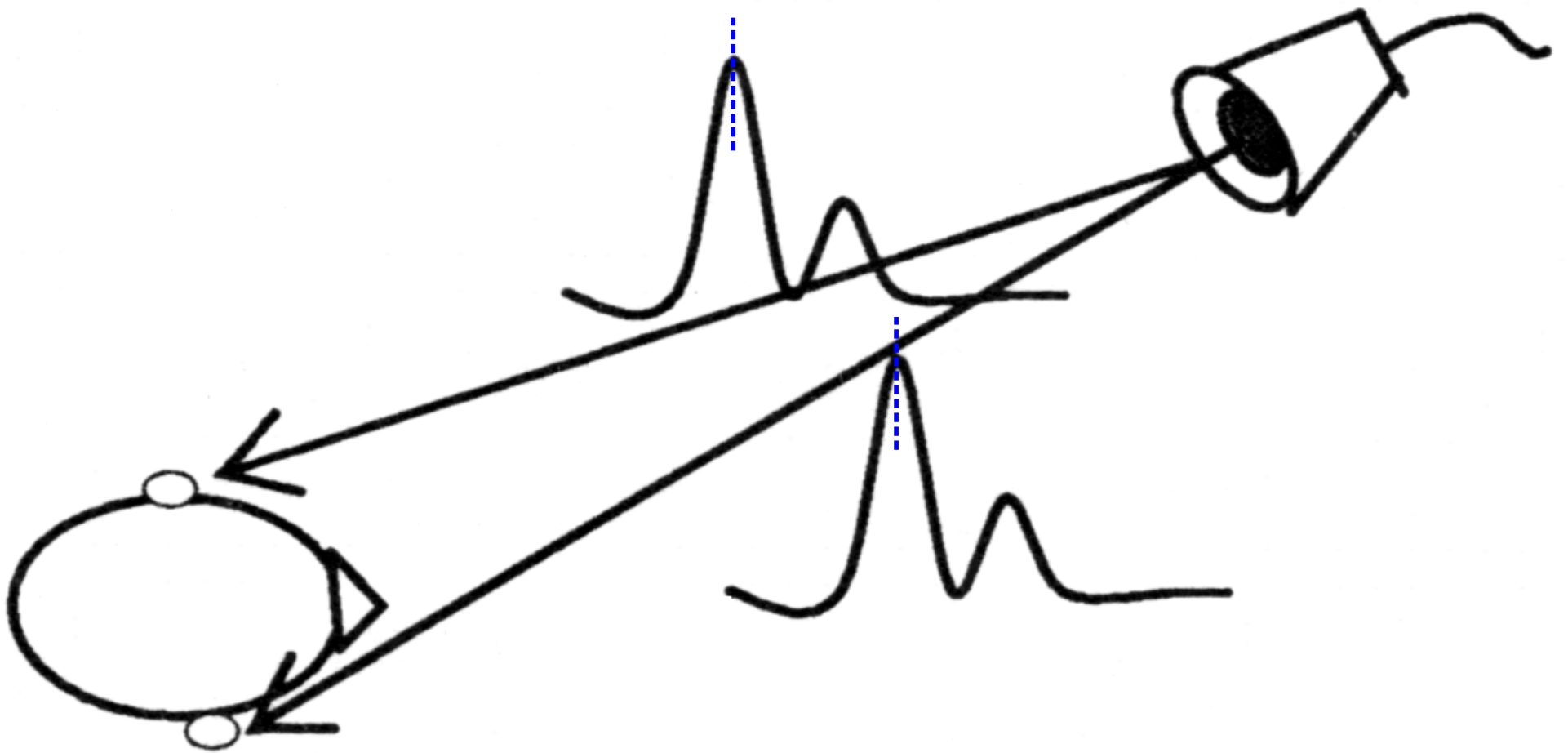
Fig. 1



Inter-Channel Level Difference

# IAD Frequency Response

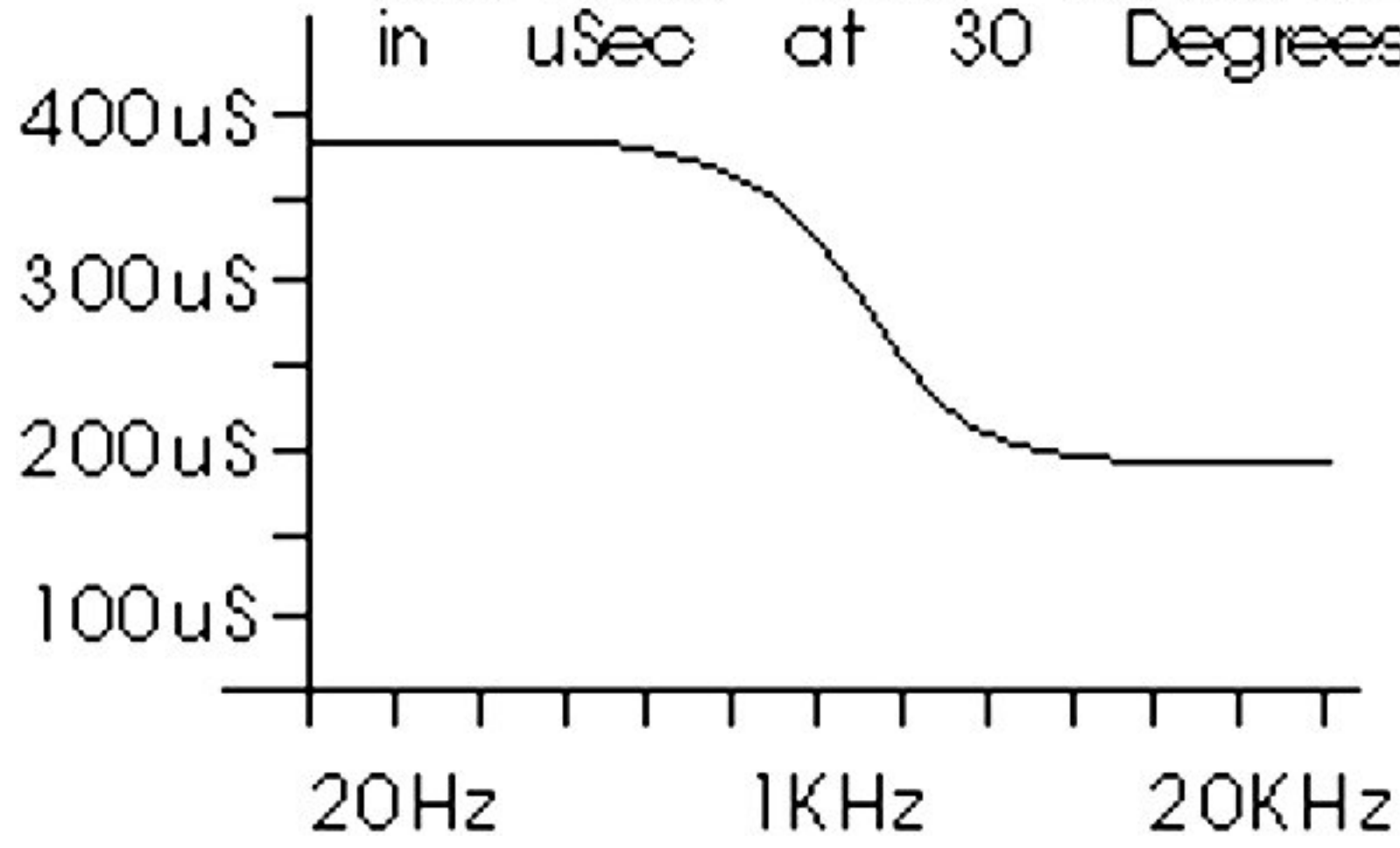




Inter-Channel Time Difference

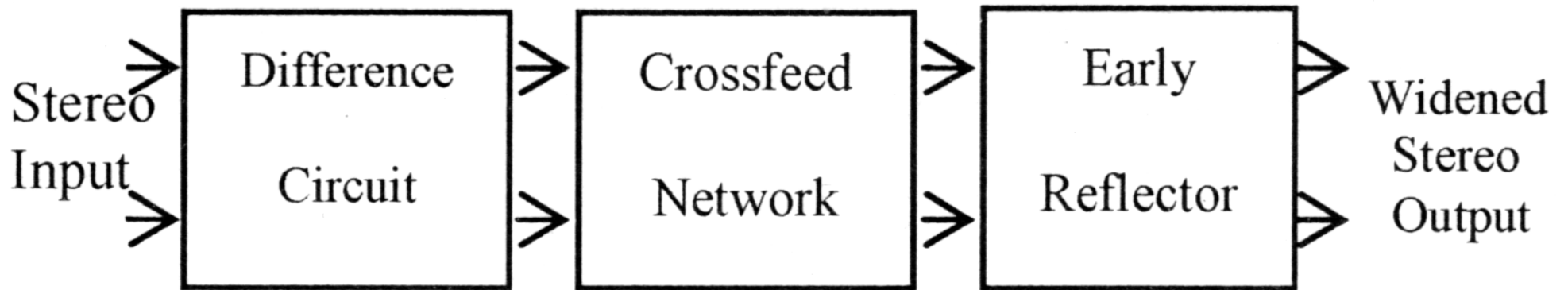


Inter-aural Time Difference  
in  $\mu\text{Sec}$  at 30 Degrees

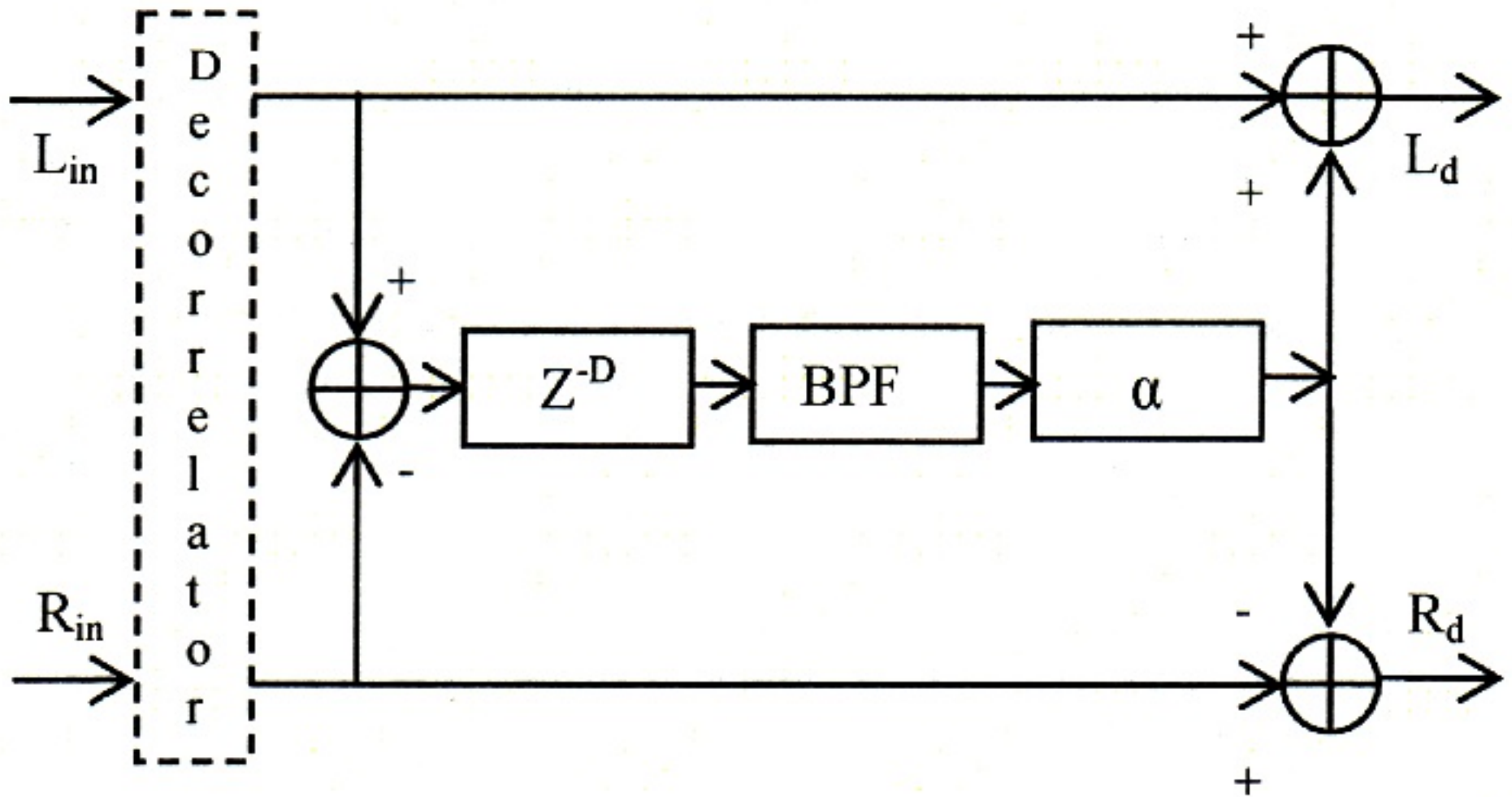




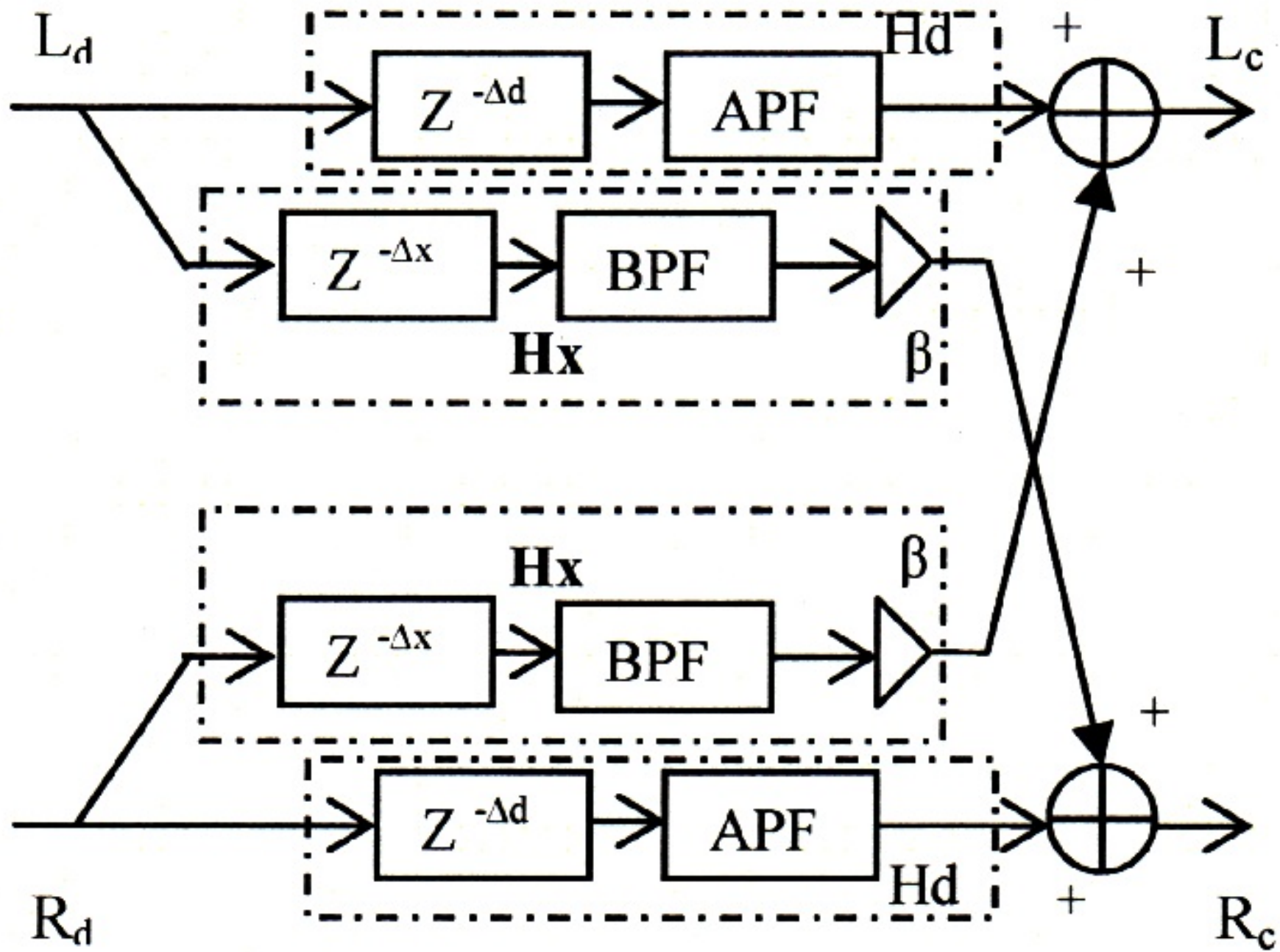
**SPL Phonitor 2730  
Crossfeed  
amplifier**



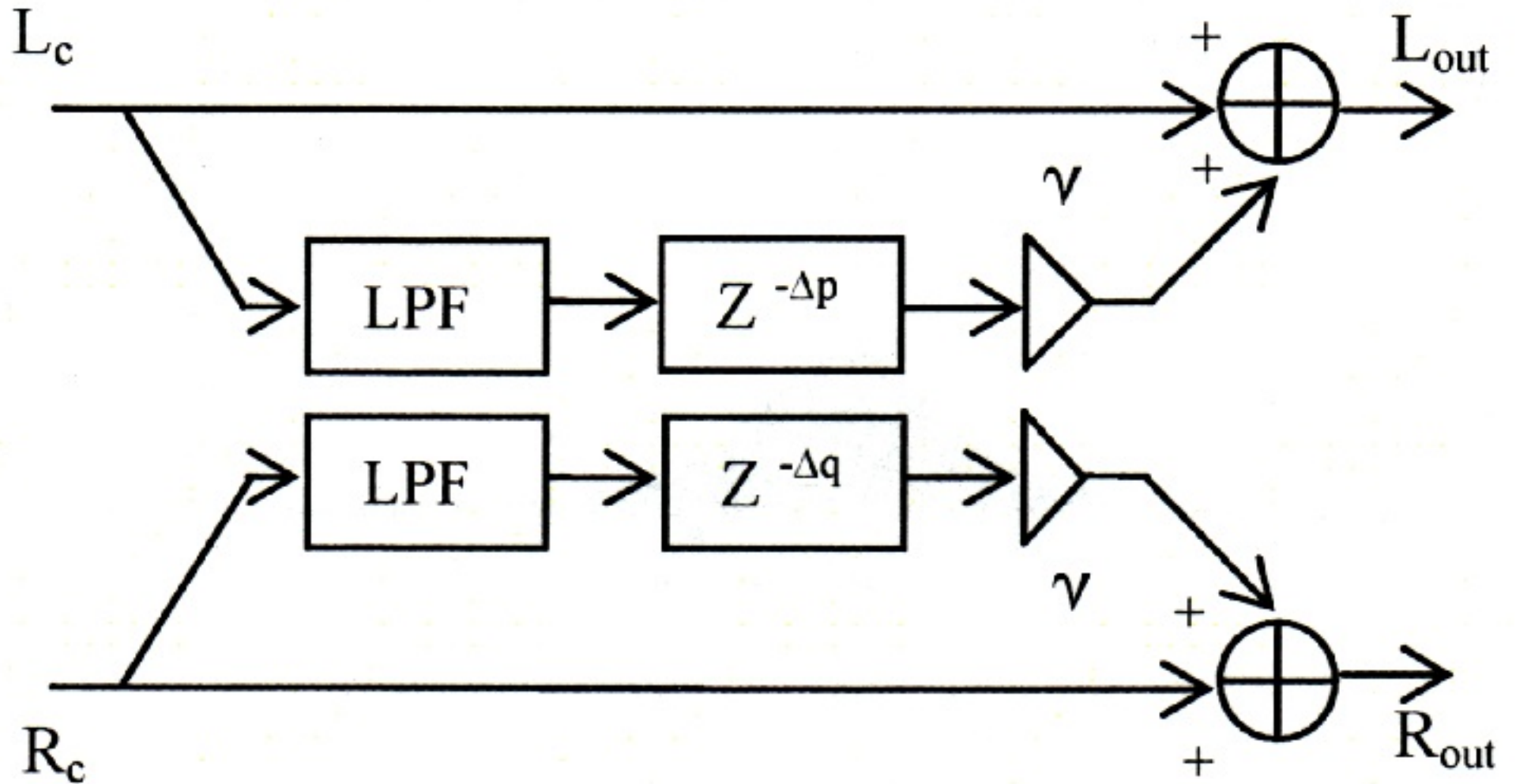
**Stereo Widening System**



Difference Circuit



Cross-feed circuit



Early Reflection Circuit

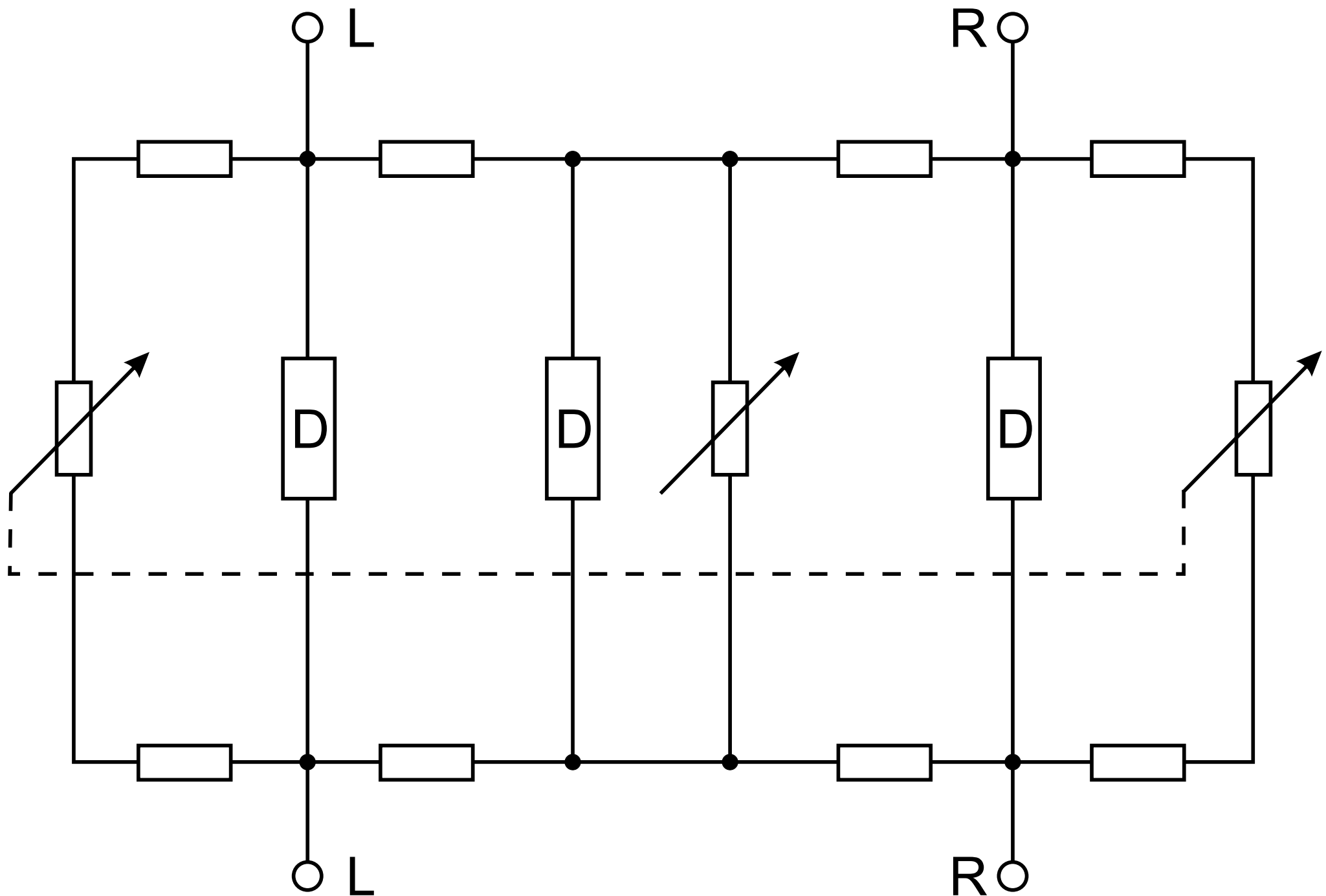


Fig. 2

Graeme's solution to the middle-of-head problem

**This presentation and Graeme's notes  
are available at**

**[LeonAudio.com.au/aes](http://LeonAudio.com.au/aes)**