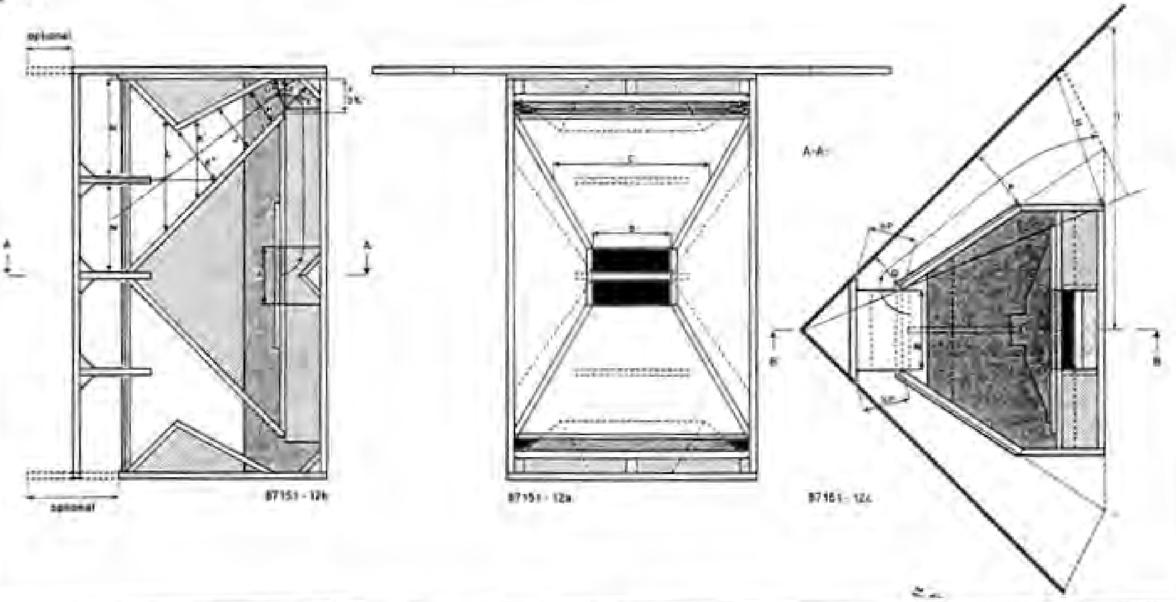
12



This time, the horn was split laterally and symmetrically if the cabinet was placed correctly. Fig. 7 shows the multi-flared profile, where the natural logarithm of the cross-sectional area has been plotted against channel distance.

Calculated performance with a Richard Allen CG12 driver

Klipsch measured the acoustic impedance, Z_T, of the horn channel with and without the air chamber (which was external in his prototype). The air chamber certainly brought down the peaky reactive part of the impedance: the result, with chamber, is plotted in Fig. 8.

More familiar to electronics engineers will be the Argand diagram in Fig. 9, where the measured acoustic impedance has been converted into its reciprocal, $\mathfrak{Z}_T$, "mobility ohms" as suited to the secondary circuit of Fig. 1b. The value of $R_E/(Bl)^2$ has also been plotted for the CG12, where R_E=6.5Ω and Bl=13.7 T m^{-1}. Maximum power is produced from a constant-voltage generator when $\mathfrak{Z}_T$ equals $R_E/(Bl)^2$, and energy efficiency is just 50%.

The degree of mismatch between $\mathfrak{Z}_T$ and $R_E/(Bl)^2$ corresponds to acoustical power loss. If $\mathfrak{Z}_T$ exceeds $R_E/(Bl)^2$, efficiency does, indeed, rise, but not enough to compensate the drop in load current. If $\mathfrak{Z}_T$ is less than $R_E/(Bl)^2$, efficiency falls rapidly, with more power being dissipated in the voice coil's ohmic resistance.

The other parameters for the Richard Allen CG12, i.e., moving mass and spring constant, were inserted into the complete electrical network and the equations for acoustical power were solved with the aid of a personal TI-55-II programmable calculator. The resulting frequency response for a 10 V r.m.s. excitation has been plotted in Fig. 10. The maximum predicted output of 5 W may be compared with the 12.3 W that would be developed in an eight-ohm resistance. The 10 V r.m.s. corresponds to a 12 W personal amplifier: the audible effect for bass guitar and concert music is atypical of a domestic 12 W system. The author can credit Klipsch's claim to have achieved a ten-fold increase in loudspeaker efficiency over infinite baffle types. For comparison, Fig. 10 also shows the calculated performance of another driver unit (4 ohm), whose Bl factor was much lower at 3.35 T m^{-1}. The lower excitation voltage of 4 V r.m.s. would not develop more than 5 W, but the point to notice is the much more peaky response, showing that the reflected voicecoil resistance has not been located centrally on the Argand diagram in Fig. 9. The klipschorn is capable of handling up to 100 W with less than 1% second-harmonic distortion at 40 Hz (which is mainly due to non-linearity of the air in the throat region (Ref. 5).

The roll-off below 60 Hz looks at first like an admission of failure, but remember that Fig. 10, and Klipsch's own prediction for his Jensen 12A, is based on measurements made on a prototype design. When Klipsch evaluated the final cabinet design, he found that

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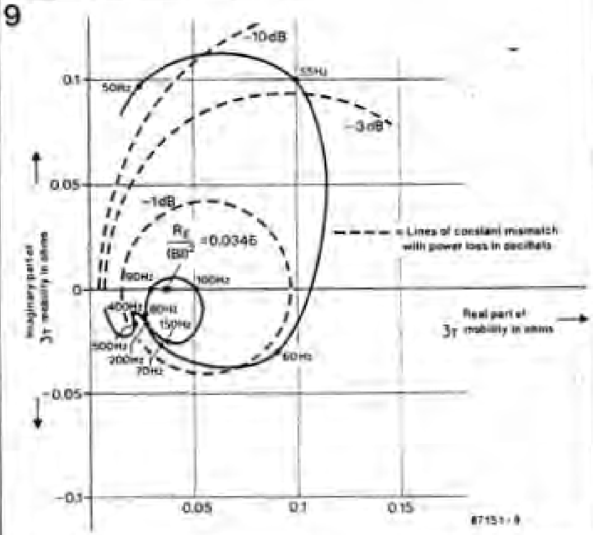

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