

9. CONCLUSIONS

- i) The maximum efficiency attainable from a horn loudspeaker system is fixed by the properties of the driver.
- ii) The driver also limits the horn system performance through the EBP.
- iii) Adjustment of a horn system to achieve maximum efficiency results in minimum high-frequency bandwidth and minimum displacement-limited power capacity.
- iv) Knowledge of the driver parameters allows the designer to determine rapidly the performance possibilities as a function of S_D/S_T .
- v) Where high performance is required from a horn loudspeaker system, the driver should provide high values of EBP, $\eta_T(\max)$, $P_{AR}(\text{ref})$ and $P_E(\max)$.

It is interesting to note that the desirability of a high value of EBP for low-frequency horn applications is incompatible with the general requirement of a low value of EBP for direct-radiator use where extended bass response is desired. Thus in general good horn drivers do not make good direct-radiator drivers, and vice versa.

10. ACKNOWLEDGEMENT

The relationships presented in this paper are based on an original analysis of horn loudspeaker systems by D. B. Keele, Jr. which was communicated privately to the author in 1976.

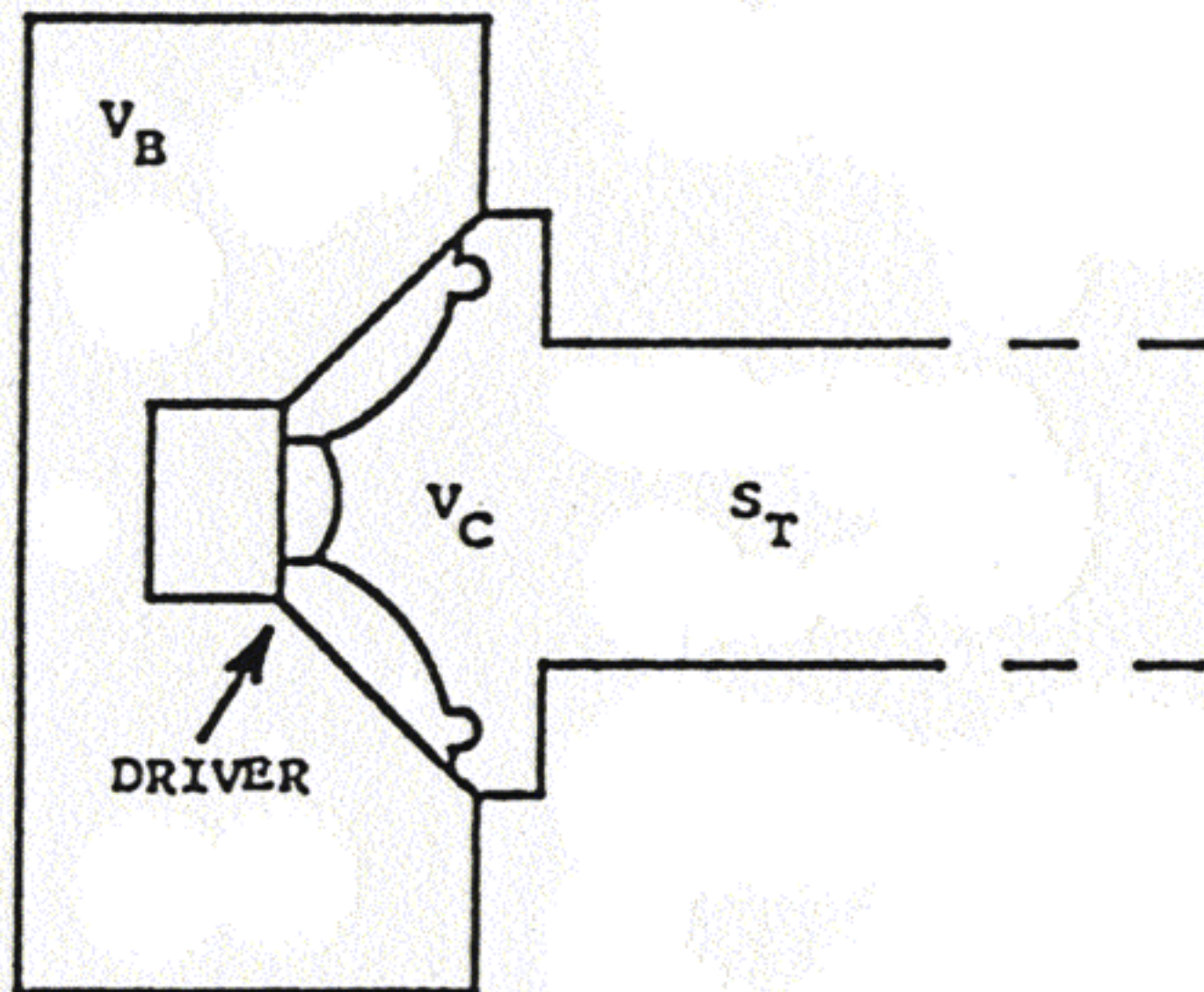


Figure 1.

Simplified horn-driver system consisting of driver, rear enclosure of volume V_B , front coupling volume V_C and throat of area S_T replaced by infinite tube.

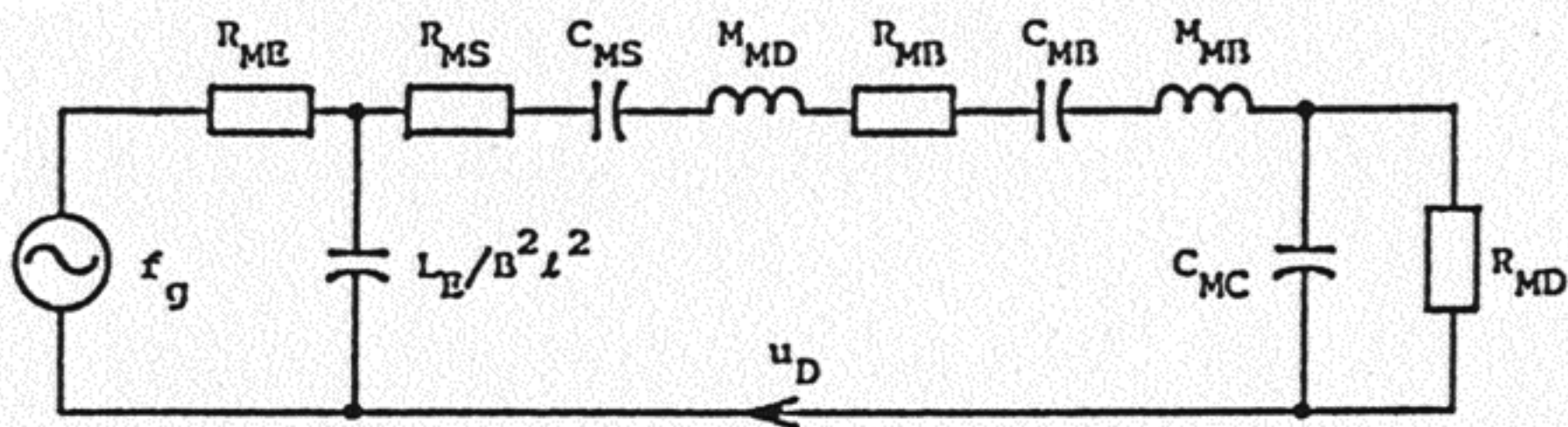


Figure 2.

Impedance-type mechanical analogous circuit for the system of Fig. 1.

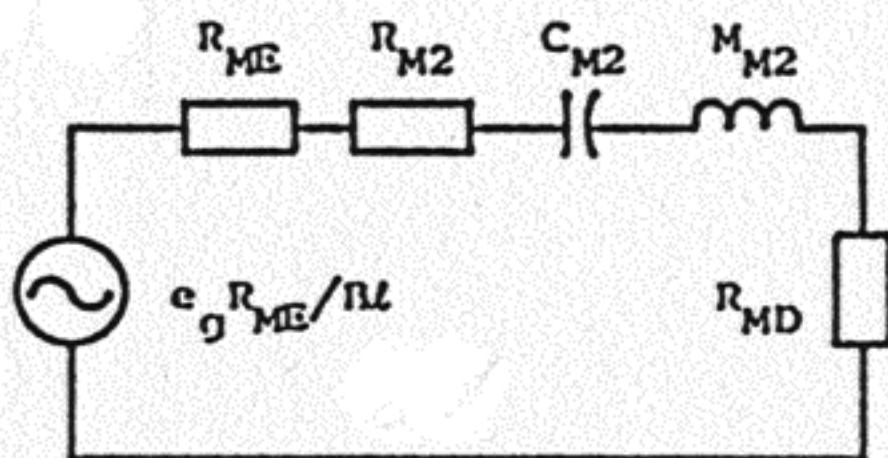


Figure 3.

The circuit of Fig. 2 simplified by neglecting the effects of voice-coil inductance and diaphragm-throat coupling volume.

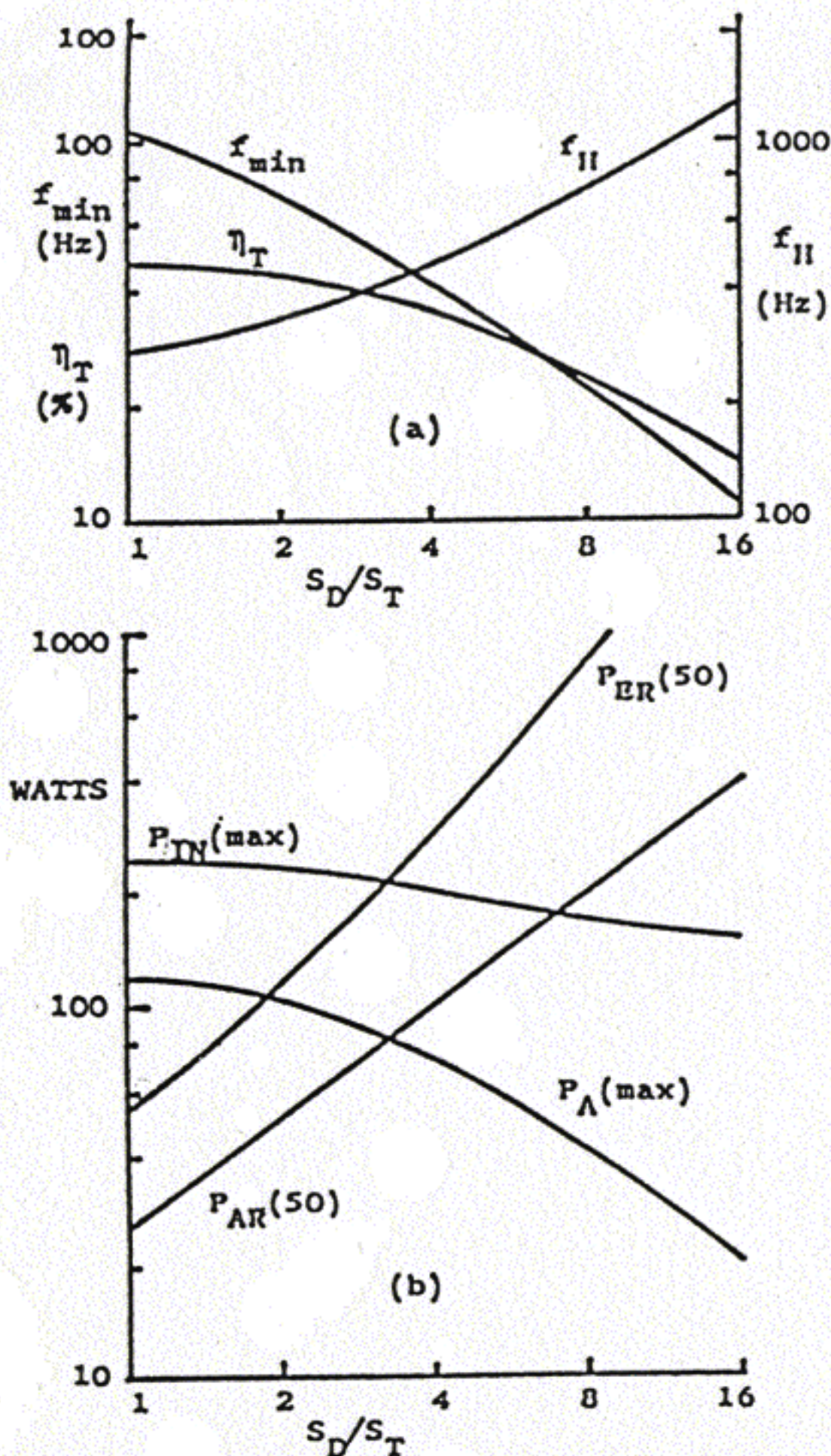


Figure 4.

The horn-loaded performance capabilities of the type 365 12-inch driver. (a) The primary small-signal performance indicators η_T and f_H , and the frequency for simultaneous thermal and displacement limit f_{min} , plotted as a function of the diaphragm-throat area ratio S_D/S_T . (b) The 50-Hz displacement-limited power ratings $P_{AR}(50)$ and $P_{ER}(50)$, and the thermally-limited power ratings $P_{IN}(max)$ and $P_A(max)$, plotted as a function of S_D/S_T .

DRIVER MODEL	NOMINAL DIAMETER	$P_E(\text{max})$	EBP	$\eta_T(\text{max})$	$P_{AR}(\text{ref})$
	in	W	Hz	%	W
FE103	4	10	180	46	0.7
5060	5	10	110	46	0.3
B110	5	30	110	58	1.7
6-25	6	25	180	50	1.1
7066	7	40	75	34	4
1L8T	8	25	70	42	6
SP1039	8	80	50	37	6
8066	8	40	55	30	7
10100	10	40	110	51	6
12100	12	40	80	48	16
365	12	130	180	48	26
D130	15	60	160	55	4
130A	15	60	210	62	4
2205A	15	150	140	61	11
LE15	15	150	100	39	40
475	15	200	80	45	43
189ES	18	500	120	63	85
24 INCH	24	500	170	65	114

Table 1.

The horn-performance driver parameters EBP, $\eta_T(\text{max})$ and $P_{AR}(\text{ref})$ for a selection of high-quality drivers.