

Horn-Loaded Bass Speaker

EARL R. MEISSNER* AND L. K. ANDREWS**

The swing to better bass response is solved by a method which is available in one form or another to anyone with patience, fortitude, lumber, a saw, and a hammer.

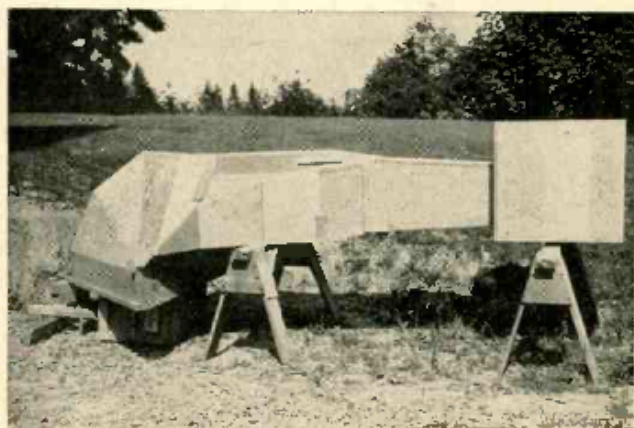


Fig. 1. Side view of low-frequency horn designed for mounting in an attic, with the horn mouth entering the room through a corner of the ceiling.

AFTER MUCH EXPERIMENTATION and careful listening to conventional types of reproducing systems, it appears to us that there is more room for improvement in the bass range than in any other part of the audio spectrum. A great improvement in the middle range of our three-way speaker system had been noted when a Western Electric 15A "Morning Glory" horn and a 555 driver unit had been installed. The question naturally arose could a comparable advantage be obtained by horn loading the bass speaker?

Thoughts lead to action, so taking a quick measurement of the front door and the arch between the living room and dining room, it was apparent that a five-foot square horn mouth could be squeezed in. Just to keep the mathematics simple, we decided to halve the cross sectional area for every foot of axis. One of our engineering friends informed us this gives approximately a 63-cps cut-off exponential horn. So section by section, an experimental horn was constructed of three-quarter-inch plywood (they give it away in Oregon), until it extended through the living room, dining room arch-way and to the back wall of the dining room.

When the throat was down to the 3 x 3 in. size, we connected our bass

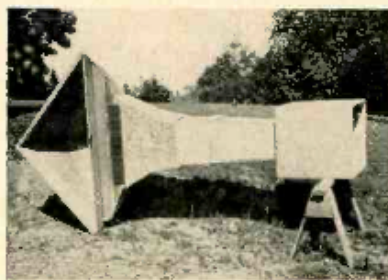


Fig. 2. "Bottom" view of the horn, to show triangular mouth.

"woofer," a four-inch \$1.59 speaker, and gave it the listening test. It sounded darned good. To get a comparison, a fifteen-inch co-axial speaker, mounted in a commercially built bass-reflex cabinet was set up for A-B testing. The results were all in favor of the horn and the \$1.59 speaker. With this encouragement, a fifteen-inch woofer, Stephens 103LX-2, was obtained, and the results were even better. The bass was much smoother with far less distortion com-

pared to anything we had heard, including folding type corner baffles. The transient response was markedly improved and the whole bass range was much "cleaner." Thus the question as to whether comparable advantages would be obtained by horn loading the bass speaker was definitely answered in the affirmative.

To determine the best match of the horn to the speaker, a few inches of the horn were cut off at a time, until we arrived at a throat area of 100 square inches, which we thought gave the best results. An engineering friend with a well-trained slip stick advised that this gave unity loading for a 15 in. cone.

Domestic Distortion

However pure and well-damped the tones emerged from the horn, there were persistent rumblings within the household. With the usual engineering approach, we went to work tracing these spurious frequencies. We knew the 50-watt amplifier had less than one-half of one per cent distortion, so that was ruled out. Again applying the listening test, we traced it to Mother and determined that it had something to do with the size of the horn and the fact that she had not been able to use the dining-room for three months! Now we knew the rumblings were ominous, and not to be solved by slide rule. Neighbors had added to the discord with a remark like "What in the World!" or by politely ignoring the colossus while carrying on a sprightly conversation as to how well the dolphins were going.

A hasty consultation was held and in the interest of family relations, the horn was reduced to kindling wood. As time passed, however, we noted the children nuzzled the horn, around, under, and in which they had played hide-and-seek.

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*United Radio Supply, Inc., 22 N. W. Ninth St., Portland 9, Ore.

**Engrg. Dept., Pacific Telephone and Telegraph Co., Portland, Ore.

¹ Since then, several articles have appeared, showing the high distortion in speakers below 100 cps and the improvement to be expected if horn loaded. See "Loudspeaker Enclosures," by Daniel J. Plach and Philip B. Williams in *AUDIO ENGINEERING*, July, 1951, p. 12; and "Loudspeaker diaphragm control," by J. Muir, *Wireless World*, July, 1951, p. 252.

Fig. 3. By constructing the horn in sections, it is possible to handle it without the aid of a crane.

