AUDIO ENGINEERING

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Audio in the Home

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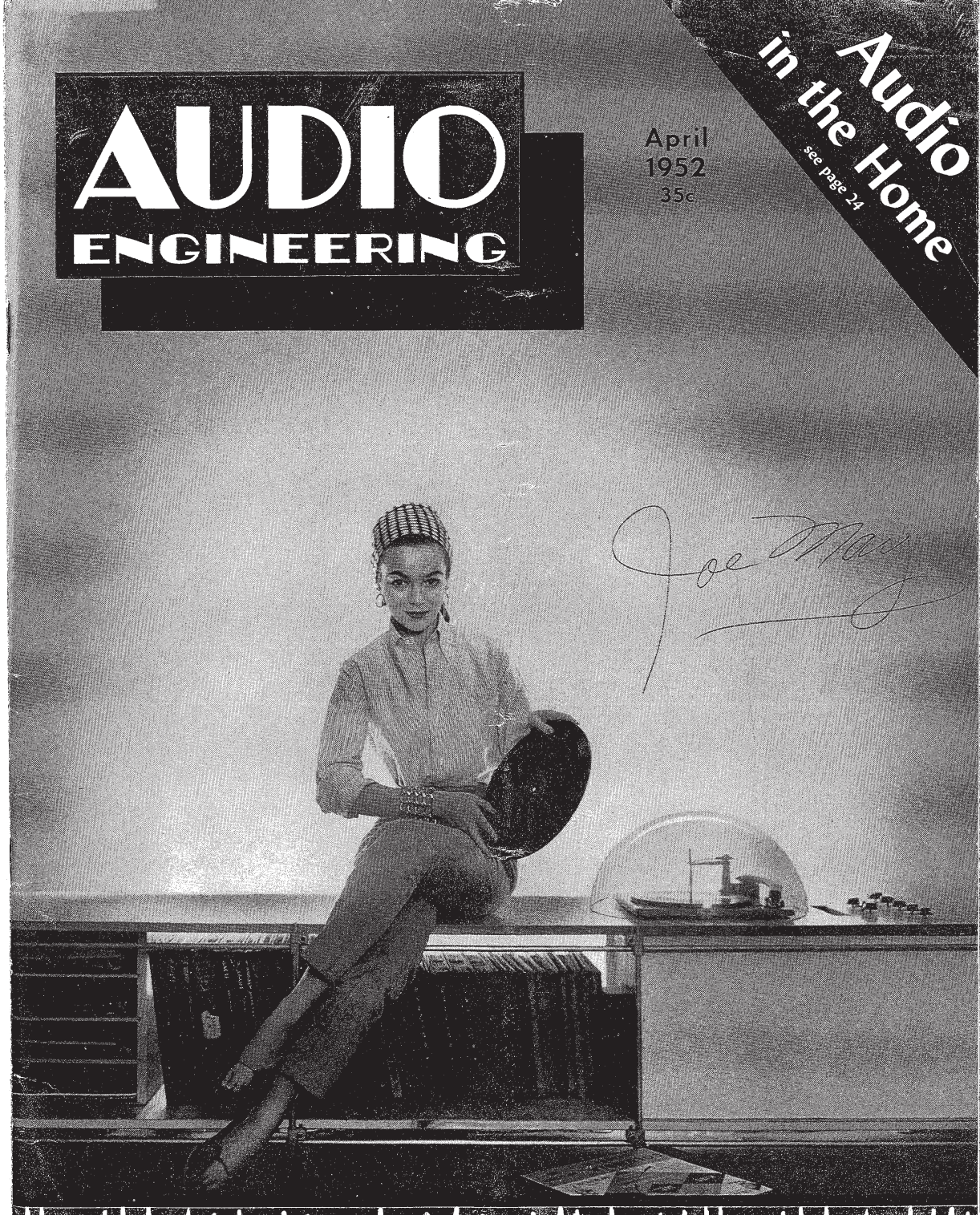

THE WORLD OF SOUND

)esign and Construction of Horn-Type Loudspeakers

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Part II. Continuing the description of exponential horns suitable for home use in the never-ending search for clean bass. This corner model should be the answer to many a question as to "How to do it."

LAST MONTH'S ARTICLE, the writer escribed a simple cabinet-type horn oaded speaker which is fairly simple onstruct, and which provides excel- bass response, in addition to satis- ory high-frequency performance. re is some improvement to be ex- ed, however, from a corner horn loying the same principles of con- ction, such as the one to be described :.

he second horn speaker to be de- ed is depicted in *Figs.* 6 to 9, with diagram and photographs showing the constructional features. The horn is vertical and opens into the *upper* corner of the room. This feature has the advantage that sound radiated from the horn avoids acoustic obstacles like chairs and other articles of furniture. Furthermore, the absorption by the ceiling is considerably less than that due to floors with carpeting. The space which is not used for the horn proper is used for shelves and this arrangement effectively hides the horn. The shelves add greatly to the rigidity of the structure.

A 12-inch driver is coupled directly to the throat of the horn and the speaker is entirely enclosed. Experiments over a period of weeks indicated that the low-frequency response was much smoother with the rear of the speaker entirely enclosed. Vents in the chamber resulted in maked resonances and "boom." Ozite and ordinary air filters of the type used in warm air heating systems are attached to the walls of this enclosure and effectively damp out undesirable cavity resonances.

The horn walls of this speaker are constructed entirely of ¼-in. plywood. The shelves, uprights, and the bottom are made of ½-in. plywood. (It is suggested that heavier wood be used for the uprights to aviod warping which has been observed over a period of fifteen months.) Plenty of bracing eliminates undesirable vibration. *Figure* 8 shows one of the two damping plates which were constructed to keep the outside walls from vibrating. They consist of a piece of ½-in. ozite glued to the outside of the walls, covered in turn by pieces of quarter inch plywood screwed to the walls through the ozite. The resistance offered by the ozite under pressure eliminated vibrations in this area. The plates must be large so that the entire area does not vibrate as a unit. No internal cross braces were found necessary.

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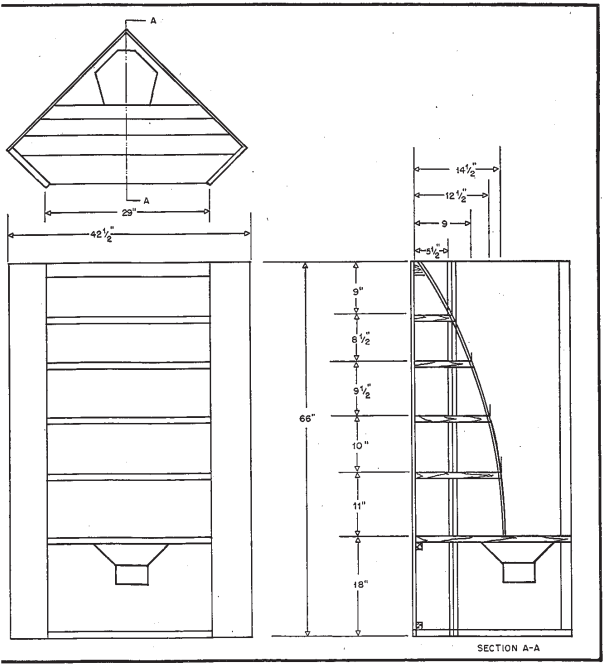

6. Constructional details for the vertical corner horn speaker, showing top and front views, together with section through the center of the unit.

Speaker Ranges Required

This woofer is designed to be used in conjunction with additional speakers for the middle and upper frequencies. Tests have indicated that although the response of the woofer continues to rather high frequencies, the "presence" is decidedly enhanced by the use of a low cross-over frequency. The writer uses a cross-over of 300 cps.

An alternative arrangement used earlier by the writer consisted of a two-way speaker in place of the woofer. In order to avoid directional effects, a curved reflector was placed in the upper corner of the room directly above the horn to disperse the middle and upper frequencies into the room. Results were excellent though rather unusual. The apparent source of the sound was, as might be suspected, at the upper corner of the room. The arrangement was finally discarded partly because members of the writer's family objected to the "buzzard's nest" way up in the corner.

It will be noted that the exponential "curve" is obtained by the use of straight boards, each one attached to two shelves.

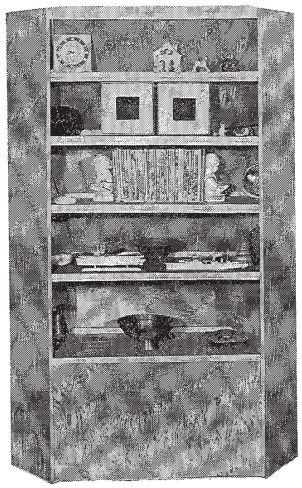

Fig. 7. Corner cabinet with vertical horn. The shelves serve to camouflage the horn and to add rigidity to the entire structure

In contrast to the other speaker described, this one is almost exactly exponential in shape. The results are better at extremely low frequencies. This is attributed to the shape and to the fact that the entire structure is larger.

In order to eliminate leaks, rubber weatherproofing strips were used to seal the corners of the horn. These strips are seen in *Fig.* 9. Their use eliminates the problem of precise fitting and also eliminates the transmission of vibrations from certain members of the structure to adjacent panels. The shelves, uprights, and other partitions are assembled with screws—nearly two gross.

Since this was originally an experimental unit, plywood was used to lower the cost. Obviously, solid woods or hardwood veneers can be used to improve the appearance, but their use would, of course, greatly increase the cost.

Preliminary Model

The two horn speakers described are merely examples of what can be done. There is no doubt that other constructors can make further improvements by added refinements in design and construction. It is earnestly suggested that anyone who desires to construct a horn speaker should first make a cardboard model. The model should incorporate all the main features of the desired structure. Its use permits the constructor to anticipate difficulties and to discard an inferior design before the speaker is started. The writer constructed several such models before building each unit. All but the last models were discarded for reasons of appearance, acoustic difficulties, or difficulties in construction. The added time spent with cardboard, shears, and scotch tape was a small price to pay for the effectiveness of the completed speakers. With one exception noted earlier, no changes were required to achieve good acoustic results. It's much cheaper to make mistakes on cardboard.

The writer's complete speaker installation consists of the two horn units described in this article, one bass-reflex unit, and high-frequency speakers. These several loudspeakers so diffuse the sound that visitors invariably ask, "Where is the sound coming from?" Like many others, the writer prefers diffused sound to that which comes from a point source.

In conclusion, two warnings should be given the prospective builder of a horn speaker. First, the improvement in low-frequency response is invariably accompanied by an increase in motor rumble. That phonograph motor which used to be "quiet as a mouse" is likely to take on the character of a roaring lion unless it is well made or unless some sort of noise suppression is used which is effective at the lower frequencies. As every audio enthusiast knows, improvement in one element of a reproducing system is likely to make deficiencies in other elements the more obvious. The second warning has to do with the fact that the larger of the two units described in this article is assembled with screws rather than with glue. The reason is—well, do you remember the story about the man who built a boat in his basement and then couldn't get it outside?

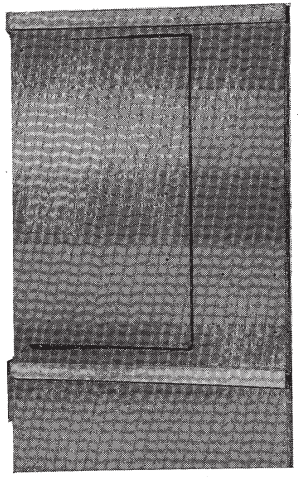

Fig. 8. Side view of the vertical horn. The damping plate eliminates all objectionable vibration from the horn walls.

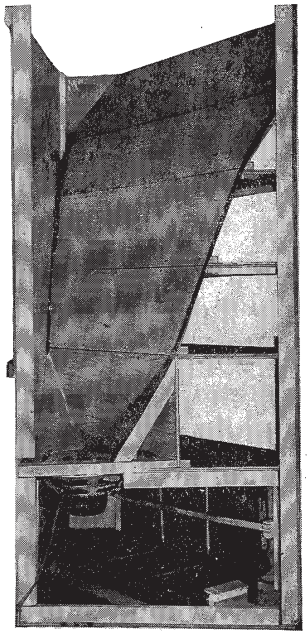

Fig. 9. Vertical horn with side removed. The constructional features of the horn and speaker chamber are clearly shown.

British Radio Component Show, 1952

Grosvenor House, Park Lane, London, is the scene of the Ninth Annual Private Exhibition of British Components, Valves, and Test Gear for the Radio, Television, Electronic, and Telecommunication Industries for three days, April 7 to 9 inclusive.

This exhibit, organized by the Radio and Electronic Component Manufacturers' Federation, will present the products of over a hundred exhibitors, bringing new evidence of research by component manufacturers toward more reliable equipment for rugged atmospheric conditions, and with increased efficiency. The trend toward miniaturization is also shown by this year's exhibits.

Among the improvements to be shown are wire insulations and sleevings which have increased resistance to high temperatures, ceramic insulators of a variety of materials, and several grades of laminated plastics.

The show extends to assemblies, with new three-speed record changers in the forefront of interesting audio items, along with a new magnetic pickup of turnover design—possibly indicating that the British record industry will bring out records in more than one speed for domestic use.

That loudspeakers have an effect upon TV pictures is acknowledged by one manufacturer, who has wisely introduced one model of permanent magnet speaker which employs a totally enclosed magnet to reduce the external field. Another manufacturer is exhibiting a new pressure-type loudspeaker unit, together with vibration equipment for industrial research.

In spite of defense requirements, British manufacturers are still able to meet demands for civilian and export markets, although shortages are experienced from time to time in certain fields, and some items are confined to Government use.