

AUDIO UPDATE

Magnetically shielded loudspeakers

THE GROWING POPULARITY OF AUDIO/video systems has produced a plethora of components, accessories, and adapters, all intended to facilitate the marriage of the two media. From a technical point of view, one of the more interesting of the newly created audio/video components is the magnetically shielded speaker system. The purpose of the magnetic shielding is to prevent the stray magnetic-flux field normally emitted by a speaker's magnet from impinging on the video monitor's picture tube. Because the electron beams inside the picture tube are controlled magnetically, any extraneous magnetic influences can have an adverse effect on the picture.

Preventing flux influx

In my youth I worked for an electronic-kit company as a test-instrument troubleshooter. The oscilloscopes I serviced were primitive devices by today's standards, but they had the virtue of being easily fixed when something went wrong. One of the things that went wrong in the customer's kits was trace distortion caused by magnetic radiation from the scope's power transformer. The fix was simple enough: A 3- by 5-inch piece of thin sheet steel was bolted to the scope's chassis in the magnetic path and then bent until the trace distortion was no longer visible. What I installed was not a magnetic *shield* but rather a magnetic *deflector*, which brings us to a rather interesting topic—the “shielding” techniques available to the manufacturers of video-ready speakers.

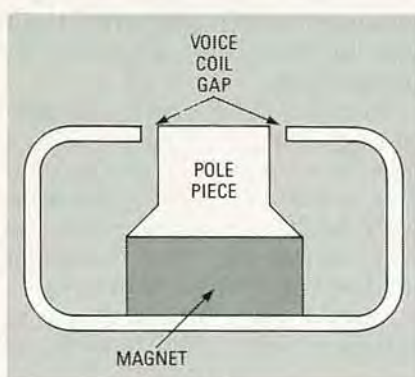


FIG. 1

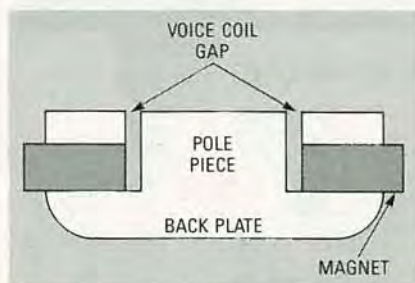


FIG. 2

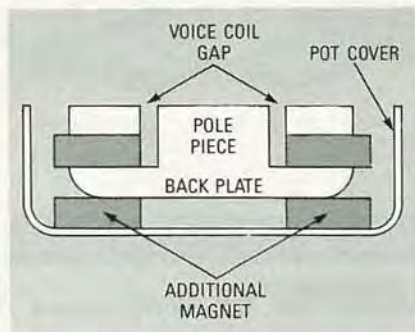


FIG. 3

Internal shielding

At a time when all speakers used Alnico magnets, shielding was a simple proposition. The Alnico magnet was in the form of a cylindrical “slug” surrounded on two



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sides by a heavy metal yoke. See Fig. 1. The yoke was actually part of the magnetic circuit that concentrated the magnet flux in the voice-coil gap. The inherent magnetic leakage from such a structure is quite low, but today the high cost of Alnico magnets has pretty much eliminated them from speaker use in favor of ceramic-ring magnets. The ceramic magnet is usually in the form of a flat-sided ceramic doughnut that surrounds the pole piece as shown in the cross-section view in Fig. 2. If you've ever handled a ceramic-magnet speaker you know that there is extensive magnetic leakage from the exposed outer edges of the ceramic-magnetic ring.

External shielding

External shielding in the form of a judiciously placed ferrous-metal cover can be effective with small speakers with low-flux magnetics such as are found in many conventional TV sets. However, when such shielding is applied to larger, better quality speakers, problems occur. Although it can be effective in suppressing magnetic leakage, the shielding diverts a substantial part of the available flux away from the voice-coil gap, which can result in an unacceptable loss of damping and efficiency.

Magnetic deflection.

The technique used to produce today's better “magnetically shielded” speakers uses no shielding at all! As illustrated in cross-section view in Fig. 3, a second, fairly hefty ceramic-ring magnet is installed piggyback at the rear of

the speaker so that its magnetic polarity is opposite to that of the main magnet. An iron housing (a "pot" in speaker-designer jargon) is part of the additional assembly and its purpose is to focus the magnetic field of the second magnet so as to divert the stray leakage-flux back toward the main magnet. It does that so effectively that an additional benefit occurs—there is an increase in the magnetic flux appearing in the voice-coil gap.

In effect, it is as though the main magnet were made more powerful. Adding an extra magnet is not a cheap solution to the flux-leakage problem, however, because the magnet is the most expensive part in most speakers.

To digress for a moment: Do *not* assume that a more effective or heavier magnet is always desirable in a speaker system. An excessively strong magnet can electronically overdamp a woofer, thus inhibiting its voice-coil/cone movement at low frequencies. Overall mid-frequency efficiency

will be increased, but at the expense of low-bass performance. A knowledgeable designer juggles (trades off) efficiency, bass performance, and cabinet size to achieve the specific results he (or the marketing department) wants.

Video psychoacoustics

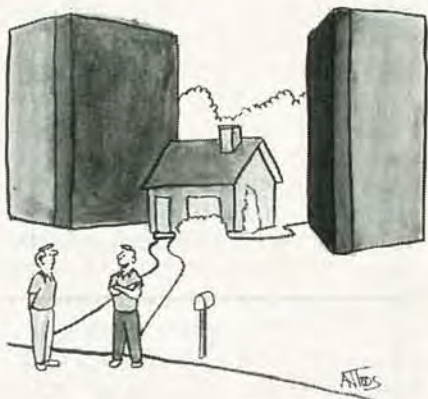
There's an important question that no one seems to be asking about shielded video speakers: Is it a product category that is really needed? For several years I've been using a pair of small B&W *LM-1* car speaker systems with my Proton video monitor. The speakers are driven directly by the low-powered stereo amplifier built into the Proton unit, which sits between them.

There's no effect on the picture as long as the *LM-1*'s are spaced a foot or so away from the screen. That is not surprising, since magnetic fields are subject to the "inverse square law." That means that the strength of the field decreases in proportion to the *square* of the distance (rather than linearly) as

you move away from its source. If you double the distance, you get a quarter of the field strength. It's easy to move the speakers to where they won't cause any trouble, considering how comparatively weak the stray magnetic field is to start with.

It seems to me that with a full audio/video system you *don't* want to install stereo speakers that close to the TV screen—or each other. In other words, the normal ground rules of stereo-speaker spacing apply whether the program source is audio or video, stereo or mono. Assuming that your speakers are correctly wired in phase, a normal 5- or 6-foot spread between them won't cause problems with imaging or centering with mono programs. Despite what some recent Japanese literature seems to imply, the human eye, ear, and brain combination is remarkably accommodating in placing the apparent source of a sound where the eyes say it should be. If you've ever watched television while listening through headphones, you know how easily the brain is able to shift the apparent location of the sound to the screen.

There's no technical reason *not* to buy a good audio/video speaker if for reasons of decor or silliness you simply must place them cheek-to-jowl with your monitor. But the odds are that some less-expensive conventional speakers, properly installed, will sound just as good. **R-E**



"I finally found the perfect speakers!"