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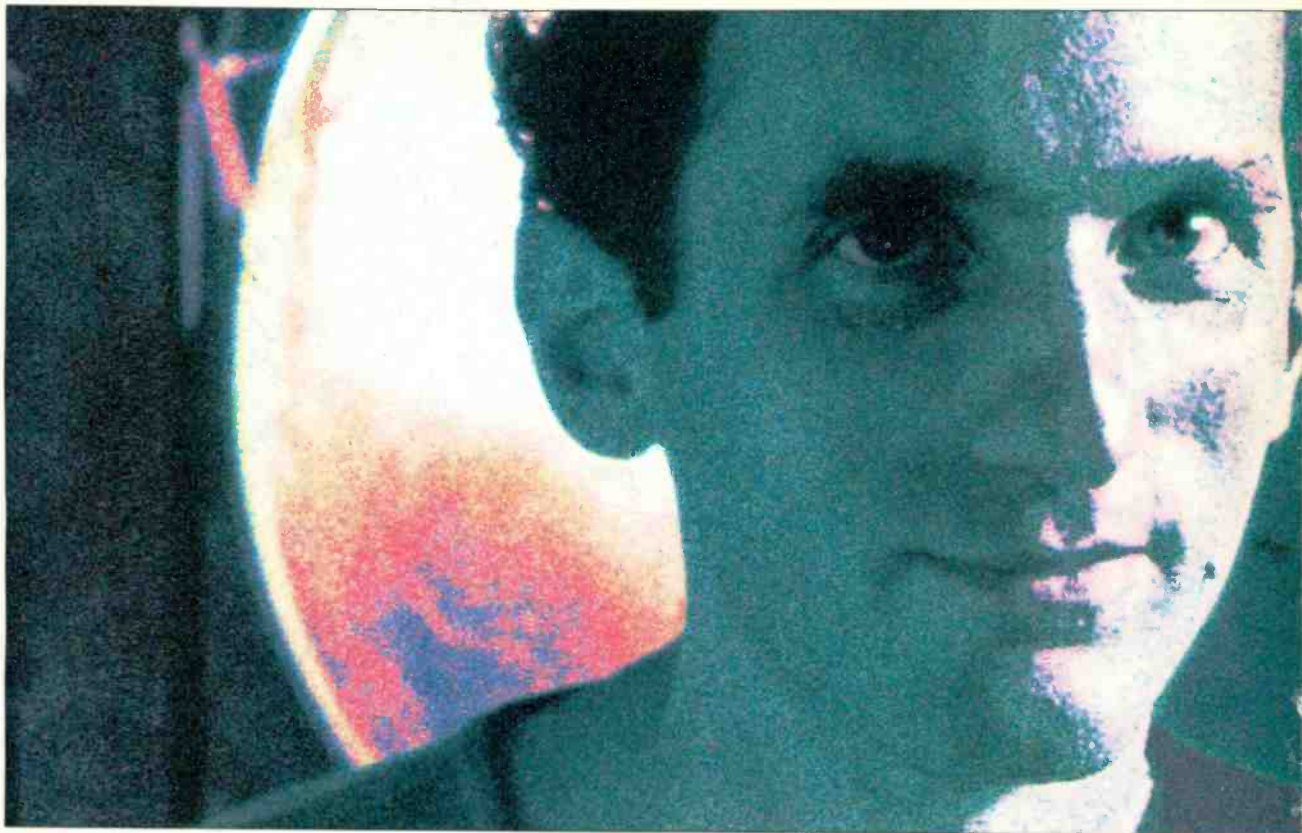
INTERVIEW
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GREAT PERFORMANCE

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Andy Narell cooks with a special set of pans.



Get a free Up Close limited edition CD featuring 6 songs from Andy Narell's *Little Secrets*. Send check or money order for \$3 (U.S. funds) to cover shipping and handling to:

The music that Andy Narell cooks up is probably best described as a stew. A little bit of everything: Jazz, Caribbean, Latin and a pinch of funk.

But that's what you'd expect from a kid who grew up in New York City playing an instrument from half a world away – the steel pan, also known as the steel drum.

On his latest Windham Hill Jazz release, *Little Secrets*, Narell works toward two goals. The first is to show how the pan can be a lead instrument – not simply a supporting voice as many other contemporary musicians have used it.

Upon first listen, you'll be amazed how Andy Narell's steel pan music sounds on our



SubSat Six three-piece subwoofer/satellite system. Each tiny satellite speaker can be

The second is to create a warmer, more spherical tone for the pan, as you can hear on the single, *We Kinda Music*.

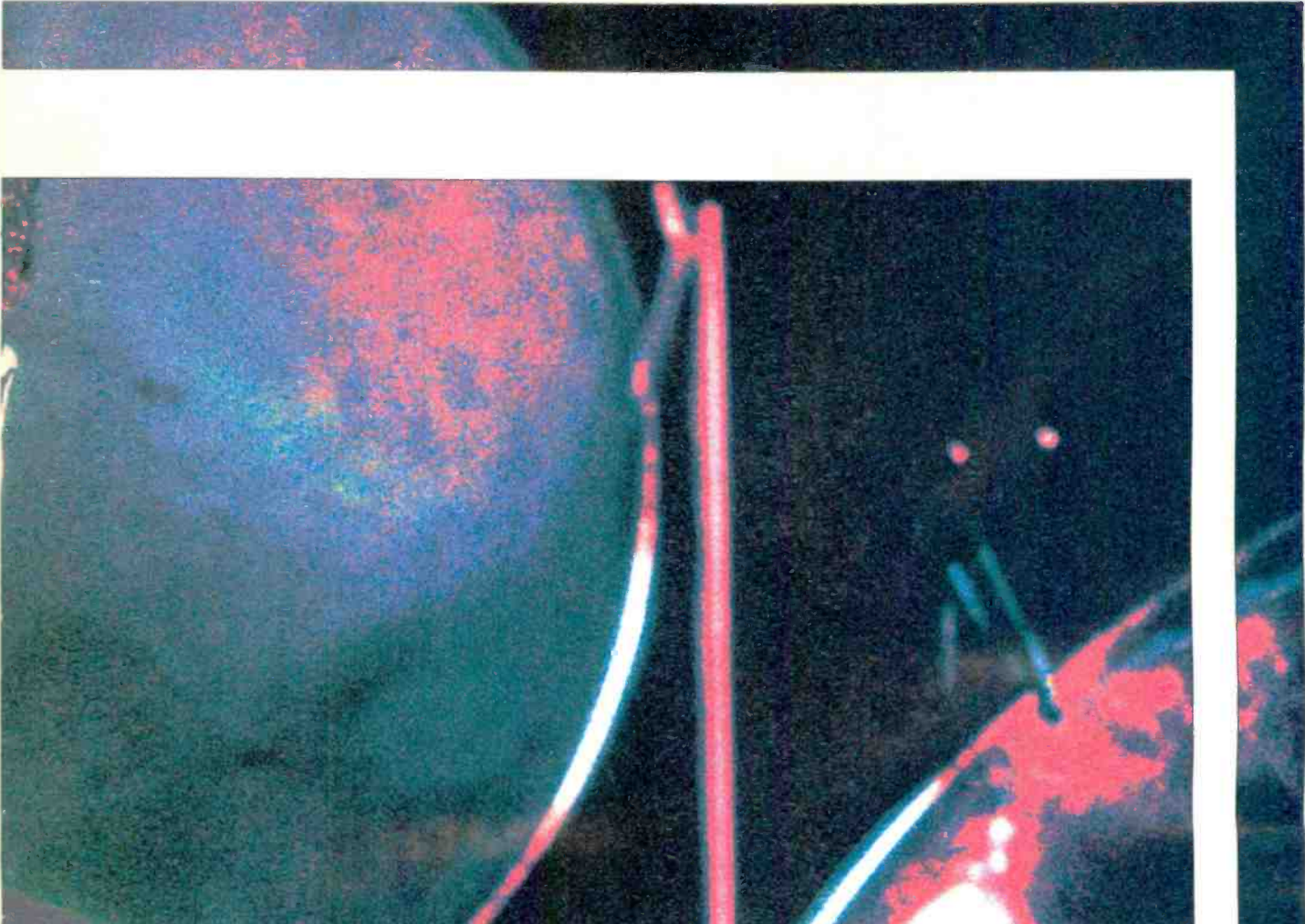
To find this tone, he first had to locate three Neumann tube microphones from the 1950s, known for their warmth and clarity. Narell uses this quality to its full advantage, placing two mikes one foot above the pan's surface and one, four feet above to capture the room's acoustics.

The voice of the steel pan is laden with overtones, especially when struck hard. To counter this, Narell plays softly, bringing out the naturally warm tones of the

mounted on your wall with optional brackets, or placed



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advantage, the PowerVent Bass Module, fits neatly in a corner



or behind furniture, and delivers deep, powerful bass down

instrument. The result is a sound which is complex and expressive – much like the human voice.

Narell plays six different sized pans on *We Kinda Music*. Those in the top range produce multiple octave harmonics, perfect fifths and other tuned overtones in addition to the fundamental tones. Bass pans resonate with a deep, warm pitch. When overdubbed together, a complex, richly layered sound is created.

Since there were no true jazz “pan heros” to model himself after while he was growing up in the 60s, Narell listened to jazz greats on

to 46 Hz \pm 3 dB. In all, the SubSat Six fills a room with a big sound, without tilling



it with big speakers. It typifies the Boston Sound: tight, clean and smooth.

WLIB radio from Harlem. Perhaps the most noticeable influences on his technique were players like pianist Herbie Hancock and vibist Bobby Hutcherson, the latter because the vibes and the steel pan are both played similarly. And because the vibes’ tone and range are the closest thing to the steel pan in jazz.

Sample Andy Narell’s cooking for yourself. Visit a Boston Acoustics dealer and ask to hear him on a Boston SubSat Six system.

Music this good should be heard on speakers this good.

BostonAcoustics

Audio

JULY 1990

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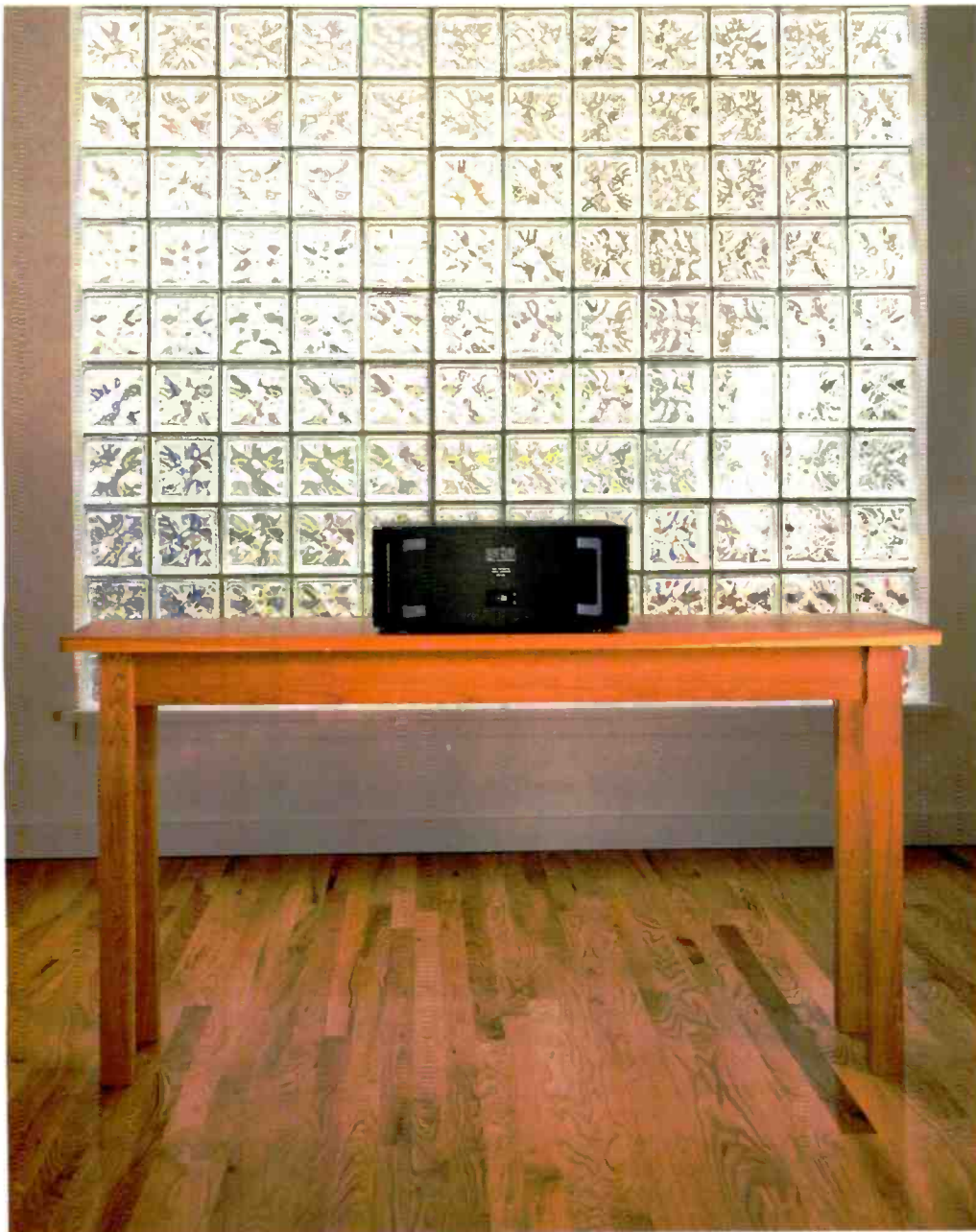
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Horns vs. Direct Radiators

Dear Editor:

In the September 1989 Issue of *Audio*, we noted the article entitled, "THX Sound System: Certified Hi-Fi for the Movies." One particular portion of the article was intriguing to us for its contention that horns produce more harmonic distortion than direct-radiator woofers and that this single criterion should condemn them. As designers and manufacturers of both types of transducers, we feel obligated to address this issue. Although we consider frequency modulation distortion to be a more offensive contributor to *total* distortion, we recently conducted additional tests on harmonic distortion.

The cabinets tested were a dual 15-inch horn-loaded enclosure (HORN) with a designed lower cutoff of 45 Hz (a Klipsch MWM) and a dual 15-inch vented enclosure (VENT) with a designed lower cutoff of 40 Hz (a Klipsch KP-450). The *identical* 15-inch drivers were used in both cases. Our measurement equipment included B & K 4133 microphones, Hewlett-Packard 3325A function generators, and a Techron TEF System 12 Plus. Tables and graphs were generated containing harmonic distortion data with fundamentals at 40, 50, 60, 70, 80, and 200 Hz; FM data with f_1 and f_2 at 50 and 230 Hz, and frequency response of the tested HORN and VENT (reflecting the 6-dB difference in sensitivity).

The data for 40 Hz reveals that the harmonic distortion levels are essentially equal for the HORN and VENT. In both cases, the woofers are in (or nearing) their nonlinear excursion range at the upper input voltages.

At 50 and 60 Hz, the harmonic components of the VENT are large when compared to the HORN. At these frequencies, we are well into the designed operating range of both systems, but the HORN is more efficient, requiring less voltage to obtain the same SPL. The HORN is not nearing its nonlinear region like the VENT.

The data for 70 Hz represents a region of apparent transition. Neither woofer is driven into a nonlinear region, and harmonic components are again at about the same levels. The data for 80 and 200 Hz confirm this.

The data for FM distortion clearly demonstrates that the HORN produces

far less of this far more objectionable type of distortion. These components are not harmonically related and are therefore more irritating to the listener. The spectrum of a musical instrument is constructed of harmonics along with the fundamental and, in general, does not contain FM components. Some might point out that FM distortion goes to zero at 90° off axis, but this is true only in the theoretical case of a plane wave. In actual tests of real speakers, the reduction generally falls in the range from 4 to 10 dB, as does harmonic distortion.

Our tests indicate that the HORN produces somewhat less harmonic distortion than the VENT. We feel, however, that an evaluation of horns versus direct radiators should not be made solely on the basis of harmonic distortion data. In the case of FM distortion, the HORN is clearly superior. Regardless of what parameters are measured, the result of *proper* horn loading is demonstrably cleaner sound over any range. All types of distortion, as well as many other characteristics, should be considered when choosing between transducer types.

We acknowledge that speaker evaluation is a highly subjective practice, yet it is our experience that properly applied horn design offers the greatest reduction in *total* distortion and compression while improving power output, transient response, and control of coverage angles. We submit that direct-radiator woofers are basically a compromise of distortion characteristics in order to obtain a better ratio of bandwidth to cubic volume. The complete test data is available from Klipsch upon request, for the price of a large envelope and 50¢ postage.

To quote the late Dick Heyser from the pages of *Audio*, "... in my personal opinion, accurate percussive bass is a specialty which a properly set-up horn seems to have to itself."

Jim Hunter
Design Engineering Manager
Klipsch and Associates
Hope, Ark. 71801

Author's Reply: Regarding my article in the September 1989 issue, I regret that space considerations did not permit a more comprehensive explanation of the experiment I performed regarding

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How Often In The History
Of Music Do We Find Something
Small, Yet Incredibly Gifted?

The job of reporting speaker distortion is not over when second and third harmonics are measured, due to a variety of distortion mechanisms.

the distortion performance of two low-frequency loudspeakers.

The experiment was performed in a 70,000-cubic-foot dubbing stage belonging to one of the most prominent post-production sound companies in Hollywood. The acoustical design called for a relatively short reverberation time (0.5 S), flat with frequency. Two sets of three loudspeakers were installed side-by-side, one set being a conventional one, with horn-loaded woofer and tweeter sections, and the other being the THX system components, with direct-radiator woofers and horn tweeters. Both were flush-mounted in a large, flat baffle, for optimum low-frequency loading, and were side by side. I spent three days after the installation adding $\frac{1}{3}$ -octave equalization to make both systems as smooth on a spatially and temporally averaged basis as possible. Then I conducted several experiments on the systems, one of which, the distortion series, was reported in *Audio*.

My first objective was to measure distortion over a much wider frequency range than is typical for loudspeaker measurements. Most loudspeaker manufacturers measure the amount of the second- and third-harmonic distortion versus frequency with the parameter of sound pressure level. Since second harmonic typifies asymmetrical distortion sources, and third harmonic symmetrical sources, users have often believed that the job of reporting was done when these were measured, expecting that higher harmonics would fall away in progression. I found this not to be true, due to a variety of distortion mechanisms which add various amounts of different harmonics.

A precursor for a good experiment is to make sure that what is being measured is not an artifact of the testing process; ensuring this was my second objective. In order to ignore power amplifier distortion, for example, it is necessary to measure the amplifier distortion and see that it is in fact several

orders of magnitude lower than the measured distortion. The generator used was a Krohn-Hite Model 4200A driving a Crown DC-300A power amplifier through the installed ADM console and Dolby cinema processor. Measurements at the output of this chain at every frequency and level used in the experiment showed the driving system's distortion to always be negligible as compared to the loudspeaker distortion (except where the loudspeakers were shown as having harmonics more than 70 dB down—for these, noise in the receiving room competed with the measurement of distortion, particularly at the higher harmonics). To prevent amplifier distortion in the sound pressure pickup, a dynamic microphone with no internal electronics (Electro-Voice Model 668) was connected directly to a Hewlett-Packard 3580A spectrum analyzer. Since the diaphragm motion of the microphone is so small at the levels employed, we expect virtually zero distortion.

“The M-200 power amplifier is a smashing success by any standard, and an absolute steal at the price.”

Kent Bransford

Hi-Fi Heretic, Autumn 1989

Highlights of the review:

Over the years, B & K Components, Ltd. has become one of America's leading manufacturers of affordable, high-quality audio electronics. B & K has done an admirable job of providing musical, reliable preamplifiers and power amplifiers within the budget of virtually any music lover.

The M-200 can drive virtually any loudspeaker load in existence. Rated at 200 watts into 8 ohms and 400 watts into 4 ohms, the M-200 can drive loads as low as .75 ohms and still pump out its rated 200 watts! Rated peak current output of the M-200 is an incredible 150 amperes.

“I was floored by the M-200's sense of pace and drive.”

Internal construction is most impressive—a massive, shielded toroidal transformer centrally sited within the steel chassis. Four filter capacitors offer nearly 70,000 mfd of

storage capacitance. The input and driver circuits are carried on a single glassfibre board that sits atop the power supply caps. A gold-plated premium input jack is included, with gold-plated 5-way binding posts handling speaker cable connection.

“I was bowled over by its combination of smoothness (a B & K hallmark) and detail.”

All too often extremely powerful amps excel on bombastic symphony works, but fall down when it comes to conveying the subtlety and nuance of “smaller” music. The M-200 proved to be a glorious exception. Yes, the massed brass and great whumping bass drum shots in “Uranus, the Magician” were appropriately startling, but equally satisfying were the quiet flute and violin passages. Delicate instrumental shadings and nuances that are so important in communicating the emotion of the music were never glossed over or homogenized. The M-200 had that essential

ability to draw me further and further into the music, rather than hurling it in my face. Equally impressive was the M-200's soundstage width and depth.

While offering the tonal naturalness that characterizes all B & K products, the M-200 goes far beyond previous B & K amps in its outstanding bass quickness and definition, as well as its excellent retrieval of low-level detail and recording acoustic.

The M-200 power amplifier is a smashing success by any standard, and an absolute steal at the price.

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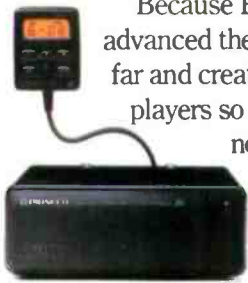


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The speakers I tested were as large as cars, so it was difficult to assemble a large number of them to test simultaneously.

tion from it, and with low distortion in the driving and receiving electronics, I believe the distortion that was reported is accurate within the resolution of the analyzer, which is about ± 1 dB.

I then sampled the three available loudspeaker systems (left, center, and right) to confirm that there were no

large differences among them. This is a relatively small sample (these loudspeakers are as big as a car, so it's hard to assemble a large number of them), but I believe the sample was a good one, because the post-production sound company had maintained a long-term relationship with the manu-

facturer and felt these to be prime examples of the model.

The next question to be raised concerns the model selected and the levels and frequency range over which it was driven. At that time, some years ago, this model represented about 80% of the installed base of theater loudspeakers in the U.S. The frequency range was chosen to be that over which the loudspeaker is routinely driven by the program material of the movies. It is true that the loudspeaker is being driven below the frequency of horn loading for this model in my lowest frequency test, but it is equally true that this is routine use of this loudspeaker, and the distortion that I measured is thus valid in practice. The sound pressure level which I chose to measure at is actually a very conservative one compared to the highest levels to be found in motion picture mixes. Measured in the dubbing stage, *Return of the Jedi* produces a maximum of 105 dB SPL in the 63-Hz octave band, obtained with all channels operating and a fast, peak-analyzer time constant. (Film sound has one great advantage over other areas of sound reproduction in that standards exist for the playback SPL of mixes, including loudness calibration, so that the experience designed by the filmmaker in the dubbing stage is transferred to the listening situation.) On the other hand, the level of measured distortion was so high in the horn loudspeaker that I felt driving it to higher levels might be destructive.

A remaining question is: Why do I rate harmonic distortion as more important than intermodulation distortion? Since "everybody knows" IM to be more audible than harmonics, which are, after all, "musical," I wanted to sort out this audibility question. If we are interested in human observers and their perception, then I believe high-order harmonic distortion to be more damaging than intermodulation distortion. The reason is frequency masking. The presence of multiple tones gives rise to intermodulation distortion in the ear itself, so intermodulation distortion arising from loudspeakers is probably often masked by the nonlinearities of the hearing mechanism. New experimental work on masking curves for human observers, arising from single



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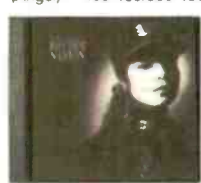
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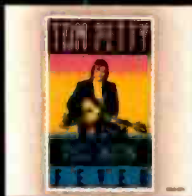
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I believe the best speaker for a particular job depends not on its technology but on its performance.

sine waves, was performed by Lewis Fielder in his study on subwoofers and published in the *Journal of the Audio Engineering Society*. His sets of masking curves form, for the first time, a method of weighting harmonics which makes sense to me. Using his data, I evaluated loudspeaker distortion for speakers in the THX program the following way:

The harmonic spectrum arising from sine wave excitation was measured at octave-band centers and at 80, 100, and 110 dB SPL, corresponding to Fielder's masking curve data. The masking curve was then plotted on top of the data. The next step was to discard as insignificant any harmonics which lay below the masking curve. For harmonics which were above masking, I added up the number of decibels by which each harmonic exceeded the masking level. This ascribed the correct weight to, for example, the very audible 15th harmonic while perhaps discarding altogether the perceptually unimportant second harmonic. In measuring a number of speakers over the last two years, I have found frequencies and levels where the "audible distortion products" range from 0 (audibly distortionless!) to 200 dB! Perhaps this test is a little too sensitive, since it gives values as great as 200 dB, which certainly seems exaggerated, but it is nevertheless well derived from the known psychoacoustics of the system.

The point of all this is really as simple as this: I believe the choice of the "best" qualified loudspeaker for a particular job depends not on the *technology* of the loudspeaker but on its *performance*. As I found, one example of a horn system may be worse than one direct radiator. Jim Hunter found the opposite. This is precisely my point: It's not the technology, it's the actual performance of individual models that matters.

The THX System is a little heretical to those who believe in a technology-based solution, since it uses different technologies for the woofer system (direct radiator) and the tweeter system (compression driver). This combination of components offered the best available method to meet goals of frequency range, smoothness, uniformity of coverage, dynamic range capability,

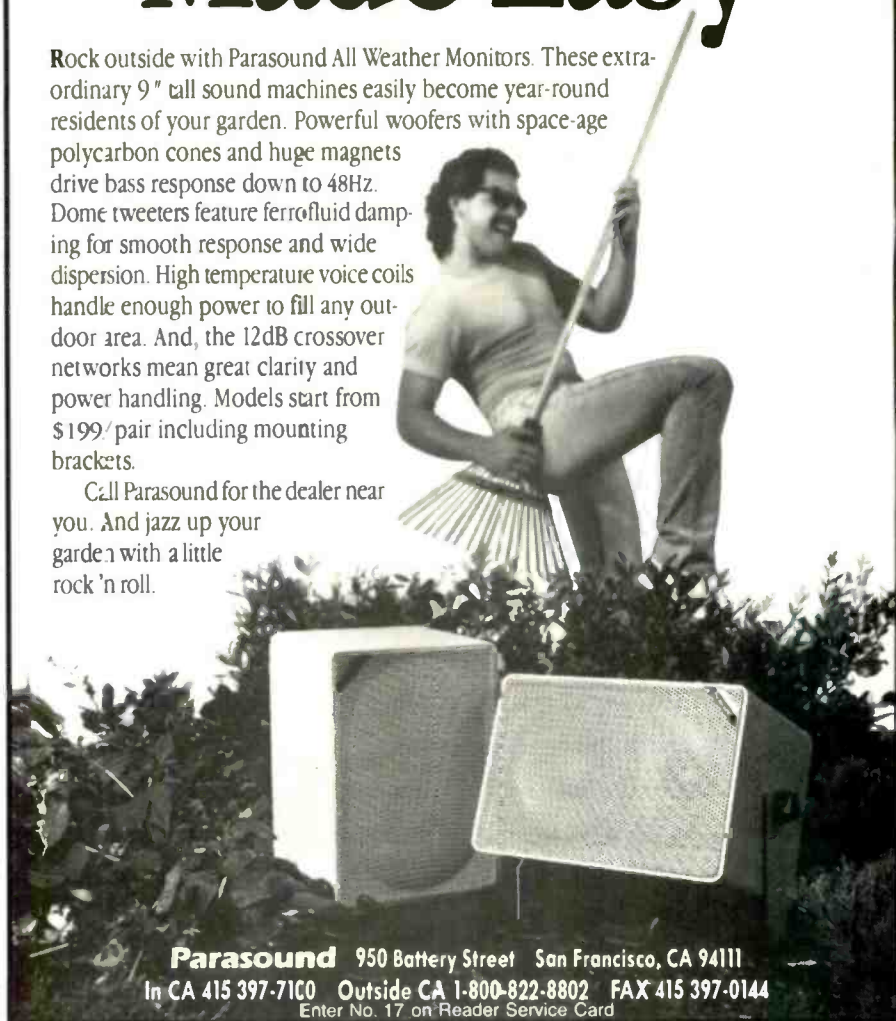
and low distortion. It was not an easy task to combine these two technologies, and it depended on recent developments on many fronts (e.g., low-frequency drivers built with Thiele-Small parameters in mind, constant-directivity horns, Frater-Linkwitz-Riley crossover) to stitch together an opti-

mum system. In fact, four parameters have to be matched at crossover to make a seamless transition: Complementary amplitude responses, matched time delay, matched phase throughout the crossover region, and matched directivity at crossover.—Tomlinson Holman

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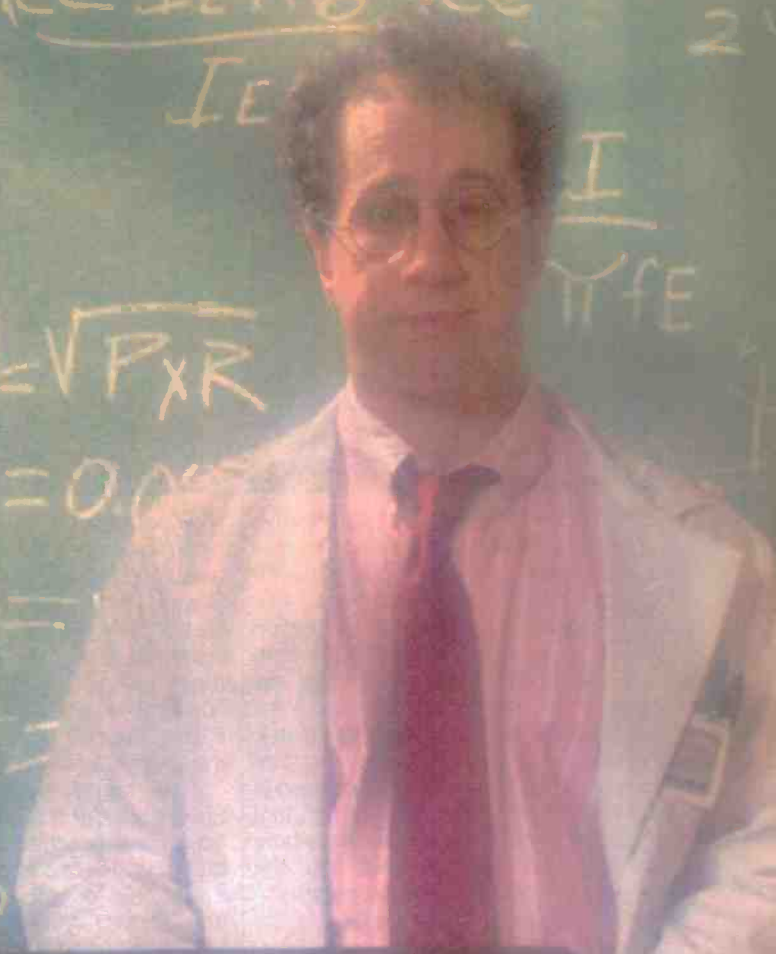
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MUSEUM MUSINGS



Along with my assorted forays into audiobiography in this space, I seem to have developed a sense of history—our audio history. So has that parallel organization of which I am an unlikely charter member, the Audio Engineering Society. We all, indeed, as a body of engineers, music listeners, musicians, car drivers, and just plain audio nuts, are becoming more and more aware of our growing audio past, the consumer hi-fi that began after WWII and, more important, the audio of the '20s and '30s, the period of basic audio development. And so on we go, backwards into the distances of time.

We are getting to the point of meaningful concentration in this field. All sorts of audio names are being memorialized, out of the past and often still present. Audio historical collections are springing up here and there all over the place, mostly informal and personal. It's like collecting antique cars, comic books, matchbook covers, Coke bottles. We have better material to go on than *that*. But we need direction, and the AES is steadily pushing its weight, which is enormous, towards more concrete audio history and preservation. So am I, weight 133. Each of us does what can be done.

Isn't it about time, then, speaking of names, to set up an Audio Hall of Fame, akin to the well-known baseball center at Cooperstown, N.Y. (and the much less known hall of fame in New York City, not a ball or a bat in sight)? More important, why not a centralized, overall, top-of-the-line Museum of Au-

dio, perhaps in several branches, to bring focus and authority to all our burgeoning historical interest, now so widely scattered? An even better idea—can't you see that comic-strip lightbulb over my head?—what we *really* need is a single, coordinated, National Audio Museum and Hall of Fame, the two aspects, the men and the products, worked in together.

This could be tourist dynamite. Should we call it a theme park? People go for any good and dynamic presentation, and audio could do just as well as whales or ancient cars. No help from Disney, thanks. We would maintain dignity and authenticity, whatever our show. And nonprofit, please—not like the commercial hi-fi shows we all have seen—and heard. This would be different and much more permanent. Museums can be shows, too.

Not the day after tomorrow. An officially recognized audio museum and hall of fame could take years of preparation and groundwork, including the vital study of museum technique. But in my opinion, this is where we are already moving—we just do not yet have a coordinated, centralized repository for all that human energy seething in so many parts of the audio field. Once we reach a certain stage of public awareness in this audio area, with all its possibilities for interesting dramatic presentation, I expect that both money and other wherewithals will burst forth in abundance. Donations of equipment, of course, both restored and in limbo condition. More important, vast resources for restorative expertise and

maintenance, the same. It already has worked that way in many other such fields.

I have several side hobbies, outside of audio, in which I have seen how this works out. Stereo photography—not collectibles in my case, but my own two-eyed color photos—is one. Another is trolleys; I am a mail-order member of two museums, and an occasional visitor. (Dave Klepper, the auditorium acoustics expert and well-known in AES circles, also belongs to one museum.) Railroading is another interest—it came to me mainly out of audio, the fabulous sound of steam (and diesel) trains recorded.

The sequence of events in these areas is very much of a common sort—the same problems we will need to solve in audio—whether it is the restoration of a stupendously huge steam locomotive (and its preservation and operation in stable working order) or a flimsy stereo picture card from the 1870s, begging for renewal. Or for that matter, the proper mounting for brand-new stereo photos like my own, which I am well aware are *not* at this point in archival condition! Every type of museum/collection has its technical side, but all share in common problems of organization, funding, account keeping, and plenty more. As you grow bigger the problems multiply.

The sequence towards official museumhood is inevitable. We all start as amateurs, if our subject is brand-new—new to the museum viewpoint. The first electric streetcar to be rescued from the looming junkpile was a

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Much of our interesting older audio is better seen than heard, including the Edison tinfoil phonograph.

lovely old open trolley from Maine, taken on by a bunch of casual amateurs almost on the spur of the moment. The urge was strong but the know-how near zero. Today, that little car runs jauntily on its own power, full of those people who have never seen, and those who fondly remember. It looks absolutely brand-new, right out of the factory not far from a century ago. Biddeford and Saco No. 31. That amateur beginning is now a highly organized and very large museum with hundreds of cars and enormous experience and expertise, even though much of the work is technically done by unpaid amateurs. It is the same with many a highly skilled steam operation—there are literally hundreds of these, all carrying passengers. The essence of a modern museum.

Beyond the developed and experienced museums are their national associations. There is a National Stereoscopic Association and a superb illustrated mag to go with it, for a central focus in this other kind of stereo. There is already a store of archival info in respect to stereo preservation—photos, that is—and, as is everywhere demanded today, active historical picture presentation for the general public. They are well ahead of us, but the first stereo photos were made as early as the 1850s—double daguerreotypes. This stereo art flourished a long century before ours got started.

These organizations have gotten as far as the regional museum, often on an impressive scale. There are already stereo photo collections on a high level of professional organization. In California and Pennsylvania, there are physically huge railroad museums: They have to be huge to handle those dinosaur behemoths of the Industrial Age! A balance is always struck, if differently, between "static" preservation and actual operating condition. We will have the same choice to make. Both can be dramatic as history. Much of our interesting older audio is better seen than heard, including the Edison tinfoil phonograph of 1877. But even more may be restored to working order and put into good use, to the fascination of the visiting listener. And this in every audio division, from mike to loudspeaker, from recording hall or studio to sports car and living room.

There is so much that can be done to make audio history widely attractive to all the people who benefit from it—that's everybody. Imagine a mock-up of a radio studio in the 1920s—the room, the equipment, and a batch of dummy human beings. Also, surely, the actual sound. Or a Victor Talking Machine recording session in the acoustic age, the buxom opera star with the huge hat standing on a little platform, the musical instruments, many with outlandish acoustic enhancers attached, tightly clustered around the well-known recording horn. (See Roland Gelatt's *The Fabulous Phonograph*.) An audio museum and hall of fame could be an exciting proposition.

You can see, then, where we stand. Poised at the beginning stages of museum activity, somewhat behind because, after all, we are the most recent of the areas I've mentioned. We are summoning up our energy, ready to go but so far in mostly fragmentary form. The trolley car people are miles ahead of us.

There is a further stage, a further consideration. Museum technology per se is now a highly specialized science above and beyond all of its historical fields, even unto the lowly comic book. As I say, every sort of historical collecting begins as just a hobby. For the fun of it. Learn while doing. Each little group on its own, with its own experience, good and bad. Museum technology does not approve. The museum people, as a rule, do not go out looking for new collectible material—say, hubcaps—on which to lavish their archival skills. Instead, the rising amateurs, with increasing experience and larger active collections, desperately need more efficient organization and, as they say, managerial techniques, to cope with the unwieldy. It's almost a matter of hands and knees—they must go begging to those who know, the museum experts, the professionals, for any help they can get. And thus comes the once unlooked for and now much dreaded moment—*accreditation*.

To what? To a whole Higher Authority that stands above and beyond all museums of whatever kind. You must have what amounts to a professional license to be a real museum. There is, as might be guessed, an association of professional museums that has the last

word. No point giving you the details—if you are in this business, you know all about it. Not even the AES, if I guess right, can set up basic standards for an audio museum, aside from the technicalities of audio itself, without consulting Higher Authority that rules over all museums.

If you want to be accepted into this haughty club, your museum must work sometimes for years to meet the official requirements. This may be painful—you think you have better ideas, at least in some favorite areas. But in the end, it is all very salutary. I have seen my two trolley museums, if strictly by mail, go through this unsettling experience, and I have sensed the anxiety, even the fear, which is like that of the final exam.

Are my fingers too big for my eyes? As a journalist, I can only encourage. My function is to stir up thoughts and energy where they need release. The energy in our field is there, and no two ways about it. I know from many a letter to me or to this magazine how much the preservation of historical audio is on our minds, even if only at the one-man level.

I should note that my thoughts this month channel directly from the *Journal of the Audio Engineering Society*, which in June 1989 (Vol. 37, No. 6) ran a remarkable special section on one of the great prototype audio museums now existing—the John T. Mullin Collection. In the fall of 1988, the AES transported the entire Mullin Collection, or the bulk of it, to the New York AES Convention. The exhibit occupied 1,600 square feet and seemed to have been the outstanding hit of the show, a perfect example of what can be done for audio history. The June 1989 article is unusual for a technical journal, beautifully done up with color photos. Beg or borrow a copy if you missed it.

I have in mind some personal reminiscences on the Mullin Collection. I was surprised at the number of items I had actually used myself, including that incredible Webcor wire recorder, previously described here. Also the Brush Sound Mirror, with paper tape, the Magnecorder PT-6 (in my back closet), and more. All I need, as you may guess, is a museum to take my stuff away and give it the pro treatment. You too? **A**

BERT WHYTE

I BAKE FOR WHALES

It is hardly surprising that consumer-type open-reel tape recorders have fallen on perilous times. They now compete with many high-quality cassette decks and soon with the even higher levels of performance afforded by the forthcoming Dolby S-type cassette decks and the imminent arrival of R-DAT recorders. Revox, Teac, Otari, and Fostex still offer a few models of upscale open-reel tape decks, but less expensive audiophile-type open-reel decks have literally disappeared from the market.

Open-reel tape was a dual-purpose medium. Audiophiles used it to make high-fidelity recordings, and in a broader sense, open-reel tape decks were used to play back prerecorded tapes. There has always been a certain elite aspect to open-reel tape. Those who could afford it enjoyed stereophonic sound, via prerecorded tapes, four years before it became available on vinyl discs.

In the early days of open-reel tape recorders, before the general availability of prerecorded tapes (around 1954), audiophiles had to make their own recordings. Most of these recordings were decidedly amateurish, both sonically and musically. However, there were insider groups fanatically devoted to recording or acquiring tapes of the highest professional quality. One of these groups became the Tape Bootlegging, Chowder and Marching Society, of which I was a charter member. Being a sales executive and musical director of Magnecord greatly abetted my recording activities. In most cases, we asked for permission to make our recordings. But since the musicians' union viewed our activities with a jaundiced eye (even though we assured them the recordings were of an "experimental nature"), we usually found a way to circumvent their lack of cooperation through technology or ingenuity.

For example, the United States Navy Band was captured stereophonically with a pair of appropriately spaced omni mikes lowered through the ceiling skylights of an auditorium in a suburban Chicago high school! *Guys and Dolls*, starring Allan Jones, was recorded in stereo with the mikes planted in the footlights of a Chicago theater. Gene Krupa, Ella Fitzgerald, Roy El-



dridge, and other performers of "Jazz at the Philharmonic" were stereophonically recorded in Carnegie Hall with the unspoken consent of the concert promoter. There were many other clandestine recordings, including one in which two people equipped with wireless microphones sat about 12 feet apart in the third row at a Metropolitan Opera performance, transmitting to an accomplice with a portable tape deck in a car parked outside of the theater! Supposedly, authorities at the Met found out about this and subsequently set up equipment to jam any future transmissions.

Many people have libraries of tapes they have personally recorded, and record companies have thousands of master tape recordings in their vaults. Whether amateur or professional, these tapes have been recorded on a variety of tape formulations, some dating from the earliest days of recording. Most record companies take precautions in storing their tape masters, while most amateur recordings are usually stored under the conditions of the typical home environment. I have acetate and even some paper-base tapes dating from 1948 which have been subjected to home storage conditions, and except for some cupping

(due to plasticizer dry-out), they are still playable. Apart from the ever-present problem of print-through, it seems that most magnetic tape recordings do remain playable for fairly long periods of time.

However, in recent years a devastating problem has developed with recordings made on certain types of magnetic tape. The problem equally affects all amateur and professional open-reel recordings. Imagine threading a valuable and possibly irreplaceable open-reel recording on a tape machine for playback. After a few revolutions of the reels, the machine grinds to a stop. Pressing fast-forward or rewind may move the tape a half-turn or so, but it stops again! A condition known as stiction has developed. Cleaning tape guides or heads will not alleviate the problem. I know some heartbroken people with hundreds of open-reel tapes afflicted with stiction.

Stiction is a term coined to describe the very high friction forces between the tape and the guides and heads of a tape machine. As noted, stiction can be great enough to stop the tape drive, even with the 1-horsepower motor of a Studer professional recorder.

Most stiction problems involving open-reel tape have occurred with var-

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ious tape formulations made between 1970 and 1976. Stiction has occurred with tapes made before and after that time, but infrequently, and is probably more attributable to environmental storage factors than to inherent flaws in the tape.

Believe it or not, the aggravated stiction problems with the faulty tapes can be traced to that great leviathan of the ocean, the sperm whale. These whales have a huge cavity in their heads filled with sperm oil. Along with the iron oxide, binder, and plasticizer in tape coating formulations, a modified sperm oil was used as a lubricant. Sperm oil was used in many other ways, and its demand was so great that these whales were being hunted to the point of extinction. In the early '70s, sperm whales were placed in the endangered species category, and most of the whaling nations agreed to greatly curtail or altogether stop the hunting of these magnificent creatures.

Without diminishing the importance of magnetic tape, it seemed proper that modern technology produce an appropriate tape lubricant without killing whales for sperm oil. Whether it was undue haste or some other factor, the tape lubricant used in place of the sperm oil in those problem tapes had the unfortunate tendency of seeping out of the tape coating, causing the high friction. In extreme cases, the oxide surface could leave a gummy residue along the entire tape path.

Jim Wheeler, an engineer in the fields of head and tape design with Ampex Corp., points out that in tapes with the lubricant/stiction problem, the actual magnetic recording is still perfectly good. Obviously, the implications of this stiction problem are different for an audiophile who wants to play back his tapes for his listening pleasure than they are for the record company engineer who wants to play back an analog tape master for transfer to digital tape and subsequent CD manufacture. The record company needs just one "good pass" to make a digital copy, whereas the audiophile would like his tapes to be usable for repeated playback. With the availability of R-DAT recorders, the audiophile will also be able to take advantage of the "single-pass" tape transfer to the digital tape.



With a \$150 air-convection oven, you can bake your tapes overnight, and the hot air will redistribute the errant lubricant.

To counteract stiction, Wheeler suggests obtaining a DuPont chemical called Krytox. Krytox is sold through scientific or chemical supply houses, or check with DuPont. Mix a solution of 1% Krytox and 99% Freon TF. Then buy a fabric called Pellon from a dry goods store. (A soft, lint-free cloth will do in a pinch.) Make a pad of the Pellon, and saturate it with the Krytox solution. Tapes with stiction problems can be rejuvenated enough to make a few passes through the program by running the oxide surface of the tape over the Krytox-soaked pad. (Incidentally, Wheeler says that the heads on a videocassette recorder never need cleaning! He says it is the tape guides that cause problems with videocassettes and suggests using an Allsop video-cleaning cassette moistened with the Krytox solution.)

While Krytox is a temporary expedient to obtain playback of a tape afflicted by stiction, a more elaborate, expensive, and time-consuming method exists: Baking the tapes! If you have an extensive collection of tapes with stiction problems, consider purchasing an air-convection oven, which costs about \$150. A candy thermometer is used to set the oven to 130°. The stiction tapes,

quarter- or half-inch, can be stacked on top of each other, six to eight tapes at a time. They are literally baked for a minimum of six hours but preferably overnight. The convection oven's hot circulating air redistributes the errant lubricant. With this method, Wheeler says, a dozen or more playbacks are possible, and the baking process can be done again. He has cycled tapes through the process quite a few times without causing apparent physical or sonic degradation.

Many people worry about accidental erasure of tapes from motors, airport security devices, nearby TV sets, and other magnetic forces. Wheeler points out that a tape held just 16 inches away from a junkyard electromagnet having a lifting capacity of 800 pounds will show just a 5% loss of signal. However, some microphones and headphones have magnetic fields strong enough to cause some second-harmonic distortion when placed on top of a reel of tape.

My understanding is that further research and development of tape lubricants since 1976 has eliminated the problems of stiction in newer tapes. As for those older ones, I'm sure the baked tapes don't have the olfactory appeal of freshly baked bread, but at least their auditory appeal can continue to be enjoyed!

I want to gratefully acknowledge the help of Jim Wheeler in providing some of the information in this column. Wheeler is one of the foremost experts in the archivability of tape (audio and video). His article, "Long-Term Storage of Videotape," which was published in the June 1983 issue of the *SMPTA Journal*, is considered an authoritative reference on the subject and has been reprinted in a number of languages. Some of the information on open-reel tape is excerpted from Wheeler's April 1988 article, "Increasing the Life of Your Audio Tape," in the *Journal of the Audio Engineering Society*. Those who have a large tape library will find this article very worthwhile for the information on print-through, environmental considerations for tape storage in home or studio, and many other helpful hints. I would also like to thank George LaForgia, field engineer for Ampex, who provided practical information on tape restoration procedures. **A**



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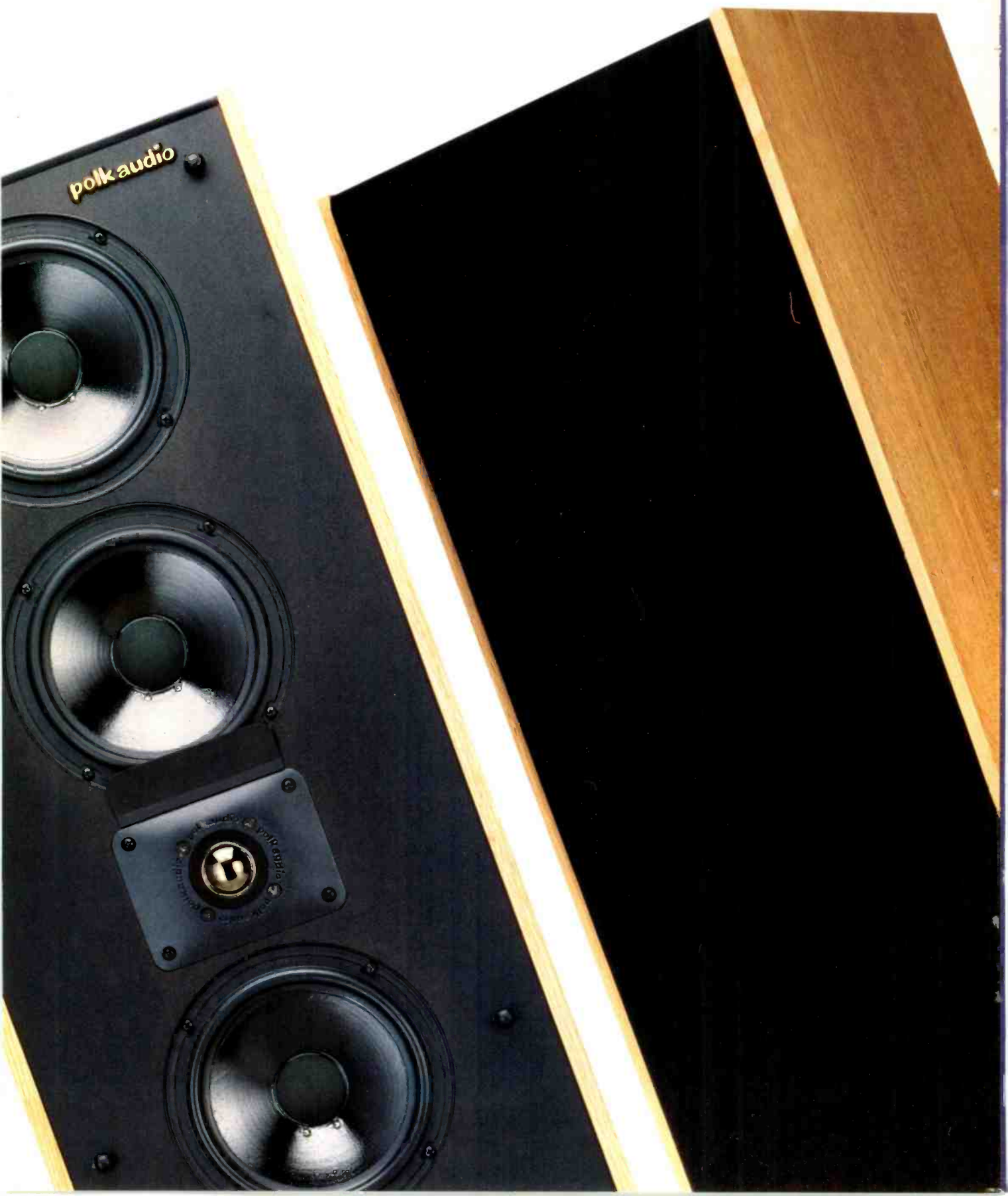
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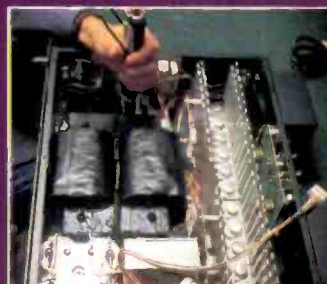
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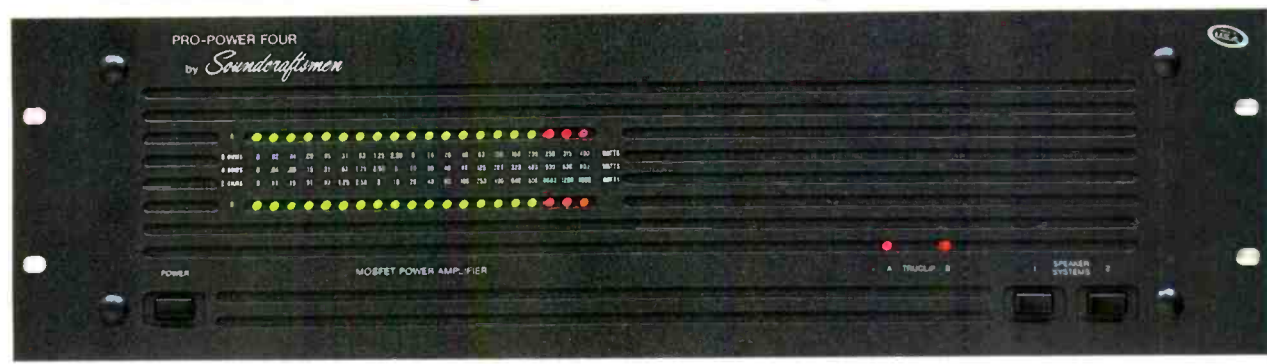
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There has been a great deal of controversy in recent months over whether or not "normal" home taping represents a problem to the record industry. Some home taping of prerecorded tapes, CDs, and LPs almost certainly displaces additional sales of these music sources. In addition, the new DAT recorders make the process a lot more hi-fi than ever before, a development that may, in some cases at least, encourage even more home taping.

Thus, one can make an argument that home taping should be discouraged. Until now, however, discussions of the ways in which we might prevent home taping have centered around technological "copy protection." I'd like to present an alternate proposal. It's not still another anti-copying technology because, as I'll explain, no technological solution, by itself, can completely solve the problem.

My suggestion to the record labels is not to just ignore home taping, mainly

Mel Lambert is a freelance writer, magazine columnist, and technical consultant with over a dozen years of active involvement with professional and consumer audio on both sides of the Atlantic.

because such a tactic would also ignore the fact that some home taping almost certainly does displace some sales of prerecorded tapes, LPs, and CDs. The solution proposed here is one that *only* record companies, rather than hardware manufacturers, can implement. For that reason, it's worth a quick review of the home taping problem from the viewpoint of equipment makers.

Recording equipment manufacturers have an interest in home taping, primarily because they have a strong interest in the protection of "intellectual property" and in a healthy recording industry. Such interest results not only from the record companies' strongly voiced opposition to DAT and other digital audio recording technology; it also has its origins in the fact that a healthy recording industry (read that as healthy sales of LPs, tapes, and CDs) is absolutely vital to continued sales of both consumer playback equipment *and* professional recording equipment.

Thus, manufacturers of DAT recorders and the record companies have a common meeting ground. That common ground has even produced an agreement that will apparently allow U.S. consumer sale of DAT recorders

equipped with the Serial Copy Management System (SCMS). Yet *The Los Angeles Times*, in a July 26, 1989 article, described the development as "an uneasy truce." Why? Because few, if any, of the record companies believe the SCMS technology or any other anti-copying technology, for that matter, will truly solve the home taping problem. They're right.

No technologically based solution to the home taping problem can be entirely successful. SCMS, for example, contains serious loopholes—lots of them. Excellent analog copies can still be made, in any quantity desired. Multiple digital copies can be made by simply using multiple digital tapes or multiple digital machines. No wonder the record companies are still worried.

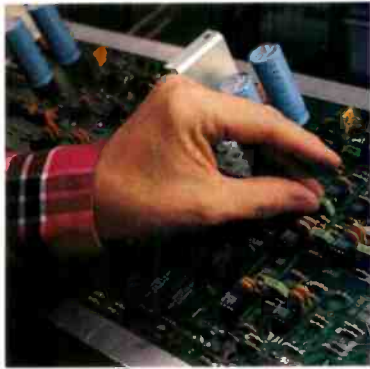
So, what's the solution? Better anti-copying technology? No! And the reason is extremely simple. No anti-copying scheme—no matter how technologically successful—can completely solve the problem!

Consider the highly successful Nintendo video game products. Distributed on circuit boards containing ROM cartridges, Nintendo games have a virtually perfect anti-copying technology. Yet this virtually perfect anti-copying technology does not bring increased sales to the Nintendo company, at least not in the quantity you might expect. Why? Because the children who use these games have an informal, but highly effective, game trading network. When an associate's 11-year-old son finds out about a newly available Nintendo game, he networks around the neighborhood until he finds a friend who has it. Then he offers to loan one of his own games as a trade. As a result, no child owns all of the Nintendo game cartridges that he or she uses. Instead, each child has a few, and he trades when he tires of them.

Nintendo could easily claim that these trading networks are displacing sales of its game cartridges. And, to some extent, the company would be right. But even with a highly effective anti-copying technology, Nintendo still cannot stop children from trading cartridges. What can the company do? The answer is that it must do the same thing that the record companies must do: Learn to promote the value of owning their product.

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No technological solution can completely solve the home taping problem. But it can't be ignored.



At this time, there is little value to a child in owning a Nintendo cartridge. To the player, the value is in playing the game. That is, the value is in the use of the cartridge. The record industry has the same problem. Ownership of an LP, CD, or tape has little intrinsic value; it's the use of the LP, CD, or tape that has value. Technically, of course, no one owns the music they listen to. Ownership rights are retained by the record companies and the artists they represent. However, when I purchase a CD, I do own the disc, if not the music. Therefore, it is ownership of the LP, CD, or tape that must be promoted. Learning how to promote value of ownership won't be easy, but there are lessons to be learned from another industry that has made major strides in promoting the value of ownership of their product.

In the beginning, computer software companies believed technologically based copy protection was their only hope of preventing widespread pirat-

ing of their product. "Illegal copying is ruining our entire industry," they cried. Dozens of different copy protection schemes were tried. In response, dozens of different copy protection *bypass* schemes appeared. Little by little, software companies learned that copy protection didn't really provide the sort of protection they wanted. Finally, most firms turned away from copy protection and leaned toward value-of-ownership promotion as their best hope of discouraging copying.

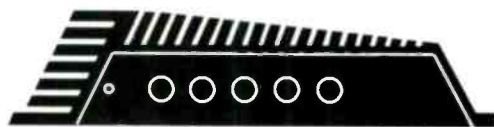
How did software companies implement value-of-ownership promotion? They added value to their products, value that could only be realized by registered owners. That value has come in the form of 800-number help lines (you have to provide your serial

number), well-written instruction manuals, low-cost upgrades, discounts on related software and hardware, and other owner benefits.

The software companies have even discovered that they can increase overall sales by using such value-added features. By providing periodic upgrades, these firms are turning what used to be a one-time sale into what now amounts to a subscription. The owner/user keeps sending money to the software company; in return, the software company keeps providing valuable upgrades. Everybody is happy. Most important, potential users of a software package with this kind of ownership value are much more likely to actually purchase the software package and much less likely to simply ask a friend for a copy.

How can these ideas be implemented in the audio industry? Some already have been. When my associate takes his two children to the mall to purchase a new cassette, they often want to

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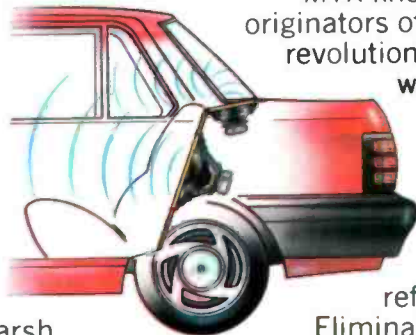


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Serious about sound

Record companies must add value to their products, value that can only be realized by actual owners.

spend their own money to purchase two copies of the same tape! Why? It has nothing to do with the recorded music and everything to do with the value-added features in the cassette box. Those features often include color pictures of the group and a small booklet containing song lyrics.

There are many other possibilities that would promote ownership value. I divide them into four groups: Inserts, subscriptions, related products, and warranties.

Inserts can include the color pictures and lyrics booklets that already come in many prerecorded cassettes.

They could also include ads from companies not directly related to the music business. How about getting Coca-Cola to sponsor the lyrics book in return for an ad? Vision Street Wear could offer to do a free artist poster with their logo. Many artists already have tie-ins with sponsors; an insert could take this association a step further and could also represent extra income for the record company.

Subscriptions are attempts to persuade the purchaser to keep buying more tapes, LPs, or CDs. Subscriptions can come in two basic forms. One is a coupon for a store discount on another purchase of a tape, LP, or CD, in the form of a simple "cents off" offer. "Collect 10 coupons and get a free album" or "cents off on the next album from the same artist" offers are other possibilities. One fun idea would be to include a "rub-off" contest coupon that entitles the winner to an instant prize (probably another tape, LP, or CD).

The second type of subscription would be some type of special offer to join the record company's own record club. There could even be a special club aimed directly at the buyers of particular tapes, LPs, or CDs. Classical music buyers or buyers of classic rock albums, for example, could be offered a special discount on "Best of" series, such as Best of the '60s, a remastered Beatles Collection, or Organ Classics. "We'll send you one now, and another one every six weeks." You know the story.

In any case, the special offer should only be available to the *original* purchaser of the tape, CD, or LP. The idea is to promote the value of ownership of the recording by making an offer available only to its owner.

Related products include anything else available from the record company, its ad agency, or from the artist or the artist's promotion agency. How about coupons for a low-cost poster of the artist or group, or a low-cost fan-club membership? How about a coupon to order a book about the history of the group or a coupon that gets you an itinerary of the group's concert touring plans? Many music buyers would consider such information to be invaluable, and it might even increase concert ticket sales!

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Give a buyer a *reason* to own the cassette, CD, or LP; persuade him to buy more music. It's a win/win concept.

Related products could also include special offers on hardware. Possibilities include tape or CD carrying/storage cases and even "special purchase" electronics, like headphones. Again, these offers must be truly valuable and available only to the owner of the tape, LP, or CD. Otherwise, while

they may bring in some income, the offers do not promote value of ownership and won't help solve the home taping problem.

Warranties on tapes, LPs, or CDs are something the record companies may shy away from. They shouldn't. A cleverly crafted warranty could provide

real ownership value to the buyer without causing major problems for the record company. The warranty would protect the buyer against defects in materials or workmanship, just like the warranty on an electronics product.

"No problem for a CD," you say, "but what about a cassette tape?" The answer is to have a *special* kind of warranty on cassettes: An offer to replace a damaged cassette within 30 (or 60 or 90) days of purchase, provided that the owner sends in proof of purchase, the damaged cassette, and \$3 (or some other nominal amount) for shipping and handling. Then, the warranty would be honored regardless of the cause of the problem. This plan would work for at least two reasons. First, the \$3 fee and proof of purchase requirements will prevent most unqualified warranty returns from coming in, and thereby contain costs. Second, the fee could actually cover a major part of the record company's real cost of a new cassette. But most important, the warranty would provide a *real* ownership value unavailable to anyone who had copied a cassette. Similar warranties could be provided with CDs and LPs and any future formats.

The point of these ideas is to give the buyer a *reason* to own the cassette, CD, or LP and, in the process, to persuade him to buy more music and related products and enjoy them all more. It's a win/win concept. More important to this discussion, these techniques, I believe, represent a far more powerful and effective way to combat home taping than any conceivable anti-copying device or other technological approach.

Value of ownership may even work so well that record companies will find they don't need a technological anti-copying solution. Even if copy protection is still attractive, the combination of copy protection and value of ownership will work much better than copy protection alone.

Will the record companies implement value of ownership concepts? We'll have to watch and see. If they do, they and everyone else will benefit. If they don't, we're probably doomed to continue fighting over the introduction of new consumer digital audio recording equipment. That's not a happy prospect.

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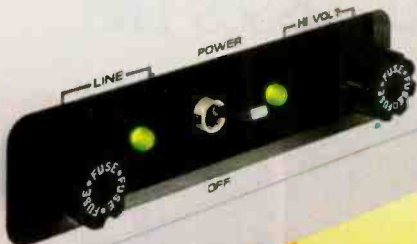
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Quite simply, the Classic 60 and Classic 30 bring world-class audio performance within reach of most music lovers. Audition one today at your nearest Audio Research dealer.

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BY HENRY KLOSS

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Henry Kloss created the dominant speaker models of the '50s (AR), '60s (KLH) and '70s (Advent)—as well as our highly acclaimed Ensemble and Ambiance™ speakers. While packing a stereo system into a suitcase before a vacation, he realized that an amplifier, a CD player and two small speakers take up the same space required for an acoustic suspension woofer to reproduce really deep bass. That was the inspiration for BassCase. Model Eleven's bass speaker enclosure which doubles as the entire system's carrying case.

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BY HENRY KLOSS

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David Clark—Audio Magazine

Ensemble

BY HENRY KLOSS

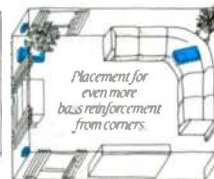
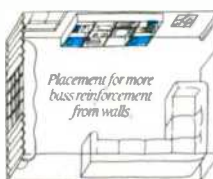
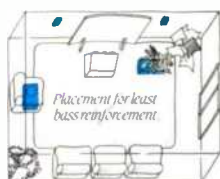
Ensemble is a speaker system that can provide the sound once reserved for the best speakers under laboratory conditions. It virtually disappears in your room. And because we market it directly, it costs hundreds less than it would in stores.

Ensemble consists of four speaker units. Two compact low-frequency speakers reproduce the deep bass, while two small satellite units reproduce the rest of the music, making it possible to reproduce just the right amount of energy in each part of the musical range without turning your listening room into a stereo showroom.

Your listening room works *with* Ensemble, not against it.

No matter how well a speaker performs, at home the listening room takes over. If you put a conventional speaker where the room can help the low bass, it may hinder the upper ranges, or vice-versa. Ensemble, on the other hand, *takes advantage* of your room's acoustics. The ear can't tell where bass comes from, which is why Ensemble's bass units can be tucked out of the way—on the floor, atop bookshelves, or under furni-

ture. The satellites can be hung directly on the wall, or placed on windowsills or shelves. No bulky speaker boxes dominate your living space, yet Ensemble reproduces the deep bass that *no* mini speakers can.



You can put Ensemble's low-frequency units exactly where they should go for superb bass. You can't do this with conventional speakers because you have to be concerned about the upper frequencies coming from the same enclosures as the low ones.

Not all the differences are as obvious as our *two* subwoofers.

Unlike seemingly similar systems, Ensemble uses premium quality components for maximum power handling, individual crossovers that allow several wiring options and cabinets ruggedly constructed for proper acoustic performance. We even gold-plate all the connectors to prevent corrosion.

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*9AM to midnight (ET), seven days a week. In Canada, call 1-800-525-4434. Fax: 617-332-9229. Outside the U.S. or Canada, 617-332-5936.

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**CD player not included in Model Eleven system.

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The phone rings. It's Uncle Marvin, calling from California. He's finally managing to get his youngest daughter—you know, the one who sees through the bottoms of Coke bottles and wore braces on her teeth until she was 30—married off. The wedding is a month off and, because I'm the family audiophile, he's calling to find out if I'll record the ceremony. "Oh, by the way," he adds, "we want to do something a little different, to provide the guests with a memento they won't forget. Money is no object. Any ideas?"

Well, yes. Since I'm going to use my DAT portable to make the recording, why not, I suggest, present the members of the immediate family with a copy of the recording—on Compact Disc, in a box with a color photo of the wedding ceremony?

"Can you do that?" he virtually shrieks. "I know I said money is no object, but can I afford that?"

I assured him that not only can it be done, but that the cost is not outrageous. In fact, for less than \$35 apiece, Uncle Marvin can present each of 50 guests not only with a CD recording of the wedding ceremony in a jewel box with a color photo cover, but a personalized label including the names of the principals and the date—and deliver it to each guest within 30 days of the event.

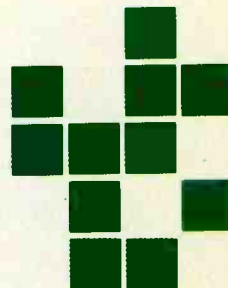
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ROBERT ANGUS

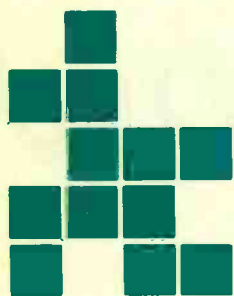
One company that offers this incredible service is tucked away in a nondescript office building in downtown Tokyo. The company, Sony Taiyo Advanced Research Technology (START Lab), is a joint venture between Sony and Taiyo Yuden (manufacturer of That's tape), set up to produce custom Compact Discs on a very limited basis and eventually to market blank discs and recording equipment. In the United States, Gotham Audio offers anyone with \$50,000 to spare his own CDR 90 optical recording system. But before you write the check, you should know that discs for the Gotham system cost about \$65 each, and there is a shortage. For a custom recording, Gotham recommends a charge of \$350 for the first copy and \$300 for each extra copy made at the same time. By contrast, START expects its hardware to cost \$3 to \$4 million initially, with blank discs priced around \$10 apiece in Japan. Neither company is predicting how long these disc prices will hold. Both systems start with a Sony PCM-1630 CD mastering processor and DMR-4000 U-Matic digital mastering recorder (included in START's price but not in Gotham's).

The Gotham system uses an encoder which was developed by Yamaha to convert the PCM-1630's PCM digital signal to EFM

Two companies already offer write-once CD recorders, but their prices are still strictly professional.



A START disc and writer:
The computer in the background is
a digital editing system sold
by Sonic Solutions, which now
sells the START Lab recorders
in the U.S.



Transferring
a 35-minute DAT to CD
takes about two hours;
transfers from analog
sources take longer.



(eight-to-fourteen modulation). A CD time encoder inserts data into the Q-channel area. All signals feed to an optical drive with special tracking servos and a high-power recording laser. Gotham's PQ Junior subcode editor/generator was developed by Dr. Benjamin Bernfeld of Harmonia Mundi Acustica and Bennett Smith, a computer scientist. Through a keyboard, the user enters such data about the master tape as SMPTE timings, song titles, catalog numbers, engineer's name, and comments on sonic quality and the like. The PQ Junior automatically formats the data, records the cue track to the PCM machine, and prints detailed master

sheets. Data thus recorded on the tape can be read and processed by any existing editor. Completing the system is the LS-101 optical recording unit, a front-loader whose optical head achieves a scanning speed of 1.3 m/s, for high-density digital recording on Fuji Film's YPD-101 write-once optical discs. The recording laser's lifetime is specified as approximately 6,000 hours of actual recording time. The recorder employs an extremely reliable, high-precision spindle motor, says Gotham, for fast access time and accurate rotational velocity. The drive signal from the encoding unit is precisely cued by the synchronizer to achieve a real-time recording capability of approximately 60 minutes. The gallium-arsenide laser diodes operate over wavelengths of 765 to 795 nm, with an output power of approximately 0.5 watt.

The START package also includes a PCM-to-EFM encoder and a CD code processor, as well as a personal computer (with monitor) which controls the entire system. Linked to it are 12 "writers" (soon to be expanded to 30), which are actually CD recorders, each about the size of a big-city phone book and lacking any controls. All the equipment is Sony-made.

There is some confusion about whether the lower priced START discs, made by Taiyo Yuden, will work on Gotham's more reasonably priced recorder. Both discs meet the Philips Red Book CD Standards, which means that both will play on any existing CD player. When asked, Gotham president Russ Hamm and START president Dr. Heitaro Nakajima claimed no knowledge of each other's process, although each system looks remarkably like the other in practice (and, as I later learned, Gotham's discs are made by Fuji under license from Taiyo Yuden).

During a recent visit to Tokyo, I was invited to visit START. About a month before the visit, however, Taiyo Yuden general manager

Photograph: Courtesy of Sonic Solutions



Alex Iida asked me to supply a DAT demo cassette, insisting that it be copyright-clear. By the time I got to Tokyo, START had transferred it to a U-matic master, complete with digital indexing and coding.

I got off the elevator and stepped into an office which could just as easily have been that of an insurance company branch. Perhaps two dozen people were busily working at their desks. Near this large office, like that of a branch manager, was the office of Dr. Nakajima, president of START and former president of Aiwa. I must have seemed surprised, having expected to find a noisy (and dirty) world of hydraulic presses like those in an LP factory or, alternately, the ghostly quiet of clean rooms peopled by technicians in white worksuits. No doubt I would discover one or the other, perhaps both, on another floor of the building.

Instead, after a few preliminaries, Dr. Nakajima led me through the outer office to what obviously had been a storeroom. There on a tabletop was the complete system. As I watched, Masahiro Hotori, the general manager of START's technical division who was dressed in a dark business suit, inserted a 3/4-inch copy of my digital tape into the PCM-1630 and a gold disc into one of the gray writer boxes. He tapped out a program on the PC keyboard and suggested we retire to Dr. Nakajima's office to continue our chat.

Hotori explained that every START CD begins with a U-Matic master, complete with index coding and timing for each track, just like a commercial CD. If the recording comes in some other form, as mine did, START sends it out to a commercial recording studio for transfer to the U-Matic format. Open-reel, DAT, Compact Cassette, LP, or even 78-rpm originals all are acceptable—provided the customer meets START's rigid requirement of certification that there are no copyright restrictions on the material to be copied. The



A Gotham CDR 90 system, installed at Sterling Sound in New York City.

Photograph: Dave King

client pays for the studio time involved in making the U-Matic master, which in Tokyo amounts to about \$180 per hour. I asked how long it took to transfer my 35-minute DAT demo. "Two hours worth of studio time," Hotori replied. "If it had been in some other [analog] format, it would have taken longer." He said that when Uncle Marvin sends in his wedding tape, he'll have to allow one week for the studio work, "unless we get it in U-Matic form to begin with, in which case all we have to do is add the PQ encoding."

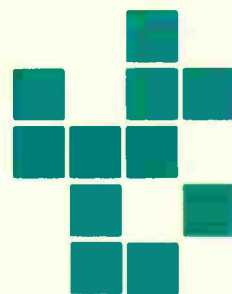
Both the START and Gotham CDs have a maximum playing time of 60 minutes (roughly the playing time of two U-Matic cassettes).

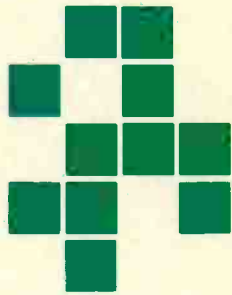
The "writers"
(actually CD recorders)
have no controls
and are each about
the size of a big-city
telephone book.

This desktop CD "factory" in START Lab's Tokyo office includes a Sony DMR-4000 U-Matic digital audio mastering recorder, PCM-1630 PCM encoder, PQ subcode generator, and CD code processor (all in rack at left), a personal computer whose display shows system status, and 12 writers (right). Closed drawers on some writers indicate that they are in use.



Photograph: Robert Angus





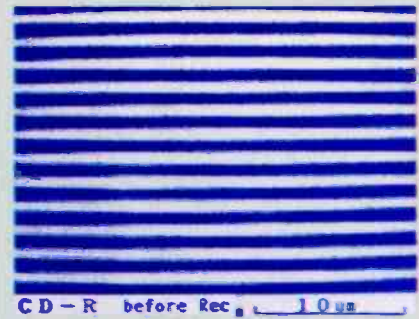
The first home
CD recorders will likely
cost about \$1,500 each,
and blank discs will
cost enough to make CDs
cheaper to buy
than to copy.

Gotham's Hamm says that longer playing times are possible with his disc—68 minutes, soon—and Hotori says that additional time is possible on a START disc, but at an increase in cost. Once it has the U-Matic master, START boasts that it can return the finished product to the client within a week, much faster than a CD pressing plant can promise. For a single disc, such as my demo, the charge would be \$215. If I had purchased 10 copies, the price would have been \$32.15 for each unit. START can provide a label printed directly on the disc, by silk-screening, at a charge of \$72.55 for the first copy and 70¢ for each additional copy. My disc came with the standard START label.

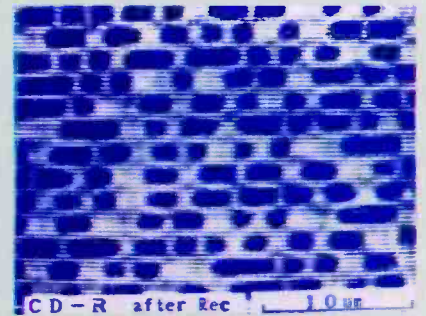
At the end of 35 minutes, my CD had been duplicated, but Hotori wasn't about to hand it over. "We play each disc through in real time to check for flaws or defects," he explained. While I waited, we talked about the copyright and standardization questions recordable CDs have stirred up. Will the Serial Copy Management System proposed to limit digital copies of DAT recordings work equally well with CD-R? "Yes." What signal would START need to begin consumer marketing of its recorders? "Legislation in Europe and North America which would mandate the use of SCMS or something like it. Six months later," Hotori said, "we could be on the market with a consumer product."

Hotori predicts a price of \$1,500 for the first consumer recorder/player. And if the marketplace and the keepers of the Compact Disc specifications will agree to home-made discs which lack indexing and timing, it should be possible for the home recordist to make CDs directly off the air or from his own discs or tapes. What then would prevent amateur copying of friends' discs? "The cost of blanks," Dr. Nakajima said. "The trend in commercial CD pricing has been downward, and I would expect that to continue. It will always be more expensive to make a copy than to go out into the marketplace and buy the original, and the packaging won't be as nice."

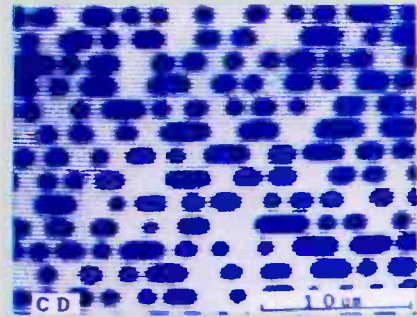
As soon as my CD had been inspected by the system's PC and found satisfactory, Hotori presented it to me, a golden wafer with a shimmering coppery green underbelly. "We use gold for the reflective layer because we find it produces better results, and because we believe it will last longer than aluminum," Hotori explained. "Gold is not subject to oxidation, as aluminum is." Just under the gold layer is a very thin layer of green dye. Under this is a layer of clear polycarbonate with a fine spiral groove pressed into it to guide the recording laser optically along a track with a pitch of 1.6 micrometers, to match the standard for commercially recorded CDs. A beam from a solid-state recording laser with 6 to 9 mW of power passes through the polycarbonate but is absorbed by the dye,



A

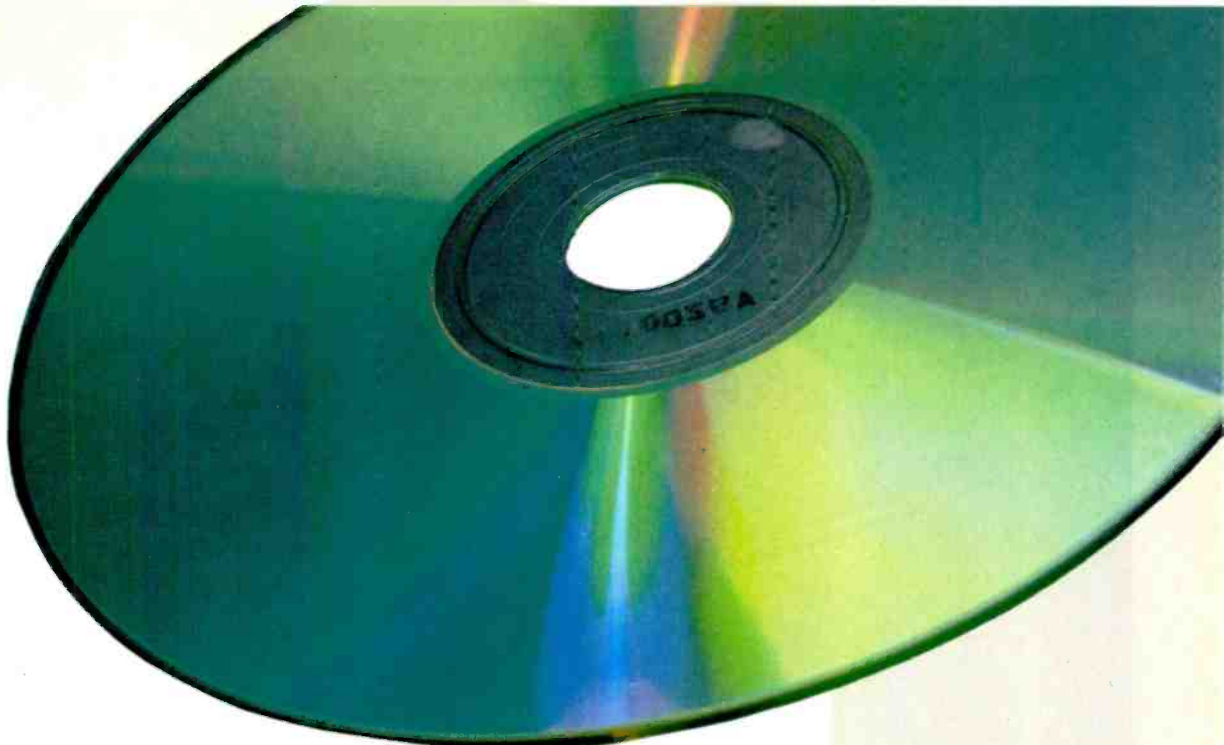


B



C

Seen through the microscope, an unrecorded START disc (A) shows only the laser-guiding grooves. A recorded disc (B) still shows faint traces of these grooves, together with data pits that are virtually indistinguishable from those of a conventional CD (C).



heating it to more than 480° F. The heat decomposes the dye and reshapes the polycarbonate resin, causing it to expand and mix with the melted dye, forming a tiny pit similar in its decreased reflectivity to those molded into a commercially pressed CD. When the disc is played back on a conventional CD player, the player's low-powered laser reads the pits as if they were those on a conventional disc.


As I settled back into my seat for the long flight home, I donned a pair of stereo headphones, plugged them into my portable CD player, and inserted the START disc. What I heard was an extremely accurate re-creation of the original, with better bass response than I remembered—and, of course, with selection timing and indexing, which didn't exist on the original. I was impressed.

How long will the discs last? Nobody knows for sure, of course, but Gotham says its unrecorded discs have a shelf life of at least one year, and its recordings are good for at least five years of archival use—10 years on newer discs. Tests by START indicate that its discs can be played more than 20,000 times without degradation under normal handling conditions. However, warns Hotori, it's always a good idea to store discs away from heat and sunlight, lest they affect the dye.

Dr. Nakajima and Russ Hamm aren't counting on Uncle Marvin to keep them in business. Hamm sees the primary market for his system among recording studios, who use it to provide clients like Barbra Streisand and Billy Joel with instant CD versions of their sessions. "The CD reference disc will quickly replace the LP for producers and artists," he said recently. "With CD now the dominant quality format, R-DAT simply isn't acceptable as a reference; it's a different medium. You can send a CD ref to an artist anywhere in

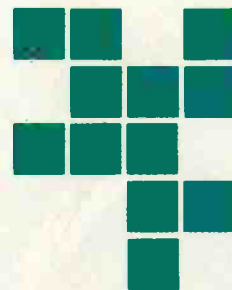
the world and say, 'check this out on your player.'"

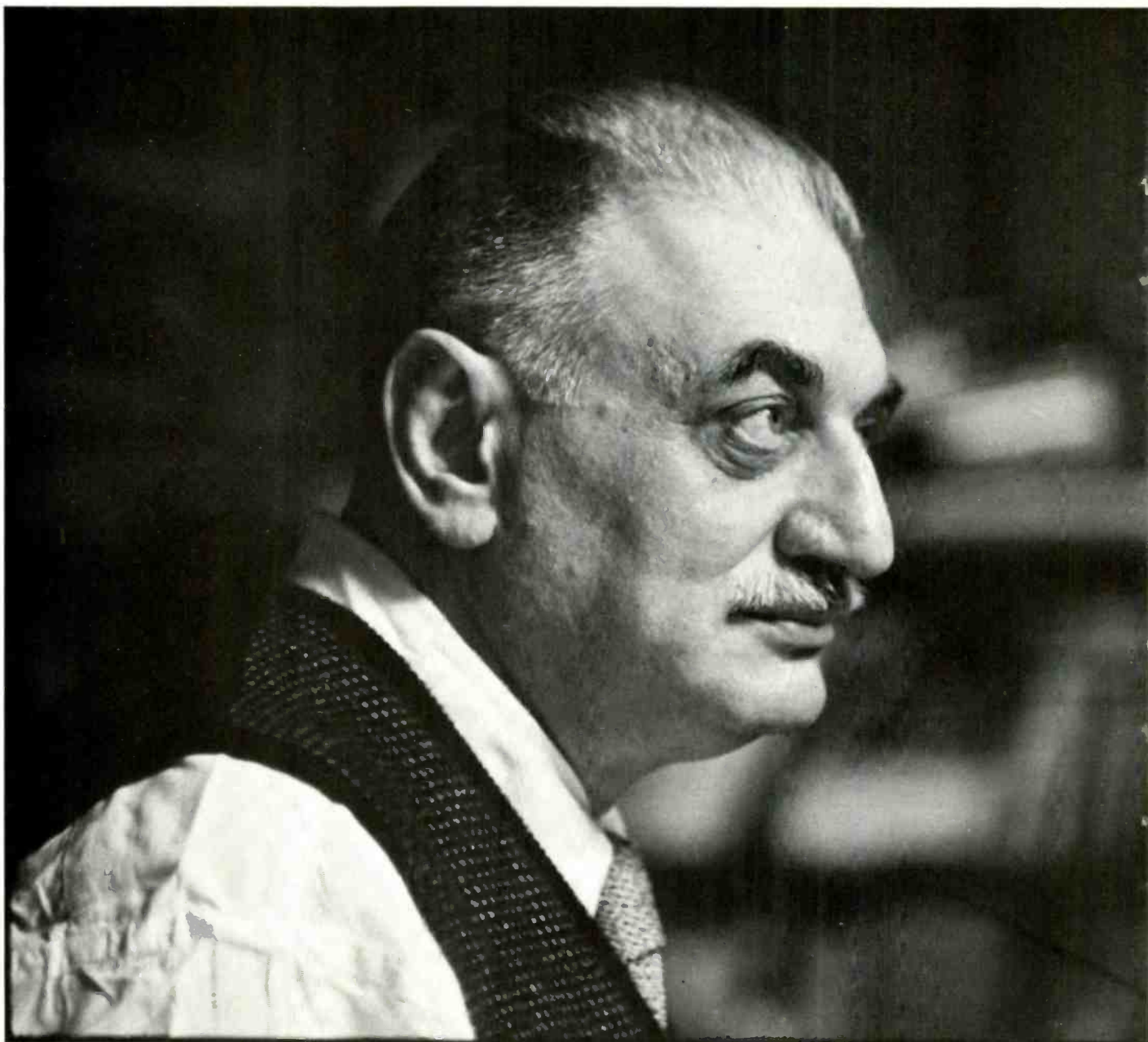
The purposes of the START partnership include working technical bugs out of the system and the discs, ascertaining what controls and features users need, and determining costs and marketing strategies for the START system. According to Hotori, initial uses have included prerelease promotion for new record albums, music demos for performers, private CD publishing, voice tracks for computer-aided instruction, sound effects and music for movie post-production work, an alternative to signal generators in audio manufacturing, replacing endless-loop tapes in public-address systems, sound and beep-tone tracks for slide-projector synchronization, a prototype in-flight audio system, radio jingles and commercials, background music, psychoacoustic studies, and limited-run CD-ROM discs.

Both START and Gotham say their systems can replicate not only CD-ROM but CD + Graphics and CD-I (interactive) discs—everything, in fact, but CDV, and that may be only a matter of time. "Whatever can be put on the master tape will appear on the disc," Nakajima says. 

Editor's Update: Just as this article went to press, START Lab named Sonic Solutions, of San Francisco, as its exclusive U.S. distributor. Sonic Solutions, best known for their NoNoise digital restoration system (*Audio*, March 1989), will market the START system together with their digital editing system. The price of the total system, including the digital editor, will be about \$48,000; the START encoder and one recorder can be purchased for \$25,000, and additional recorders for \$15,000 each. Blank discs will be priced at \$40 each in this country.—I.B.


Gotham says recordings made on its system will last five to ten years; START Lab claims 20,000 plays without degradation.





Willie Dixon, Big Joe Williams,
Memphis Slim, and
Charles Edward Smith, 1961

Photographs: ©David Gahr



MOSES of ASCH FOLKWAYS

THE AUDIO INTERVIEW

lowed out instructions for orders and shipments, and he pored over tapes and manuscripts, seeking another unique evocation worthy of addition to the Folkways mosaic.

Even if viewed only from a narrow business perspective, Asch's achievement is astounding. For four decades, he persevered despite erratic distribution and cash flow. Over that time, Folkways issued as many as 40 titles a year, encompassing a mind-boggling range of musical, literary, political, religious, instructional, and experimental recordings. Though best known for folk recordings by Woody Guthrie and Pete Seeger, Folkways boasts of ethnic, country and bluegrass, blues, spoken word, classical, children's, and sea chantey recordings, as well as an extensive repertoire of electronic digital computer compositions. There are more than 2,000 titles in the Folkways catalog and, though you won't find them all in your neighborhood record

store, one of Asch's proudest legacies is that no Folkways release has ever been taken out of print. When asked about this policy, he would reply, in his East European accent, "Do we remove the letter J from the alphabet because we don't use it very much?"

The son of renowned Yiddish writer Sholem Asch, Moe Asch was born in Warsaw, Poland on December 2, 1905, and came to America in the last major wave of Jewish immigration in 1915. After studying electronics in Germany, he embarked on a career as a sound engineer in New York. In 1939, when cutbacks at Columbia and RCA left radio stations without ethnic records for immigrant audiences, Asch entered the recording business. He opened and closed two other labels before founding Folkways in 1947.

To Asch, sales were necessary but irrelevant. This utter disregard of the demands of the marketplace mystified many industry peers, but he made rec-

What do The Carter Family, Bertolt Brecht, P. G. Wodehouse, Duke Ellington, Huey Newton, John Cage, Leadbelly, Richard Nixon, Bob Dylan, and Gertrude Stein have in common? They are all featured on Folkways recordings.

Folkways Records, a safehouse for the preservation of global culture in sound, represents the life work of Moses Asch. Until he died in October 1986, Asch could be found six days a week, 52 weeks a year, amid the clutter of art and artifacts that filled the Folkways offices. There he conspired with musicians and scholars; he bel-

G A R Y K E N T O N

Folkways

Just one institution could encompass the mass of Moe Asch's archives and the full scope of his vision—the Smithsonian.



Mary Lou Williams, 1944

Photograph: Frank Driggs Collection

ords for posterity, not prosperity. While labels came and went with the tides of fashion, Folkways ambled on. When Asch died, only one institution could encompass the sheer mass of his archives and the full scope of his vision—the Smithsonian.

Asch had a strictly utilitarian view of recording as a means of documentation, which explains why a steady stream of sociologists, anthropologists, and musicologists beat a path to his door. He saw himself as a conduit, not an interpreter, and he accepted the rough edges and mistakes of field recordings as the price of authenticity. Moreover, he viewed the artist as a transmitter of cultural information rather than as an individual working in a creative vacuum. He viewed such techniques as multiple takes and overdubs as indulgences that threaten honesty and spontaneity. He incorporated cassettes into his catalog grudgingly; he would not have liked CDs.

The following interview was culled from various discussions I had with Moe Asch from 1979 to 1984. I have also included some material from interviews conducted in 1971 by sound designer and media consultant Tony Schwartz, who worked with Moe Asch, beginning in the 1950s, and made a number of records under Asch's expert direction. G.K.

Before you started making records, you had an impressive career as a sound engineer. How did you become interested in electronics?

Before America got into World War I, I had been involved with a neighbor who built radios. I think his name was Osborne. Radio had no tubes in those days; it worked by sparks. We were among the first ham radio operators in Brooklyn. I began corresponding with operators all over the world. This was my first exposure to radio and the possibilities of communication without boundaries.

And when did you get formal training?
After the war, my brother and I joined my father in Germany. This was around 1922. Because of the German economy, I could live very well on the dollar a day that my father gave me. I went to the Technical School in Koblenz. I lived in the occupied territory. First the Americans had troops there, but then

the French sent in Senegalese troops, serving under white officers, to patrol the area. These guys were very rough and resentful about having to serve in the French army.

The school was built on the site used by the Germans during the war for their radio broadcasts and reception from all over the world. The guy who was the head of this project was a professor at the school. He was doing the first experimentation on high frequency, with short wires and reflectors. A few of us students would communicate from dormitory to dormitory using Morse code on the wireless. It happened that the French had a radio station and we were interfering with their signal. They had a dragnet and used directional finders, and they eventually found our transmitter. There was hell to pay. We weren't breaking any laws. We had a right to be there, but they said it was anti-military.

Wasn't it while you were in Germany that you first became interested in American culture?

I was interested before that. My father used to send me literature from all the cities he visited throughout the U.S. on his lecture tours. In every town, they had sheets listing past events of the place, how these frontier towns began and grew. Always included was a folk song. So I knew there were songs from every area of the U.S. that had been documented. But when I was in Germany, I was always hearing from the other students—I was the only American—that America had no culture of its own. Then on a trip to Paris, I found a copy of the book *Cowboy Ballads* by John Lomax, with an introduction by Teddy Roosevelt, where he said that this was the true American culture.

When did you return to the U.S.?

About 1926. Germany was no longer a place for Jews. The Hitler Youth were already in evidence. I later came to own several tapes of songs by the Nazi SS troops, but I won't issue them. I won't issue propaganda or anything that is used against people.

When I came back, I was experimenting with multi-aerial receivers for apartment houses, where they didn't have an aerial for every radio set. I created a gadget that allowed you to detach the master antenna without untuning everyone's radios. I got introduced to Gen. Sarnoff, who headed RCA. He was from the same village in Poland as my father, though he didn't like to admit it. Sarnoff told me not to go into engineering, that a Jew could only be successful in sales. He referred me to the chief engineer for RCA in Princeton, New Jersey, and I got my

first job cataloging Radiolas for RCA. Radiola was the first mass-produced radio set that came with instructions. You were assured that each one would act the same as another. Up to that time, each radio was unique and there were no standards. My job was to catalog and itemize every part of the Radiola, to create the nomenclature.

At the time, there was tremendous competition between RCA and Zenith over control of the airwaves. RCA had been created during World War I from Telefunken's German patents through the Army. Zenith was created by the Navy from Marine patents. To be sure that no one could figure out the circuit arrangement, Zenith put in beeswax so that when you opened it, there would be no way to work on it without tearing out all the wires. It was such a secret that I was followed home every night by an agent. I lasted there maybe six or seven months. Then they told me I was getting to know too much.

Where did you go from there?

First I commuted from Brooklyn to Jersey City to work with Lee DeForest. He was the one who showed how you could produce signals from tubes loud enough to drive a loudspeaker. He and Edwin Armstrong, who was a friend of mine, applied for patents for the feedback circuit process around the same time, but the courts gave it to DeForest. Armstrong later invented FM radio. DeForest also set the scene for the use of sound in motion pictures. I worked

with him for a short period on transformers. Then I became the eastern repair representative for Stromberg-Carlson, which was the Rolls-Royce of radio. I was in business for myself.

Is that when you started Radio Laboratories? What year was this?

It was around 1935. Stromberg-Carlson gave me an entree to all the record shops. At that time, when you walked into a record store all you saw was RCA, Decca, and Columbia. This is how the record business was set up. You had to buy a certain amount of records to be a franchise dealer. After World War II, that was broken because it was anti-trust.

What were some of the various projects you got involved with at Radio Laboratories?

Well, under the auspices of the International Ladies Garment Workers Union, I built the loudspeakers for Franklin Delano Roosevelt's second inaugural speech at Madison Square Garden in 1937. I built range finders for some bootleggers who were still in business after Prohibition. They were wonderful people. And because the burlesque houses needed hidden microphones for their stage shows, and were non-union, I got a lot of jobs. I became part of the burlesque establishment.

Didn't you do a job for Les Paul?

He was an electronics genius. We built an amplifier for the electric guitar he designed, and we made a special microphone for him. He was the first one

to "double up," to do multiple track commercial recordings. I have some of the discs of his experiments in working with six generations of guitar. His equipment was so good that you couldn't tell the difference between each generation.

How did you start making records?

Radio Laboratories had built equipment for several radio stations, including WEVD [a New York station named after socialist leader Eugene V. Debs]. In 1939, the international series of RCA and Columbia were dropped. Radio stations like WEVD needed recordings of foreign and ethnic material. Specifically, WEVD needed Jewish records. I created the Asch label to supply them. My first commercial issue was "Jewish Folk Songs" by The Bagelman Sisters. Then I made a record of the Kol Nidre, the holy song of the Jewish people, with Cantor Waldman, who was a regular on WEVD. RCA had the best-selling recording of Cantor Rosenblatt singing the Kol Nidre, but they took it off the market just when I issued mine. This was in the summer and the Jewish High Holidays are in September. So I took my record to Philadelphia, Boston, and New York to the big shops, and they ordered it because they needed it for the holidays. That got me a foot in the door.

So you started making records to fill an immediate need. When did you begin to feel that this was going to be your life's work?

Right: Pee Wee Russell and Moses Asch, 1945.

Below: Moses Asch and Fred Ramsey, Jr., mid-'50s.



Photograph: Frank Driggs Collection



Photograph: ©David Gahr

Folkways

One of Asch's proudest legacies is that none of Folkways Records' releases has ever been taken out of print.



James P. Johnson, 1940

Photograph: Frank Driggs Collection

Right away I started to think, "In what manner should Asch Records go in terms of recording?" I was also encouraged by my father and many other people, including Albert Einstein, who was a friend of my father's. I visited Einstein in his home in Princeton—I have recordings—and he told me this was the right direction.

When did you branch out beyond ethnic recordings?

In 1941, when Si Rady introduced me to Leadbelly. Si was the producer of *Pins and Needles* [the off-Broadway show sponsored by the ILGWU], which we did the sound system for and which ran for several years. John Lomax had discovered Leadbelly and made the Library of Congress recordings, but everything centered around Leadbelly being an ex-convict. He had photographs of Leadbelly in prison clothes. After his contract ran out, Lomax dumped him. When Leadbelly came to me, we decided not to do murder ballads; instead, we recorded children's songs. I got more publicity on that than anything I've ever done.

Could you describe your theory of recording?

What I'm interested in is what intellectual knowledge do we get from a record, rather than is this super high fidelity or does it reach 10,000 cycles. I felt that since we have one brain and one means of translating what we hear, the best method of reproduction was with one mike. I used the RCA ribbon mike, set in such a way that there was balance between the instruments and the voice. That's still the cleanest sound there is.

At first, we recorded directly on wax. It was a direct-from-microphone-to-wax process. The original plate, or mother, was made of gold, not dirty copper as it is today. They can't use pure copper, so it's mixed with alloys and there are always clicks and abrasions. Then we went to acetate. The metal parts were made from the original acetates, and then the records were pressed. Then after the war, there was tape.

My philosophy was to make a "flat" record. This means that the frequency used was as flat as possible to the sound that it produced. My practice has always been to record things as

they are, with the simplest means of reproduction. All my records were recorded on a flat surface with a needle cutting at a constant speed. The record industry went to four-track recording, and then eight-track. This means that if there are four musicians, each one has a microphone and a separate track to record on. When it is all over, the producer reconstructs what happened in the studio to fit somebody's idea of what it should be, but that is not what actually happened.

But you have issued numerous multi-track recordings.

Some of the tapes I get from individuals are multi-tracked. That phase of it that is not part of the documentation of culture, I issue because of the content. These people still have something worthwhile to say.

Were you affected by the shellac shortage during World War II?

I had been supplying ethnic records for a couple of years—Ukrainian, Italian, Greek, and so on. This went on until World War II when Japan overran Singapore, where most of the shellac came from. They made this rule that the only record companies that could get shellac were ones that were in business before 1939. The government gave you a percentage of what you used the year before. I wasn't in business in 1939, so I got nothing. Then I met Herbert Harris, who was selling Russian records on the Stinson label. In 1939, Russia was cut off from the world, so Stinson had an allocation of shellac but no material. I had material of national interest but no shellac. So I made a deal with Stinson during the war to use their shellac, and they sold my records.

When did Asch Records evolve into Disc Records?

As the war was ending. Because shellac was not available, the pressing plants were grinding up old records to stretch the supply. They even put sand and concrete in with the shellac. I had no control over the quality of our pressings, and we got a reputation as a noisy label. To get away from this stigma, I went in with Norman Granz and we created Disc. He was a jazz impresario who worked with Billie Holiday, Count Basie, and many others. In 1945, he started the "Jazz at the Philharmonic" series. Some we recorded for Disc.

We also got help from Charles Edward Smith. He wrote the first book about jazz published in this country, *The Symposium*, and was working on an essay on Leadbelly when he died [1970]. In 1942 was the American Federation of Musicians strike. They

thought that the popularity of records was a threat to the live performance, and they demanded royalties. Charles Smith came to me and told me which artists were excluded from the union and were available. We recorded Mary Lou Williams, James P. Johnson, Coleman Hawkins, Vic Dickenson, and all the jazz greats.

Can you describe a typical session?

My studio was at 117 West 46th Street in New York City. The entire office was 10 feet x 18 feet. The studio was only 10 feet x 10 feet and the desks and the electric cutting machine were outside of that, and there was a window that looked into the studio. The studio was lined with cork, and there was a piano. There was a cork floor with linoleum on top. It was in the back of the building, so no street noises came in.

The recording machine was a fly-wheel that weighed a ton and kept perfect synchronization. The cutting head was made by [Fred] Van Eps, who in addition to being a mechanical engineer was a world-class banjo player. He was to the banjo what Les Paul was to the guitar. We used the RCA ribbon mike, which was fitted. You have a distance between the ribbon and the magnets—when you speak, the ribbon vibrates and the magnets pick up the vibrations and electronically transfer them. We had very close tolerances and got a very good sound from this method.

In 1944, Mary Lou Williams would come in with Coleman Hawkins, Vic Dickenson, Frankie Newton, and others, and I would let her do what she wanted. We had 10 people with one mike, and the sound was perfect. No headphones. Each of these musicians knew what it was about and didn't try to override the other guys. Today they blow wild and expect the mike to adjust. That's why you have to have 48 channels for 48 musicians; each one has headphones and a microphone, and the engineer is supposed to be the musician. We didn't have that. First of all, Mary Lou Williams is a great musician, and she told each one what they should do. That's why all those records got such good reviews and we got known for jazz.

I believe you had begun to record with Woody Guthrie and Pete Seeger by this time. Was this very different?

Woody would just show up unannounced and say, "I'm ready," and I would go right to the equipment and start recording with no rehearsal. He might go over the thing once or twice. Once I knew the characteristics of the artist, I didn't have to worry about setting up each time. I knew exactly where the mikes should be. We were all interested in the content, not in the engineering. Woody wouldn't be directed. He was an individual. He would sit on the floor and you couldn't move him. Leadbelly would walk out of the

place—and so would Pete—unless they felt at home.

When did Disc give way to Folkways?

What happened was that Disc Records became too costly to operate. Norman Granz wanted me to pay Nat King Cole \$10,000 for a recording, and we were a small company and only able to sell 1,000 albums. I couldn't pay all my creditors; Disc went under, owing about \$300,000. Jack Kapp of Decca Records heard about my problems. He told me that Asch and Disc made an important contribution to the recording industry and he didn't feel competitive because he knew we filled a need that Decca, RCA, and Columbia could not fill. He gave me \$100 a week. The gal who ran the office, Marion Distler, got \$25 a week. I got \$25 a week, and the rest was used for overhead. George Mendelsohn of Vox Records also helped me. I got a loan of \$3,000 to buy back my recording equipment from the authorities. Today, everyone files Chapter 11, but that didn't exist then. If you owed your creditors, they took you to court and took everything away from you. In four months, I got back on my feet because dealers needed what I had. That was how Folkways started.

Who were some of the artists you were working with at this point?

I came into contact with Leadbelly, Pete Seeger, and Woody Guthrie when it was still Asch Records, but it wasn't

Right: Cisco Houston, 1960.

Below: Woody Guthrie and family, 1960.



Photographs: ©David Gahr

Folkways

Asch viewed overdubbing and multiple takes as indulgences threatening honesty and spontaneity.



Elizabeth Cotton, 1964

Photograph: ©David Gahr

until Disc that I really diversified. I kept that going with Folkways. Cisco Houston was very important to Folkways. He made records by himself and with Woody. And there was Sonny Terry and Brownie McGhee, although I was not the first to record them. They were recorded in the '30s by Columbia.

The material wasn't the only thing that set Folkways apart. The whole look of the enterprise was different. Was this a conscious decision on your part?

I felt I had an obligation, not just to the recording but to the creation of a package that represented the contents. It had to have a look of intellectualism. If it was a blues, I had to show that this black country musician had value. Thank goodness I had help from artists like David Stone Martin and Ben Shahn. We created the first picture cover on a 78 record. Until then, the covers had only lettering. From the beginning, each record had lyrics and descriptive notes—they were talking books.

Didn't Columbia introduce the long-playing record shortly after Folkways started? Can you describe your involvement in the transition from 78 to 33 rpm records?

The 78s were a hindrance for me because they only lasted 2½ minutes. The 12-inch 78s lasted 3¾ minutes. Most ballads could not be recorded in that amount of time. Before the folk artists got started, the record was finished. They had to edit and think about time and everything else. We were very happy with the long-playing record. We could do longer narratives. The only problem was what to do with our inventory of 78s. I was very lucky that Sam Goody agreed to buy 100 each of all my 78s. It was Goody's financing and the fact that he backed the LP against the 45 that made it possible for me to issue LPs. The only label doing LPs at that time was Columbia.

Wasn't Decca releasing LPs?

No. Decca held out to the very last. Jack Kapp almost committed suicide on this issue. He didn't know which way to go. Columbia was selling turntables to encourage the LP, but RCA came up with their own turntable for 45s. When London finally came in on the LP, that really tilted the thing against the 45.

But weren't you one of the few people who expressed concern at that time over the possible decline in sound quality with the LP?

Yes, because the LP pinched the tracks, so the high frequencies were bad and the low frequencies were suppressed. Because the technology was not yet able to reproduce sounds that the public wanted, London Records started to boost the highs on their recordings, which they called "High Fidelity." All the other record companies went with the high boost. I knew that I was documenting these sounds and that 100 years from now somebody could reconstruct what it sounded like by having a flat curve. For the other records, they would have to know how the boost worked and reverse it.

When did you stop doing most of the recording for Folkways yourself?

I quit recording jazz in the be-bop era and when the recording equipment revolution began in the late '50s. I sold my equipment to Cue Recording, which was next door to Folkways on 46th Street. After that, I would send people to Mel Kaiser at Cue. He knew what I wanted. The only time I went back into that studio was in 1964 with Bob Dylan for the Broadside sessions. Cue later donated my recording equipment to the Smithsonian Institution.

What about the ethnic series? You made the early records for WEVD with local talent, but later you issued records from all over the globe. How did this happen?

In this country, there have always been independent companies going into small towns to record local musicians singing about local happenings. Then they press the records and bring them back to the town and sell them.

In Germany, it was the same only it was international. Recording teams would go to China, India, Egypt, Algeria, and other countries for material. So the heart of the music of the world was pressed in Germany. This professor of music, Dr. Erich Von Hornbostel, was able to get hold of these exotic recordings, bring them to his university, and analyze them. He realized that each person expressed himself through the music of his culture. Each music was different and had a homogeneousness of its own. Alan Lomax later tried to do the same kind of analysis with a computer.

Béla Bartók, Henry Cowell, George Herzog, and others sat at the feet of Von Hornbostel and listened to his lectures. They wrote symphonies based on the music of various cultures and the theories of Von Hornbostel. They became the guiding factors of modern

music. Today all the pupils argue over what Von Hornbostel said. When the Allies bombarded Berlin, we destroyed all the archives and all the cylinders they had. Thanks to Henry Cowell, some copies were saved. I issued recordings of this material through Indiana University.

George Herzog left Germany during the war and became head of anthropology at Columbia University. He saw in what I was doing a chance of bringing authentic primitive material to the general public. He had the idea for the ethnic series. Up to this point, the only company that issued anything like that was RCA, which had put out Laura Bolton's early recordings among the American Indians and in Africa. But RCA dropped it, and she came to me.

Herzog surrounded himself with young people like Harold Courlander, who had been with the OSS during the war. He had been in Ethiopia and had recorded there, and he saw how the people and the music fit. When he came to the States, he became interested in anthropology and studied with Herzog. Herzog sent him to Haiti, where he made historic recordings.

So I had issued material from Herzog and Bolton when Courlander came to me. He said that I didn't know anything about this material, that I needed to have an editor so that the ethnic series would have merit and authenticity. With him, I eventually issued about 400 ethnic albums.

How would you get material? Certainly you couldn't afford to pay for people's trips to Africa.

Most of my material comes from people who are already in the field. Once we established a reputation, people came to us with field recordings. I issued the music of Cuba, Africa, and others that came from collectors and anthropologists.

What guidelines did you establish for what you put out?

First, I want to know the content of the material. Second, I want to know under what conditions it was recorded. In other words, is this one guy who had a wild night and cut something strange or is it an anthropologist or ethnomusicologist who was after a specific thing? Or was it a poet who just wanted to have his poetry on record the way he wanted it?

After that I'll figure if it fits into the mosaic of what Folkways is. I'm trying to document as much of contemporary life as exists, that is able to be recorded. If I have a hole in the area of the material that is coming in, then I want it. If I have three or four recordings in the same area, it has to be pretty special for me to add to that category. In some areas, I have six albums, but each tells a different story.

What would cause you to reject a recording project?

If it was too commercial. The problem with very commercial items is that the presses at the factories are over-

worked to meet demand. If I had a hit going now, then 500 records of different kinds would not be issued because I'd be using up all my press time on that one item. What I usually do when I have a record that is really moving is to give it to a different factory than the ones I normally use, which press only 100 to 200 copies of a specific record. If I gave them my best seller that's all they'd want, and they wouldn't take my bread and butter items.

It almost sounds as if you regard a hit record as a disruption.

In many cases when I have a hit, I lease it to others. For example, The Fugs for me was a big hit. I issued the original Fugs and leased it to ESP-Disk. There are some others that Decca and MGM had.

Who are some of the other individuals who have had a major impact on Folkways? Robert Palmer of The New York Times said that the three-box Anthology of American Folk Music sets that Harry Smith put together in the early '50s started the folk revival.

Harry Smith is a genius, but a little wild. He is known as an experimental filmmaker, but he was the first one to reissue recordings on a serious basis. During the Depression and in World War II, record companies were trying to get rid of stock, so collectors could pick up records very cheap. Harry Smith collected the records and all the information he could find about the individual artists.

Right: Moving Star Hall Singers, 1964. Below: Sonny Terry and Brownie McGhee, 1959.



Photographs: ©David Gahr

Folkways

Culture doesn't die, Asch believed; it may be covered with layers of sophistication, but it's still there if you dig down far enough.



Moses Asch and
Allen Ginsberg, 1970s
Photograph: ©David Gahr

The problem we had was that this material had all been issued on 78s on other labels. I could get sued if I issued some of this stuff. So I went back to the Constitution. There is a provision in the copyright law that says people have the right to know. Actually it came out of the policy on automobiles, which I was familiar with from my work with the American Standards Association. If a manufacturer stopped making a certain part of a car, his whole factory could be thrown into public domain. Car owners had a right to those parts. We applied the same logic to these records that were no longer available. But I wrote a disclaimer in the introduction to the Smith albums to avoid legal complications. There were threats of legal action, but mostly these people understood that I was too small to be bothered with.

How about Fred Ramsey, Jr.? Isn't he the driving force behind the 11-volume Folkways "History of Jazz" series?

I met Fred Ramsey through Leadbelly. Ramsey produced his last sessions. Then Ramsey got Guggenheim Fellowships to make field recordings in the South, which I issued. He and Charles Edward Smith wrote *The Jazzmen*, a scholarly book and the first to explore the roots of jazz in New Orleans.

And Sam Charters?

Sam Charters is really a poet. We issued an album of his poetry done during the war, when he was a GI. But his primary interest was rediscovering the blues people who were popular in the '20s and '30s. He felt they had a genuine contribution to make to American music. We started by reissuing the old 78 recordings that Sam had. The first one, *The Country Blues*, was used as the basis for his first book, which he dedicated to me. Most of the material had been issued on other labels, but we decided again that they were in the public domain. Charters did a series of recordings under the initials "RBF." If the Smith records launched the folk revival, then the RBF series started the blues revival.

Did you sell a lot of records during the '60s folk boom?

I sold a few more records in 1964, but most of my records were too ethnic, too primitive for the popular audience. But other labels wanted my material. MGM leased about 10 recordings from

me that they issued as the Verve/Folkways label. After two years, they returned everything to me. The folk boom was over.

You've outlasted all the booms and trends. Obviously this is because you look for something that has inherent, lasting value. Is it difficult to tell the difference between a legitimate cultural expression and something that is not authentic?

Not so difficult. As time goes on, you get to know what is the truth and what is falsehood. For instance, you know the way that so many folk singers developed a twang in their voice like Bob Dylan? This is false. It's not common to the man. With Dylan, of course, it was the poetry that counted more than the rendition. His popularity was due to both the rendition and the poetry. On the Broadside sessions we did [using the name Blind Boy Grunt because he was under contract to Columbia], Dylan was dealing with specific political and economic problems, so he didn't falsify his voice. He stated it as he felt it. This is my main criterion. Does a guy actually mean what he says or is it just something he thinks he can make a couple of bucks out of? The guy has to live it and feel it and has to say, "I'm being browbeaten by society and I've got to get it out of my guts. . . . I'll go to Asch and see what he says." That's the kind of thing I look for.

Don't you sometimes feel that you're swimming against the current? You've documented that America has a cultural heritage, but does America care?

Any culture that is worthwhile will always live. You don't see it because it goes underground. It gets covered with layers of sophistication. If you dig down enough, it will always be there. They still sing folk music in the mountains. The problems that the working man has in his everyday life will be expressed somehow, and there will be people who respond to this expression. Documenting this has been part of the service provided by the American record industry since 1898.

Don't think that the culture dies; it's just that there are so many distractions. Today the kids, instead of singing or becoming part of the community, are playing video games. They are isolated. They think they can live without knowing about their own cultural background. I couldn't live that way. This is the thing which guides me, knowing where I fit. I'm safe. I'm on ground. They are not. I try to convince them that they need ground in order to be safe, too. You have to give them materials that will communicate and still show them some truth. **A**

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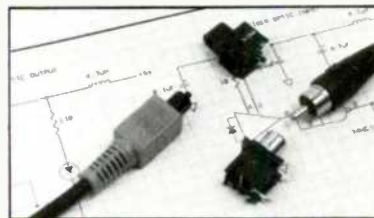
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1

COUNTERPOINT SA-220 POWER AMP

Manufacturer's Specifications

Continuous Power Output: Stereo, 220 watts per channel into 8 ohms, 420 watts into 4 ohms, 640 watts into 2 ohms, 730 watts into 1 ohm; bridged mono, 600 watts into 8 ohms, 700 watts into 4 ohms.

Peak Power Output Per Channel: Stereo, 310 watts per channel into 8 ohms, 590 watts into 4 ohms, 900 watts into 2 ohms, 1,000 watts into 1 ohm; bridged mono, 840 watts into 8 ohms, 980 watts into 4 ohms.

Peak Output Current: 50 amperes into 0.1 ohm, for 1-kHz signal switched on for 20 mS and off for 480 mS.

Voltage Gain: Stereo, 29 dB; bridged mono, 35 dB.

Frequency Response: 0.2 Hz to 200 kHz into 8 ohms, 0.2 Hz to 32 kHz into 8 ohms plus 8 μ F.

Rise-Time: 0.6 μ S into 8 ohms, 5.0 μ S into 8 ohms plus 8 μ F.

THD Into 8-Ohm Load: Stereo, 0.5% at 200 watts out, 0.1% at 10 watts, 0.05% at 1 watt; bridged mono, 0.5% at 200 watts, 0.10% at 10 watts, 0.08% at 1 watt.

S/N Ratio: 84 dB below 1 watt out, measured from 400 Hz to 80 kHz, with 8-ohm load.

Input Impedance: 100 kilohms plus 100 pF.

Output Impedance: 0.12 ohm, typical.

Damping Factor: 60, re: 8 ohms.

Signal Polarity: Noninverting.

Power Consumption: 260 watts at idle.

Dimensions: 19 in. W x 6.7 in. H x 19 in. D (48.3 cm x 17 cm x 48.3 cm).

Weight: 69 lbs. (31.3 kg).

Price: \$2,795.

Company Address: 2610 Commerce Dr., Vista, Cal. 92083.

For literature, circle No. 90



The SA-220 is the larger of two hybrid power amps made by Counterpoint. The smaller unit is rated at 100 watts per channel into 8 ohms; the SA-220, reviewed here, is rated at 220 watts per channel into 8-ohm loads. Counterpoint also makes an output-transformerless, output-capacitorless, all-tube power amp and a number of tube preamps. The company's products have been well reviewed and accepted by the audiophile community.

Rather than using a solid-state front-end and tube output stage with output transformer, as some hybrid amps do, the SA-220 is of the type that uses a tube front-end and a solid-state, transformerless output stage, in this case utilizing complementary MOS-FET output devices. Excellent sound can be produced from either approach when the proper design techniques are employed.

The SA-220's front panel has a rocker "Power" switch at the lower right. An LED indicator above and to the right, near the manufacturer's logo, glows red when the amp is first turned on and then turns green after a suitable but long delay of about 90 S, signifying that the amp is ready.

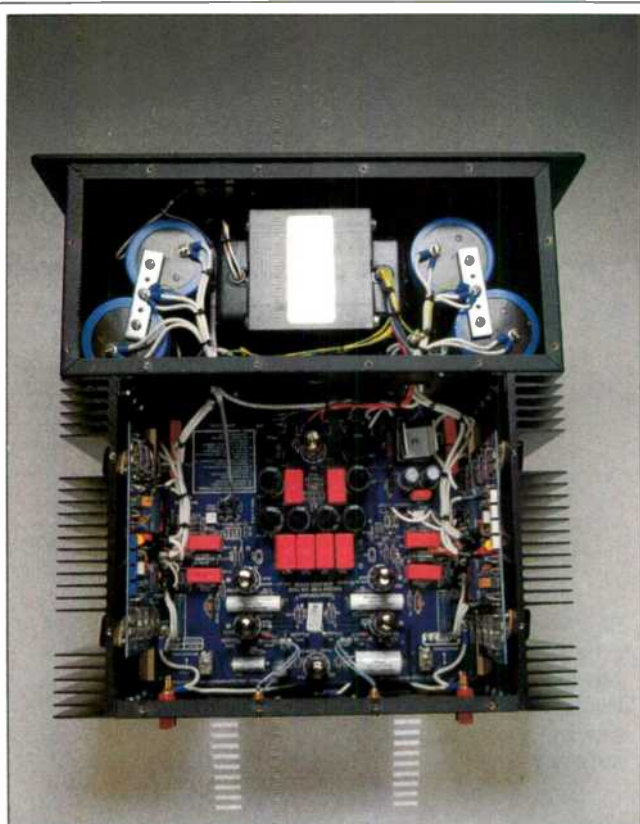
On the rear panel are a pair of Tiffany input phono connectors, a pair of five-way binding posts for speaker connections, and the a.c. power cord. An a.c. line fuse, positive and negative power-supply fuses for each channel, and speaker fuses are inside the unit.

Checking out the interior of the SA-220 reveals that the front third of the space is taken up by an appropriately large and beefy power transformer; two pairs of 25,000- μ F, 75-V filter capacitors, and two bridge rectifiers. The rest of the space is occupied by a large double-sided p.c. board on which the input circuit tubes and most of the amplifier circuit parts are mounted. Two more circuit boards, one per channel, hold the protection circuitry. These boards are mounted on the insides of the heat-sinks and connect the protection circuitry directly to the output devices.

Physically, the SA-220 is a reasonably sized package for what it contains, and it weighs in at nearly 70 pounds. The main chassis is made up of one piece that is bent up and spot-welded together to form the bottom, the front subpanel, the front third of the sides, and the rear panel. This chassis is copper-plated, which Counterpoint feels makes the unit sound better. Making up the rear two-thirds of the sides are the extruded heat-sinks for the output stage.

The front panel is rack width (19 inches) and 6.7 inches in height. The panel's thickness is about $\frac{3}{16}$ inch. Another piece, $2\frac{1}{2} \times 19 \times \frac{1}{4}$ inches, with tapered top and bottom edges, is bolted across the front panel, about halfway up, to create the distinctive front-panel appearance of Counterpoint components. Finally, a vented top cover completes the enclosure. This top cover is attached to the main chassis with numerous 6-32 screws threaded into Pemm nuts mounted on a half-inch ledge. This ledge goes all the way around the top of the chassis, except where the heat-sinks are.

I have had the opportunity to compare Counterpoint's earlier SA-20 with the newer SA-220 reviewed here, and I find that the later model's metalwork is quite an improvement in terms of general sophistication and elegance. The SA-220 reviewed had a black anodized front panel; a brushed silver anodized finish is also available on all Counterpoint products.



Circuit Description

Signal input is directly coupled through a series resistor into the grid of the first-stage tube. A resistor to ground across the signal input sets the input impedance at 100 kilohms. The first stage is operated as a common-cathode amplifier, with the output signal taken at its plate. This output is capacitor-coupled to the second stage, which is also operated as a common-cathode amplifier. The plate output of the second stage is direct-coupled to a third tube acting in common-plate or cathode-follower mode. A fourth tube is connected as a current source to the cathode follower.

The circuitry just described is implemented with two 6DJ8 dual triodes. Each of the three stages' plate circuits is decoupled from the power supply with a series resistor and a shunt capacitance made up from paralleled electrolytic and film capacitors. A proprietary feedback loop encompasses this entire front-end tube circuit. The net result of all this tube circuitry is to provide the amplifier's voltage gain as well as a low output impedance to drive the output stage and, being tubes, to help produce the sonic wonder that the whole design is to exhibit!

In addition to the two 6DJ8s per channel, half of another dual triode is engaged when the amplifier is in bridged mode. The fifth tube acts as a unity-gain phase inverter to reverse the polarity of the right channel. This inverter circuit is completely out of the signal path when the SA-220 is in stereo mode.

The output stage is composed of four N-channel and four P-channel MOS-FET power devices configured in a comple-

In few amps is the distortion so consistent between 1 kHz and 20 kHz—and it's even a bit lower at the frequency extremes than at the midband.

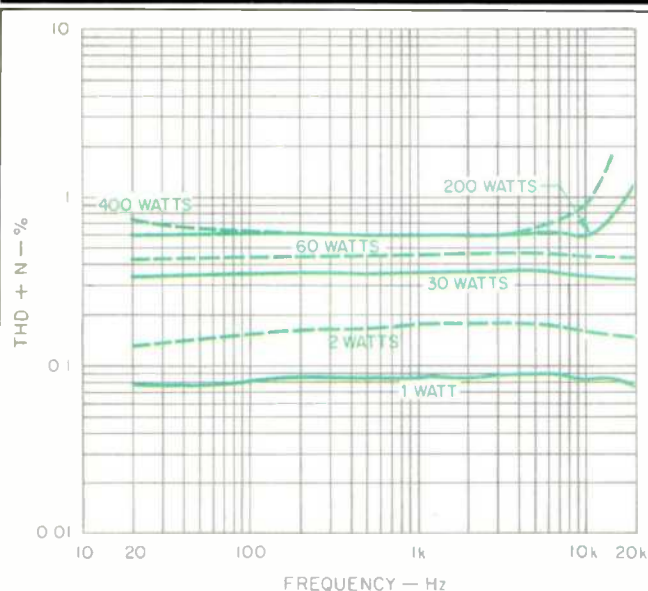


Fig. 1—THD + N as a function of frequency and power output for 8-ohm loads (solid curves) and 4-ohm loads (dashed curves).

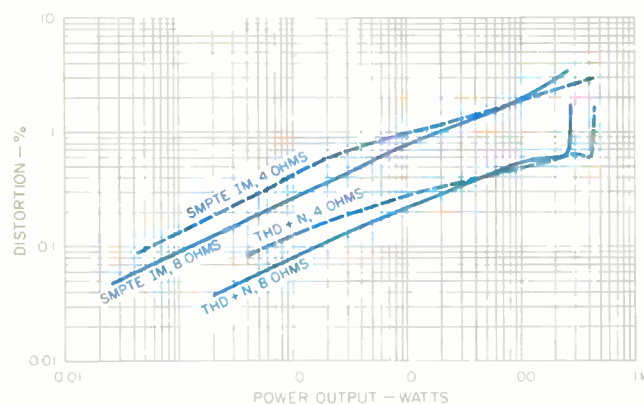


Fig. 2—SMPTE IM and THD + N vs. power for 8- and 4-ohm loads.

mentary source-follower arrangement, the four N-channel and P-channel devices being wired in parallel in two groups for increased power handling capacity. The devices employed are International Rectifier TO-3 metal-cased units, which are being used increasingly in new designs because

their reliability and characteristics have improved. The tube stages' output cathode follower is connected to the output stage via separate coupling capacitors to the gate circuits of the N- and P-channel devices. Constant-current-fed zener diodes provide stable positive and negative voltage sources to feed a resistive voltage-divider circuit connected to the MOS-FET gates. This divider feeds the bias-spreading regulator and allows adjustment of the amplifier output's d.c. offset to 0 V.

Contrary to popular belief, not all MOS-FET output stages have negative temperature coefficients at the idling currents typically used in MOS-FET power amplifiers. The Hitachi MOS-FETs found in many early and current designs do cross over from a positive to a negative temperature coefficient at a fairly low current, with the coefficient being negative at the idling currents typically used. In contrast, most modern devices made by International Rectifier and other companies have a positive temperature coefficient up to several amperes. Consequently, output stages using these devices need a bias-spreading regulator that exhibits a negative temperature coefficient to keep the quiescent current stable with temperature. The biasing and output-zeroing circuits are stable enough so that amplifier d.c. offset is not a problem.

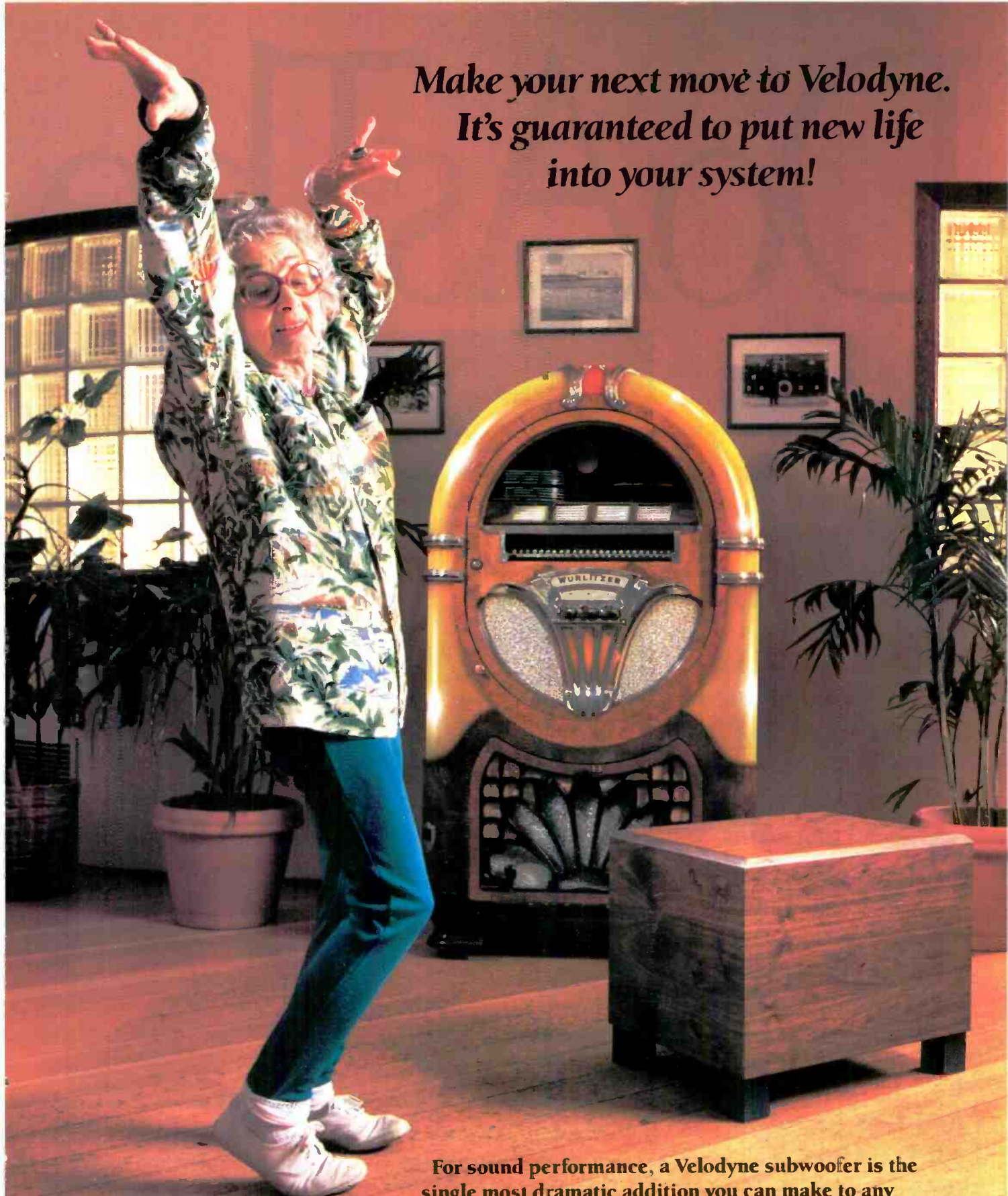
There is no overall feedback loop in this design. The output stage has no feedback correction other than the approximately 100% current feedback inherent in its topology as a complementary source follower.

A muting relay with two pairs of normally closed contacts is connected from each gate's drive line to ground through small-value resistors. When a.c. power is turned on, these relays keep the MOS-FET gates shorted to ground while the tube front-end warms up and charges the coupling capacitors to the output stage. After the delay circuit times out at about 90 S, it energizes the relay coils, unshorting the gates' drive lines and thus activating the amplifier. When power is turned off, the time-delay circuit immediately activates the muting relays to keep any turn-off noises or surges out of the amplifier's output.

A very well-thought-out protection circuit monitors output current and voltage and, by a clever circuit topology, derives an analog of the voltage waveform across the output devices. Subsequent processing computes the instantaneous product of current and voltage in the output stage. This instantaneous power is then converted to its rms value to get the true heating effect of the power dissipation in the output stage. With due regard for the safe operating area of the output devices versus time and power, the computed rms value is applied to a threshold detector. When tripped by excessive dissipation in the output stage, this detector turns on signal shunt gates that short the drive lines to the MOS-FET output devices and puts the circuit in the mute/start-up mode. The net result of this protection is to allow about 780 watts per channel into a 1-ohm load and to rapidly reduce the available power output as the load impedance drops below 1 ohm. Approximate powers available below 1 ohm are 400 watts into 0.9 ohm, 180 watts into 0.7 ohm, and 20 watts into 0.1 ohm.

The power-supply circuitry is relatively simple for a hybrid amp. The power transformer has four secondary windings.

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Do As The

If you share the beliefs of the most serious audiophiles, *Audio* magazine is something you live by. And if you saw the March 1990 issue, you must surely see the wisdom of TDK.

But in case you missed it, allow us to enlighten you.

In that issue, *Audio* revealed the results of a massive test it conducted among 88 blank audio cassettes. And all it could do was praise TDK.

**AUDIO MAGAZINE RATED
TDK AR-X #1 OVERALL AMONG ALL
NORMAL BIAS CASSETTES.**

The test began with *Audio* evaluating and comparing normal bias Type I cassettes from virtually every conceivable manufacturer.

After the data was polled, *Audio* concluded TDK AR-X was not only the best Type I tape, but "... close to the best for Type II as well."

A finding that isn't all that surprising considering the technology that goes into AR-X, which results in the



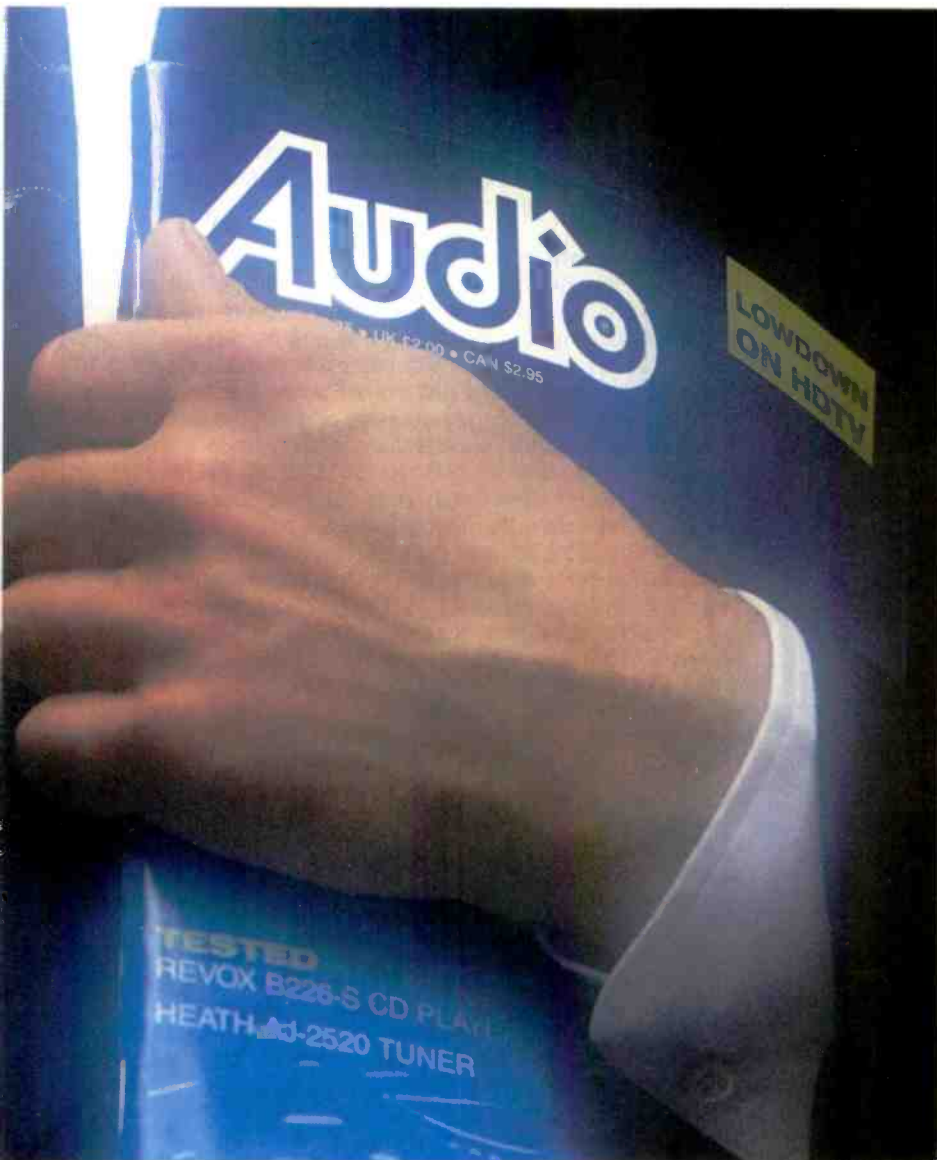
highest high-frequency SOL.

**AUDIO MAGAZINE RATED TDK SA-X
THE #1 HIGH BIAS CASSETTE IN TERMS
OF DYNAMIC RANGE (S/N RATIO).**

The next area for review was the high bias Type II segment. And in this highly

competitive arena, the engineer *Audio* used found the performance of TDK no less impressive: TDK SA-X, with its dual coating of Super Avilyn particles, has the

Bible Says.



widest dynamic range of any high bias tape. Which perhaps explains why serious audiophiles have always found CD recordings made on TDK SA-X to be so incred-

ibly faithful to the original.

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TDK has a long history of innovation in metal tape technology, the most recent

example of which is the MA-XG. And by the end of the test, it was the chosen tape of *Audio*.

After a close and exhaustive scrutiny of Type IV tapes, based on several parameters, TDK MA-XG was not only the choice as the best Type IV tape, but also the best tape on the market. Period.

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If you're serious about your sound, you'll practice what *Audio* preaches, and use TDK.



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The SA-220's strong points include wide bandwidth, high power and current output, plus low distortion and noise.

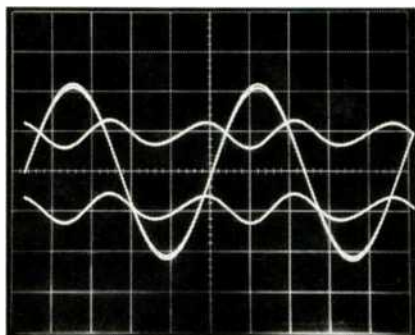


Fig. 3—Distortion residues and 1-kHz signal, for 10 watts into 8 ohms. For left channel (upper residue trace), THD measured 0.226%; for right channel (lower residue trace), distortion was 0.22%.

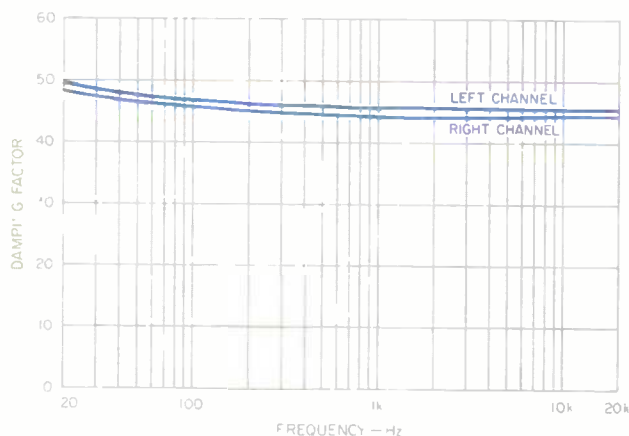


Fig. 4—Damping factor vs. frequency for 8-ohm load; see text.

The first feeds a full-wave bridge rectifier and a set of 27,000 μ F, 75-V filter capacitors for each channel, providing the positive and negative 68 V for the output stages. The output from the second winding goes through a full-wave bridge rectifier, a capacitor input filter, and further RC filtering to run the tube heaters and the circuit for the time-delay and LED driver. (As mentioned, the LED glows red during the turn-on delay and green thereafter.)

The third winding, for high voltage, feeds a tube full-wave rectifier that, in turn, feeds a capacitor input filter. Further filtering, via a series resistor and another filter capacitor, produces the final +350 V for the amplifier front-end circuits. That is it; there are no fancy regulators in the high-voltage supply, just good old-fashioned RC filtering and decoupling as in the tube circuits of old.

The fourth secondary winding is to power the heater in the tube rectifier. It has to be floated up at the cathode potential of the rectifier tube (+370 V d.c.), so it needs its own transformer winding.

All in all, the circuitry of the SA-220 is deceptively simple and straightforward. But don't be fooled: Great care was exercised in the choice of topology, circuit values, and types of parts used in its design.

Measurements

Since the SA-220 runs quite hot when it's just idling, I initially considered not giving this amplifier the standard IHF preconditioning test of running it at one-third power for one hour, as my experience with other amplifiers suggested to me that the amp would get too hot under these conditions. However, I did gather my courage and ran the test; the SA-220 passed the test successfully, getting up to a stabilized heat-sink temperature of about 68° C (154° F). Remember that normal, or even harsh, music use seldom heats up an amp to the extent that this test does.

The SA-220's left and right channels are not labelled, so in the measurements that follow they are identified as seen from the front of the unit.

Voltage gain was measured at 30.4 dB for the left channel and 30.1 dB for the right channel. Sensitivity was 85 mV for the left channel and 90 mV for the right.

Total harmonic distortion plus noise, as a function of power output and load, is plotted in Fig. 1. The channels were very similar, so the left one was arbitrarily chosen to plot in this and other Figures. This amp is one of the few that I have tested that has relatively constant magnitude of distortion between 1 and 20 kHz. The SA-220 even has slightly less distortion at the frequency extremes than in the midband over much of its power range.

Figure 2 shows THD + N at 1 kHz, and SMPTE-IM distortion, as a function of load and power output. Second-harmonic distortion was the dominant order over most of the amp's power range.

Figure 3 illustrates the shape of typical harmonic distortion residues. The top trace is for the left channel, which measured 0.226%; the bottom trace, for the right channel, was 0.22%. It can be seen that the distortion character and magnitude are unusually well matched.

Output noise for several measurement bandwidths and IHF signal-to-noise ratio are provided in Table 1. Looking at this unit's output noise on my instruments revealed a few things of interest. With the measurement bandwidth set for wideband, normal line-voltage surges caused subsonic surges on the order of 0.5 mV in the amplifier's output. There was some microphony in the tubes due to acoustic noise or hitting the amplifier case. Generally, the amount of random noise and hum related to line harmonics was quite low in the SA-220.

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to just a few years ago. Manufacturers of digital audio tape (DAT) recorders and the recording industry are at loggerheads over this new technology. DAT's sound is sensational and its cassette format is convenient, but the recording industry is concerned over DAT's ability to make superior copies.

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3. PLAY

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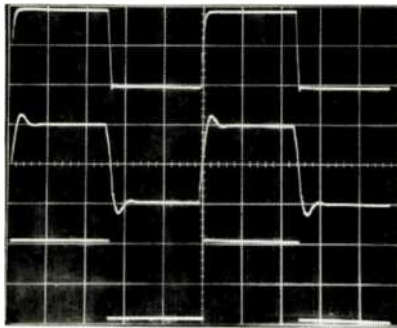


Fig. 5—Square-wave response. Top trace is 10 kHz with 8-ohm load, middle trace is 10 kHz with 2- μ F capacitance across the 8-ohm load, and bottom trace is 40 Hz into 8 ohms. (Scales: Vertical, 5 V/div.; horizontal, 20 μ S/div for 10 kHz, 5 mS/div. for 40 Hz.)

Interchannel crosstalk was 6 to 8 dB higher in the right-to-left direction, where it measured -82 dB at 20 Hz, increasing to -77 dB at 100 Hz, to -60 dB at 1 kHz, and to -41 dB at 20 kHz. This amount of crosstalk at high frequencies borders on affecting stereo separation. Further, crosstalk was dependent on load current flowing in the driving channel, which suggests that the amount of crosstalk will vary with load impedance.

Damping factor versus frequency is shown in Fig. 4. Hey, look at this! Finally, an amp that has constant output impedance from 1 to 20 kHz! (I don't understand, though, why the damping factor rises a bit below 1 kHz.) The SA-220's uniformity of output impedance with frequency would likely help make this amp relatively speaker-independent, so its sound should not be affected by different speaker impedance curves.

Table I—Output noise. The IHF S/N ratio was 91.6 dB for the left channel and 94.0 dB for the right.

Bandwidth	Output Noise, μ V	
	LEFT	RIGHT
Wideband	250 to 300	250 to 300
20 Hz to 20 kHz	130	110
400 Hz to 20 kHz	72	57
A-Weighted	76	54

Frequency response at the 1-watt level was quite extended at the high-frequency end, being down about 1.2 dB at 100 kHz. Response was up to reference level at 10 Hz at the low end. Four-ohm loading resulted in a few tenths of a dB more attenuation at frequencies approaching 100 kHz. Rise- and fall-times for ± 5 V into 8 ohms were about 1.8 and 1.6 μ S, respectively. Scope traces of square-wave behavior are shown in Fig. 5; some slewing is visible on the negative-going transition of square waves. The top trace is for 10 kHz into 8 ohms, and the middle trace is for 10 kHz into 8 ohms paralleled by 2 μ F. The bottom trace is for 40 Hz into 8 ohms, and excellent (read, extended) subsonic response is indicated by the small amount of tilt visible in the waveform.

Dynamic power, measured using the IHF tone-burst signal, was 289 watts into 8 ohms and 544 watts into 4 ohms. This translates to figures for dynamic headroom of 1.2 and 1.1 dB, respectively, into these loads. Power output at clipping was 250 watts into 8 ohms and 420 watts into 4 ohms; the corresponding figures for clipping headroom are 0.56 and 0 dB.

For a 1-ohm load, with only one channel driven, the amp put out ± 50 V before clipping, which is also ± 50 amperes—most impressive.

The SA-220's a.c. power-line draw was about 2.2 amperes, and it stayed constant within 0.1 to 0.2 ampere from cold startup through being baked in the 4-ohm power tests.

From a measurement point of view, I'd say the SA-220's strong points include low-order distortion that is constant with frequency, constant output impedance with frequency, low output noise, wide bandwidth, and high power output and current capability. On the negative side are its relatively high crosstalk at high frequencies and its relatively high amounts of measured distortion. Now, let's move on to what it all sounds like.

Use and Listening Tests

Equipment used to evaluate the SA-220 consisted of an Oracle turntable fitted with a Well Tempered arm and Koetsu Black Goldline cartridge, a Technics 1500 open-reel recorder, and a Nakamichi 250 cassette deck. My Cook-King reference tube preamp and switched attenuator were used for input switching and volume control, and a Mark Levinson No. 25 phono-only preamp was used for some of the LP listening. Other power amplifiers on hand for comparison included a pair of EAR 519 mono tube units, Jeff Rowland Model 7s, and a Boulder 500AE. The speakers used were Siefert Research Magnum IIIs.

I liked the sound of the SA-220 as soon as it started to pass music through to my speakers. Music reproduced through this amp had a big, easy sound. The midrange was open and clear, the highs were airy and extended, and the bass was full and deep. The bass was not quite as tight and damped as with some other amps, but it sounded quite musical to me and blended well with the lower midrange. Depth and dimension were very good.

The SA-220 is an amplifier that satisfies my musical sensibilities and has a great measure of wallop when needed! I highly recommend prospective buyers give it a listen.

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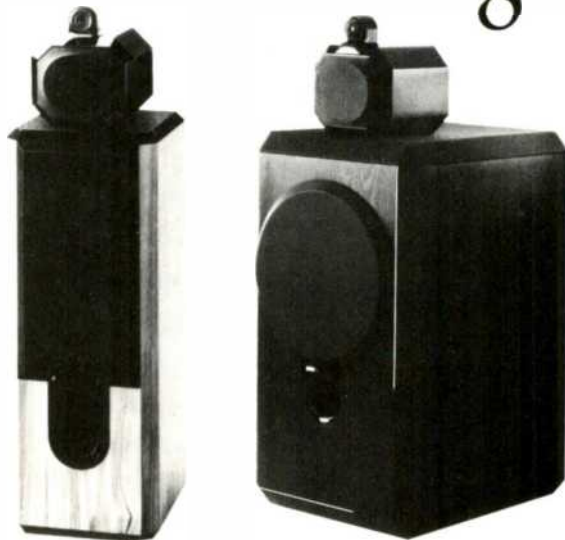
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Lewis Lipnick—Stereophile, Vol. 10, No. 9, December 1987

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Fanfare, Jan/Feb 1990.

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2

NHT MODEL II SPEAKER

Manufacturer's Specifications

System Type: Tower style; three-way, dual-chamber acoustic suspension.

Drivers: Two 6½-in. (165-mm) polypropylene cone woofers, one 6½-in. (165-mm) treated-paper cone woofer/midrange, and one 1-in. hard-polymer semi-dome tweeter.

Frequency Response: On axis, 43 Hz to 22 kHz, ±3 dB.

Sensitivity: 87 dB SPL at 1 meter for 2.83 V rms band-limited pink-noise input.

Crossover Frequencies: 80 Hz and 3.3 kHz.

Impedance: 8 ohms nominal (3.3 ohms minimum at 65 Hz measured).

Recommended Amplifier Power: 35 to 200 watts per channel.

Dimensions: 37 in. H × 7 in. W × 12 in. D (94 cm × 17.8 cm × 30.5 cm).

Weight: 44 lbs. (20 kg).

Price: \$900 per pair.

Company Address: Now Hear This, 537 Stone Rd., Building E, Benicia, Cal. 94510.

For literature, circle No. 91



Now Hear This, a not-so-crazy name for a sound company primarily involved in manufacturing loudspeakers, produced the system evaluated in this review. The Model II, even though rated as a three-way system, is unconventional in the sense that it is essentially a small-format, two-way system with added woofers that is housed in a sleek, high-gloss black tower structure (also available in oak veneer). The system is deeper than it is wide and stands about 3 feet high with attached stabilizers. These speakers are targeted toward the mainstream consumer rather than the esoteric market. In this market, appearance, value, and good sound for the money are quite important. The Model II's appearance was well liked by all members of my family, including me.

The two most noticeable visual traits of the system are its shiny, black, marble-like finish and its inward-slanted front panel. The 22° slanted front baffle orients the drivers' axis inward, towards the center of the listening area. This, according to the manufacturer, improves its imaging qualities in a concept NHT calls Focused Image Geometry. The design is said to minimize excessive side-wall reflections and reduce "interaural cross-correlation" and thereby maintain a consistent soundstage and stereo perspective throughout a broad listening area. Because of the slanted baffle, the speakers are only sold in mirror-image pairs.

The Model II is a direct descendant of NHT's first product, the compact, two-way bookshelf Model I system, which was released in 1987, and it uses many of the same components as the Model I. Kenneth L. Kantor, a founding partner of NHT (formerly of Acoustic Research, NAD, and Proton), is NHT's primary designer and was the driving force behind the Models I and II. (Kantor, no stranger to the pages of this magazine, has written a number of informative *Audio* articles. His "Speakers by Design," published in November and December 1988, is particularly informative and shows some of the trade-offs a system designer must juggle to come up with a workable design.)

Small-format, two-way loudspeaker systems have always had a reputation for very good pinpoint imaging and stereo soundstage capabilities, due primarily to their small size and simplicity. Using a single driver to cover the entire low and middle frequency ranges eliminates the problems of a crossover point that invariably ends up in the critical mid-band region of 250 Hz to 1 kHz. Unfortunately, the bass response suffers in this format because of small physical size. The Model II essentially gets around this problem by melding a small two-way system with an acoustic-suspension bass system containing two small high-excursion woofers, and then packaging the whole in a tall, narrow tower. The system can be thought of as a small two-way system sitting on its own built-in "subwoofer and speaker stand," as NHT points out. In the last few years, another logical solution to this dilemma has grown very popular, the three-piece design that uses two small satellites with a separate woofer or subwoofer.

The two bottom woofers of the system have the air-moving capability of a 10-inch-diameter woofer but with the width of only a 6½-inch woofer. This allows the Model II to maintain the narrowness of a typical, small-format, two-way system but have the bass response of a larger, wider system. The

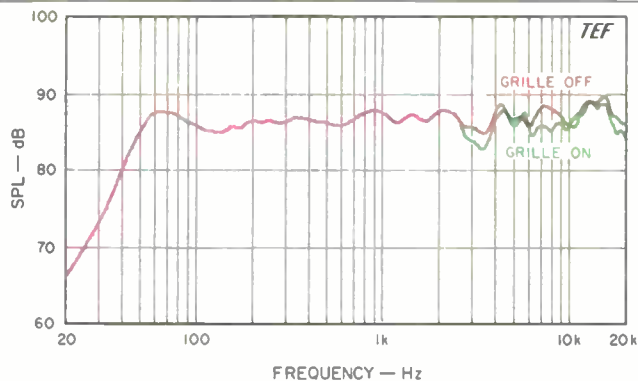


Fig. 1—On-axis frequency response.

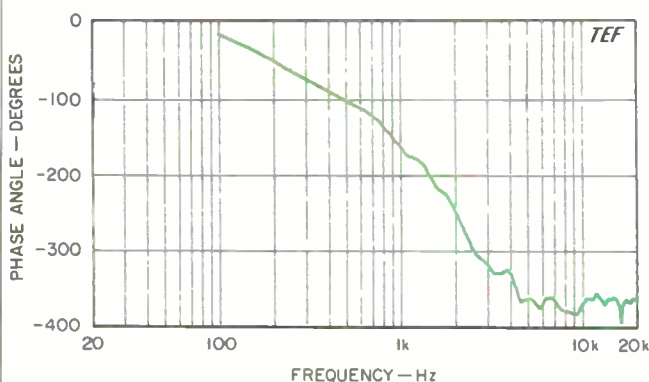


Fig. 2—On-axis phase response, corrected for tweeter arrival time.

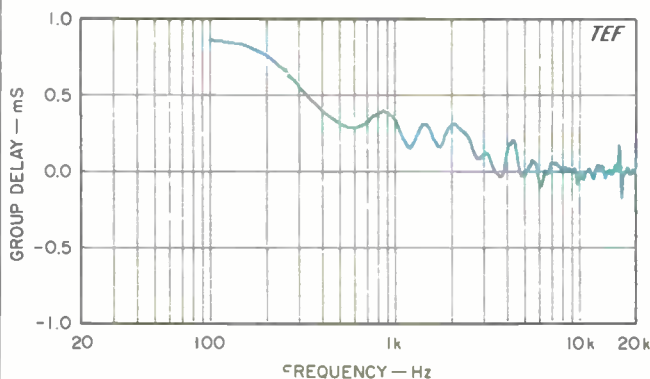


Fig. 3—Group delay corresponding to phase response of Fig. 2.

The Model II's format melds the imaging and narrowness of a small two-way system with the bass response of larger, wider woofers.

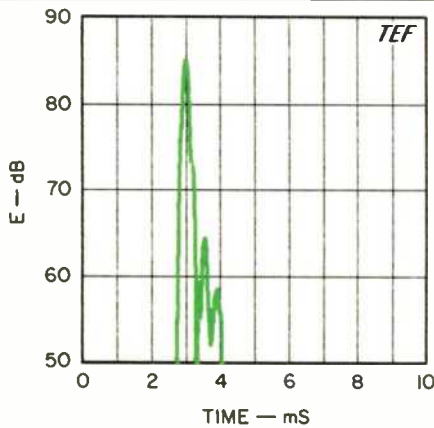


Fig. 4—One-meter on-axis energy/time curve, measured with grille off.

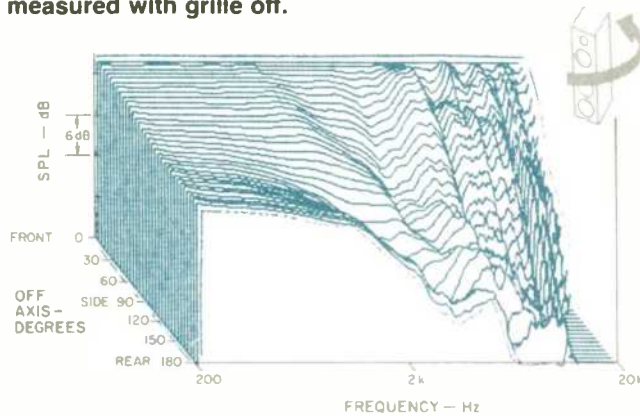


Fig. 5—Horizontal off-axis responses, taken from the front, around the side, and to the rear of the speaker and normalized to the on-axis response; see text.

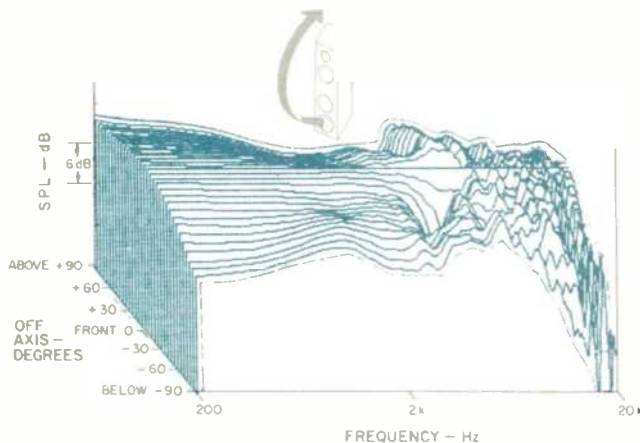


Fig. 6—Vertical off-axis responses taken from below, up the front, and to the top of the speaker.

two bottom woofers are only active in the bottom octave of operation, from 40 to 80 Hz. The upper woofer/midrange, rather than being rolled off as the bottom woofers come into operation, is actually used most of the way down and only rolled off below 45 Hz. From 45 to about 80 Hz, all three woofers are operating essentially in parallel.

The crossover uses a minimalist approach, using the fewest possible components. Most filters are essentially first-order, 6-dB/octave designs with a single capacitor or inductor—except for the dual woofers' low-pass filter, which is a second-order, 12-dB/octave type. The upper crossover, between the woofer/midrange and tweeter, effectively has only a high-pass filter on the tweeter. (Electrical drive measurements of the woofer/midrange revealed that its series inductor was only attenuating the response by about 6 dB at 20 kHz.) The natural acoustic roll-off of the woofer/midrange is relied on to provide the low-pass action. In support of this design, Kantor states:

It is my experience that well-controlled driver motion (damping, transient response, phase linearity) is best achieved when the most direct electrical path to the power amplifier is maintained, i.e., the simplest crossover possible. This approach, rather than lowering net cost, simply shifts the burden of spectral accuracy to the drivers themselves.

Read on later to see how well this design approach worked for the Model II.

Because each speaker is quite tall, somewhat top-heavy, and only takes up about ½ square foot of floor space, the Model II is somewhat unstable and inclined to fall sideways. To improve lateral stability, NHT provides two sets of steel stabilizer base frames, attachable to the bottom of the cabinets, to increase the width of the base of the enclosure to 13 inches. These base frames are an absolute necessity if the speaker systems are used on carpet, in particular where children live.

As stated before, the most eye-catching feature of the Model II is the hard, shiny black outside finish. The system is finished on all six cabinet surfaces. The surface treatment is achieved by applying a 1/16-inch-thick, high-pressure black laminate over medium-density, ¾-inch-thick fiberboard. No internal cabinet bracing was evident. The non-square configuration of the cabinet and the internal divider separating the top chamber from the bottom served very well to strengthen the cabinet. Only one mild side-panel resonance could be detected, at 450 Hz, on the bottom half of the narrow side of the cabinet.

A rear panel contains the recessed, double-banana, five-way binding-post connectors along with an internally mounted p.c. board for the crossover. The crossover contains six components: Two inductors (one large iron-core and one smaller air-core), three capacitors (one quite large and two smaller), and one power resistor. I did not remove the crossover to trace its circuit, due to removal difficulties. No tweeter level control is provided (or needed).

All drivers are flush-mounted and centered horizontally on the front baffle. The tweeter is mounted on the top of the front baffle, with the woofer/midrange just below. The two extra woofers are mounted one on top of the other using the



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The fairly smooth, wide-angle response of the Model II's means they image quite well over a broad horizontal listening area.

bottom internal two-thirds of the cabinet as a closed-box enclosure. Removal of the top two drivers revealed individual magnetic shielding on each. The tweeter used a second ring magnet, reversed and glued on the rear of the first, to cancel its magnetic field. The woofer/midrange actually had a covered magnet assembly somewhat similar to that on old speakers with Alnico-5 magnets. The bottom two woofers had identical, unshielded magnets much larger than that of the top woofer/midrange.

Each system has two removable grilles made of stretch fabric covering a molded plastic frame. Each frame has molded projections on the rear that mate with corresponding rubber grommet-filled holes on the cabinet's front baffle.

Measurements

The Techron TEF System 12 Plus analyzer, which uses the late Richard Heyser's technique of Time Delay Spectrometry (TDS), was used for most of the measurements in this review. The measurements were performed at several locations including my own new listening room, Crown International's microphone test chamber, and outdoors on my driveway. Evaluation methods included elevated free-field, near-field, and ground-plane techniques.

The measurement of system on-axis frequency response was done at an actual distance of 2 meters, on an axis halfway between the tweeter and the upper woofer/midrange driver, normal to the front baffle (not in a direction parallel to the sides of the cabinet). The input level was 2.83 V rms, which corresponds to a level of 1 watt into the manufacturer's nominal 8-ohm rated impedance. The on-axis response was corrected to the standard distance of 1 meter for display of the data. The parameters of the measurement and resultant post-processing were set so that the data was essentially smoothed with a tenth-octave filter.

Raw data was transferred from the TEF System 12 Plus to a Macintosh computer via serial link for post-processing and graphing. Most of the graphs and associated processing were done with a new Macintosh program called Igor, from WaveMetrics of Lake Oswego, Oregon. (Igor is a general-purpose graphing and data analysis tool with a lot of power. I highly recommend it.)

Figure 1 shows the on-axis, 1-watt, 1-meter frequency response of the Model II. The speaker exhibits a reasonably flat response from 50 Hz to 20 kHz (± 2.5 dB), with some mid- and high-frequency roughness between 2 and 10 kHz. This is especially true with the grille on. Mounting the grille produces modest additional response variations of roughly +1 and -3 dB in the range above 3 kHz. The grille's main effect is to add two shallow, half-octave dips in the response at about 3.5 and 8 kHz. Figure 1 also indicates an average midband sensitivity of approximately 87 dB SPL, which matches the manufacturer's rating.

A separate test, comparing the axial response of both right and left speakers (not shown), yielded a not quite-so-good match of about ± 1.5 dB over the frequency range from 100 Hz to 15 kHz. The right speaker was approximately 1 to 1.5 dB hotter than the left above 2 kHz while being lower than the left by about 1 dB below 1 kHz.

Near-field measurements (not shown) revealed the response of the Model II's woofers. The response of the upper

woofer/midrange extended down from the tweeter crossover to 65 Hz, where it rolled off at 18 dB/octave. An additional 6-dB/octave roll-off for the upper woofer was provided by a series capacitor. Its response had a slight, 1.5-dB hump at 75 Hz before rolling off at lower frequencies. The lower woofers, wired in parallel, exhibited a symmetrical bandpass response centered at 56 Hz, with a bandwidth of 31 Hz extending from 45 to 76 Hz at the 3-dB-down points. This represents a bandpass Q of about 1.8 (center frequency divided by bandwidth, which is approximately equal to 56 divided by 31). Roll-off was 12 dB/octave above and below the 3-dB-down points. The manufacturer states that "the dual woofers operate over a relatively narrow band designed to complement and effectively equalize the upper portion of the system."

The woofers' excursion capabilities and frequency dependence were assessed by sweeping with a constant-voltage sine wave covering the low-frequency range. As the frequency was swept down from 200 Hz, the upper woofer/midrange reached an excursion maximum at 70 Hz. At this frequency, the lower woofers had a displacement of about 33% of the upper. Equal excursion between upper woofer

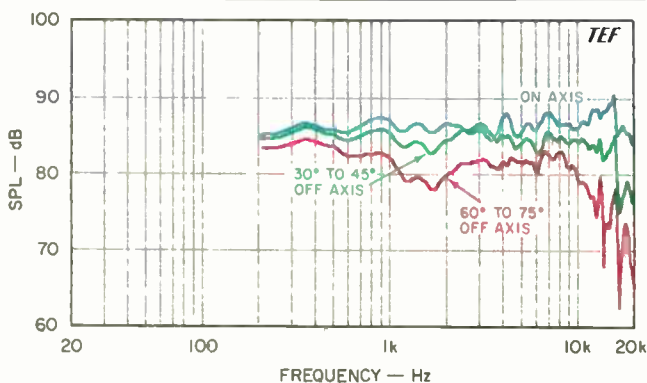


Fig. 7—Mean horizontal response, derived from data of Fig. 5; see text.

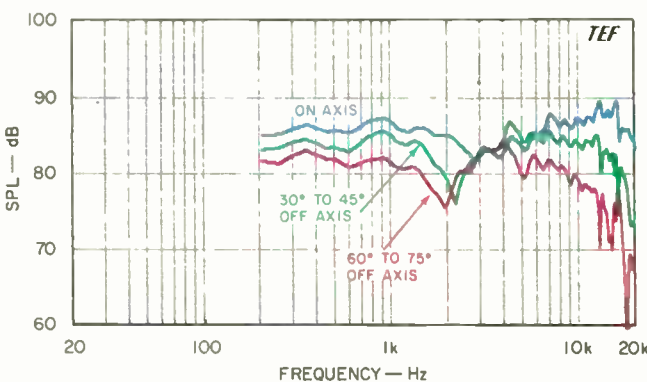


Fig. 8—Mean vertical response, derived from data of Fig. 6.

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Response was reasonably flat, within +2.5 dB, over the range from 50 Hz to 20 kHz, and was only about 6 dB down when it reached 40 Hz.

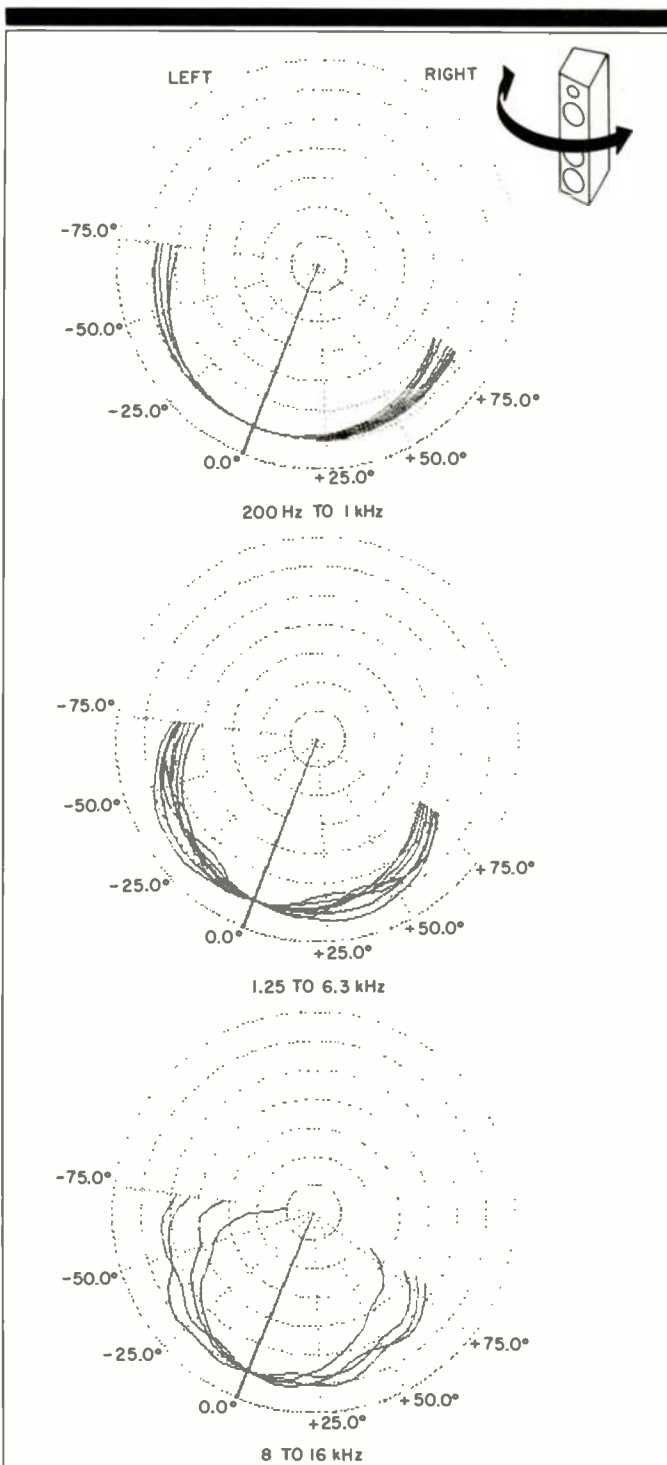


Fig. 9—Horizontal composite polar responses, measured at right angles to the speaker's front panel.

The offset angle of the 0.0° line corresponds to the front panel's offset from the cabinet walls.

and lower woofers was attained at about 60 Hz. At 50 Hz, the bottom woofers attained their maximum. At this frequency, the excursion of the top woofer/midrange was about 75% of the bottom woofers'. At lower frequencies, the upper woofer's excursion diminished in direct proportion to the lowering of frequency. The bottom woofers' excursion, however, reached a plateau of about 60% of its maximum no matter how low the frequency. At 40 Hz, even with the series capacitor, the excursion of the top woofer was about half that of the bottom woofers.

The top woofer also exhibited a significant amount of "dynamic offset" or "oil canning" effect in the range from 60 to 100 Hz, above 7 V rms. The bottom woofers were clean of this distortion. (See *Audio*, September 1989, page 90, for more information on the "oil-can effect.")

The maximum linear excursion capability of the top woofer/midrange was about ± 0.2 inch (0.4 inch peak to peak), while the bottom woofers' capability was about ± 0.25 inch (0.5 inch peak to peak). Both drivers had effective radiating diameters of about 5 inches.

Figure 2 shows the on-axis phase response of the system, corrected for the arrival time of the tweeter signal. Figure 3 shows the related group delay versus frequency for the phase curve of Fig. 2. The group delay indicated that the woofer trails the tweeter by about 0.14 mS (140 μ S), which corresponds to a distance of 1.9 inches (48 mm). At the crossover of 3.3 kHz, this offset represents approximately 0.46 wavelength, or 170°.

The 1-meter, on-axis energy/time response (ETC) is shown in Fig. 4 for a test signal swept over the range of 200 Hz to 10 kHz. The response is good except for a few minor delayed peaks some 20 dB below the first arrival peak. Be mindful of the fact that this ETC represents essentially the tweeter's response only and emphasizes energy in the range of 2 to 9 kHz.

The off-axis response of the system was measured in three different ways. The first method displays the data in a three-dimensional format similar to the one seen in *Audio* loudspeaker reviews for the last few years. The second method closely follows the way the on- and off-axis response curves were measured and derived at Canada's National Research Council test facilities (see page 75 of the September 1989 issue for more information). The third method I used in evaluating off-axis system response displays the data in a polar format, showing how level changes with direction at a particular frequency.

Figures 5 and 6, respectively, show the "3-D" horizontal and vertical off-axis frequency response curves of the Model II. These curve sets were derived from measurements made at 5° increments along the major horizontal and vertical planes of the system. No additional smoothing was done on these curves except for the fairly high-resolution, 300-Hz, constant-bandwidth smoothing that results from the TDS data gathering process. Note that these plots have a logarithmic frequency scale and that all curves have been referenced (normalized) to the on-axis frequency response. As a result of the normalization, the on-axis response curve is a straight line. The normalized format is beneficial because it clearly indicates the differences between the on- and off-axis curves.

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The Model II's designer shaped its vertical polar response so that the sound would be smoothest at the listener's ears.

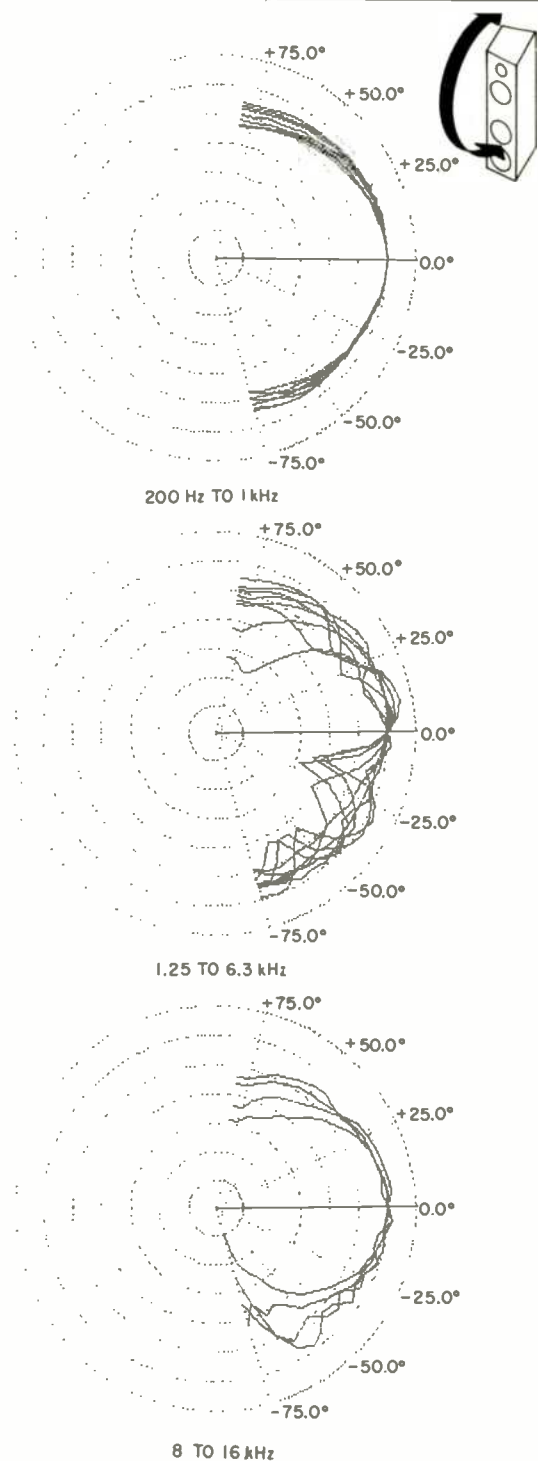


Fig. 10—Vertical composite polar responses.

The horizontal "3-D" off-axis curves in Fig. 5 indicate well-behaved off-axis behavior with wide, high-frequency coverage up to 12.5 kHz and out to about 50° off axis.

The vertical off-axis curves in Fig. 6 clearly indicate the effects of the crossover in a wide, two-octave range extending from 1.5 to 6 kHz. An off-axis null zone exists in the region from 2.5 to 4.5 kHz at angles between 10° and 20° below axis. At corresponding angles above the axis, a moderate peak in the response is evident in the same frequency range. The 5½-inch (140-mm) center-to-center spacing of the tweeter and woofer corresponds to about 1.3 wavelengths at the 3.3-kHz crossover frequency.

The asymmetrical up and down behavior of the vertical frequency response indicates that the woofer and tweeter are somewhat acoustically out of phase in the crossover region. This denotes a moderate amount of "lobing error" in the crossover frequency response. A separate measurement of tweeter and woofer/midrange individual phase-magnitude responses (not shown) revealed that the drivers were about 30° to 45° out of phase between 2.5 and 3.5 kHz. The phasing was such that the unavoidable crossover directional lobe was aimed upwards at about 12°. In this situation, the lobing error worked to the designer's advantage in smoothing the frequency response for upward angles at the expense of downward angles. If you frequently lie on the floor while listening to your system, this may not be the design choice for you.

The separate tweeter and midrange measurements also disclosed that the roll-off rates (electric and acoustic) in the crossover region between 1.5 and 5 kHz were approximately 6 dB/octave. This indicated why the crossover region covered such a wide frequency range, with its related irregular response behavior.

Electrical measurements of the crossover voltage drive established that the tweeter was rolled off below 3 kHz at 6 dB/octave. The woofer/midrange drive had a 6-dB/octave roll-off below 50 Hz and was allowed to run essentially on its own at all higher frequencies. (Apparently the series inductor on the woofer/midrange wasn't doing much because the electrical drive only fell at about a 1-dB/octave rate from about 1 to 20 kHz, where the total attenuation was only about 6 dB.) The lower woofers, wired in parallel, had a 6-dB/octave roll-off above 50 Hz, changing gradually to a roll-off of 12 dB/octave at higher frequencies.

Figures 7 and 8, respectively, show the mean horizontal and vertical on- and off-axis responses, measured and derived in the manner of the NRC tests. These responses were derived from the previous "3-D" data by calculating response averages of several adjacent curves in specific on- and off-axis angular regions. This spatial averaging (rather than frequency averaging or smoothing) tends to suppress the effects of localized response aberrations, due to diffractive effects, without minimizing overall response problems exhibited over broad angles. In a departure from the NRC test methods, mean axial responses were calculated separately for horizontal and vertical planes by averaging all the individual responses in a ±15° window. The mean off-axis responses were computed separately in both the horizontal and vertical directions from the ±30° to ±45° and ±60° to ±75° off-axis curves.

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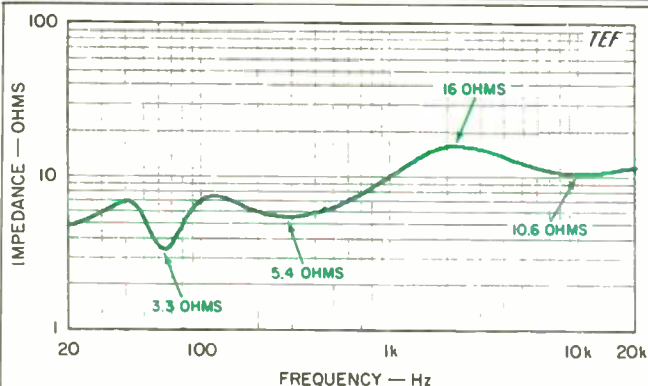


Fig. 11—Magnitude of impedance (see text); note the logarithmic impedance scale.

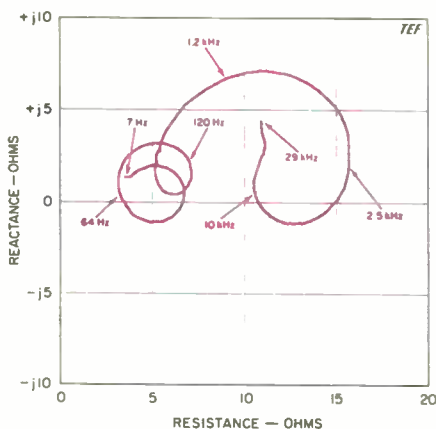


Fig. 12—Complex impedance, showing reactance and resistance vs. frequency.

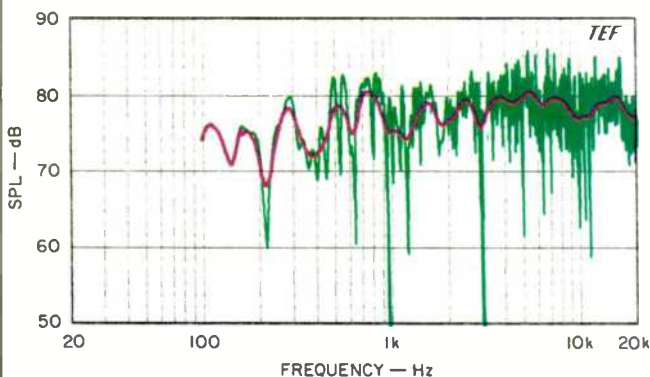


Fig. 13—Three-meter room response, showing both raw and smoothed data; see text.

The mean horizontal response curves are shown in Fig. 7. The mean axial horizontal response curve is fairly flat, although somewhat rough, falling within a ± 3 dB envelope out to 20 kHz (± 2 dB if the peak at 16.8 kHz is excluded). This curve represents the average frequency balance within $\pm 15^\circ$ of the axis horizontally but on-axis vertically. The slightly choppy 30° to 45° response fits in a fairly tight envelope of ± 2.5 dB out to 16.5 kHz. The 60° to 75° response is still not too bad out to 10 kHz, where the level drops quite rapidly with increasing frequency. Evident in all the curves is a tweeter high-frequency resonance occurring at 16.8 kHz.

The 60° to 75° response is representative of the spectrum of the sound energy that is reflected off the side walls in a typical listening room. If this response were quite uneven, it could contribute to making the image wander from side to side with frequency. The fairly smooth wide-angle response of the Model IIs means that they should image quite well over a broad horizontal listening area. The off-axis horizontal curves exhibit the effects of box-diffraction narrowing from 1 to 2 kHz. In this range, the box is approximately $\frac{1}{2}$ to 1 wavelength wide.

The mean vertical responses are shown in Fig. 8. The mean axial vertical response curve is not as flat as the mean axial horizontal response curve due to crossover effects from 1.5 to 6 kHz. The interference effects of the lobing error just below the axis, included in the $\pm 15^\circ$ averaging, affect the mean axial vertical response curve quite strongly. The mean off-axis curves, although somewhat similar to the horizontal curves, include crossover dips in the 2-kHz range. The 60° to 75° mean response represents the spectrum of the sound energy that is reflected off the floor and ceiling in a typical listening setup. An uneven vertical response, at large angles up and down, may cause an image to shift up or down with frequency because of differing amounts of reflective energy at different frequencies.

Figures 9 and 10 show, respectively, the horizontal and vertical off-axis behavior of the Model II in a polar format. These curves show how the level changes with direction at a particular frequency over the angular range of about $\pm 75^\circ$. All curves have been referenced (normalized) to the on-axis level and are shown for all the third-octave center frequencies in the range of 200 Hz to 16 kHz. For each figure, three composite polar plots are shown: Low to middle frequencies (200 Hz to 1 kHz), the crossover region (1.25 to 6.3 kHz), and high frequencies (8 to 16 kHz).

An omnidirectional response, exhibiting no change of level with direction, would be a perfect circle centered at the origin. A so-called constant-directivity speaker, even though having noncircular polar curves, would have curves that do not change with frequency, i.e., the shapes would be the same at all frequencies.

Figure 9 shows the horizontal composite polar plots, which are quite well behaved over the complete frequency range. Broad, even coverage is exhibited at most frequencies. Narrowing is exhibited in the crossover range due to box diffraction and exhibited at high frequencies due to tweeter directivity.

The vertical composite polar plots, shown in Fig. 10, are quite well behaved below 1 kHz and above 8 kHz. However,



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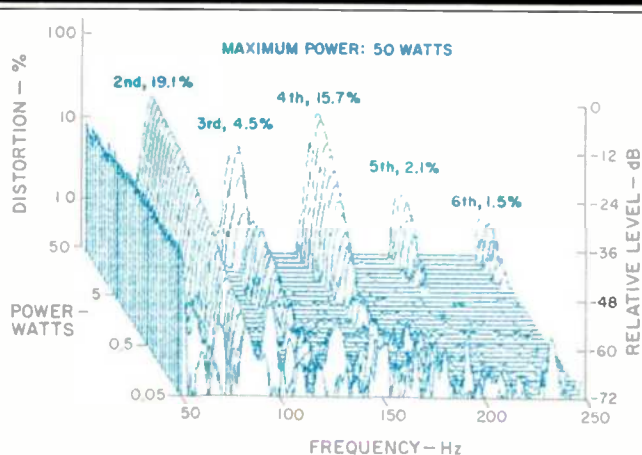


Fig. 14—Harmonic distortion products for the tone E_1 (41.2 Hz).

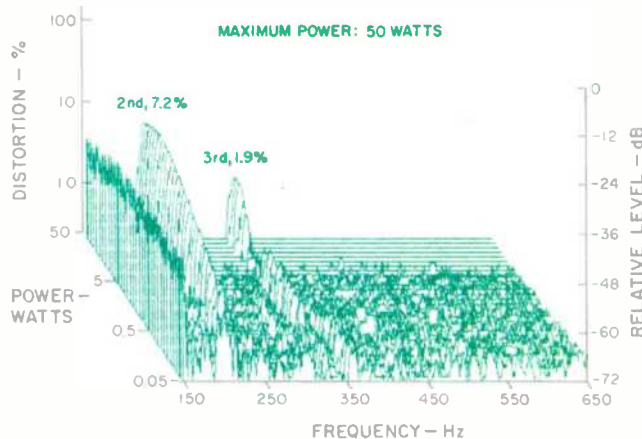


Fig. 15—Harmonic distortion products for the tone A_2 (110 Hz).

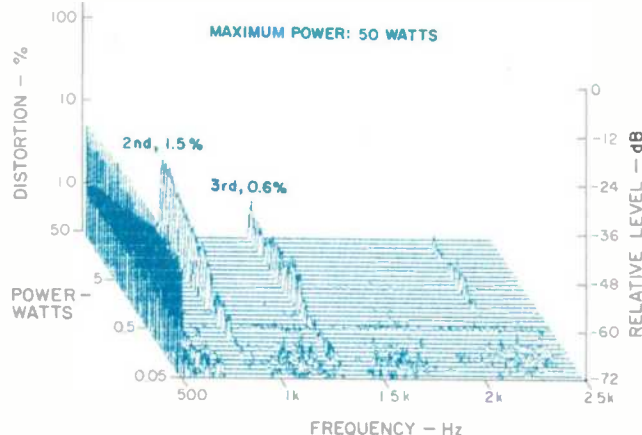


Fig. 16—Harmonic distortion products for the tone A_4 (440 Hz).

the crossover range of 1.25 to 6.3 kHz is quite uneven and exhibits many lobes. These unavoidable response variations are due to the physical displacement of the midrange and tweeter; as noted before, the units are separated by about 1.3 wavelengths at crossover. Note the response dips of 10 to 15 dB just below axis and the drastically changing level with angle. Note also the absence of such response dips at angles between 0° and 25° above the axis.

Clearly seen in the middle plot of Fig. 10 are the effects of lobing error (midrange and tweeter somewhat out of phase at crossover), which aims the lobe at crossover 10° to 15° above the axis. The designer is only free to change the direction of the main lobe at crossover by manipulating the drivers' relative phasing. A system exhibiting no lobing error would have its lobe facing straight ahead. Other relative phasing of the drivers will shift the lobe direction up or down. In the Model II, the designer has chosen to aim the lobe slightly upward, thus maximizing on-axis and above-axis frequency response at the expense of below-axis response. The shape of the lobe and its angular width depend primarily on the center-to-center spacing of the drivers, a parameter the designer does not have much control over.

Figure 11 shows the input impedance of the Model II plotted over the range from 20 Hz to 20 kHz and with a logarithmic vertical scale covering 1 to 100 ohms. A minimum impedance of 3.3 ohms at 65 Hz and a maximum of 16 ohms at 2.2 kHz was measured in the operating range of the system. Though the Model II is rated at 8 ohms, the 3.3-ohm minimum impedance reached in the bass range makes paralleling two sets of these systems a possible risk for most amplifiers—especially at high bass levels.

What appears to be the low-frequency, double-humped impedance characteristic of the vented-box cabinet is in reality the result of the Model II's crossover network combining the response of the three closed-box woofers. At the point of lowest impedance, 65 Hz, all three woofers are operating and are essentially in parallel.

The complex magnitude-phase (Nyquist) polar plot of the impedance is shown in Fig. 12. The polar curve is quite well behaved. No minor loops are exhibited, which indicates no spurious higher-order resonances in the cabinet or woofer drivers. The maximum positive (inductive) phase angle of 38° is attained at 900 Hz; the maximum negative (capacitive) phase angle of -14° is reached at 52 Hz. These moderate maximum phase angles will present no problems to most amplifiers.

Figure 13 shows the 3-meter room curve of the right-hand system when it was placed in the normal listening position in my new listening room. The test microphone was placed at ear level on the sofa where the listener normally sits. The system was swept from 100 Hz to 20 kHz with a 2.83-V rms sine-wave signal, equivalent to 1 watt into 8 ohms. The resultant SPL generated can be read directly off the graph. Also shown is a sixth-octave smoothed curve.

The parameters of the TDS sweep were set so that the direct sound and 13 mS of the room's reverberation were included. This amount of room sound represents approximately the effective averaging of the human ear, with its emphasis on the direct sound plus early energy arrivals. In general, the curve is not too ill behaved except for a peak at

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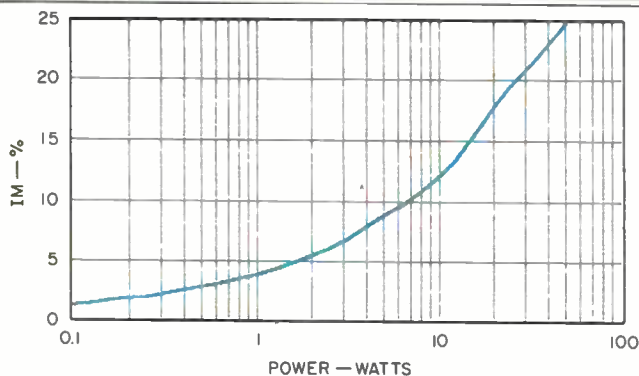


Fig. 17—IM distortion on 440 Hz (A_4) produced by 41.2 Hz (E_1) when mixed in one-to-one proportion.

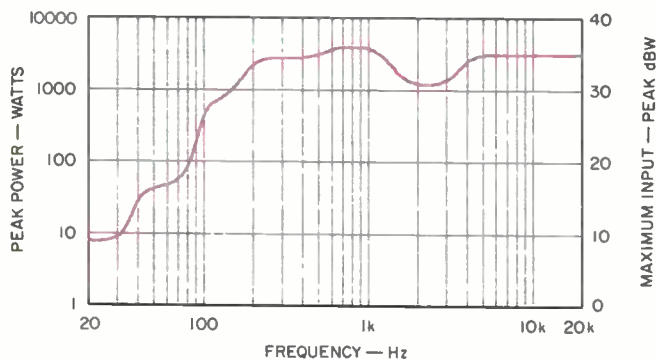


Fig. 18—Maximum peak input power vs. frequency; see text.

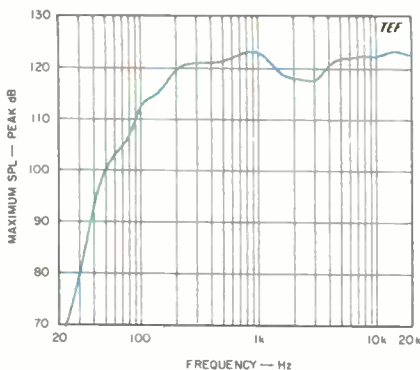


Fig. 19—Maximum peak sound output, measured at 1 meter on axis, for the input levels shown in Fig. 18; see text.

800 Hz and a depression in the lower ranges, presumably due to room effects. The effect of the floor-bounce reflection is clearly seen at about 220 Hz. I am going to reserve final judgement on this curve until I get more experience with other systems measured in this new room.

The distortion characteristics were measured in two different ways—by performing three single-frequency distortion spectra versus power level and by running an IM distortion measurement versus power level.

Figures 14, 15, and 16 show, respectively, the single-frequency harmonic-distortion spectra versus power level at the musical notes of E_1 (41.2 Hz), A_2 (110 Hz), and A_4 (440 Hz). These curves indicate how much harmonic distortion is generated by the Model II with the application of a single-frequency sine wave at power levels covering the range from 0.05 to 50 watts (–13 to 17 dBW, a 30-dB dynamic range). The power levels were computed assuming the rated impedance of 8 ohms.

The curves were run by successively increasing the sine wave input level in 1-dB increments (each step about 26% higher in power than the previous level). At each power level, a swept spectrum analysis was done over a frequency range covering up to the fifth or sixth harmonic. Two precision 1-dB/step attenuators were used in the setup—one in the send path and one in the receive path—to ensure that the steps in power level were accurate. The receive attenuator provides a constant fundamental level to the spectrum analyzer so that distortion percentages can be directly read off the plotted data scales.

Figure 14 shows the harmonic data for E_1 (41.2 Hz). The nonharmonically related spikes at lower power levels are byproducts of the measurement setup's background noise and are not generated by the loudspeaker. At most power levels, the second and fourth harmonics were found to predominate. At this frequency, the distortion was generated primarily from the high excursion of the system's dual woofers.

Separate near-field waveform measurements, comparing the top woofer/midrange with the bottom woofers, revealed that most of the distortion was being generated by the top woofer/midrange. The top woofer's waveform was highly distorted in one direction, with appreciable fourth harmonic visible in the waveform. The bottom woofers' waveforms were quite clean in comparison. A one-sided asymmetrical distortion mechanism generates high levels of second and higher even-order harmonics. This means that the top woofer was running out of excursion capability quite heavily in one direction.

The harmonic data for A_2 (110 Hz) is shown in Fig. 15. The data shows that only the second and third harmonics were significant. The second harmonic increased gradually with power, reaching a level of 7% at 50 watts. The third harmonic was quite low over most of the range and reached a level of 1.9% at 50 watts.

Figure 16 shows the harmonic measurements for A_4 (440 Hz). Again, the predominant distortion is a low amount of second and third harmonics, with only a very small amount of fifth harmonic.

Figure 17 shows the IM distortion on a 440-Hz (A_4) tone created by a 41.2-Hz (E_1) tone of equal input power. The IM



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An NHT Model II can generate respectable peak levels in excess of 115 dB SPL; a pair of them in a room could generate 123 to 131 dB SPL.

distortion gradually rises with power, reaching a level of about 18% at 20 watts and 25% at 50 watts. The first-order ($f_2 \pm f_1$) and second-order ($f_2 \pm 2f_1$) side frequencies contributed most to the measured total distortion, but IM products out to the fifth order were contributors. These IM levels are moderately high for a system having a combined woofer size equivalent to a woofer 10 to 12 inches in diameter. As before, near-field measurements revealed that most of the distortion was being generated by the top woofer/midrange.

Overall, the distortion measurements on the Model II are quite low for a system of this size, with the exception of IM. A high level of IM distortion is objectionable because it modifies the reproduction of upper frequencies when they coexist in music with high-level, low-frequency signals. It can cause a muddiness of mid- and upper-range reproduction and a masking of inner voices. (For more information, refer to several good papers by Paul Klipsch on modulation distortion in the April 1969, February 1970, and December 1972 issues of the *Journal of the Audio Engineering Society*. These and other highly recommended writings by Mr. Klipsch are available from Klipsch and Associates, Hope, Ark. 71801.)

Figures 18 and 19 show the short-term, peak-power input and output capabilities of the system, as a function of frequency. The tests were run by applying a shaped toneburst test signal consisting of $6\frac{1}{2}$ cycles of a sine wave, shaped using a Hamming raised-cosine envelope. The resultant test signal covers a third-octave bandwidth, and its time duration increases as frequency goes down. The burst is presented at such a low duty cycle that the long-term thermal characteristics of the speaker under test are not exercised. The test consisted of evaluating the maximum peak input power-handling capacity and maximum output peak sound pressure levels, at all the third-octave center frequencies in the range from 20 Hz to 20 kHz. A very powerful amplifier, capable of generating 5,500 peak watts (+37 dBW!, ± 210 V into an 8-ohm load), was used to drive the system. The peak input power was calculated by squaring the measured peak driving voltage and dividing by the rated 8-ohm impedance.

The test sequence consisted of determining how much of the special signal could be handled by the speaker, at each frequency, before the output sounded audibly distorted or the acoustic output waveform appeared distorted, whichever occurred first. At each frequency, the maximum peak input voltage and the corresponding generated peak output sound pressure level at 1 meter were recorded.

Figure 18 shows the maximum peak electrical input power-handling capacity of the Model II. The peak input power-handling capacity is seen to rise with frequency until about 200 Hz, where it levels out at about 3.2 kW. The knee in the curve at about 75 Hz and the dip at about 2.5 kHz were caused by excursion limitations of the upper woofer/midrange and the tweeter, respectively.

Though the system could not handle any more than about 10 watts below 25 Hz (for moderately clean output), high-level subsonic program material in this range will not cause intermodulation of the higher frequencies due to the high-pass filter on the upper woofer/midrange. However, be-

tween 40 Hz and 90 Hz, where the majority of bass energy is found in typical program material, the system is primarily limited by the excursion of the upper woofer/midrange because the internal high-pass filter has no effect in this range.

The Model II can actually handle more power than the curves show but at the expense of much greater distortion and possible risk of damage at higher frequencies. Conducting these tests, I actually burned out a tweeter at a level of 180 V peak at 4 kHz. (Gee whiz, the system would only handle 4,000 watts—it's no darn good! Only kidding.) I subsequently limited the level to 160 peak V, which resulted in the high-frequency, 3.2-kW system limitation.

Figure 19 illustrates the maximum peak sound pressure levels the system generated at a distance of 1 meter on axis for the levels shown in Fig. 18. The graph shows that the Model II can generate very respectable peak levels in excess of 115 dB SPL at frequencies above 150 Hz. Between 20 and 100 Hz, the maximum output rises at about 20 dB per octave. Of course, two of these systems operating in a typical listening room will be able to generate much higher levels in this critical low-frequency range, due to mutual coupling and boundary effects. The room provides some 5 to 10 dB of low-frequency gain, while a pair of systems increases the level some 3 to 6 dB.

Use and Listening Tests

The listening tests were conducted in my new listening room, which, with a volume of about 3,400 cubic feet (43 cubic meters), is fairly large. The room dimensions are approximately $15\frac{1}{2} \times 27 \times 8$ feet. The floor is carpeted, and the room has normal living-room style furnishings. The short wall is filled with deep floor-to-ceiling bookshelves and an equipment cabinet. Listening equipment consisted of an Onkyo Grand Integra DX-G10 CD player, a Krell KSP-7B preamp, a Krell KSA-200B power amp, and Straight Wire interconnects and speaker cables. As usual, most of my listening evaluation was done before the measurements were made.

The Model II loudspeakers were placed well out in the room, 6 feet (1.8 m) away from the short wall, and separated by about 8 feet (2.4 m). This left a spacing of about 4 feet (1.2 m) from the side walls. The sides of the systems were parallel to the room's walls, which aimed the systems' axes directly at me due to the slanted configuration of the cabinet's front baffle. Most listening took place on the sofa, about 10 feet (3 m) away.

My first impression of the systems was quite favorable because they did a good job in filling my new, larger listening room with a broad, well-defined, controlled soundstage. The stereo imaging was quite precise, and lateral orchestral instrument placement was very good. The speakers also had no trouble reaching very respectable levels on program material that demanded it.

The NHT systems did a good job on solo soprano voice but were a bit crisper on high frequencies than my reference system when playing *The English Lute Song* (Julianne Baird and Ronn McFarlane, Dorian DOR-90109). A fine sense of air and detail was demonstrated on the delicate high-frequency bell and percussion sounds on track 6 of David Chesky's *Club de Sol* (Chesky JD33). The reproduc-

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The highs were listenable and revealing, and the lower bass will please all but those who like their rooms to shake.

tion of male vocals and harmonies on Papa Doo Run Run's *California Project*, which includes a very good Beach Boys simulation (Telarc CD-85501), revealed a smooth upper bass and midrange character.

The low bass below 40 Hz was definitely lacking, however, as compared to my reference systems. This was judged by playback of the 20-, 25-, and 31.5-Hz third-octave band-limited pink-noise tracks on the Brüel & Kjaer Pro Audio demo disc (CD-4090). In the next higher octave, between 40 and 80 Hz, where the major bass energy in typical program material is found, the NHT speakers did a very respectable job. Reproduction of the proverbial Telarc bass drum on the "Poet and Peasant Overture" (*William Tell and Other Overtures*, CD-80116) sounded as powerful as ever. The kick drum on *The Sheffield Track and Drum Record* (CD-14/20) did not quite have the gut punch of my reference systems but was still very satisfying. The NHTs did do an excellent job on the high-level dynamics and transients of the drum solo on track 5 of the Sheffield disc.

Playback of high-level, band-limited noise between 50 and 100 Hz did reveal some distressed clicking sounds which were generated by the upper woofer/midrange. Some unevenness in the bass line and a slight one-note bass characteristic on the acoustic guitar and double bass of track 12 of the *Stereophile Test CD* (STPH-002-2) were noted. Some muddiness of choral vocals was heard on

track 7 of the same disc when high-level pipe organ pedals were played.

On pink noise, the system passed the walk-around, stand-up, sit-down test to check evenness of coverage. However, upper-midrange roughness and changes in spectrum were heard when moving up and down. Minimal differences could be heard on piano reproduction when compared to my reference systems, and the NHT speakers had good lower register reproduction and impact (B & K CD, track 4). The Model II did an excellent job, at high levels, reproducing the live jazz club ambience and kick drum on "Count Down" from *Dave Grusin and the NYLA Dream Band* (GRP GRD-9501).

In conclusion, the Model II speakers yielded excellent stereo imaging and lateral soundstaging along with a smooth, coherent upper bass and midrange. The high-frequency reproduction, although a bit on the bright side, was very listenable and revealing of program material. The bass reproduction, despite exhibiting somewhat higher distortion than it could have, was quite capable and did justice to most of what I listened to. Only aficionados of large, room-shaking subwoofers would be disappointed in the NHT's lower-octave bass response. The compactness, performance, striking physical styling, and innovative design features of the Model II make it a desirable system to own.

D. B. Keele, Jr.

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REFINED RECORDER



Vivaldi Recorder Concertos. Peter Holtslag; The Parley of Instruments. Hyperion CDA 66328, CD; 59:59.

Vivaldi is still everywhere these days, though his aristocratic nose is mildly bent by that later rival, Mozart. If you are still with Vivaldi, here is a fine chance to get closer to his enormous output of practical music, largely composed to show off the extraordinary prowess of the female orphans he taught at the Pietà, a remarkable place where these ladies were trained for life in the highest circles.

You must understand that the baroque-period concerto was first of all a contrast between a solo virtuoso, or solo group, and something larger—often hardly any larger at all. There is no "orchestra" here, just individual instruments, but you will be aware of the familiar concerto sound, soloistic passages set off by intervening "tutti"—even without an orchestra. Via recording, you can make the music as loud as you wish, and these performances are satisfyingly full bodied.

Three of the works are for soprano recorder, an astonishing tiny instrument. Two dogs' ages ago, I bought one for myself to supplement a much bigger alto instrument. It was slightly

larger than a fat pencil; my fingers were too wide to fit over the tiny finger holes, so I could barely play the simplest tunes. One day it flew out of my shirt pocket, it was so portable, and that was that. If I were not familiar with this music, I would gasp at these soprano concertos. Remember the piccolo in Sousa marches? It's that kind of music but nonstop, the most astonishing virtuoso stuff you'll ever hear. Yet obviously it was played in Vivaldi's time; it is played again now, better and better, on exactly the same little instrument, so many holes in a piece of wood. Unbelievable.

The other concertos feature a larger recorder, the treble, which is better known in the U.S. as the soprano in C. Lovely stuff, this too, the recorder matched to two violins, pleasantly steely in sound (are they the older baroque configuration?) and a varied continuo, organ or harpsichord, properly subdued in the background. One concerto in particular, the next to last on the disc, is suddenly more powerful, definitely beyond the others and evidence of Vivaldi's reserve power—it may remind you of the pastoral music in Beethoven's Sixth Symphony in the same key of F. Good recording!

Edward Tatnall Canby

Penderecki: Symphony No. 2; Bruzdowicz: Concerto for Double Bass and Concerto for Violin. Polish Radio National Symphony Orchestra, Jacek Kasprzyk. Arthur Rubinstein State Philharmonic Orchestra of Lodz, Andrzej Markowski; Fernando Grillo, double bass; and Krzysztof Jakowicz, violin.

Olympia OCD-329, CD; 67:19.

This is a bit of a grab bag. Krzysztof Penderecki's Second Symphony, called the "Christmas" Symphony, was commissioned by Zubin Mehta for the New York Philharmonic and composed during 1979 and 1980. The reference to Christmas is occasioned by quotations of "Silent Night," but the general texture is quite un-Christmasy, being dense and even rather morose, with heavy reliance on oppressive brass harmonies.

The program notes refer to it as a one-movement work to which the composer has said he plans to add. The recording, made in Katowice in 1981 (that is, only about a year after the first New York performance), is divided into two movements with a more than minimal pause between them. I'm at a loss to explain the disparity.

The scoring is vivid, as you can expect from Penderecki. The orchestra, which is efficient and altogether professional, has no special luster to bring to the score, however. The recording itself is similarly no more than competent. All in all, it is an effort that is worth acquiring for Penderecki's sake, though it will win no orchestral or recording awards.

The two concertos of Joanna Bruzdowicz, recorded in 1984 and presumably in Lodz, are an entirely different matter. A Pole who studied in France and married a Belgian, she founded and directs the Frederic Chopin and Karol Szymanowski Society in Belgium (which, perhaps not coincidentally, also happens to be home for Pavane Records, co-producer of this release). Her music demonstrates the influence of her teacher, Nadia Boulanger, but it is sufficiently witty and creative to avoid any suggestion of being derivative.

The beautifully recorded Concerto for Double Bass (1982) is quite exciting, in fact. Granted, a solo double

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Laura Hunter is splendid on an unexpected classical instrument, and synthesist Brian Connelly provides sympathetic accompaniment.

bass generally sounds like a dancing elephant—particularly when it tries not to do so. That is, the daintier it attempts to sound, the more preposterous it becomes. But Bruzdowicz revels in its very bulk and ungainliness; in consequence, the piece works. The very close miking of the solo instrument, picking up every nuance of the articulation, adds to the sonic intensity.

The Violin Concerto, written six years earlier, is more rhapsodic and, partly because the solo instrument is more conventional, less striking. The solo instrument is perhaps too closely miked in this case; it sounds rather oversized and slightly harsh. But the writing is no less intense than that of the other concerto, and both are rewarding.

Robert Long

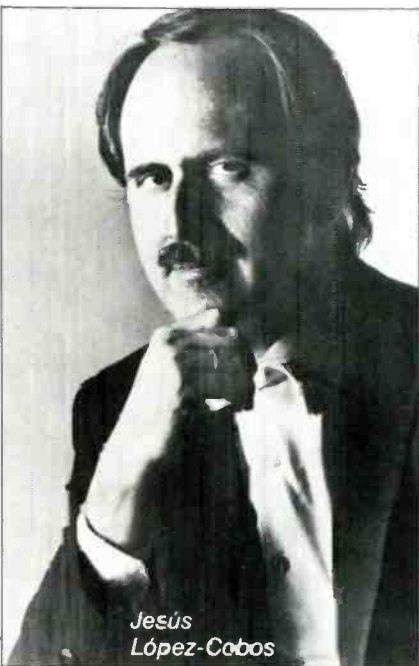
Duo Vivo. Works by Rodney Rogers, William Bolcom, Paul Cooper, Arthur Gottschalk, and Steven Galante. Laura Hunter, alto sax; Brian Connelly, Yamaha P1/DX7 synthesizer.

Crystal CD-651, CD; 67:29.

I got to listen to about half of this lively duo's offerings, enough to find that Laura Hunter is a splendid artist on her unexpected ("classical") instrument, and Brian Connelly a closely sympathetic accompanist. Unfortunately, when number 8, the second of four impromptus by Paul Cooper, flashed up on my player's display, things began to go awry—Cooper for a moment seemed terribly repetitive, as I listened some distance from the player. He was indeed—the same spiral of pits, over and over, while the numbers jumped crazily. I tried all the usual remedies, taking the disc out and replacing it carefully and with a half turn, all to no avail. My player would go no further. It happens—this machine is in-

formative if only because, being a few years old, it perhaps is more sensitive to disc faults than some newer players. Useful for a reviewer! So I heard the Rodney Rogers "Nature of the Working Wheel" and William Bolcom's "Lilith," in five short movements. The Yamaha DX7 synthesizer, alas, remained silent, in the unplayable portion.

Crystal Records' Peter Christ (rhymes with gist) is well known for excellent programming, in the choice of instruments and artists, and especially in the actual performance order that we hear. This is an interesting close-up view of the familiar sax in its not-so-well-known classical and contemporary vein. Quite something! This is a very versatile instrument, in case you think its main personality is 1930 big-band sound. Never forget that the saxophone was invented strictly for "classical" purposes. Monsieur



Jesús López-Cobos

Adolphe Sax was the Frenchman responsible, quite some years before big band and jazz!

Is it wise to begin with a less-than-exciting work? Maybe, if you are going to include it in your program. The piece about the wheel is full of symbolism, but the music, 16 minutes or so, is one of those all-too-derivative works, skillfully written, covering an old-fashioned idiom with splashes of dissonance, suggesting now this earlier composer, now another, and always (to my ear) with the thought that the original was a lot more persuasive. The novelty of the sax was very present, to carry forward your interest. William Bolcom, an older contemporary and somewhat of a curmudgeon, was more fun. He is on the acid side and not lovely, but your attention is immediately grabbed. A good man, if cantankerous.

That's as far as I got. I regret Mr. Cooper's repetitious grooves, and Messrs. Gottschalk and Galante remained mum. Maybe it was just my individual pressing.

Edward Tatnall Canby

Bruckner: Symphony No. 7 Cincinnati Symphony Orchestra, Jesús López-Cobos.

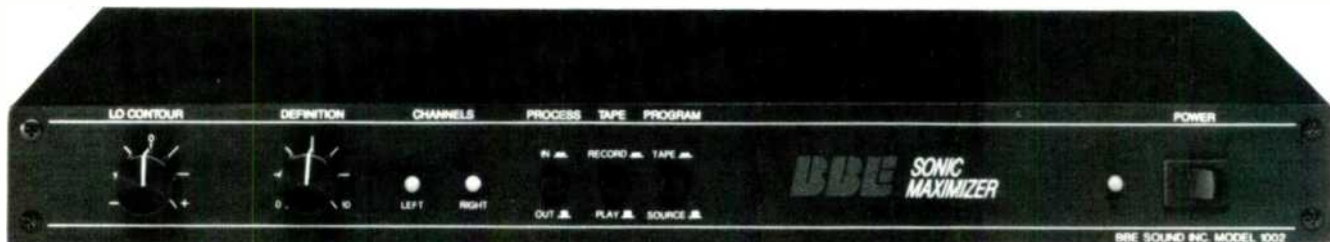
Telarc CD-80188, CD; DDD; 66:40.

At first glance, this recording may seem somewhat incongruous—the new conductor of the Cincinnati Symphony Orchestra, Spanish-born Jesús López-Cobos, performing the music of Bruckner. One expects a conductor with a Spanish background to be especially empathic to the music of countrymen Falla and Albéniz, and indeed, Telarc has recorded López-Cobos in a splendid performance of Falla's ballet *The Three-Cornered Hat*. However, it turns out that López-Cobos has made a specialty of the music of Bruckner.

In this recording of the composer's Seventh Symphony, he provides a performance in the best grand Mittel European tradition. Against such Bruckner stalwarts as the late Herbert von Karajan, López-Cobos makes a profound musical statement. His performance has nobility and majesty, as exemplified in the great second movement. The scherzo is dynamic and propulsive. The finale is at a tempo consistent with Bruckner's admonition, "doch

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- DJ Times

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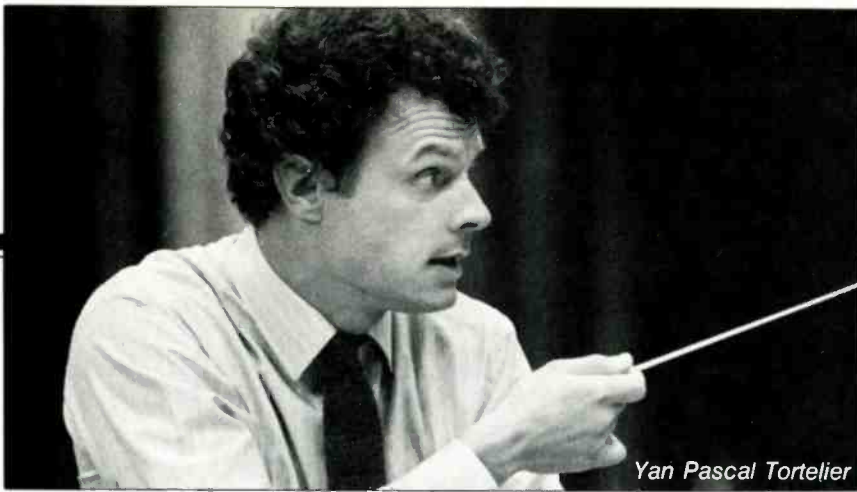
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Yan Pascal Tortelier

nicht schnell" (not too fast), and the music progresses to grandiose climaxes with massive brass chords.

No question, this is a most compelling read, but it also has the considerable advantage of some of Telarc's most resplendent sonics. The disc was recorded in Cincinnati's Music Hall, and its sound combines tremendous weight and thrust with great clarity and detail, as well as very wide, expressive dynamics. One can hear, especially in the scherzo, great outpourings from the trumpets, trombones, and tuba on the right; the same phrase is then answered by huge French horn chords on the left. A moment later, there are timpani figures played at barely audible pianissimo levels, with the timbre of the drum heads still perceptible. All in all, this Bruckner Seventh Symphony is a triumph—glorious sound and an uplifting musical experience. *Bert Whyte*

Debussy: La Boîte à Joujoux; Ravel: Ma Mère l'Oye. Ulster Orchestra, Yan Pascal Tortelier.
Chandos 8711, CD; DDD; 57:09.

Both the rarely played "Toybox" of Debussy and the more familiar "Mother Goose" ballet of Ravel are prime examples of extravagant orchestral color. The string writing, exotic percussion, and above all, the intricate interplay of the woodwinds and variations in dynamic expression require playing of very high order. Any recording of this music must provide a very clean, open, and highly detailed sound.

The Ulster Orchestra, now under the baton of Yan Tortelier, exceeds the demands of the music, and Chandos has produced a superbly balanced recording in the richly resonant acoustics of Ulster Hall in Belfast.

There are quite a few CD recordings of the "Mother Goose" ballet with prestigious orchestras and conductors, but Tortelier wins the day with his light, deft touch and exemplary execution from

his players. This Chandos recording is a model of high orchestral definition coupled with transparency and acoustic warmth. *Bert Whyte*

Carl Philipp Emanuel Bach: Musikbeispiele. Assorted German performing groups.

Capriccio 10-999, CD sampler; DDD; 25:00.

Longtime record collectors remember the LP sampler, a sales device that became possible when the LP first appeared—the 78 being much too short, in itself no more than a sample. With CD, the breed is returning in improved form. This one is astonishing, simply in that it samples a series which contains an enormous batch of CDs covering a considerable part of the even more enormous output of this middle Bach son, the most gifted and learned next to the old man himself. A generation ago, C. P. E. Bach was mostly a name in the history books, though he was a profound influence in his time and later. A few pieces in student books, a movement or two, and that was it.

Yet now comes this series of 14 well-filled CDs, every last note by C. P. E. Bach. Judging by the samples here, every CD is worthy of your attention, if you enjoy a kind of introspective cross between "old Bach" (*the* Bach) and Mozart, who learned much from Carl Philipp Emanuel and his younger brother in London, Johann Christian. You'll hear the "Mozart" all right—though that genius was a child when much of this music was composed. You'll also hear gratifying echoes of the baroque and the earlier Bach, the son after the father.

This sampler gives one *complete* movement—unaltered—from each of eight items: Concerti, symphonies, choral music, a flute sonata. And there's plenty more where this came from; the volumes are all available separately. *Edward Tatnall Canby*

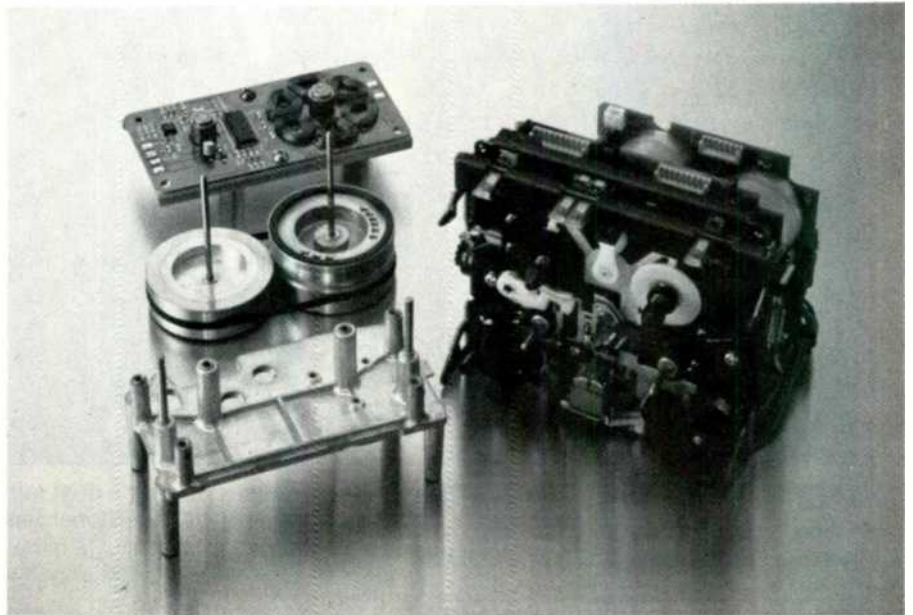
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Missing . . . Presumed Having a Good Time: The Notting Hillbillies
Warner Bros. 26147-2, CD; DDD;
 40:45.

Sound: A- Performance: B

Mark Knopfler has decided to reform Dire Straits in the fall of 1990; perhaps this little side trip through some of his roots helped him make that decision.

The Notting Hillbillies consist of Knopfler, Steve Phillips and Brendan Croker on guitar and vocals, Guy Fletcher on keyboards and vocals, Knopfler's manager Ed Bicknell on drums, and Nashville studio ace Paul Franklin on pedal steel guitar. Phillips and Knopfler were students in Leeds, England in the late '60s, when they worked together as a guitar duo doing American traditional country songs by the Delmore Brothers and others of that ilk. When Knopfler moved to London to start Dire Straits, Brendan Croker took his place with Phillips, but Mark stayed in touch. More recently, on Croker's fine pub-rock album, *Brendan Croker & the 5 O'Clock Shadows* (Silvertone 1209-2-J), Knopfler played sparkling lead guitar on the opening track, "No Money at All," and brought along his

buddy Eric Clapton to sing a duet with Croker on another track. Fletcher has been a stalwart in Knopfler's music since '83, when they worked together on the film score of *Cal*.

Missing is an amiable and low-key affair. It sounds like the music these fellows might play in a living room circle, swapping tunes old and new. "Railroad Worksong" is a variation on Leadbelly's "Take This Hammer" filtered through Merle Travis. "Bewildered" is a pop song, vintage 1938. "Blues Stay Away from Me" is one of the best and best known of the Delmore Brothers songs, while "Weapon of Love" is a Korean War/Louvin Brothers hymn in uniform. Charlie Rich first did his "Feel Like Going Home" back in '70, and "Run Me Down," "One Way Gal," and "Please Baby" are all listed as being traditional arrangements by The Notting Hillbillies. For new songs, Knopfler contributed the languid "Your Own Sweet Way" (which might have been an appropriate title song), Phillips wrote the traditional sounding "Will You Miss Me," and Croker contributed the wistful "That's Where I Belong."

Most of all, this is a country album played with the warmth and intimacy of long-standing camaraderie. It is an en-

semble album in the very best sense, as the spotlight is shared both vocally and instrumentally. Still, it is usually very easy to pick out and savor the distinctive style and sound of Knopfler's guitar leads. Franklin's pedal steel (rumored to be an element in the re-forming Dire Straits sound) and Fletcher's keys are more atmospheric than anything else. The project started as Knopfler and Fletcher producing the Phillips/Croker duo, so it seems fitting that those two do the lion's share of the lead vocals. However, the four-way harmony is as smooth as it needs to be.

The recording is digital, so the excellent presence and clarity come as no surprise. Bill Schnee's mix is right on the money, balancing all the parts beautifully.

Missing is an easy-to-take album. The ensemble performance feels ego-free, something all too rare. This is not the most fiery work these guys have done, but the pure class of the work and its smoothness have forced me to reconsider the performance grade I originally gave the album. I have upgraded a C+ to a B for these reasons. Here, familiarity breeds appreciation. The album achieves just what it sets out to do. It delivers a warm set of music shared by friends.

Michael Tearson

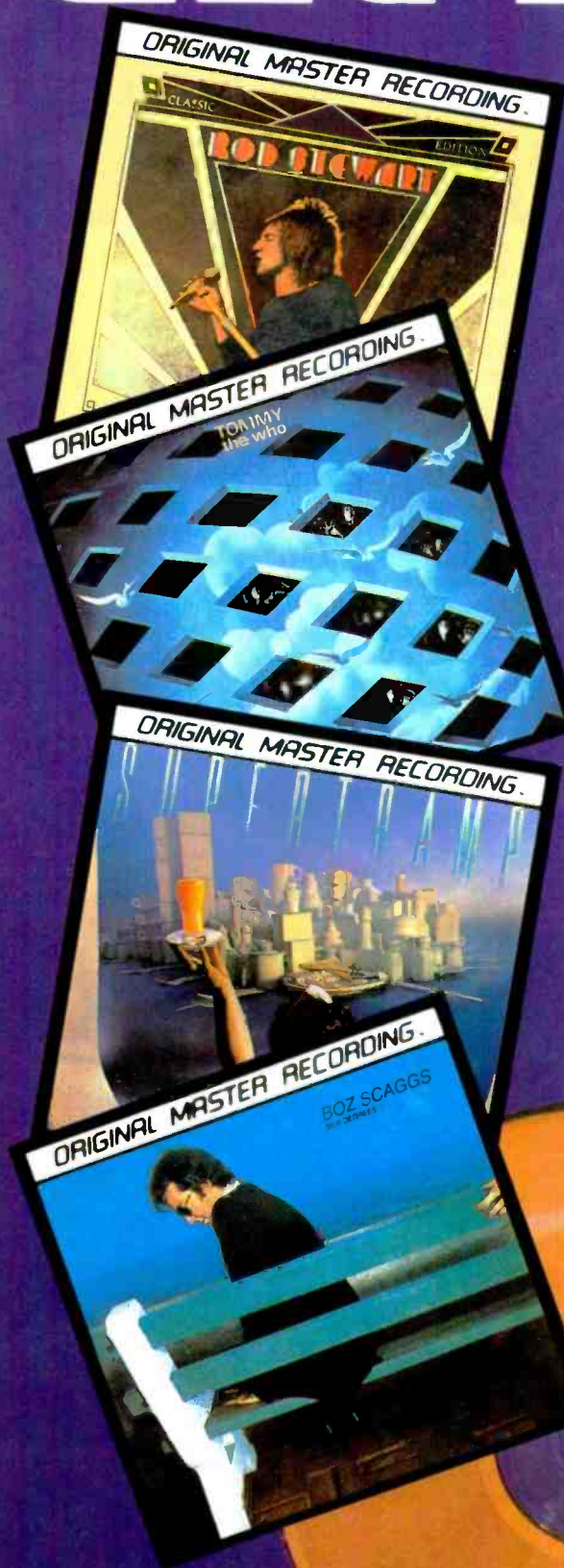
Blazing Away: Marianne Faithfull
Island 422-842-794-2, CD; AAD;
 72:07.

Sound: A- Performance: B+

Marianne Faithfull has had a very strange career and life, and in this live document she manages to combine their disparate elements into one concise package. Although it may be hard to reconcile that all of the songs on this album could be conveyed by the same person, such is the case. If one were to take the studio versions of "As Tears Go By," "Sister Morphine," "Broken English," and the newest song, "When I Change My Life," and string them end to end, there would be a problem with consistency, but Faithfull manages to personalize her delivery to such an extent that there is no radical jump between songs. Instead, the album more or less illustrates her life story better than if she told it.

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Marianne Faithfull manages to personalize her delivery, so the album illustrates her life story better than if she told it.

The band backing her up on this tour de force is a very capable bunch, led by her co-writer/rhythm guitarist Barry Reynolds, who is responsible for about half of the song collaborations. Bassist Fernando Saunders and pianist Mac (Dr. John) Rebennack turn out very respectable performances, and there is a very nice blend of band and audience response (credit producer Hal Willner). Guitarist Marc Ribot and trumpeter Lew Soloff sound a bit out of place at times, but those who have witnessed Faithfull's more recent concert appearances, accompanied only by Reynolds (and at times Saunders), can attest to the fact that the woman is most compelling when her backing is minimal. On the songs that lean the furthest in this direction, "Sister Morphine" and "As Tears Go By," the marriage of singer and musicians works the best. Any art student knows that a beautiful picture works best with the least intrusive frame.

The title track, which is the only studio performance on the album, is fairly good, but the live performance of "When I Change My Life" (also a



Luka Bloom



brand-new song) ranks far superior. One hopes that soon the comparisons to Edith Piaf, Lotte Lenya, and Marlene Dietrich will evaporate and people will realize that indeed Faithfull is an artist all to herself. *Jon & Sally Tiven*

Riverside: Luka Bloom
Reprise 26092-2, CD; ADD; 44:31.

Sound: B+ Performance: B+

Irish bard Luka Bloom spins songs that are by turns bright and joyous and dark and mysterious. At the core of *Riverside* is the singer strumming his guitar. There are additional instruments strategically deployed throughout the album—fiddle, mandolin, cello, flute, keyboards, and bass and electric guitar plus drums, bodhran, and tombak for percussive colors. But the focus stays on Bloom, his guitar, and the songs.

On the upbeat side, highlights include the aptly named "Delirious", which opens the album with a chuckle from Bloom, the imaginary love fling of "An Irishman in Chinatown," and the jaunty "You Couldn't Have Come at a Better Time." On the somber side, but equally impressive, are Bloom's moving song to the father he never knew, "The Man Is Alive," the longing "Dreams in America" and "This Is for Life," and the story behind the suicide of Jacqueline Roque, the wife who survived Picasso, in "Gone to Pablo."

Luka Bloom wasn't always Luka Bloom. He used to be Barry Moore, younger brother of Christy Moore, who is regarded as a national treasure back home in Ireland. To escape Christy's long and imposing shadow, Barry felt he had to reinvent himself. The Bloom comes from James Joyce's masterpiece, *Ulysses*, and the Luka comes from the Suzanne Vega song of that title. Here Luka Bloom emerges as a poetic romantic of the first order. The

air of mystery deeply infused into the album recalls Van Morrison's *Astral Weeks*.

Riverside really is a debut for Bloom even though Barry Moore previously made several records in Ireland, material he now dismisses. As a debut it is quite auspicious and successful, for it stakes out Luka Bloom's territory and styles and establishes him as a vivid song man with a sure eye for detail and a keen ear for melody. He also has real confidence, which supports his performance.

One quibble about the packaging: *Riverside* is an album that fairly begs for a lyric sheet to better admire and appreciate Bloom's fine wordplay.

Michael Tearson



Blue Sky Mining: Midnight Oil
Columbia CK 45398, CD; DDD; 46:52.

Sound: A Performance: C-

Very few established, veteran bands do college-radio music well. There's something in that music's mix of new-found intellectual emotion that can't easily be duplicated once you've grown a little jaded and the blinders come on—even, as *Blue Sky Mining* disappointingly proves, if you're Peter Garrett and obviously sincere.

The sincerity part I can deal with; it's the album's obviousness that sends me screaming, though the almost utter lack of rhythmic dynamics doesn't

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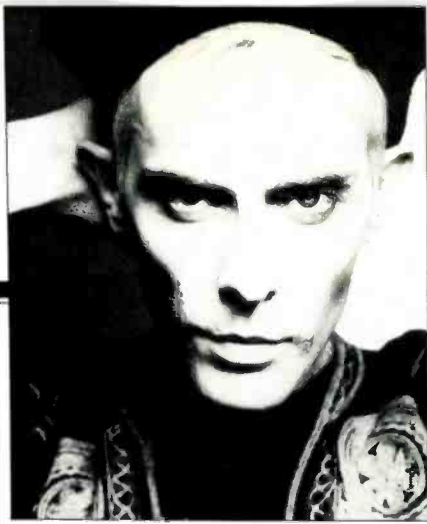
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Peter Murphy's fusion of folk-rock, techno-pop, and intelligent lyrics might tickle your cerebrum while you boogie.



help. Garrett and company start out promisingly time and again, with ringing, crystalline acoustic-guitar melodies, or spooky, minor-chord thrums like a 25th-century jungle ("Bedlam Bridge"), or even somber chants ("Antarctica") that evoke desperation. The musicianship is unerring, the sound al-

most off-putting in its flawless reproduction. And each song devolves into hopeless meandering melodies and alternately abstruse and hackneyed, uninspired lyrics.

Those lyrics are all as high-minded as fans of Midnight Oil have come to expect, but there are more iconic clichés per minute than in your standard TV news year/decade/century-in-review clip. One song exhumes Kennedy's shadow and Elvis Presley's white shoes. "Forgotten Years" opens with an intriguing traffic-sound montage and a catchy guitar run but resurrects a worn-out rock lyric—"Few of the sins of the father are visited upon by the son"—that I had hoped had been retired after Bruce Springsteen's *Darkness on the Edge of Town* period. Nor are the songs' concerns and observations much more than generalities. "The dollar is driving us still," Garrett intones in drummer Rob Hirst and guitarist/keyboardist Jim Moginie's "River Runs Red." Really? Yawn. Elsewhere we simply get clubbed over the head and are left dazed and confused: "If the sugar refining company won't save me/Who's gonna save me?"

I confess I felt the same thing waiting for *Blue Sky Mining* to be finished.

Frank Lovece

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Deep: Peter Murphy
Beggars Banquet/RCA 9877, LP;
45:14.

Sound: A Performance: A -

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Michael Wright

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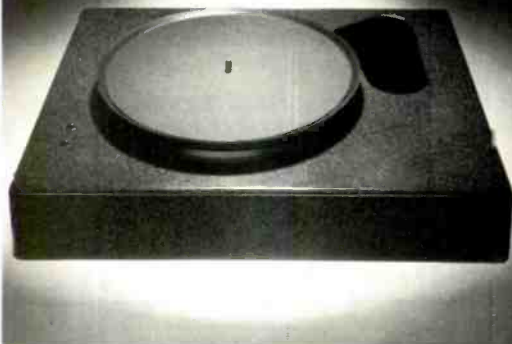
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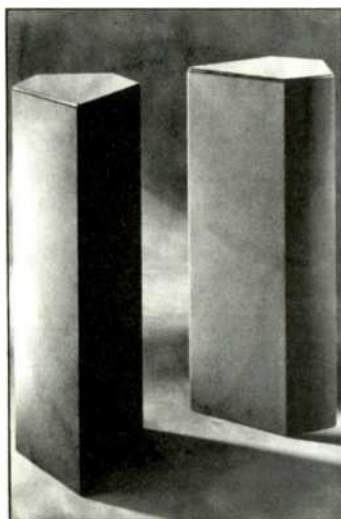
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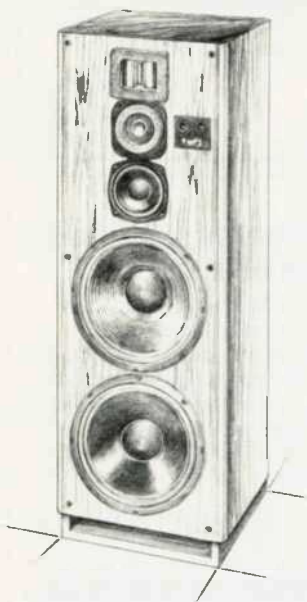


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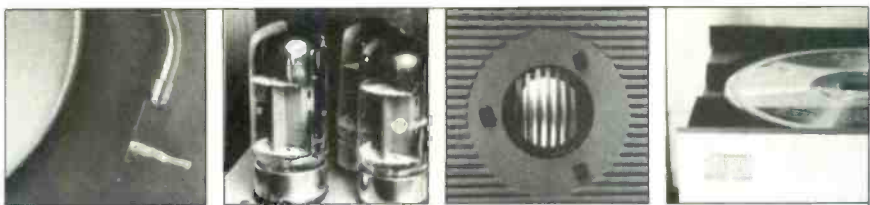
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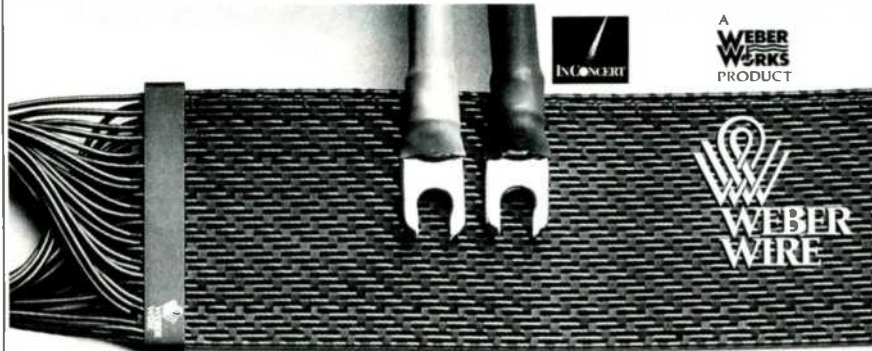
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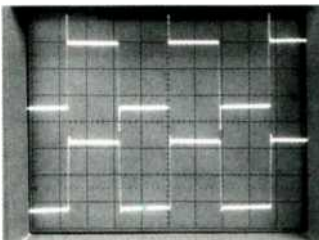
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