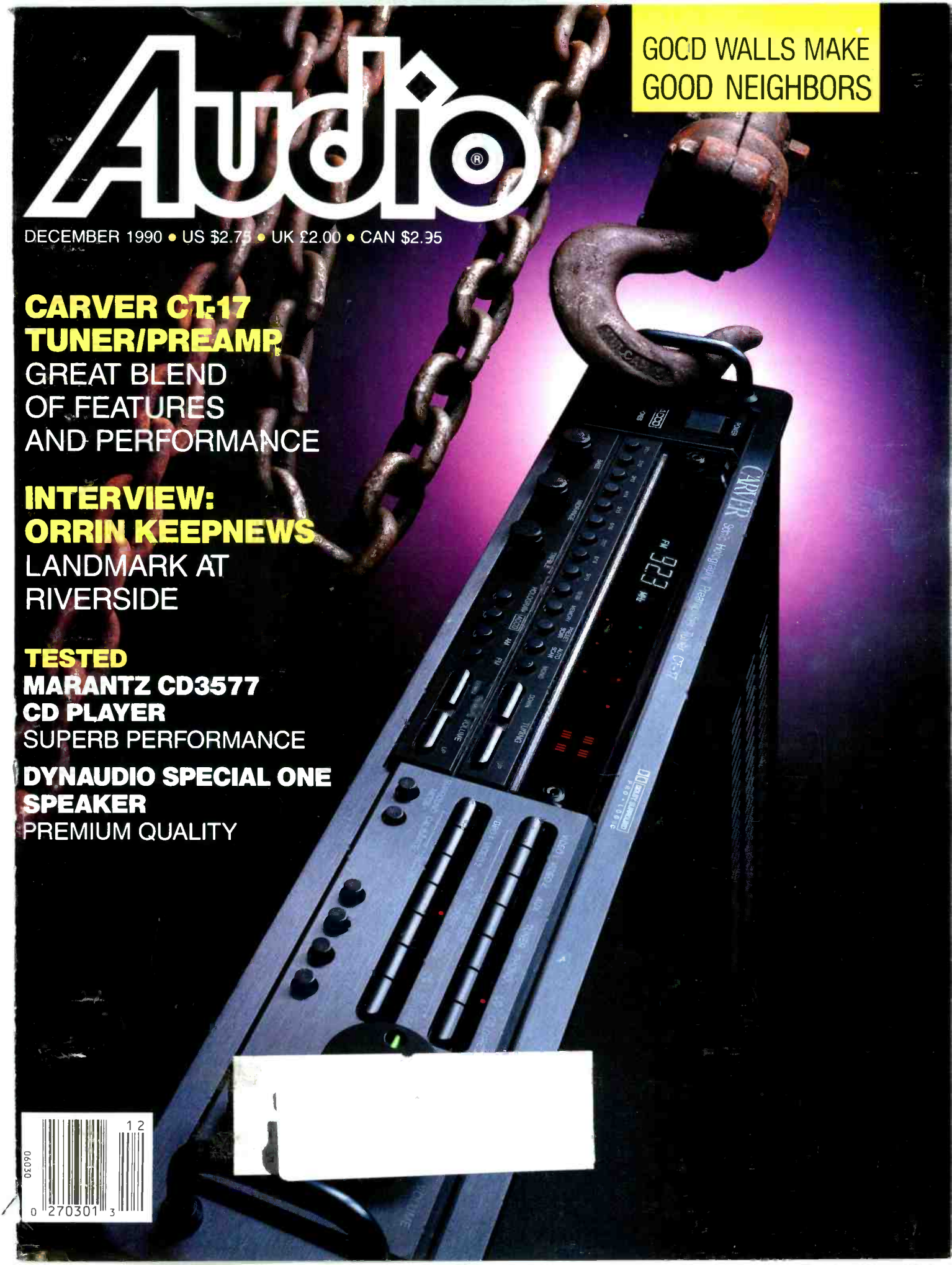
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(Bound for Sound, June 1990)

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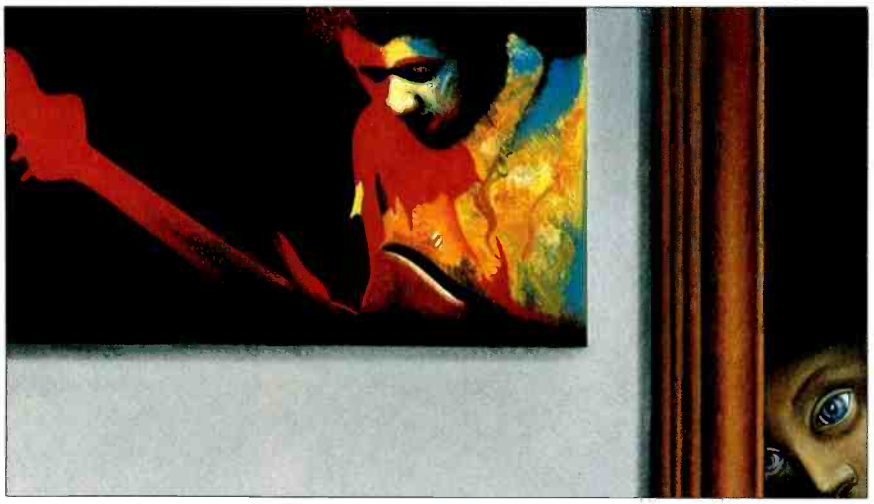

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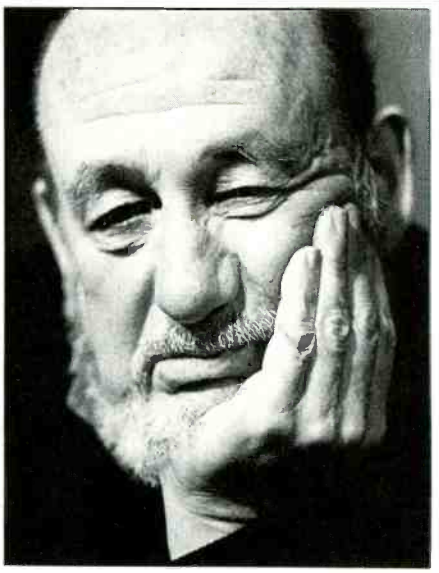

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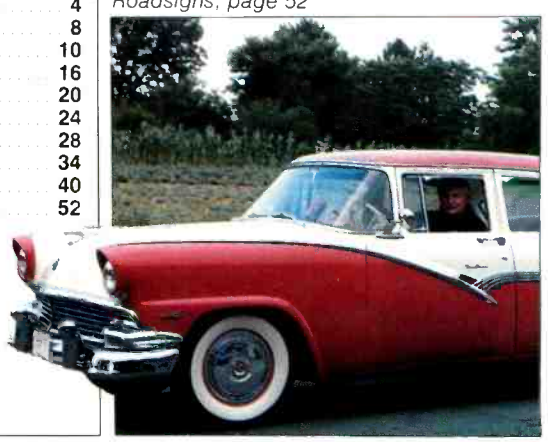

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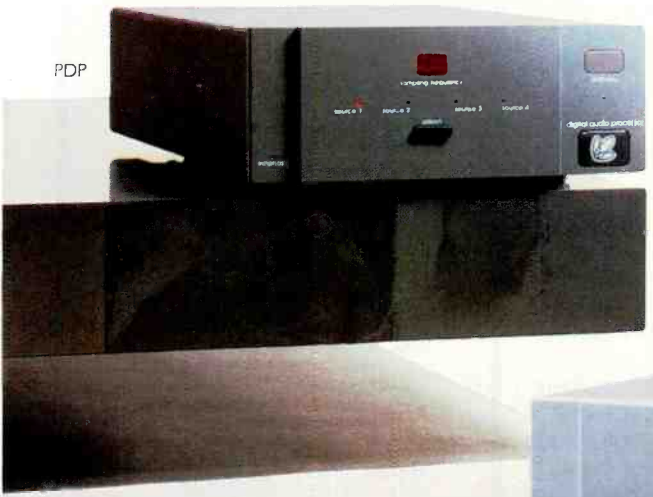

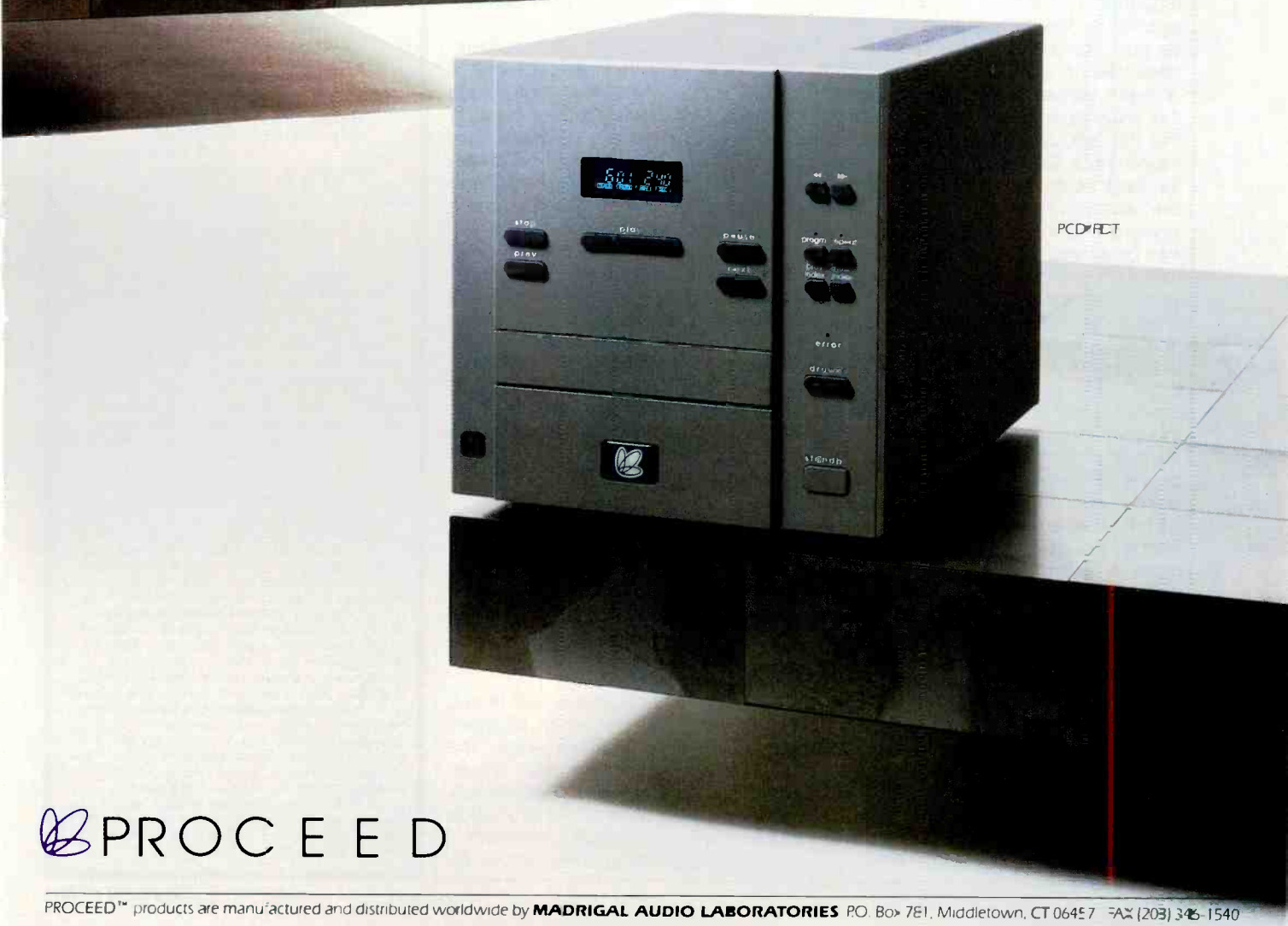

PCD/PDT

PROCEED

SIGNALS & NOISE

Twin Tweaks

Dear Editor:

I read the review of the Lirpa Labs VCDRS CD player (April) with great interest. My work on similar devices leads me to offer, with all due respect, suggestions for two modifications that should be helpful in suitably furthering the development of this equipment:

- The problem with rumble will be cured only to a limited extent by scanner tire and suspension refinements. One of the other contributors to the problem is flexing of the scanner control line. This can be greatly improved by making the line of hollow tube filled with heavy, silicone damping fluid. I believe the Swiss are a likely source for this tube.
- The major contributor to the troublesome rumble, however, is Doppler modulation of the r.f. signal from the scanner to the pickup antenna that is on the control unit. As the scanner rotates, the r.f. signal will be modulated at rates varying from 8.333 Hz when the scanner is at the outside track of the CD (500 rpm) to 3.333 Hz at the inside track (200 rpm). Assuming that the patents on the Leslie Tone Chamber rotating speaker assembly have expired, the VCDRS Doppler problem can be solved by mounting the control unit's pickup dish on a turntable synchronized to the CD turntable.

With the above improvements, the VCDRS should be everything that is expected of it. By the way, I am offering a useful accessory for the VCDRS, a small light that mounts on the base of the scanner assembly and shines up to illuminate the label on the CD. The power for this light will be supplied by a modification that makes the scanner r.f. link a duplex channel, thereby eliminating the need for wires. Prices on request, providing the people in the white coats will let me receive mail.

Norman S. Cromwell
Al. Llihneerg 8472
Lynchburg, Va.

Reception Perceptions

Dear Editor:

I read with interest the "Auricle" review of the AudioPrism 7500 indoor FM antenna (December 1989). Reading this review reminded me that I do not ever recall seeing a review of a real outdoor FM antenna. While products such as the 7500 may be useful, those of us who live more than a few miles from a major city need a real outdoor antenna, probably mounted on a tower. In my case, I listen to two public radio stations. One is a 10-kW station, and the other is 2,500 watts. Both are located about 45 air miles away. Obviously, a component like the AudioPrism is inadequate for many of us outside a major metropolitan area.

I rely on my amateur-radio friends for antenna information. In many cases, this technology is not directly transferable, as there are significantly different technical considerations for transmitting antennas.

There are many sources of high-gain antennas. Please consider reviewing this often overlooked component.

W. Lloyd Piper
Kokomo, Ind.

Editor's Reply: Actually, it has been quite some time since we did a test of a true outdoor antenna, but—thank goodness!—some things, like the laws of physics, don't change. Thus, a four-part article by M. J. Salvati on antennas seems to be what Mr. Piper, and perhaps other FM devotees in the fringe areas, needs. This article appeared in our January through April 1978 issues. Salvati also wrote a book on this subject, which still seems one of the very best of its kind: *TV Antennas and Signal Distribution Systems* (Sams 21584). I believe that the book is out of print, but you may be able to find it in a library or a used book shop. Incidentally, the AudioPrism antenna really ought to work reasonably well at 45 miles.—*E.P.*

Wood-Affected

Dear Editor:

With regard to Kurt Staiger's letter published in the March 1990 issue, I believe recognition of correct absolute polarity is definitely a learned skill, just like learning to listen to classical music in junior high school.

Last fall, I purchased a well-known $3,300 D/A converter which happens to have an absolute phase switch. The manufacturer stated that with proper phase orientation, "the better defined, more energetic bass and more stable imaging will be obvious." However, I couldn't find anything consistent to de-

Audio

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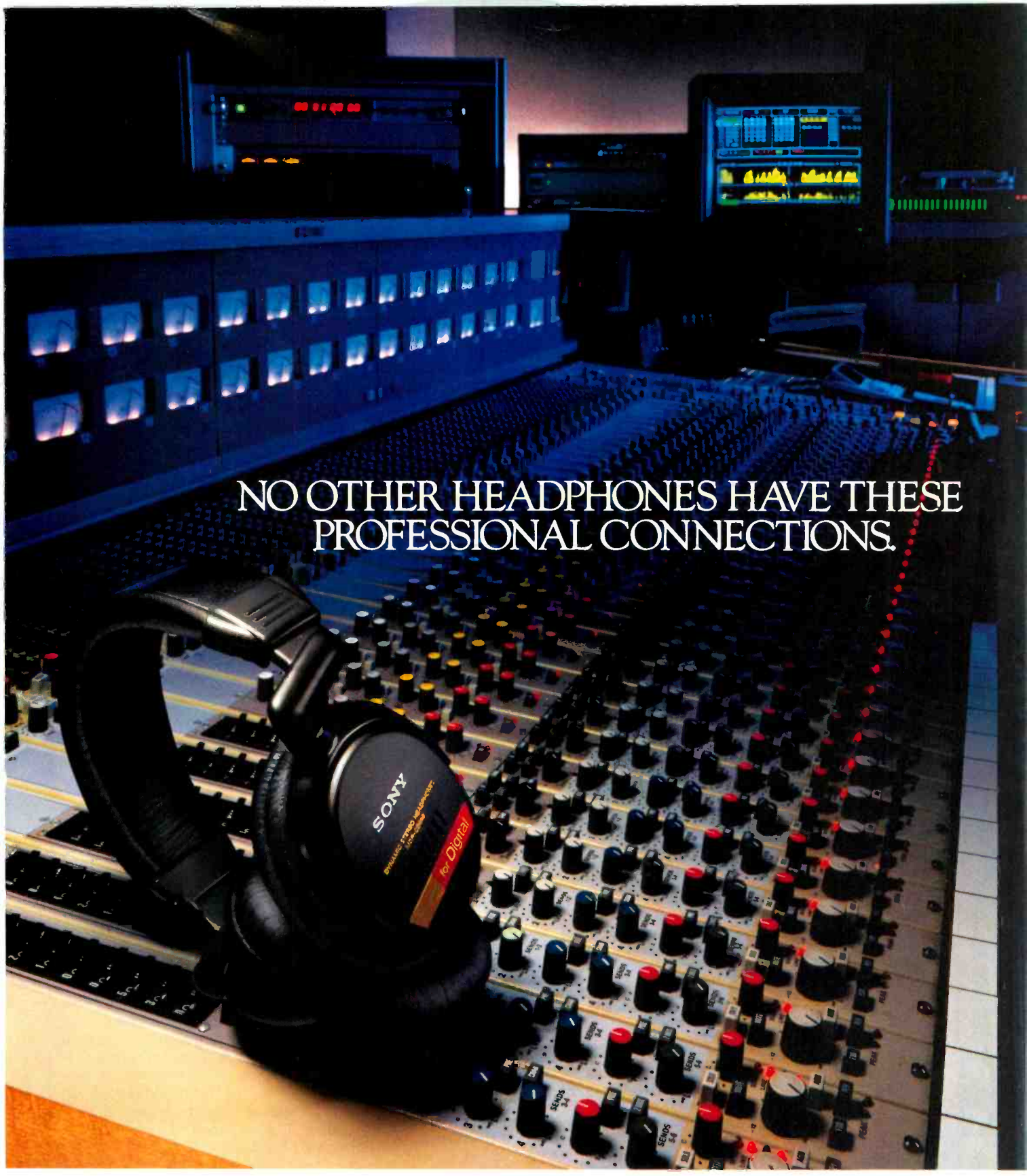

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I now know what to listen for in recordings I think are 180° off; a singer's sibilants are a giveaway.

termine the proper setting and generally left it on 0°.

Then I obtained a copy of R. C. Johnsen's *The Wood Effect*, and read it very carefully. One important point the author brought out was that you will not hear absolute phase effects from speaker systems that have multiple 12-dB/octave crossovers because the phase structure of transients simply isn't preserved in such systems. Electrostatics or ribbons are best, but a dynamic system with 6-dB/octave crossovers, as is the case with the units I am using, should also be phase coherent.

Johnsen provides a short list of recordings that he has identified as being 180° out of phase. I already possessed three of these, and played them several times over my system with the phase knowingly correct and incorrect. I finally began to perceive what Johnsen was talking about. For someone without a phase-reversal switch, the new Chesky test record is invaluable (*Jazz Sampler and Audiophile Test Compact Disc, Volume I*, JD37). It contains a trumpet solo, recorded first in phase and then out of phase. I should think anyone could hear the deleterious effect on the tapped or brushed cymbals by being played out of phase. I highly recommend this disc to Kurt Staiger.

I now know what to listen for in recordings I suspect might be 180° off. Organ recordings are particularly easy to evaluate: Does the "chirp" of the organ pipe appear at the same time and place as the voice of the pipe? A singer's sibilants are another giveaway.

Bernard A. Engholm
Carlsbad, Cal.

Grateful for Johnson

Dear Editor:

The intent of this letter is to express my sincerest appreciation to Michael Wright and your staff for your excellent review of Eric Johnson's *Ah Via Musicom* (August). I listen to many styles of music, classical included, and I have many favorite musicians. Eric Johnson, however, is one of those whose music has touched my heart and soul like no other. His attitude about life and music sets a tremendous example for musicians everywhere. This *is* rock music for the most part, and this album is a testament to those "golden-ears" that rock 'n' roll should stay firmly in place in the world of audiophiles. Eric's display of talent on this record is surpassed only by his performance on stage. He is truly deserving of success. Thanks again for helping to spread the word.

Albert Madariaga
Dallas, Tex.

Erratum

The address of Terk Technologies, whose Pi^2 FM antenna was reviewed in the November issue, is: 233-8 Robbins La., Syosset, N.Y. 11791.

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AUDIOCLINIC

JOSEPH GIOVANELLI

Personal Radios in Cars

Q. I am interested in using a portable Walkman-style CD player/radio in my car. I understand that these devices typically use headphone leads as the antennas for radio reception. How is this accomplished? Is there any way that I can insert a lead into the headphone jack to act as an antenna when I use the portable in my car? Can I connect the car's existing antenna to the player in some way to improve reception in the car?—Donald S. Leitner, Wayne, Pa.

A. First of all, using a headphone portable while driving is not a wise thing to do. Headphones isolate you from the road sounds which provide cues as you drive. Passenger use of headphones is okay, of course.

Many people do use portables such as yours in cars but as an inexpensive way to add a CD player to an existing sound system, to be heard through loudspeakers. Adaptors that let you feed your CD player's signal in through a cassette slot are available from Radio Shack (No. 12-1951, $19.95), Recoton, and others. Other adaptors, available through car stereo dealers, feed CD player signals into car radios via their antenna inputs or even via the car's cigarette lighter. For car stereo systems with separate amplifiers, there are adaptors that feed a portable CD player's signal directly to the amps.

Your question, however, emphasizes uses of your portable's tuner section. There are technical problems with that beyond the ones you mention. The front-ends of such radios are designed to have high sensitivity at the expense of a tendency toward overload. As a result, any strong station is likely to pop up at several points along the dial, often interfering with other stations. Portable radios are also hard to tune while driving because of their small dials and controls and because they slide around as you drive. A cheap car radio, if you can still find one, will probably give you better results and be easier and safer to use. Low-cost radio/cassette units can be had, complete with speakers, for under $100.

As to the use of the headphone cord as an antenna, any such wire will pick up some r.f., especially if its length is appropriate for the wavelengths to be received. In small portable radios, the headphone jack is connected to the r.f. input. An r.f. choke in series with the line between this point and the amplifier output keeps r.f. out of the audio circuits but passes audio signals.

To use the radio with an existing antenna and still be able to use headphones, you'd need a Y connector. Chances are that you won't be able to use the shield of the antenna cable, and therefore you will pick up extraneous noise. If the point of all this is to use headphones, it would seem simpler to connect them to a more conventional car radio, adding an attenuator to avoid burning the 'phones out and to minimize hiss when the volume is turned down.

Voice-coil Problem

Q. I have a problem that's driving me nuts! What I hear is a sound something like low-frequency thunder. I am familiar with 60-Hz hum, but this sounds lower in frequency and constantly varies in intensity. It is heard on all program sources: CD, tape, phono, TV, and VCR.

I have rearranged wires, hooked separate ground systems, hooked the CD player directly to the power amplifier (bypassing the preamplifier), used two different power amplifiers, and used two different CD players. Nothing changes this sound. What does all this mean?—A. B. Carter, Apple Valley, Cal.

A. It's really great when a reader gives me lots of information because I can be much more certain of my answer. If I had to bet money on this one, I would tell you that your loudspeakers are at fault. Why do I say this? Well, you eliminated the preamplifier and still heard the annoying sound. You eliminated the CD player by using two different units. You eliminated the power amplifier by substituting a second one. With tests like those, we can eliminate the TV set, the VCR, phonograph, etc. Although not so rigorous, I think we can eliminate grounds and wiring layout as well.

What you are hearing is the sound of the voice-coil of at least one of your drivers rubbing against its pole piece. You should connect one speaker at a time, run the system and see if you hear the sound. It may be that one loudspeaker will work fine and the other won't. It is possible that both are defective—which could have occurred if you continuously feed more power into the speakers than they can safely handle. The heating of the voice-coils created by that condition would eventually lead to their going out of round. If the loudspeakers are valuable to you, the manufacturer probably can repair them. Of course, if they are under warranty and if the maker finds that the failure was natural rather than caused by abuse, the speakers would be repaired at no cost other than shipping.

Volt-Amperes and A.c. Power

Q. The rear panel of my amplifier says "450 W a.c.". Does this indicate the power at full audio output or at idling? This same panel also shows "520 VA". Is this the output current or voltage at maximum power output?—Aron Goldberg, Los Angeles, Cal.

A. The 450 watts shown on the rear panel of your amplifier is the power taken from the a.c. line. If this amplifier is a Class-A device, this power remains constant regardless of the amount of audio power being produced. If the amplifier is Class B or somewhere between Classes A and B, then this power will be drawn when the amplifier is fully driven.

The "520 VA" is the product of the maximum voltage and current draw. While power in watts is frequently defined as the product of the volts and amps involved, this actually holds true only for d.c. or for a.c. circuits whose voltage and current are in phase. The discrepancy between the power and VA figures is because they are not in phase here. As with power, the amplifier's class of operation will determine whether the VA figure applies all the time or only at maximum audio output.

CDs Left in Cars

Q. I am considering a CD changer for my car. Can I leave the discs and changer in my car, or must I remove them? In this part of California, if the trunk gets as hot as the car's interior, then temperatures inside the trunk in summer can run between 120° and 140° F.—Samuel J. Neiditch, Redlands, Cal.

A. I have heard no reports of heat damage to either CDs or changers, and the changers are designed to be

left in car trunks. Nevertheless, CDs and many of the parts in today's audio gear are made of plastic. Unless these plastics are of the thermosetting type, they will melt or soften at high temperatures. I think it's better to be safe than sorry, and to remove both the discs and (if possible) the player when the temperature is expected to rise much above 90° F.

I have no experience with this, however. Have any readers suffered heat damage to CDs or changers? Or can any of you in hotter climates than mine state from experience that there is no such problem? Please let me know.

Center Hole Damage to CDs

Q. It would appear that, after years of usage, some wear to the hole in the center of a CD should occur from placing into or withdrawing it from its plastic storage container. If this happens, what effect would it have on performance? Was this possibility of damage considered when the packaging for CDs was developed?—John P. Pavelchak, Forest City, Pa.

A. I agree that, after many insertions and withdrawals of a CD, its center hole might be slightly enlarged. This process would be greater at first but decline as the tension of the box's spindle "fingers" decreased. Also, some of the wear will affect the spindle rather than the disc.

In all events I do not think that change in the center hole diameter will be very great. This fact becomes less important when we realize that tests have been conducted showing that there is room for a certain amount of disc misalignment. A CD player's servo tracking is surprisingly flexible and forgiving.

I have no data as to whether or not this matter was considered when the packaging of CDs was developed. Given all the care taken when developing this product, however, I have to believe that this matter was examined. In any case, one can reduce the risk of wear by pressing on the fingers of the spindle while withdrawing the disc.

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

TAPE GUIDE

HERMAN BURSTEIN

Dolby Mistracking

Q. I recently sent my cassette deck to the manufacturer's service department because it lacked bass and treble. When it was returned, I was delighted with the clarity of my new recordings. But as it turns out, the tapes are brighter than the source. The problem is more evident with Dolby NR on than off. The increase in treble also produces an increase in noise. The problem occurs with all tape types. What could be wrong? Do you believe this will be an expensive thing to repair?—Scott Hauk, Holland, Pa.

A. It seems that something has gone wrong with the Dolby circuitry and that you are entitled to have the problem corrected free of charge either by the manufacturer or by an authorized service shop in your area. It may be worth the expense of a long distance telephone call to contact the service center and ask what procedure to follow.

My guess is that the Dolby circuit is barely working, if at all, in playback. When you encode with Dolby in recording, you are boosting the treble. In playback, Dolby is supposed to provide complementary treble cut. But your deck apparently is failing to do this properly.

If you pay for the repair yourself, I have no idea what the cost would be. But it could be quite high, as the minimum charge these days is often $50 or more.

Reading About Audio

Q. I have the opposite problem from the reader who complained, awhile back, that some of the "Tape Guide" questions were too unsophisticated for him; I find Audio *too advanced for me. I need a book for beginners that explains the terminology used. One has to start someplace, and if one doesn't have prior experience,* Audio *is all Greek, especially the equipment profiles. Could you please recommend a few books that might be helpful to a novice like me?*—Rick Frank-Jones, O'Fallon, Mo.

A. Rather than recommend specific titles, I would like to make some general suggestions. Visit audio dealers in your area to see what books they have. Glance through them to see if any are your cup of tea. Write to Tab Books, Blue Ridge Summit, Pa. to find out what they currently have available. Tab has published a number of books on audio for beginners, but they go out of print from time to time. You can also write to the Audio Engineering Society, 60 East 42nd St., New York, N.Y. 10165 and inquire what they have. Two other good sources are Mix Magazine's Bookshelf, 6400 Hollis St., #12, Emeryville, Cal. 94608, and Sams, 11711 North College Ave., Carmel, Ind. 46032.

Check your local library. Comb back issues of periodicals such as *Audio*, *Stereo Review*, and *High Fidelity*, which from time to time have contained explanatory material. And keep reading *Audio* (and other periodicals) even though the material is initially over your head. Gradually, it will start to make sense. If an article appears to contain important information, read it several times. We publish book reviews, less frequently than we'd like, so watch for The Bookshelf column. Our current favorite for the type of knowledge you desire is Glenn D. White's "The Audio Dictionary" from the University of Washington Press.

Silent Spots

Q. Every so often, when I play back a cassette tape, the sound will abruptly stop for a second and then resume, as if the tape head were losing contact briefly. This happens only once in a while, but it is extremely bothersome to me.—David Abbou, Alexandria, Va.

A. The problem could be in the tape, the head, or the electronics. If the silence always occurs at the same places in the recording, the tape is at fault. Causes could include improper coating of the oxide or embedded d rt. If the silence occurs randomly, the fault could be in the tape head. If your deck has separate record and playback heads, there may be an intermittent connection to or within either head. If the problem disappears when the tape is played on another deck, the trouble may be in your playback head. However, the problem could be in either the record or playback electronics, again perhaps owing to an intermittent connection. It could also be that a high signal level, either in recording or playback, is overloading the electronics and causing them to "block" momentarily, resulting in a brief silence until the electronics recover.

This kind of problem requires systematic signal tracing, and you may well need the help of an expert technician. Inasmuch as your problem occurs only once in a while, it becomes hard to track down, so that repair would be expensive. The best course may be to live with it until the trouble becomes more frequent and thus easier to spot.

Which Tape?

Q. I recently bought a mono AM-FM radio with non-Dolby cassette recorder. Please tell me the better brands and types of tape, mostly for voice. —Oscar Weinberger, New York, N.Y.

A. For your purpose, a low-price, name-brand ferric-oxide (Type I) tape should be adequate. The policy of this magazine prohibits me from recommending specific brands. Leading brands and their prices are listed each year in the October *Audio*, and from time to time the magazine runs large-scale comparative test reports of tapes. (The last such test was in the March, 1990 issue.) Check with your audio dealer as to which brands he carries and sells the most of. Avoid unbranded tapes, even though their prices may be attractive; they are more likely to cause difficulties.

Deconfusing Playback Equalization

Q. I am 18 years old and have acquired a general knowledge of audio products and their functions. But one thing puzzles me about recording with chrome tapes. One day I noticed that if I recorded such a tape with the deck in Chrome position and later played it back in the Normal position, the sound was more brilliant than if I played it back in the Chrome position. Is this the way it's supposed to be done? I further noticed that if I recorded and played a chrome tape with the deck in Normal position both in recording and playback, the sound lacked that brilliant punch that led me to use chrome tapes in the first place. I hope that you can

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

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It is important to at least *record* at the setting that corresponds to the tape type in use, to ensure correct bias.

clear all this up for me.—Charles Eisenhardt, Whitestone, N.Y.

A. Recording and playback equalization are designed to work together so that they will, when the tape's own response is taken into account, yield a record-playback response that is essentially flat. Playback equalization consists of a defined bass boost (which can also be considered as a treble cut); recording equalization is a slight treble boost.

The equalization originally developed for what is now called Type I tape uses less bass boost in playback and less treble boost in recording than Type II equalization. As a result, recordings made and played back with Type I equalization are less prone to saturation (i.e., have more headroom), but have a few dB less S/N than recordings made and played back with Type II EQ—*regardless of the actual tape type used.*

When you make a recording with Type II (Chrome) EQ and play it back with Type I (Normal) EQ, you are applying less of a treble drop than is required for flat response. This is equivalent to a treble boost that amounts to about 4.5 dB by the time you get out to 10 kHz or above. Therefore, the playback will sound bright. At the same time, you are getting slightly less S/N than if you used Type II equalization throughout. If, on the other hand, you were to play a Type I recording with Type II playback equalization, you would get less treble, and a duller sound, than if you had used matching EQ in playback and recording, but you'd also gain a few dB of S/N.

If your deck's record equalization and bias are both selected by the same switch, however, it is important that you at least *record* at the switch setting that corresponds to the tape type in use, to ensure proper bias. Recording Type II tape with Type I bias would result in exaggerated treble and increased distortion; recording Type I tape with Type II bias would result in noticeably diminished treble.

What Happens If . . .

Q. When taping an LP in stereo, if the channel levels on the LP are unequal but I make them equal in recording, what happens to my tape recording? Does it become for all intents and purposes a mono tape, or will there still be stereo separation?—Joe Wilson, Pasadena, Cal.

A. Equality or inequality of recorded levels has no effect on stereo separation, although of course it can affect imaging. Adjustment of the balance control of your audio system in playback can restore proper imaging. This assumes that you are experiencing a constant, overall imbalance; momentary imbalances toward one channel or the other are normal in stereo recordings, as not all musicians in a group play equally loud at any given moment.

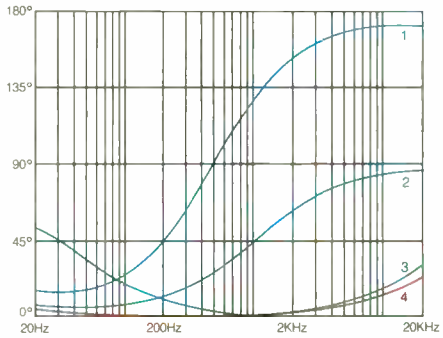
If You've Heard Live Music, This Receiver Will Sound Familiar.

There are those who will tell you audible differences among modern amplifiers are largely imagined. Not among them, however, is Steve Cullison, amplifier designer extraordinaire at Nakamichi's research and development center in California. His theory of **Harmonic Time Alignment** (HTA) in amplifier circuits sheds new light on age-old mysteries. And in Nakamichi's new Receiver1, this theory has been proven in practice.

The HTA principle, simply stated, asserts that the *timing* of an amplifier's harmonic distortion components has more to do with its sound quality than perhaps any other single factor. When distortion components are phase shifted with respect to the main signal, even small amounts can destroy an amplifier's musicality.

Nakamichi engineer Steve Cullison, inventor of Harmonic Time Alignment (HTA) amplifier circuitry.

HTA explains why conventional specifications utterly fail to describe how an amplifier sounds...why many audiophiles still prefer tube electronics for the middle to high frequences...and why solid state designs are nonetheless often preferred for low-frequency reproduction.



Computer analysis of Harmonic Time Alignment for four amplifier designs: 1) typical early solid-state, 2) typical recent solid-state, 3) typical tube, and 4) Nakamichi HTA.

In Nakamichi Receiver1, every stage from preamp input to power output has been designed in accordance with HTA principle. The result is astonishing. There is no trace of harshness or graininess. Instrumental timbres are convincingly accurate. Presence and soundstage information are reproduced intact.

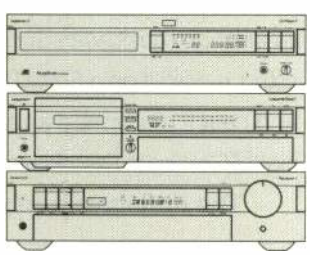
But the story doesn't end there. Receiver1 is a full-featured control center around which you can build a complete, state-of-the-art audio/video system. You get a high-current, low-impedance HTA power amplifier stage rated at 80 watts per channel*; a superb quartz-locked PLL frequency-synthesis tuner section; 3 video inputs and 2 video outputs with high-quality buffer amplifiers; independent source selectors for listening and record outputs; Nakamichi's proven Multi-Regulated Power Supply and Isolated Ground circuitry; a precision motorized volume control; truly useful "Nakamichi-concept" tone controls; and much more.

Receiver1 also comes with a wireless System Remote control that lets you operate the receiver plus compatible Nakamichi CD players and cassette decks from your chair. Make that *chairs* in up to three additional rooms when you use Nakamichi's optional Multi-Room System Remote sensors.

Combined with Receiver1's remote speaker A/B switching feature, it's almost like having another complete system in a different room.

If all this sounds too good to be true, ask your Nakamichi dealer to demonstrate Receiver1. Compare it to other receivers for versatility, ease of use, and value. But for sound quality, compare it, as Nakamichi engineers do, only to the ultimate reference standard: live music. You'll be amazed by the resemblance.

Receiver1 is one of three new Nakamichi receivers. Write or call for complete information on Nakamichi's new line of CD players, cassette decks, and receivers.



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For a convincing demonstration of audible differences between CD players, listen to the CDP-C85ES Carousel Changer. Its High Density Linear Converter™ system solves what university researchers* have found to be the number one sonic shortcoming in conventional CD players: low-level non-linearity. Sony overcomes this with a pulse converter design operating at an unprecedented 45 MHz. So you hear all the overtones that distinguish a Guarnerius violin from a Stradavarius, and differentiate the voices in gospel harmonies.

Quite an arrangement.

Sony's TA-E1000ESD Digital Signal Processing Preamplifier lets you rearrange music to suit your source material, your listening room and your taste. Take the music and expand it. Compress it. Equalize it and place it in an acoustic environment down to the row and seat number of your choosing. Proprietary Sony integrated circuits perform all of these wonders in the digital domain. So not only are CD and DAT

*A landmark study using objective and subjective testing performed by Lipshitz and Vanderkooy at the University of Waterloo. Audio Engineering Society Preprint No. 2586.

digital inputs kept digital, but analog noise and phase distortions are kept away.

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Now you can make tape recordings with digital precision, thanks to our DTC-75ES Digital Audio Tape Deck. This is the very first of a new generation of tape recorders in the DAT format, itself the result of years of Sony ES research. DAT captures up to two full hours of CD-quality sound on a durable, reusable tape that's 47% smaller than the cassettes you're using now. Making DAT a breakthrough of incredible proportions.

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Arrange the performance to suit your taste: Digital Signal Processing.

Recording virtuosos: Digital Audio Tape Recorders.

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WHAT'S NEW

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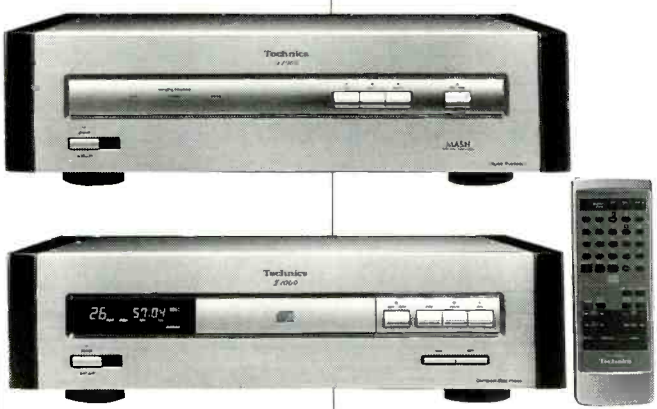
The Model M1000 delivers 120 watts mono into 8- or 4-ohm loads. All tubes, including the eight selected 6550 output tubes, are triode-connected, and the circuit has low feedback. The output transformer is a wide-bandwidth, low-ratio type. Signal paths have been kept extremely short, and hard-wired wherever possible. Price: $8,499.

For literature, circle No. 100



Technics
Two-Piece CD Player

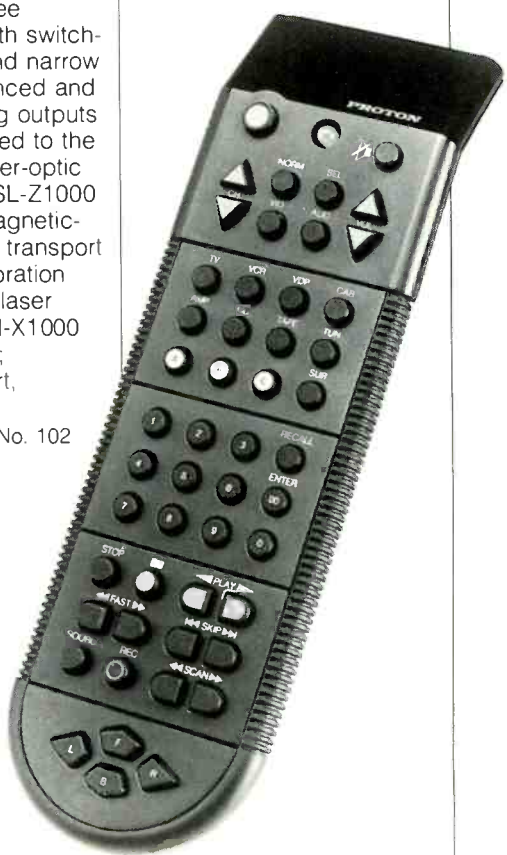
The signal processor section of this player, Model SH-X1000, uses MASH noise-shaping circuits and pulse-width modulation ("one-bit") D/A converters. It has three digital inputs and an automatic Jitter Free Interface circuit with switch-selectable wide and narrow modes. Both balanced and unbalanced analog outputs are provided. Linked to the processor by a fiber-optic cable, the Model SL-Z1000 transport has a magnetic-guide linear-motor transport to help prevent vibration from affecting the laser pickup. Prices: SH-X1000 processor, $4,000; SL-Z1000 transport, $4,000.

For literature, circle No. 102

Proton Universal
Remote Control

With its built-in library of control codes, the UVA-2000 can replace up to 13 remote controls for audio, video, lighting, and security equipment, yet it requires no laborious programming. Multi-command sequences can, however, be programmed onto a single button, and the code library can be updated for new components. The ergonomic design features functional control groupings, rubberized side grips, central balance, and an angled head for easier aiming. Price: $140.

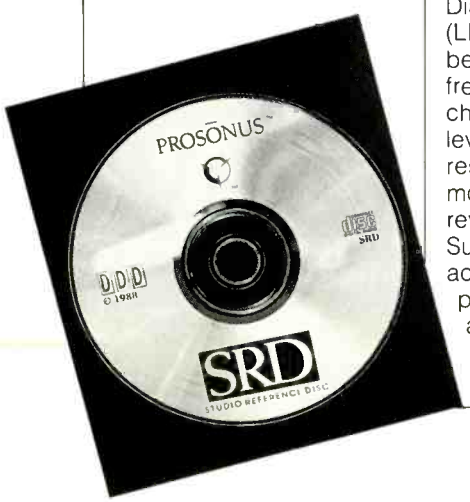
For literature, circle No. 103

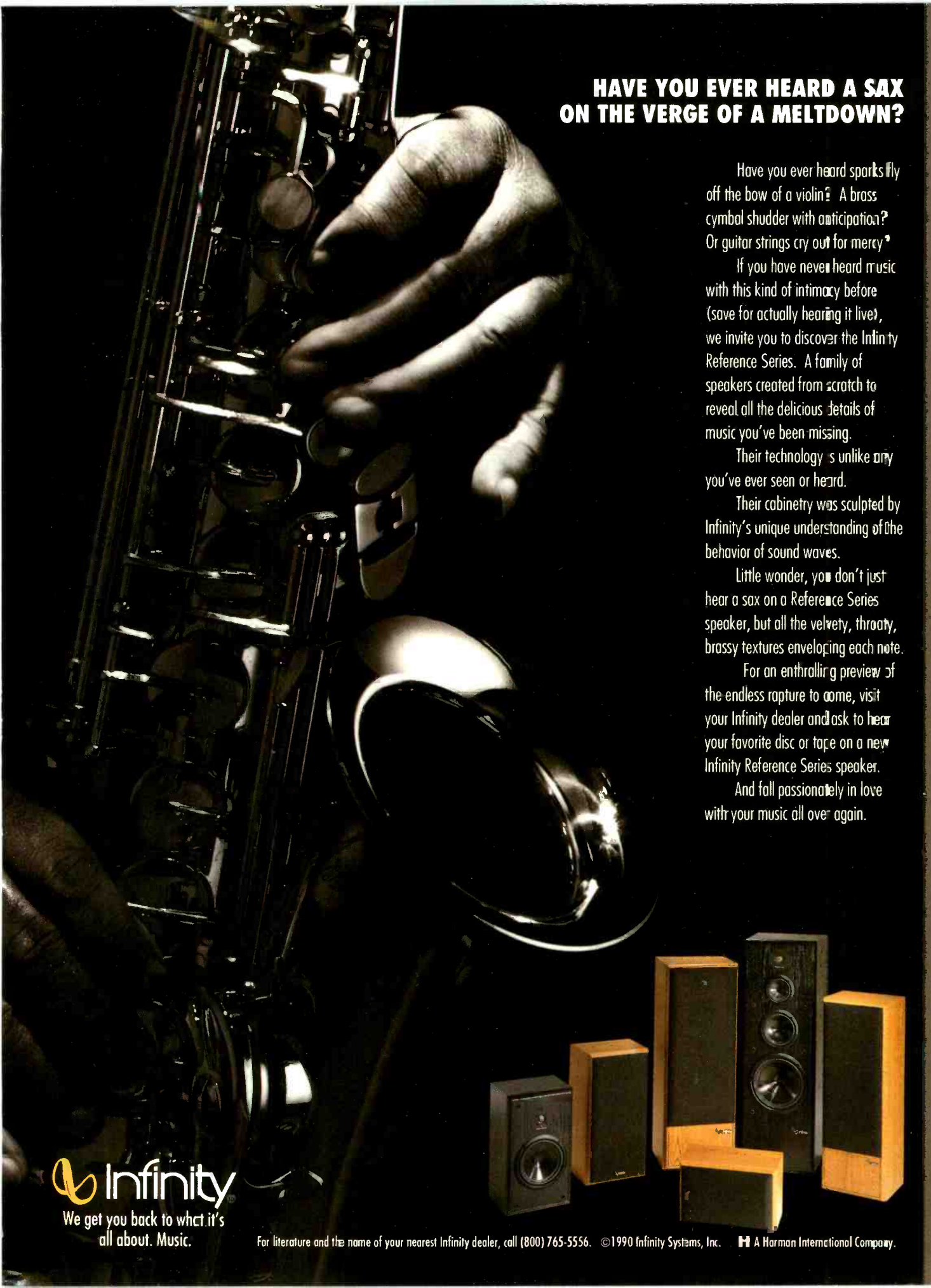


ProSonus Test CD

Intended to let a CD player substitute for test generators, the Studio Reference Disc includes 69 tracks of digitally generated test tones as well as a few specially recorded musical tones (plus one left-to-right locomotive pass) for use with test instruments or for evaluation by ear. The tracks include white and pink noise, third-octave sine-wave bursts, sine waves in 17 bands from 15.525 Hz to 16 kHz, impulse clicks, musical pitch references, and Listening Environment Diagnostic Recordings (LEDR). These tracks can be used to test for frequency response and changes in response with level, room or speaker resonances, analysis of monitoring systems, room reverberation time, Dolby Surround processing accuracy, D/A converter performance, slew rate, and more. Price: $69.95.

For literature, circle No. 101





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For literature and the name of your nearest Infinity dealer, call (800) 765-5556. ©1990 Infinity Systems, Inc. A Harman International Company.

Philips CD-Portable Stand

For those who use portable CD players as sound sources with fixed stereo systems, the SBC3545A01 stand supplies an attractive support plus convenient connections to an audio system, headphones, and external power. The stand base can be inserted under existing audio equipment for greater stability, and the gooseneck design allows the height of the player to be adjusted. Rubber feet atop the upper platform secure the player against sliding. Price: $129.95.
For literature, circle No. 104

Go-Video Dual-Well VCR

The VCR-2's unique dual-well construction allows it to record two programs at once, record a program while playing a second tape, and make duplicate or edited copies of existing tapes. Audio features include MTS stereo decoding, SAP decoding, and linear stereo audio tracks with Dolby noise reduction. The tuner is a 155-channel, cable-ready type. Price: $1,095.
For literature, circle No. 105

Cambridge SoundWorks Transportable Music System

Designed to be used with portable CD and tape players, the Cambridge Model Eleven system includes a miniature three-channel integrated amplifier, two satellite speakers, and a carrying case that becomes an enclosure for the 7-inch woofer. The case also has a cushioned compartment to hold the portable player. The amplifier, which delivers a total of 36 watts rms, has separate outputs for the woofer and the two satellites, with the frequency response of each output tailored to match the speaker it drives. Power from 110- or 220-V a.c. and 12-V d.c. sources can be used, and a 9-V output is provided to power portable CD or tape players. Each satellite speaker houses a 3-inch mid-bass/midrange driver and a ¾-inch dome tweeter. Price: $749.
For literature, circle No. 106

Jensen Loudspeaker

The Digital Series 3080 is a tower speaker with dual 8-inch woofers and a 3-inch cone tweeter. Its frequency response is rated at 43 Hz to 21 kHz; sensitivity is 91 dB SPL at 1 meter for 1 watt input, and power handling is rated at 60 watts continuous, 150 watts peak. The finish is hickory vinyl veneer, and the cabinet's front edges are beveled to reduce diffraction. Price: $359.90 per pair.
For literature, circle No. 107

How to make an Onkyo receiver as good as its competition.

If we wanted to make an Onkyo receiver as good as our competition, it wouldn't be too hard.

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Next, we'd substitute a much lighter, cheaper heat sink. Of course, this greatly increases the chance of thermal overload when the music's cooking, but since we'd already be using a low capacity transformer, the music would only be half baked anyway.

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As a finishing touch, faceplates & chassis would be plastic instead of metal. True, that wouldn't give us the same structural integrity. But we'd be cutting so many other corners you'd probably never notice the difference.

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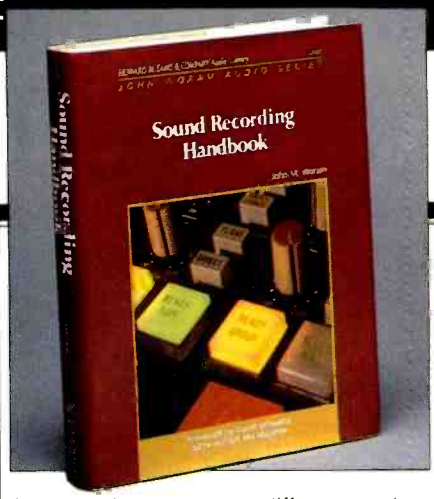

Sound Recording Handbook by John M. Woram. Howard W. Sams & Co., Indianapolis, 616 pp., hardcover, $49.95.

John Woram is well known in the professional audio field. He was editor of *dB* magazine for many years, and his earlier book, *The Recording Studio Handbook*, was a standard text in audio-recording education. This, his new book, is part of Howard W. Sams & Company's John Woram Audio Series.

Because Woram is a journalist and recording engineer with many credentials, one expects that he will bring a high level of competence and clarity to the presentation of technical ideas. His writing is always direct, and the chain of cause and effect is never broken. While his earlier book spent more time in the studio, this new book goes into far greater depth. It is truly a handbook, in terms of its vast reference capabilities, but it is also a fine text for teaching.

The book opens with basic audio theory. Here are covered the elements of logarithms, the decibel, trigonometric functions, and basic waveform analysis. Acoustics is covered in terms of sound intensity and power, the wavelength-dependent nature of sound reflection, refraction and diffraction, and, finally, a discussion of sound fields.

In a chapter called "Music, Electronics, and Psychoacoustics," Woram discusses the importance of musical knowledge on the part of the recording engineer. Such topics as the harmonic series, evolution of musical scales, and harmonic analysis are presented, along with loudness and localization.

Woram's chapter on microphones is extremely detailed, both in terms of operating principles and pattern derivation. Woram further elucidates microphone pattern control in terms of such concepts as random energy response, random energy efficiency, directivity factor, distance factor, unidirectional index, and front-to-total ratio. While not all of these terms are standard, or even necessary to define a given pattern, they all assist the reader in gaining an intuitive feel for what microphone directivity is all about—i.e., the relationship between the useful acceptance angle of the microphone and its overall response to diffuse, random acoustical power. Stated in other terms, we use a cardioid microphone not because it is supposed to reject sounds originating at 180° but because it has the desired acceptance angle and is some 5 dB less sensitive to random sounds than to sound sources located along the principal axis. This is the essential rationale for directional microphones, and it is often misunderstood by neophyte engineers. The author's lengthy exposition goes far in clarifying the matter. With the microphone fundamentals covered, Woram then moves on to a discussion of the first-order cardioid family, presenting directional data both in the familiar polar form and in the Cartesian coordinate form normally favored by radar and sonar engineers. Such matters as proximity effect and off-axis coloration are then covered.

Stereo microphone theory is then presented, first as coincident technology as seen in X-Y/M-S equivalence and then as quasi-coincident and spaced techniques. Woram's coverage of M-S is surely the most detailed in current literature, and there are many equations to daunt the neophyte. However, the text is still clear enough, in an intuitive sense, for the student to get the gist of it all. As stated earlier, the value of this work as a handbook is underscored by such depth of detail.

The author then moves on to methods of synthesizing various patterns by combining the patterns of two microphones. This ultimately leads to a discussion of the Soundfield microphone, in which four directional elements can be combined to produce first-order cardioid-family patterns oriented toward any direction around, above, and below that microphone. The problems solved by the use of boundary layer microphones are then detailed.

The following chapter is on monitor loudspeakers and is far ranging, covering some loudspeaker types rarely encountered in monitoring (electrostatic speakers, for example). The basic mechanisms are treated, along with bandwidth, directional properties, and the effects of room boundaries. Low-frequency enclosure types are discussed, as are horns and their associated compression drivers. (In general, horns and horn types are covered in more detail than necessary for a book devoted to recording.) Systems concepts come next, with a discussion of dividing networks, time-offset correction, phase shift, and absolute polarity.

Woram then turns to the major areas of signal processing. Delay and reverberation systems are presented first. As a preliminary discussion, the author describes the nature of sound propagation in real spaces in terms of the direct, early, and reverberant fields which are set up. The "real thing" is described before the model is envisioned to duplicate it. Woram then moves on to the problems of recording the various time-related events, leading ultimately to the need for specific hardware to duplicate those events. Delay-related effects and the work of Haas are cited, and various early implementations of time-related signal processing are described. Tape loops, reverberation chambers, springs, and plates get their due before the discussion shifts to modern digital methods.

Studio implementation of time delay and reverberation are covered next, along with the role of delay in "correcting" the time anticipation in the use of accent microphones and in creating new sounds via "flanging." Further applications include generating chorus effects and creating phantom images by subtle signal delay. Concluding this chapter is a discussion of control-room acoustics. While this subject could have been dealt with in the preceding chapter, the author prefers to present it here, primarily as a caveat to users of delay-related signal processing. Woram's admonition is that early control-room reflections should not be so pervasive that they interfere with natural studio reflections picked up by the microphones. Only when the control room has been tamed, so to speak, can proper judgments be made and the signal properly processed with additional delay or reverberation.

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The AV 1000 is destined to become the centerpiece of the most sophisticated home theaters. Its uncompromised reproduction of both music and cinema soundtracks provides the perfect complement to Philips WallVision home-theater system. To experience this innovation for yourself, call 1-800-223-7772 for your nearest Philips audio-video specialist.

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A journalist and recording engineer, John Woram brings a high level of competence and clarity in presenting technical ideas.

The next area of signal processing deals with equalizers and filters. For most readers, this chapter will be a difficult one, inasmuch as it deals chiefly with theoretical considerations based on passive equalizer designs. Such designs have all but disappeared from the modern recording studio but still may be found in older recording and sound-reinforcement equipment dating from the early '70s and before. In general, more space could have been devoted to applications and far less to theoretical considerations.

The next chapter covers the principles of signal compression and limiting in a very thorough manner. First, the need for dynamic range control is established, and manual methods are compared with electronic ones. The operating parameters of practical devices are then defined and discussed. Noise gates (expanders) are covered, as is the combination of all three gain-control modes—compression, limiting, and expansion—into a single unit for "smart" hands-off gain control in a typical transmission channel. Specific application—such as de-essers, voice-over compressors (duckers), and other frequency-dependent functions—are discussed.

The following two chapters deal with analog magnetic recording; the first goes into the basic recording process in great detail, while the second covers tape transport mechanisms from both the design and the operational points of view. It is the author's conviction that recording engineers will be working more with analog than with digital recording gear in the immediate future, and thus the strong emphasis on the older technology. All of this makes sense insofar as there is more that a recording engineer *needs* to know about his analog equipment. With digital equipment, it either works or it doesn't; there is little—outside of keeping it clean—that can be done in the way of first-echelon maintenance. By comparison, optimum analog tape recording is dependent on regular adjustment of many operating parameters.

The basic recording process is described in terms of its essential nonlinearities, and the role of bias (a.c. and d.c.) in linearizing the process is then clearly presented. The dependence of distortion on bias, recorded wavelength, and record-head gap length is covered in detail, as are set-up procedures for ensuring optimum performance. Tape erasure and print-through are also reviewed.

Magnetic-head losses are described, leading to a discussion of tape equalization standards, reference levels, and high-output tapes. The chapter concludes with a detailed routine for playback and record alignment of a typical recorder.

The second chapter devoted to magnetic recording presents just about everything you might want to know about tape transports—including various drive and braking systems, tape path configurations, and control systems. Tape motion problems are discussed, both in terms of wow and flutter and long-term timing accuracy. Multi-track machines get most of the attention here, and the various functions of remote-control units in a normal studio setting are covered in detail. Such procedures as automatic search, rehearse mode, punch-in/punch-out, and track bouncing are clearly presented. The chapter ends with a discussion of maintenance and alignment of multi-track machines.

The chapter on noise reduction follows naturally, since NR is intimately involved with multi-track recording. The author describes all the current NR systems (as well as some no longer seen) in great detail, with graphs showing the effects of slight misalignments of the various systems. Even consumer-type systems are discussed, and appropriately so, since studio engineers are normally responsible for preparing the duplicating masters usd in making cassette tape products. While studio noise-reduction systems are double-ended—i.e., they require processing in both recording and playback—single-ended systems (those that operate only during tape playback) are useful in a wide variety of transfer processes. Woram discusses these as well. Thorough coverage is given to Dolby SR recording, and the various NR systems are compared. The author stresses the specific effects of calibration errors in the various systems, implying that the user should not treat them lightly. Many of these errors are small enough to go unnoticed, but alignment procedures should be scrupulously followed in order to maintain optimum performance.

The final major chapter deals with recording consoles. The discussion goes quickly through early evolution, concluding with the in-line console philosophy that is today's virtual de facto standard for multi-track recording. Woram's coverage of this type of console design is just about as complete as one could desire. For readers unfamiliar with this concept, the in-line console facilitates the one-microphone-per-track recording method central to many multi-track activities. In that recording mode, the direct microphone output is fed to its destined track. All tracks are then monitored through another section of the same input/output module, allowing these tracks to be auditioned as stereo program—complete with limiting, compression, equalization, reverberation, and everything else desired. The tracks that are being recorded are absolutely straight and are not affected in any way by the signal processing. The advantages here are creative freedom for the producer and the engineer, reserving all final musical decisions until later while allowing them to exercise interim options as they please. (In another mode of operation, the in-line console can function in the standard manner, in which all signal-processing options are reflected in the program signals going to tape.)

Final sections of the book present the basics of the SMPTE time code as well as an extended glossary.

The only subjects not covered are digital recording and console automation; Woram eschews the overview approach, and presenting these complex topics in any cursory way would not fit the mold of this book. Further, digital recording is well covered in many other publications, and console automation is developing so rapidly that documentation at this level can afford to wait.

Overall, Woram's new book presents its various topics with clarity, depth, and superb graphics. I highly recommend it to anyone involved in recording. Many of *Audio*'s more technically oriented readers will also find this book informative, and to them, too, it is highly recommended. *John Eargle*

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***FLASH!** Jack Mullin historical audio collection transferred to frozen North. Minnesota Broadcasters attach it to Pavek Museum of Wonderful Wireless near Minneapolis as an extension of that collection. The two original U.S. Mullin Magnetophons, basis for U.S. tape recorder industry, are included.*

This remarkable news I first received via phone from one of Jack Mullin's close associates and the author of the *Journal of the Audio Engineering Society* article (June, 1989) describing the Mullin equipment that was shown at the 1988 AES Convention in New York. Now it comes again, from the horse's mouth, as they used to say—no, not Mullin himself but the receptors of his choice in, er, the frozen North, 'way up there in Minneapolis. Jim Wychor, Executive Director of the Minnesota Broadcasters Association, has sent me the glossy brochure for the Pavek Museum and the news that he and his cohorts, whose address is the same as Pavek's, are aiming with this acquisition to build "The Pavek Radio, TV and Audio Museum," quoting Wychor's own words. How's that for progress, frozen or no? Not exactly national, but surely on the way, if a bit north of our central audio axis.

Joseph Pavek, a name new to me here in my own tiny state of Connecticut, is a man roughly of Mullin's generation (or maybe a bit older as I figure), who has had the same passion for collection and meticulous restoration as Mullin himself though his interest in radio, centered earlier than Mullin's in audio, came in a different way. Pavek received an amateur radio operator's license some 65 years ago, with the call letters W9OEP, no doubt proudly displayed on whatever tin lizzie he drove at that time. Pavek still holds that license but it has been cryptically transformed (and thereby lies a story which I do not know) to, oddly, WØOEP, the first O, but *not* the second, equipped with a slant like those in computer printouts—or, much further back, in thousands of old words in languages such as Dutch and Danish, pronounced like the French *peu* or *beurre*. So now do we say "Double-you Eu, Oh, Eee P?," speaking on the ham air?

Anyhow, that set of call letters is significant in that somehow this Pavek persuaded the State of Minnesota to make up a special *car license plate* with the O-slant on it. WØOEP. Now *that*, friends, takes persistence, patience and lots of personal heft! Obviously, the man had the umph to create and build a personal museum, be it radio, audio or whatever.

The Pavek radio brochure—that is as far as I have gotten so far—is fascinating. Its cover shows a double-page spread of a (restored) Grebe Synchrophase Seven of 1927, TRF, with seven batteries and seven tubes. My family owned a Kolster of similar age, our first-ever radio, kept sanctimoniously in my father's inviolable literary study. We heard King George V on it. And the famed English Singers at Christmas. Inside the Pavek is a sumptuous picture of a Murdock rotary-spark-gap transmitter of 1912,—phew, is it new and shiny! Yep, there's an electric motor with odd looking spikes on a wheel attached to its shaft—must be the rotary spark gap.

A gorgeous Atwater Kent radio adorns one full page, mounted with a background screen, 1920s modern—a galleon, big clouds, palm trees—which apparently was an advertising display. This ultra-shiny number has three discrete elements, two rounded boxes each with a condenser dial (please—there were no capacitors in those days) and a third round platform with three big tubes snuggled incredibly close together (heat buildup?). This was a "breadboard" model or as we would say, a kit, Model 3945 of 1923, regenerative, battery operated.

My own very first radio experience would have been close to this moment in time, and it was with an Atwater Kent, one of those plain black models with no fewer than three tuning condensers lined up in a row out front, which everybody had in those days. We were visiting my grandfather in Wilmington, Delaware. He was a bit nouveau riche, out of shipbuilding, and had to have everything first, including the first two automobiles in that city, circa 1907. (He took his entire family around Europe in those cars, and surely hired a few more to carry spare parts and attending mechanics.) Hence the Atwater Kent, in his "gun room," a large study sheathed entirely in wood and containing mainly a Steinway grand, on which he improvised while his family crept around the house in awe, never daring to disturb the great genius. A kindly soul, even so, in a day when that sort of pretension could be gotten away with.

Alas, no audio! My brother and I spent an entire morning, our hard Bakelite (?) headphones on each of us, twirling those *three* separate dials in search of—anything, just *something*. A noise. Audio. The miracle of radio in our own ears! Not a chance. That business-like Atwater Kent did not produce a sound for us, not even static. We were terribly disappointed. Probably a dead battery. My first radio sound came later from the previously mentioned Kolster. It worked and worked well, until we traded it in for a Philco mantelpiece radio, the gothic arch type.

As far as I am concerned, all those advanced circuits, culminating in the superhet (for a while available only from RCA as finished sets, though one could buy and build superhet kits) was not the real dawn of the age of radio. That dawn came with two more or less

Pavek Wireless Museum

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With the acquisition of the Mullin collection, Wychor and his cohorts are aiming to build the Pavek Radio, TV and Audio Museum.

external factors, of immense importance for a potential mass public. The first, of course, was "plug-in" power, the use of a.c. Big, unwieldy batteries—not the little wonders of today—were a perfect nuisance—you never trusted them and blamed all poor or missing reception on them as a matter of course. A.c. was unfailing and forever. People fell for it with gusto, and radio was really launched.

And second, actually earlier, was the consolidation of those multiple tuning condensers onto one knob. So simple, it seems now. But during the '20s most radios displayed two or three tuning knobs. This was impossible! To get two, or three, of them precisely tuned at two, or three, different micro-spots among the numbers was a pain, and indeed very difficult. Imagine, trying to refind a weak station that you had lost. As soon as ONE knob to tune everything appeared, radio took off. 'Nuff said.

One of the big questions I raised—I use that term deliberately—in my writing on the possibilities for a national Audio Museum was the matter of restoration. As you discovered (see "Audio ETC," July and September), I was all for it, beginning in 1929 with the original Deutsches Museum in Munich in the days before the start of real restoration among collections of old musical instruments. In that musical area, even today, there is not much doubt: An inoperative ancient harpsichord is now non-working only because it is beyond repair—and many harpsichord builders would deny that *any* such instrument is beyond hope, if you don't mind replacing 99% of its structure. Why not 100%? Done every day, in brand-new instruments based meticulously on the old, with enormous and accumulating knowledge of harpsichord building techniques (and other instruments as well) amounting by now very nearly to the expertise of the original makers.

In audio, as in railroad restorations, trolley cars, and similar, the question is not so easily settled. I spoke too loudly, out of memory, when I mentioned the original Edison phonograph, in fact exaggerating the unseemly dirt and dust though not my memory of the same. We received a very friendly letter—thanks be!—from Dr. Michael Biel of Morehead State University in Kentucky, concerning that unique machine, still resident at the East Orange Edison facility. No, it is not "musty and covered with dirt" as I remembered with a bit too much emotion. The brass merely has a patina "that it has earned in its 113 years," as Biel puts it. Moreover, "during the day the machine was (and is) encased under a glass cover. At night, at closing time, it is tucked away in a vault." During the 1977 celebration, Biel says it was announced that the original machine was not useable for a re-creation ceremony—hence the "spanking new exact replica." So there you have it in an Edisonian nutshell. To restore or not to restore—a special question with no final answers, to be resolved uniquely in every different case.

An Edison recording, actually, is not very practical on any machine due to the unique nature of the original process, indentation of a spiral groove on *tinfoil*, wrapped carefully around a cylinder. In 1977, the centennial year, a number of kind souls sent me samples of this *tin*foil, the real thing, as contrasted with our present ubiquitous aluminum foil. I have two samples tacked on my wall along with a piece of aluminum. A striking difference. The tin is yellower, more like polished silver, and remarkably soft, as limp as fine silk. Aluminum is relatively tougher and much springier. Without a doubt Edison chose this tinfoil as having the most desirable characteristics for his delicate indentation and playback.

Biel agrees with me that there is value in a hands-on "working" museum—his six-year-old daughter enjoyed the present-day Deutsches Museum as recently as last summer. But he points out that there are, and must be, two aspects to the museum operation: Those items specially prepared for the public to enjoy as directly and positively as possible, and the equally urgent and longer-range need for the archival approach, which may dictate preservation but not public participation nor fancy show.

I think immediately of the famed cave painting at Lascaux, now entirely closed to the public, the inside of the caves expensively maintained with air conditioning. That was an emergency measure, taken when the incredibly ancient wall paintings began to disintegrate merely by the presence of human beings and the variable outside atmosphere.

What was the museum at Lascaux? Astonishingly, an "exact replica," a whole new set of faked caves and reproductions of the originals, only a few yards away. Also, a detailed color film regularly shown on the spot. And no doubt thousands of documentary photos were available.

There are all sorts of in-between problems in restoration, whether for public show or not. The railroad and trolley museums have endless debates as to which stage in a long lifetime a steam engine or interurban car should be reproduced. Almost all such equipment has gone through endless alterations and ownership over the practical working years. At the Maine trolley museum I was unnerved when an open trolley on which I surely rode as a child appeared not in the standard Connecticut Co. yellow but a shocking pink! Seems it might have been pink for a few early years under the Consolidated label. How about those conversion kits for the famed Dynaco audio line—to bring your stuff up to current state of the art? Would you enjoy the thought? Or are you shocked, as I was over the pink trolley?

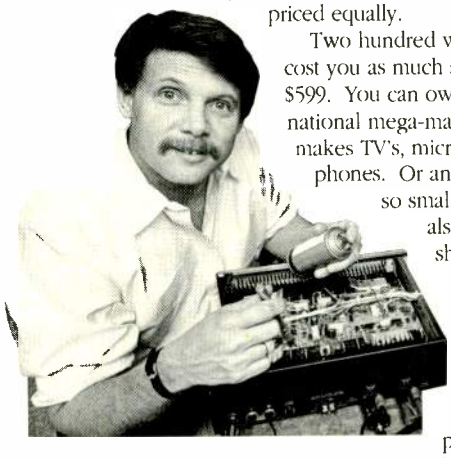
Once again, do not forget the Sistine Chapel. Furious battles still rage over the restoration of the great ceiling art there. Part of the problem is that not only were all sorts of later renovations and even changes made over the centuries but the artist himself seems to have begun with a kind of detailed sketch in place, over which he worked in much later and maybe better painting. (The work extended over a very long period.) Some of the new restoration brings forth the earlier sketches or "original versions"—rightly or wrongly?

Reverting to Pavek's radio museum, now moving into audio via Jack Mullin, I think we can see Minnesota as a good advance towards the documenting of audio's history and perhaps we may in time see similar centers East, West, and South, in addition to the frozen North. And, hopefully, major interchanges between these centers and others. If a million $$$ of Van Gogh or Cézanne can be shipped around, why not a batch of ancient tape machines—priceless too?

HOW MUCH SHOULD A GOOD AMPLIFIER COST?

Reflections on the esoteric myths and economic realities of power amplifier design, by Bob Carver.

Thumb through *Audio's* Annual Equipment Directory and you'll see vivid proof that all power amplifiers are neither created equal nor priced equally.



Two hundred watts per channel can cost you as much as $8,400 or as little as $599. You can own an amp from a multi-national mega-manufacturer who also makes TV's, microwaves and cellular phones. Or an amp from a company so small that the designer is also the assembler and shipping clerk.

Can it be that amplifiers are sonically equal? Some seem to have muscular power reserves far beyond their FTC-rated output. Others sound great until they're challenged by a dynamic passage and then sound like a Buick hitting a row of garbage cans. Some are (to indulge in audiophile jargon) so "fluid" that you practically need a drop cloth under them. Others seem to sound harsh, "metallic" and brittle at any output level.

A casual comparison of perceived sound quality versus price tags may lead to an erroneous conclusion: that an amplifier must be *expensive* to sound good.

The truth is a bit more complicated: Cosmetic glitz aside, an amplifier's cost is primarily determined by its power supply.[1] In other words, within reason, you generally do get what you pay for when you buy a conventional amp design. But the key word here is "conventional."

My decidedly *un*-conventional Magnetic Field Power Supply is capable of outperforming conventional power supplies of the same size. Result: A significantly better power amplifier value for you.

Let me explain.

NO MAGIC. JUST FOUR CRITICAL QUANTITATIVE FACTORS.

When I fervently state that "*the sound of an amplifier need not be related to its price*," you might think we're veering off into the land of Snake Oil and Gimmicks. Quite the contrary.

I and other members of the scientific audio community know that just four factors determine the sonic characteristics of an amplifier:

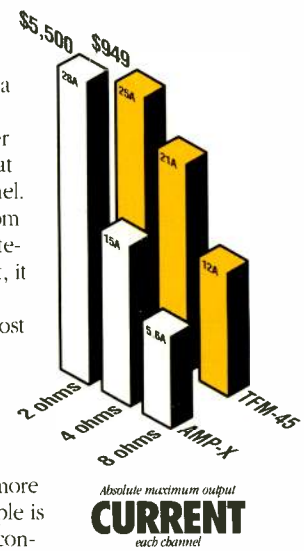
1. *Current output*
2. *Voltage output*
3. *Power output*
4. *Transfer function* *as evidenced by the interrelationship of frequency response and output impedance.*

These factors transcend the usual trivial debates over tubes vs. solid state, MOS-FETs vs. bi-polar, Class A vs. AB, silver Leitz wiring vs. copper, gold-plated front panels, WonderCaps and my favorite: hand-ground-open transistors filled with a proprietary crystalline substance that stops ringing (honest, I'm not kidding!). An amp can have any combination of these entertaining variables (plus special bricks stacked on top) and yes, sound wonderful...provided it ALSO has high current, voltage and power output and the correct output impedance.

Thus the Four Factors explain why expensive amplifiers generally sound better than cheap amplifiers. But also why that doesn't necessarily have to be the case.

FACTORS 1-3: THE POWER SUPPLY BEHIND THE SOUND

An amplifier's power supply produces current and voltage. A preponderance of one without the other is meaningless.[2] To maximize SIMULTANEOUS current and voltage output using traditional design approaches costs serious money. For example, we recently tested a competitor's $2,000 amplifier that was rated at 20 watts/channel. Believe me, from a parts and materials standpoint, it was worth $2,000, with most of that money being spent on an amazingly rugged power supply. Another more extreme example is my own ultra-conventional Silver Seven Tube amplifier design. Its "money-is-no-object" power supply helps set the price of a pair of S-7's at around $20,000.00.



Now, since it is universally agreed among amplifier designers that current/voltage/power output directly affects the sound of an amplifier,

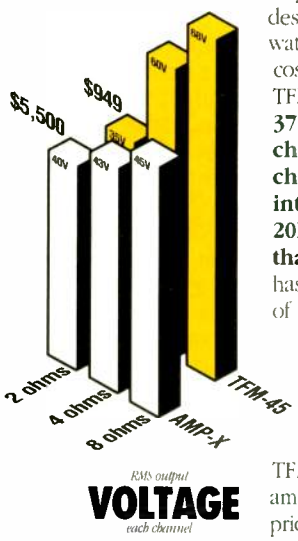
and since good traditional power supplies are costly, price and sonic quality ARE often closely related.

But what if there was a way around the economic constraints of conventional, inefficient power supplies? What if there was a power supply that could deliver awesome simultaneous current and voltage into real-world speaker impedances without shocking your pocketbook?

TFM-45; 375 watts RMS/ch. into 8Ω 20-20kHz with no more than 0.5% THD ($949 sugg. retail.)and TFM-15; 100 watts RMS/ch. into 8Ω 20-20kHz with no more than 0.1% THD ($399 suggested retail).

That's just what my patented Magnetic Field Power Supply does. Without gimmicks, mysticism or loss of bass response. Simply put, a Magnetic Field Power Supply uses progressively more of each line voltage swing as amplifier power demand increases. It's just plain more efficient. How and why this works is explained in our new White Paper called *"The Magnetic Field Story Parts I, II & III"* which you can get free by calling 1-800-443-CAVR.

Right now, let's consider the tangible benefits. The series of comparison charts in this ad shows how my Magnetic Field Power Supply successfully challenges the previously hard-and-fast rule that high-performance power supplies must be expensive. Amp X is a highly-respected solid state design rated at 200 watts into 8 ohms. It cost $5,500. My TFM-45 is rated at **375 watts per channel both channels driven into 8 ohms 20-20KHz with less than 0.1% THD.** It has a suggested retail of $949.



Even more impressive is this same sort of comparison chart with the TFM-45 vs. other amplifiers in its own price range. In deference to how utterly we trounce similarly-priced, conventional competition, we've confined those charts to our new White Paper.

To summarize: Magnetic Field Power Supply technology allows reasonably-priced power amplifier designs to deliver simultaneous current and voltage levels previously only found in extremely expensive "esoteric" designs. Or to look at it another way, in a given price range (say $900-$1,000), Carver simply gives you far more for your money.

FACTOR 4: TRANSFER FUNCTION

Consider two hypothetical amplifiers with identical power supplies. Same power rating; same gain, etc. Yet they still sound different when powering identical speakers through identical cables.

Why? A fourth quantifiable factor is at work. One that, unlike power supply output, is totally independent of economic constraints.

I've left Factor 4 (transfer function/frequency response/damping) until last intentionally. Because until an amplifier can deliver sufficient power with simultaneous current and voltage (Factors 1-3), transfer function is immaterial.

Amplifier with resistor test load

Same amplifier connected to cables and loudspeaker.

Frankly, I'm guilty of not making this fully clear in the past. Some readers may have gotten the impression that by magically adjusting some arcane parameter called transfer function, one could somehow cause a cheap amp to sound like an expensive one. Nothing could be further from the truth. If there's no guts (power supply), there's no glory (optimized transfer function).

By transfer function, I mean the effect an amplifier's output impedance has on real world frequency response. I don't mean the flat, "DC to light" Rated Full Power Bandwidth found in column 11 of *Audio's* Equipment Directory, which is measured using a resistor as a load. Rather, I'm referring to the frequency response curve that occurs when an amplifier and speaker cables interact with a specific speaker.

As distinctive as a fingerprint, this curve determines the "sound" of each amplifier design. Its warmth or harshness. The quality of the bass. The definition of its upper registers. Even the configuration of the stereo "sound stage" it can create.

My engineering department and I are capable of making one amplifier design sound like another amplifier design to within 99 parts out of 100 (a null of 40dB). For example, we've used Transfer Function Calibration to closely emulate the sonic characteristics of my reference Silver Seven in our TFM-45 and TFM-42 solid state designs. In other cases we've used the process to simply adjust the sound of an amplifier to have pleasant but unique sonic characteristics: in general, a warm "tube" sound with rich, rolling bass and soft yet detailed treble (such as our TFM-22/25 , S-7t and TFM-15). Either way, we use painstaking measurement and adjustment processes to finetune output impedance/frequency response. Not magic.

And, needless to say, we start with highly capable power amplifier designs before the Transfer Function Modification process.

ARE YOU INTRIGUED...OR THREATENED?

My Transfer Function Calibrated power amplifiers have suggested retail prices of from $399 to $1,000. That I even dare to suggest they can sound as good as designs in the $2,000 to $6,000 price range has not endeared me with some audiophiles or underground magazine writers.

That's a real shame, because I have absolutely nothing but respect for well-made, high-ticket conventional amplifiers. Like Rolexes and Lamborghini's, they are a joy to own if you can afford them. But just as a Rolex doesn't tell time any better than the inexpensive watch I'm wearing right now, good sound does not necessarily have to be costly.

If this concept intrigues you, please visit a Carver dealer soon. Bring demo material you're familiar with and be willing to do some critical listening. Compare my designs to competition costing about the same amount as well as to more expensive models.

Your ears alone should be the final arbiter. I feel confident that you will join the tens of thousands of audiophiles who have gotten the best possible value by owning Carver.

Bob Carver

Bob Carver, President

CARVER

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1 *My definition of cosmetic glitz is any part of an amplifier whose sole audio contribution is to cause one's friends to go, "Ooooo!!" when they see one's new purchase. My own Silver Seven amplifier's hand-rubbed piano lacquer and solid granite surfaces meet this definition.*

2 *Since power (watts) equals voltage times current, the same wattage can represent significantly different combinations of voltage and current — and thus very different performance into the same load.*

BERT WHYTE

JEWELS OF AUDIO ART

Illustration: Steve Dininno

Last month, in the first part of my review of FM Acoustics' Resolution Series 811 power amplifier and 244 preamplifier, I detailed some of the ultra-precision handcrafting, cost-no-object quality of parts, and proprietary devices and procedures which contribute so heavily to the truly extraordinary sonic accuracy and musicality of these gilt-edged components. The goal of Manuel Huber, the perfection-minded head of FM Acoustics, was to design and build an amp and preamp free from any constraints imposed by time and manufacturing costs. His intent was to redefine and go well beyond the previous state of the art. Many of his ideas and design philosophies fly in the face of conventional wisdom, and almost fanatical attention to every detail, from input to output, was needed to achieve this.

For example, the 811 features a special soft-start surge-protection circuit which limits the in-rush current known to make capacitors age faster. This circuit uses no relays or resistors, and it greatly extends the life of the capacitors. The capacitors used in the 811 are proprietary designs made exclusively for FM Acoustics. Many audiophiles seem to feel that capacitors which resemble 105-mm artillery shells are indicative of a high-quality power supply. Huber points out that the larger a capacitor is, the higher its inductance and resistance at high frequencies. In addition, a capacitor has a nonlinear electrical series resistance (ESR) with respect to frequency. The FM Acoustics capacitors reduce the ESR by a factor of about five as compared to conventional capacitors. Thus, their ripple current capacity is extremely high. This allows the use of smaller and fewer capacitors, making the ESR lower and far more linear over the entire frequency band.

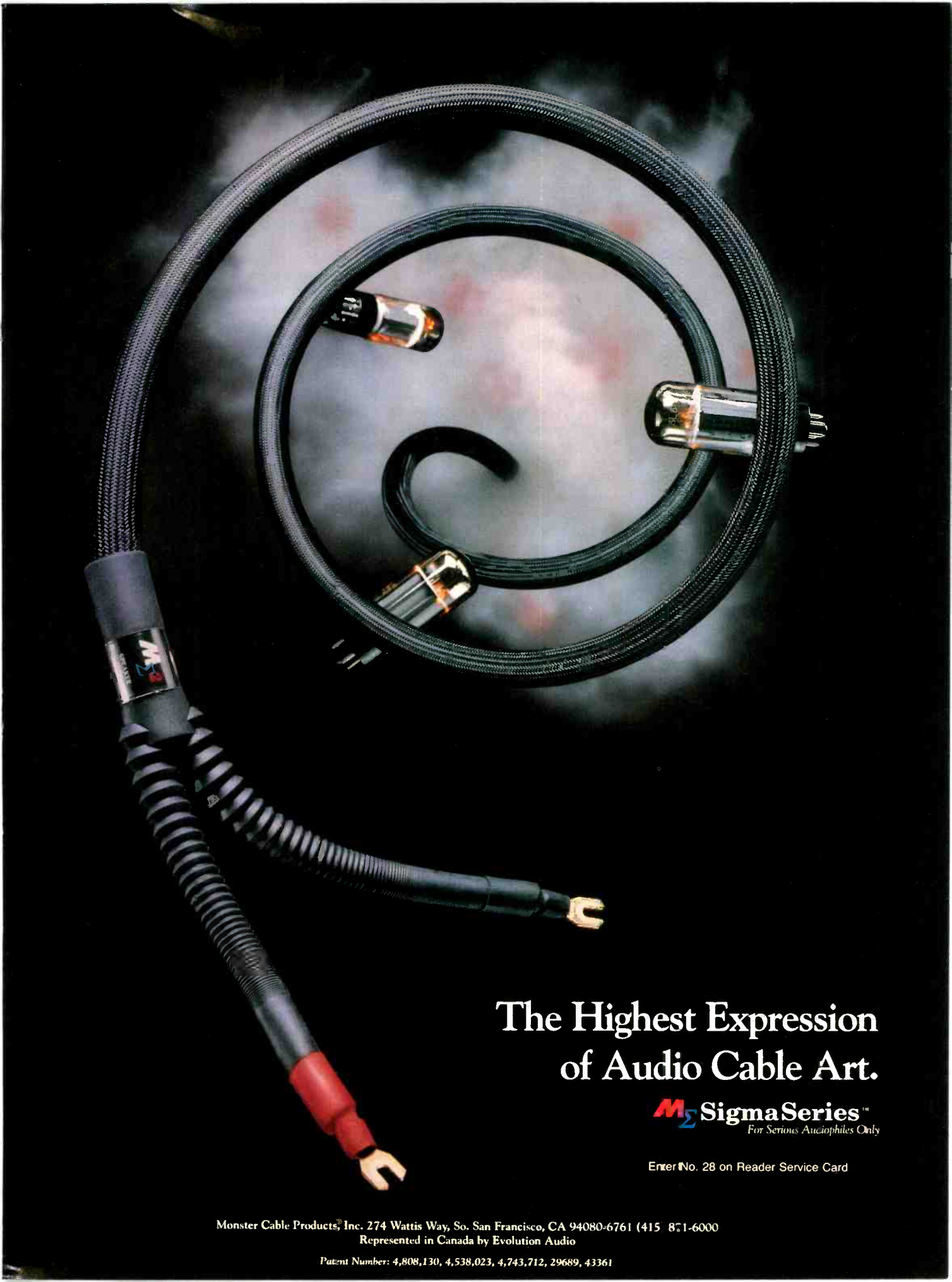
The 811's, 2,900-VA transformer (described last month), proprietary capacitors, and matched pairs of power transistors (with their huge 46-sq.-mm chip area) mounted directly onto the cooling fins are part of the reason it can supply an immense output current. However, it is the 811's unique onboard analog computer which really makes possible its virtually unlimited output current.

The computer measures peak and continuous output current, output voltage, rail voltage, bias, temperature, and other parameters 20 times per second and compares this data to optimum values stored internally. If you introduce, for example, a very dynamic signal (but not a short circuit), then the output voltage will on average be very high, while the average current will be reasonable—but the peak current will be huge, while the rail voltage remains stable. So here the output current remains absolutely unlimited, producing as much dynamic current as is required by the load. This, of course, requires huge reserves (another reason for the cooling fan), and the amplifier will reproduce precisely what is fed to the input, limited only by what the a.c. power can supply.

If a short-circuit situation develops, peak current is high, continuous current is shooting extremely high, and the rail voltage drops (because it collapses with such great amounts of current). At that moment, the amplifier shuts off before the output stage can be damaged. There is no limiting, compression, or anything similar. The amplifier shuts down, and the front-panel display shows an error message. Another circuit is immediately activated to measure the load impedance 20 times per second. As soon as the short circuit is removed, the amplifier automatically resets and becomes operational. Thus, the amplifier either works perfectly—or shuts off. No negative influence on the audio signal is possible.

The computer also monitors other error conditions. For instance, the 811 is provided with separate positive and negative d.c. sensors on both outputs; if there is any d.c. above 1 V, the amplifier switches off and the display shows "DC Error." The computer keeps measuring (20 times per second), and as soon as the d.c. is removed, the amp resumes operation.

The 811 has sensors for high-frequency oscillation that might occur because of ground loops or oscillating equipment. The sensors allow short bursts of high frequencies, like those from tape machine bias, to pass. However, with any continuous oscillation over 20 kHz, the amplifier instantly switches off. It should be noted that in the case of d.c. offset and high-frequency oscillation, the inputs and outputs of the 811 are switched off, as continuous very-high-frequency input into the 811 could destroy it. A proprietary relay with special contact material has 16 parallel contacts, each rated at 2,500 watts, to switch off the amplifi-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FM Acoustics' Manuel Huber set out to exceed the state of the art, regardless of time and production costs.

er. This relay makes sure that the superb damping provided by the 811 actually gets through to the speakers.

Another feature of the 811 is that it has a star grounding system of super-low impedance, the type used in many professional recording studios. Star grounding is expensive. Every single amplification stage (there are seven in the 811)—every single active device, in fact—must be grounded by a separate wire or connector to the central grounding point. This method, free from ground modulation, guarantees proper grounding, very low impedance and resistance, and no influence of any stage on any other. This is one of the reasons FM Acoustics can make a single-chassis stereo amplifier that equals or surpasses the separation of monoblock amps.

Before it leaves the lab, the 811 goes through elaborate testing. FM Acoustics subjects the 811 to a wide variety of loads and to switchable short-circuit tests. Accurate voltage and current measurements are taken. High-voltage insulation and accurate operating temperature are tested, and the protection circuitry is checked with a d.c. offset generator. Multiple burst measurements are also made. The 811 is run through 599 thermal cycles in a 100-hour burn-in and then subjected to violent vibration on a shaker table for an hour. After this abuse, the entire test procedure is repeated. While FM Acoustics uses many precision tools and devices, many of them proprietary, in the manufacture of the 811, I still have little doubt that there is more labor-intensive handcrafting on the 811 than on any other amplifier.

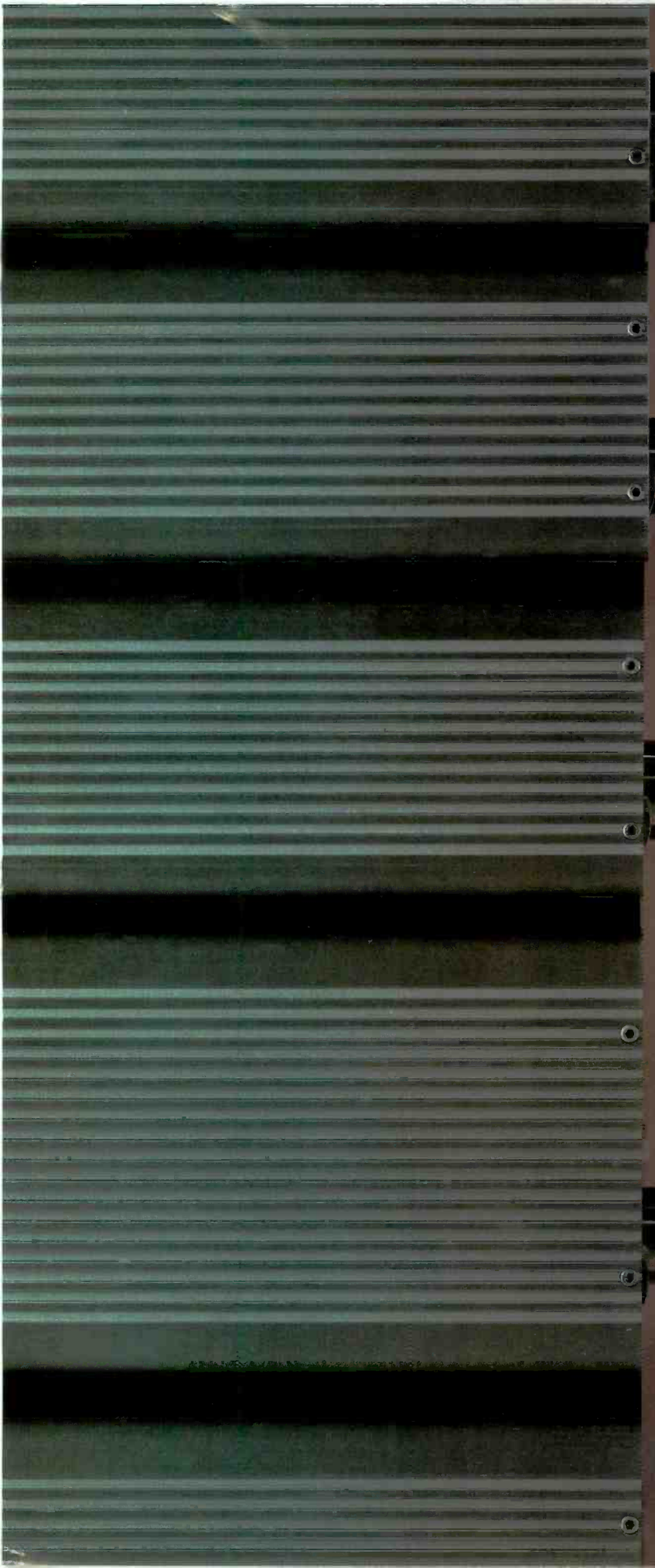
The FM Acoustics 244 preamplifier, the companion unit for the 811 power amplifier, is built to the same uncompromising level of quality as the 811. The 244 has absolutely zero feedback or feedforward in its circuitry. The proprietary signal-amplification circuitry is encapsulated in plug-in modules, which have discrete Class-A circuitry. As in the 811, all transistors are hand-selected and matched on a curve-tracing instrument. (Around 400 transistors must be checked to find enough matching pairs for one Model 244!) The front panel has push-button switches to select a phono input and three high-level inputs. There is a tape loop, mono/stereo switch, headphone jack, and balance and volume controls. The headphone jack doesn't have the usual IC headphone amp but uses a discrete Class-A amplifier. Balance and volume controls are sealed, conductive-plastic, multi-wiper potentiometers which are checked to ensure that they do not deviate by more than 1 dB over a 55-dB range. Another feature of the balance and volume controls is that they are isolated from the gain stages by pure Class-A buffers.

The 244 is available in Version A for moving-coil cartridges, Version B for moving-magnet cartridges, and Version C for purely high-level operation. In Version A, mini switches on the back panel allow for selecting resistance and capacitance for various MC cartridges. As in the 811, the 244 uses a star grounding system, and on the back panel is a ground-lift switch which can be used to check for ground-loop problems.

The bandwidth of the 244 is extremely wide, extending from 2 Hz to 2 MHz! There is said to be no phase shift from 20 Hz to 20 kHz. The output impedance is a very low 10 ohms, allowing the unit to drive several hundred feet of cable without attenuation. Rated distortion on line is an impressive 0.025% THD and on MC phono is 0.03%. Rise- and fall-time is 0.2 μS, with no overshoot. On line, hum, and noise are 90 dB below 0 dBV.

The straightforward specifications of these units are impressive, but although the numbers should be indicative of good sound, in no manner can they prepare you for the stunning musical verisimilitude provided by this gear. After months of intensive auditioning with the most demanding music, there is no doubt in my mind that a new pinnacle of musical performance has been achieved.

No amplification equipment should have a sonic "signature," but many do. Total neutrality, with no euphonious embellishment, is the ideal. The 811 and 244 reproduce *exactly* what is recorded on the source. If distortion and noise are in the recording, they are as faithfully presented as the music. Likewise, there is no alteration to the ambience of the original recording hall or any glamorizing or romanticizing of the musical instruments.



THE END OF HYSTERESIS

"A generation later, transistor designs by such companies as Levinson, Krell, and Threshold have gained my respect as being eminently musical despite their silicon hearts. To this list I can now add Kinergetics Research."
Dick Olsher
Stereophile Vol. 13, No. 1.

"Those audio fanatics who want to be bombarded by jet planes earthquakes, thunderstorms, and even atomic bombs would probably not like the Kinergetics sound, but if they're searching for music, here is an oasis."
Lewis Lipnick
Stereophile Vol. 10, No. 5.

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John Atkinson
Stereophile Vol. 13, No. 1.

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Neil Levenson
Fanfare, Jan/Feb 1990.

"Kinergetic's KCD-20... the first CD player to crack the Class 1 Sound barrier"
Peter Montcriaff
"International Audio Review",
Hotline #43-45.

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Though specs are often good indicators of sound quality, the 811's and 244's numbers can in no way prepare you for their superb performance.

The 811 and 244 are incontestably the best I have ever heard in what I call dynamic expression, the ability to fully reproduce the wide dynamic range of the best CDs with absolute accuracy and to do so without the slightest hint of compression, all throughout the musical spectrum. I heard things on familiar recordings which I had not previously perceived.

On a CD featuring Mitsuko Uchida's monumental performance of Debussy's "Etudes for Piano" (Philips 422212-2), the piano is reproduced as if it were in your listening room, at live playback levels! The dynamics of Uchida's great fortissimo bass chords never sound strained or harsh but simply resound with huge, resonant authority. Her quicksilver runs and trills are totally accurate. Every note is completely articulated, and there's never a trace of transient blunting.

On a disc of Shostakovich's Eighth Symphony, with Neeme Järvi and the Scottish National Orchestra (Chandos 8757), the most thrilling music of the third movement—with its relentlessly rapid unison string passages punctuated by high-level tympani strokes, brass fanfares, and snare-drum rolls—is reproduced with stunning accuracy. The unfettered dynamics give the music an exhilarating panache.

John Eargle's landmark recording of Respighi's "Feste Romane" (Delos DCD-3070) is simply unbelievable. The tumultuous outpourings of brass, huge bass drum explosions and accenting tam-tam, fierce high-register strings, and thunderous organ-pedal counterpoint are reproduced by the FM Acoustics components with simply overwhelming sonority. The demands of dynamic expression on this recording are probably as great as you'll find on any CD and will severely tax even the best audio systems. If your speakers can handle this musical onslaught at realistic levels, the 811 will flawlessly provide the requisite dynamics.

On his dmp label, Tom Jung has produced some of the cleanest, most explosive and demanding recordings on CD. On his *Heat of the Moment* (dmp CD-468), track 5 has just about the most tremendously sonorous piano you'll ever hear. It is deliberately larger than life, for Tom coupled the mike pickup on the piano through a MIDI to a synthesizer, recording subterranean bass frequencies along with huge bass chords from Warren Bernhardt's piano. For the vast, rumbling, ultrapowerful bass, the 811 has the immense reserves of output current needed to reproduce it cleanly.

At $27,000 for the FM Acoustics 811 power amp and $6,000 for the 244 preamp, few people are likely to own these simply incomparable jewels of the audio art. But I can tell you that listening to great music through them is on the same level as driving fast cars or indulging in other thrills. So now I've got to fill out my lottery tickets. . . . A

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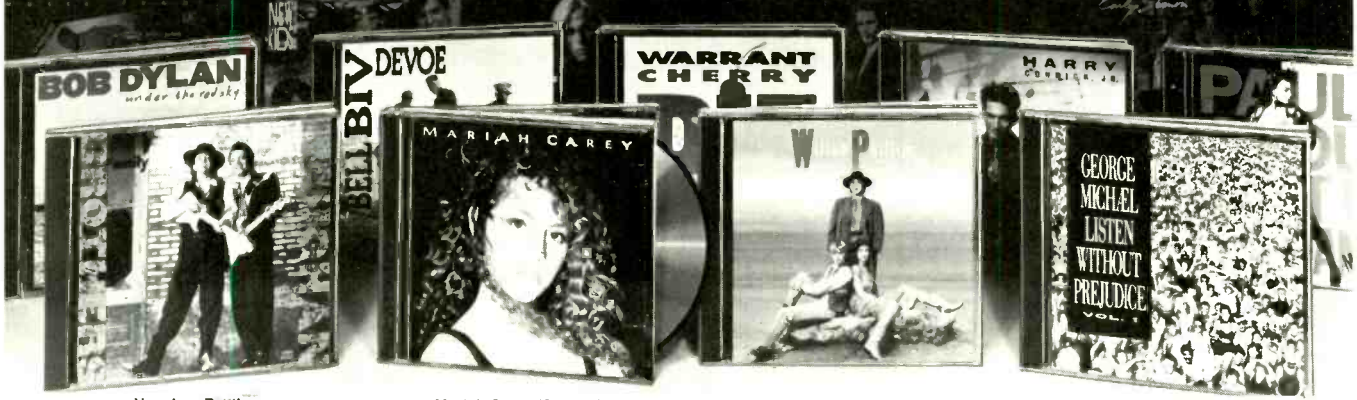

Vaughan Brothers—Family Style (Epic/Associated) 411·306

Mariah Carey (Columbia) 407·510

Wilson Phillips (SBK) 406·793

George Michael—Listen Without Prejudice, Vol. I (Columbia) 411·181

Pump Up The Volume—Original Soundtrack (MCA) 412·593

Jackson Browne—The Pretender (Asylum) 292·243

Frank Zappa—Apostrophe/Overnite Sensation (Rykodisc) 412·395

David Bowie—Changesbowie (Greatest Hits) (Rykodisc) 412·247

Pixies—Bossanova (Elektra) 410·753

Duran Duran—Liberty (Capitol) 410·449

Kronos Quartet—Black Angels (Elno) 409·912

Bonnie Raitt Collection (Warner Bros.) 409·466

Aerosmith—Greatest Hits (Columbia) 306·225

James Taylor—Greatest Hits (Warner Bros.) 291·302

Warrant—Cherry Pie (Columbia) 411·389

Bob Dylan—Under The Red Sky (Columbia) 411·199

Eagles—Greatest Hits 1971-1975 (Asylum) 287·003

Esa-Pekka Salonen—Stravinsky: The Rite Of Spring/Symphony In Three Movements (Sony Classical) 409·342

Vladimir Feltsman—Tchaikovsky: Piano Concertos Nos. 1 & 3 Mstislav Rostropovich National Symphony Orch. (Sony Classical) 409·227

Gene Loves Jezebel—Kiss Of Life (Geffen) 408·377

Michael Franks—Blue Pacific (Reprise) 408·328

Pat Metheny Group—Question And Answer (Geffen) 408·286

Carly Simon—Have You Seen Me Lately? (Arista) 411·066

Nelson—After The Rain (DGC) 411·009

Linda Ronstadt—Greatest Hits (Asylum) 286·740

Steve Vai—Passion And Warfare (Relativity) 408·104

Spyro Gyra—Fast Forward (GRP) 407·817

Zubin Mehta, Cond.—New Year's Concert 1990 Wiener Philharmoniker (Sony Class.) 407·189

Kathleen Battle—Handel: Arias Academy Of St. Martin In-The-Fields Neville Marriner (Angel) 407·155

Wynton Marsalis—The Resolution Of Romance (Standard Time, Vol.3) (Columbia) 406·637

Branford Marsalis—Music From Mo' Better Blues (Featuring Terence Blanchard) (Columbia) 410·928

Ratt—Detonator (Atlantic) 410·456

Barry Manilow—Greatest Hits (Arista) 288·670

Roger Norrington—Early Romantic Overtures London Classical Players (Angel) 406·090

The Boston Pops Orchestra—Music Of The Night/ Pops On Broadway 1990/ John Williams, Conductor (Sony Class.) 405·993

Najee—Tokyo Blue (EMI America) 405·910

Heart—Brigade (Capitol) 405·555

Depeche Mode—Violator (Sire/Reprise) 405·423

Sinead O'Connor—I Do Not Want What I Haven't Got (Chrysalis) 405·001

Ricky Van Shelton—RVS III (Columbia) 402·040

Poison—Flesh & Blood (Capitol) 408·963

Bell Biv Devoe—Poison (MCA) 406·819

Simon & Garfunkel—Greatest Hits (Columbia) 219·477

Basia—London Warsaw New York (Epic) 401·752

Dionne Warwick—Greatest Hits (1979-1990) (Arista) 401·679

Yo-Yo Ma—Great Cello Concertos (CBS Master) 401·604/391·607

Best Of The Canadian Brass (CBS) 401·596

Barbra Streisand—A Collection: Greatest Hits and more (Columbia) 401·141

The Best Of Luther Vandross—The Best Of Love (Epic) 400·473/390·476

Winger—In The Heart Of The Young (Atlantic) 406·678

Harry Connick, Jr.—We Are In Love (Columbia) 406·645

Brahms: Violin Concerto; **Bruch**: Concerto No. 1 Nadja Salerno-Sonnenberg; De Waart, Minnesota Orch.(Angel) 400·135

Linda Ronstadt—Cry Like A Rainstorm, Howl Like The Wind (Elektra) 389·874

Janet Jackson—Rhythm Nation 1814 (A&M) 388·918

Aerosmith—Pump (Geffen) 388·009

Billy Joel—Storm Front (Columbia) 387·902

Faith No More—The Real Thing (Reprise/Slash) 387·399

Billy Idol—Charmed Life (Chrysalis) 386·789

Paula Abdul—Shut Up And Dance (The Dance Mixes) (Virgin) 406·264

New Kids On The Block—Step By Step (Columbia) 405·415

Dvorak: Violin Concerto; Romance; Carnival Over. Midori; Mehta, NY Phil. (CBS Master) 386·573

Richard Marx—Repeat Offender (EMI) 380·915

Grateful Dead—Skeletons From The Closet (Warner Bros.) 378·406

Roy Orbison—The All-Time Hits, Vols. 1 & 2 (Columbia Special Prod.) 377·945

Fleetwood Mac—Greatest Hits (Warner Bros.) 375·782

Journey's Greatest Hits(Columbia) 375·279

Marvin Gaye—Greatest Hits (Motown) 367·565

Best Of The Doors (Elektra) 357·616/397·612

Rolling Stones—Sticky Fingers (Rolling Stones Rec.) 350·645

The Police—Every Breath You Take... The Singles (A&M) 348·318

A Decade Of Steely Dan (MCA) 341·073

Billy Joel—Greatest Hits Vols. 1 & 2 (Columbia) 336·396/396·390

Elton John—Greatest Hits (MCA) 319·541

Michael Bolton—Soul Provider (Columbia) 383·083

Living Colour—Time's Up (Epic) 410·357

Jane's Addiction—Ritual De Lo Habitual (Warner Bros.) 407·098

Prince—Graffiti Bridge (Paisley Park) 409·870

Anita Baker—Compositions (Elektra) 408·989

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JOHN EARGLE

DIGITAL, MY DEAR TRACY

It should come as no surprise to *Audio* readers that digital has finally found its way into the motion-picture theater. In fact, most readers are probably wondering why it has taken so long to get there. There are several good reasons, but to understand them requires taking a quick look at the history of motion-picture sound.

When sound was introduced in motion pictures in the late 1920s, it represented the culmination of years of audio research by scientists at Bell Laboratories and was, quite simply, the best sound around. The Vitaphone system made use of a 16⅔-rpm disc run in sync with the film, but that system was doomed when film prints would inevitably break in the field and have to be spliced back together—minus a frame or two. The disc could not be adjusted so what might have begun in sync didn't always stay that way. The optical soundtrack was the answer to the problem of keeping sound and picture together through splices, but its quality was limited, and motion-picture sound remained on a plateau. Only *Fantasia* in 1940, with its three-channel stereo presentation, gave a hint of what the future could bring.

Meanwhile, the hi-fi industry was beginning, and by the late 1940s, the accomplishments of such pioneers as Gilbert Briggs, Paul Klipsch, Frank McIntosh, and Arthur Haddy (developer of English Decca's *ffrr* recording technology) were known to a wide audience. By comparison, movie sound was little better than it had been during the mid-1930s.

In the early 1950s, Cinerama, with its six-channel magnetic tracks on film, advanced motion-picture sound a giant leap. This technology was incorporated into general Hollywood practice in the mid-1950s, with four magnetic tracks on 35-mm film (later abandoned for the now-standard optical tracks). For the first time, left, center, and right screen loudspeakers and a multiplicity of surround loudspeakers became commonplace across the country, and motion-picture sound took another stride ahead of consumer audio. A bit later, Todd-AO pioneered the use of six magnetic tracks on 70-mm film, and the lead of motion pictures over consumer audio increased even more.

The stereo disc changed the industry dramatically in 1957. With it, stereo was introduced into the home in a big way, and within just a few years, the performance of phonograph cartridges improved by an order of magnitude. Stereo recording techniques were being honed, and the recording art was entering the first of several "golden ages" that are still with us today in the form of CD reissues. I cite here the early Everest catalog, the RCA recordings of Charles Münch and Fritz Reiner, and the English Decca recordings of Ernest Ansermet, to name only a few. Continuing refinement of microphones and loudspeakers was a part of this steady evolution during the 1960s, and by the middle of that decade it was clear that the best sound was to be heard in the home of the audiophile. The rest is recent history. By the mid-1980s, the fussy consumer could expect digital recording of the highest quality played over electronics and loudspeakers of exemplary quality. The only limitation was that there were only two channels.

©Touchstone Pictures

Meanwhile, back in Hollywood, Dolby Laboratories was hard at work convincing motion-picture producers and sound engineers that noise reduction (and new standards for loudspeaker equalization) could lead to dramatic improvements in theater sound. This was during the early 1970s, and by late in that decade, *Star Wars* had convinced Hollywood and the public alike that improvement in movie sound itself could be an extremely important part of a film's overall success.

When digital recording was introduced by Denon (in Japan) and Soundstream in the mid-1970s, it set in motion the revolution that eventually led to the Compact Disc and Digital Audio Tape. It also set minds in Hollywood thinking about how the new technology could be adapted to film. The optical medium itself did not have the resolution necessary, at normal film speeds, to permit digital information to be encoded directly on film. There was no serious thought given to running digital tapes in sync with films since this would be a replay, as it were, of the old Vitaphone problem—not to mention the heavy costs of outfitting theaters with expensive digital playback machinery.

One interesting possibility was the application of a very thin transparent coating of fluorescent dye directly on the film, which could carry digital information across the entire width of the film. To my knowledge this process was never implemented, but it was certainly discussed at length.

Another interim step was the use of the Sony PCM-F1 two-channel digital audio processor. This was a relatively low-cost consumer digital recording system that used a normal Beta (or VHS) VCR to store the signal. Since it was TV-based, a variety of sync techniques could be used to maintain multiple F1's in sync with a film. But again, as a dual system, how was it to handle the problem of film splices?

At least one inventor, John Karamon, has found a way to wed CD technology and standard film technology without splice problems. His 1989 patent describes a method in which CDs or other digital media can be run in tandem with a film's optical soundtrack. Ten seconds before the projector starts, the digital player begins feeding its signals into a memory bank. Within microseconds after the film's analog soundtrack starts, the Karasync system synchronizes the digital signal to it and fades to the digital soundtrack.

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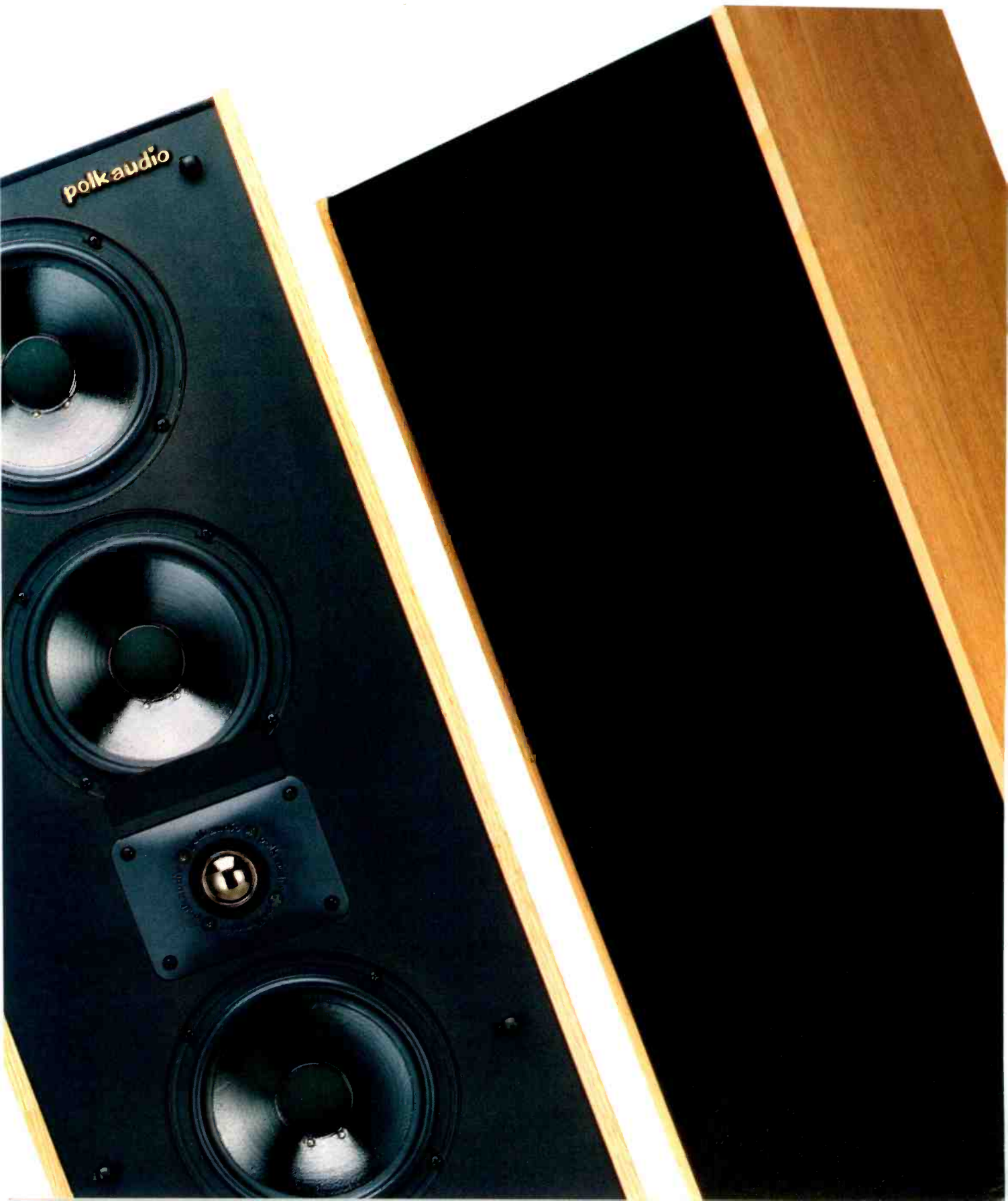
Client Support: free access via Email. **Hardware Requirements:** IBM® PC/Compatibles with 384K usable RAM, MS-DOS® 2.1, two floppy drives or a hard disk system – or Macintosh® 512KE or higher, 800K drive. Hayes® compatible modem also required. ***Limitations:** Over 20 monthly transactions involve a nominal surcharge ($3 per ten payments or portion thereof).

Breathtaking



the new Polk RTA 15t

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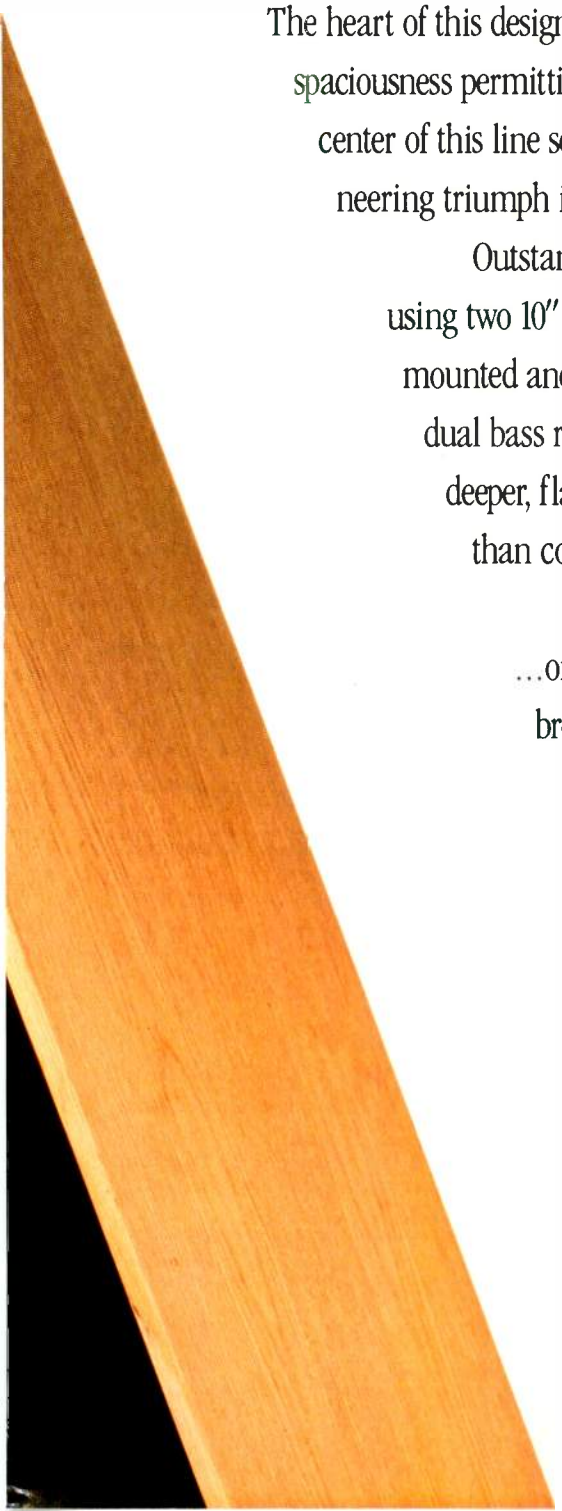

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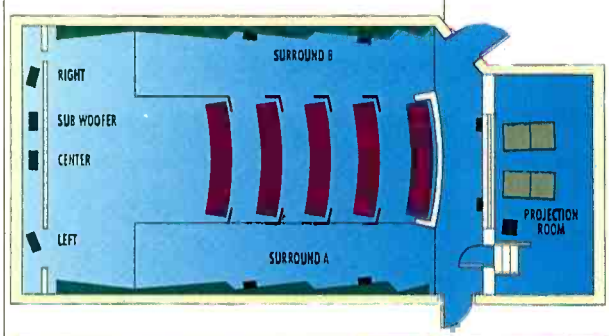
Enter No. 36 on Reader Service Card

Cinema Digital Sound just offered *Dick Tracy* viewers six-channel sound with S/N and bandwidth rivalling those of Compact Disc.

Synchronization is continuously checked. If there are problems, the system fades to analog, resynchronizes, and then fades back to digital.

The most attractive aspects of Karamon's method are that the film format itself is not changed in any way and that foreign language versions of a film do not need new prints but rather new CDs to go with them. These CDs would probably contain music and effects in stereo plus monophonic dialog tracks in English (to maintain sync) and other languages. There would be brief lapses into English whenever sync was lost, but it's still an attractive, though complex proposition.



Speaker locations in a theater with Cinema Digital Sound.

Magnifying the CDS optical soundtrack shows its digital nature.

Kodak and the Optical Radiation Corp. (ORC) collaborated on the development of Cinema Digital Sound (CDS), the format recently introduced and used for the film *Dick Tracy* in selected venues. It is a new film stock which makes the process workable, by reducing granularity in the film so that microscopic digital data can be recorded and retrieved. ORC developed the specific digital coding for the process, along with the method of compensating for film skewing.

The audio track format for CDS is one that the film industry applauds: Five full-range tracks and a single subwoofer track. There are, in addition, an SMPTE time-code track and a MIDI control track (which can be used for various operations in the theater itself, such as dimming house lights or opening curtains). The five full-range channels are allocated left, center, and right (behind the screen), along with a split surround system (surround left and surround right). Split surround is an option which the film industry has not often used, probably because it has always required a good bit of reformatting in the field. There is no doubt, however, that it helps "flesh out" an ambient sound field in a very important way. Its use on a routine basis should open up many new possibilities.

Specifications for the digital channels include signal-to-noise ratio of 96 dB and bandwidth of 20 to 20,000 Hz. This certainly implies performance comparable to the Compact Disc's. The process is currently applied to 70-mm film, with 35 mm to follow soon.

Although loudspeaker technology in movie theaters has moved ahead in the last eight years, there is still room for improvement. The screen is a complex low-pass audio filter, and if response out to 20 kHz is to be realized in the theater, there is more work to be done in several technological areas.

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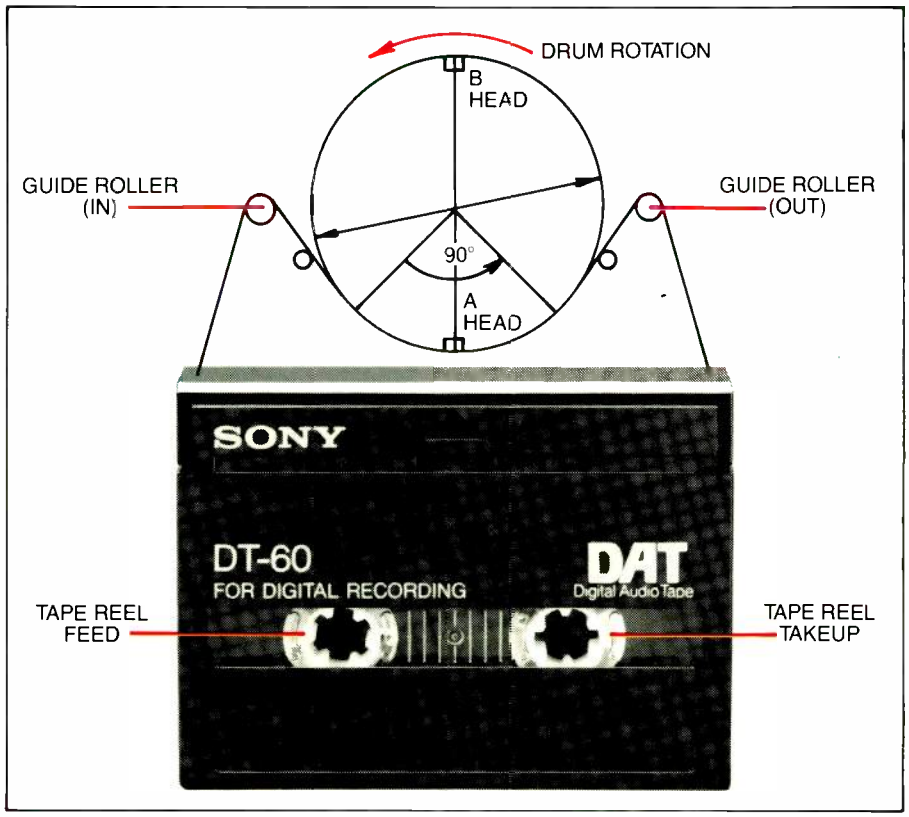

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ACCESSORY AFTER THE FACT

Cleaning Up in Lirpa's Wake

For some inexplicable reason, few manufacturers have produced accessories specifically designed for Lirpa products. Allsop, however, is a notable exception. Expanding their already broad range of audio and video cleaning systems, they've produced a cleaner fully compatible with the Lirpa Vehicular Compact Disc Reproduction System (VCDRS) CD player reviewed in (as usual) our April issue.

Allsop's prototype, on the left in the group photo, was modelled closely after the Lirpa player, and indeed could be made to cruise the disc just ahead of the VCDRS, ensuring a freshly cleaned surface at all times. Its articulated design helped negotiate the tight bends where the CD's circumference narrows, towards the disc's center, and its blade could dislodge even the blobs of peanut butter used by misguided Lirpaphiles as a sound-enhancing disc treatment. The articulated design proved a drawback, however, in radial cleaning (which, as designer Eivind Clausen pointed out, is the preferred mode for CDs); the scraper section was likely to go off at an angle when the system was backed up to the center for another pass along the next radius.

Lirpa's original Vehicular Disc Reproduction System (VCDRS) CD player

Lirpa-compatibles at last: Allsop's prototype (left) and production version

Photograph/Construction: James Nazz

The final production version, on the right, is therefore an entirely different design. Its unarticulated (or "unhinged") design and shorter wheelbase permit its use in both cruise-ahead and radial modes, while its Caterpillar tread provides better traction on the disc's smooth surface. In radial mode, the blade lifts automatically as the cleaner goes into reverse for its next pass, and differential tread drive repositions the unit at the precise angle required each time. The addition of the soft, absorbent "Lir-pad" to the blade, plus a reservoir of track-cleaning fluid in the unit, gently remove fingerprints which, research shows, are a more common problem than peanut butter in most homes. Removing the pad reveals a scraper blade which is capable of cleaning residue even from bubble-gum rock records.

Buy-Outs and Buy-Ins

While Clarion Shoji Co. Ltd. does make some home electronics, it's best known for car stereo, which comprises 83% of its business. That may be changing: In July, Clarion purchased McIntosh Laboratory for $28.6 million. Clarion has stated that it intends to retain McIntosh's product and production policies and its senior management. The sale, which was triggered by the death last year of McIntosh's co-founder and president Gordon Gow, will probably increase Clarion's prestige in Japan, where the McIntosh name is treated with respect bordering on reverence. The infusion of new capital may also lead to an expansion of McIntosh's product line—possibly even to car stereo. As McIntosh's longtime National Sales Manager, Dirk Roos, told *Audio Week*, a trade newsletter, "I think we're in a position to market something for Mercedes; they're not."

Earlier this year, Philips purchased a 25% stake in Bang & Olufsen. This minority share is tied in with agreements between the two companies for cooperation on technology, purchasing, components, and subassemblies, extending a relationship that has existed since B & O's founding in 1925. Philips reports that it will not hold seats on B & O's board or participate in its daily management.

On the domestic front, International Jensen purchased Now Hear This (NHT). Unlike such previous Jensen acquisitions as Phase Linear, Advent, and Acoustic Research, NHT will continue to be headed by its co-founders, Ken Kantor (author of several *Audio* articles) and Chris Byrne.

Perhaps the biggest news was the announcement that Sansui had been purchased by Polly Peck International, a British company involved in the food, textile, and leisure industries as well as in the manufacture of mass-market electronics. The resulting infusion of capital has already allowed Sansui to set up a new sales headquarters in Italy and strengthen its sales in other countries. It also allowed Sansui to purchase the audio interests of Mission Electronics a few months later. (Farad Azima, Mission's former principal owner, will continue to be the company's chief operating officer, however.)

The least expected news was the announcement that Polk Audio has signed a letter of intent to purchase AGI, the British holding company that owns KEF and Boothroyd Stuart (makers of Meridian).

None of this activity belies the current wisdom that the rash of mergers and acquisitions that characterized the '80s won't continue into the '90s. After all, the '90s don't officially begin until 1991.

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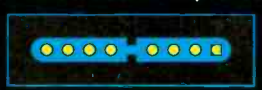

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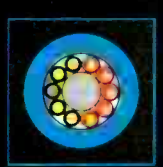

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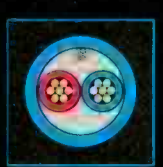

*Lapis Hyperlitz**

All diagrams are 1½ times actual size.

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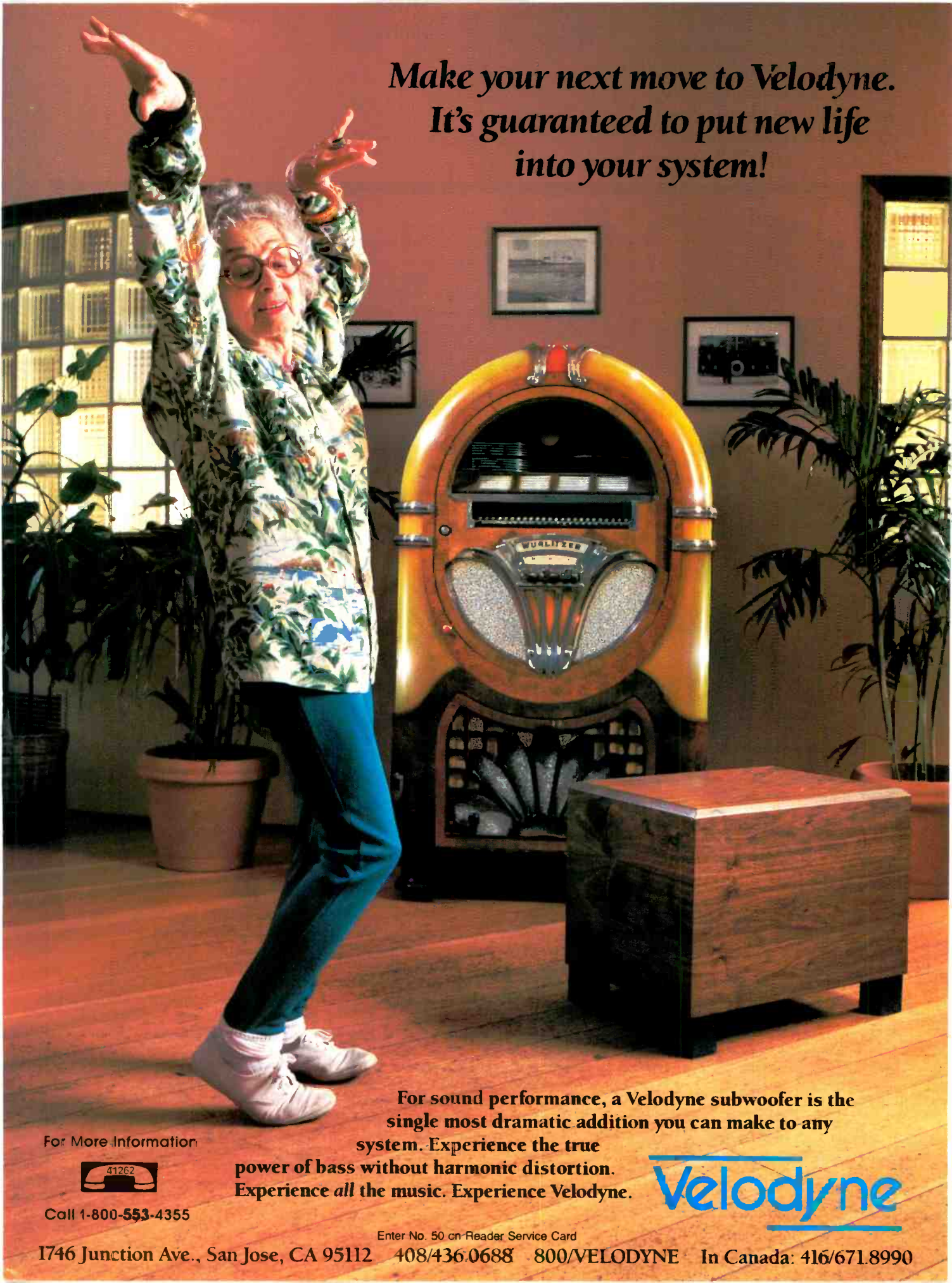
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Coughs and concerts have the same season, but lately concert halls are fighting back with bowls of cough drops at the entrances.

Off with the Cough

Coughs and concerts have the same season, alas, but lately concert halls are fighting back. At one performance in Ann Arbor, Mich., last winter, I noted bowls of cough drops at the entrance doors, individually wrapped in relatively noise-free waxed paper instead of crackly cellophane. According to Rich Warren of the *Chicago Tribune*, this is common in Michigan. This live-music noise-reduction technique may be spreading further: My wife just noted a similar bowl in the women's room at Avery Fisher Hall in Lincoln Center. (I didn't see any in the men's room, though.)

According to Warren, the audience's cough rate is a good indication of how well they like the concert. The fewer coughs per minute, the greater the audience's approval.

Directory Follies

We can't personally verify the thousands of items of data that manufacturers provide for our Annual Equipment Directory (and our May Car Stereo Directory), but we do check them for obvious errors, such as preamps rated at 50 watts per channel or crossovers with three bands separated by a single crossover frequency. And while some questionnaires are completed by people who know too little about the product, at least one was filled in by The Man Who Knew Too Much. Under "Notes," he commented: "Hideous board layout." We won't name the guy or the product, though; why lose an honest man his job?

Illustrations: Teresa Anderko

dBmystery Resolved

Some mysteries don't last long, especially when you put *Audio* readers to solving them. I mentioned in our February issue that the audio manufacturers who listed "dBm" in the specs for their CD players' fiber-optic outputs couldn't tell me what it meant, but readers from several companies have replied since then. As in electronics, the dBm is a measure of power, re: 1 milliwatt (0 dBm = 1 mW). It is not, however, referenced to any particular impedance, says transmission technician Ed Lippman of New Jersey Bell (like most phone companies, a major user of fiber optics).

The power levels involved in fiber optics are quite low. Output levels of typical emitters are −10 to −20 dBm (0.1 to 0.01 mW); to allow for losses in long fiber runs, typical optical receivers have a sensitivity rating of −35 to −40 dBm (0.32 to 0.1 μW), according to engineer Dan Brown and president Michael Coppola, of Meson Design and Development (who make fiber-optic test equipment).

Further elaboration came from Randy Yates, an R & D engineer at Digital Sound Labs, which is involved in digital audio signal processing. According to Mr. Yates:

> A complete answer to the definition of dBm would bring up Maxwell's equations for electromagnetic wave propagation, so I hope a greatly abbreviated explanation will do.
>
> Just as in audio, dBm is a means of specifying optical power, and is given by the following equation:
>
> $$\text{dBm} = 10 \log \frac{P}{0.001 \text{ watt}}$$
>
> where P is the *total* optical power launched by the fiber-optic transmitter or received by the fiber-optic detector (receiver). More generally, optical power is a function of the aperture area and therefore has units of watts/m^2, but in many cases fiber-optic systems use launched power since most of the power is coupled into or out of the cable. . . . The basic goal is to ensure that the power launched by the transmitter, minus cable and interface losses, is greater than or equal to the power required by the receiver.

As to the levels found in home equipment, David Birch-Jones of Philips adds:

> The de facto standard optical connector/transmission system for digital audio is the Toslink system, adopted by everybody by mutual consent, since there is no apparent alternative at affordable cost. The system is specified by Toshiba as having a bandwidth from d.c. to 6 megabits per second (6 Mb/S). The transmitter output range (at the source component) is specified at between −21 and −15 dBm, and the receiver sensitivity (at the destination component) is specified at between −24 and −14.5 dBm. Apparently, 19 dBm is the typical value of the output level of a digital audio component that uses the Toslink system.

Here's the Pitch

Since 1938, an international standard has set the pitch of the musical tone A at 440 Hz. For music written before then, this pitch is actually a bit sharp: Handel used an A of 422 Hz in 1740, Mozart used 421.6 Hz in 1780, and Verdi used 432 Hz. (About 1880, he even got the Italian Parliament to pass a bill mandating that pitch.)

To the distress of opera singers, orchestras are ignoring the standard and tuning sharper still, in order to sound more brilliant and exciting. Many major U.S. orchestras use 442 Hz, von Karajan used 448 Hz with the Berlin Philharmonic, and some orchestras have tuned as high as 452 Hz. That's almost a semitone higher than Verdi's pitch and more than a semitone above Mozart's. As a result, arias written in the key of C, for example, are now sometimes sung in the key of C sharp.

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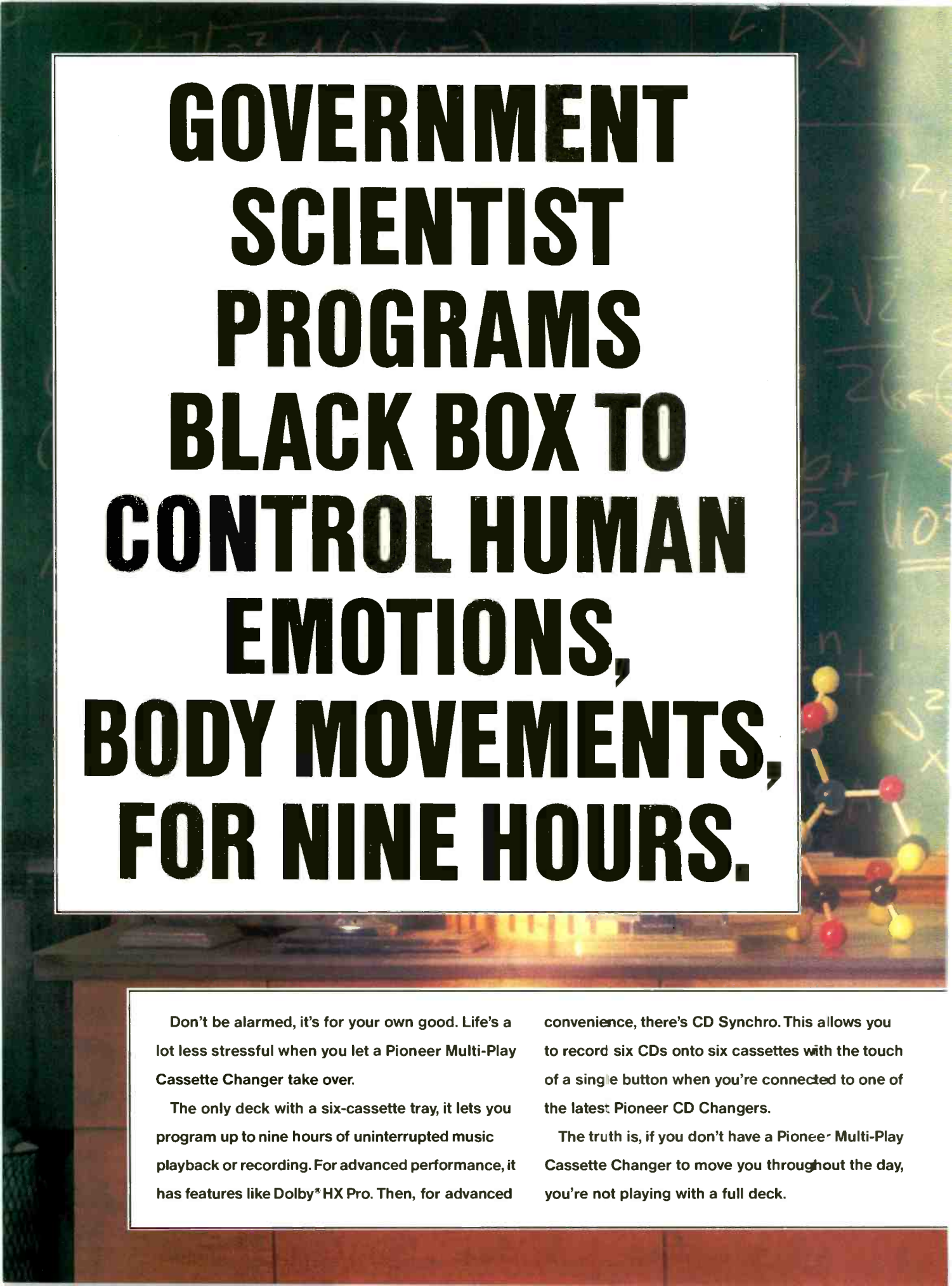

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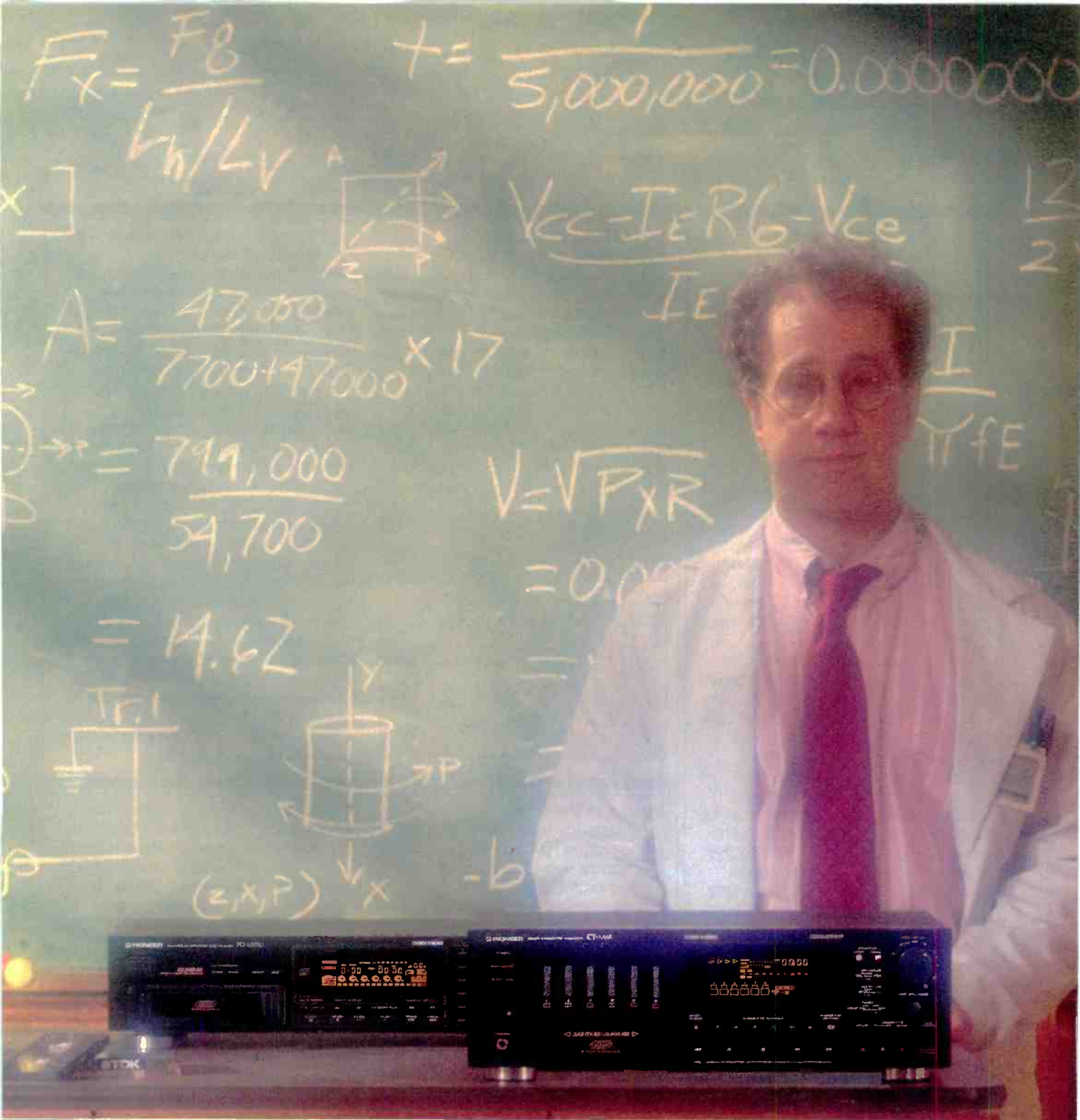

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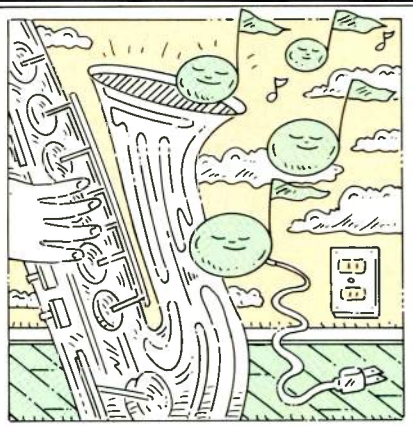
For the second time, Sony is taking the heat for the rest of the industry in a copyright-infringement lawsuit.



Jazz in Its Natural Juices

At the JVC Jazz Festival in New York this past summer, Stan Getz made it clear that the microphone pickup attached to his sax with Velcro was no friend of his.

During his first set, Getz did the finger-across-the-throat gesture twice to the man on the huge mixing console at the back of Carnegie Hall. Then he played unamplified, with obvious relish.

Toward the end of the set, the pickup eluded the Velcro and dangled, like a dead mouse, from its cord. Getz seemed to ignore it, and played on gloriously, the rich sound of his horn only a little softer, with Kenny Barron's piano-playing a little gentler underneath. Getz's expression, though, was pure boyish mischief, and he moved around the stage more vigorously so the audience could see the microphone, humbled. As the last note faded, a soundman in a jacket and tie appeared on stage and firmly replaced the device in its Velcro trap.

As the second half drew to a close, the equipment became balky again. The same soundman appeared at pianist Kenny Barron's elbow to discreetly whisper that the batteries in the sax microphone had begun to give out. Barron told Getz loudly at the first opportunity, and Getz told the audience: "This thing's dead. But then, so am I!" And then, having vanquished the microphone, he played on much longer, the sound rich and unamplified, the boyish grin intact. And we never saw the soundman on stage again.

Roberta Thumim

Out of Your Head

Sounds that sit between the speakers in stereo listening sit between our ears when we listen to stereo recordings via headphones. The reasons were known as far back as the 1970s: Headphone listening bypasses the normal interactions between the pinna of the ear and sound waves arriving from different points in space. But the solution then available was to record the sound of speakers in a room by using mikes placed in a listener's ear canals and then to play *those* recordings to the listener via headphones.

With digital signal processing, it's now possible to synthesize these pinna effects. So far, according to F. L. Wightman of the University of Wisconsin (*Journal of the Acoustical Society of America*, January 1990), this technique is being used for auditory and perceptual research, and it is being studied for the use of pilots and crew in space stations and aircraft—which probably means that the technique is not yet cheap.

"Not yet" does not mean "never." Home and car stereo equipment that uses DSP for other purposes is already on the market. It should not be terribly difficult to come up with a digital algorithm to simulate the effects of average pinnae and to use that algorithm in processing signals directed to the headphone outputs. In the future, it might even be possible to measure an individual listener's pinna effects and generate custom algorithms to be incorporated into the listener's audio equipment.

Ironies in the Fire

After nearly three years of legal maneuvering, DAT is here. Once the electronics and recording industries agreed on the Serial Copy Management System (SCMS) and bills had been introduced to mandate SCMS in all home DAT recorders, Japan's Ministry of International Trade and Industry (MITI) gave the go-ahead for their export. The first to actually export DAT was Sony, and they were slapped with a lawsuit from a group of songwriters and music publishers. The suit seeks to halt the sales of DAT on grounds that it contributes to copyright infringement; the people behind the suit favor levying royalty fees on recorders and blank tapes.

This is the second time Sony has taken the heat for the industry in a copyright-infringement suit. When the Betamax VCR was introduced, the company was sued on grounds that taping TV programs off the air would infringe copyright; the Supreme Court ruled in Sony's favor in 1984. When the Betamax case was filed, however, Sony was defending its own proprietary technology, which had been brought out without consensus by the Japanese electronics industry. With DAT, the manufacturing consensus is already in place. This time, the EIA is expected to aid Sony's defense fund. And both Sony and its competitors vow to continue selling DAT.

The upshot of the Betamax case was a dual irony. The movie industry, which had tried to block home VCRs, now makes a substantial portion of its income from home video sales and rentals. But Sony's Betamax, which cleared the legal ground for all home VCRs, in great part lost out to the newer format, VHS, whose proponents had developed enough of a consensus to make it a virtual industry standard (and whose dominance is now threatened by 8-mm video, which Sony developed).

Similar ironies could come of the DAT suit. After all, the music and recording industries make a substantial portion of *their* income from sales of prerecorded cassettes and would stand to make still more from prerecorded DAT releases.

Illustrations: Teresa Anderko

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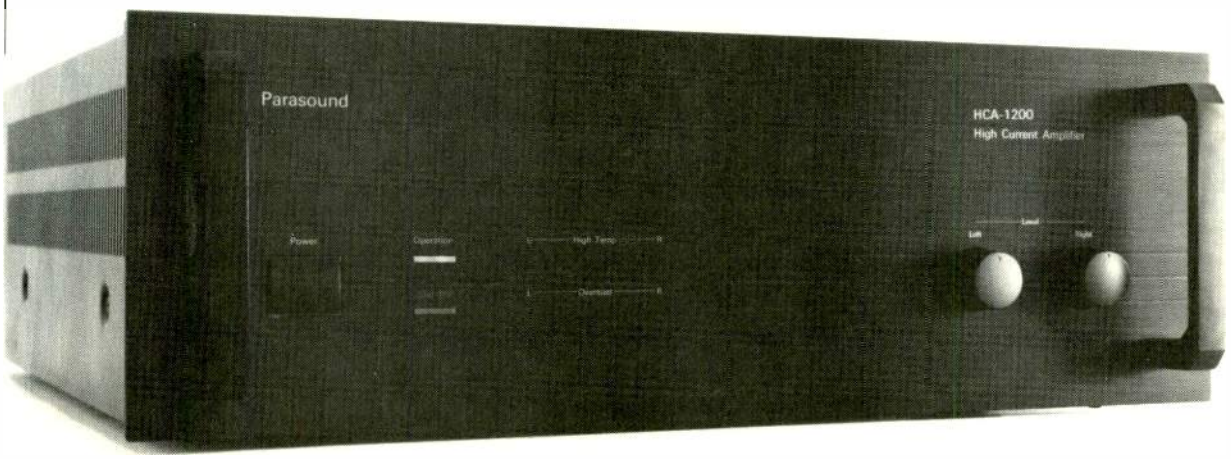

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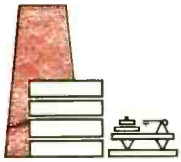

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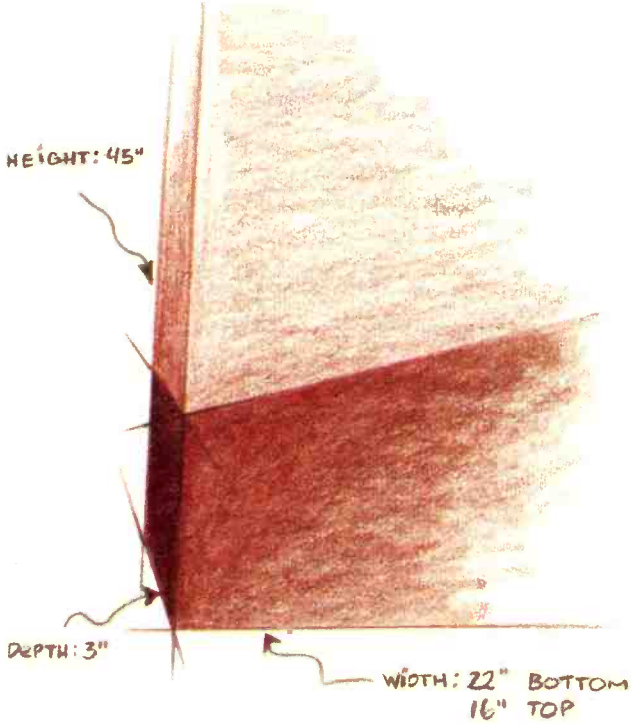

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IVAN BERGER

CACHE PRIZES

The Fairlane, with 111,000 miles on its odometer and owner Johnny Stephens at the wheel.

Photographs: Leon E. Skipwith

'56 Digital

A '56 Ford Fairlane is a lot more precious now than it was back in '56. Johnny Stephens of Tupelo, Miss. takes his Fairlane to car shows, where it wins prizes in the Original Production class. So when he took it to his son-in-law, car stereo installer Lee Capps of DeCa Auto Sound, he was brief but particular in his instructions. "If this installation is visible," he said, "I'll kill you. And I'll take my daughter back."

Mr. Capps, I'm glad to say, is still alive and married. The car still looks totally stock; it just no longer sounds that way, with a Compact Disc player, subwoofer, and three channels of KEF speakers.

Fairly ordinary means of concealment sufficed for the signal source and amps. A Denon DCC-1570 changer is hidden beneath the driver's seat; a slide-out rack beneath the front passenger seat holds an Audio Control ESP-3 center-channel processor with ambience restoration and the two amplifiers. The larger of these last, a Linear Power 2652, delivers 30 watts per channel to the main stereo speakers and 60 watts to the monophonic subwoofer; its built-in crossover is set to roll off the subwoofer above 60 Hz and the main speakers below 175 Hz to compensate for the car's acoustic resonance in the range between those two frequencies. The other amp, a Linear Power 652i, is used in bridged mode to provide 60 watts to the center-channel speaker. Though Linear Power amps are available in red, Capps painted them and the ESP-3 to match the car's restored interior precisely.

Hiding the speakers was just a little harder. To hold the KEF KAR-110 midrange/woofers for the left and right channels, Bill Heytens of DeCa custom-built fiberglass enclosures to fit behind the kick panels and covered them with new hardboard kick panels, slotted to double as unobtrusive grilles. The tweeters, KEF KAR-33s, were mounted behind an existing trimplate in the A-pillars between the dashboard and the front doors, and new grilles were fabricated and painted to match the trim. For the center channel, Capps mounted another KEF KAR-110 and KAR-33 behind the grille that originally covered the car's own radio speaker (radios were mono back in '56). For a subwoofer, he used Linear Power's Bass Vent, a system using two 8-inch drivers that feed to the car through a vent tube small enough to fit behind the stock grille on the rear parcel shelf.

What won my heart was the cleverness with which Capps hid the controls. To operate the changer, you must pull the ashtray out; even then, you don't see anything, because the changer's wired remote control is built into the *underside* of the tray. The space that's left for ashes is now shallow enough that I suspect they might blow out when the car is running with its windows open (this is Mississippi, and the car lacks air-conditioning), but Mr. Stephens doesn't smoke. Capps hollowed out the car's stock radio to hold a Linear Power PA-II preamp. The radio's original volume knob now operates the preamp's level control, and the preamp's four tone controls (sub-bass, mid-bass, midrange, and treble) are concealed beneath the radio's buttons. Since there are no rear speakers other than the subwoofer, the PA-II's fader control is not used.

About the only thing that needs to be visible is the changer's digital disc and track display, and it is—but only when the system is in operation. Turn the music on, and two green digits glow behind the radio dial. Turn it off, and the display goes dark, blending into the dial's black background.

Also visible, at Johnny Stephens' house, are three new first-place trophies the Fairlane has won since the stereo was installed. Says Capps rather proudly, "They didn't even notice it was there."

Absolutely stock . . .

. . . or is it? Note the CD changer's remote control under the ashtray (top), the preamp knobs peeking out from under the radio buttons, and the digital display barely visible between 8 and 10 on the radio dial.

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Removable control panels afford better physical protection for car stereos and should help in theft deterrence.

Everything but the CD slot comes off Pioneer's DEH-750.

Face-Off

Sliding your stereo out of the dash and lugging it along with you will keep it from being stolen from your car. But it does expose stereos, especially CD players, to accidental damage once they're no longer protected by the dash. It's not a total protection against theft (I've known them to be stolen, bag and all, from gym lockers). Nor does it stop thieves from breaking into cars with empty dashboards and "No Radio" signs, on the chance that the owner has hidden the stereo rather than carried it. Since more expensive stereos are heavier (up to 4 or 5 pounds each), the odds on owners doing that are fairly high.

So instead of taking the stereo with us, let's take just the control panel. It's small and light enough to fit into a pocket, so we'll never leave it behind. And once thieves get used to the idea, they'll catch on to the paradox that if there's something blank-faced in the dash, there's nothing worth stealing.

You needn't take a crowbar to your stereo to do this. Manufacturers have been making models with removable controls or faceplates for a few years now. The first one I saw came from Italy, the country that also gave us the original slide-out mount, the Bensi Box. That head unit (from Autovox, as I recall) is apparently no longer sold here, but Sharp reintroduced the idea about two years ago, followed now by LA Sound, Pioneer, Premier, and Profile.

While all these systems let you pocket the panel and walk off, there are differences between them. Sharp's RG-F816 (now discontinued) took the conspicuous approach: Removing its panel revealed a big red warning sign. Pioneer's Premier KEX-M800 tuner/cassette and their DEH-750 and Premier DEH-80 tuner/CD units take the opposite approach, with plain black underpanels that are inconspicuous yet still obviously incomplete. The tuner/cassette units from LA Sound (Models LA 515, LA 525, and LA 555) and Profile (Models DN-924 and DN-928) emphasize pocketability by making only small panel areas removable. What's more, LA Sound backs up its anti-theft approach by offering to replace any stolen units—just send in the police report as proof of theft and the removable module as proof you hadn't left it in the unit.

In Europe, incidentally, Blaupunkt offers yet another form of carry-along security, a plug-in keycard. Removing the card extends a tray with a conspicuous anti-theft warning sign; inserting it retracts the tray and makes the unit operational. Some models accept several different keycards, one for each member of the owner's family, for example, and change the contents of the tuner's station preset memories according to which family member's card is in the slot. This system is not slated for sale in the U.S., however.

The security of any removable-part security system, including slide-out mounts, ultimately depends on how carefully the manufacturer controls the distribution of the parts a thief would need to get a stolen stereo going again. You should have to prove legitimate ownership before anyone would sell you a replacement in-dash slide mount, control panel, or keycard—but the proof should not be too onerous. You could present your original sales slip, go back to your original dealer, or have a dealer check with the manufacturer to make sure the warranty card was filled out in your name. (You *do* fill out and send in your warranty cards, right? Oh, I thought so.)

Other proof would be specific to each system. Want a mount so you can share your slide-out radio with a second car? Drive up and show that a mount's already installed in your first car. Did Junior lose a keycard? Bring your own keycard in as proof of ownership. Lose your control panel? Show you know what stations are keyed into the memories. Few dealers will go to these lengths. They're not in the business of discouraging sales, even of parts and accessories, and people whose stereos get stolen usually come back to buy replacements. If enough dealers and manufacturers cooperated, and enough owners took sufficient care, car stereo theft could be eliminated. Just don't hold your breath.

Carriage Trade

Apparently there are places where theft of electronic gear from cars is such a minor threat that people buy fake car phone antennas to impress their friends. New York City is certainly not one of those places. Here, the best-selling car accessory is a window sign saying, "No Radio." One reader of *The New York Times* has even seen this sign placed on a baby carriage!

Better Is As Better Does

Music in our cars makes us feel better, but does it also make us drive better? If psychologist Marilyn Turner of Wichita State University is correct, the answer is a qualified "yes." According to *Car Pages*, a magazine for New York City car owners, her tests show that music makes drivers react faster and that their reactions quicken as the music gets louder (not softer, as had been expected)—but only until the volume reaches the driver's personal comfort level. The same tests showed that this comfort level varies from person to person. (From my own experience, personal preference also varies from time to time and with the driving difficulty; I turn the music down when in heavy traffic or when parking.) The study also showed that men usually prefer their music at higher volumes than women do—but most of us knew that.

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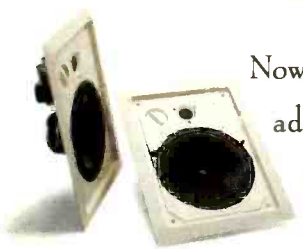

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Though not a car system, the Moseley Music Pavilion *is* mobile, as it's designed to be rolled to two dozen locations.

Holy Moseley!

I don't know if the Carlos Moseley Music Pavilion covered by Edward Tatnall Canby in his column last month would qualify for entry in the car stereo sound-off competitions, but it *is* a mobile sound system. It's designed to be rolled along the streets between the 24 park locations where the New York Philharmonic and Metropolitan Opera give their summer concerts.

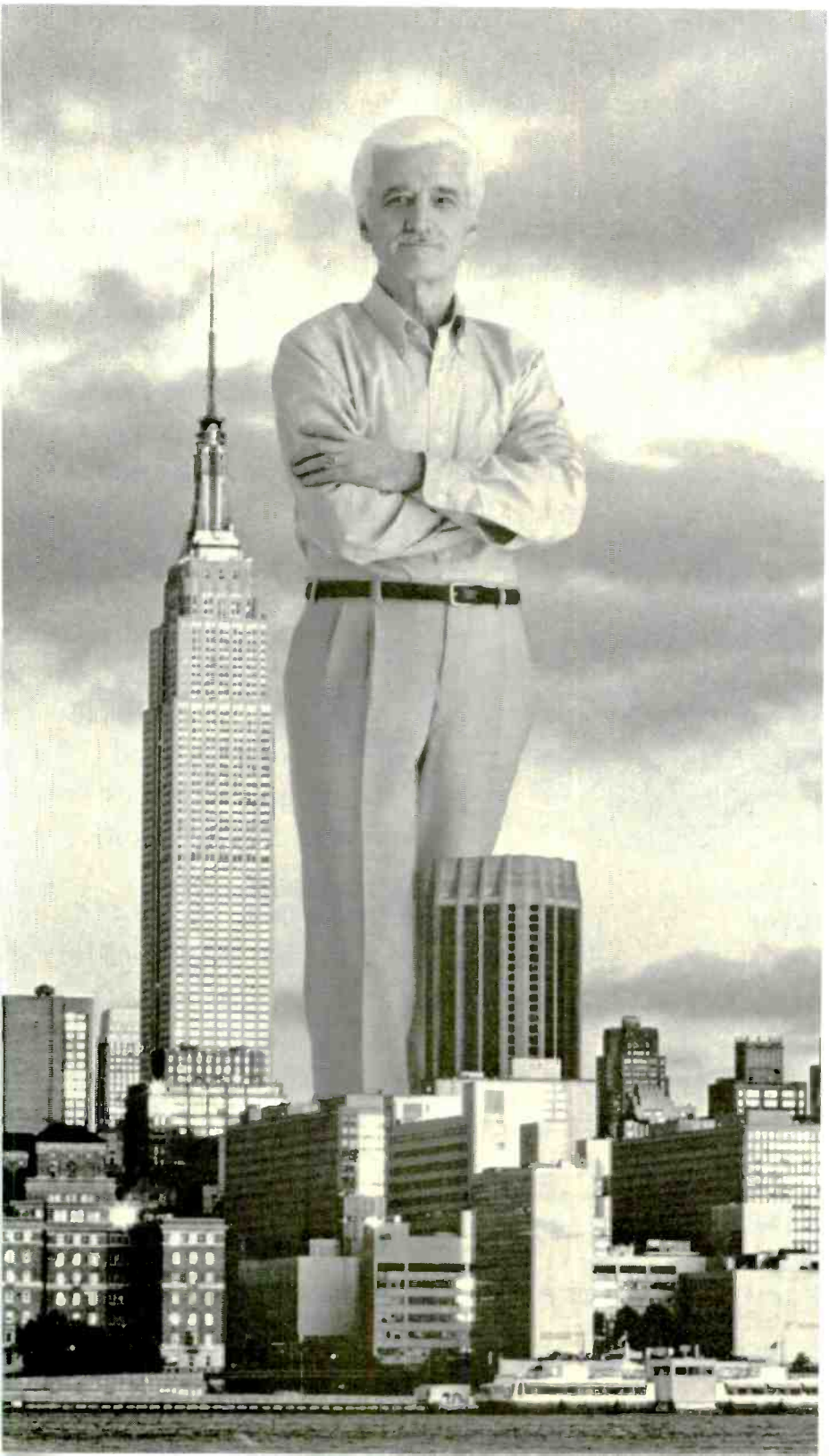
Some of its equipment would not seem out of place in a car stereo system either: An 18-inch subwoofer, two 12-inch woofers, two 5-inch midranges and a tweeter array, an electronic crossover, an additional 8- or 10-inch two-way speaker system with passive crossover, and four Linear Power 5002 amplifiers. But that's the equipment list *per tower*—and there are 24 such towers in the system.

Three of the four amps in each tower are bridged to mono, with one amp apiece for the subwoofer, the pair of woofers, and the midrange pair. The remaining amp operates in stereo, with one channel feeding the tweeters while the other feeds the two-way speaker that projects the delayed "ambience" signal back toward the stage. The 5002 is rated at 250 watts per channel in stereo and 565 watts in mono, so each tower potentially has 2,195 watts at its disposal—and the system as a whole has 52,680 watts! Those amps are fed by six Exide deep-discharge batteries per tower, rated at 105 ampere-hours apiece. According to the folks at Maryland Sound Industries, who built the sound system, that's enough to provide several hours of music.

The amplifiers are the only consumer components in the Moseley Pavilion system. The rest is all professional gear—which is probably why Maryland Sound Industries had Linear Power change the amps' faceplates to something more esoteric.

If any of you power freaks out there are tempted to emulate this system, just write me about it from afar, okay? I don't want to hear 52,680 watts thumping their way down my block some midnight.

AMIDST ALL THE FAST TALK, PHONY DISCOUNTS AND HIGH PRESSURE SALES PEOPLE, ONE MAN STANDS TALL.



Lies, lies, lies.

That's what you get at most audio stores. The prices are rigged, the equipment is second-rate and the only thing the fast talking sales people care about is the size of the commission.

But there is one exception.

A place that hasn't sold out. A small, specialty high-end audio store that many consider to be New York's finest: Park Avenue Audio.

At Park Avenue Audio you'll find only the highest quality, latest equipment. Fair, honest prices. Unquestioned integrity. And the man who keeps it that way, Yetkin.

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If you're interested in high-end audio equipment, you owe it to yourself to visit Park Avenue Audio. Whether your budget is $500 or $50,000, you'll find a system that's perfect for you. Just ask for Yetkin. You'll notice him right away.

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The Best Audio Tape

▶▶ No one has a longer or more distinguished history of leadership and innovation in metal tape than TDK. So when we introduced the MA-R back in 1979, it instantly became the benchmark all other metal tapes would be measured against.

Since that time, however, the evolution of digital recording sources has progressed far beyond what anyone ever expected. Beyond what even the most advanced metal tapes in the world are capable of reproducing.

Which is why we created the new MA-XG. A tape which is not only the best audio tape in TDK's history.

But the best tape in recorded history.

DIGITAL MUSIC DEMANDS PERFECTION IN A CASSETTE.

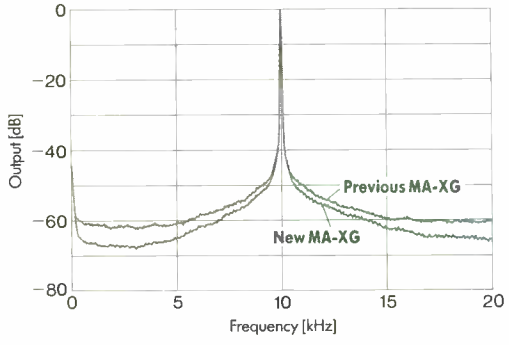
Music from digital sources is dynamic to say the least. It can go from absolute silence to maximum loudness instantaneously. And for an audio cassette to reproduce its power and dynamic range accurately and free from distortion, the audio tape has to have extremely high output capability or what is known as MOL (Maximum Output Level).

But digital music can also go from maximum loudness to absolute silence instantaneously. And the lack of background hiss makes the clarity of the pianissimos and the transparency of the passages that linger and fade striking. To convincingly reproduce this kind of delicacy requires a tape with extremely low bias noise. Otherwise, music signals which are softer than the tape noise will be masked and inaudible.

The perfect recording tape then, for CDs and other digital sources, is one with the highest possible output and the lowest possible noise. The kind of tape it was almost impossible to design. Almost.

THE WORLD'S BEST DUAL-LAYER PURE METAL TAPE.

Rather than settle for a tape which compromises output for low noise, or low noise for output, TDK opted for a tape that compromised nothing. So the MA-XG combines two separately "tuned" layers of ultrafine Finavinx magnetic particles. The bottom layer utilizes a unique high-density Finavinx particle designed for *highest possible output.* The upper layer consists of *low*



MODULATION NOISE SPECTRUM

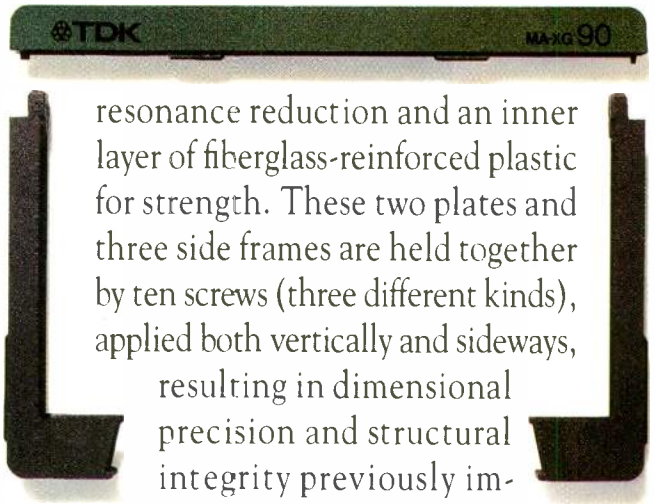
In Recorded History.

noise ultrafine Finavinx particles arranged in a high-density coating with the help of TDK's proprietary particle orientation technology. What this unique design results in is a metal tape with the highest output (+7.5 dB at 315 Hz) and the lowest noise (−59 dB) of any analog cassette. Or more simply put, the ultimate "digital ready" tape.

A MECHANISM AS SOPHISTICATED AS THE TAPE.

You don't even have to listen to the MA-XG to know how advanced its design is. Just hold it in your hand. Its extra heavy-weight RS-III mechanism

utilizes an unprecedented super-rigid five-piece construction which provides the ultimate defense against vibration and the sound-smearing effects of modulation noise as shown on the modulation noise chart. The unified dual-layer molded face plates consist of a non-rigid plastic outer layer for



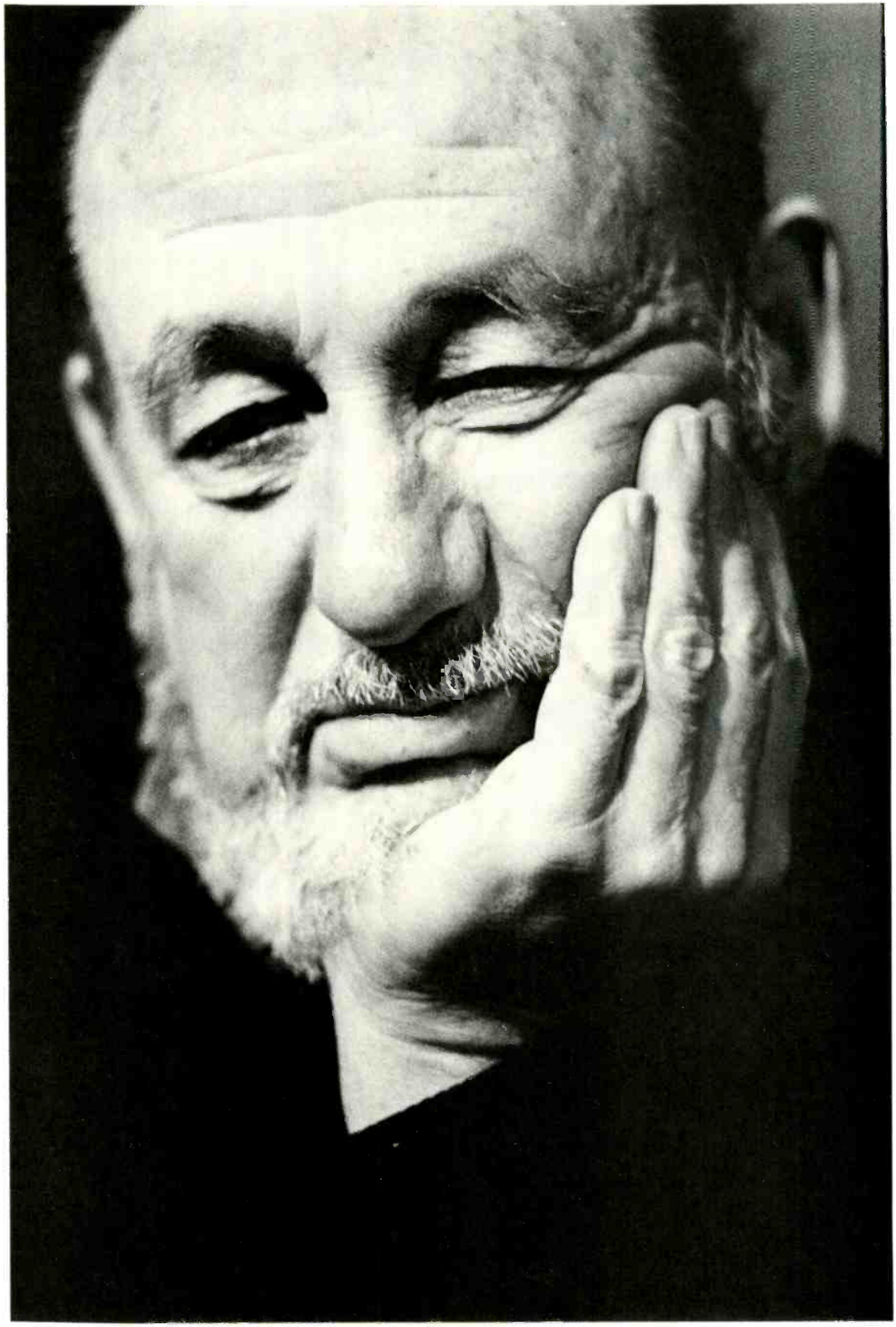
resonance reduction and an inner layer of fiberglass-reinforced plastic for strength. These two plates and three side frames are held together by ten screws (three different kinds), applied both vertically and sideways, resulting in dimensional precision and structural integrity previously impossible to achieve. It even employs a system of internal sound stabilizer weights and super high-precision guide pieces to ensure maximum vibration attenuation and the highest degree of azimuth accuracy.

AUDIO MAGAZINE AGREES MA-XG IS THE BEST EVER.

That the TDK MA-XG is the ultimate recording tape is not just our opinion. It's a belief shared by the ultimate authority: *Audio* magazine. After an exhaustive test of 88 audio cassettes (the results of which were published in the March 1990 issue), *Audio* found the MA-XG to be not only the best of any metal (Type IV) tape, but the best of any tape. Period.

So, if you're going to record digital music, make sure you record it on the new MA-XG. Because the best music in recorded history shouldn't lose anything in the translation. ◀◀

TDK®
As Serious As You Can Get.



PHOTOGRAPHS: DAVE KING

THE AUDIO INTERVIEW

Orrin Keepnews

THERE AND BACK AGAIN

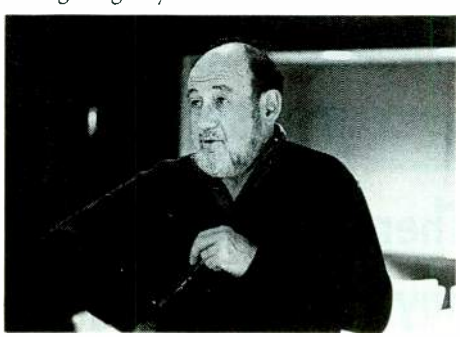
JON W. POSES

Orrin Keepnews is enthusiastic about what he does, preserving the musical thoughts of great jazz artists. It's what he's been doing since he co-founded Riverside Records in 1953. For the past five years, the transplanted Manhattanite has run Landmark Records, based in Berkeley, Cal. He proudly calls Landmark "a personal indulgence," stating politely but firmly, "I record who I want."

Although he's never made an actual count, Keepnews reckons he's produced more than 500 albums — not including numerous reissue projects. He has won three Grammys — one for producing 1987's Best Historical Album, *Thelonious Monk: The Complete Riverside Recordings*, and two more for Best Album Notes. In 1986 *Down Beat* presented him with a Lifetime Achievement Award. This producer's credits are second to those of no other living jazz producer.

Starting his working life in book publishing, at 25 Keepnews joined *The Record Changer*, which he amusingly recalls as "a strange and esoteric magazine; originally a means of buying and selling rare 78-rpm jazz records, it also became something of an intellectual journal, a sort of *Partisan Review* for jazz fans." He and college classmate Bill Grauer founded Riverside as a reissue house and released Bix Beiderbecke, King Oliver, Ma Rainey, Blind Lemon Jefferson, Jelly Roll Morton, and other jazz and blues stars of the '20s. Soon Riverside was a home for living legends, too: Thelonious Monk, Cannonball Adderley, Wes Montgomery, Bill Evans, Johnny Griffin, Charlie Byrd, Barry Harris, George Russell, and many others. Keepnews was the first to record Montgomery and Evans.

Two years after Riverside closed in 1964, Keepnews founded Milestone Records with pianist/producer Dick Katz, recording Joe Henderson, Lee Konitz, McCoy Tyner, Jack DeJohnette, and Sonny Rollins (whose 1972 return to recording was at Keepnews' urging). In 1973, Fantasy Records, in San Francisco, profiting mightily from the success of its huge '60s rock act, Creedence Clearwater Revival, bought the Riverside and Milestone catalogs and asked Keepnews to head an ambitious jazz program. Under Fantasy's aegis, Keepnews spent the rest of the '70s reissuing works from the already classic Riverside and recording new Fantasy albums with Rollins, Tyner, Flora Purim, Ron Carter, and others. By 1985, the producer again had his own label, Landmark. Its first release, vibist Bobby Hutcherson's *Good Bait*, was followed by works from The Kronos Quartet, Donald Byrd, Mulgrew Miller, Ralph Moore, and Jack DeJohnette. At 67, Keepnews is also heavily involved in reissue programs at RCA and MCA.



In 1988, Oxford University Press published *The View from Within*, a collection of Keepnews magazine articles, liner notes, and other writings from 1948 to 1987 drawn from his long, intense, and immensely productive involvement with jazz. *J.W.P.*

Photograph: Frank Driggs Collection

Wes Montgomery went through life thinking he'd never made a good take; it was up to Keepnews to say, "Hey, we've got it."

There weren't any courses on how to produce, no all-embracing idea of how it all worked, so it's been a very personal expression.

What sparked your initial interest in jazz?

It's a very standard, clichéd bit. I heard a little jazz on the radio; I remember a jazz disc jockey/writer of sorts named Ralph Burton. He had a program on the New York City-owned station, WNYC, back in the days before public radio. When I was a kid, of course, it was the '30s, and there was a good deal of big band stuff being played on standard radio. In the late '30s and early '40s, I began to listen to live jazz around New York. I wasn't particularly in search of jazz, but there were notably inexpensive places to hang out and nurse a drink for an entire evening with a date. That's where my listening to live jazz began. I was hanging out at places such as the Hickory House on 52nd Street and Nick's in Greenwich Village.

My attraction was more toward traditional jazz as opposed to the big swing bands. I probably suffered from a normal sort of snobbery even back then: I was going to be attracted to the less popular, more esoteric music—Dixieland and New Orleans—rather than swing.

How did you become involved in producing?

Well, in the beginning, Riverside Records was an offshoot of the same burst of activities that started Bill Grauer—my partner in Riverside—and me working on the Label X reissues for RCA. Riverside, in other words, began as a reissue outfit. The first live artist we were involved with was Randy Weston.

Randy was the assistant to the chef at a summer jazz camp in the Berkshires. Grauer discovered him; we signed him. That was the first person I went into the studio with. So rather than a spark, it was a gravitation. It slowly developed that I was more comfortable producing than Bill; he was better with business. It was pretty casual and incidental until 1955. That was the beginning of my association with Monk. The albums *Monk Plays Duke Ellington* and *The Unique Thelonious Monk* were my first serious productions.

Where and how did you acquire your production skills?

I learned them by seat-of-the-pants, on-the-job training. I do recognize the very dangerous beginning I had. Working with Thelonious before I knew what I was doing turned out to be extremely valuable—the same way you could say it's extremely valuable to be thrown into the pool to learn how to swim.

But the skills, which I've always insisted are as much interpersonal skills as anything else, just developed through doing them. This is a luxury, of sorts, that I had in common with a number of my contemporaries; it's really the basic pattern of the independent, jazz-label world of the '50s. In essence, the concept is that a guy becomes a producer because he says he is. If it's your company, there isn't anyone around to say you're not. There was no rule book, no set pattern of how you get to be, or how you behave as, a jazz producer.

None of us was necessarily welcome at each others' sessions; none of us really had an opportunity to develop a mutual or all-embracing idea of how it worked. There were no courses on the subject. You learned it by doing it, and so it became a very personal expression. It was obviously—as I came to discover later—done very differently by very different people, even if we ended up producing rather similar kinds of records. Take Bob Weinstock at Prestige, Alfred Lion of Blue Note, and me at Riverside. Although I can see lots of basic differences between our records, the product was relatively similar. But the personalities, and therefore the producing styles, were wildly different. There's nothing even remotely similar about the attitudes, the approach, the taste of Weinstock, Lion, and Keepnews. It's a mixed bag indeed.

You can certainly see lots of basic differences between what we three did and what was being done at Contemporary or Pacific Jazz. It's easier to see these differences because the personnel on the records was different. I probably had more kinship to Les Koenig of Contemporary, although our tastes in jazz were miles apart. Lester was one of the few of my contemporaries with whom I eventually established a good personal relationship. Everyone knew everybody, but Lester was a friend.

The guy who set the pattern, to a very large extent, was Alfred Lion. It's impossible not to have respect for his results. I would single him out. I would agree with a lot of people that Blue Note was a very distinguished operation. But, quite frankly, when you're in there battling for survival—even though we claimed, and I think fairly accurately not to be directly competitive with each other—we were, each of us, trying to carve out a suitable amount of turf, in an economically tough situation, where we were definitely the minority.

The fact is, I'm still in very much the same kind of situation. The world has changed somewhat more than 100% in the time I've been active in jazz. But my relative position is unchanged: A guy trying to maintain his own standards of taste in a highly competitive world where most of the fiscal assets seem to be in somebody else's department. That still leaves me with the feeling that I'm engaged in a battle for the preservation and advancement of jazz as I see it—a personal, egotistical battle that has always been true of all of us jazz producers. I'm still not inclined to sit back and do a producer's retrospective. I'm still hacking out a path in the jungle.

Over the years, how has the idea, the concept, of being a producer changed for you?

I think the main change I notice in myself is an inevitable growth in confidence. I've been doing this for over 30 years. I've achieved a lot of results that I'm proud of—a lot that I'm not, too, but that's beside the point—a lot of things that people have patted me on the back for. By now, I accept the fact that I am what I claim to be—a jazz record producer. So I tend to be, probably because of greater self-assurance, more of a hands-on producer, more of an active contributor in terms of the mechanics of a date, its repertoire and personnel.

There are still some artists where the best thing to do is to leave them alone, maybe exercise veto power if you think they're making a disastrously bad decision. That is one of the approaches I've always favored. Still, I tend to grow more aggressive in my relationship with an artist the more secure I feel in my knowledge of what he's all about. I've always been fairly assertive in the studio as far as saying, "That was a good take" or "That wasn't." In the studio, it's perfectly clear, somebody's got to be in charge.

Another shaping factor in my early years was dealing with three of the greatest self-doubters in the history of jazz—Bill Evans, Wes Montgomery, and Sonny Rollins. Bill and Wes went through life thinking they'd never made a good take, let alone a good album; Sonny still operates on that belief. Sometimes they changed their minds once they were finished. But on the job, you have to be decisive: "Hey we got it" or "We'll fix it later." If I'd had too much of a laissez faire attitude, I might still be trying to get a good take on my first tune with Bill Evans after 35 years!

However, I have always been someone who feels it's perfectly proper that the artist's name appear a lot bigger on the album than mine. It's not my album, it's his. My job is to work with him to attempt to create what I consider to be the best possible package or what we *mutually* consider to be the best. I'm rather leary of unilateral decisions to a great degree. On the other hand, the more you get to know about the scene as a whole, and the better you get to know the individuals you are working with, the easier it becomes to make what would otherwise seem dogmatic decisions.

Once you decide to make an album, how do you make the various decisions about what to record, what to keep?

One of the fascinating things about jazz is that there is no one set of answers to questions like that. If there were one or two sets of answers, I think I would have been bored to death a long time ago.

I like to have an agreement going in that says repertoire and artists are going to be mutually arrived at. It's a tricky thing. Making a record is a set of circumstances under which a series of firm, final decisions eventually have to be made. The trick is knowing the right time to make the decision. I have, many times, come out of a record date feeling very firmly that a particular take was *the* one—and, for a variety of reasons, subsequently changed my mind or had my mind changed for me. I've never been bothered by that. If I had to characterize the best way to run a record date, I would say you shouldn't

One of Riverside's early commercial successes was recorded by saxophonist Cannonball Adderley.

Photographs: Frank Driggs Collection

Thelonious Monk's reissued Riverside recordings won 1987's Best Historical Album Grammy for Keepnews.

close doors or box yourself in. Don't say, "That's the take, you can erase all the rest of them." On the other hand, you can't go around saying, "I *think* one of those three was it, let's go on."

One point I'll make is that you learn with hindsight. In recent years, we've had a tremendous amount of reissuing going on and a tendency, quite legitimately, to issue alternate takes. Sometimes, going back over sessions done years ago, I find myself not at all sure why the hell I chose take eight instead of take seven. So I've had the opportunity to reverse myself and put out the one I hadn't before. An example: I put out about three albums' worth of wonderful Wes Montgomery alternate-take material. Nearly all of it sounds as good as the original release—and in a couple of cases it sounds better.

When issuing alternate takes, from a marketing and consumer standpoint versus a "completist" standpoint, where do you draw the line in changing history, as it were, or patching up history? How many takes do you put on an album?

The answer to that is going to depend largely on what extent the original producer maintains artistic control over the product. I'm sure there are many record companies whose attitude is, "Oh, boy, look at all these free goods, look at all this scrap material." We should not, however, mistakenly think that this is a new attitude. The first example of it I can think of are some early Savoy LPs where you get virtually every breath that Charlie Parker took; you get false starts and drastically incomplete takes. So it's not just an '80s attitude. It goes back, and it is obviously often just plain exploitative.

For 25 years I haven't owned any of the Riverside product, but during a great deal of that time I've been in a position to work with that product. I've been fortunate enough that the people I have worked for have rather unhesitatingly given me artistic control. Nobody ever stood over me and said, "I don't care whether you like that alternate take or not, we're going to put it out." As I said, I've been fortunate. My children—the early Riverside masters—have been in good hands for many years, under Fantasy's control since the early '70s.

Ralph Kaffel, who runs Fantasy, not only is a record company president but also used to be a distributor. These are the two stock villain figures in the mythology of the jazz record business—but this is one of the most tasteful, honorable men you're going to run into.

If you have a good record that turns out to sell well, then you have everything; if it doesn't sell, you still have satisfaction.

The point I'm making is that there is quite legitimate value in many of the alternate-take situations. When you are dealing with the product many years after the original fact, you *do* have a different attitude toward it. When you are making a new recording, you're not going to put out two or three takes of a number. That means, no matter how interesting those last two solos are, you're only going to pick one. When you return to that material many years later, there's very good reason to think, "That unissued take had a helluva solo on it, despite the fact that they didn't have the out-chorus together, which was a fatal flaw originally." Inevitably, there's an historical feel to a reissue, although I'm not crazy about the completist approach—putting out four takes of the same thing, one after another. I don't like to issue anything I wouldn't find interesting if somebody else had put it out and all I was doing was listening to it. Nevertheless, I've been involved with two projects in recent years that have been labelled as completist, and pretty accurately so: The complete Riverside recordings of both Monk and Evans. There are a number of scraps and fragments and duplication of material, and I think in all cases they are historically interesting, aesthetically valid.

How much of a battle have you fought with yourself in creating a record for art's sake and wanting to sell X number of copies? In other words, how do you balance commercialism versus art?

I would say, I have done a bad job of balancing them in the sense that if I'd paid more attention to commerce, I might have retired to a palatial estate years ago. "Commercial" is an extremely subjective word. To begin with, there's almost nobody I know in jazz who went into it with the idea of getting rich. I think the one thing producers and musicians have in common in jazz is that most of us probably would have done better, in terms of hours worked and pay received, if we'd gone into some more sensible line of work, such as truck driving.

We're in a limited, specialized field. The earliest jazz independents never had overhead problems because we were all operating small, shoestring companies. Basically, the idea was to sell enough copies to do the next record. My goals haven't changed that much over the years. I used to say if you had a good record that turned out to be commercially successful, then you had everything; if it didn't sell, then you still had your satisfaction. If you did a record where your only goal was to sell and it didn't, you didn't have anything.

There are times when the line is very hard to draw. There are times when people will *accuse* you of having gone over the line. The first time I ran into that problem was when I had my earliest real commercial success: The first recording with the Cannonball Adderley Quintet. In 1959, I went into a club in San Francisco and did a live date with this group. It was performed in front of an audience that loved it. It turned into a record that for its time, and given the size of the jazz market, was a monster. Cannonball Adderley was probably the Wynton Marsalis of his day. On an independent label, that's something.

The first thing that happened, of course, is that all of the starchier critics, and even some of the musicians, put it down, saying it wasn't really jazz. I knew perfectly well what Cannonball's intent and my intent had been, and it really wasn't what they were saying it was. This was not an attempt to be commercial, but it succeeded as such. Again, only a few years later I was given the opportunity to have Mongo Santamaria, who was under contract to us, record this Herbie Hancock tune that Mongo's band had been playing. Obviously we had commercial thoughts. That was one of the few times in my life I went into the studio and cut a single—"Watermelon Man." That's what we were trying to do, but we didn't ask, "What's the hook?" "What can we do to be tricky and commercial?" It was, "Gee, this is an infectious, happy tune; there's a chance a lot of people will like this." We recorded that tune, put something else on the "B" side, and it was a single. As I'm fond of saying, it's the only Top Ten single in my whole life.

While it's possible to do jazz and jazz-type records and say, "Yeah, I'm going to go out there and achieve big commercial success," by and large that's never been my concern. I believe in the value of making the most attractive package. I don't believe that in order to have an honest, straightforward, artistic jazz record you have to put it out in a plain brown wrapper. I believe in good graphics, striking covers, and, wherever possible, aggressive promotion. But we are in an art medium, not an overtly commercial medium.

In the '70s, I was accused, amusingly, of subverting Sonny Rollins, trying to turn him into a "commercial" artist. People who made that statement—never mind how little knowledge they had of me—had *no* knowledge of Sonny Rollins whatsoever. I swear, you don't kick Sonny Rollins around in the slightest. He tells you where he wants to be. Sonny, at that point, very legitimately found himself fascinated by certain kinds of repertoire and instrumentation. He was very interested in electronic music, in plugged-in music. A lot of people thought it was a crime that he wasn't playing exactly the way he had in 1958; they called it commercial, called it bad. That's their privilege; I happen to think they're dead wrong.

I would say, if you have commercial goals as a musician or producer, sooner or later you're going to move far enough away from jazz, as we call it. And to everybody's confusion, the trade papers will undoubtedly list the resulting music as jazz. By somebody's definition, it's still jazz. I have always been fascinated by the people who are resolute tightrope-walkers—Herbie Hancock, for instance, who manages to have his feet in about four different camps at about the same time. More power to him. And he still remains, when he wants to be, a helluva powerful jazz musician.

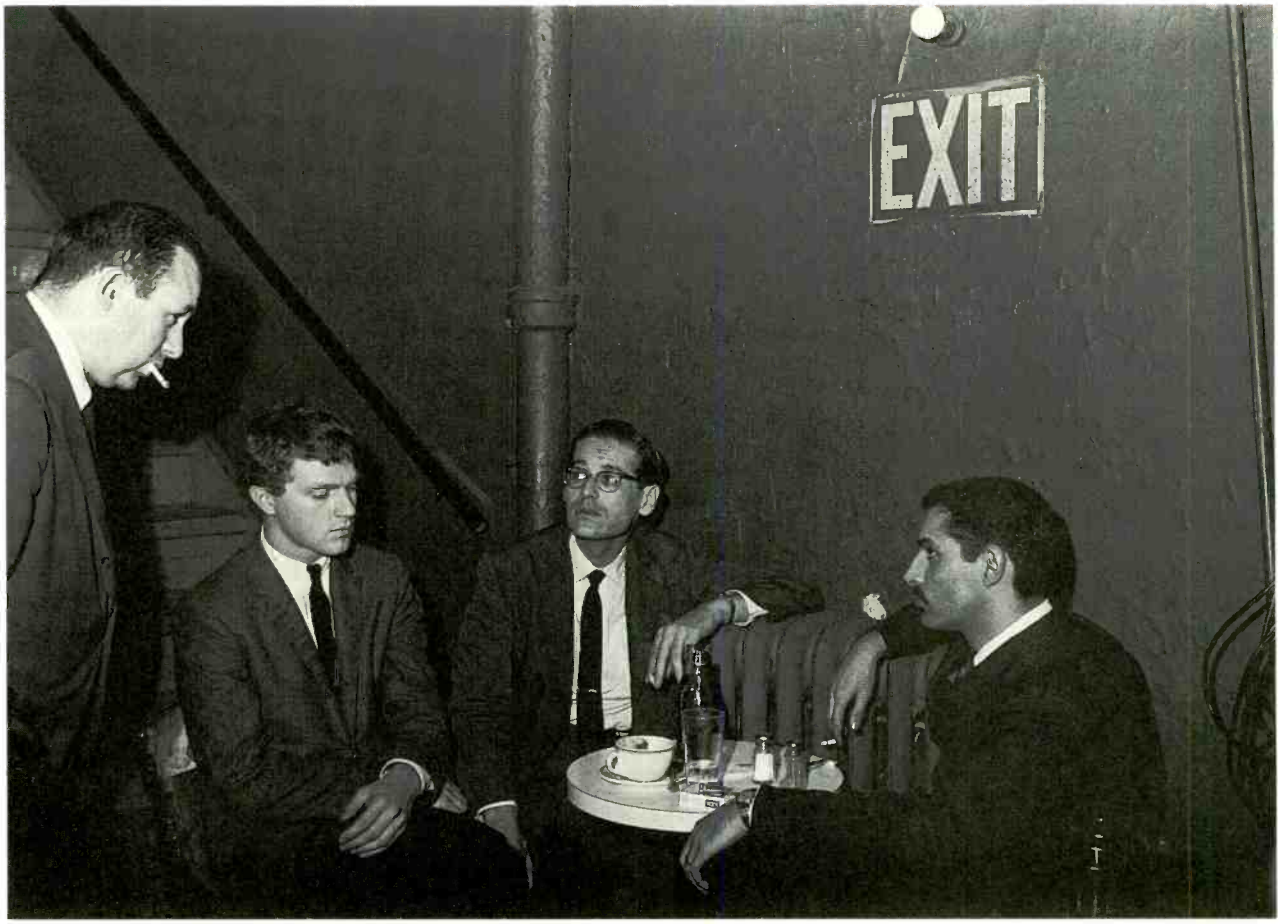
If you're in jazz for a long time, I think that speaks for itself as to what your principal motivation is. I have been at it a very long time; I have made a living at it, which is different than getting rich out of it. I now recognize my motivation has become rather different.

When I started, like most people, I felt bigger was better. Unfortunately, Riverside got to be a big enough balloon so that it burst after eight or nine years. It was overextended in many ways, which has to do with some rather dubious fiscal handling that I don't want to get into. It was a company that created a number of lasting records and ended up in bankruptcy. People can draw their own conclusions as to who was the good partner in that scene. [*Laughs.*]

How was the Riverside setup different from your current project, Landmark Records?

With Landmark, I can legitimately say my goal is *not* to grow up to be a tremendously big company. For better or worse, I've grown up already. The only reservation I have about the quality of records I'm doing on Landmark is that I doubt I'll be around to reissue them in another 30 years.

With Landmark, what I'm trying to do is indulge myself, trying to do records I



Photograph: Steve Schapiro

Keepnews (left) with The Bill Evans Trio in 1961. Seated are Scott La Faro, Evans, and Paul Motian.

Eventually we're going to find certain things are artistically possible on CD that hadn't been possible on LP.

enjoy doing. They have to sell somewhat because if they don't, I won't be able to stay in business. But I hasten to add, the artists I record are entitled to have more commercial thoughts than that—we *are* in this to make a living.

Ultimately, that's not what jazz is about. It's about being enslaved—whether you like it or not—by this very demanding music. I know few people in jazz who have any option in the matter. Most of us are thoroughly addicted to jazz; most of us wouldn't know how the hell to get out of it even if the thought occurred to us.

Has the availability of three configurations—CD, LP, and cassette—helped or hurt Landmark?

I don't know, because it's such a shifting situation. Even though Landmark has been in business about five years, we started without paying any attention to CDs. Now the CD is coming in so hard, it's difficult to find out where things are. I'm somewhat startled to know that my records are coming out in Japan *only* as CDs, and this is getting to be a very general situation there. In Europe, the LP-to-CD sales ratio seems to be just about even money; probably CD is getting further ahead. Domestically, the LP is showing more staying power [in jazz] than a lot of people thought it would. Maybe it's because the jazz audience in this country is basically conservative, doesn't like to move too fast.

What's happened is that wholesalers and retailers pushed like crazy for the CD quite possibly because some of

them are as old as I am and have clear memories of the horrors of various other transitions we've gone through in the last 40 years: The initial changeover from 78s to LPs, the somewhat smaller but still rather devastating change from the 10-inch to the 12-inch LP and, the changeover from mono to stereo, which is quite comparable to what is happening with the CD revolution. There were years in each of those instances when distributors had to maintain double inventories; records were issued in monaural and stereo, just as they are now issued on LP and CD. A lot of the reason is there isn't enough hardware out there. A lot of people have CD players, but a helluva lot of people don't. Looking at it historically, I guess the CD has become *the* configuration. Right now, though, it's a pain in the neck. You have to manufacture in duplicate ways, which is expensive; you have to sell in duplicate ways. It's pretty much a wash right now. The manufacturing costs on CDs have come down a good deal, though.

Who knows? By the time this interview is published, the LP may very well have become extinct.

Frankly, I am very fond of CDs; on the whole, they're a remarkable improvement. Among other things, the CD has done wonders for the surge in reissues. And that's something I'm deeply involved with, and which I feel is valuable and important.

Right now, the CD is a marketing situation. It's not yet an artistic situation. I think one of the things that is apt to happen is going to be very interesting. The LP freed us from the three-minute format, leading to wonderful advances and some dreadful abuses. In the same way, we're being freed by the CD from the approximately 20-minutes-per-side situation of the LP. All those skills in programming that producers developed over the years—you know, worrying about what's going to be the lead-off track on side two—all that's gone with CD. There ain't no more side two. I think we're going to find certain things that are artistically possible with the CD that were not with the LP. But we haven't scratched the surface with that yet. It should be fun, because it will present something new to us. And there will always be that interesting struggle between the art and the technology.

Does it concern you that a lot of great music recorded in mono or on LP may get lost in the shuffle and become unavailable?

Yeah, but by the same token, that's not a new reality. You have to remember, even with the tremendous amount of reissues going on now, there are many LPs that have not seen the light of day again. That's always going to be the case. As far as music that doesn't make the conversion from LP to CD, I think the basic advice is to hang on to your turntable.

With respect to Fantasy, how much freedom do you have at Landmark in your choice of artists, in the number of copies released, the release date, etc.?

Here's the best way to understand this. Landmark has what is known in the trade as a P-and-D deal with Fantasy Records. That's nothing exotic; it stands for pressing and distribution. We're a totally independent operation that has a business relationship with Fantasy. Strictly speaking, Landmark creates product as it sees fit, with no direction from anyone but me.

One of the best examples of the value of my situation was Landmark's first Kronos Quartet album. If I were working for a company, or were an independent producer looking for outlets for my brilliant ideas, and I went to anybody in this business and said, "I've got this great idea. I want your money to finance my concept of a string quartet that specializes in contemporary music and that practically no one outside of San Francisco has heard of (this is a few years ago). We want to do an album of Thelonious Monk material. . . ." I knew perfectly well that anybody I went to would've patted me on the back and said, "There, there," intimating that senility had finally come upon me. There's no way I could have gotten somebody else to finance and produce that album. When I did it, it was because I believed in it. When I handed it to Fantasy, they had no option except to put it out there because I gave it to them as finished product, under our deal. And it's done very nicely for everyone.

What's your relationship with RCA's Bluebird reissue program?

A producer named Ed Michel, who started his career working for me at Riverside, phoned me about three years ago and asked, "How'd you like to write the liner notes for a Jelly Roll Morton CD I'm putting together for RCA?" I said, after I put my jaw back in shape, "It sounds like a very nice idea because you are undoubtedly using the same material I used for some 1953 reissues for RCA's Label X, so I can crib from my own liner notes." Since then, I've worked out an arrangement with Steve Backer [director of RCA's jazz activity] where I have been dealing with the pre-tape era: All of the '20s and '30s and most of the '40s stuff in the Victor catalog—an immense, rich catalog. I've been conducting an ongoing program of reissues which is CD-oriented. One of the problems, ironically, with CDs and old records is that despite how nice it is to have the noise-free Compact Disc, if you don't do something about it, it's going to reproduce all the original deficiencies and all the wear and tear the decades have wrought in this material. All the cracks, crackles, pops, rumbles, and hiss we found acceptable in 78s and LPs can be intolerable on CD.

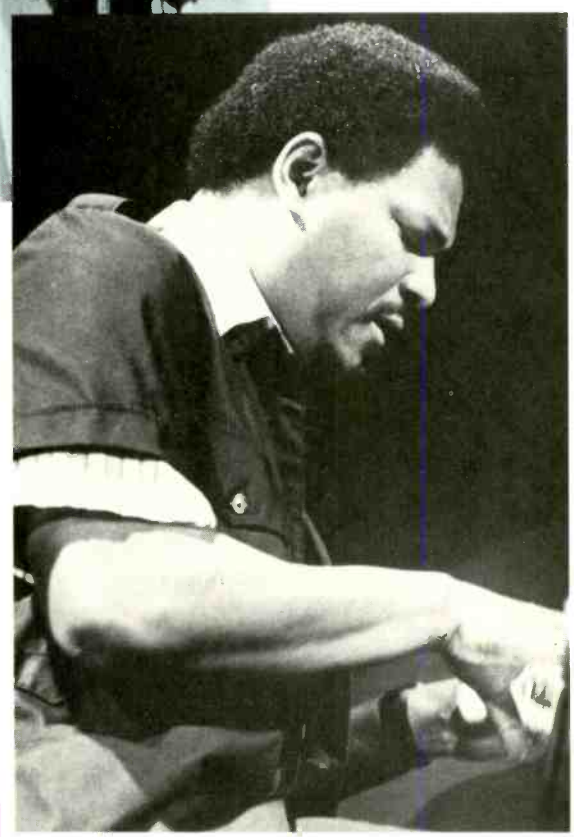
There are a number of sophisticated, very contemporary noise-removal processes. RCA has been using NoNoise, from a San Francisco-based outfit called Sonic Solutions. It's a wonderful computerized system. It is not perfect, and some of our more loud-mouthed critics have made ugly noises about this particular system. It seems to me they entirely miss the point. The point is, we've got more jazz reissuing going on today than at any time I can think of. I have yet to see that celebrated as the wonderful, magnificent fact it is.

I've been in a constant battle to improve the lousy sound, the dominant noise, of old records. I welcome any ally that comes along. I do know there are things sometimes you have to sacrifice. Hell, when noise removal consisted of cutting the tape with razor blades, you got to the point sometimes where you had sliced out so many clicks and pops with the razor blades that you discovered you'd turned the meter around! And sometimes we didn't let even that stop us, having decided noise removal was intensely important. It's kind of hard to ask people to listen to records if the noise is at a higher level than the program. So with reissues right now, the trick is to put out records that will sound reasonably acceptable to today's ears. There is nothing wrong with people who grew up in the '70s and '80s being uncomfortable with the sound of the '30s in its raw, natural shape.

One of my least favorite critics used the term "colorization" to describe this form of noise removal. "Colorization" is a great buzzword, because we all know what Ted Turner is doing. Putting all those pastel tints in those wonderful old movies is lousy. So you use the word "colorization," and immediately you get all kinds of people rallying behind you against some presumed vil-

It was due to Keepnews' urging that saxophonist Sonny Rollins decided to return to the studio in the '70s.

Photographs: Frank Driggs Collection



Keepnews produced very interesting recordings of McCoy Tyner both with and without overdubbing.

Multi-tracking allows you to correct, but worshipping correctness just because it's technically possible—that's all wrong.

lainy. Fact is, before there was colorization in movies, there was phony stereo in recording. To me, *that's* the audio equivalent of colorization. But trying to take away as much aural distraction as possible is, to me, a legitimate and praiseworthy effort.

I'm also intrigued as hell by the fact that in doing reissues for RCA, I sometimes find that the best available source materials are transfers to tape made in 1953 and 1954, when Bill Grauer and I were doing 10-inch LP reissues for Label X. So, as you see, my life has come amazingly full circle. I'm used to the fact that, for many years now, I've been reissuing records I produced in the first place. But here I am, reissuing records that I *reissued* 35 years ago!

Additionally, MCA has gotten underway with a Decca reissue series, and I'm involved with that. I guess it proves one thing: If you last long enough, you become a grand old man of the business.

Even though I started off in life as a jazz traditionalist, a moldy fig, and have always been, by and large, a jazz purist, my attitude toward reissues is pragmatic: Use the best source material that you can find. I have worked with metal, with shellac records, with previous tape transfers. What I want is whatever is going to sound best. I don't have a purist attitude toward source material. I remember one story, an early experience. Riverside had done a number of 10-inch reissues. We had leased a whole bunch of early Paramount Records material—Chicago in the '20s. I had one particular item, one of several Ma Rainey reissues. We had a leasing deal with London Records, that is, English Decca. They had released these Raineys in England, and they'd fooled around a bit, done some sound enhancement in addition to what we had done. Generally, I thought they'd improved on what we'd done with these things. So in the '60s, I was putting together a Ma Rainey reissue on Milestone and found that the best-sounding source material was a nice, clean, unplayed copy of the 10-inch London LP. I took the material from that, transferred it to tape, and did some re-equalizing and noise removal. A guy I knew, a young man originally from England, was very excited about this particular reissue; he told me how great he thought it sounded, saying, "Until this came out, the only source I had to listen to was the old 10-inch London LPs, and this sounds so much better." I learned a valuable lesson: He

liked what I had done much better than what I had used as my best-available source material. I was being practical; I was using a reissue LP as my source material for a reissue LP, and it worked just fine. In reissue, as far as quality is concerned, the goal is to have something that people can listen to without pain.

Has it been difficult for you to adjust to audio's ongoing technical revolution?

I'm a little older than stereo, professionally speaking. I started in a mono situation and lived through the birth of stereo. The magic word back then, before it was replaced by the word "mix," was "balance." In two-track days, we had to, in effect, "pre-mix." You had to have the sound in the right proportion before you recorded. Then there was really a tremendous revolution as multitrack came in; you could record in layers and add things to your basic tracks. There was the ability to correct, the ability—to use the now-classic phrase—to fix it in the mix. There are a lot of positive values in that. I see absolutely nothing wrong with overdubbing. I have felt that technology was in some respects very valuable, in some respects very debilitating. It made possible a certain amount of laziness in technique. I don't know how many bass players got into the habit of saying, "Let me punch in, I played a wrong note," completely losing sight that the function of a bass player is not to play right notes for the sake of playing right notes but to provide rhythmic support. This is the way rock music gets created—in little bits and pieces. It's always bothered me. Sure, I don't want to do another take of a song that was excellent except for one tiny glitch, and I don't want to tell a player, "We're going out into the world with you playing the wrong note." But worshipping correctness as an ideal in itself, just because it's now technically possible—that's all wrong. The phrase "close enough for jazz" is very important. It speaks to the preeminence of feeling, the preeminence of soul over total accuracy. Total accuracy doesn't necessarily do a damn thing for jazz.

There are some very interesting McCoy Tyner records both with and without overdubbing. On the one hand, McCoy did an album with 10 strings and a couple of woodwinds, everything done live, at the same time, in the same studio. But we did an album right after that where his working group consisted of multi-reed players; we did multiple overdubs where we had as many as nine parts going with three players. It was appropriate—I'm a great believer in appropriateness! I'm also fascinated by the way the cycles come around again. With digital multitrack still so expensive, an awful lot of two-track recording is being done. Suddenly, two-track is hip again. The problem is, there are a lot of engineers with no two-track training—guys who grew up on multi-track.

What I'm saying about multi-track is basically that it opens up a lot of things for you, but it also can lead to what I'll call very bad habits and sloppy attitudes in recording. The important thing to remember is to use the technology and not let it use you.

I will now use direct to two-track wherever I feel the circumstances are right. If I'm doing a small group with normal instrumentation, I'll certainly go two-track. But if I'm doing anything where I'm the slightest bit shaky . . . I'll give you an example. The vibes are an intensely sensitive, very difficult instrument to record. I generally would want to record multi-track with Bobby Hutcherson, particularly where he chose to play vibes and marimba on the same number, physically juxtaposed to each other. The level of response from those instruments is so vastly different. I'd use multi-track with Bobby simply to have the luxury of control, to be able to really feel that I can get balances and levels right. Even on a small-group album with Bobby—with any vibes player—I'd feel more comfortable doing it in multi-track and mixing down.

What makes a good live recording?

Certain artists cry out for live recordings. Like Cannonball Adderley. The charisma of the man, which dates to a time when we didn't even use the word charisma [*laughs*] . . . the excitement, the audience reaction. And there are certain artists who are better off not doing live dates.

The positive element is the excitement, the spontaneity, the *liveness*. The fact is, however, most club performances tend to be a helluva lot longer than make sense on a phonograph record, not only in terms of the length limitations of the LP or CD but also, beyond that, because live performance involves visual elements you can't bring to the record. Sometimes what's interesting in person isn't quite that interesting at full length on record. So you try to figure out the extent of solos, though you don't say, "Don't you take more than two. . . ."

What *is* a problem is your relative lack of control. Often you're only getting one shot at the material. So you use a bit of ingenuity. Example: Monk's classic *At Town Hall* recording. We missed the opening of a tune, so Monk did it over for his encore. That's just thinking on your feet. I must add, that was Monk's solution, not mine. He knew he'd goofed. Monk was very good at that, I must say. He had instant awareness of where the responsibility lay. When someting was his fault, he knew it and he took it upon himself to correct it.

If you're recording a club performance, you have the luxury of playing a piece many times—you just don't play each take one after another, as you tend to do in the studio. That leeway, however, can backfire. With Cannonball Adderley, the second time we went into the Jazz Workshop, we had about five cracks at it and there was such an absence of tension that we almost blew the whole thing! But I have always been very partial to live dates, probably because the greatest commercial success of my life was Cannonball's first Jazz Workshop album. And arguably one of my top artistic successes was the Bill Evans Village Vanguard series. So, yes, I love live recording.

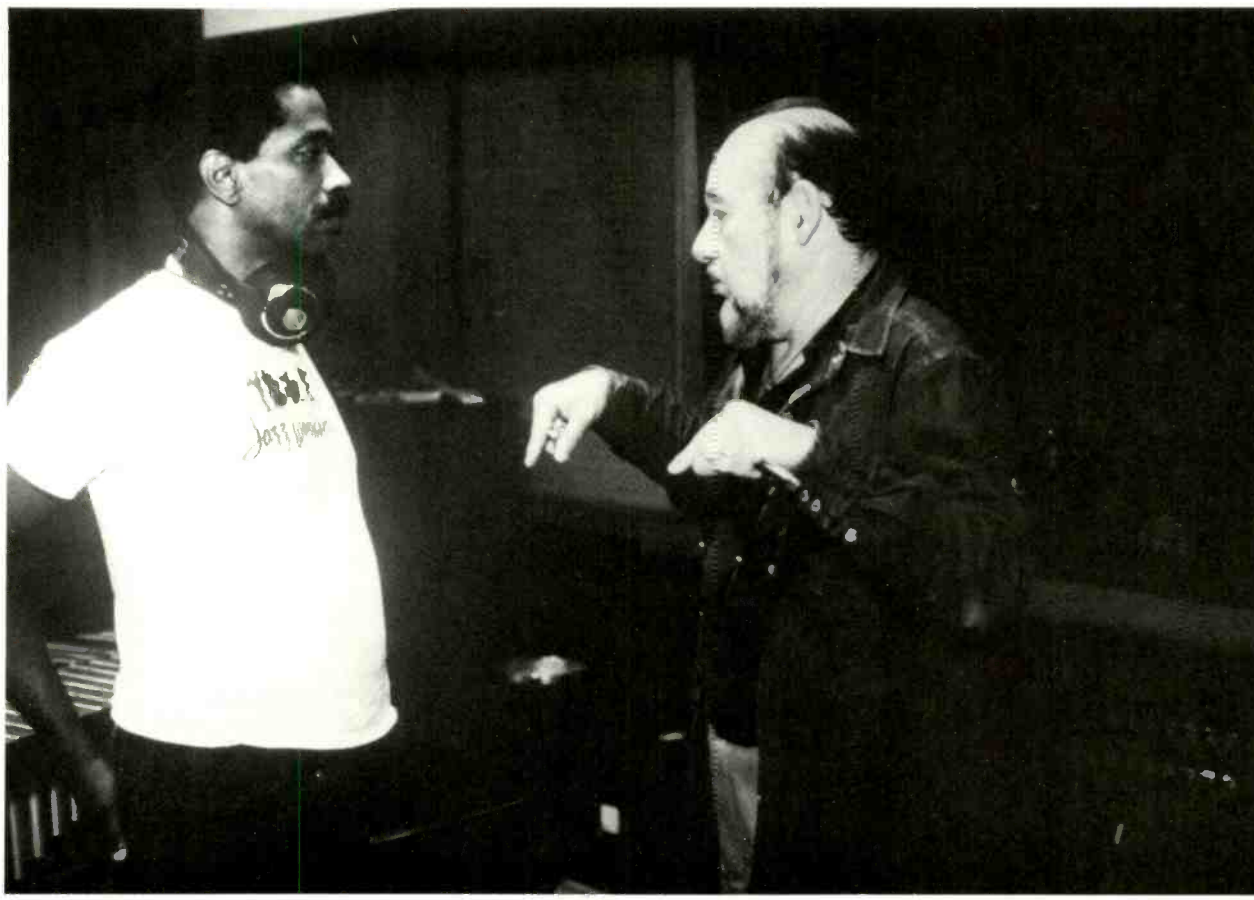
Moving away from the live situation, how do you decide what studio to use and what engineer to employ?

A lot of times, circumstances control it. I've been in a lot of situations where my choice of studios was preordained. In the Riverside days, we worked primarily in two rooms—Reeves Sound Studios and, later, Plaza Sound, which was a wonderful, big, former broadcast studio atop the Radio City Music Hall building. I just was put into those situations because my partner, Bill Grauer, had made very inexpensive, annual-guarantee-type deals with those studios. I was informed, "Hey, this is your home."

Basically I find—and this is an extreme generalization—that while some studios are obviously much better than others, you can live with almost every reasonably professional room. Regarding engineers, there are some I've loved working with who really understood the music and made a large contribution. And I've also worked with some really marginal engineers.

If it's humanly possible, I want to be familiar with the room or, if that's impossible, the engineer. I'll fight like hell to have either of those. I want some kind of constant.

Today it's relatively simple. If I'm working in New York, I'm most likely to



Photograph: Phil Bray

Keepnews with vibist Bobby Hutcherson, who was the first to release a record on Landmark.

Making jazz more appealing is not necessarily good because one way to do it is to water it down, to bastardize it.

go to Rudy Van Gelder's, although Rudy is not necessarily the easiest man in the world to work with—for very good reasons. He knows what he's doing, and if you don't agree with him you're not necessarily going to win the discussion. That's his room and he's been in it for 30-odd years. But it's good. Rudy gets good results. Rudy became—and still is—the world's greatest two-track engineer. He's now in an excellent situation with the advent of digital. As I said, two-track digital has become very hip, and Rudy loves to work that way.

When I'm out here in the Bay Area, I tend to work in the Fantasy studios. Again, I know the room. One studio in particular, Studio C, I'm extremely happy with. And whenever possible, I like to work with Danny Kopelson, an independent engineer.

The more things you can do automatically in a studio situation, without thinking, the better. If the room is sufficiently familiar to you, then you don't have to argue, you can just say, "Let's put the drums there."

An example of how the familiar helps you defeat the unfamiliar is the first album I did with The Kronos Quartet. It was done in Studio C at Fantasy with Danny Kopelson. The unknown—a very important unknown—was that I had never in my life worked with a string quartet. I started with a premise: As far as I'm concerned, this is a jazz album. Therefore, I'm going to mike

these people the way I would mike a jazz date, with as much presence as possible. So we close-miked everybody. I soon discovered that when you mike strings closely, you get an incredibly ugly sound. Being stubborn, I didn't say, "Okay, that doesn't work. I guess we'll record the way people record classical music all the time, with a lot of ambient mikes way up in the ceiling. . . ." Instead I said, "Let's start backing off and checking; sooner or later we'll get to a point where it won't sound ugly anymore and we'll have as much presence as we can hope to get." So we arrived at that compromise situation. This would have been incredibly difficult with an unknown engineer or studio, or both. We did throw in lots of over-head, in-the-ceiling, ambient miking. In the mix, we used a little bit of everything. They may have been prejudiced or just trying to be nice to me, but David Harrington said the recorded sound was the best he'd ever heard of a string quartet. Since it was his album—he's the first violinist in the group—I took that to mean we had done it right.

What's the state of jazz right now, from your point of view?

I'm one of those who feels very positive about it. People often say to me, "Well, it's not really a period of creative ferment. . . ." But I think that the consolidation that is going on right now is important, the way that a lot of artists are extending the tradition—veterans like Bobby Hutcherson, younger artists like Mulgrew Miller and my favorite Marsalis, Branford. It's the first time in the history of jazz—well, I can think of one other instance—where the younger generation does *not* feel required to be antagonistic to what was done before them. You now have these people looking at the past positively, consolidating and advancing within a tradition. As I said, it's not actually unique. If you go back to the '20s, the young white jazz musicians in Chicago picking up on the New Orleans tradition were a case of a generation looking back to the past. But it certainly has not been the norm in jazz to have continuity. I don't happen to believe that creativity can only be measured by going off at right angles or doing a complete about-face.

I am aware, for instance, of the fact that Thelonious Monk in many ways held a deep respect for the past. Monk knew perfectly well that he came out of Duke Ellington and the stride piano players as well as his own head.

What can you do to get jazz, legitimate jazz, that is, more widely recognized and accepted?

I haven't the faintest idea. Literally. I've been working in jazz for a great many years, and I've concentrated on trying to assist in the creation of the most interesting and valid jazz possible. I have never liked those jazz movies where the last scene is the big concert in Symphony Hall, where jazz has just become respectable and everyone loves it. For instance, I thought the worst moment in a picture I generally enjoyed, *'Round Midnight*, was the stupid jazz-rock concert after the hero's death. It was exactly the equivalent of those jazz concerts in Symphony Hall.

But I don't worry about how to legitimize jazz, how to bring it to the masses. I don't know those answers. I've never been a public relations expert. I never really felt that merely making jazz appeal to more people was necessarily a good thing. One of the ways you make jazz appeal to more people is you bastardize it, water it down, make it sound more like other forms of commercially appealing contemporary music. I don't necessarily think that's an improvement. By and large, I like plain, old, limited jazz. I don't think I can answer your question because I don't approve of the way such a question gets phrased. I suppose it's a legitimate question in the bigger-is-better sense, in the sense that if you sell 10 times as many records you've achieved a greater success. But there *are* some of us who, honest to God, feel that as long as we can stay alive, it's not necessarily the best thing in the world to make as much money as possible.

Do you think, as a producer, you've ever become stale or repetitive, and how do you fight that?

There are times when I feel I'm on more of a roll than others. I've never really felt repetitive or stale, simply because one of my tenets has always been that every artist is different. Every album is different, and I try like hell to make it that way. I have now arrived at a state where if I don't think something is going to be an interesting and valid challenge, then I won't do it.

At Riverside, in my youth, I wanted to devour the world and do everything. I look back at the recording dates of Riverside, and I see how *closely* things happened. We recorded the first Wes Montgomery album in New York, about 10 days before we did the hit Cannonball Adderley record in San Francisco. Then there was one week where I was in the studio for four straight days, and when the week was over, I had done *The Incredible Jazz Guitar of Wes Montgomery* and Nat Adderley's *Work Song* that Wes appears on. That was a helluva week.

Basically, I've had the ins and outs and ups and downs. I try to be less hysterical in my activity than when I was younger. Put it this way: There are times when I've been less successful than others, obviously. Sometimes I've made some very wrong guesses as to who was an important artist of the future, although I think my track record makes me a pretty good guesser.

Do you feel as if you've accomplished everything you wanted to? Is the quest to document never-ending?

I did have this naive feeling that as you get older you're supposed to slow down. I tried that. I left Fantasy in 1980 and tried to slow down. It didn't work. So, I'm not trying anymore; I'm just taking things as they come along. If there is something I want to do, I do it—literally. When there are things that legitimately interest me—such as the reissue projects, which still fascinate me, or creating a soundtrack album for the Thelonious Monk documentary, *Straight, No Chaser*—I wouldn't know how to say no. Why should I deny myself the pleasure of doing them? I guess I haven't reached the saturation point.

What would you like to accomplish further on down the road?

Actually, I'm pretty happy. This amazes me. I'm pretty happy with the circumstances I have now, running a label. I'd like to sell a little bit more, so I could more effortlessly do the things I have in mind to do. On the other hand, if I didn't have a constant series of budget problems, then I wouldn't recognize Landmark as the kind of jazz label I've been with most of my life!

If I keep on operating just about the way I'm operating now, that would be lovely. I know I won't. I know something's got to give with what's going on right now. Just about everyone has a jazz program; just about everyone has a reissue program. But I can't believe that's a permanent state of affairs. We've seen too many of these. You go from a boom to a jazz-is-dead period almost before you can turn around. I suspect someone will, one day, cancel their jazz program. That will show the marketing people at other labels that it's okay to cancel a jazz program. You see, no one would want to be the first to cancel jazz—that would make you a philistine. But it's okay to be the second one.

Good Walls Make Good Neighbors

Peter Jurew

This is a story of how, through a marriage of acoustics and carpentry, tragedy was narrowly averted. The potential tragedy was the impending homicidal assault of one neighbor—a lover of jazz, classical, and sonically pure music—upon another, a headbanging rocker. This story has a happy ending because, by spending about $900 and every weekend for a month, Robert Frost's aphorism, "Good fences make good neighbors," was expanded to include shared walls.

The tale begins one winter in a nearly empty apartment where two newlyweds are bedded down in sleeping bags on their first night in their first apartment together. At 8:00 a.m. the next morning, Mr. Newlywed is startled awake by the incongruous realization that someone has broken into the apartment, set up a powerful stereo, and cranked up The Grateful Dead's "Touch of Gray" as they no doubt danced around the living room.

On rising, Mr. Newlywed and his equally worried wife discover to their relief that the apartment's living room is just as barren that morning as it had been the night before. However, the groggy couple slowly realize that they are still hearing "Touch of Gray" as if it *were* inside the room. Needless to say, they are extremely upset.

Searching for cracks, leaks, or holes in the wall from which the catchy tune is emanating, Mr. Newlywed finds nothing. It's a good, solid wall. He despairs at the thought of the incredible irony: They'd found a one-bedroom apartment at an affordable rent in Manhattan, and now this! The person (or persons) on the other side of the wall segues into "Disco Fever." It is 8:07 a.m. His brain spins wildly through alternatives, as though he and his wife have been trapped alive. He knows that furniture reduces echo—the moving truck is arriving today. He knows that pictures and wall hangings cut down sonic reverberation—they'll put up temporary frames, mirrors, anything. They decide that this can't go on.

Twelve hours later, Mr. and Mrs. Newlywed are sitting on their boxes, crates, and furniture, listening to their faceless friend next door unwittingly regale them with The Doors' *Greatest Hits* at maximum volume. "Should we say something?" Mrs. N asks. Taking this as his cue, Mr. N steps through the piles of belongings and makes his move.

When he gets to the door down the hall, he notices that the entire floor is echoing with his neighbor's musical overflow. He wonders if anyone else has ever said anything about the noise. He rings the doorbell, and the music goes down. A second later, clad only in leopard-print tights, the neighbor appears.

"Hi, uh, I'm your new neighbor . . .," says Mr. N. The neighbor smiles.

"Hey, great to meet you," says Tarzan in a heavy Brooklyn accent. "I hope you don't mind the music. I like to play it loud,

Illustration: Griesbach/Martucci

and the lady who lived in your apartment before you had a problem with it."

"Well, I, uh, I really love The Grateful Dead. . . ."

"Yeah? Seen 'em 30 or 40 times. But they're not what they used to be. Listen, you want me to turn it down, just let me know. No problem."

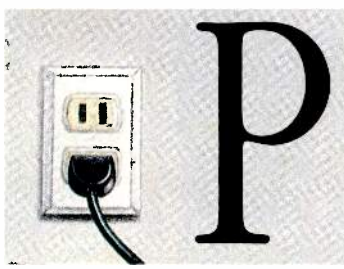
"Gee, that's really nice of you. We love music too, but you wouldn't believe how clear your stereo sounds in our living room. In fact, we can hear everything in our *bedroom*, which is two rooms away."

"Really? Wow, I'm sorry. I'll try to keep it down."

"Hey, we'd really appreciate it. Thanks. Oh, I have a couple great Dead tapes you might like. Fillmore East, '71?"

"Got it. Great stuff, huh? Listen, take it easy. Name's Mark."

The door closes. When Mr. N gets back, his wife is near tears. He immediately discovers the reason: Mark is on the phone now, his television is on, and every word is loud and clear in the newlyweds' living room. Mark is yelling



Perhaps the dream apartment the first place because of the

at someone on the phone; on the TV an anchorman is describing recent events. The newlyweds are petrified.

They survive the night, the week, the weekend. They decide to try to live as normally as they can. They wonder whether or not Mark was the reason their dream apartment became available in the first place. He is quickly driving them crazy; they are tense about coming home, expecting and receiving regular aural assaults through the living room wall. The saddest thing about the situation is that they like—and even own—many of Mark's musical selections. Now these tunes are being used like weapons against them.

The breaking point comes the night they are celebrating their three-month anniversary. There is a special dinner, good wine, candles. The mood is perfect, and the newlyweds are especially happy. Then, in the middle of dinner, they hear Mark come home. They hear his door slam shut. They hear him turn his locks and flick three light switches. They hear his stereo come on—he's dialing the radio for a station. He finds one playing Led Zeppelin. The volume goes up. Dinner is destroyed. Mr. N becomes irrational. He goes over to *his* trusty Marantz receiver, which puts out 100 watts per channel, pulls his speakers together, and then turns them toward the wall. On the turntable he places their one album that Mark, with his own special tastes, will likely hate—it's punk rock. Give him a very large taste of his own medicine: Stereo war!

By the middle of side one, the first stereo battle is over. Mark apparently detests punk rock as much as Mr. N thought he might. Both stereos are quiet. But Mark is on the phone. Enough for one night, Mr. N thinks, but his wife is irate. Something, she tells him, has to be done. And she's right.

The next day Mr. N makes several phone calls. One is to a friend who knows acoustics. Another call is to a friend who builds houses. He is trying to find out what solutions exist in the marketplace. He wants to buy his way out of misery.

The friends, from different backgrounds, have both suggested a floating wall. But first he's told to find out more about the source of the problem—find out what Mark's got that rocks the wall, and where it is.

That evening, the research commences. As soon as he hears Mark come home, Mr. N is at his door. Mark is surprised to see his neighbor because he hasn't even had time to turn on the stereo. Mr. N excitedly tells Mark about his plan to build a wall that will help each of them. Mark looks puzzled. But Mr. N pushes on; he just needs to see where Mark keeps his stereo so he can plan out how serious a wall he will need.

"Well, I move it around."

"You what?"

"I move it around. There's my box." He points to a street stereo, an AM/FM/cassette player. Mr. N's jaw almost hits the floor.

"You make that much noise with a boombox?"

"Yeah. My stereo was ripped off, and I'm down to this."

"Uh, okay. Thanks a lot. But, listen, will you do me a favor and keep it away from the wall? Let's see if we can solve this thing."

"Sure. No problem."

The task before Mr. N seems formidable. In fact, it seems almost beyond his grasp. He's done basic carpentry, but he's never built a wall, never used sheetrock, never taped a joint. But he realizes that peace of mind, perhaps even his marriage, hinges on his success. He's got to build a wall that will keep Mark's noise out.

Construction begins the following week, when a van delivers eight 4 × 8-foot slabs of sheetrock, forty 8-foot 2 × 3 studs, four boxes of nails, two boxes of sheetrock screws, joint tape and compound, six tubes of GE silicone caulk, 80 feet of 3-inch-wide, ⅛-inch-thick rubber tubing, and three electrical outlet boxes. The approximate cost is $900.

The plan is this: Build two new false walls adjacent to the two existing shared walls of the two apartments—effectively an "L" that *will touch no single part* of either of the existing walls. By creating such a barrier, it is hoped that any aural penetration will be trapped and absorbed. The false walls will not be anchored to the existing walls in any way; they will stand free, or "float," being held in place by the combination of rubber tubing and silicone caulking where the wall meets both the floor and ceiling.

On the first day, frames are hammered together using the studs. Each false wall to be built is 20 feet long and 8 feet high. Two full 8 × 8-foot frames will be needed per false wall, and two 4 × 8-foot frames will be built to form the inside corner. By the end of the first day, the frames have been nailed together after carefully measuring each supposedly 8-foot-high ceiling. (Many ceilings are not precisely 8 feet, so cuts on the uprights will vary.) Phase II, mounting, can begin.

First, rubber tubing is rolled out along the entire length of each 20-foot existing wall, and is placed with fair precision about 2 inches out from the wall. Next, it is glued to the floor using the silicone caulk. Finally, more sili-

cone caulk is applied to the top of the tubing, in preparation for mounting the frames.

The frames, one by one, are lifted into place and temporarily held up by jamming a wedge between the top crossbeam and the ceiling. Working down the line of top crossbeams, rubber tubing is worked into the space between the beam and ceiling, allowing one frame after another to stand on its own weight. Finally, when the entire length of one new wall frame is fixed with the rubber and the builders are confident of its strength, silicone caulk is applied to seal the gap. This amazing product, which bonds to any household material and sets like iron in hours, is the key to the project's success. It allows this new wall to be constructed 2 inches from the existing wall without a single rigid connection of any kind between them.

After the second new wall frame is similarly supported and sealed, the first phase of the project is finished. It's time to give the new wall frames a chance to settle in, give the caulk time to set completely, and call the electrician to come and move the outlets out of the existing wall. (Crossties had already been cut and nailed into place between the studs closest to the outlets, in anticipation of the electrician.) While Mark's music continues to pound through their apartment, the newlyweds are sleeping a little easier knowing they've at least taken matters into their own blistered hands.

The following weekend, bright and early, the electrician arrives to move the outlets. The entire operation takes about 90 minutes. It could have been done without the electrician. However, building codes make it illegal to do such operations without a professional. Besides, it's unsafe.

At this point a dispute arises among the construction team, which has been joined by Mrs. N's father. It is a difference in soundproofing theories. One theory holds that no more insulation than the air pocket created by the new wall is necessary to effectively deaden and eliminate the sounds crashing through the old wall. The other theory is, "too much insulation ain't enough." This theory, promoted by the father-in-law, calls for bringing in 6-inch fiberglass insulation, stuffing it between and behind the frames, and sealing it up with sheetrock. Under the notion that one can't be too carefu , this theory wins out. Fiberglass insulation is called for, enough to run the length of a football field. No one's taking any chances.

The rest of the weekend is spent cutting the 3-foot-wide fiberglass rolls into 16-inch slices that will fit between the studs. The leftover, smaller pieces will be stuffed behind the studs to effectively blanket the entire old wall with insulation. The fiberglass installers all wear heavy work gloves to protect themselves from the glass fibers, which are painful and difficult to remove from skin. (One method is to use masking tape to lift off the glass; it works for both skin and clothing.) They also wear protective glasses and masks.

At last, they're ready to mount the sheetrock wallboards. For this purpose, a Phillips-head screw bit has been bought to employ a high-speed drill as a screw gun. The wallboards go up snugly and are quickly affixed to the frames with screws. Another theory has been modified here: It had originally been proposed (by the friend who knows acoustics) that the optimal way to mount the boards would be by using the silicone caulk *only*, with no screws. But the friend who builds houses has talked the team out of that notion, saying that as long as no part of the new wall touches the old, the use of screws will have no effect whatsoever. Nevertheless, once the boards are mounted with screws, caulk is applied to seal all edges. The point is, since nobody's too sure if this thing is going to work in the first place, why not use *all* viable ideas?

Before completing the sheetrock mounting, the team has cleverly cut out holes in the three boards that will fit over the outlets. In addition, by using a chalk line, they have located all of the studs that they will screw the boards into. And they have cut one of the boards to be used for the inside corner in such a way as to take into account the fact that the existing walls are not perfectly flush with each other. Somehow, when the walls were built, the plaster warped; a slight correction has been made.

Once the sheetrock is in place, the apartment becomes transformed. And once the silicone caulk sets, an eerie silence descends over the living room. Worried frowns come to the newlyweds' faces. Is Mark out? Since the last screw has been pushed into the wallboard, they haven't heard a song or a phone conversation, not even a single flick of his wall switches. They wonder, has he moved away?

They agree that it's time for a sound check. Mr. N at last gets up the nerve to go next door and make his bizarre request.

"Hi, Mark. Uh, listen, would you mind turning your stereo *up*?"

Mark's probably heard stranger things in his life. But not much. He asks to what he owes this unusual fortune, for ever since the punk rock incident, he has acted distant, cornered. He obliges, however, with a singularly awful track from a long-forgotten band.

"Thanks. That sounds great. I'll be right back." With that, Mr. N returns to his own abode. His wife looks at him, confused.

"What's the matter, he's not in?"

"What are you talking about? He's got it cranked . . . ." They embrace.

The newlyweds are elated over their victory. Mr. N rushes back to Mark's door, through which a gushy, string-laden disco hit can now be heard clearly.

"Thanks, Mark, you've been great. We really appreciate it."

Mark seems entirely confused but is more than happy to see his normally irked neighbor looking so elated with his behavior.

So they all live happily ever after. The wall has prevailed even when warm weather brings open windows. And as it ages, it seems to become more and more a symbol of rational behavior—even if that doesn't sound like a whole lot of fun. A

had only become available in nightmare neighbor next door.

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1

CARVER CT-17 TUNER/PREAMP

Manufacturer's Specifications

Tuner Section

Mono Usable Sensitivity: 14.3 dBf.
Mono 50-dB Quieting Sensitivity: 18.3 dBf.
FM Mono S/N: 78 dB.
FM THD: 0.15%.
FM Alternate-Channel Selectivity: 72 dB.
AM Suppression: 62 dB.
FM I.f. Rejection: Greater than 75 dB; nominal, 82 dB.
FM Capture Ratio: 2.5 dB.
FM Stereo Separation: 46 dB.
AM THD: 1.2% at 30% modulation, 2 mV input.
AM Selectivity: 30 dB.
AM Image Rejection: 46 dB.
AM I.f. Rejection: 65 dB.

Preamplifier Section

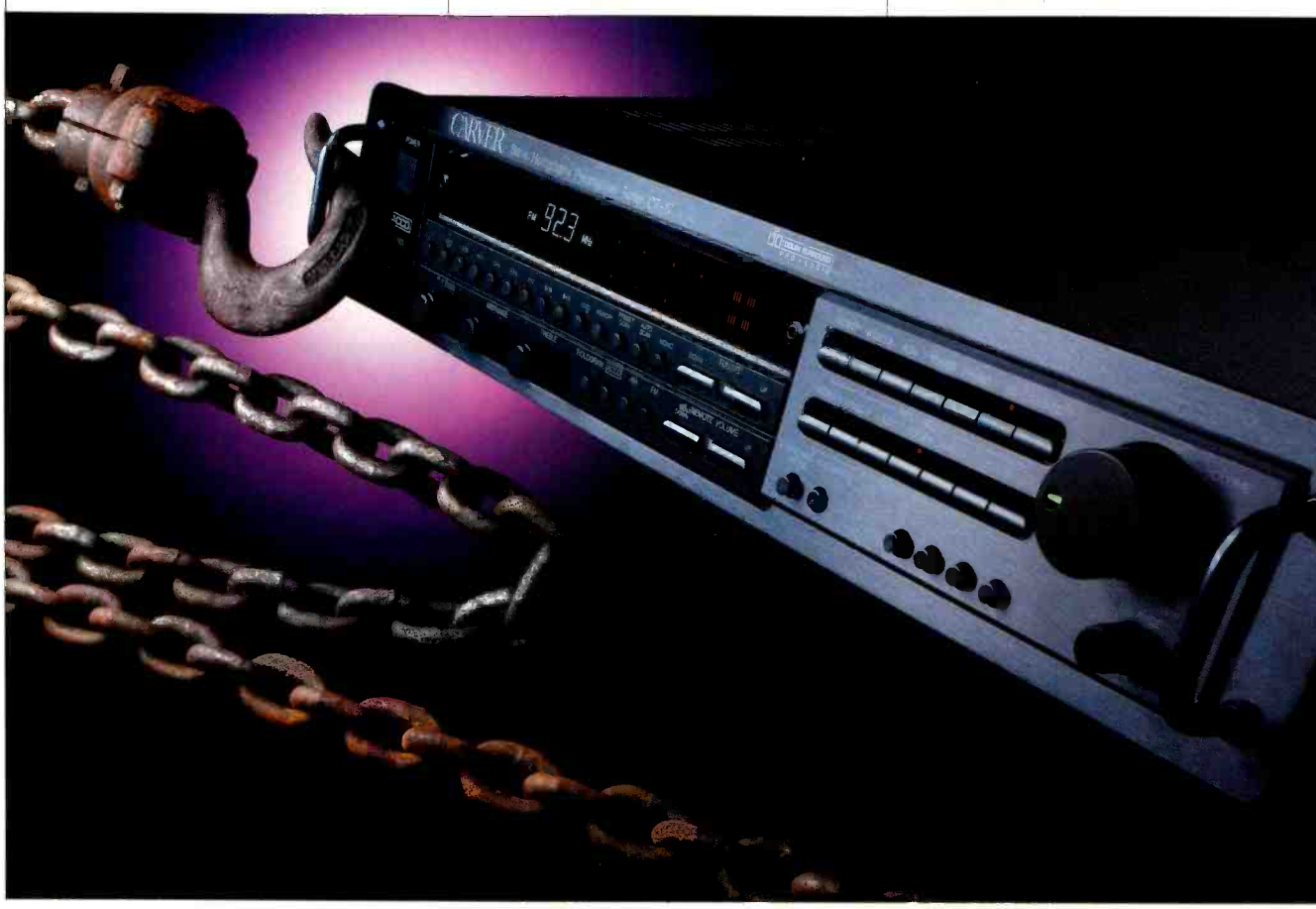
Frequency Response: Phono, RIAA, ±1.0 dB; high level, 20 Hz to 20 kHz, ±0.5 dB.
THD: 0.015% or less below 2.0 V output.
S/N: Phono, 80 dB below 5 mV input; high level, 95 dB below 1.0 V output.
Rated Output: 6.0 V.
Input Sensitivity: Phono, 2.7 mV; high level, 180 mV.
Tone Control Range: Bass, ±8 dB at 100 Hz; midrange, ±6 dB at 1 kHz; treble, ±8 dB at 10 kHz.
Muting: −20 dB.
Loudness: 3 dB at 100 Hz.
Headphone Sensitivity: 125 mV for 1 V out at preamp out.

Video Section

Frequency Response: 10 Hz to 3.0 MHz, ±2.0 dB.
Input Impedance: 75 ohms.
Video Input and Output: 1.0 V, peak to peak.

General Specifications

Dimensions: 19 in. W × 3½ in. H × 12¼ in. D (48.2 cm × 8.9 cm × 31.1 cm).
Weight: 12 lbs. (5.4 kg).
Price: $799.95.
Company Address: P.O. Box 1237, Lynnwood, Wash. 98046.
For literature, circle No. 90



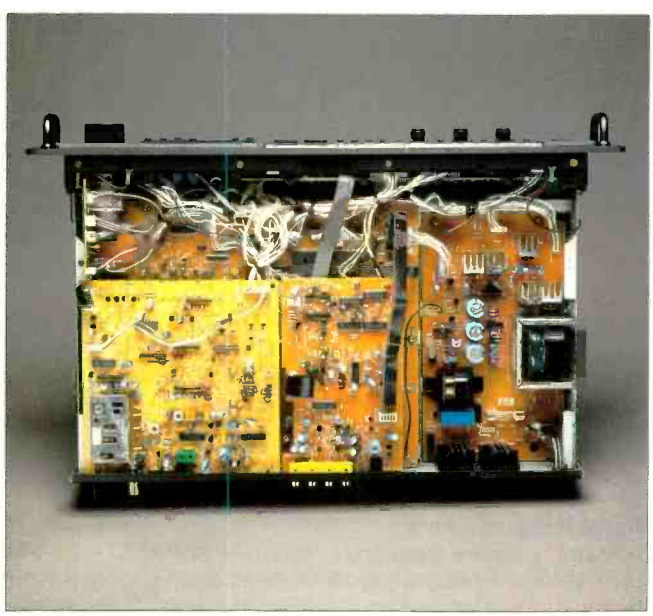
Photograph: Michael Groen

I've often wondered why more manufacturers don't offer tuner/preamplifiers. After all, there are no technical disadvantages to combining a tuner and a control preamplifier in a single chassis, and the arrangement still allows you to choose a power amplifier suited to your needs while reducing the number of basic components in your stereo system from three to two. Obviously, Bob Carver must have felt the same way, but in typical Carver fashion, he has incorporated much more than just a tuner and a preamplifier in this interesting unit. The CT-17 combines the functions of an audio/video preamplifier and an AM/FM tuner, all right, but it also includes a Dolby Pro-Logic surround sound decoder and Carver's well-known Sonic Holography—the circuitry that enlarges the perceived stereo image if you set up your speakers correctly and sit where you are supposed to sit.

For Sonic Holography or normal stereo operation, a two-channel amplifier is all that needs to be connected to the CT-17's main outputs. For the three surround modes (Dolby Pro-Logic, "Hall," and "Simulate"), you would ideally need five channels of amplification—the front and surround pairs, plus front center. However, as there is no difference between the right and left surround signals in Dolby Surround, you could use four channels in Dolby Pro-Logic mode if your surround-channel amp can handle the impedance of your two surround speakers in parallel.

The CT-17 has inputs for phono, CD, and AUX; it also has inputs and outputs for two audio tape decks and for an external processor such as an equalizer or a compressor/expander. In addition, it has audio and video inputs and outputs for a VCR, audio and video inputs for an additional video source, and a video output to feed these sources to a monitor screen.

Besides the attributes noted, the CT-17 is essentially two preamplifiers in one. In other words, you can simultaneously play two different music sources independently in two different areas of your home. Both can be controlled by the CT-17's supplied remote control or by using Carver's room-to-room system, which the company calls RemoteSystemLink.



The owner's manual is well written. It provides adequate descriptions of every feature and, more importantly, has clearly written step-by-step instructions for setting up the various surround sound modes and Sonic Holography. A tour of the controls on the front panel and the remote will clarify how some of the CT-17's features are used.

Control Layout

The power switch, a stereo headphone jack, and an indicator light that reads "ACCD" (when a corresponding pushbutton is pressed) are at the left end of the front panel. "ACCD" stands for Asymmetrical Charge Coupled Detector, a name that Bob Carver gave his special FM stereo circuitry. Next is a large display area that shows signal strength, tuned-to AM or FM frequency, station preset numbers, type of surround sound in use, volume level for rear or remote channels, and the status of several other functions. Below the display are 10 numbered preset buttons, a "Memory" button for storing presets, a "Preset Scan" button (used for 5-S auditions of each preset station frequency), an "Auto Scan" button (for seeking usable signals on the AM or FM radio band), a "Mono" button, and an up/down tuning bar. Although there are only 10 preset buttons, each can be used to store two AM or FM frequencies. Holding a button down for several seconds changes the preset from its normal single-digit value (e.g., 1, 2, 3) to an alternate double-digit value (11, 12, 13, etc.).

Below the station presets are rotary bass, midrange, and treble tone controls and buttons for selecting Sonic Holography, ACCD, and AM or FM. An up/down control bar for

The CT-17 is essentially two preamps in one, since you can play two program sources in two different areas of your home.

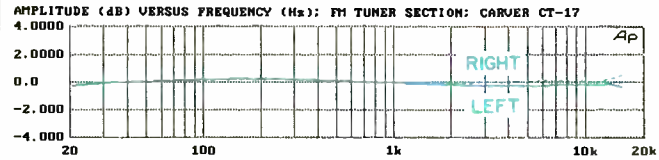


Fig. 1—FM frequency response.

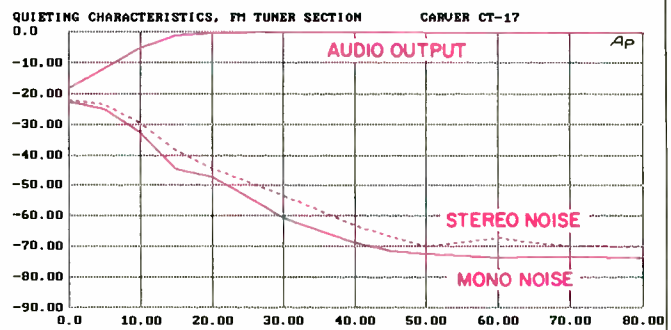


Fig. 2—FM quieting characteristics.

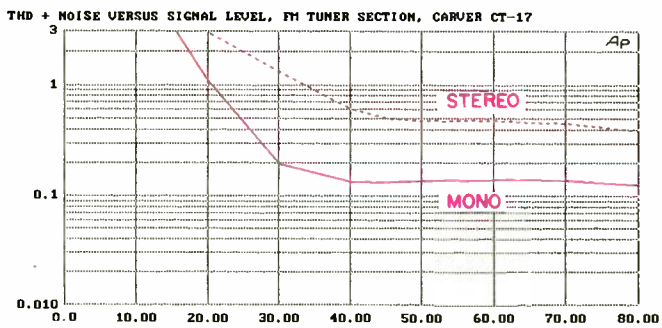


Fig. 3—FM THD + N versus signal level.

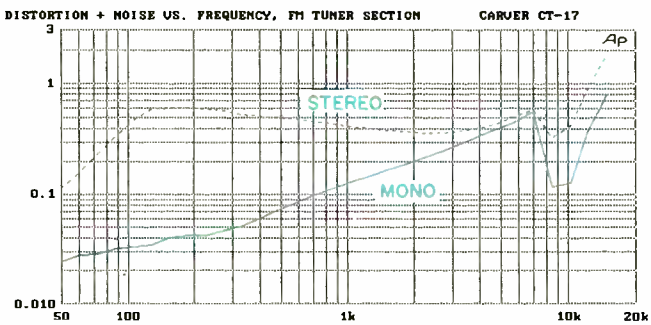


Fig. 4—FM THD + N versus frequency.

remote volume is also in this area. Two banks of program source selectors are at the right end of the panel, along with balance and volume controls and buttons for surround mode, tape monitoring, a high-cut filter, and loudness; a "Calibrate" button activates a test signal used in calibrating levels for Dolby Surround listening. The upper row of source buttons is used to select video 1, video 2, AUX, tuner, phono, CD, or "CD Direct." The latter bypasses the tone and loudness controls, and other special circuits, to obtain the shortest and most direct signal path between the CT-17's inputs and outputs. The lower band of pushbuttons offers the same selection but with the exception of "CD Direct." Normally this bank is used to feed the tape output jacks so that you can listen to one program source while recording another. When the last button in this row, "Engage," is pressed, the function of all other buttons in this bank changes. Now, the selected signal is routed to the "Remote Output" jacks on the rear panel. It is in this way that Carver allows you to hear one program in one part of your home and a different program in another part.

Before going further, a few words about ACCD might be in order. While the acronym and the words it stands for (Asymmetrical Charge Coupled Detector) have little to do with what this circuit actually does (Carver loves to use esoteric-sounding technical names for his inventions), the function of ACCD is clear. It provides a "stand-in" L – R stereo FM signal when the real L – R signal is so weak and noisy that stereo FM cannot normally be enjoyed. This surrogate L – R signal is created within the tuner itself, and while it may not truly represent the signal needed to create the correct stereo image being transmitted, it certainly provides a very good approximation. The result of this "disguise" is that weak-signal stereo can still be enjoyed and that it will sound like stereo—stereo minus the noise that would otherwise detract from its enjoyment. Actually, the explanation I've just given is a bit oversimplified. In reality, Carver provides a sort of "mix" between the real L – R signal and the internally generated one—the proportions of the mix being determined by just how weak the actual received stereo signal is.

The supplied remote control has 39 functions, including most of those on the front panel plus several others. These extra functions are surround volume up and down, center volume up and down, "Center Mode Dimension" (delay time), remote volume up and down, muting, and four transport controls that may be used with most Carver CD players.

The rear panel houses no fewer than 35 RCA-type input and output jacks (including jacks for video in and out and for video monitor output), a 75-ohm FM antenna terminal, a pair of terminals for connecting the supplied AM loop antenna, a turntable ground terminal, and four convenience a.c. outlets (two switched, two unswitched). There's also a terminal for connecting an external infrared remote sensor should you wish to have remote-control capability in another part of your home.

Tuner Measurements

Figure 1 shows frequency response of the CT-17's FM tuner section. Response at 15 kHz was down a mere 0.2 dB in the left channel and up 0.5 dB in the right. Surprisingly,

Frequency response of the FM tuner section was among the best that I've ever obtained.

Carver fails to provide a specification for tuner frequency response; despite this, the response was among the best I have ever measured.

Figure 2 shows FM quieting characteristics as a function of input signal strength. Mono S/N was 73 dB for strong signals; in stereo, S/N was 69 dB at 65 dBf input and increased just a bit further, to 70 dB, for still stronger signals. Fifty-dB quieting required 22 dBf of signal strength in mono (somewhat poorer than the 18.3 dB claimed) and about 25 dBf in stereo.

Figure 3 shows how THD + N varied with signal strength. At 65 dBf, the mono reading was 0.12%, just slightly below Carver's claim of 0.15% (which, I presume, applies to mono for modulating signals of 1 kHz). The result in stereo for an input signal of 65 dBf was 0.39% and decreased to 0.3% at stronger signal levels. This graph also serves to establish the usable sensitivity figure for the FM tuner section, which was 16 dBf in mono and 20 dBf in stereo.

Carver's specifications fail to comply with EIA/IEEE requirements in many respects, not the least of which is a failure to specify THD for stereo and for modulating frequencies other than 1 kHz. I plotted THD + N versus frequency in mono and stereo; results are shown in Fig. 4. Satisfied that there was good correlation between the figures at 1 kHz obtained in these plots and those obtained in Fig. 3, I noted that at 100 Hz distortion was a very low 0.033% in mono and in stereo was 0.4%, as it was at 1 kHz. Just above 100 Hz, however, stereo THD + N rose above 0.4%. At 6 kHz (the other frequency at which THD is supposed to be reported), I obtained readings of 0.45% in mono and 0.5% in stereo.

Figure 5 shows how separation varied with frequency for strong stereo signals. The solid curve represents output from the modulated channel, and the dashed curve shows separation relative to that output level. At 1 kHz, separation was a very high 57.5 dB. I should point out that my test equipment is only guaranteed to provide separation of 60 dB in the signals it generates, so this Carver FM stereo circuit came quite close to the limits of my measurement capability! The separation at 100 Hz was even slightly higher, 59 dB, and at 10 kHz remained well above average, with a reading of 44 dB.

Figure 6 is a spectrum analysis of the CT-17's left and right outputs for a stereo FM input signal whose left channel was fully modulated by a 5-kHz test tone. The spike at 5 kHz for the left channel establishes the reference (0-dB) level for the desired signal; all other spikes represent harmonic distortion components and other spurious signals, such as subcarrier products and their sidebands in the modulated channel. The level of these spurious signals in the unmodulated (right) channel was virtually identical, so this curve was lowered 20 dB for clarity. To read values for the top curve, one should therefore use the left-hand scale; values for the bottom curve should be read using the right-hand scale. In both channels, residual 19-kHz pilot signal was down some 60 dB, and although the sidebands of the suppressed 38-kHz subcarrier are visible at 33 and 43 kHz, the 38-kHz subcarrier component is almost buried in the noise floor of the display. While the overlap of the two curves at 5 kHz conceals the 5-kHz level in the unmodulated channel, it was about 50 dB down.

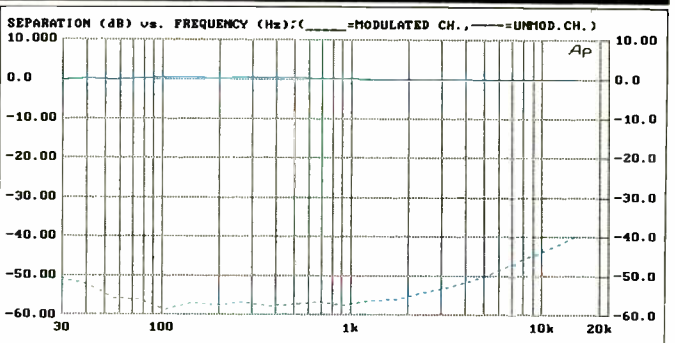


Fig. 5—FM frequency response (top curve) and separation.

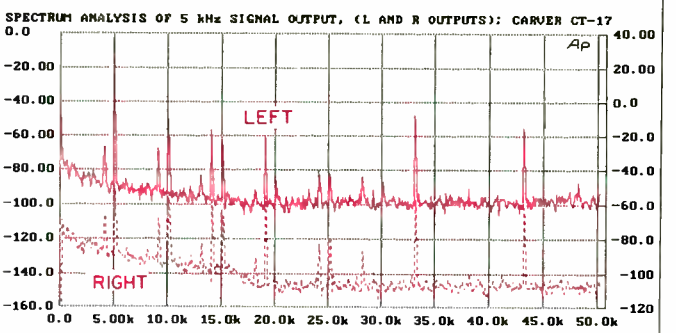


Fig. 6—Spectrum analysis of FM section while a fully modulated, 5-kHz signal was applied to the left channel only. The right-channel curve has been displaced for clarity and should be read against the right-hand scale.

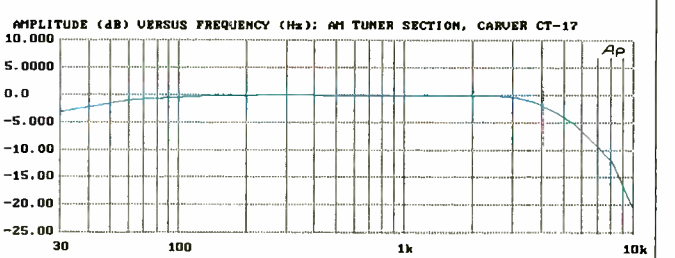


Fig. 7—AM frequency response.

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David Clark
***Audio* Magazine, Sept. '89**

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The absence of treble boost in the loudness circuit shows Carver understands what's required for proper listening at low levels.

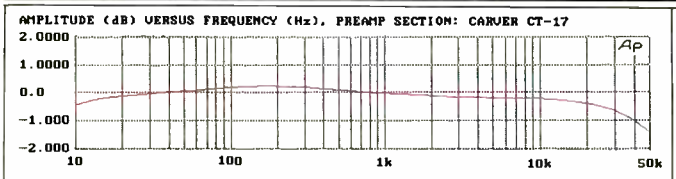

Fig. 8—Preamplifier frequency response.

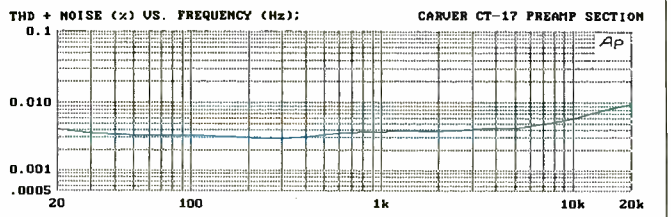

Fig. 9—Preamplifier THD + N versus frequency, at 3 V rms output.

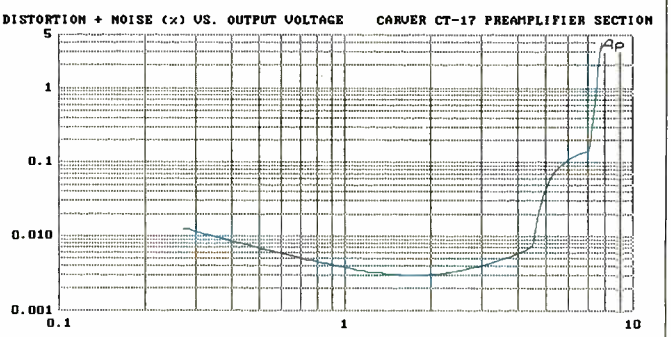

Fig. 10—Preamplifier THD + N versus output voltage for a 1-kHz test signal.

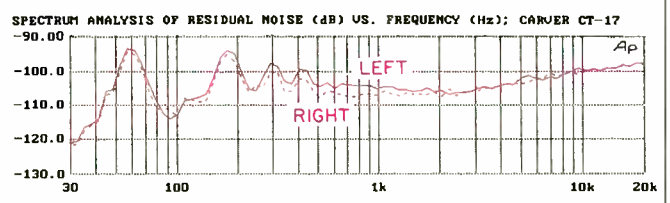

Fig. 11—Spectrum analysis of preamplifier's residual noise, referenced to an output level of 500 mV.

I.f. rejection for the FM tuner section was 85 dB, and alternate-channel selectivity was 73 dB. Capture ratio was 2.5 dB, AM suppression was a very satisfactory 60 dB, and image and spurious rejection were both in excess of 90 dB.

Figure 7 is a plot of AM frequency response. Although it did not extend out to 7.5 kHz, as recommended in the National Radio Systems Committee (NRSC) voluntary standard, response was better than average. It extended to nearly 6.0 kHz for the −6 dB cutoff point, more than a full octave better than most AM tuner sections that I've tested.

Preamplifier Measurements

With a sweep signal applied to one of the CT-17's high-level inputs, I measured frequency response of the preamplifier circuitry. Results are shown in Fig. 8. Referenced to 0 dB at 1 kHz, response was within ±0.2 dB from 20 Hz to 20 kHz and was −1.0 dB at 40 kHz.

Maintaining an input regulated to produce a constant 3 V output from the preamplifier, I measured THD + N versus frequency (Fig. 9). At 1 kHz, the reading was 0.004%, well below the 0.015% specified by Carver. In fact, the specified noise level was approached only at the extreme high end of the audible spectrum, 20 kHz, where harmonic distortion is irrelevant. Figure 10 is a plot of THD + N versus output level, using a 1-kHz test signal. Carver lists the *rated* output of the preamplifier as 6.0 V, but I presume they mean this is the *maximum* output voltage since at that level, distortion was just over 0.1% and rose rapidly above 7.0 V.

Signal-to-noise ratio for the high-level inputs was 90.2 dB for the left channel and 91.2 dB for the right. Here, Carver chose to specify S/N in an unorthodox manner, referencing the S/N value to an output of 1.0 V. The standard method of measurement uses a reference input of 0.5 V, with the master volume control turned down to produce an output of 0.5 V, or unity gain in the case of a preamplifier. A reading of 90 dB or better using this standard method is superb for any preamplifier, so I wonder why the manufacturer used a higher reference level so as to be able to claim S/N of 95 dB. Figure 11 is a spectrum analysis of the residual noise at various frequencies. As you can see, the only significant noise peaks were those associated with the power-line frequency of 60 Hz and its harmonics. Even the worst of these was down more than 90 dB with respect to 0.5 V output.

For phono S/N, Carver also strayed from the standard measurement method. Here, the company referenced the reading to 1.0 V output instead of 0.5 V. Although this method yielded a published specification of 80 dB, the correct method resulted in S/N readings of 82.4 dB for the left channel and 81.8 dB for the right. Again, these are superb figures for an MM phono input, and I can't imagine why Carver resorted to their own reference levels.

Figure 12 shows loudness compensation characteristics of the preamplifier with volume-control settings ranging from maximum to −40 dB, in 10-dB increments. Happily, Bob Carver and his engineers understand the requirements of proper loudness compensation for low-level listening and have refrained from incorporating treble boost in their loudness circuitry. Figure 13 shows the maximum boost and cut range of the bass, midrange, and treble controls. Action of

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Tenth Anniversary Amplifier

Ten years ago, Adcom produced its first stereo amplifier. Between those early days and now, more and more audiophiles have come to recognize Adcom's leadership in providing both high performance and exceptional value. And the critics have agreed, consistently rating Adcom components superior to those units costing two and three times as much.

To commemorate these ten years of achievement, Adcom will produce a limited number of its new model GFA-585, a 250 watt-per-channel* stereo power amplifier. Designed for a select number of music lovers, this innovative component contains the accumulated benefits of Adcom's advanced technology which has evolved over the past decade. Its price-to-performance ratio is so remarkable, it can only be offered on a limited production basis. A potential "collectible" for those with an eye to the future.

Think Of It As Two GFA-565s On One Chassis

Recently, Adcom set new objectives for

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amplifier performance with the introduction of the GFA-565 300 watt-per-channel* mono amplifier. Designed without compromise for the perfectionist, the GFA-565 quickly became a reference standard by which other amplifiers are judged. The new GFA-585 is basically a stereo version of the phenomenal GFA-565, with a few mechanical differences, yet incorporating all of the critical circuits designed for the GFA-565. The GFA-585 is the right product for those who want even more power than the benchmark GFA-555 II, but don't have the space for a pair of GFA-565s... the GFA-585 will deliver 250 watts per channel* into 8 ohms at any frequency between 20 Hz and 20 kHz at less than 0.02% THD. At 4 ohms, it will deliver a formidable 400 watts per channel.*

(over, please)

** Measured in accordance with FTC requirements.*

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The Adcom Advantage of High-Current Output Stages

Many of today's high performance loudspeakers present particularly difficult loads to an amplifier's output stage. In order to take full advantage of these loudspeakers as well as the breakthroughs in software technology (CDs, DAT, etc.) an amplifier must be capable of delivering large amounts of undistorted power continuously into these complex loads.

The GFA-585 features two massive output stages, each capable of delivering extremely high current into low-impedance reactive loads. No protection circuitry or current limiting devices are used which could restrict the delivery of full power. Instead, protection against short-term overloads, short circuits or long-term, excessive output is achieved by using noninterfering power supply fuses and thermal circuit breakers.

The Adcom Advantage of a Well-Regulated, High-Current Power Supply

In order for an amplifier's output stage to deliver its full potential of undistorted output, it must be provided with virtually unlimited, electrically pure power. This power must be available instantaneously and, of course, continuously, not just for milliseconds.

The massive power supply of the GFA-585 has an extraordinary ability to deliver enormous amounts of power. Featuring 72,000 microfarads of filter capacitance and a huge 1.25 kVA potted transformer, this no-compromise power supply eliminates all the audible limitations of lesser supplies. Hum, vibration and noise have been reduced to an unnoticeable minimum.

The Adcom Advantage of Value

The GFA-585 is Adcom's contribution to the "state-of-the-art" in high-performance audio. Its capabilities are virtually unlimited. You should not hesitate to compare it to the world's best and most expensive amplifiers on a pure performance basis. Then compare value. You'll soon hear why Adcom's family of components have gained a reputation for offering more sound for less money.

If you are among those who want the best sound possible, and recognize exceptional value, ask to hear this remarkable, limited-edition stereo amplifier at your authorized Adcom dealer. But do not delay. There's a definite limit to the number which will be made.

Specifications

Power Rating: (To FTC Requirements)
250 watts continuous average power into 8 ohms at any frequency between 20 Hz and 20 kHz with both channels driven at less than 0.02% THD.
400 watts continuous average power into 4 ohms at any frequency between 20 Hz and 20 kHz with both channels driven at less than 0.02% THD.*

IM Distortion (SMPTE):
1 watt to 250 watts into 8 ohms: < 0.005%
1 watt to 400 watts into 4 ohms: < 0.005%

THD + Noise at 250 watts into 8 ohms:
20Hz: 0.002%; 1kHz: 0.002%; 10 kHz: 0.004%; 20 kHz: 0.010%

Frequency Response @ 1 watt 8 ohms:
10 Hz to 20 kHz: +0, -0.3 dB

Power Bandwidth (-3 dB): 0.7 Hz to 80 kHz

Dynamic Headroom into 4 ohms : 2.1 dB

Signal-to-Noise Ratio, "A" Weighted:
250 watts into 8 ohms: >110 dB

Gain: 27 dB

Input Impedance : 50,000 ohms

Input Sensitivity: 250 watts into 8 ohms: 2V rms
1 watt into 8 ohms: 130 mV rms

Damping Factor: 20Hz to 20 kHz: >600

Rise Time: 5 kHz, 120 V peak-to-peak square wave, 20% to 80%: 2.9 us

Semiconductor Complement: 72 transistors, 11 zener diodes, 31 diodes, 2 ICs, 2 diode bridges

Power Consumption (Continuous, Both Channels Driven): Quiescent: 90 VA
Maximum: 1800 VA
250 watts into 8 ohms: 750 VA;
400 watts into 4 ohms: 1300 VA

** With fan option installed.*

Optional Accessories

RM-8 Rack-mount adaptor
Fan Option: Continuously variable cooling fan
Balanced Line Output

General

Power: 120 VAC / 50-60 Hz (available in 220 V or 240 V on special order)
Chassis Dimensions:
8" (203mm) x 17" (432mm) x 12 3/16" (310mm)
Maximum Dimensions: 8 3/8" (213mm) x 17" (432mm) x 12 3/16" (310mm)
Weight: 45 lbs. (20.5 kg)
Weight, Packed: 49 lbs. (22.5 kg)

The Adcom GFP-565 Direct Gain Preamplifier is the perfect companion to the GFA-585 Power Amplifier. You may also wish to consider the GTP-500 II Preamp/Tuner, the GFP-555 II Preamp or the GFB-800 Music Control Center for use with the GFA-585.

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The preamp section does what's expected of a good preamplifier: It provides signal control without signal degradation.

all three tone controls conformed very closely to the published specifications.

Sensitivity for the high-level inputs was 75 mV for 0.5 V output; for the phono inputs, 1.05 mV of input signal at 1 kHz was required to produce that same output level. Figure 14 shows how the phono equalization circuitry handled RIAA playback. The plot shows deviation from the RIAA curve versus frequency. Equalization was virtually perfect from 1 kHz upward, but it was off by an almost constant +1.0 dB from 200 Hz downward.

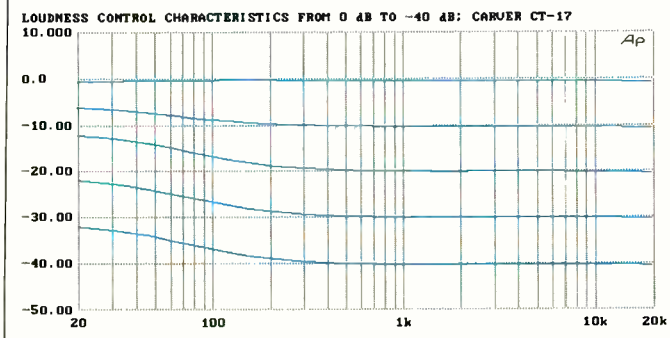


Fig. 12—Loudness control characteristics.

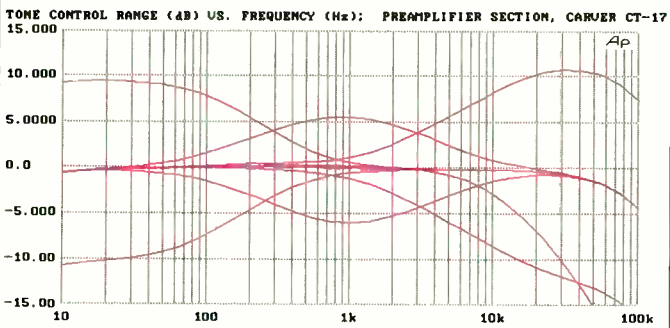


Fig. 13—Range of bass, midrange, and treble controls and action of high-cut filter.

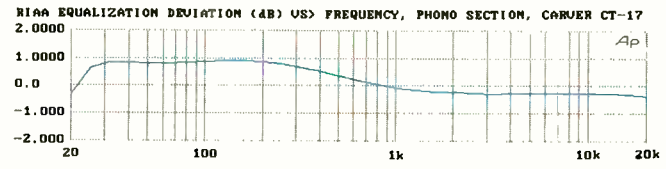


Fig. 14—Preamplifier's deviation from RIAA phono equalization.

Use and Listening Tests

Some years ago, I tested one of the first Carver tuners to employ his ACCD circuitry. The circuit behaves in much the same way in this latest version. Without ACCD activated, I was able to pick up 48 FM signals using my outdoor antenna. Some 44 of these were received as stereo signals, but of these, six were so noisy that I normally would have had to listen to them in mono. Using ACCD, four of the six became quiet enough to enjoy in stereo. Now, when I say these signals became usable "in stereo," I recognize that's a bit of a misstatement; the L − R component in this case is a combination of the true L − R and a simulated L − R created by the ACCD circuitry. Still, it *sounds* like good stereo and imaging, and I'd rather listen to this signal manipulation than to an intolerable level of noise and static.

My judgment of Sonic Holography remains the same as it's always been: The system works well so long as you remain at or very close to the so-called "sweet spot." You may also find, as I did, that some repositioning of your speakers is necessary to take full advantage of this feature.

For my listening tests, I played a couple of new CDs released by Telarc. The first (CD-80219) contains a couple of Mozart piano concertos (including the familiar No. 21 in C major, from which the *Elvira Madigan* theme music was taken). I must say that the Carver CT-17, hooked up to the rest of my reference system, introduced no noticeable coloration. This, after all, is what is expected of a good preamplifier—signal control without signal degradation.

The Cincinnati Pops, under the direction of Erich Kunzel (CD-80223), provided my other listening fare. In this unusual disc, Doc Severinsen, the trumpeter and band leader of *The Tonight Show*, demonstrates that his musical talents extend to the classical, as he plays various arias in which the sound of his trumpet replaces vocals. I've found that a trumpet, played properly, can serve as an excellent program source in evaluating audio components for absence (or presence) of many forms of IM distortion. Happily, the Carver CT-17 exhibited none of these, and the music came through sounding much the same as it did when my reference CD player was hooked directly to my reference power amplifier. Perhaps even more interesting, a few other listeners and I could detect no difference in sound quality (other than a very tiny shift in level) when I switched from "CD" to "CD Direct." Although I did not take the time to hook up separate listening zones to take advantage of the CT-17's ability to provide different program material to two different locations, I evaluated this feature on the test bench; it worked exactly as claimed. I did check out the Dolby Pro-Logic circuitry, however, and it worked perfectly.

A final word is in order concerning the owner's manual. It is written in the friendly and easy-to-understand manner that is so typical of Bob Carver's style. Each section of the manual is complete unto itself and offers step-by-step instructions that are easy to follow. There's a message from Carver himself, near the front of the book (along with a photo of this audio *enfant terrible* hovering over an open chassis full of electronics). Here, he describes the CT-17 as a "high quality 'straight wire' preamplifier with extremely low distortion and noise." I couldn't have summarized its attributes better myself.

Leonard Feldman

2

DYNAUDIO SPECIAL ONE SPEAKER

Manufacturer's Specifications

System Type: Two-way, aperiodic-damped vented box.

Drivers: 7-in. (177-mm) cone woofer with 3-in. (75-mm) voice-coil and 1.1-in. (28-mm) soft-dome tweeter.

Frequency Range: Not stated; 47 Hz to 20 kHz, ±3 dB, measured.

Sensitivity: Not stated; 81 dB SPL measured at 1 meter for 2.83 V rms, averaged over range from 250 Hz to 4 kHz.

Crossover Frequency: Not stated; 2.5 kHz measured.

Impedance: 4 ohms nominal.

Recommended Minimum Amplifier Power: 50 watts per channel.

Dimensions: 15¾ in. H × 8⅝ in. W × 11 in. D (40 cm × 22 cm × 28 cm).

Weight: 21 lbs. (9.6 kg) per system.

Price: $2,500 per pair; optional stands, $385 per pair.

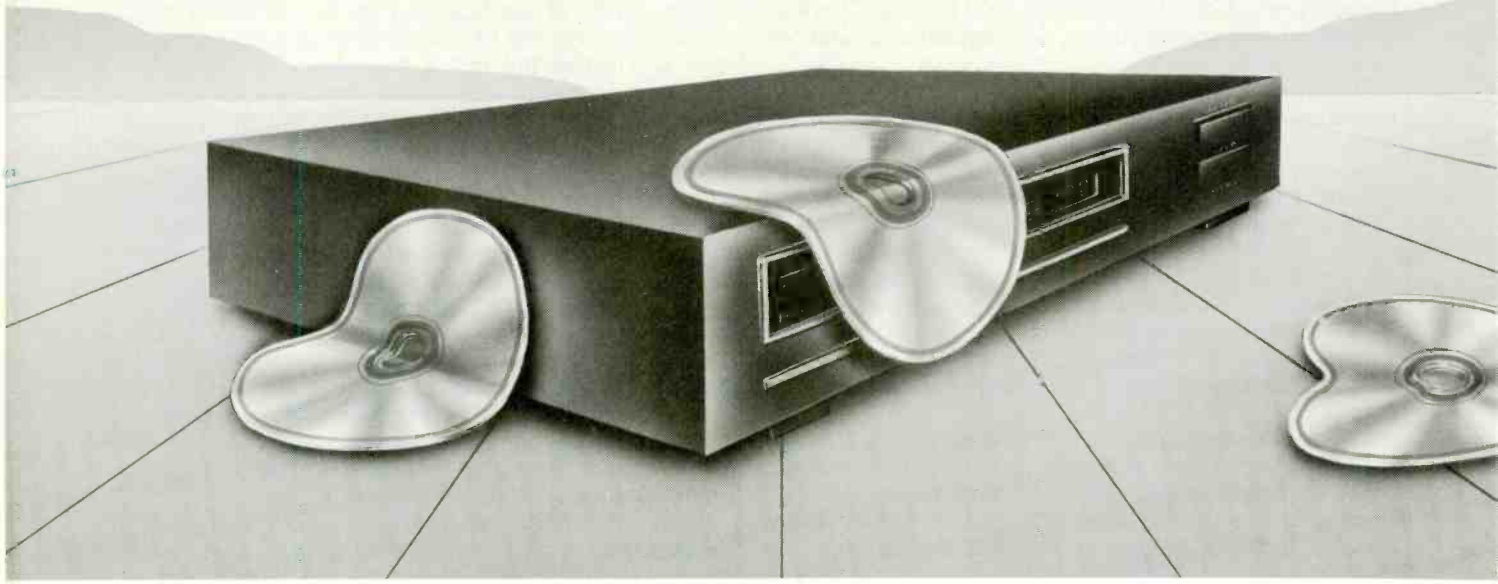
Company Address: P.O. Box 13686, Research Triangle Park, N.C. 27709.

For literature, circle No. 91

The Dynaudio Special One is a premium-priced, compact two-way system aimed solidly at the high-end audiophile market. The system is a two-way direct-radiator design composed of a rather exotic-looking woofer, about 7 inches in diameter, and a 1-inch Ferrofluid-damped soft-dome tweeter. The box is "aperiodically" damped by the use of a plastic-framed, resistive Variovent, 4 inches in diameter, mounted at the top rear of the cabinet. The Variovent is an opening which contains damping material that acts as flow resistance to the air passing into and out of the cabinet.

Dynaudio is a European manufacturer, based in both Denmark and West Germany. It is best known in the U.S. for its rather extensive line of high-quality loudspeaker components and kits, and as an OEM source for manufacturers. (Companies such as Madisound Speaker Components of Madison, Wisc. have sourced Dynaudio for nearly 10 years.) Dynaudio's literature reminds me of the glory days of hi-fi in the '50s and '60s, when building systems from components and kits was very popular. In those days, companies such as Electro-Voice, University, JBL, and Jensen had extensive lines aimed at the do-it-yourself market. If you're into home speaker building, get some of Dynaudio's literature and plans—they're great! If you thought there might be a connection between Dynaudio and the old Dynaco, you're right. In the early '70s, Dynaudio's managing director and founder, Gerhard Richter, helped the Dynaco A-25 speaker become one of the most popular and best-selling systems in the European market.

Without WADIA, Chances Are Your CD's Sound Like This



Time-distorted harmonics are inevitable in CD playback which uses conventional digital-to-analog conversion.

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All WADIA D-to-A Converters* incorporate the patent-pending TIME-BASED Bio Digital™ Algorithm and DigiMaster™ software. The result is CD listening without harshness or time-smeared harmonics.

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The WADIA DigiMaster X-32 provides mainframe computing power with 32x resampling for superior transient and impulse performance. The flagship WADIA 2000 and the new WADIA DigiMaster X-64.4 use 18-bit BOSS DACs and resample at 64x to set new standards in D-to-A conversion accuracy.

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Test the musical realism of a WADIA TIME-BASED Converter at your audio dealer today. To get the cleanest signal, you'll want to listen with a new WADIA CD Transport featuring exclusive Glass Fiber Optic modem and interconnect.

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The Special One's handsome cabinet comes in matched rosewood-veneered pairs, finished on all sides, but, curiously, with no grilles.

Dynaudio has been big in the systems market in Europe for 12 years but has only sold systems in the U.S. since earlier this year. Their U.S. lineup consists of 14 systems, extending from the Contour I MkII at $1,800 per pair up to the very pricey Consequence at $21,000 per pair. These are all serious high-end products, with appearance and features to match.

The Special One's handsome cabinet comes in matched rosewood-veneered pairs, finished on all six sides, but curiously is not supplied with a grille. (It looks great without it, however.) Both the appearance and the fit and finish of the system and components are superb. The systems were supplied to me with optional wooden stands that raise the cabinet about 19 inches (0.48 m) off the floor, which places the tweeter about 31 inches (0.79 m) high. The stands are angled so that the system axis is aimed upwards at about 2.7°, effectively orienting the tweeter axis toward the ears of a seated listener 10 feet (3 m) away. No spikes were supplied for the bottom of the stands for placement on carpet.

In addition to a standard set of gold-plated, five-way, double-banana jacks on the rear panel for input connections, the system has an additional input connector, about ½ inch (12.7 mm) in diameter, that is similar to a coaxial r.f. panel connector. This jack conforms to the Optional Connection System (OCOS) of precision loudspeaker cables and connectors, which is marketed by Dynaudio in Europe and by Sumiko in the U.S. The OCOS design closely matches the cable's characteristic impedance to the loudspeaker impedance, and this, it is claimed, improves sonics by minimizing the effect of the cable on the transmission of energy from amplifier to loudspeaker. Unfortunately, I was not supplied a set of OCOS cables and therefore was not able to evaluate the connection system's performance.

A design feature of the Special One that does improve its performance, with any kind of cable, is Dynaudio's use of impedance-correcting circuits to minimize the speaker system's impedance variation with frequency. This makes the system's impedance essentially resistive above 100 Hz. With impedance correction, the system is much less susceptible to the effects of series cable resistance, which causes the voltage drive to an uncompensated system to vary with frequency. Theoretically, for a perfectly compensated speaker system, cable resistance will not cause any irregularities in frequency response but will only produce a drop in level.

The crossover of the Special One is noteworthy in that it contains 21 parts (three inductors, eight capacitors, and 10 resistors), most of which are dedicated to driver equalization and impedance correction. Dynaudio's crossover philosophy stresses first-order, 6-dB/octave designs with a single coil and capacitor in the signal path. Only film capacitors are used; the inductors are all air-core, and two of them use several conductors, with different diameters, in parallel. This was done to improve the inductors' high-frequency operation and to decrease skin effect, which "is an important contributor to the fidelity of the system," according to the Special One's brochure. All internal connections are made with large-diameter multi-strand audiophile cable. Although the crossover mounting board appears to be a printed circuit, it is not. The board is just a mounting surface for the components and allows all the parts to connect on the rear of the board by direct soldered connection of each of their leads.

The woofer of the Special One (a modified version of Dynaudio's 17W-75) has an effective radiating diameter of only 4.9 inches but has a huge voice-coil, 3 inches in diameter. Dynaudio claims that this large voice-coil provides a "balanced force transmission" and an ideal transfer of acceleration force from the coil to the cone, and that it contributes to the woofer's fast transient response. The large coil does provide a real increase in thermal power-handling capacity. It also allows the ceramic magnet to actually fit inside the coil, thus creating an efficient magnet structure that is completely self-enclosed. The rear of the woofer appears very similar to that of the old Alnico speakers whose magnets were enclosed in iron pot structures. This structure also has very low external stray magnetic fields, which would make it ideal as a speaker to be used with video systems. The woofer does not have a conventional cone and dust cap but has a shallow, one-piece, inverted diaphragm of hemispherical shape composed of "magnesium silicate loaded polypropylene."

High frequencies are handled by a Dynaudio D-28 AF tweeter (it's nice to have complete specification sheets on the individual drivers of a system!), a soft-dome unit with a 28-mm diaphragm. The dome is made of a treated fabric that Dynaudio claims is free from the high-frequency breakup problems associated with metal or hard plastic domes. The tweeter's voice-coil uses hexagonal wire to maximize the amount of conductor in the magnet's air gap. It is then cooled and damped by Magnaflex, Dynaudio's own version of Ferrofluid.

Measurements

The equipment I used in evaluating the Special One's performance consisted of a Techron TEF System 12 Plus Time-Delay Spectrometry (TDS) analyzer, a B & K 4007 condenser microphone, a Crown Macro-Tech M2400 power amplifier, and various Leader general-purpose test instruments. Tests were performed at a number of locations, including my own listening room and lab and outdoors on my driveway, using elevated free-field, near-field, and ground-plane measurement techniques.

The test of system on-axis frequency response was performed at a distance of 2 meters, normal to the front baffle, on an axis halfway between the tweeter and the low-frequency driver. The input level was 2.83 V rms, which is equal to a level of 2 watts into the system's nominal 4-ohm impedance. The on-axis response was corrected to the standard distance of 1 meter for display of the data, and a tenth-octave filter was used to smooth the response.

The 1-meter, on-axis frequency response of the Special One for an input of 2.83 V rms is shown in Fig. 1. The curve, of course, was taken without a grille because none is supplied. The main feature of the curve is its low level, about 81 dB SPL (averaged over the range from 250 Hz to 4 kHz). If 2 V rms had been used instead, corresponding to 1 watt into the rated impedance of 4 ohms, the sensitivity would have been an even lower 78 dB SPL. The response exhibits a

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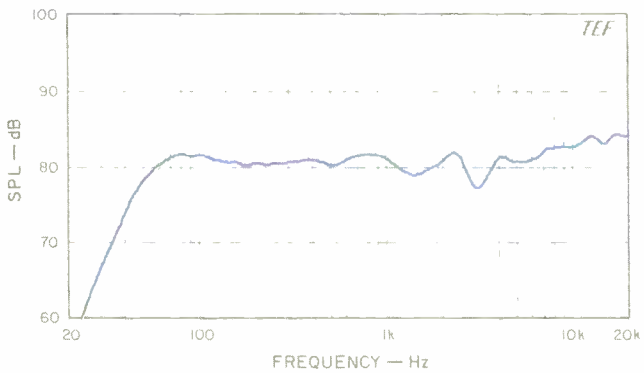

Fig. 1–On-axis frequency response. The system exhibits a significantly low sensitivity of about 81 dB SPL for 2.83 V rms applied.

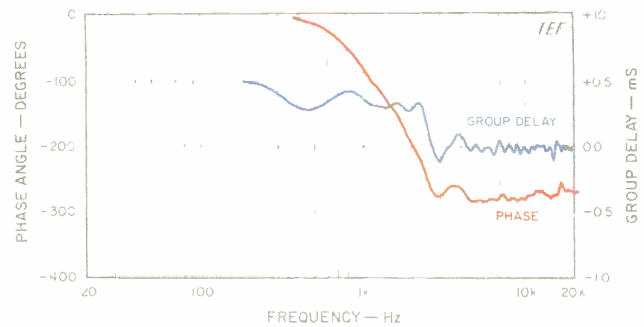

Fig. 2–On-axis phase response and group delay, corrected for tweeter arrival time.

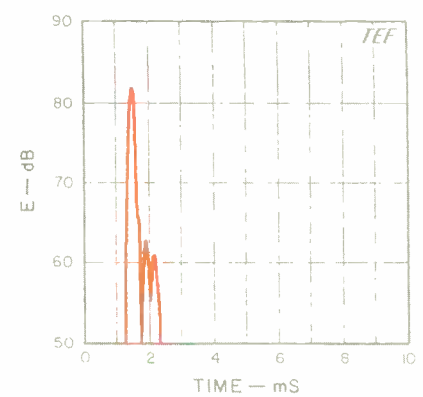

Fig. 3–One-meter on-axis energy/time curve.

deviation of approximately ±3 dB from 47 Hz to 20 kHz; its major feature is a 5-dB peak-dip combination in the crossover range of 2 to 4 kHz. If the crossover anomaly is excluded, the response is even tighter: ±2 dB from 55 Hz to 10 kHz.

A separate test, comparing the axial response of both right and left speakers in the range from 200 Hz to 20 kHz (not shown), yielded a moderately good match of about ±1.5 dB. The level differences were primarily due to one unit's woofer being lower in sensitivity than the other's.

Figure 2 shows the on-axis phase and group-delay responses of the system, corrected for the time arrival of the tweeter. The phase response exhibits a fairly small amount of phase rotation, about 180° between 1 and 20 kHz. The group delay indicates that the woofer trails the tweeter by a significant 0.50 mS (500 μS), which corresponds to a distance of about 6¾ inches (171 mm). This time offset represents approximately 1.25 wavelengths, or 450°, at the crossover frequency of 2.5 kHz. Some of this measured offset is due in part to phase aberrations, minimum-phase in character, which would go away if the system's amplitude were flatter in the crossover region. As Richard Heyser pointed out in his writings, use of the term "group delay" is technically correct only when applied to systems whose amplitude response is essentially unchanging with frequency (R. C. Heyser, "Loudspeaker Phase Characteristics and Time Delay Distortion, Part 2," *Journal of the Audio Engineering Society*, April 1969).

The crossover frequency and its phase relationships were determined by reversing the woofer leads and then noting the changes in the axial frequency response (curve not shown). If the woofer and tweeter are essentially in phase throughout the crossover range (which minimizes lobing error), the response with the connections reversed will exhibit a deep null at crossover. With the connections reversed, a dip of about 15 dB was noted at 2.5 kHz, which indicates that the crossover is at or near this frequency. However, below crossover, between 800 Hz and 1.8 kHz, the response actually rose by about 2 to 3 dB under these conditions, indicating that the woofer and tweeter are somewhat out of phase in this region when connected normally. This corresponds to the shallow depression in the axial response between 1 and 2 kHz.

I further scrutinized the Special One's crossover by measuring each driver's input voltages and acoustical response while both drivers were connected to the network. The electrical measurements (not shown) indicated that the crossover was essentially a first-order, 6-dB/octave design, but the acoustic measurements revealed that the result was not a pure first-order response. (This is good, as a first-order acoustic response also has a maximum amount of lobing error because the phase of the drivers differs by 90° at crossover.) The tweeter rolled off at 6 dB/octave through most of the crossover region but ultimately rolled off at 12 dB/octave below 1.5 kHz. The woofer, however, was fairly flat up to crossover, where it rolled off at the high rate of about 60 dB/octave above 2.5 kHz: Its response dropped 30 dB between 2.5 and 3.5 kHz!

The measured acoustic phase response of the individual drivers' output (driven by the crossover) established that

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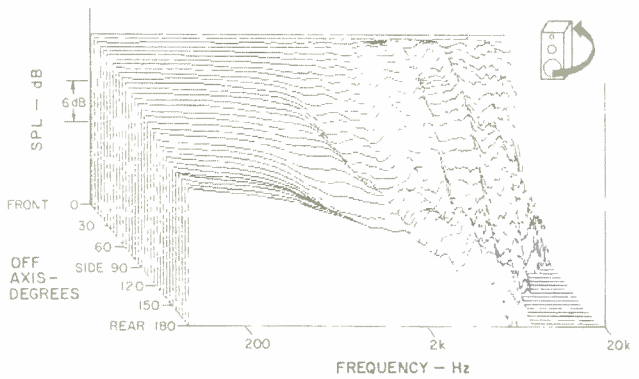

Fig. 4–Horizontal off-axis frequency response, taken from the front, around the side, and to the rear of the speaker and normalized to the on-axis response; see text.

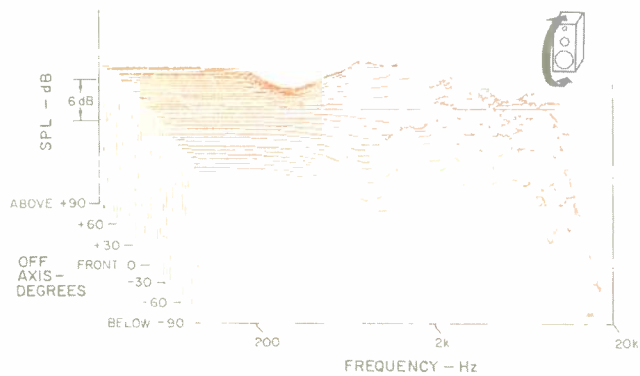

Fig. 5–Vertical off-axis frequency response, taken from below, up the front, and to the top of the speaker and normalized to the on-axis response.

both drivers were effectively in phase at crossover and above but rapidly went out of phase below crossover. This out-of-phase condition was the primary cause of the lobing error below crossover noted previously.

A high-level, low-frequency, sine-wave sweep revealed that the woofer's maximum linear excursion capability was about ±0.12 inch (0.25 inch peak to peak). The driver was quite capable of being driven to much higher excursion amplitudes, up to about 0.75 inch peak to peak, but with correspondingly higher distortion. Moderate dynamic offset was noted at frequencies between 80 and 140 Hz at levels of 8 V rms and higher.

The woofer had an effective radiating diameter of about 4.9 inches (125 mm). The box was quite well sealed except for its air-resistance port. The enclosure side walls were quite rigid and exhibited no wall vibrations.

The effect of the air-resistance vent was evaluated by making near-field response measurements and by running a high-level sine-wave sweep to check the effect of the vent on the displacement of the woofer. Near-field measurements were made on the woofer with the vent open and closed. This disclosed that the vent reduced the woofer's output by an average of about 1.5 dB over an octave centered at 60 Hz. A near-field measurement of the vent revealed that it had a bandpass response characteristic which peaked at 60 Hz at a level about 15 dB below the woofer's output and then rolled off at about 6 dB/octave above and below 60 Hz. The high-level sine-wave sweep revealed that the vent reduced the cone's displacement by a maximum of about 20% at 60 Hz.

These measurements are consistent with conventional vented-box operation: The woofer's displacement and output are reduced at box resonance while, at the same time, maximum sound energy is radiated from the vent. The major difference here is that the vent contains damping material which acts as a resistance to the flow of air. The high amount of damping changes the vented-box response into a quasi-closed-box response. The overall response, rather than rolling off at 24 dB/octave below cutoff like that of a standard vented box, rolls off initially at 12 dB/octave like a closed-box system and then at 18 dB/octave far down below cutoff. The vent's output also rolls off initially at 6 dB/octave on either side of box resonance rather than the vented box's 12 dB/octave.

Damping the vent gives a vented-box system many of the advantages of a closed box. For one thing, the system's rolloff becomes more gradual below cutoff, affording better transient response and superior subsonic control of cone displacement. Above cutoff, however, the system retains some of the vented box's displacement and distortion-reduction capabilities. A full vented-box alignment for this woofer would allow much more displacement and distortion reduction at and near box resonance but would yield much poorer subsonic control of cone displacement and poorer transient response at cutoff.

The on-axis, 1-meter energy/time response (ETC) for an input of 2.83 V rms is shown in Fig. 3. The test signal is swept over the range from 200 Hz to 10 kHz and primarily emphasizes the tweeter's response. The response is quite well behaved, with only two later arrivals some 20 dB down.

Figures 4 and 5 show, respectively, the "3-D" horizontal and vertical off-axis frequency response of the Special One. These curves were derived from measurements made at increments of approximately 5° along the major horizontal and vertical planes of the system. No additional smoothing was done on these curves except for the constant-bandwidth smoothing that results from the TDS measurement process. These graphs are normalized and have logarithmic frequency scales. The normalization clearly shows the differences between the on- and off-axis curves, because

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The horizontal responses are smooth, indicating that the systems should maintain good stable stereo images over a broad listening area.

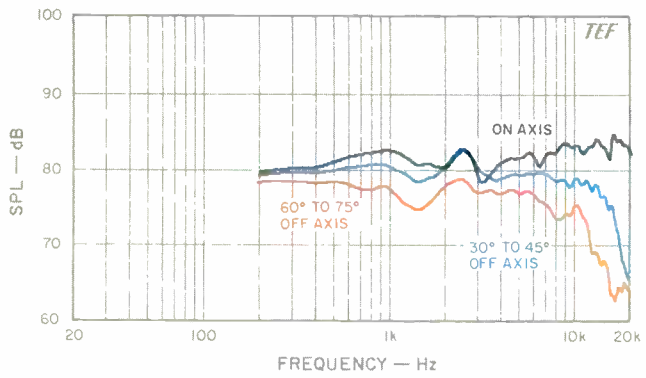


Fig. 6–Mean horizontal responses derived from data of Fig. 4; see text.

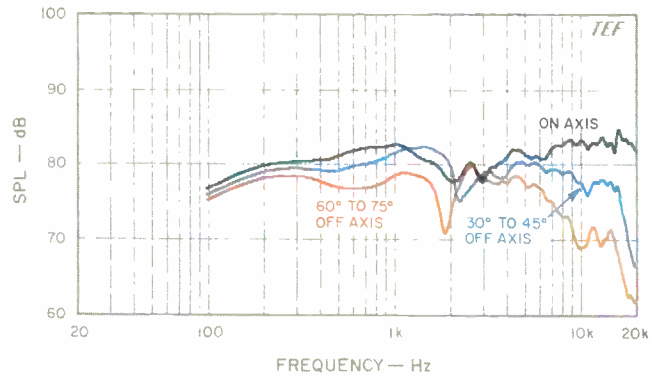


Fig. 7–Mean vertical responses derived from data of Fig. 5.

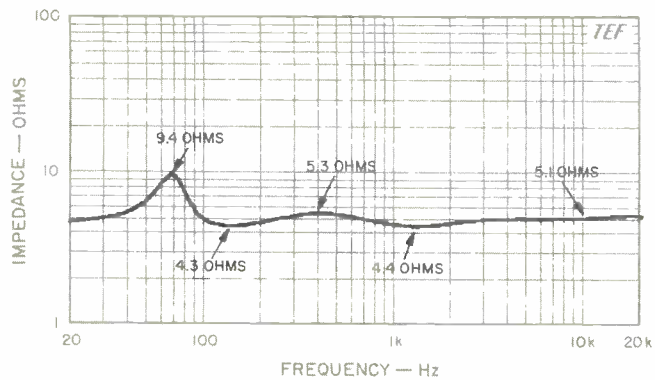


Fig. 8–Magnitude of impedance; note the logarithmic vertical scale.

the on-axis curve is a straight line and the off-axis curves only show the deviation from it.

The curves in Fig. 4 indicate fairly good behavior off the horizontal axis, with high-frequency coverage out to 40° off axis up to about 17 kHz. The vertical off-axis curves in Fig. 5 are also fairly well behaved but exhibit some asymmetries just below crossover, between 800 Hz and 25 kHz. Fortunately, the resulting lobing error makes the response smoother for upward rather than downward angles, thus improving the response for standing listeners. Note that the down-angle responses are at the front of this graph.

The mean horizontal and vertical on- and off-axis response curves of the system are shown in Figs. 6 and 7. These responses were derived from the previous data by calculating response averages of several adjacent curves in specific angular regions.

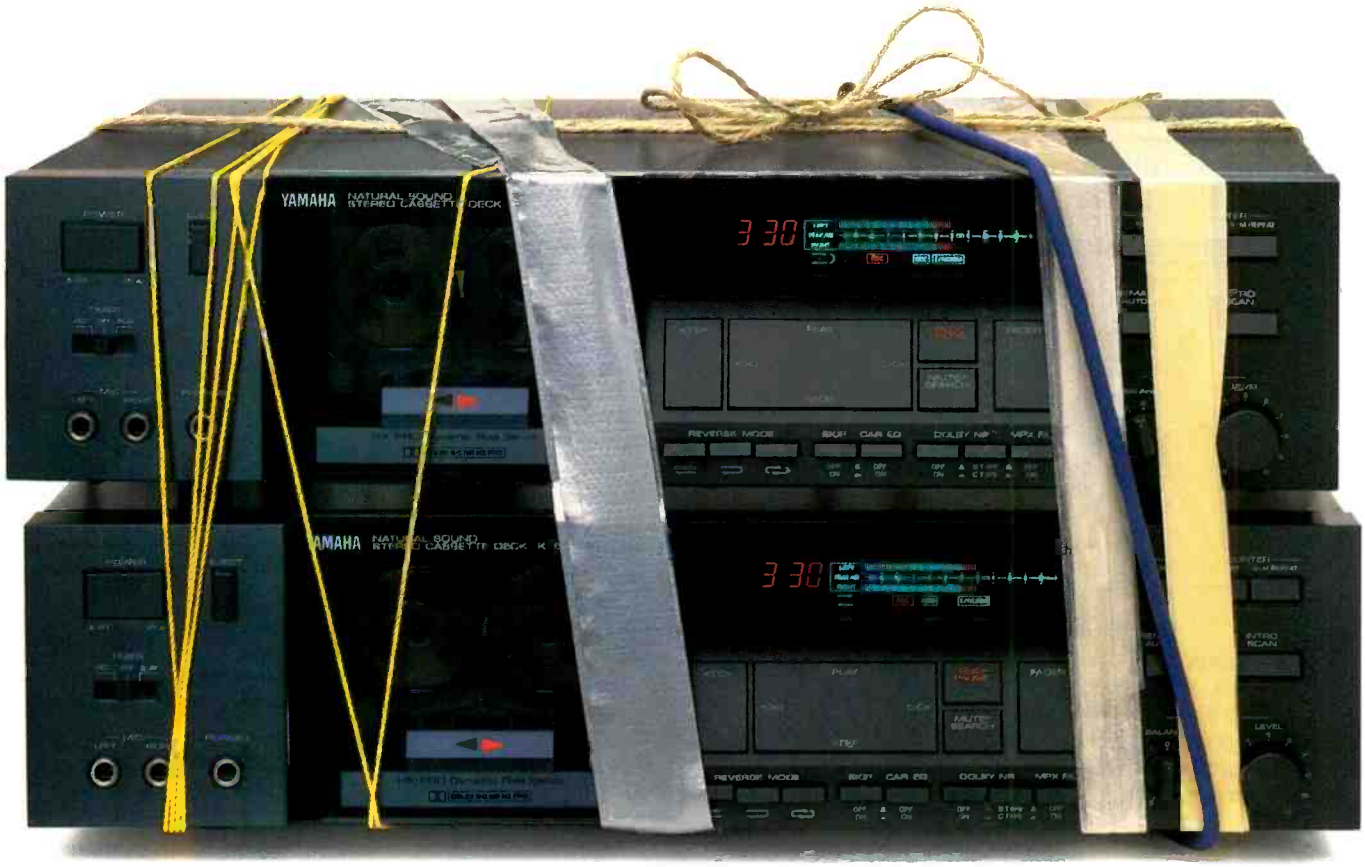
The mean horizontal responses are shown in Fig. 6. All three curves are mostly flat and fairly smooth except for progressively more high-frequency roll-off as the angle increases. The fairly smooth horizontal responses indicate that the systems should maintain good stable stereo images over a broad horizontal listening area, but with some high-frequency loss at extreme angles.

The mean vertical responses are shown in Fig. 7. Except for a slight depression between 1.5 and 3.5 kHz, the mean vertical axial response—covering positions ±15° of the axis—is very similar to the mean horizontal axial response. Because ±15° includes both sitting and standing listeners, the similarity of these two curves indicates that the tonal balance of the system should change very little with changes in listener height.

The 30° to 45° mean response, also fairly smooth, has a narrow dip centered at 2.2 kHz and a rise in the response just below crossover, in the region from 1 to 2 kHz. The 60° to 75° mean response has a deeper notch in the response, at 1.9 kHz, and rolls off above 8 kHz. The fairly uniform vertical mean responses imply that the Special One should reproduce the height information encoded in some CDs quite well.

Figure 8 shows the Special One's magnitude of impedance from 20 Hz to 20 kHz. A minimum impedance of 4.3 ohms at 150 Hz and a maximum of 9.4 ohms at 70 Hz were measured. Above 100 Hz, the impedance only varied from a minimum of 4.3 ohms to a maximum of 5.3 ohms! This low variation of impedance over the whole frequency range makes the Special One quite insensitive to cable resistance. Because the impedance changes very little with frequency, fairly high cable resistance, up to 0.3 ohm, can be tolerated before it causes peaks and dips of more than 0.1 dB in the voltage drive.

Figure 9 is a Nyquist diagram of the complex impedance (that is, a polar plot of magnitude versus phase) over the range from 15 Hz to 30 kHz. Note that the horizontal and vertical scales only cover a range of 10 ohms. Most of the activity on the graph occurs around the resistive 5-ohm point on the horizontal scale. The large circle is due to the primary closed-box resonance of the woofer, which occurs at about 70 Hz. The designers of the Special One have chosen to impedance-correct the system only above 100 Hz. The corrected range does include the very important



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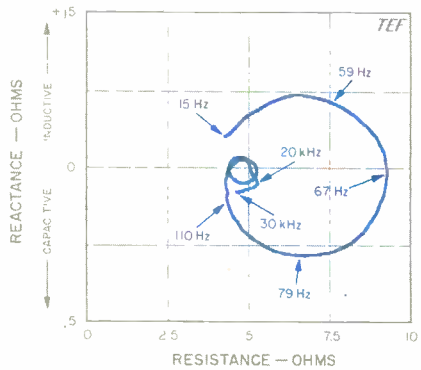

Fig. 9–Complex impedance, showing reactance and resistance vs. frequency. Note that the horizontal and vertical scales cover only a 10-ohm range.

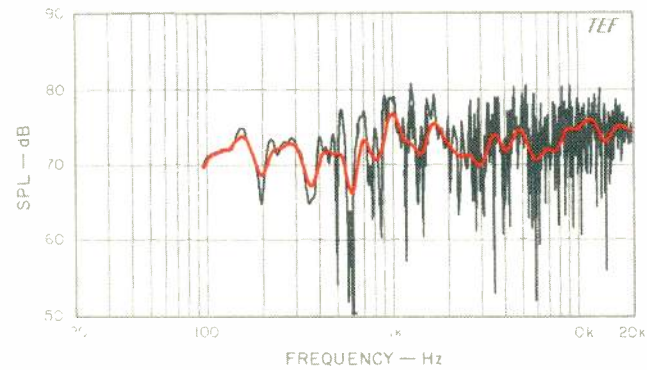

Fig. 10–Three-meter room response, showing both raw and smoothed data; see text.

upper bass and midrange areas of the system's response, however. The rather low impedance variation of the system indicates that it should present a very well-behaved load to any amplifier.

Figure 10 shows the 3-meter room curve of the system; both raw and sixth-octave smoothed data are shown. The system was located in the right stereo position, with the test microphone placed at ear height, at the listener's position on the sofa. The system was swept from 100 Hz to 20 kHz with a sine-wave signal at a level of 2.83 V rms, corresponding to 2 watts into a 4-ohm load. The resultant sound levels can be read directly off the graph. The parameters of the TDS sweep were chosen to include the direct sound plus 13 mS of the room's reverberation; this mimics the averaging time of human hearing. In general, the curve is fairly flat and extended except for some peakiness in the smoothed response in the upper midrange between 800 Hz and 2 kHz. The effects of floor bounce in the upper bass and lower midrange are not much in evidence.

Figures 11, 12, and 13, respectively, show the spectra of harmonic distortion 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 the level of harmonic distortion generated by the system with the application of a single-frequency sine wave at power levels from 0.1 to 100 watts (−10 to +20 dBW, a 30-dB dynamic range). The power levels were computed using the rated system impedance of 4 ohms.

The curves were run by successively increasing the sine-wave input level in 1-dB increments. 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 accurate power-level steps. 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 11 shows the E_1 (41.2-Hz) harmonic distortion data. The nonharmonically related spikes, at lower power levels, are due to background noise in the measurement setup and were not generated by the loudspeaker. At lower power levels, the second and third harmonics are primarily evident, with the second harmonic higher; at higher power levels, the fourth, fifth, and sixth harmonics join the lower ones. At these higher levels, the third harmonic predominates and reaches a level of 67% at 100 watts. The second harmonic reaches its maximum of 37% at 10 watts and then, curiously, decreases to a measure of 5.6% at 100 watts. The high levels of third harmonic indicate that the suspension is symmetrically running out of excursion capabilities in both directions, while the high second harmonic indicates a one-sided nonlinearity.

Even though the system was generating quite high levels of harmonic distortion at 100 watts, I was impressed by its ability to sound undistressed at these high levels. The speaker overloaded quite gracefully and did not generate any of the nasty extraneous sounds that many other woofers generate when overloaded. Note that this system generates roughly 95 dB SPL at 1 meter with an input of 100 watts at 41 Hz.

The A_2 (110-Hz) harmonic data is shown in Fig 12. The graph illustrates that only the second harmonic was significant over most of the power range. The second harmonic increases gradually with power, reaching a fairly high level of 19.5% at 100 watts. As before, even at 100 watts, the system was not making any bad noises, even though severely overloaded. As in the previous graph, the nonharmonic, random information seen in the plot was *not* produced by the speaker but by background noise and other uncontrolled effects in the test setup.

The A_4 (440-Hz) harmonic measurements are shown in Fig. 13. As in Fig. 12, the predominant distortion is a low amount of second and third harmonics with negligible amounts of higher orders. The second harmonic, which is somewhat obscured by the fundamental bleedthrough at the left of the graph, did not exceed 0.3% at any power level. The third harmonic measured only 0.6% at 100 watts but reached an intermediate peak of 1.5% at 3.16 watts. This harmonic exhibited strange behavior, jumping up from

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At high levels, the woofer overloaded very gracefully; it did not sound distressed or produce nasty, extraneous sounds.

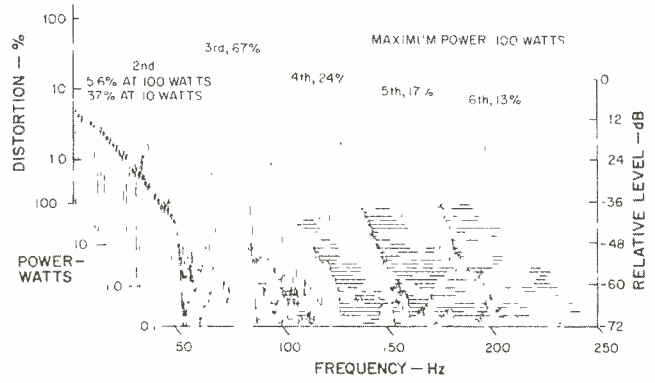

Fig. 11–Harmonic distortion products for the musical tone E_1 (41.2 Hz). Even though the distortion measured quite high at 100 watts, the system was not generating any audible "distress type" sounds, so the output did not sound as bad as the high levels of distortion would suggest.

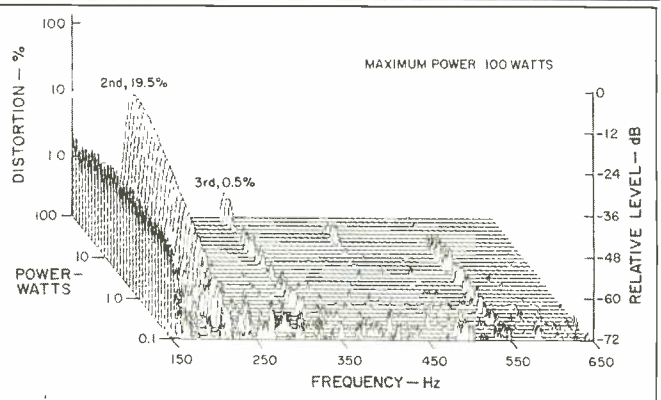

Fig. 12–Harmonic distortion products for the musical tone A_2 (110 Hz).

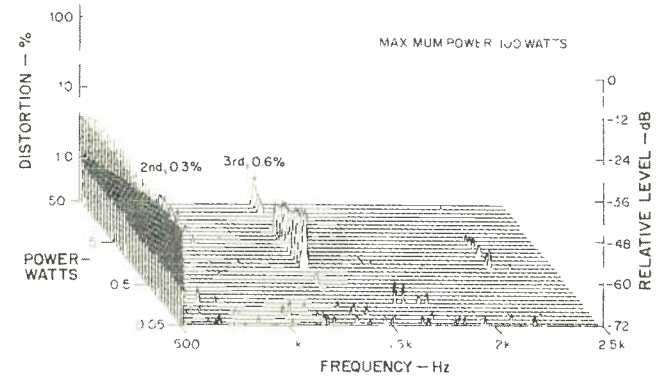

Fig. 13–Harmonic distortion products for the musical tone A_4 (440 Hz).

negligible distortion at the 2.5-watt step to 1.5% at 3.16 watts. I repeated this test on both systems and got essentially the same result. I have no explanation for this behavior, but fortunately the distortion was quite low in either case.

Figure 14 shows the IM distortion on a 440-Hz (A_4) tone created by the simultaneous reproduction of a 41.2-Hz (E_1) tone of equal input power. The distortion gradually rises with power, reaching a high level of about 46% at 100 watts. The first-order ($f_2 \pm f_1$) and second-order ($f_2 \pm 2f_1$) side frequencies predominated in this power range. The distortion was quite high because the rather small woofer handles all frequencies up to 2.5 kHz, including both frequencies of this intermodulation test.

Figure 15 shows the system's short-term peak-power input and output capabilities as a function of frequency. The tests were run by exercising the system with a high-level, shaped, 6½-cycle, sine-wave tone-burst signal generated by the Crown M2400 power amplifier configured in the bridged mode. The test signal covers a third-octave bandwidth with a time duration that increases as the frequency goes down. The duty cycle of the test signal is low enough so that the long-term thermal characteristics of the speaker under test are not exercised.

The test consisted of determining the maximum peak input power-handling capacity and maximum peak output sound pressure levels, in the range from 10 Hz to 20 kHz, at all the third-octave center frequencies. The peak input power was calculated by assuming that the measured voltage was applied across the rated 4-ohm impedance.

The test sequence consisted of determining how much of the burst signal could be handled by the speaker, at each frequency, before either 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.

Dynaudio actually implements a test similar to my peak power test. They measure the frequency response of a speaker dynamically, using tone bursts applied at various power levels. The technique is explained in a Dynaudio white paper which describes a series of tests actually run on the tweeter of the Special One (a D-28 AF). These tests show that the frequency response of the tweeter, measured dynamically, changes very little for peak levels from 1 to 1,000 watts.

The maximum peak electrical input power-handling capacity of the Special One, as seen in Fig. 15, rises fairly smoothly with frequency until about 600 Hz, where the peak limit of the power amplifier was reached at about ±180 V.

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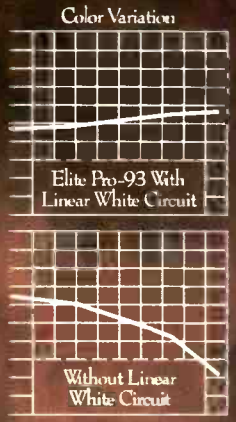

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The Special One's very low sensitivity is offset by its rather high peak input power-handling capacity.

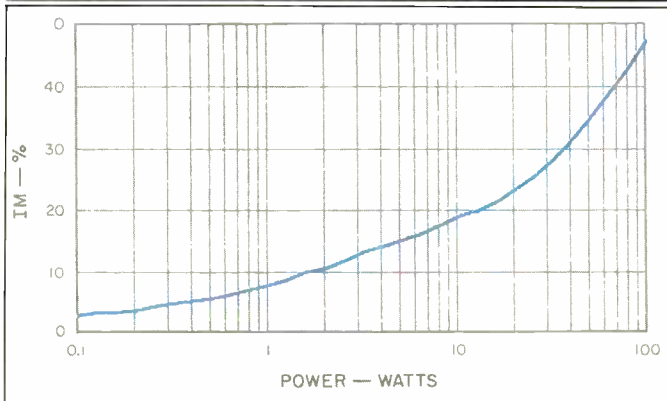


Fig. 14–IM distortion on 440 Hz (A_4) produced by 41.2 Hz (E_1) when mixed in one-to-one proportion.

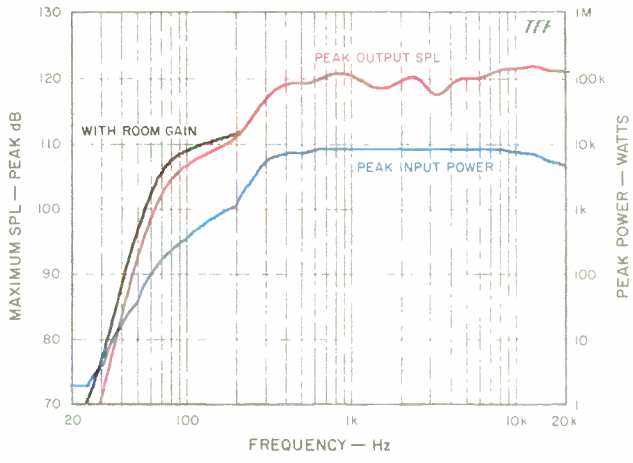


Fig. 15–Maximum peak sound output, measured at 1 meter on axis, and corresponding maximum peak input power levels. The effect of gain for a typical room is shown below 200 Hz on the output curve. At 630 Hz and above, the peak power was limited by the test amplifier's clipping at 8.5 kW into 4 ohms. Though the speaker is quite low in sensitivity, it can reach the quite commendable level of 120 dB SPL above 300 Hz.

Assuming the rated system impedance of 4 ohms (the actual impedance is somewhat higher), this is a power level of about 8,000 watts! The slight roll-off in input power above 10 kHz is due to the amplifier's high-frequency peak power limitations.

Below 100 Hz, however, the input power handling drops rapidly to 15 watts peak at 40 Hz and to 2 watts at 25 Hz (and all lower frequencies) before linear operation is exceeded. As stated before, even though these low-frequency power ratings are quite low, the system could handle considerably more power with increased distortion but without sounding stressed.

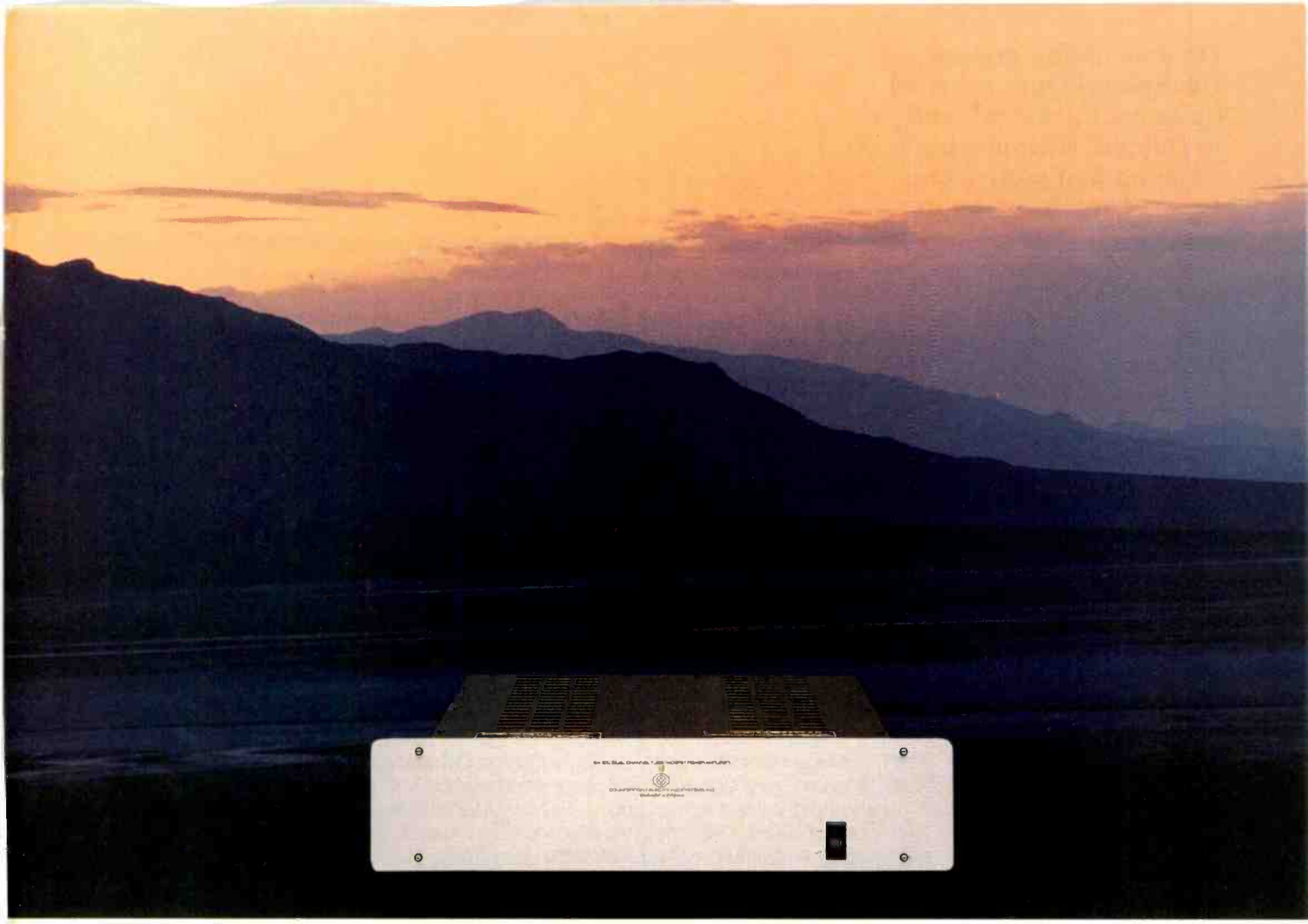
The upper curve in Fig. 15 shows the maximum peak sound pressure levels the speaker can generate at a distance of 1 meter on axis for the levels shown in the lower curve. Also shown on the upper curve is the "room gain" of a typical listening room at low frequencies. This adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz. (See the Dahlquist speaker review in the August 1990 issue for more information on room gain.)

Above 400 Hz, the speaker can generate very substantial peak levels, about 120 dB SPL. (That's about as high as any speakers I have evaluated using this test.) This means that even though the sensitivity of the Special One is quite low, it has a correspondingly higher input peak power-handling capacity, which more than makes up for its decreased sensitivity. The maximum output drops quite rapidly below 100 Hz, however, falling at the rate of about 50 dB/octave between 25 and 50 Hz. With room gain, a single system can generate fairly clean peak levels in excess of 110 dB only above 120 Hz. At 40 Hz, the level drops to 90 dB and at 25 Hz is an essentially unusable 73 dB SPL.

Fortunately, a pair of these systems operating with a mono bass signal will be able to generate levels some 3 to 6 dB higher in these ranges. However, one can offset the subjective effects of the low output at low frequencies by boosting the input to the speakers in this range. As mentioned, the system is capable of much higher maximum output if one can accept the resultant distortion, and the ear is quite tolerant of distortion at low frequencies. The Special One's woofer is different from most in that it overloads quite gradually when driven beyond its linear range and can generate significantly higher low-frequency output but with increased distortion. Dynaudio's specification sheet for the 17W-75 woofer used in the Special One rates the linear excursion of the driver at 0.22 inch (5.5 mm) peak to peak and the maximum excursion at a healthy 0.75 inch (19 mm) peak to peak, some 3.5 times higher! Woofers typically have maximum ratings only about 1.5 to 2 times higher than their linear ratings, which means that their distortion rises much more rapidly when their linear ratings are exceeded.

Use and Listening Tests

Listening was conducted in a room which has dimensions of approximately 15.5 × 27 × 8 feet (4.7 × 8.3 × 2.4 m); it is furnished as a normal living room and has wall-to-wall carpeting. Source driving gear included an Onkyo Grand Integra DX-G10, a Rotel RCD855, and Meridian 206 CD players; a Krell KSP-7B preamp; a Krell KSA-200B solid-state power amplifier, and Straight Wire Maestro speaker



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On demanding material, the Special Ones sounded quite open, neutral, and uncolored, with precise imaging and positioning.

cables and interconnects. As noted, I did not have access to OCOS speaker cables and so was not able to evaluate the Special Ones using the OCOS input jack. As in the past, most of my listening was done before the measurements were made.

The Special Ones' lack of front grilles had its down side: My youngest boy poked in one system's tweeter dome with his fingers. I carefully popped the dome out with a straight pin, and the system fortunately did not suffer any ill effects. This is one minor advantage of a cloth soft-dome tweeter over a metal hard-dome unit.

Most of my listening was done with the Special Ones placed at my usual source position, which is well out in the room, about 6 feet (1.8 m) away from the short rear wall, and separated by 8 feet (2.4 m). This left a spacing of about 4 feet (1.2 m) from the side walls. All the listening was done with the speakers mounted on the supplied wooden stands. The systems were aimed horizontally at my normal listening position so that I was on the speakers' axis. Listening took place on the sofa, about 10 feet (3 m) away.

My initial listening was done using a B & K demo disc (Brüel & Kjaer Pro Audio, CD-4090). I was quite impressed with the Dynaudio speakers' ability to sound very similar to my reference systems. Excluding very deep bass, I sometimes found myself favoring the Special Ones over my reference systems. The Ones were slightly brighter on vocal sibilants, as demonstrated on the first track (Little Feat) of the B & K sampler. Imaging was always sharply focused when the selection required it, as in Julianne Baird's tracks (3 and 13). On the pink-noise track, the systems essentially passed the stand-up, sit-down test; there was only slight midrange coloration when standing up. Horizontal high-frequency coverage was quite adequate and smooth, with no hot spots.

Very low-frequency capabilities were assessed by playing the third-octave, band-limited pink-noise tracks on the B & K disc. The playback level was set using the 20-, 25-, and 31.5-Hz tracks so that when I listened from close up, the systems were just below the audible overload point at these frequencies. Back at the listening position on the couch, I found that at that level a single system was only audible when playing the 40-Hz and higher bands. With both systems operating in mono, I could hear the 31.5-Hz band but with minimal level. When the level was raised, the lower frequencies did seem to become audible, but the high-frequency distortion components seemed to predominate. Note that band-limited pink noise is quite demanding because of its high crest factor; the Special One handled steady-state signals (such as sine waves or sustained organ pedal notes) much more effectively, generating fairly adequate levels. Moving the systems closer to the rear wall corners improved the low bass but at the expense of the upper bass and mid-frequencies. The acoustic bass on the Tuck and Patti selection (track 12), which contains low end more in the Special One's range, was reproduced very evenly, with very little overemphasis of individual notes. On the very demanding organ arrangement of "Pictures at an Exhibition" (Dorian DOR-90117), the Special Ones did surprisingly well on the high-level pedal notes; intermodulation distortion sounded fairly low. However, to reproduce the heavy pedal notes at 0:51 to 0:56 of track 2 without high subjective distortion, the speakers could be turned up only to 85 dB on the sound level meter's "C" scale.

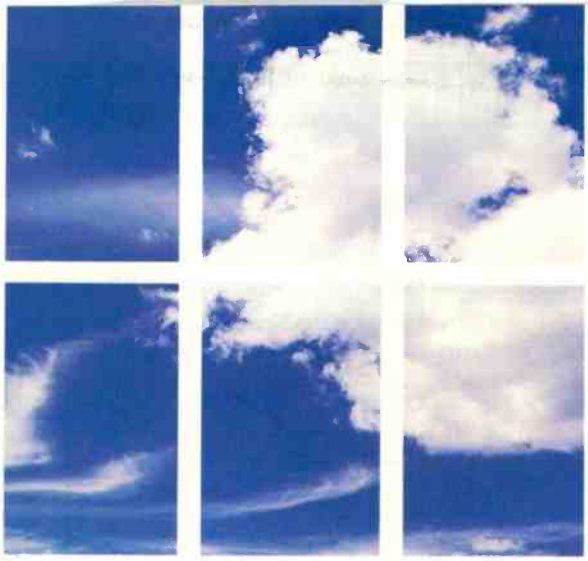
I initially had some reservations about the Special Ones due to their low sensitivity, but now that I have used them for a while, my reservations are gone. With an amplifier of adequately high power, the systems can generate very respectable levels at all frequencies except very low bass. I played several selections, monitoring the output at the listening position with my sound level meter's "A" and "C" scales and the corresponding amplifier peak output voltages with a peak-responding voltmeter. On Stravinsky's "Symphony of Psalms" (track 8 of the *Klavier Sampler*, KCD-1990), the massed vocals in the finale, which were reproduced very cleanly, generated 91 dBA on the meter's slow scale from a peak input of 37 V (340 watts peak into 4 ohms). The quite clean and realistic playback of the horns on track 14 of the same disc generated 96 dBA on the fast scale (loud!) with peaks of 57 V (810 watts peak). If one used an amplifier of more modest power, maximum levels would be somewhat lower. However, these measurements do show that the Dynaudio speakers won't take a back seat to most other systems if a powerful enough amplifier is used. For the Special Ones, there is essentially none of the usual trade-off of output capability for small size, only the inevitable trade-offs of higher power requirements and somewhat lower bass output.

The Special Ones reproduced the delicate high-frequency sounds on track 6 of David Chesky's *Club de Sol* album (Chesky JD33) with much smoothness and realism. (This is one of my favorite CD tracks for contemporary nonclassical demo purposes.) On *Bob's Diner* (dmp CD-471), the vocals on track 4 were reproduced with no trace of harshness. The cymbal crashes at 0:33, 0:37, and 0:40 on cut 7 were very clean; overall, the track had good dynamics and ample low-end underpinning. On track 12 of *Reference Classics: First Sampling* (Reference Recordings RR-S1CD), the harpsichord was rendered very realistically and the distinctive, sharp attack sound of the plucked strings was conveyed very well.

On demanding program material, the Special Ones presented an uncolored, quite open, neutral sound. Extended listening did not diminish my enjoyment of them. The small size of the systems, coupled with the vertical orientation of their drivers, contributed to very precise stereo imaging and unambiguous lateral source positioning. The Special Ones had smooth response in the upper bass, and the quality of the reproduced male voice was quite natural and not tubby.

Except for the very low bass, the Special Ones can keep up with the best systems. Adding a quality subwoofer and an associated high-level crossover to the Special Ones could give you a very high-quality, audiophile-grade satellite system that would not take backtalk from many other systems regardless of cost.

Are the Special Ones for you? At $2,500 a pair, the Special Ones are definitely premium priced. Like fine wine, however, the higher price may be acceptable to those whose wallets allow and who desire a very accurate, good-looking, high-performance small system with many audiophile qualities. *D. B. Keele, Jr.*



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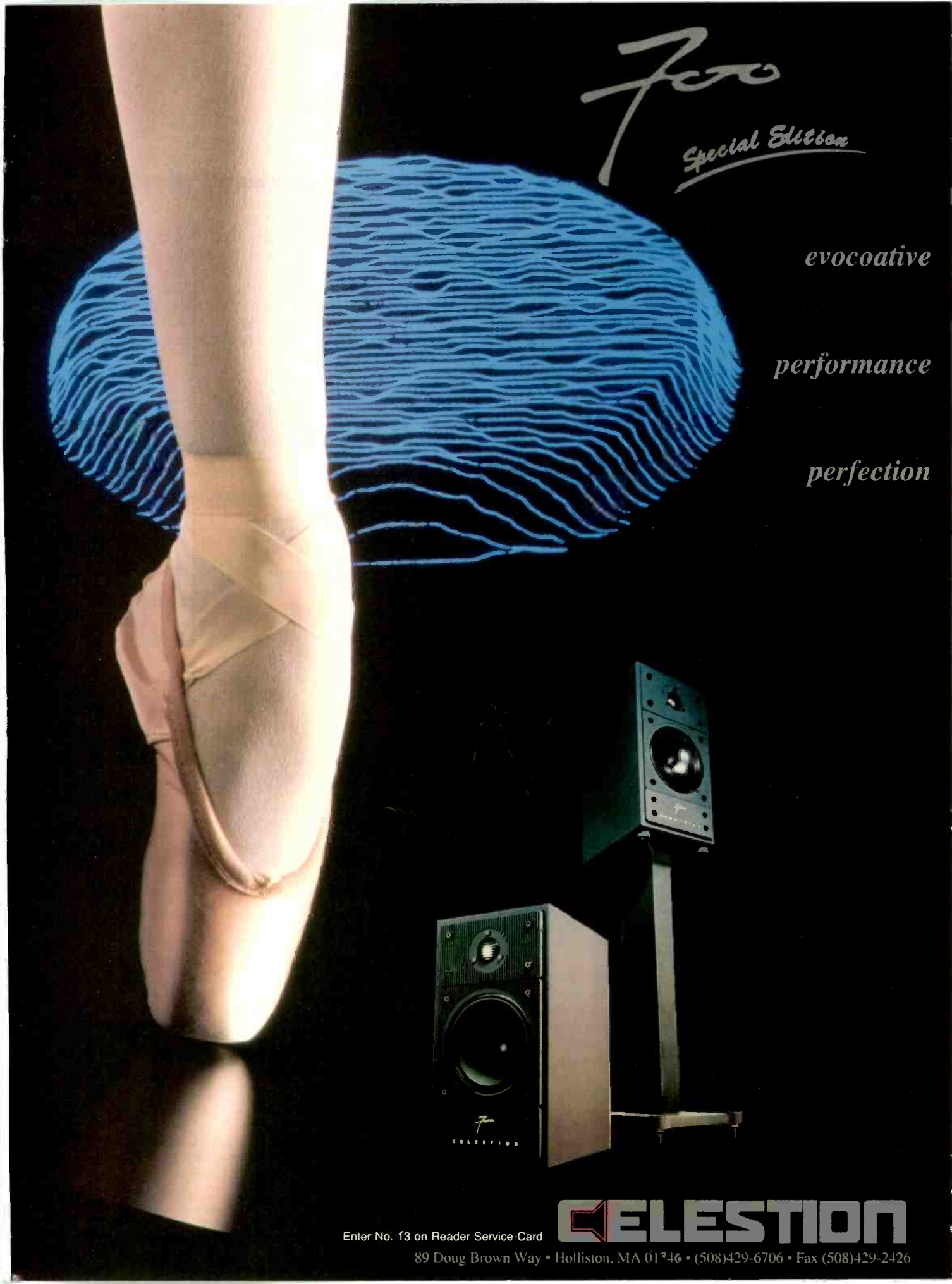
3

MARANTZ CD3577 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 20 Hz to 20 kHz, ±0.5 dB.
THD: Less than 0.005% at 1 kHz.
S/N: Greater than 100 dB.
Dynamic Range: Greater than 96 dB.
Output Level: Normal, 2 V, variable; digital coaxial, 0.5 V peak to peak, ±0.1 V.
Number of Programmable Selections: 20.
Power Consumption: 120 V a.c., 60 Hz, 13 watts.
Dimensions: 16 15/16 in. W × 4 3/8 in. H × 12 7/8 in. D (43 cm × 11.1 cm × 32.6 cm).
Weight: 9.3 lbs. (4.2 kg).
Price: $450.
Company Address: 700 North Commerce St., Aurora, Ill. 60504.
For literature, circle No. 92

The Marantz CD3577 serves as a good illustration of how the much-discussed, one-bit D/A conversion system can be used to produce a superb-sounding CD player whose low-level linearity rivals that of players costing several times this handsome unit's relatively modest price. Different manufacturers have come up with different names for the one-bit D/A conversion process. Marantz chooses to call their approach Class DX one-bit conversion. As Marantz describes the system, Class DX is intended to solve both low-level nonlinearity and zero-crossing distortion (the error that occurs when signal polarities change). It does so by first increasing the sampling rate, with a digital filter, to 256 times the CD's sampling rate of 44.1 kHz. A computerized interpolator then changes the pulse code to pulse-width modulation by monitoring *changes* in value rather than discrete values of each digital word. Timing is quartz-controlled.



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The Compu Edit feature shows you how to arrange CD tracks to fit onto cassettes of any length.

The pulse-width modulation (PWM) signal then goes through a low-pass filter that changes it to analog, continuous-waveform audio. All one-bit systems introduce higher residual noise levels than do conventional ladder-type D/A converters. Accordingly, a process known as noise-shaping is required. In the Marantz CD3577, third-order noise-shaping is used. This process moves the generated noise components up and out of the audible frequency range.

More apparent features of the CD3577 include a track "calendar" display, a fluorescent multi-function status monitor, four repeat play modes (track, complete disc, program, and A-B segments), 20-track programmability, random play, dual editing controls for programming and timing, and a coaxial digital output jack. A supplied 27-key infrared remote control can access all major functions including adjustment of volume level.

The disc tray is configured to accept standard discs as well as the smaller, 3-inch singles without the use of an adaptor ring.

The CD3577 is available in a brushed-gold or matte-black aluminum finish, and optional lacquered-rosewood side panels can be purchased if you want to dress up the unit even more. The sample I tested had a brushed-gold finish, and I must confess that, to my eyes at least, this is a refreshing change from the black front panels that have become standard for most audio components these days.

Control Layout

Attractively sculptured square and rectangular pushbuttons are used for powering up the CD3577, for selecting track numbers (for immediate play or during programming), for opening and closing the disc drawer, for skipping to tracks in either direction, and for the usual transport functions. At the extreme right of the panel is a large rotary knob that resembles a master volume control. In fact, this knob can be turned only a few degrees in either direction from its neutral point and is used for fast-searching through a disc in either direction. When I first examined this player, I was somewhat annoyed that there was no direct way to move from index point to index point within a track. I quickly discovered, however, that the fast-search knob serves just as well for this purpose, since it is easy enough to watch the display and stop at the desired points within a track. A tiny pushbutton near this knob alters the time-display mode (track elapsed time, remaining track time, total elapsed time, or total remaining time).

Smaller keys along the lower edge of the player handle such functions as random play, auto space (for insertion of a 4-S space between tracks during play), program checking and clearing, normal play (the default mode when power is applied), programming, and editing. The "Edit" key is used when you want to select and record all the tracks on a disc that can fit on a tape of designated length. During this mode of operation (which Marantz calls Compu Edit), the track advance and reverse keys can be used to enter any popular cassette length, while the large jog/shuttle knob normally used for fast-searching can be used to fine-tune the tape length in 1-minute increments.

The display area shows the current track number and elapsed or remaining time for the track or disc. Other indicators on the display show the status of such functions as programming, random play, auto spacing, Compu Edit, repeat play, output-level setting (by means of a bar graph), and the "music calendar" (for up to 20 tracks).

The supplied remote has most of the main control functions found on the front panel plus volume up/down buttons for controlling the player's output level. Because the default setting when power is first applied is maximum volume, users are cautioned to keep amplifier volume at a suitably moderate level.

Measurements

Frequency response of the Marantz CD3577, shown in Fig. 1, was within 0.15 dB from 10 Hz to 20 kHz. Output levels of both channels were within 0.1 dB of each other when output was adjusted for maximum.

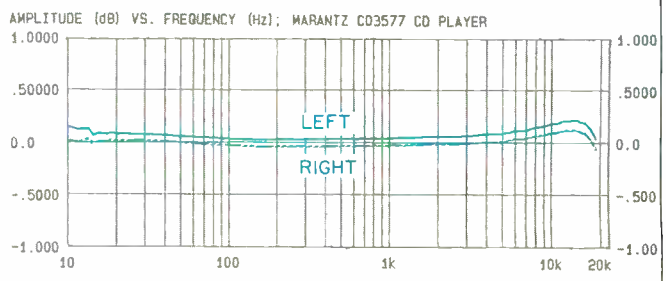

Fig. 1—Frequency response.

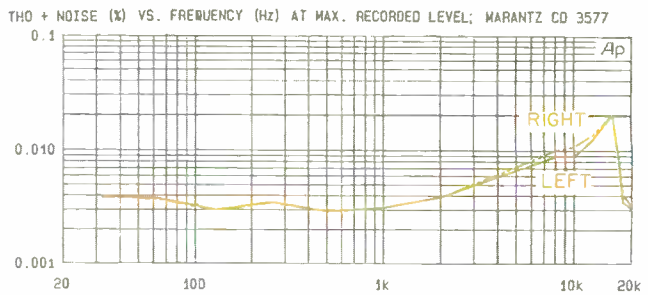

Fig. 2—THD + N vs. frequency.

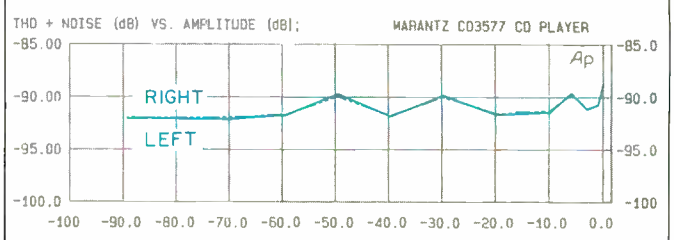

Fig. 3—THD + N vs. signal level.

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-Music Technology

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-Julian Hirsch, Stereo Review

"Forgive us if we rave unabashedly about BBE Sound's Sonic Maximizer....And what does it do? Well, it makes just about everything sound marvelous. With virtually no effort. No kidding."

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A-12

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The CD3577 serves as a good illustration of how one-bit D/A conversion can provide superb linearity and sound at a moderate price.

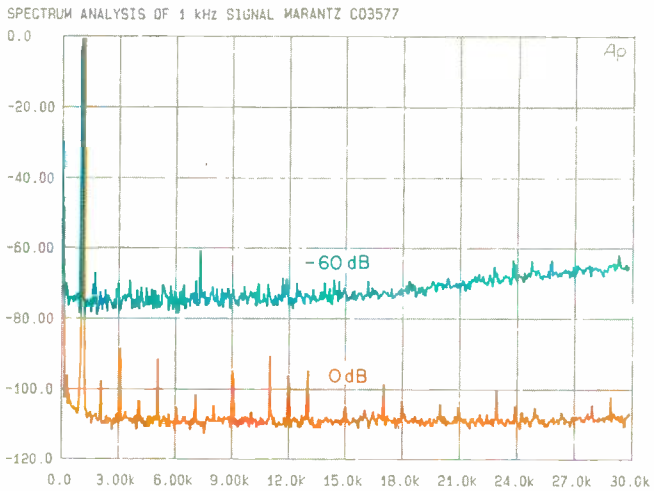

Fig. 4—Spectral analysis of 1-kHz signal at two recorded levels. Each curve is averaged result of 16 acquisitions, to reduce displayed noise and improve display of coherent signals.

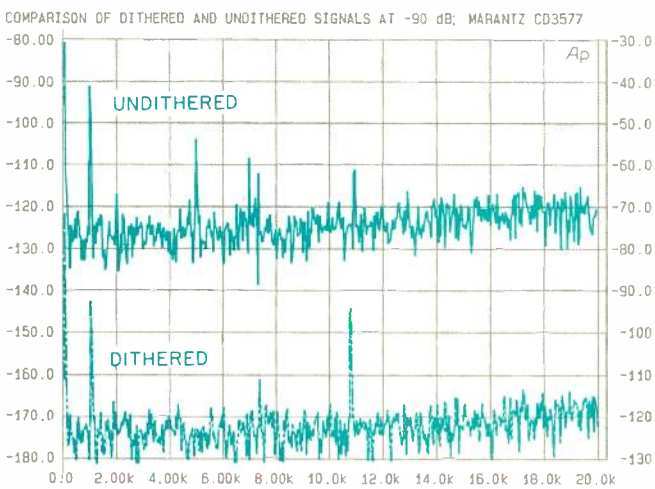

Fig. 5—Spectral analysis of 1-kHz signals recorded at −90 dB.

Figure 2 shows how THD + N varied as a function of frequency during playback of signals recorded at maximum level. At mid-frequencies, distortion was approximately 0.003% and increased somewhat, to 0.02%, at 15 kHz.

Figure 3 shows how THD + N varied with recorded level from −90 dB to 0 dB (maximum level). All readings are in dB and referenced to maximum recorded level; they range from −89 dB at maximum recorded level to −92 dB at lower levels. Translating these readings to percentages of maximum output yields figures of 0.0035% to 0.0025%, providing good correlation with the results obtained in Fig. 2.

To determine the player's actual harmonic distortion (as opposed to distortion plus noise) when reproducing a 1-kHz test signal, I used the FFT spectrum analysis capability of my DSP-equipped Audio Precision System to plot the graphs shown in Fig. 4. For each of the two signal levels shown, 16 acquisitions of the signal were made to reduce random noise and to highlight only the actual harmonics of the desired signal. For a 1-kHz signal recorded at maximum level, the more significant (though very low-level) harmonics can be seen at 3, 5, 9, 11, and 13 kHz; each is more than 90 dB below maximum recorded level. For a 1-kHz signal recorded at −60 dB, "0.0" dB in the graph represents the level of the test signal. Even at this low level, the only significant harmonic component that can be observed (at 7 or 8 kHz) is 60 dB lower than the test signal itself, or actually 120 dB below maximum recorded level. This shows that the harmonics seen in the curve for the 0-dB signal were more than likely generated by the player's analog audio stages rather than by any of its digital circuitry.

Figure 5 shows how low-level signal recovery can be improved by proper use of dither during the recording process. Both curves represent spectrum analysis of signals recorded at 90 dB below maximum record level. With undithered signals, a substantial fifth-harmonic component of the 1-kHz test signal is quite prominent (only about 14 dB lower in amplitude than the desired 1-kHz signal itself). With dithered signals, that spike has all but disappeared, as have the spikes from harmonics of lower order. Overall noise levels increased very slightly for the dithered signal, but hardly enough to negate the advantages of dithering. I have no immediate explanation for the increase in amplitude of the 11-kHz component in the curve made using dithered signals, but I seriously doubt if it could be heard at its level of about −95 dB.

A-weighted S/N ratio of the Marantz CD3577 was 99.7 dB for the left channel and 99.2 dB for the right. Figure 6 shows how noise level varied with frequency when I used a ⅓-octave swept-bandpass filter to "track" the noise. There was no significant contribution to overall noise at the power-line frequency or its harmonics.

Separation, plotted in Fig. 7, measured 95.5 dB at 1 kHz for both channels. At 16 kHz, it decreased to 91.5 dB for the right channel and 80.7 dB for the left.

A spot reading of SMPTE-IM distortion was made for a test signal recorded at maximum amplitude, and the result was 0.0096% for either channel. Frequency, or "clock," accuracy was also checked and found to be +0.0032% of perfect.

The advantages of Marantz's one-bit D/A conversion system were immediately apparent when I measured deviation from perfect linearity (Fig. 8). Whether for undithered signals from 0 to −90 dB or dithered signals from −70 to −100 dB, deviation from perfect linearity was about as low as I have ever seen for any CD player, regardless of price. I am not saying that superb linearity is not obtainable with other D/A conversion techniques. However, the relatively moderate price of the CD3577 confirms the claim that achieving such

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Soft passages of solo instrument recordings or vocals will show off the CD3577's clarity of reproduction.

excellent low-level linearity is less costly when a one-bit D/A conversion system is employed.

The fade-to-noise test, using dithered signals from 60 to 120 dB below maximum recorded level, showed equally impressive low-level linearity. The results (shown in Fig. 9) also enabled me to establish the EIA dynamic range for this unit, which was approximately 110 dB. Using the EIAJ method, dynamic range was exactly 90 dB.

Use and Listening Tests

I found all controls of the CD3577 to be easy to use and understand. The search knob provided fast access to specific points on a disc yet was sensitive enough so that I could stop at almost precisely the point I wanted in any musical or test disc.

The one disappointment occurred when I subjected the player to my usual error-correction and tracking tests. Using the special Pierre Verany test disc that has areas of measurable data obliteration, I was somewhat surprised to find that the player began to mistrack when it encountered opaque tracks of only 1 mm in length. Now, I realize that in the early days of CD, I waxed enthusiastic over players that could ignore missing data extending to 0.7 mm. Still, recent players have generally been able to do much better than this, sailing through missing data that was 1.5, 2.0, and in some cases even 3 mm in length. It is possible that only my sample exhibits this limited tracking ability, but I have no way to confirm it. If you are interested in this otherwise superb player, I suggest that you give the unit a less-than-gentle tap on its top and sides to check for mistracking, muting, or other sonic glitches. Playing a disc that you know has some minor surface scratches is another good test for trackability.

As for the Marantz's musical reproduction of discs, I have nothing but praise. Audition this player using solo instrument recordings, piano recordings, or vocals. Listen, particularly, for low-level passages and then compare the clarity of sound you hear from the CD3577 with that of similarly priced players which have conventional ladder or parallel-type D/A converters. I'll venture a guess that you will hear the same differences that I did when I listened to the Marantz versus an early player that I still own (but that has been relegated to a secondary system, far from my lab and its reference-grade components). A few selections that may serve to prove the point are track 6 of a Delos recording (DE 3064) featuring, among other Franz Joseph Haydn works, his Piano Concerto No. 5 in G Major, with soloist Carol Rosenberger, and tracks 11 and 16 of another Delos disc, *Romantic Cello Favorites* (DE 3065). For an evaluation of vocal reproduction accuracy, I listened to tracks 8 and 11 of a Telarc disc (CD-80194) featuring vocal religious works by Vivaldi (Gloria in D Major) and J. S. Bach (Magnificat in D Major). These other discs confirmed my belief that it is now possible to obtain superb musical reproduction from a CD player that is both modestly priced and handsomely styled. Marantz classifies the CD3577 as part of their Century Collection, a group of audio components which, in their words, "demonstrate the Marantz commitment to the art and science of audio—art on the outside and state-of-the-art on the inside." I couldn't agree more. *Leonard Feldman*

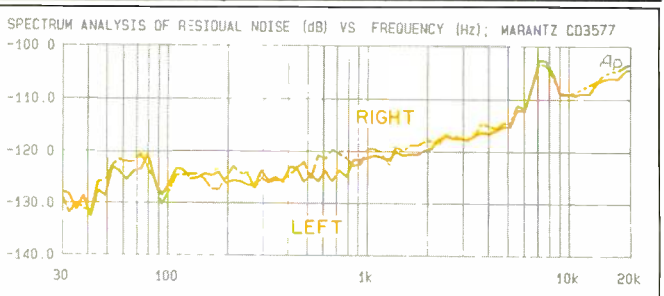

Fig. 6—Spectral analysis of residual noise for "no-signal" track of CD-1 test disc.

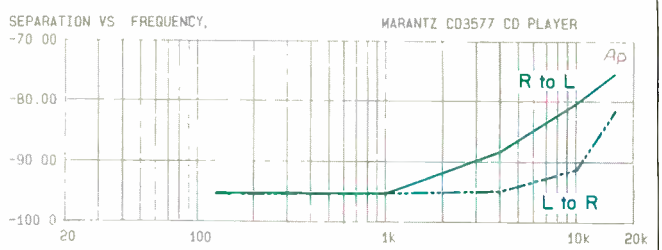

Fig. 7—Separation vs. frequency.

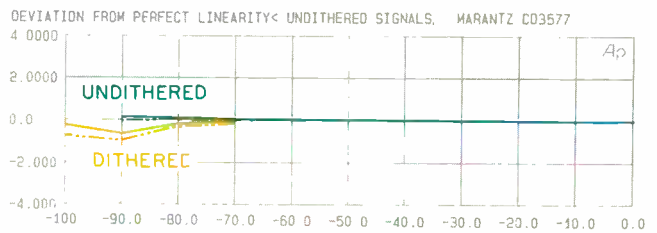

Fig. 8—Deviation from perfect linearity for low-level signals.

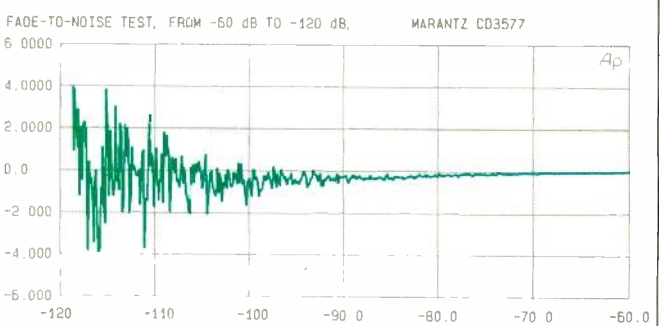

Fig. 9—Fade-to-noise test, using a gradually attenuated dithered signal.

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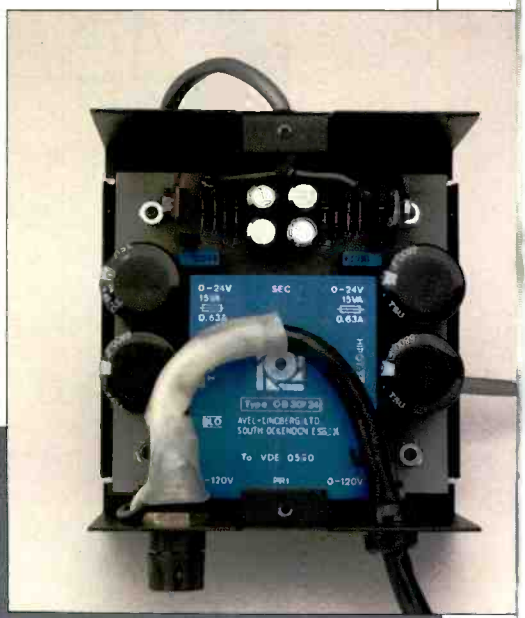
VENDETTA RESEARCH SCP-2B PRE-PREAMP

Manufacturer's Specifications
Frequency Response: 0.1 Hz to 1 MHz.
S/N: 90 dBA.
RIAA Accuracy: ±0.1 dB, 10 Hz to 100 kHz.
THD: 0.01% or less at 3 V out, 10 Hz to 30 kHz.
IM Distortion: 0.01% at 3 V out.
Nominal Gain: 62 dB, re: 1 kHz.
Noise: 0.4 nV√Hz or 10 ohms equivalent.
Input Impedance: Adjustable up to 47 kilohms; continuously variable between 10 and 200 ohms.
Polarity Inversion: Does not invert polarity.
Dimensions: Main unit, 19 in. W × 2 in. H × 6¼ in. D (48.3 cm × 5.1 cm × 15.9 cm); power supplies, each 4¾ in W × 3 in. H × 5 in. D (12.1 cm × 7.6 cm × 12.7 cm).

Weight: 10 lbs. (4.5 kg).
Price: $2,495.
Company Address: 2031 Rumrill Blvd., Suite 16, San Pablo, Cal. 94806.
For literature, circle No. 93

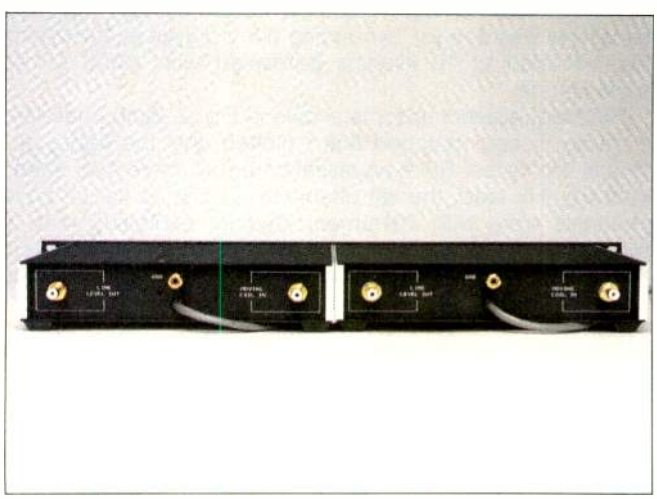


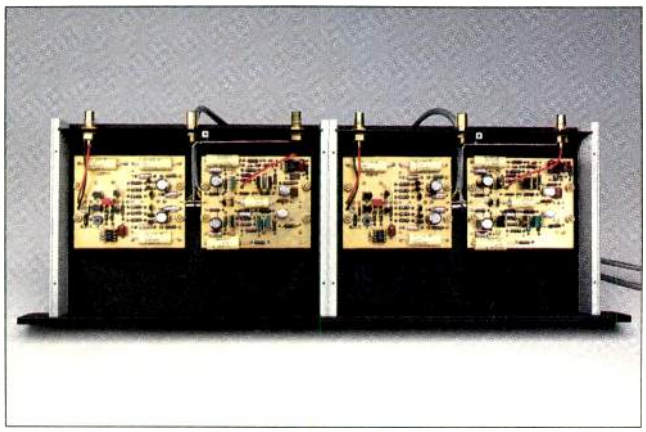
I have known John Curl, the designer of the SCP-2B, for close to 20 years, and we have had many interesting conversations about circuit and noise theory. I respect John very much for his single-minded dedication and diligent work in improving the art and sound of solid-state audio electronics. Having had the opportunity to listen to the earlier "A" version of the Vendetta unit for a while, I was very enthusiastic about it, and through a variety of circumstances, am now reviewing the updated, "B" version.

The Vendetta Research SCP-2B is an RIAA-equalized phono preamp for moving-coil cartridges, with about 60 dB of gain at 1 kHz. It can be used as a stand-alone MC phono stage feeding a line input of a preamp that has a phono stage or to add phono capability to some of the new line-level controllers that don't have phono stages built in.

Physically, the unit consists of two separate power supplies connected to the preamp unit by 6-foot cords. The preamp itself is really two separate preamp channels, each in its own enclosure, mechanically tied together by the front panel. On the rear of each channel is a pair of Tiffany female phono connectors for signal input and output, and a gold-plated binding post for ground connection; the ground lead from one's turntable can be connected to either channel's binding post. A 120-V a.c. power cord and fuse-holder are on one end of each power-supply enclosure, and a d.c. power cord to the preamp is at the other end.

The cables between power supplies and preamps are hard-wired, with no plugs. Keeping the two cables untangled is therefore somewhat of a pain if the preamp is moved around very much. No doubt there are sonic reasons for not using connectors, and I, for one, would rather put up with the lack of connectors than to sacrifice any of this unit's sonic attributes. Also, there are no power-on indicators on either the power supplies or the preamp itself. The only user-adjustable features of the SCP-2B are the input-resistance controls. These are very high-quality trimpots inside each preamp and are adjustable from 10 to 200 ohms. To get the desired input resistance, one must measure with an ohmmeter while adjusting these controls. If higher values of input resistance are desired, the 10-ohm limiting resistors can be removed from their sockets and replaced by resistors of higher value. Since these resistors are paralleled by 47 kilohms, simply removing them will change the input loading to this value.





Circuit Description

What kind of circuitry do we find inside the SCP-2B? I was astonished to find a number of small vacuum tubes mounted with rubber bands. (Just kidding! John Curl designs solid-state circuits.) Although I have knowledge of most of the SCP-2B's circuit details, John asked me not to reveal the actual schematics. A block diagram of the signal path is shown instead (Fig. 1). As can be seen, the RIAA equalization is broken up into two parts, with the high-frequency roll-off above 2,120 Hz being accomplished in the interstage coupling between the input pre-preamp block and the output amplifier block. This works with a parallel RC network because the output impedance of the pre-preamp block is very high. Gain of the pre-preamp section below the 2,120-Hz transition frequency is controlled by the magnitude of R; in conjunction with R, C sets the transition frequency at 2,120 Hz. The RIAA bass boost from 500 down to 50 Hz is done in the feedback loop of the output amplifier section.

The resistor marked R in Fig. 1 was in a different location in the earlier SCP-2A. In the "A" version, it was a shunt to ground across capacitor C. The output amplifier did not invert polarity; because the pre-preamp section did invert, the "A" version was inverting overall. In the "B" version, the output amp is set up to be inverting and the pre-preamp still inverts, so the overall polarity of the unit is noninverting. Resistor R now acts as the input summing resistor to the inverting output stage.

The amplifier circuitry in both sections is, naturally, fully complementary, a hallmark of John Curl designs. In the pre-preamp section, a nondifferential complementary first stage is made up of two paralleled N-type and two paralleled P-type junction FETs of very high transconductance. The drains of the first-stage devices are direct-coupled to the sources of another complementary set of junction FETs in what has been termed elsewhere a "folded cascode" arrangement. Two groups of junction FETs serve as power-supply decoupling regulators to feed lower rail voltages to this circuit section. In the output amplifier, a combination of junction FETs and MOS-FETs is used to create the necessary characteristics. Both the pre-preamp and the output

Response to pre-equalized square waves was just about perfect; the only wiggles in the wave were from my 'scope, not the Vendetta.

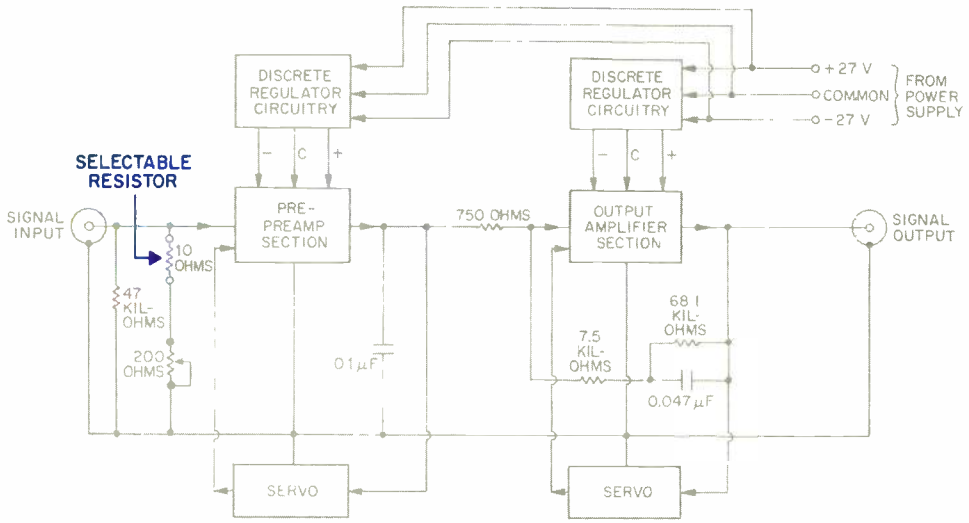


Fig. 1—Block diagram; see text.

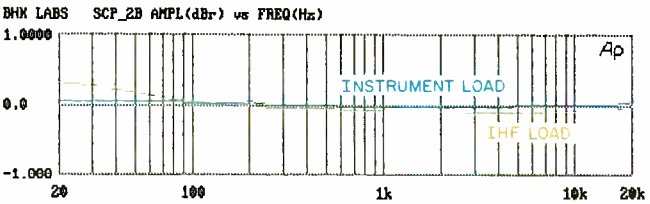


Fig. 2—RIAA equalization error for right channel; see text.

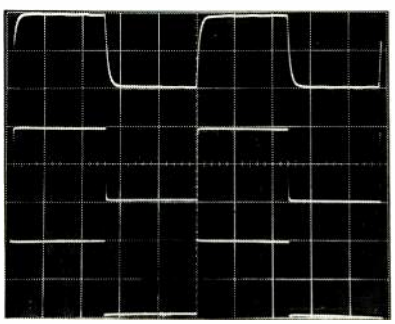


Fig. 3—Response to pre-equalized square waves at (top to bottom) 10 kHz, 1 kHz, and 40 Hz. (Scales: Vertical, 0.5 V/div.; horizontal, 20 μS/div. for 10 kHz, 200 μS/div. for 1 kHz, and 5 mS/div. for 40 Hz.)

amplifier sections have their own servo circuits to keep d.c. offset to low values.

The power-supply enclosures contain the power transformer, main filter capacitors, and main voltage-regulator circuitry. These voltage regulators are of the TO-220 size, adjustable-output type. The main regulators' outputs are about +26 and −26 V d.c. Inputs to the main filter capacitors are about +33 and −33 V d.c. Each supply has two 6,800-μF capacitors for each voltage polarity, for a total of 27,200 μF per channel—substantially more than many power amplifiers have in their power supplies.

Measurements

Before making my measurements, I removed the 10-ohm limiting resistors that are normally in series with the input-loading trimpots, leaving the 47-kilohm resistors so as to have a high input impedance for the measurements and the subsequent listening tests.

Voltage gain for both channels measured 59.7 dB. IHF sensitivity was 515 μV, producing 0.5 V output at 1 kHz into the IHF load of 10 kilohms paralleled with 1,000 pF of capacitance.

RIAA equalization error is shown in Fig. 2. Both channels were so closely matched that I plotted only the right one. This is the lowest RIAA equalization error I have ever seen. With the IHF load, the left channel was just as flat as both channels were with instrument loading, exhibiting only a slight drop in output level, but the right channel exhibited the mild low-frequency rise shown. Interestingly, this slight low-frequency rise would not occur if the channels were separately fed and measured without a common ground connection between them. Since in most music systems the output grounds are tied together in the following piece of equipment, this phenomenon may occur in practice.

Figure 3 illustrates response to pre-equalized square waves of various frequencies. The SCP-2B's responses are just about perfect. (To anyone with a sharp enough eye to

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I felt I'd as soon listen to the Vendetta as my tube unit, which, for a die-hard tube freak, is blasphemy!

see some wiggles along the positive half-cycle of the top trace in Fig. 3, these were produced by my 'scope and not the SCP-2B.)

Next I looked at THD + N. It is quite difficult to measure this in a phono preamp with moving-coil gain and not have some hum contamination limit the resolution. At 3 V output, THD + N was less than 0.01% in either channel. (Both channels of this preamp were very much alike in all respects.) I pushed the unit to higher output levels, and you can see from Fig 4 (which shows THD + N at 10 V out) that distortion rises at the higher frequencies. Results were virtually the same for either my instrument load or the IHF load. This preamp can drive the IHF load (10 kilohms in parallel with 1,000 pF) with impunity. The fall-off in distortion below about 500 Hz is due to the use of a 400-Hz high-pass filter to get rid of some 60-Hz noise in the setup. The results are valid above, perhaps, 1 kHz. If the hum were not present, I would estimate distortion at 0.01% or so below 1 kHz. A spectrum analysis of harmonic distortion for a 1-kHz signal at 5 V output appears in Fig. 5. Notable here is the lack of higher-order distortion products, the plot indicating only second and third harmonics being present. These data all suggest that the SCP-2B would have vanishingly low distortion at working levels of 0.5 to 2.0 V output.

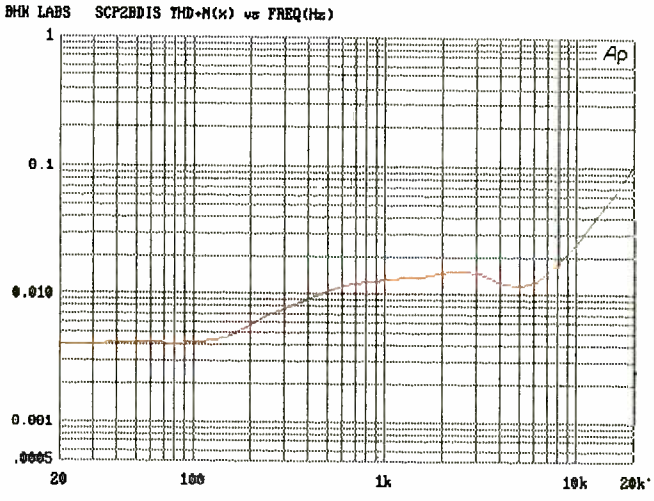

Fig. 4—THD + N vs. frequency at 10 V output into IHF load, measured with 400-Hz filter; see text.

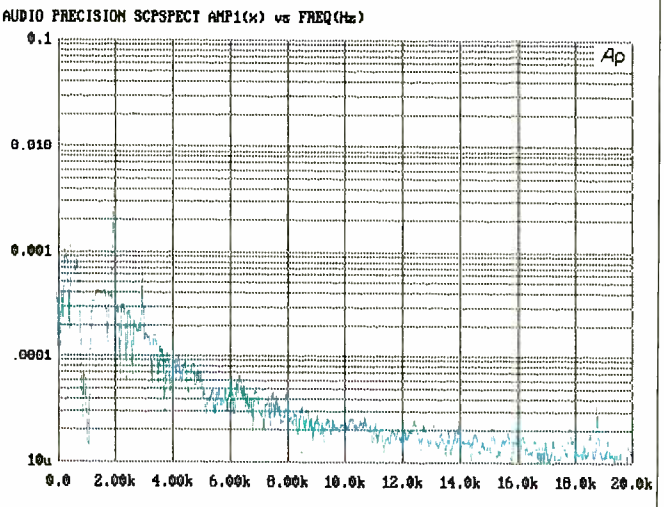

Fig. 5—Spectrum of distortion residue for 1-kHz signal at 5 V out into instrument load.

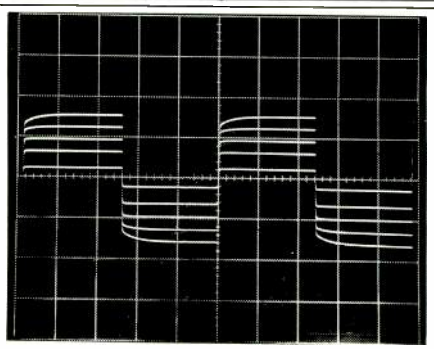

Fig. 6—Results of deliberate high-frequency overload from 1-kHz square waves at four different input levels. Note the symmetrical clipping; see text. (Scales: Vertical, 2 V/div.; horizontal, 200 μS/div.)

The SCP-2B clipped at about 15 V rms with either instrument or IHF loading. When loaded with 600 ohms, it clipped sooner, at 13 V. Although distortion is higher with a 600-ohm load, the SCP-2B will drive it competently. I got less than 0.1% THD + N at 4 V output over most of the audio range.

Table I shows the data for phono overload versus frequency. Results are the same for both channels and for instrument or IHF loading. As can be seen, the behavior is ideal in that the attainable output level at visual onset of clipping is constant with frequency. Related to the sine-wave overload with frequency is the reproduction of pre-equalized square waves at increasing output levels. As I have mentioned in other reviews, it can be argued that the high-frequency content of this signal is rather out of band, i.e., above 20 kHz. Yes—but so is the distortion that results from mistracking in many moving-coil pickups; the high-frequency distortion test is one measure of circuit (or cartridge) excellence. In Fig. 6 we see that the Vendetta puts out a healthy ±2 V before high-frequency compression sets in. As can be seen, the waveform stays symmetrical in shape when compression does occur, a desirable trait.

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The Vendetta's sound is very delicate and detailed, with great resolution but no sign of irritation and edginess.

Table I—Phono overload vs. frequency. Overload occurred at an output level of 15.0 V for all frequencies, and was the same for both channels and for instrument and IHF loads.

Frequency, Hz	Input, mV	Frequency, Hz	Input, mV
20	1.7	5k	40.0
50	2.2	7k	54.0
100	3.4	10k	76.0
300	8.3	15k	112.0
1k	15.8	20k	135.0
3k	27.0		

Table II—Referred input noise and IHF S/N ratios vs. source impedance.

Source Impedance and Bandwidth	Referred Input Noise, nV Left Channel	Right Channel
Zero Ohms		
Wideband	80.0	80.0
20 Hz to 20 kHz	40.0	43.0
400 Hz to 20 kHz	19.5	20.0
A-Weighted	20.0	21.0
10 Ohms		
Wideband	80.0	80.0
20 Hz to 20 kHz	50.0	55.0
400 Hz to 20 kHz	27.5	28.0
A-Weighted	28.3	28.3
100 Ohms		
Wideband	140.0	140.0
20 Hz to 20 kHz	110.0	110.0
400 Hz to 20 kHz	66.0	66.0
A-Weighted	67.0	67.0
	IHF S/N Ratio, dB	
10 Ohms	85.0	85.0
100 Ohms	77.5	77.5

Interchannel crosstalk was looked at, although one wouldn't expect to see any in a real dual-mono design such as this. Nary a trace of crosstalk could be found; the undriven channel just produced its amplified input noise.

Referred input noise as a function of source resistance and measurement bandwidth is given in Table II. As can be seen from the data, this circuit has very low noise. The noise measured over a bandwidth from 400 Hz to 20 kHz and with zero source resistance is right down there with the lowest I have ever measured. Vendetta Research claims an equivalent input noise resistance of 10 ohms—i.e., that increasing the source resistance from 0 to 10 ohms would increase the referred input noise by 3 dB. My measurements of A-weighted noise and of noise in the band from 400 Hz to 20 kHz bear this out.

A few miscellaneous measurements: The output impedance of the SCP-2B was found to be about 35 ohms, a very low value, and d.c. offset at the outputs was within 2 to 3 mV of zero.

Use And Listening Tests

Record playing equipment used to evaluate the Vendetta Research SCP-2B consisted of an Oracle turntable fitted with a Well Tempered Arm and Spectral MCR-1 Select cartridge. Other preamps on hand were a Berning TF-12 and my everpresent Cook-King reference unit (a tube phono preamp with a passive selector switch and stepped attenuator). Power amplifiers used were EAR 519, Berning EA-2101, and Cary Audio monoblock CAD-50SLs. Speakers used were pairs of Siefert Research Magnum IIIs and Martin-Logan Monolith IIIs.

I must admit that I liked the sound of the Vendetta unit when I first tried the "A" version a number of months ago. My listening notes from that experience indicated that I felt the sound was the best that I had heard from a solid-state phono preamp. Though the sound was different from my reference tube preamp as outlined below, I even went so far as to say that I would just as soon listen to the Vendetta. Blasphemy! What is going on here? The die-hard tube freak liking a solid-state unit just as much?

Now that I am reviewing the revised version, I can better describe what I currently hear. Since I didn't have both versions available at the same time, I really shouldn't comment on the presumed improvement in the "B" version, but I can say that the sound that I get with the present unit is very delicate and detailed, with great resolution. In fact, I get more of these qualities than with my tube phono preamp. What I really like about the SCP-2B is that the detail and resolution come without the irritation and edginess so common in preamps. On the other hand, the tube circuit seems to be a bit softer and puts a deeper, more believable space around things. If I compare the sound of the SCP-2B preamp with other commercially available preamps that I have listened to on my setup, I would put the Vendetta right up there with the best of them.

(I haven't expressed this thought before in these pages, but I can't help thinking of an analogy between the sound of the better pieces of audio gear and bottles of fine wine. With both, it frequently boils down to a question of which bottle of wine or audio component I want to enjoy at a particular moment rather than which bottle is rated "best" or which component is most accurate on an absolute basis.)

No operational surprises or glitches occurred in using the SCP-2B. Hum and noise were simply not present when playing levels louder than I would normally use. I would recommend leaving the unit on and powered continuously, as its best sound takes a while to develop.

In summary, I really think the Vendetta Research SCP-2B is a great piece of equipment. During the measurements, it performed excellently in every way and serves as an example of superior circuit design and what can be achieved by it. I have surely enjoyed using the SCP-2B and am seriously considering getting one for my own musical pleasure and to have as a reference. Give this unit a serious audition.

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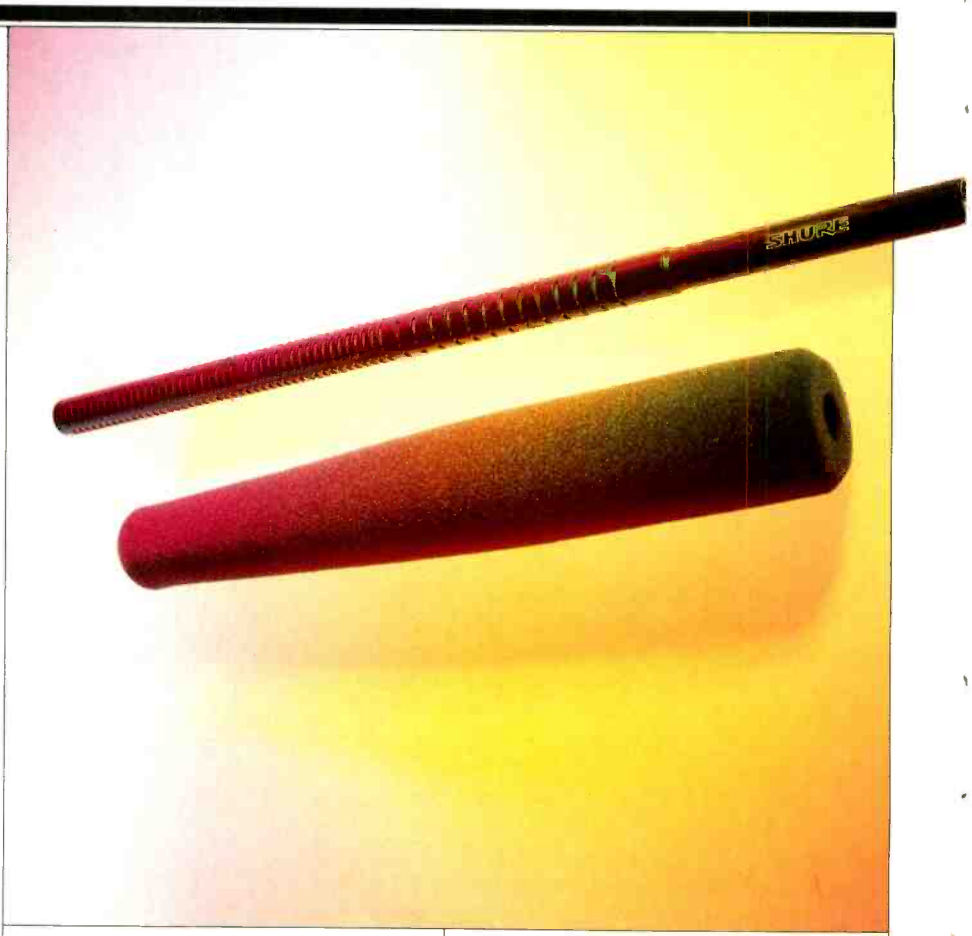
5

SHURE SM89 SHOTGUN CONDENSER MIKE



Manufacturer's Specifications

Type: Combination pressure-gradient and line.

Transducer: Electret condenser.

Frequency Range: 60 Hz to 20 kHz.

Polar Pattern: Hypercardioid at low frequencies, lobar at frequencies above 1 kHz; symmetrical about axis.

Output Impedance: 150 ohms nominal, 100 ohms actual; recommended minimum load, 800 ohms; minimum permissible load, 150 ohms.

Output Level at 1 kHz: Open-circuit voltage, −53 dB re: 1 V/μ bar (−33 dB re: 1 V/Pa).

Output Clipping Level and Maximum SPL Input (at 1 kHz for 0.5% THD): With 800-ohm load, −1 dBV (0.89 V) for 127 dB SPL input; with 150-ohm load, −12 dBV(0.25 V) for 119 dB SPL.

S/N Ratio: 79 dB re: 94 dB SPL.

Hum Pickup: Less than 3 dB equivalent SPL in 0.001-gauss (1 mOe) magnetic field at 60 Hz.

Output Noise: 16 dB equivalent SPL, A-weighted.

Polarity: Positive pressure on diaphragm produces positive voltage on XLR output connector pin 2 relative to pin 3.

Power Requirements: 11 to 52 V d.c. phantom power, 2-mA current drain.

Filter: Integral low-cut filter, switch-selectable 15-dB/octave roll-off below 60 Hz in "flat" position and below 160 Hz in roll-off position.

Operating Conditions: −20° to +135°F (−29° to +57° C), 0% to 95% relative humidity. Temperatures to 265°F (74°C) and relative humidity up to 80% acceptable for storage.

Dimensions: 13/16 in. handle diameter × 20⅝ in. long (2 cm × 52.4 cm).

Weight: 6.9 oz. (195 grams).

Supplied Accessories: Carrying case and foam windscreen.

Optional Accessories: Model A89SM shock mount; Model A57E swivel adaptor; PS1A power supply.

Prices: SM89, $900; A89SM, $90; A57E, $12.50; PS1A, $150.

Company Address: Shure Brothers, 222 Hartrey Ave., Evanston, Ill., 60202-3696.

For literature, circle No. 94

Shotgun, or line, microphones are designed for high directivity in long-distance sound pickup. While early models (see sidebar) used tubes 5 or 6 feet in length, modern units like the Shure SM89 use slotted or perforated tubes, about one-third as long as those of early shotguns, coupled to high-sensitivity transducers. These line microphones use the principle of wave interference to achieve their high degree of directivity. When a line mike is aimed at the source of sound, all the sound waves from that source entering the slots or holes in the line arrive at the transducer simultaneously, and audio putput is at its maximum. When the mike is angled away from the source, the sound waves reach the transducer at different times and cancel each other, minimizing audio ouput.

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With rated sensitivity 20 dB greater than dynamic mikes, the SM89 will get the same output 10 feet from a source as ordinary mikes at 1 foot.

Fig. 1—Output impedance vs. frequency with response switch set for "flat" (solid curve) and low-cut (dashed curve).

A line mike's directivity increases with frequency, so its pickup pattern is narrow at high frequencies and wide at low frequencies. This could result in nonuniform audio quality when picking up groups of performers or musical instruments. Shure, however, claims uniform frequency response throughout the SM89's sonic acceptance angle of 60°. They have minimized the problem of frequency-dependent directivity by designing this mike's line tube to have nonuniform acoustical impedance and by using a pressure-gradient transducer whose pattern at low frequencies is hypercardioid. This is indicated by the SM89's precisely machined slotted acoustic line, whose slots are spaced more widely at the transducer end.

Even before I got to that precise machining, the SM89 had impressed me as a high-quality product. That impression began with the sturdy, fabric-covered case the mike was packed in and continued with its tapered foam windscreen. The low-cut filter switch on the handle is semirecessed and the microphone is very light in weight. However, the microphone does not come with any mounting accessories (though a shock mount and swivel adaptor are available), and the user must furnish a cable to mate with the three-pin XLR male plug on the microphone.

In an article on the SM89 ("Reducing Off-Axis Comb-Filter Effects in Highly Directional Microphones," *Journal of the Audio Engineering Society*, June 1987), the author, Shure's Yuri Shulman, indicated that the mike's design also avoids the high-frequency roll-off and the comb-filter effects that can produce holes in the frequency response for sounds outside a line mike's narrow frontal angle of acceptance. Shure has conducted field tests in television studios and at location recording sessions that indicate response uniformity throughout a frontal angle of 60° is desirable so that aiming would not be overly critical.

The rated sensitivity of the SM89 is about 20 dB greater than that of an efficient dynamic microphone. Therefore, the SM89 will produce the same output at 10 feet from a person speaking that a dynamic unit will give at 1 foot. This output level is remarkably high for a small-diameter (less than ¾ inch) condenser microphone. To achieve this high sensitivity, the electret is charged to an equivalent potential of 180 V. The diaphragm, of gold-coated Mylar, is spaced 0.002 inch from the electret element on the backplate. According to Shulman, a charge of 100 V for each 0.001 inch of spacing is safe from electrical pop noise.

Measurements

As always, I first tested the SM89's electrical output impedance. For this and other tests, the microphone was powered by Shure's PS1 power supply, a 21-V unit listed on the SM89 data sheet as an acceptable option.

The constant-current test setup for impedance measurements (see "The Compleat Microphone Evaluation," *Audio*, April 1977) requires one of the microphone's output conductors to be grounded. To avoid shorting the d.c. on the mike leads, a heavily shielded 1:1 isolation transformer was used between the PS1 and the impedance test circuit. This introduced a small series resistance, which was measured by substituting a precision 150-ohm resistor for the mike and subtracting 150 from the measured total impedance. This value was then subtracted from the reading obtained with the microphone connected.

Figure 1 shows the actual impedance of the SM89. In the midrange, it was exactly 100 ohms, as specified. The rising impedance above and below this region suggests that the SM89 should be connected to a preamp whose input impedance is much greater than 100 ohms; otherwise, some bass and treble roll-off will result. Note that the low-cut equalizer setting does not affect the impedance of the mike.

Shure's specifications indicate that the SM89 will clip at lower input levels with low-impedance loads. However, many contemporary mixing boards, including several from Shure, will provide high enough input impedance and adequate powering for this mike.

Next, the frequency response in a free field was tested. Instead of measuring polar patterns at fixed frequencies, I measured frequency response at various angles. These curves are more meaningful than polar plots, whose curves are adjusted in size (normalized) so that the on-axis (0°) output is at the 0-dB reference point for all test frequencies. For this highly directional microphone, responses were measured at more angles than are used in testing an omnidirectional or cardioid mike.

The choice of distance between test source and mike is critical. The object is to select a distance where the arriving sound will be a plane wave (i.e., will provide a uniform sound level all over the microphone). Additional requirements are that this condition should apply down to the lowest frequency of interest (f) and that the testing distance should be at least four times the maximum dimension of the microphone. L. J. Anderson used a 28-foot testing distance for his early, 6-foot long mike ("A Line Type of Microphone for Speech Pickup," *Journal of the Society of Motion Picture Engineers*, March 1941). Shure and I both used a distance of 6 feet in testing the SM89, whose acoustical line is 16 inches long. At this distance, my large spherical sound source, which uses an 8-inch speaker, looks like a point source. Also, Leo L. Beranek's book, *Acoustic Measurements*, quotes Anderson as stating that the testing distance shall be at least 350 divided by f. If f equals 60 Hz, as it does here, 6 feet is an adequate distance for establishing plane-wave conditions.

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My sensitivity measurement was within 1 dB of the rated value, a sign of excellence in manufacturing as well as accuracy in measurement.

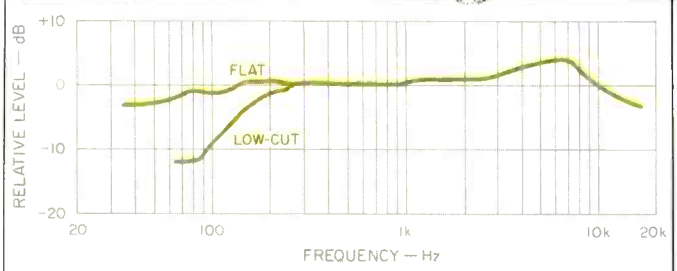

Fig. 2—On-axis frequency response and sensitivity. (The 0-dB point is 54 dB below 1 V/μbar.)

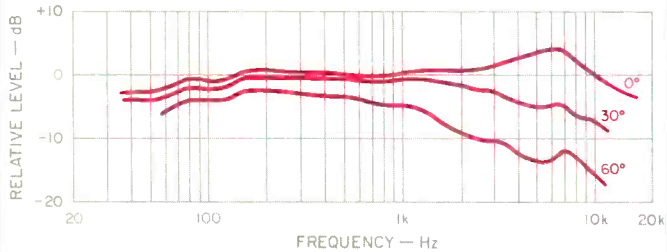

Fig. 3—Frequency response vs. angle for sounds orginating in front of the microphone.

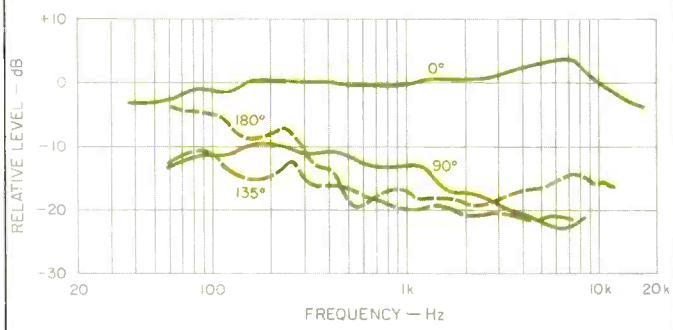

Fig. 4—Frequency response vs. angle for sounds from the side and rear.

I used my large sound source outdoors and calibrated it with the SPX Laboratory Ribbon microphone, as described in the September 1978 issue of *Audio*. This setup was used for the review of the Nakamichi mike system in that issue because it included a shotgun attachment. Later, in the March 1983 issue, this outdoor setup was used to test an early Crown PZM microphone. At that time, I added an RC equalizer to flatten the speaker response somewhat, making for easier interpretations of microphone curves. All tests with this source have been conducted at the 6-foot distance. I had to calibrate with the SPX mike as it has a figure-eight pattern, which cancels potentially troublesome reflections from the ground, just as the shotgun mike does.

Figure 2 shows the axial response of the SM89. Note that the sensitivity is only 1 dB lower than the specified value! I trust that this reflects excellence in manufacturing as well as accuracy of measurements. The slight rising response above 3 kHz is desirable in long-distance sound pickup to offset losses due to absorption by room materials and air. The low-frequency response below 60 Hz is flatter than Shure shows and would seem to indicate that the 60-Hz cutoff filter was not working when the switch was set to "flat." This is uncertain, as spherical-wave conditions below 60 Hz could have boosted the bass response. The roll-off setting does provide a rapid cutoff below 160 Hz, as specified. This should reduce low-frequency noise and reverberant bass boost in rooms without affecting speech quality.

Figure 3 shows just the front response curves of the SM89. The differences between the 0° and 30° curves are actually less than those seen in Shulman's article. However, the difference is 9 dB at the highest speech frequency, 6 kHz, and I was curious as to why Shure feels that these results represent uniform front response characteristics. For comparison, I measured the only shotgun on hand, a contemporary Japanese shotgun mike that is battery-powered and sells for perhaps one-third the cost of the Shure. On axis, its response rose steeply above 1 kHz, and at 30° off axis, the curve went downhill rapidly, developing a hole 25 dB deep at 8 kHz. I also noted in my September 1978 review of the Nakamichi CM-700 that its response with its shotgun attachment fell steeply above 7 kHz at 0° and at 30° fell rapidly above 4 kHz. All of this leads me to the conclusion that the test data on the SM89 probably represent adequate uniformity of frontal response. It is remarkable that Shure has been able to achieve good response to 15 kHz with the interference tube as an obstacle in front of the diaphragm. This is the first shotgun mike I have tested whose response seems suitable for music pickup.

The curves for side and rear frequency response are shown in Fig. 4. In this region, a desirable gaol would be 15 dB (or more) rejection of sound, as compared to the axial reference curve. I measured the SM89's 90° rejection as being less than 15 dB. However, reflections in the test setup can affect the results, and when 90° rejection is measured in my setup, the microphone faces a building that reflects sound. I note that in my 1978 review of the Nakamichi mike, the 90° rejection was also a little less than 15 dB. At low frequencies, I would accept as little as 10 dB of rejection, but the 180° rejection of the SM89 is less than 10 dB below 250 Hz. Shulman's test data show a similar trend at 180°, so

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The SM89's high output was astonishing. I had to use a very low mixer gain setting for loud speech 25 feet away!

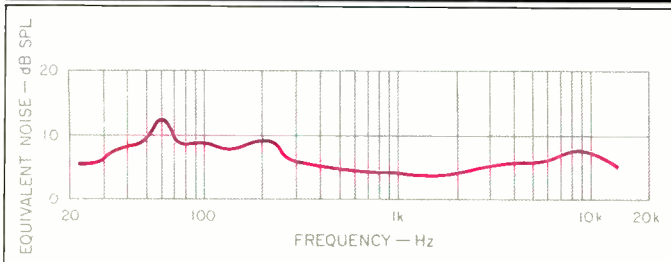

Fig. 5—Third-octave noise spectra of SM89 plus PS1 power supply. (The 0-dB point is 20 μPa.)

my results are probably indicative of this mike's hypercardioid-style rear lobe. (I note that both the Nakamichi shotgun mike reviewed in 1978 and the contemporary shotgun mike used as a comparison here show 10 dB or more of rejection in this range. Thus, I do not think the test setup suffers from a reflection.) This is a minor deficiency in the SM89, as the results for rejection at 90° and 135° are acceptable. The 180° rejection is of less importance. If you visualize a microphone's directional pattern in three dimensions, you'll see that while all points 90° and 135° off axis form circles, 180° is just a single point, directly to rear of the microphone.

The noise of the microphone and power supply was measured as described in the September 1978 issue. The microphone was put in a sound attenuating box, which in turn was placed in my quiet listening room (sound level less than 30 dBA). In this test, the isolation transformer had to be used, as my ultra-low-noise amplifier (the old vacuum-tube RCA OP-6 broadcast remote amplifier) has a grounded center tap. Figure 5, the third-octave spectrum, shows small peaks at the power-line frequency of 60 Hz and its harmonics, which were much attenuated by the A-weighted filter used for overall level measurement. Otherwise, the noise spectrum of the SM89 is uniform with frequency. The overall noise level was 17 dBA (equivalent SPL re: 20 μPa), which is incredibly close to the specified nominal value of 16 dBA. With no weighting (flat meter response), the noise was a quite acceptable 22 dB.

Use and Listening Tests

With some advice from the editor, I prepared a list of applications that *Audio* readers might have for a shotgun mike. In some of these cases, the mike would likely be used with a video recorder. The applications list includes: Recording music at long distances in auditoriums; recording indoor or outdoor events (a speech or concert); recording outdoor sounds (such as birds, animals, trains, or planes), and sound amplification of theatrical events at schools and churches.

To check out the mike's general characteristics before doing any serious taping, I set up the SM89 and a Shure mixer outdoors, monitoring the output through an amplifier and a pair of noise-excluding circumaural headphones. My nearby sound source was a five-year-old child, and there was plenty of ambient noise from traffic and other children. (There weren't any birds around—it was winter.) With the child 25 feet away and the mike pointed at him, his voice was heard clearly, with excellent quality, and was well above the ambient noise. At 30° off axis, sound quality and S/N were both good, supporting Shure's claims and my test data. When I pointed the mike 90° off axis from the child, I could only hear echoes of his voice from the building the mike was aimed at, plus ambient noise. Rejection of the sound source was good all over the rear hemisphere (90° to 270°). This simple set of tests indicated that the SM89 has

Historical Notes on Shotgun Mikes

The earliest commercial shotgun microphone I am aware of was introduced in 1937. It was 5 feet long, "in the form of an acoustic impedance element designed for easy attachment to the Western Electric 618A or 630A moving-coil microphone," according to W. P. Mason and R. N. Marshall of Bell Labs ("A Tubular Directional Microphone," *Journal of the Acoustical Society of America*, January 1939).

Dr. Harry Olson of RCA developed an experimental mike, 10 feet long and with five ribbon elements, at about the same time. In 1940, L. J. Anderson developed the RCA MI-3042, a 6-foot shotgun with multiple moving-coil transducers. Les Anderson recently told me that although the Olson mike was never produced, about 10 of the 3042s were manufactured. One 3042 was successfully used for long-distance pickup at a political convention. These early mikes used multiple pipes and were referred to as rifle or gun microphones.

Because they are used relatively far from the source, shotgun mikes need to have high sensitivity. One way to achieve it is with condenser elements, as used in RCA's Varidirectional condenser mike, introduced in the 1950s, which had a detachable line consisting of many small tubes of varying length. While moviemakers were one of the prime markets for which shotguns were designed, the Varidirectional was not very popular with them. Olson, inventor of this microphone, told me that it was "a law of physics" that a condenser microphone would, at some point, emit a pop sound. He indicated that the film people were afraid such an inevitable pop would occur during a long dialog scene.

The popular Electro-Voice 642, produced about the same time, used a dynamic element with heavy magnets to achieve high output. However, the weight of this mike made it difficult to use on a boom or pole.

Apparently, the early mikes were not successful because they were too large and heavy to use on a crowded movie set. The Shure SM89's half-meter length and its light weight are more suited to modern television and movie studio use, as well as for amateur and professional use with video or audio equipment. *J.R.S.*

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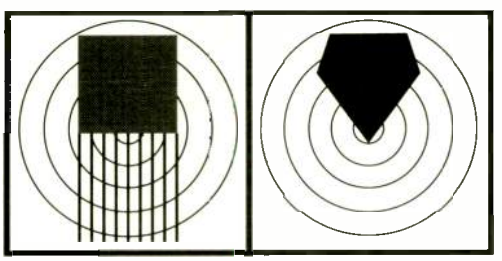

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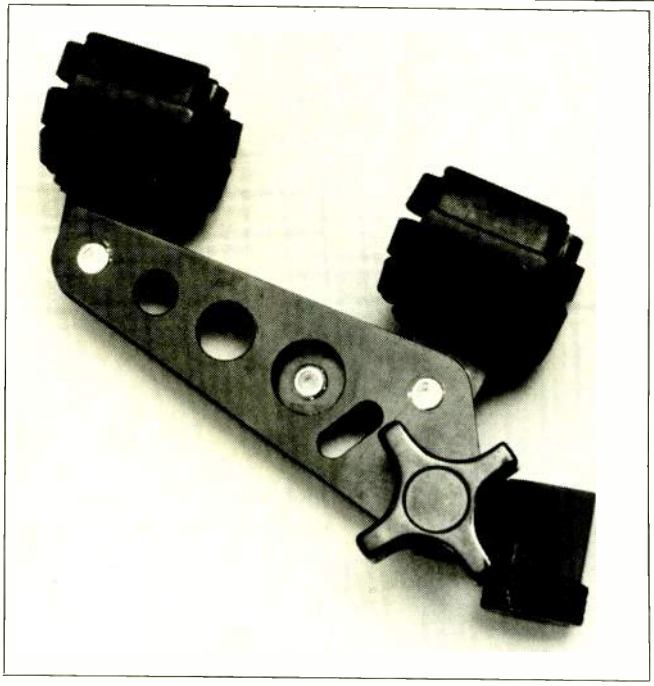

A89SM accessory shock mount

good sound quality throughout its 60° angle of acceptance and that it has adequate rejection of off-axis reflections and unwanted noise.

The high output of the mike was astonishing—the mixer gain had to be reduced to a low setting for loud speech at 25 feet! At 200 feet, I was able to hear children's (raised) voices fairly well above the ambient noise. The windscreen prevented noise from the 10- to 15-mph wind, and fast motion of the microphone did not cause any wind noise.

I recorded a concert with pipe organ, synthesizer, and piano in the United Methodist Church in Haddonfield, N.J. The SM89 was located at the rear balcony rail, which is 100 feet from the synthesizer and piano and about 120 feet from the organ pipes. Video cameras are frequently set up here, and videophiles report horribly reverberant audio using their camera-mounted mikes. I usually provide audio from a Soundcraft mixing board to the video recorders, derived from a permanently flown AKG C-422 stereo microphone, 20 feet overhead.

For this concert, the AKG was set for figure-eight patterns, and its capsules were angled 90° apart. The SM89 was set for flat response and connected directly to an Aiwa F990 cassette recorder. A simultaneous Beta Hi-Fi videotape was recorded from the console. I did not expect very good results from any mike at the balcony location, but the SM89 recording surprised me. The audio was fairly comparable to the AKG's with respect to high and mid-frequencies and reverberant quality. The principal difference was heavy and almost subterranean bass from the SM89 on pedal notes. Reasons for the bass boost include reverberant sound buildup at the long distance and reduced directivity of a shotgun at low frequencies. This is easily remedied by rolling off some of the extra bass with equalization in the recording mixer or by setting the SM89's filter switch to its roll-off position.

Next, an SM89, along with several old Nakamichi CP-703 shotguns, was set up in a high school auditorium for reinforcing a show. In this case, the mikes were aimed upward from the orchestra pit, and the reinforcement speaker overhead turned out to be only 60° off the microphone axes. In this test, all of the mikes gave useful reinforcement with adequate audio quality, but aiming was less critical with the SM89. Because the Nakamichi mikes had a narrower acceptance angle, they allowed more gain before the onset of feedback than the Shure did. To get full coverage of the show, the narrow pattern of the Nakamichis had to be overcome by using several of these low-cost mikes. Had SM89s been used instead, their broader pattern would have permitted fewer microphones to be used.

I highly recommend using Shure's accessory shock mount. It includes two of Shure's "half mounts" (which are the best mounts I've found for vocal mikes on stands) plus an all-important snubber to prevent cable noise. Prior to receiving the shock mount, I had mounted the SM89 on a desk stand for the concert taping. During the recording, I accidentally hit the table supporting the mike and stand. The resulting noise was very loud, as the mike was far from the sources of sound and the SPL at the mike was low. I suspect that this would not have happened had the shock mount been attached.

Regarding the possibilities for electrical pop noise, I did not hear a pop in several hours of listening. However, I did not test the microphone under adverse temperature and humidity. These conditions might have increased the chances for electrical popping.

The user may encounter some difficulty in removing the cable plug due to a rubber pad inside the barrel that prevents rattling of the connector when the mike is mounted on a boom.

I conclude that the SM89 is excellent for making high-quality recordings of concerts and events, particularly from the frequently unfavorable location of a video camera. Outdoor sound pickup is no problem, and collectors of nature sounds and other outdoor sounds will appreciate the mike's excellent fidelity and flexible-aiming capability. Because of its light weight, high fidelity, and remote powering, the SM89 can be used advantageously as a permanently flown mike above vocal groups and musicians. *Jon R. Sank*

Acknowledgements

I am grateful to Les Anderson for providing first-hand information on early shotgun microphone developments; to Jim Webb, Hollywood sound mixer, for digging out some early RCA and Bell Labs literature on shotgun mikes; to George Somes of San Diego, who provided some of that information; to A. J. May for trying the SM89 in the show application, and last (but not least) to my grandson Jonathan Seladones for his tireless efforts in generating sound outdoors. *J.R.S.*

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Mahler: "Des Knaben Wunderhorn" and "Songs of a Wayfarer." Dietrich Fischer-Dieskau, baritone; Berlin Philharmonic, Daniel Barenboim.
Sony Classical SK 44935, CD; DDD; 65:34.

This CD is part of the initial release of recordings on the new Sony Classical label. As I am sure you are aware by now, Sony bought CBS Records, and while most of the CBS facilities, technical personnel, and artist rosters have been retained, Sony has made some significant changes. Most notably, there has been an ambitious expansion of classical music recording. Sony is in the process of negotiating new alliances with prominent conductors, artists, and orchestras. The company has also shown more flexibility in the use of independent producers and recording engineers.

A case in point is this recording of Mahler lieder, which pairs veteran CBS Records producer David Mottley with engineer Michael Sheady. The very talented and perceptive Sheady has made many wonderful recordings for EMI and other record labels. His skill is evident in this superlative recording, which was made in the notoriously difficult acoustics of Berlin's Philharmonie.

On this CD, Daniel Barenboim conducts the Berlin Philharmonic Orchestra and Dietrich Fischer-Dieskau, the great German baritone, in Mahler's "Des Knaben Wunderhorn" (The Youth's Magic Horn) and "Lieder Eines Fahrenden Gesellen" (Songs of a Wayfarer). Unlike much German lieder, which is usually composed for a soloist with piano accompaniment, Mahler set these old German poems to large-scale symphonic orchestration. A curious cross relationship exists between his song cycles and his symphonies. For example, track 8 of the "Wunderhorn" cycle, "St. Anthony preaching to the fishes," is familiar as the second movement scherzo of his monumental second symphony, "Resurrection." Similarly, the music for the second and fourth songs of the "Wayfarer" cycle were used, respectively, for the first and third movements of his first symphony.

In the 12 tracks of "Des Knaben Wunderhorn" and the four tracks of "Songs of a Wayfarer" is a fascinating admixture of Mahler's musical utterances. As in his symphonies, there are frequent allusions to martial themes, especially huge, powerful marches. It is generally thought that this predilection comes from Mahler's youthful exposure to the "ruffles and flourishes" he heard from an army garrison near his home town. Mahler also had metaphysical leanings, and this is reflected in his preoccupation with dreams and death.

The music in these song cycles is intensely dramatic and runs the gamut of dynamic vocal and orchestral expression. Fischer-Dieskau has been preeminent in German lieder for a long time. Here, his performance is enthralling, as he is at turns passionate and tender. He still has wonderful control, whether applying his soft-edged falsetto or tackling the most vehement declamatory passages.

Although Barenboim is not regarded as a Mahler conductor, he seems quite at ease in this idiom. His accompaniment is very sympathetic, and he certainly gets some splendid playing from the Berlin Philharmonic. The smoothness of the high strings is especially noteworthy.

This disc is one of Sony's vaunted new 20-bit digital recordings. How much this contributes to the truly clean, transparent, and highly detailed sound is hard to say. The 20-bit digital master had to be processed through the Sony 1630 for CD production, which, of course, is restricted to the 16 bits of the PCM system. However, it is likely the 20-bit input ensured that all 16 bits in the 1630 were properly exercised and fully utilized right down to the least significant bit.

In any case, the sound is exemplary. Engineer Sheady has struck just the right balance between Fischer-Dieskau and the orchestra, with the voice always completely articulated. The placement of the orchestra in the Philharmonie is equally well gauged, with a warm ambience not usually apparent in other recordings in this hall. A stellar musical and sonic achievement, this CD is a must for Mahlerites. *Bert Whyte*

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The Modern Mandolin Quartet is on the musical mission of taking the mandolin away from bluegrass and into the classical realm.

Intermezzo. Modern Mandolin Quartet.
Windham Hill WD-1091, CD; DDD; 48:00.

The concept of a mandolin consort is a venerable one, stretching back at least to Renaissance lute and viol ensembles. Even in this country around the turn of the century and into the '20s, mandolin orchestras, playing popular and classical numbers, provided parlor and public entertainment. Enter *Intermezzo* by the Modern Mandolin Quartet—led by ex-David Grisman Quartet member Mike Marshall—with the mission of taking the instrument away from bluegrass and into the classical realm.

The MMQ's instrumentation includes two mandolins, mandola, and mandocello (look at the endings for the string quartet equivalents). Their program consists of arrangements ranging from baroque and Romantic selections (such as Bach's Fugue in G Minor, the finale to Haydn's String Quartet, Op. 64, No. 5, and Brahms' Intermezzo in A, Op. 118, No. 2) to more recent pieces (such as Bernstein's "Cool," Copland's "Hoedown," and Kodály's "Gavotte"). The most effective moment in the set comes with a shimmering rendition of Ravel's "Empress of the Pagodas." Unfortunately, the delicate voices, poor sustain, and limited dynamic range of these instruments make them sound more like tinkling toys than serious music makers in this context, despite the generally high level of musicianship. In the end, *Intermezzo* will more likely be viewed as curious kitsch than as the next big thing in the classical world. *Michael Wright*

The Young Bach. Michael Murray, organ.
Telarc CD-80179, CD; DDD; 58:17.

This is a surprising and wonderfully appealing Bach record from Telarc's organ genius, Michael Murray, spiritual scion of the great line of French Romantic organists and composers going back to César Franck. Murray's teacher and mentor was Marcel Dupré, the Frenchest of the French. Murray is an experienced and knowledgeable expert on the great French organists and organs of the last century, and of course his outstanding work has been in music of that sort.

Bach? Yes. They all play Bach. But when he started, Murray did it like the French: On organs that are inherently the extreme opposite of the great early Bach-period instruments.

I had considerable contact with this organist when Telarc was still known as Advent Records (an accidental conflict with the eastern-based Advent hi-fi). Murray made no bones about his dislike of the old mechanical (tracker) organs—the "modern" organ was so much better. His early tracker recordings (no doubt done to satisfy a demand) were not impressive, I thought. Wiser to let him play Bach as he knew

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Murray's playing, faultless and expressive, showcases the high colors created by the modern mechanical organ.

Bach, on the big monsters of the sonic art! There, his technique was fantastic, notably in the famous Toccata and Fugue in D Minor, which every organist must face down sooner or later.

All I can say is that Murray, who was and surely is a thoughtful and literate musician, has grown. Perhaps it was the Methuen organ, an intermediate mid-19th century instrument preserved from an earlier music hall in Boston? In any case, this recording of young Bach (always my own favorite!), played on a modern all-tracker mechanical organ in Minnesota built by Gabriel Kney, is faultless—expressive, appreciative of the high colors such organs create, and an altogether high-level model of "authentic" organ playing to match the very best. Try, for example, the ultra-familiar "Little G Minor" fugue, not much of a fugue (its theme is preposterously long) but an all-too-popular showpiece for organists. Murray takes it at a reasonable, thoughtful speed, and for once the silly piece makes its own best sense! The other, heavier or more brilliant pieces make the same sort of mature, thoughtful, maximum musical impact. Beautifully recorded, too, in Telarc's usual digital.

Edward Tatnall Canby

Tchaikovsky: Piano Concerto No. 1; Rachmaninoff: Rhapsody on a Theme of Paganini. Horacio Gutiérrez, piano; Baltimore Symphony Orchestra, David Zinman.
Telarc CD-80193, CD; DDD; 56:58.

These are outstanding performances, beautifully captured. Particularly if you're unaware of how the Baltimore Symphony has matured, you owe it to yourself to hear them. Its former "permanent" conductor (what an odd ring that term has in today's music world!), Sergiu Comissiona, certainly deserves some of the credit here, but Zinman is no slouch either.

It is Horacio Gutiérrez, however, who makes the recordings so very special. His sensibilities continuously remind one of Sergei Rachmaninoff (in, for instance, the electrical recording of his own Second Concerto with Stokowski). At the same time, Gutiérrez subtly suggests how these late Romantic works draw on inspiration derived from Mendelssohn and Chopin. There is a delicacy to the sentiment that is as utterly right as it is utterly honest.

By contrast, conventional performances—of the Tchaikovsky, in particular—are acts of brutalization. Several generations of pianists who have tried to out-pound the last of the Liszt pupils in the opening bars of this concerto (and the Grieg) have left us with a Romantic tradition focused too much on quantity at the expense of quality. While he certainly doesn't eschew a big sound, Gutiérrez here demonstrates what we have been missing.

Perhaps no recording of this music—even Rachmaninoff's of the Paga-

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nini Variations—can ever be truly definitive in the preemptive sense. The writing is intended, at least in part, as a vehicle, and thus is deliberately subject to the insights of individual performers. But I can think of no recording of either work that I could recommend more highly. Bravi tutti! *Robert Long*

Bizet: Carmen Suites Nos. 1 and 2; L'Arlesienne Suites Nos. 1 and 2. Ulster Orchestra, Yan Pascal Tortelier. **Chandos CHAN 8816,** CD; DDD; 65:26.

There are many recordings of the *Carmen* and *L'Arlesienne* suites on CD, performed by some of the most illustrious conductors and their famous orchestras. Nevertheless, if you are fond of this music, I can enthusiastically recommend this new Chandos recording.

Yan Pascal Tortelier, the new conductor of the Ulster Orchestra in Belfast, is the son of cello virtuoso Paul Tortelier. This recording is one of a series in a survey of French music Chandos will record with Tortelier and the Ulster, with financial help from a Belfast corporate sponsor.

Tortelier does not treat this music as inconsequential "bon-bons," but offers finely crafted readings, with plenty of Gallic flair and fervor. The playing Tortelier elicits from his orchestra is quite extraordinarily refined from what is essentially a provincial orchestra.

Chandos makes some of their very best-sounding recordings in the Ulster Hall. This exceptional venue has a lovely, warm, and spacious ambience that imparts a wonderful "bloom" of realism of every orchestral element. High strings are sweet and smooth, celli and contrabasses are richly resonant; woodwinds are superbly clean, brass strong and assertive. This is a high-level recording with very wide, highly expressive dynamics. In short, this is the sonic exemplar for this delightful music. *Bert Whyte*

Fernando Sor: Werke für Gitarre. Tilmann Hoppstock.
Signum SIG X14-00, CD; DDD; 51:33.
Sound: A Performance: B –

Ponce: Variations. Eduardo Fernández.
London 421 816-2, CD; DDD; 56:31.
Sound: A Performance: A

Two new recordings, one by Tilmann Hoppstock and another by Eduardo Fernández, reflect curiously contrasting approaches to making classical guitar records.

Tilmann Hoppstock's *Fernando Sor: Werke für Gitarre* takes an academic approach, offering a program of music by one of the guitar's great Romantic composers. Presented are the ubiquitous Variations on a Theme of Mozart, Op. 9 (with a rarely heard introduction); 12 études; Bagatelle and Etude, Op. 43, No. 35; Sicilienne and Allegretto, Op. 33, No. 35, and the concert piece,

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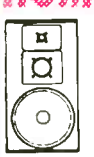
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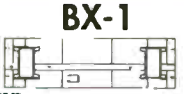

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Eduardo Fernández offers just about everything you could want in a guitar album, with fresh material and exciting ideas.

Introduction and Variations on "Nel cor piu non mi sento," Op. 16. Hoppstock, who is 29 and studied with Eliot Fisk, has mastered his technique, playing cleanly and aggressively in a way that would rarely be heard in a young player even 10 years ago. What's lacking, however, is a sense of adventure, of interpretation. One is left wanting something more . . . Romantic. Although some uncommon pieces are included, his choice of an all-Sor program doesn't help. Sor is technically demanding, but Beethoven he wasn't, and an hour gets to be long.

Eduardo Fernández' *Ponce Variations*, on the other hand, pursues a thematic approach, playing a cross section of works by Latin American composers. Fernández, who is well known in international guitar circles, offers just about everything you'd want in a guitar record, with fresh material and exciting ideas. The 22-minute Variations and Fugue on "La Folia," by the Mexican composer Manuel Ponce, is moderately familiar but not overdone. Fernández carries off its sweeping landscape with intelligence and verve. From the pen of Cuban Leo Brouwer, Fernández has chosen 1981's "The Black Decameron," three exquisitely delicate and sweetly melodic pieces that use touches of modern harmonies for coloration but are fairly conservative and free of the percussive tricks that mark much of Brouwer's earlier work. More contemporary sounds are found on "Gandhara" by Uruguay's Héctor Tosar and Jaurés Lamarque-Pons' Sonatina. A rousing Latin Batucada by another Uruguayan, Isaias Savio, concludes this impeccably played and recorded set.

If you're a guitar fanatic, you'll probably find Tilmann Hoppstock's record interesting, if not particularly moving. If you just like a good round of classical music and like to hear something new, Eduardo Fernández' record will reward your efforts. *Michael Wright*

Tchaikovsky: Symphony No. 4; Serenade for Strings. Bornemouth Symphony, Andrew Litton.
Virgin Classics VC 7 90798-2, CD; DDD; 75:21

This disc is a good example of Virgin Classics' values: An excellent performance group playing first-class repertory, captured cleanly (though perhaps with marginal overstatement) in reasonably believable acoustics and with outstanding dynamic range. In case you hadn't heard, the Bornemouth is a world-class orchestra, and Litton leads it with panache and efficiency.

The end product has something of the luster of burnished chrome: A good deal of glitter, but not a lot of warmth or emotional depth. If heart is the first thing you demand in Tchaikovsky, this may not be the recording for you. If you want a very fresh version of these favorites, then give it a try. *Robert Long*

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PENTANGLE: A NEW ANGLE

So Early in the Spring: Pentangle
Green Linnet GLCD 3048, CD; AAD; 44:07 (available from Green Linnet, 43 Beaver Brook Road, Danbury, Conn. 06810).

Sound: A Performance: B

Around 1968, when popular folk music had pretty much been forced underground by heavy psychedelic indulgence, a basket of light appeared called Pentangle. Fusing traditional English music with a bit of rock and jazz, the group was the last gasp of the '60s folk movement before it returned to the festivals from where it came. Twenty years or so later, Pentangle has reformed as a quintet and released *So Early in the Spring* under the aegis of original vocalist Jacqui McShee and guitarist/vocalist Bert Jansch. Notably missing are guitarist John Renbourn and bassist Danny Thompson.

The new Pentangle is recognizably similar, although both they and the world have changed much through the years. Their set, as before, consists mainly of arrangements of traditional songs and several original compositions. McShee's distinctively sweet, crystal clear voice rings out on the title cut, "The Blacksmith." At brief moments, as on "Gaia," she almost gathers the power of Joan Baez or Joni Mitchell. Jansch contributes an additional, folksy vocal on "Lucky Black Cat" and "The Baron of Brackley," but his real presence is felt in the fingerstyle guitar for which he's become so well known. There's one instrumental, "Eminstra." The album's highlight is the enthusiastic and rhythmically intriguing remake of "Bramble Briar," one of their best songs.

Despite this wonderful reunion of McShee and Jansch, the new Pentangle isn't the old one. New bassist Nigel Portman Smith manages to capture much of Danny Thompson's trademark swooping lines. But the emphasis is more on a folk-rock sound, without the exotic percussion or a capella tours de force that made the original group so inspiring. Almost all arrangements contain electric guitar leads by Rod Clements, which is fine, but he fails to distinguish one from another.

Well, things change. *So Early in the Spring* isn't a bad record by any means but gone with the boldness is some of the spirit. If you want to experience the greatness of Pentangle, search out the original records.

Michael Wright

Fakebook: Yo La Tengo
Bar/None 7 72641-2, CD; AAD; 44:24.

Sound: A Performance: A–

Hoboken, New Jersey's, Yo La Tengo enjoy a growing reputation in alternative music circles for their varied and intelligent approach to music, and for having evolved quickly from noisy guitar-driven rock. *Fakebook* finds the quartet in their most folk-oriented manifestation yet, peforming covers (hence the album title) of some of their favorite tunes along with a few originals.

Performing unpretentious arrangements with acoustic (sometimes electric) instruments, Yo La Tengo's vision includes country-style renditions of The Flying Burrito Brothers' "Tried So Hard," folk-rock renditions of Peter Stampfel's "Griselda," a Byrds-flavored version of the Flamin' Groovies' "You Tore Me Down," early '60s pop with Cat Stevens-cum-Tremoloes' "Here Comes My Baby" and the more contemporary "Yellow Sarong" by The Scene Is Now, and a gospel R&B satire of Rex Garvin and the Mighty Cravers "Emulsified." Very fetching are the mostly acoustic conceits of Daniel Johnston's "Speeding Motorcycle" and John Cale's "Andalucia." Two of the band's previously-recorded songs are reinterpreted here as well—a pleasant jam on "Barnaby, Hardly

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Lloyd Cole: Lloyd Cole
Capitol C11H-92751, LP.

Sound: B+ Performance: B+

Lloyd Cole's backup group, The Commotions, is gone but the commotion remains. Deservedly. After a hit maker stint in his native Britain a year or three ago, Cole has transplanted himself to New York, and his solo debut melds these two worlds' sensibilities in a rare but welcome way: Jaunty music, thoughtful lyrics.

"Thoughtful" can easily mean self-indulgent and pretentious, but that's not the case here. Cole has an observer's eye for specific details, and that gives his lyrics a ring of firsthand experience. Coupled with imaginative but understated arrangements, and accentless, unadorned vocals that lend an otherwordly feel, those lyrics become all the more compelling.

"A Long Way Down," for example, opens with a relatively long but uninsistent string instrumental that's somehow rich without being lush or syrupy—a feat of terrific preciseness. It sets the stage like a movie soundtrack on an establishing shot, right before we meet the hero or, better put, the protagonist, because heros aren't too plentiful in Cole's vision of the city and the world.

Most of the songs are like that, focusing on one or two people at a moment when time stands still—moments of private epiphanies. In "Undressed," it's a cozy lover's morning without responsibilities, but too much time for thought: "You look so good when you're depressed," Cole sings. It's the kind of thing one says when you're laying warm and happy and comfortable enough to say something honest and stupid. "No Blue Skies" takes a standard romantic pop song melody, slows it a touch to give a sinister undertow and a sad tension, and then presents us a supposedly resigned lover at the end of a love affair, outwardly calm but so torn up inside he wants "to tear the stars out of the sky."

Cole and his musicians are delicate yet forceful, in an acoustic-dominated mode. Synthesizers pop up but unobstrusively except for the brooding "To the Church"—a minor distraction in an album that successfully walks the hairline between melancholy and the blues. *Frank Lovece*

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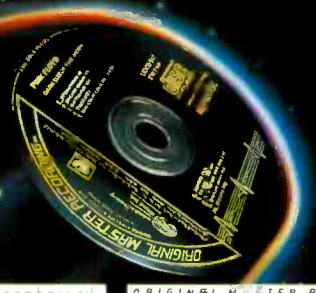

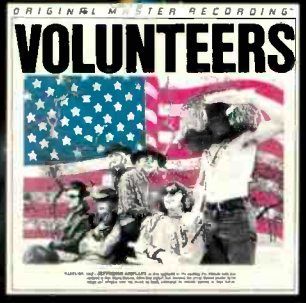

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LONG LOST LENNIE

Live in Toronto 1952: Lennie Tristano Quintet
Jazz Records JR-5CD, CD; ADD; 46:47.

Sound: C+ Performance: A–

The music of pianist Lennie Tristano remains, much like that of counterpart Bill Evans, one of the jazz genre's wondrous joys. Subtly influential, the late New Yorker's music found a special niche. Much like Monk, Tristano was iconoclastic, his motives and sentiment often misunderstood, his note choice, his phrasing and composing quite atypical and individual. Though a quintessential East Coaster, there was a part of the pianist that fit easily into the West Coast's "cool" school. Lennie Tristano's playing always sounded forward-thinking, yet he drew heavily from Art Tatum.

As on *Live in Toronto 1952*, the pianist surrounded himself with a coterie of instrumentalists on whom he relied and with whom he often played. Present are his two favorite hornmen, tenor saxophonist Warne Marsh (recently deceased) and altoist Lee Konitz, who, along with reedmen such as Gary Foster, are carrying the Tristano torch into the '90s.

This live endeavor is a typically fine example of Tristano & Co.'s fluid approach. While at points the sound quality falters and distracts (most often heard via poor miking of Ed Levitt's trap set and occasional wavering modulation), Tristano's lucidity dominates, exemplified through the unison lines between Marsh and Konitz. The ensemble's smooth presentation, whether on ballads such as "You Go to My Head" or uptempo smokers such as "Lennie's Pennies" and one of the pianist's classics, "317 East 32nd" (the location of Tristano's personal recording studio), continuously entices. Levitt's often-employed brushes (on Konitz's "Sound-Lee," for instance) underscore the ensemble's musicality.

In addition to "317 East 32nd Street," at least one other Tristano favorite, "April," is included. As is the case with numerous originals, it's a piece that Tristano and, subsequently, Konitz recorded often and tinkered with throughout their careers.

There is something I've always found intriguing and mysterious about Tristano solos: They're crafty, and their complexity belies the ease of delivery. Fortunately, many of the half-dozen selections on *Live in Toronto 1952* house Tristano's mellifluous and satisfying work. Engineering flaws/limitations do detract from this recording. However, not so much so that this wondrous music shouldn't be heard. (Jazz Records' address is P.O. Box 30273, New York, N.Y. 10011-0103.) *Jon W. Poses*

Dresses Too Short: Bobby Radcliff
Black Top BT 1048, CD; AAD; 41:43.

Sound: B+ Performance: B–

Add some tape hiss and stray pops to this music, and *Dresses Too Short* might be mistaken for a long-lost '60s Buddy Guy session. Guitarist Bobby Radcliff's debut album crackles with dynamic, crisply performed, vintage Chicago blues.

There's just one small problem—it's all been done before to perfection. Radcliff performs not only Guy's material but also employs his guitar tone, phrasing, and even his instrumental flourishes. From the back of a bar, Radcliff's vocals could pass for Guy's. If that's not sufficiently imitative, he repeats the feat with the music of Jimmy Dawkins and Otis Rush. It's no surprise to learn that his stage act once included a segment in which he impersonated several bluesmen. You can't fault Radcliff's choice of idols, for Chicago's West Side guitarists created a timeless, cutting style that dominates modern blues and contributed to today's rock. Yet if Radcliff has mastered his heroes' riffs and learned their lyrics, he's missed their message: Speak your own piece when playing the blues.

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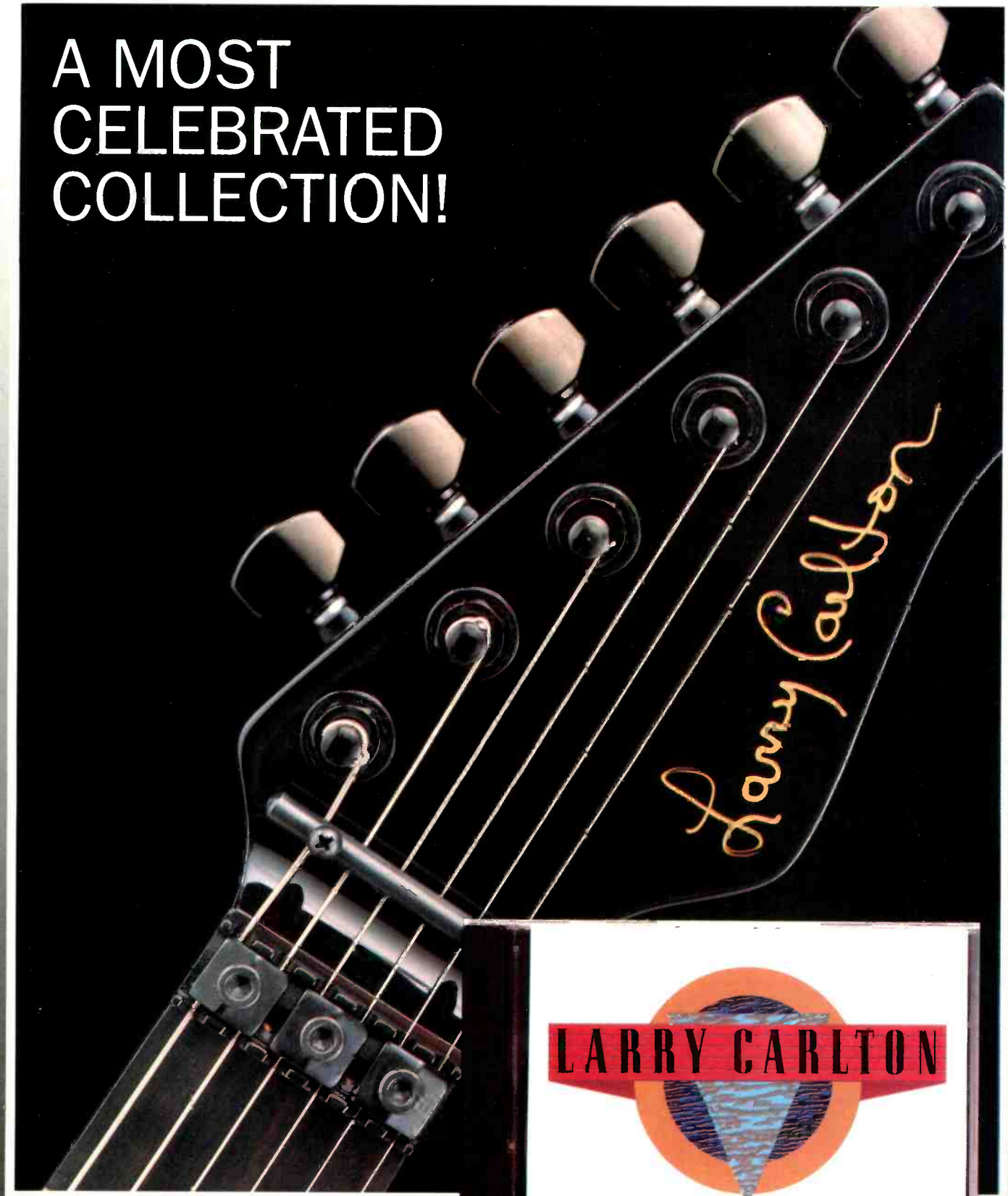

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The debut recording of Bobby Radcliff crackles with his dynamic and crisply performed vintage Chicago blues.

Listen to this album after Buddy Guy's *I Was Walking Through the Woods* (MCA/Chess CHD-9315), and Radcliff reminds you of a kid pretending he's a grownup by dressing up in his father's clothes. You'll wince when the Maryland-born musician goes so far as to sing "noive" for "nerve."

There's clearly substantial talent here, and *Dresses Too Short* has more to recommend it than a number of other contemporary albums. Still, there's not much originality. Radcliff needs the equivalent of a musical kick in the pants. He should cut his next set in Chicago with veteran local sidemen who won't tolerate a carbon copy. Although he'll be put on the spot, I bet that he'll come through nicely.

Roy Greenberg

Is That You?: Bill Frisell
Elektra/Musician 9 60956-2, CD; ADD; 51:53.

Sound: B Performance: B–

The '80s was Bill Frisell's decade. The guitarist, once a little-known sideman playing with jazz intellegentsia such as Jan Garbarek, Paul Motian, and Paul Bley, became a leader in his own right, with albums on ECM Records and, now, Elektra/Musician. In addition, his name is often spoken in the same breath as avant-garde *enfant terrible* John Zorn. Frisell has played with Zorn for the last several years, most recently in the highly acclaimed Naked City band.

It's Zorn's influence that pervades *Is That You?*, a title that might be turned on the guitarist himself. Frisell's composition style is clearly indebted to Zorn, with its sudden shifts of form and rampant use of musical quotations from pop, jazz, classical, and film sources. One minute he's paraphrasing Kurt Weill on "Hello Nellie." The next he's turning Henry Mancini's sentimental "Days of Wine and Roses" into distended abstractions which barely reveal the melody. Then he changes "Chain of Fools" into a heavy metal screamer.

"No Man's Land" signals that this isn't a free-for-all electric blowing session. Frisell uses spacious architecture with odd corners and disjointed fragments. There's a sense of danger lurking through the next door, which he usually bursts open with slicing guitar work. All this sounds too disjointed to be composed and too angular to be improvised.

As one of the leading electric guitarists of the day and a gifted conceptualist in his own right, it's inevitable that *Is That You?* has many startling finds near the kitchen sink that Frisell has thrown into this recording. "Half a Million" is a languid, laconic reverie where Frisell displays more nuances within a single bent note than many guitarists find in an album's worth of solos. "Someone in My Backyard" could have stepped out of a recent John Zorn album with

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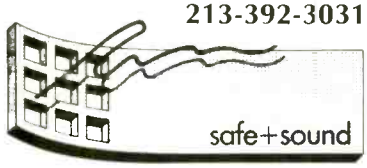

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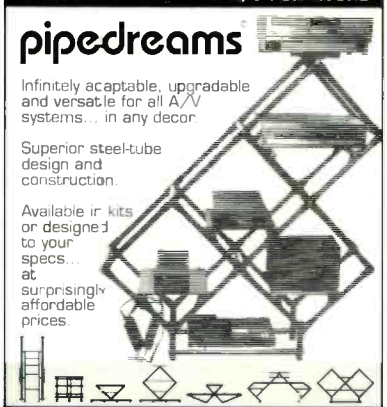

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Bill Frisell uses spacious architecture with disjointed fragments and odd corners on *Is That You?*

psychedelic blues scrambled in free-form scrawls and raw bluegrass banjo. The title track is an imagistic homage to slide guitarist Ry Cooder, with a misty bayou ambience for multiple electric and acoustic guitars.

Frisell uses sparing instrumentation, with keyboardist Wayne Horvitz adding texture and shadows to Frisell's angular lines while drummer Joey Baron shuffles the rhythmic shifts like a card shark.

Frisell tried too hard to answer the question his album posits, attempting to reconcile too many influences and experiences on one record. On *Is That You?* we hear parts of Bill Frisell, but we don't hear the sum. *John Diliberto*

Malayan Breeze: The Dolphins
dmp CD-474, CD; DD; 56:08.

Sound: B+ Performance: B–

The Dolphins' recording premiere on dmp (Digital Music Products) is indicative of much of what is both positive and negative about electric jazz as it is rendered by this group and others, including Kenny G., Pat Metheny, and Stanley Jordan. That said, first the good news.

Malayan Breeze is a 10-song collaboration written, arranged, and co-produced (with Tom "Dr. Digital" Jung) by The Dolphins. The four-piece act consists of Rob Leon, bass; Vincent Martucci, keyboards; Mike DeMicco, guitar, and Dan Brubeck, drums. All are young veterans who have played with a wide circle of well-known musicians ranging from Jack DeJohnette to Warren Bernhardt to Paul Butterfield. Keyboardist Martucci contributed the bulk of the material, which also includes efforts by DeMicco and a revamped working of Dave Brubeck's "Blue Rondo á la Turk" (drummer Dan is composer/pianist Dave's son).

The positive side of these mid and uptempo, atmospheric (*not* New Age) jazz pieces is how flawlessly and technically proficient these studied and well-schooled musicians play. DeMicco and Martucci, who are responsible for most of the melody structures and solos, especially showcase their talents as they smoothly segue from rhythm support to intricately developed solos.

The downside of this album is that the tight, textbook-perfect, note-clustered solos and arrangements leave too little room for heart and emotion. Even Dave Brubeck's "Blue Rondo á la Turk" loses the fire it had when originally touched by that jazz prince's "flame of cool."

Most of *Malayan Breeze* sounds as if each composition had been charted so exactly beforehand that each note falls into its preplanned place on schedule—unruffled and untouched by human emotions. The rhythm section of Brubeck and Leon seems, at times, to want to deviate from the written structure and raise the music to a higher and more visceral level but seems confined by the arrangements. Jazz is at its best when technical expertise and risk taking become inseparable, with each player urging the other to step beyond the prescribed limits of the music. No danger, no magic.

The sense of sonic immediacy you hear on this CD is due to its having been digitally recorded "live to two-track." However, astute listeners will notice that there are more parts than four musicians could play at one pass, so, in fact, overdubs were utilized on this recording. I have to assume that Jung first recorded the basic tracks onto one two-track and then simultaneously recorded them along with new solo and additional chordal parts onto a second digital two-track. I would have preferred the musically riskier live feel of one live pass without the overdubbed parts or even of having the chordal support sections preprogrammed and sequenced via MIDI. Nevertheless, Jung makes it all work.

The Dolphins are an excellent electric jazz group. They play extraordinari-

Photograph: ©David Gahr

ly well and therefore deserve to gather a substantial audience. However, they could rise to greatness if, next time out, they take the music more to heart.

Hector G. La Torre

Abbey Sings Billie: Abbey Lincoln
Enja R2 79633, CD; AAD; 56:58.

Sound: B+ Performance: B+

For far too long, particularly with the recent resurgence in popularity of female vocalists (i.e., Carmen McRae, Betty Carter, and Cassandra Wilson), Abbey Lincoln (also known as Aminata Moseka) has not received her just desserts. In more than three decades since her beginnings and earliest days with drummer Max Roach, Lincoln has enjoyed taking risks; consistently, whether on stage or in studio settings, she's placed herself in one integrity-filled situation after another. Some failed commercially; few, if any, fell short artistically.

Abbey Sings Billie is Lincoln's personal tribute to Lady Day. Recorded with a quartet in 1987, it is a further example of Lincoln's approach to her craft. Again, she demonstrates the ability and the need to draw more attention to the rich jazz tradition than to herself. Presented by Cobi Narita's New York-based Universal Jazz Coalition, the 10-song set includes eight vocal interpretations of Holiday material and, curiously, two lengthy instrumentals by her accompanists, the late tenor saxophonist Harold Vick, pianist James Weidman, bassist Tarik Shah, and drummer Mark Johnson, which close out the set. Admittedly, the inclusion of a 10-minute reading of Mal Waldron's "Soul Eyes" fits. After all, the expatriate keyboardist was Holiday's last pianist, working with her from 1957 until her death two years later. Also proper is the nine-minute instrumental rendition of Harold Arlen's "Ill Wind," a tune Holiday recorded in 1956. But to place them at the conclusion, instead of incorporating them into the program, doesn't make sense aesthetically.

As for Lincoln, she possesses a complex style that is less obvious, perhaps less likable, than her counterparts. Initially, many may find her throaty approach and unique phrasing difficult to absorb. However, her delivery is very decisive and ultimately it grows on you. Personally, I find that Lincoln's prowess as a singer provides a great deal of satisfaction. Here, she seems quite calm and relaxed whether she's leading the uptempo "What a Little Moonlight Can Do," the classic Billie ballad "Lover Man," or the chant-like, haunting, and ominous "Gloomy Sunday."

As for Lincoln's quartet, Vick's unexpected death a couple of years ago looms as a tragic loss to the jazz community. A hard-edged tenor player, he was stylistically well versed, sounding at times like he had studied Illinois Jacquet and Johnny Griffin. On *Abbey Sings Billie*, Vick is steeped in Coltrane, not only during "Soul Eyes" (Waldron, the composer here, also worked with Coltrane) but also on "Strange Fruit" and several other selections. Also worth noting is Dexter Gordon's influence on Vick's playing; the appropriate, spacious sound becomes most apparent on "I Only Have Eyes for You."

The rhythm section is adequate, but except for an occasional spark from drummer Johnson, it fails to reach the improvisational level that Lincoln and Vick attain throughout. Thus, sometimes the band sounds ordinary, if not lackluster. Still, *Abbey Sings Billie* remains noteworthy.

Jon W. Poses

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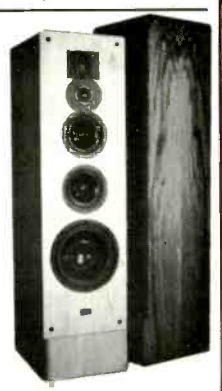

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GENERAL INFORMATION—Ad copy must be typewritten or printed legibly. The publisher in his sole discretion reserves the right to reject any ad copy he deems inappropriate. **ALL ADVERTISERS MUST SUPPLY:** Complete name, Company Name, Full street address (P.O. Box numbers are insufficient) and telephone number. Classified ads do not carry Reader Service Card Numbers. Frequency Discounts not fulfilled will be short rated accordingly.

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DISPLAY ADVERTISERS should make space reservation on or before the closing date. Ad material (film or velox) may follow by the tenth. DISPLAY ADVERTISERS MUST SUPPLY CAMERA READY ART. PRODUCTION CHARGES WILL BE ASSESSED ON ANY AD REQUIRING ADDITIONAL PREPARATION.

ALL DISPLAY CORRESPONDENCE should be sent to:

Carol A. Berman, AUDIO MAGAZINE
1633 Broadway, New York, NY 10019

FOR RATES & ADDITIONAL INFORMATION:
DISPLAY ADS: Carol Berman (212) 767-6292
CLASSIFIED LINE ADS: 800-445-6066

ANNOUNCEMENTS

ALLEGRO SOUND is moving. Over 100 hard-to-find **CLASSIC & HI-END** items must be sold. Call/write for **FREE** printout. 15015 Ventura Blvd, Sherman Oaks, CA 91403 (213) 859-5543.

AUDIO CLASSICS

Precision Stereo Components Bought-Sold-Traded-Repaired-Modified. Authorized Dealers for Acoustat, Audio Control, Counterpoint, Dahlquist, Hafler, JSE, KEF, Lexicon, Magnum Dynalab, Philips, Stax, Velodyne. **AMPLIFIERS:** audio reseach D75N $800; conrad-johnson MV100 $2299; Counterpoint SA220 Demo $2495; Crown D150A $349; Hafler XL280 Demo $549; Krell KSA80B $2700; KSA100 $1675 KSA200B $4500; Lazarus H1A ($1920) $1549; Marantz 8 $600; McIntosh MC225 $600, MC240 $1000, MC250 $350, MC275 Bid, MC752 $675, MC2205 $1400, MC2505 $450; Precision Fidelity M7A $500. **BOOKS:** on audio Bought-Sold-Traded. **CD PLAYERS:** Adcom GCD575 ($600) $399; Denon DCD3300 $500; Hafler Iris Demo $469; McIntosh MCD7000 $800, MCD7007 $1500; Nakamichi OMS4 $400; Philips Demos CD40 $249, CD50 $300, CD60 $399, CD80 $675; Sony CDPX7ESD $1200; Stax Quattro II $1999. **EQUALIZERS:** Audio Control, all models; McIntosh MQ101 $175, MQ104 $175, MQ107 $400. **INTEGRATED AMPLIFIERS:** McIntosh MA5100 $349, MA6100 $550, MA6200 $1200; Philips DFA980 Demo $649. **PREAMPLIFIERS:** Adcom SLC505 New $125; Counterpoint Demos SA1000 $795, SA2000 $1335; Hafler Iris Demo $649; McIntosh C20 $600, C28 $450, C29 $850, C31V $1200, C34V $1700; Philips DAC960 Demo $699; Precision Fidelity C7All $330. C7AR $330; PS Audio IV $325; Threshold FET Ten/HL ($3000) $1899. **PROCESSORS:** Sansui DS77 $199; Shure HTS5000 $284; Yamaha DSP3000 $700. **RECEIVERS:** McIntosh MAC1700 $399, MAC1900 $499, MAC4280 $1500, MAC4300V $2200. **SPEAKERS:** Acoustat Spectra 11 ($1095) $899, Spectra 22 $1099; Bowers Active 1 $1200; Dahlquist Demos DQ8 $728, DQ20i $1714; Infinity RS2.5 $999; JSE 1 $600, 2 $1500; Magnepan 1D $800; McIntosh ML1C $450, XR19 $3000, XL1W $399; Theil CS3 $1199, 3.5 $2120; Velodyne ULD12 $1095, ULD15II $1669, ULD18 $2195. **TAPE DECKS:** Philips FC40 $259, FC50 $329, FC60 $499. **TEST EQUIPMENT:** Free Catalogue. **TUNERS:** Adcom GFT555 ($300) $225; Hafler SE130 $325; Magnum Dynalabs FT11 $325, FT101 $499. McIntosh MR65B $299, MR67 $500, MR71 $600, MR77 $750, MR78 $1200, MR500 $800, MR510 $900, MR7082 $1200. **TUNER PREAMPS:** McIntosh MX110 $299, MX112 $449, MX113 $499. **TURNTABLES:** Sonograph SG3MT w LMT arm $595; Thorens TD126 III $400; VPI HW19 JR w MMT arm $789, HW19 III $975. **FREE Catalogue.** Layaway Program. Major Credit Cards accepted 8AM-5PM EST Mon.-Fri., **AUDIO CLASSICS,** POB 1766AAA Walton, NY. 13856.

607-865-7200

—Audio Advertiser for over a Decade—

ANNOUNCEMENTS

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It is impossible for us to verify all of the claims of advertisers, including product availability and existence of warranties. Therefore, the following information is provided for your protection.

1. Confirm price and merchandise information with the seller, including brand, model, color or finish, accessories and rebates included in the price.

2. Understand the seller's return and refund-policy, including the allowable return period and who pays the postage for returned merchandise.

3. Understand the product's warranty. Is there a manufacturer's warranty, and if so, is it from a U.S. or foreign manufacturer? Does the seller itself offer a warranty? In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, what do you have to do, and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.

4. Keep a copy of all transactions, including cancelled checks, receipts and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.

5. If the merchandise is not shipped within the promised time or if no time was promised, 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.

6. Merchandise substitution without your express prior consent is not allowed.

7. If you have a problem with your order or the merchandise, write a letter to the seller with all the pertinent information and keep a copy.

8. If you are unable to obtain satisfaction from the seller, contact the consumer protection agency in the seller's state or your local U.S. Postal Service.

If, after following the above guidelines, you experience a problem with a mail order advertiser that you are unable to resolve, please let us know. Write to Scott Constantine, Advertising Director, at AUDIO Magazine. Be sure to include copies of *all* correspondence.

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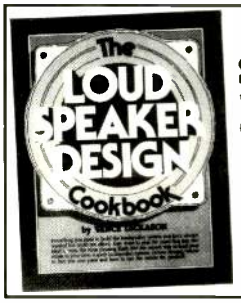

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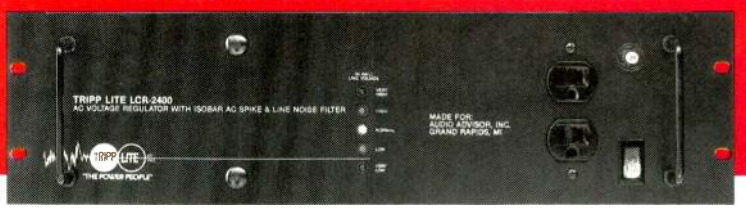

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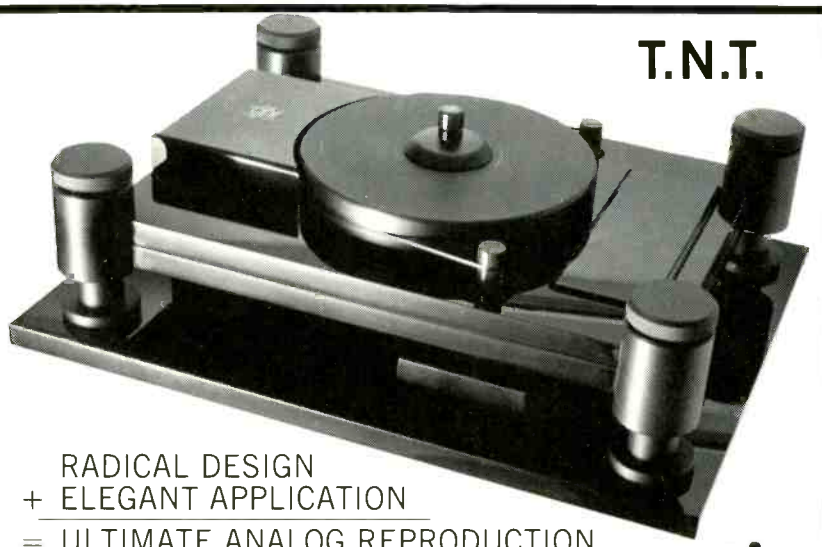

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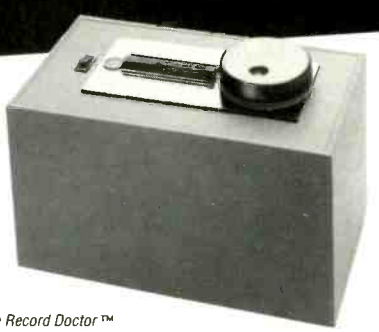

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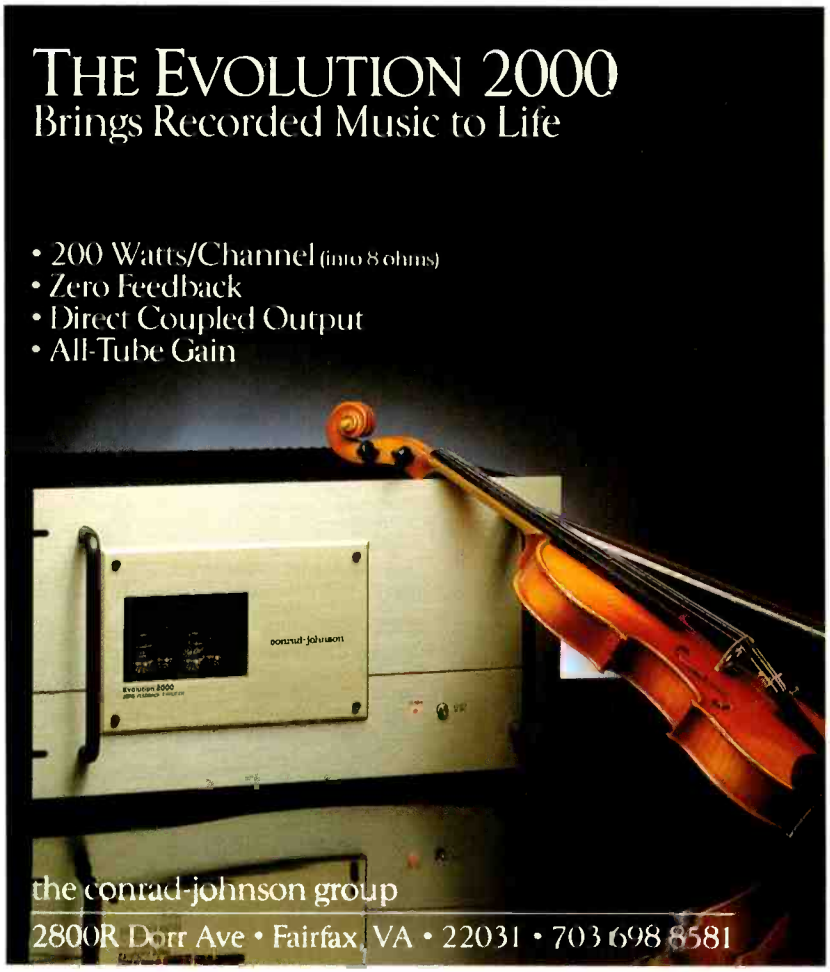

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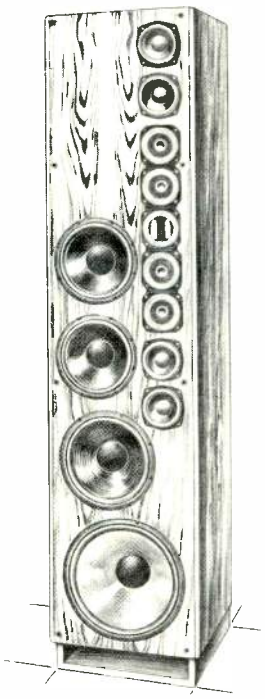

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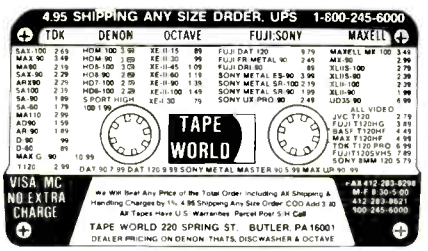

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