Audio

JANUARY 1988 • $2.50

HOW WELL DOES BULK ERASING WORK?

KLYNE SK-5A PREAMP – VERY LIKABLE; ADDED MUSICAL ENJOYMENT

TAPING THE GRATEFUL DEAD
RECORDING AMERICA'S MOST POPULAR ROCK BAND

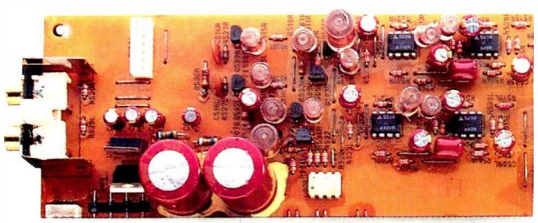
TESTED
INFINITY 9 KAPPA SPEAKER – SOMETHING SPECIAL

HARMAN/KARDON CITATION 23 TUNER ANCE

These anti-resonant chassis spacers are made with Kyocera's proprietary Fine Ceramics.

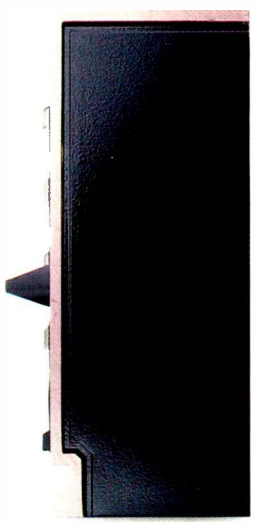
Fine Ceramics laser guide shafts hold their tolerances five times longer than other materials.

These are the CD features they'll be copying next.



3rd-order analog filters cause less phase shift than the 7th- and 9th-order designs that others use.

Since Day One, every Kyocera player has had true 16-bit oversampling.



The front fascia of all our players is brushed aluminum, not plastic.

While our supplied remote controls are great, this optional full system remote control lets you operate a complete Kyocera system from anywhere in the house!

Our real wood side panels help damp resonance. They also look good.

In May of 1983, Kyocera introduced a CD player with true 16-bit digital filters. Today, the competition's calling this circuit "the latest thing." Years ago we had four-times oversampling. This year every high-end player worth mentioning has a similar design. In September, 1984 Kyocera raised some eyebrows with the world's first Fine Ceramics anti-resonant CD chassis. Now the stores are full of flimsy imitations.

How did all these innovations happen to come from Kyocera, and not some household name? Perhaps because Kyocera's knowledge of digital circuitry comes from years of building computers for some of the best-known names in electronics. Perhaps because Kyocera is a world leader in Fine Ceramics, the technology used to house circuitry in aerospace and other advanced applications. Or perhaps because some top-rated CD players from other brands were actually made by Kyocera.

Now Kyocera has four world-beating Compact Disc Players, ranging in suggested retail price from $350 to the $800 model DA-710CX shown here. Each boasts technology so advanced, it's a preview of what the competition will be selling in 1989. After all, history does repeat itself.

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Kyocera Electronics, Inc., 100 Randolph Road, CN 6700, Somerset, New Jersey 08873-1284 (201) 560-0060
Kyocera Canada, Inc., 7470 Bath Road, Mississauga, Ont., L4T 1L2, Canada (416) 671-4300

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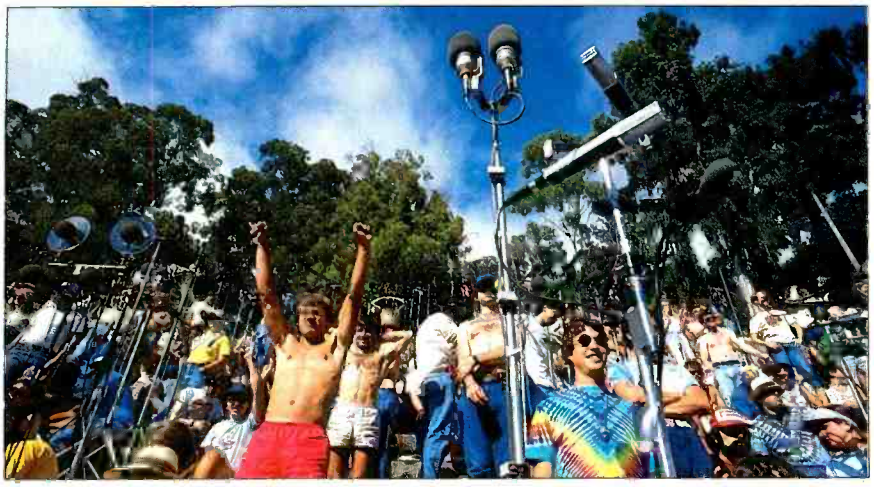
Audio

JANUARY 1988 VOL. 72, NO. 1



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MUSIC REVIEWS

DEPARTMENTS

The Cover Equipment: Klyne SK-5A preamplifier.
The Cover Photographer: ©1987, Jay Brenner.

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ABC

MPA

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THE SHAPE OF THINGS TO COME

Products recognized for their ability to reproduce music and to advance our perception of high fidelity emerge from unique companies. The community of individuals dedicated to the production of Mark Levinson components has established an unequalled tradition of excellence and accomplishment, while accepting the responsibility for refining the state of the art in music reproduction within the boundaries technology and imagination allow.

The No. 26 Dual Monaural Preamplifier introduces a new level of performance in audio system control. Until now, the most musically accurate preamplifiers have had limited control flexibility due to the sonic advantages of direct signal paths. The new generation of circuitry developed for the No. 26 provides full control flexibility, for six audio sources with two tape loops, and such refinements as absolute phase selection, all with greater sonic purity than even the minimalist preamps of the past.

The No. 26 offers two optional phono input sections for precise matching with any phonograph cartridge. Either of these circuits can be factory installed at the time of purchase, or added later by your dealer.

The No. 26 also offers the option of true differential balanced connection to associated equipment. While this superior interconnection technique has been taken advantage of in professional equipment for many years, only recently have domestic products offered it as an option. The No. 26 will allow you to achieve the maximum performance from Mark Levinson amplifiers and other products offering balanced connection capability.

All Mark Levinson products are handcrafted in limited quantities to ensure their high standards. Visit your Mark Levinson dealer to hear how good music can sound in your home.

Mark Levinson® products are designed and manufactured by **MADRIGAL AUDIO LABORATORIES**
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SIGNALS & NOISE

Battle Report

Dear Editor:

Bravo to Michael J. Rodney for his letter ("Signals & Noise," August 1987) regarding the service side (or lack thereof) of the audio industry. While I empathize with Mr. Rodney's comments, I also find some small consolation in his confirming that state-side audio enthusiasts experience the same frustrations as we do here.

It's good to know that Mr. Rodney found performance and service satisfaction in the McIntosh company. I've been fighting an almost year-long battle with New York Audio Labs, which offered to modify my Moscode 600 amplifier. They accepted my deposit but have not yet performed the work or replied to my request for a refund.

David S. Stott, Jr.
Paris, France

Editor's Note: Harvey Rosenberg of NYAL replies: "The recent disaster on Wall Street was the death blow for NYAL. I am going to have to put the company into bankruptcy. There were a couple of people who did not get their amplifiers modified."

Let It Be

Dear Editor:

Your October 1987 issue contained several letters from angry readers who bought Beatles CDs without knowing they were in mono. I do not understand why they didn't know; long before the discs were released, numerous articles appeared in newspapers about the discs being in mono, and still more appeared after they were released.

I bought the discs knowing they were in mono. It didn't bother me that much, although Capitol could've crammed both a mono and a stereo version on one disc.

Ki Suk Hahn
West Covina, Cal.

An Encouraging Word

Dear Editor:

In regard to two letters printed in the October 1987 "Signals & Noise" column ("Two Sides of a Coin"), I would make the following comments:

In a day and age when your Equipment Directory has over 261 different listings for speaker manufacturers, with products ranging in price from $79.95 to $100,000, I commend the entire *Audio* staff for its ability to accurately cover as wide a diversity of products as it does!

As a professional involved in the field of music, I appreciate the reviews of automotive equipment, knowing its ability for true high-fidelity reproduction, which apparently Mr. Paskowitz isn't aware of. Also, as a subscriber to *Stereo Review* as well as *Audio*, I can accurately state that your magazine still very much caters to high-end equipment, whether it be car audio, home audio, or home video.

I fail to understand why someone such as Mr. Bufka would continue to read a magazine that he is unable to appreciate. Keep on reviewing the categories of equipment that you are now doing such a good job on. You can count on me to be renewing my subscription for many years to come.

William S. Wells
Nashville, Tenn.

Happy Family Member

Dear Editor:

I would like to second Michael J. Rodney's "nomination" of McIntosh Laboratories as a company deserving praise for their outstanding service to their customers ("Signals & Noise," August 1987). I am pleased to have been a member of the McIntosh family since the early '60s and to own components still performing up to their original specifications.

G. Gary Kirchner, M.D.
Lancaster, Pa.

Voice of Experience

Dear Editor:

You've made an excellent choice in having Frank Driggs review jazz releases for *Audio*. Having read his writings in many contexts, especially set booklets and liner notes, I've come to appreciate him as an authority who indeed knows what he's writing about. Since reviews are necessarily pared to the bone, his every sentence rings with truly detailed knowledge and experienced listening and thought. I think the reader can count on the accuracy of his judgments and summations. Although his writings are frequently on reissues of "period" jazz, you could just as well employ his knowledge in the review of anything current. Let him

Audio

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Jessup MD 20794
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take a crack at that marvelous electronic stuff that takes some of today's musical giants six months to a year to get right.

Speaking of musical giants, I loved those letters about The Beatles CDs and whether the albums were originally in mono or stereo. I put such discussions in the category of UFO sightings and the new cleft in Michael Jackson's chin.

Geoffrey Wheeler
Manassas, Va.

The Megabuck Stops Here

Dear Editor:

I read with interest the letters of Ronald Stone and Bruce Bender ("Signals & Noise," November 1987) concerning the Mark Levinson No. 20 mono amplifier review by Laurence Greenhill and David Clark. It appears that Mr. Greenhill and Mr. Clark's high commendations are predetermined because they know they are dealing with a megabuck product. I wonder how their opinions would change if they believed the unit cost $4,000 less, or, conversely, if they were led to believe an $800 amplifier had a $4,800 price tag. I believe they could be far more objective and more frugal with superlatives if they were unaware of the manufacturer, model, and price of the unit to which they were listening.

Jerome Swabb
Erie, Pa.

Examining an Issue

Dear Editor:

I have some comments on several articles in the November 1987 issue of *Audio*:

First, in "Digital Domain," the metal oxide varistors (MOVs) connected to ground in Fig. 2 are a no-no, according to electrical codes. I know; I sent a sample computer to Underwriters Labs connected just this way, and it was rejected. The MOVs do a good job: Last month a neighbor dropped a tree across a 125,000-V transmission line so that it fell on the 12,500-V distribution line. Several thousand houses had TVs, VCRs, microwaves, computers, etc. destroyed. All I lost were some MOVs and ground-fault interrupters. Unfortunately, my garage-door opener had its MOV soldered in a circuit board. The runs were vaporized! By the way, MOVs have a finite life. Each time they absorb a surge, their characteristics are changed somewhat. A Transorb, a large zener diode, does a better job, but it is very expensive.

Second, a note about "Spectrum." Thomson SA, formerly Thomson-Houston, is an offspring of an American company of the same name. In about 1890, it merged with Edison to form General Electric. How about that!

Third, the Brush Soundmirror mentioned in "Behind the Scenes" came out in about 1948. Our local radio station had one, and later our high school band did also. The tape we had was not plastic, it was paper. You really had to be careful on rewind.

Finally, I think all the fuss about copy-protecting music is ridiculous. I expect it to be about as effective as the car seat-belt interlock. I can't imagine spending good money for a recording with a hole in the middle of the treble. I'll stick with the discs I've got, going back to 1908.

Gilbert A. Johnson
Woodinville, Wash.

Let's Discuss It

Dear Editor:

John Eargle's review of the CD recordings of Holst's "Planets" ("A Plethora of Planets," October 1987) is to be commended. Mr. Eargle's understanding of each recording's background and the effect of the techniques involved is second to none. The combination of technical insight and musical sensitivity in one writer is a treasure that should not be kept in a closet!

Please see if Mr. Eargle can be persuaded to do similar comparative reviews. There are too many $16 CDs out there which are not deserving of the medium and which need to be "discussed."

Jim Fullmer
Salt Lake City, Utah

Adventures in Collecting

Dear Editor:

So much has been written about CDs since their inception, but little of it explores their psychological impact on our music culture. Although I have always found the prospect of pure sound very exciting, there are other considerations which fit into the total picture. CDs sound great, but somehow, watching them spin is about as exciting as watching a blender. Having been conditioned to deal with analog formats for years, it may be a long time before digital finds a place in my life.

As a collector and student of many different forms of music, the analog world has allowed me some colorful adventures. It is an alien planet filled with hidden treasures. At junk stores and yard sales, I often find near-mint LPs in a vast variety of bizarre and obscure pop mutations for as little as a dollar—or sometimes even a quarter. Along with closed-out 8-tracks, I can use them to re-create this lush landscape piece by piece on cassettes. The final quality depends on the equipment and skill I use.

These types of diverse, odd artifacts would never translate into CD culture; they would never make it onto disc. At premium prices, each CD is a finished piece of permanent software. I'd have to like the music quite a lot to make each investment. There are few modern releases I like and even fewer I would play all the way through in any format. Vinyl-to-tape is a state of mind—interactive, creative, and flexible. The digital world is a perfectly consistent mirror image, but the surface is flat, hard, and cold.

Beam me up, Scotty.

Theodore Curley
Framingham, Mass.

Righting a Wrong

Dear Editor:

We at ECM Records are pleased that Edward Tatnall Canby enjoyed Kim Kashkashian's recording, *Romances and Elegies for Viola and Piano* (November 1987, "Compact Discs"). Unfortunately, he misidentified the musicians in the review. Please note that it is Kim Kashkashian who plays the viola and Robert Levin who plays the piano.

Kathryn King
ECM Records
New York, N.Y.

Editor's Note: Please forgive the error. We hope our readers were more observant than we were: As anyone can easily see, it is a viola (and not a piano!) that Ms. Kashkashian is holding up in the photograph that accompanies the review.—*E.M.*

Challenging Design.

FOR UNDER $600 YOU CAN OWN AN AMPLIFIER JUDGED TO HAVE THE EXACT SOUND CHARACTERISTICS OF AN ESOTERIC $3000 MODEL.

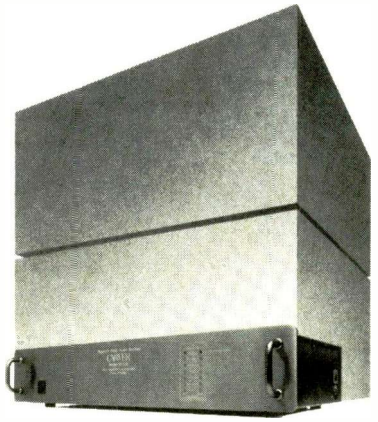
Bob Carver recently shocked the staid audiophile world by winning a challenge that no other amplifier designer could ever consider.

The new M-1.0t was judged, in extensive listening tests by one of America's most respected audiophile publications, to be the sonic equivalent of a PAIR of legendary, esoteric mono amplifiers which retail for $3000 each!

CARVER'S GREAT AMPLIFIER CHALLENGE. Last year, Bob Carver made an audacious offer to the editors of *Stereophile Magazine,* one of America's exacting and critical audio publications. He would make his forthcoming amplifier design sound exactly like ANY high-priced, esoteric, perfectionist amplifier (or amplifiers) the editors could choose. In just 48 hours. In a hotel room near *Stereophile's* offices in New Mexico! As the magazine put it, *"If it were possible, wouldn't it already have been done? Bob's claim was something we just couldn't pass up unchallenged."*

What transpired is now high fidelity history. From the start, the *Stereophile* evaluation team was skeptical *("We wanted Bob to fail. We wanted to hear a difference").* They drove the product of Bob's round-the-clock modifications and their nominees for "best power amplifier" with some of the finest components in the world. Through reference speakers that are nothing short of awesome. Ultimately, after exhaustive listening tests with carefully selected music ranging from chamber to symphonic to high-impact pop that led them to write, *"...each time we'd put the other amplifier in and listen to the same musical passage again, and hear exactly the same thing. On the second day of listening to his final design, we threw in the towel and conceded Bob the bout. According to the rules... Bob had won."*

BRAIN CHALLENGES BRAWN. Below is a photo of the 20-pound, cool-running M-1.0t. Above it are the outlines of the *pair* of legendary mono



amplifiers used in the *Stereophile* challenge. Even individually, they can hardly be lifted and demand stringent ventilation requirements. And yet, according to some of the most discriminating audiophiles in the world, Bob's new design is their sonic equal.

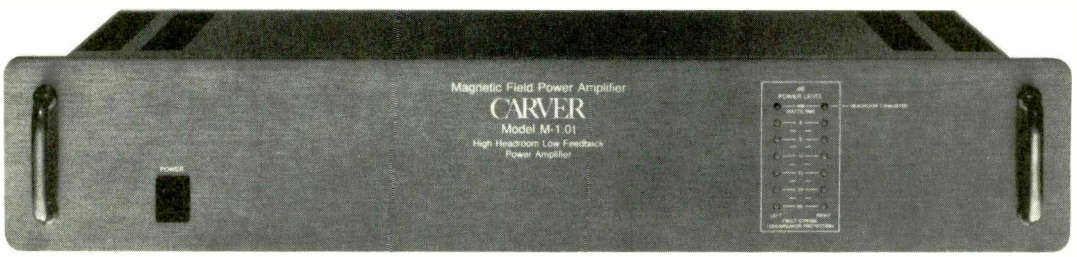
The M-1.0t's secret is its patented Magnetic Field Coil. Instead of increasing cost, size and heat output with huge storage circuits, Magnetic Field Amplification delivers its awesome output from this small but powerful component. The result is a design with the dynamic power to reproduce the leading edge attacks of musical notes which form the keen edge of musical reality.

A DESIGN FOR THE CHALLENGES OF MODERN MUSIC REPRODUCTION. The M-1.0t's astonishingly high voltage/high current output and exclusive operation features make it perfect for the demands of compact digital discs, video hi-fi and other wide dynamic range playback media. The M-1.0t:

- **Has a continuous FTC sine-wave output conservatively rated at 200 watts per channel.**
- Produces 350-500 watts per channel of RMS power and, bridged, 800-1100 watts momentary peak power (depending on impedance).
- Delivers 1000 watts continuous sine wave output at 8 ohms in bridging mode without switching or modification.
- Is capable of handling unintended 1-ohm speaker loads without shutting down.
- Includes elaborate safeguards including DC Offset and Short Circuit Power Interrupt protection.

SHARE THE RESULTS OF VICTORY. We invite you to compare the new M-1.0t against any and all competition. Including the very expensive amplifiers that have been deemed the M-1.0t's sonic equivalent. You'll discover that the real winner of Bob's remarkable challenge is you. Because world class, superlative electronics are now available at reasonable prices simply by visiting your nearest Carver dealer.

SPECIFICATIONS: Power, 200 watt/channel into 8 ohms 20Hz to 20KHz, both channels driven with no more than 0.15% THD. Long Term Sustained RMS power, 500 watts into 4 ohms, 350 watts into 8 ohms. **Bridged Mono power,** 1000 watts into 8 ohms. **Noise,** -110dB IHF A-weighted. **Weight,** 20 lbs.



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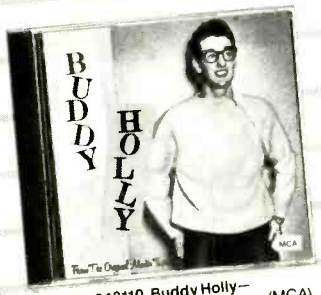
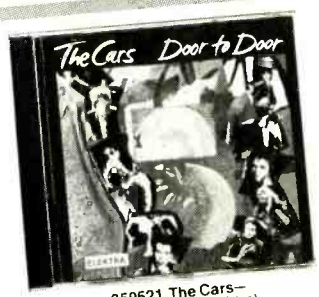


348110. Buddy Holly—From the Original Master Tapes. (MCA)

358507. Madonna—Who's That Girl (Orig. Soundtrk.) (Sire)

359901. Mick Jagger—Primitive Cool. (Columbia)

359208. Loverboy—Wildside. (Columbia)



359521. The Cars—Door To Door. (Elektra)

357939. "La Bamba"—Orig. Soundtrk. (Slash/Warner Bros.)

337659. U2—The Unforgettable Fire (Island)

347955. Huey Lewis & The News—Fore! (Chrysalis)

349985. Johnny Mathis/Henry Mancini—The Hollywood Musicals (Columbia)

348979. Tina Turner—Break Every Rule (Capitol)

352633. Dolly Parton/Linda Ronstadt/Emmylou Harris—Trio (Warner Bros.)

336396-396390. Billy Joel's Greatest Hits, Vol. 1 & 2. (Columbia)

349324. South Pacific. K. Te Kanowa, J. Carreras, etc. (*Digital*—CBS)

347153. Cyndi Lauper—True Colors. (Portrait)

347039. Billy Idol—Whiplash Smile. (Chrysalis)

346643. Andreas Vollenweider—Down To The Moon. (CBS)

346478. Madonna—True Blue. (Sire)

356576. John Adams: The Chairman Dances—DeWart, San Fran. Sym. (*Digital*—Nonesuch)

356675. Beverly Hills Cop II—motion picture soundtrack album. (MCA)

361980. Roger Hodgson—Hai Hai. (A&M)

356196. The Cure—Kiss Me, Kiss Me, Kiss Me. (Elektra)

343319. Janet Jackson—Control (A&M)

349571. Boston—Third Stage (MCA)

356287. Suzanne Vega—Solitude Standing. (A&M)

344721. Lionel Richie—Dancing On the Ceiling. (Motown)

355156. Vladimir Horowitz Plays Favorite Chopin. (*Digitally Remastered*—CBS Masterworks)

352948. Wynton Marsalis—Carnaval. Hunsberger, Eastmon Wind Ensemble (*Digital*—CBS Masterworks)

353946. Bryan Adams—Into The Fire. (A&M)

234062. West Side Story—Original Cast (Columbia)

354985. Billie Holiday—From The Original Decca Masters. (*Digitally Remastered*—MCA)

323899. The Best Of The Alan Parson's Project. (Arista)

352666. REO Speedwagon—Life As We Know It. (Epic)

355115-395111. Prince—Sign 'O' The Times. (Paisley Park)

354951. Mozart: Flute Quartets—Rostropovich, Rampal, Stern, Accardo (*Digital*—CBS Masterworks)

356329. Randy Travis—Always & Forever. (Warner Bros.)

355990. Motley Crue—Girls, Girls, Girls. (Elektra)

355529. Philip Glass—Dance Pieces. (*Digital*—CBS)

357871. Tchaikovsky: Waltzes—S. Comissiona and Houston Symphony (*Digital*—Pro Arte)

319996-399998. Motown's 25 #1 Hits From 25 Years. (Motown)

355776. Stravinsky: The Firebird (1910 version); Song Of The Nightingale—Boulez, New York Phil. (*Digitally Remastered*—CBS Masterworks)

355834. David Bowie—Never Let Me Down. (EMI America)

346536. The Monkees—Then & Now...The Best Of The Monkees (Arista)

345785. Top Gun—Soundtrack. (Columbia)

355362. Whitesnake. (Geffen)

319541. Elton John—Greatest Hits. (MCA)

318089. Michael Jackson—Thriller (Epic)

340323. Sade—Promise. (Portrait)

339903. The Cars—Greatest Hits. (Elektra)

321307. Air Supply—Greatest Hits. (Arista)

342105. Bangles—Different Light. (Columbia)

357889. Copland: Billy The Kid; Appalachian Spring; etc.—Bernstein, NY Phil. (*Digitally Remastered*—CBS Masterworks)

355958-395954. Beethoven: Symphonies Nos. 8 & 9 (Choral)—Michael Tilson Thomas, English Chamber Orch. (*Digital*—CBS Masterworks)

290916. The Best Of Earth, Wind & Fire, Vol. I (Columbia/ARC)

343715. Vivaldi: Four Seasons—Maazel cond (*Digital*—CBS Masterworks)

323261. Lionel Richie—Can't Slow Down (Motown)

346809. Dvorak: Symphony No. 9 (New World), Carnival Overture—Batiz, London Philharm. (*Digital*—Verese/Sarobande)

Classic Rock from the Sixties and Seventies

300095. Electric Light Orchestra—Greatest Hits. (Jet)

279133. Meat Loaf—Bat Out Of Hell. (Epic)

358887. Grateful Dead—Workingman's Dead. (Warner Bros.)

358358. Joe Cocker—Classics. (A&M)

357277. The Who—Who's Next. (MCA)

345157. Jethro Tull—Aqualung. (Chrysalis)

327742. The Best Of Kansas. (CBS Assoc.)

291864—391862. Original Soundtrack—Woodstock. (Atlantic)

290171. The Steve Miller Band—Greatest Hits 1974-78. (Capitol)

291526. Emerson, Lake & Palmer—Brain Salad Surgery. (Atlantic)

286914. Fleetwood Mac—Rumours (Warner Bros.)

244459. Santana's Greatest Hits (Columbia)

257279. Bruce Springsteen—Barn to Run (Columbia)

231670. Janis Joplin's Greatest Hits (Columbia)

214650. Blood, Sweat & Tears Greatest Hits (Columbia)

287003. Eagle's Greatest Hits 1971-1975 (Asylum)

293597. Led Zeppelin—Houses Of The Holy. (Atlantic)

350736. Rolling Stones—Rewind. (Rolling Stones Records)

269209. Boston—Boston. (Epic)

291021. Supertramp—Breakfast In America. (A&M)

291278. The Doobie Brothers—Best of the Doobies. (Warner Bros.)

308049. Creedence Clearwater Revival Featuring John Fogerty/Chronicle. 20 greatest hits. (Fantasy)

260638. Chicago's Greatest Hits (Columbia)

341073. Steely Dan—A Decade of Steely Dan. (MCA)

292243. Jackson Browne—The Pretender (Asylum)

351957. Yes—Fragile. (Atlantic)

286740. Linda Ronstadt's Greatest Hits. (Asylum)

357616-397612. The Best Of The Doors. (Digitally Remastered—Elektra)

353102. Jimi Hendrix—Are You Experienced. (Reprise)

345777. Peter Gabriel—Sa. (Geffen)

246868. Jim Croce—Photographs And Memories—His Greatest Hits. (Saja)

334391. Whitney Houston. (Arista)

314443. Neil Diamond's 12 Greatest Hits, Vol. 2. (Columbia)

343582. Van Halen—5150. (Warner Bros.)

326629. Bruce Springsteen—Born In The U.S.A. (Columbia)

342097. Barbra Streisand—The Broadway Album. (Columbia)

219477. Simon & Garfunkel's Greatest Hits. (Columbia)

348649. Pachelbel Canon & Other Digital Delights—Toronto Chamber Orch. (*Digital*—Fanfare)

353771. Bolling/Rampal: Suite #2 for Flute & Jazz Piano Trio (*Digital*—CBS)

348318. The Police—Every Breath You Take—The Singles (A&M)

346312. Billy Joel—The Bridge. (*Digital*—Columbia)

337519. Heart. (Capitol)

336222. Dire Straits—Brothers In Arms. (Warner Bros.)

314997-394999. Stevie Wonder's Originol Musiquarium 1. (Tamla)

348987-398982. Linda Ronstadt—'Round Midnight (Asylum)

353789. Sly & The Family Stone's Greatest Hits. (Epic)

351122. Europe—The Final Countdown. (Epic)

346544. Kenny G—Duotones. (Arista)

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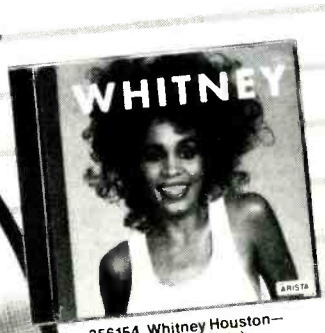

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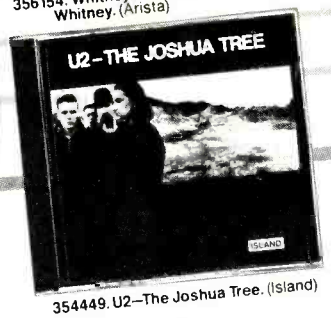
360115. Bruce Springsteen—Tunnel Of Love. (Columbia)



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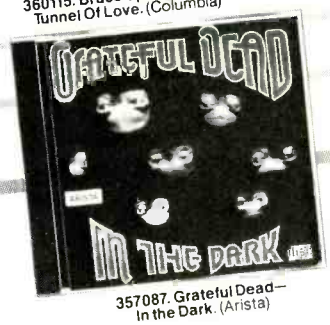
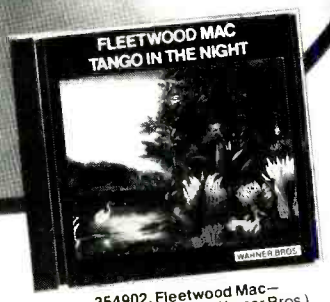


357087. Grateful Dead—In the Dark. (Arista)

359075. Aerosmith—"Permanent Vacation". (Geffen)



354902. Fleetwood Mac—Tango In The Night. (Warner Bros.)

356667. Heart—Bad Animals. (Capitol)

337402. The Manhattan Transfer—Vocalese. (Atlantic)

346957. Steve Winwood—Back In The High Life. (Island)

344622. Anita Baker—Rapture. (Elektra)

138586. Bob Dylan's Greatest Hits (Columbia)

343954. Paul Winter—Canyon. (Living Music)

357657. Beethoven: Piano Concerto No. 5—Murray Perahia. (*Digital*—CBS Masterworks)

357640. Wynton Marsalis—Marsalis Standard Time. (Columbia)

357186. Hooters—One Way Home. (Columbia)

353920. Simply Red—Men and Women. (Elektra)

352229. Carly Simon—Coming Around Again. (Arista)

356444. Dionne Warwick—Reservation For Two. (Arista)

354829. Lisa—Lisa And Cult Jam With Full Force—Spanish Fly. (Columbia)

356501. Benson/Klugh—Collaboration. (Warner Bros.)

361022. Tchaikovsky: Symphony No. 6—Claudio Abbado, Chicago Symph. Orch. (*Digital*—CBS Masterworks)

357350. The Duke Ellington Orchestra—Digital Duke. (*Digital*—GRP)

356741. Bach: Preludes And Fugues For Organ, Vol. I. (*Digital*—Newport Classic)

354100. Crowded House. (Capitol)

354035. Dwight Yoakam—Hillbilly Deluxe. (Reprise)

345751. Paul Simon—Graceland. (Warner Bros.)

356279. Gloria Estefan And Miami Sound Machine—Let It Loose. (Epic)

358077. Hank Williams, Jr.—Born To Boogie. (Warner Bros./Curb)

357863. Barbra Streisand..."One Voice." (Columbia)

357574. Original Soundtrack—The Lost Boys. (Atlantic)

357467. Sammy Hagar. (Geffen)

336669. Sting—The Dream Of The Blue Turtles. (A&M)

357806. Mussorgsky: Pictures At An Exhibition, Night On Bald Mountain—Leonard Slatkin, St. Louis Symphony Orchestra. (The Moss Music Group)

360974. Squeeze—Babylon And On. (A&M)

360149. Echo & The Bunnymen. (Sire)

360016. Spyro Gyra—Stories Without Words. (*Digital*—MCA)

357798. The Art Of Beverly Sills, Album 2. (*Digitally Remastered*—Angel)

357145. Richard Goode Plays Brahms Piano Pieces, Op. 76 & 119/Fantasies Op. 116. (*Digital*—Nonesuch)

357103. Boccherini: Cello Concerto—Yo Yo Ma, Zukerman, St. Paul Chamber Orch (*Digital*—CBS Masterworks)

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AUDIOCLINIC

JOSEPH GIOVANELLI

Dust and Humidifiers

Q. I have an ultrasonic humidifier which deposits a coating of fine, white dust onto my stereo and TV set. I understand that this dust is from minerals, primarily calcium carbonate, found in hard water. Will this dust damage my electronic equipment? How can I eliminate it?—Jose E. Gonzalez, San Juan, P.R.

A. There is no way that dust settling onto equipment can do it any good. On heat-sinks, dust impairs heat transfer. On contacts, it makes controls erratic and noisy. If it gets into bearings, wear can become significant.

The simplest scheme is to cover the equipment with plastic (or other material) when it is not in use. A somewhat more elaborate plan would be to filter the mineral solids from the water before you put it into your humidifier's tank. Many simple filters are available; they attach to the faucet from which you fill the tank. There are also more complex water-treatment systems using chemicals as well as filtration. These units must be interposed between the water line and the faucet, which involves some plumbing work.

Alternatively, you could use distilled water. Considering that a humidifier uses approximately two gallons of water per day, this will not be an inexpensive solution. Of course, you can buy quite a bit of distilled water for the price of an elaborate water-treatment system.

Be sure to follow directions as to how best to clean *all* of your humidifier's internal surfaces which come into contact with the water. If those surfaces are free of mineral deposits and other dirt, they can't add to the dust being passed into the air. Cleanliness will also help keep the humidifier producing moisture at peak efficiency.

CDs from Older Recordings

Q. I like music which was originally recorded in the 1960s and early '70s. A great deal of this music is being issued on CDs. Would it be worthwhile for me to obtain the CDs of these performances? Is the sound going to be better than on records and cassettes?—Mike Haller, Lincoln, Nebr.

A. Phonograph records will have more background noise than was present on the original master tape, especially if the records have been played many times. Cassettes will also contain more noise than the original master tapes. True, master tapes from 15 to 20 years ago will have signal-to-noise ratios poorer than what a CD is capable of reproducing. Still, on CD you will be able to hear your music free from much of the noise you have become accustomed to hearing.

Add to this the fact that cassettes can jam or fail in other ways, and that LPs can be scratched, and you can see that the CD has another advantage too: It will last virtually forever if properly cared for. What's more, CDs are certainly easier to store than phonograph records.

Hi-Fi VCRs and Noise Reduction

Q. Why don't Hi-Fi VCRs have either Dolby or dbx noise reduction? What is the "hi-fi" all about? Is this just a delayed channel?—Darrell C. Fong, Franklin Park, Ill.

A. Actually, the Dolby system *is* used with some Hi-Fi VCRs. It is, however, not used on the Hi-Fi tracks; if it is present, it is used on the standard, longitudinal tracks, and probably just on those few Hi-Fi VCRs whose longitudinal tracks are in stereo. This is because noise is more of a factor with these tracks in stereo than in mono; in stereo, the available track width must be shared by two channels rather than devoted to one monophonic track. (I don't know why the Dolby NR system was chosen rather than dbx.) The Hi-Fi channels do not need additional noise reduction because their scheme of encoding/decoding FM subcarriers results in a very good signal-to-noise ratio, perhaps a figure as great as 80 to 85 dB.

The Hi-Fi system is not just a gimmick, nor does it use delay. Using delay to create reverb can be effective for some applications, but it is certainly not a means of obtaining the faithful reproduction that is implied by the term "hi-fi."

Loudspeaker Equalizers

Q. I have read that loudspeaker makers sometimes use equalizers as a part of their designs. It is my understanding that equalizers are nothing more than boosters, so why are they used?—Andy Johnson, Chicago, Ill.

A. Equalizers are definitely used by some speaker manufacturers. Although many loudspeakers can cover a wide range of audio frequencies, they may not be "flat" over that range. Thus, the speaker designer makes up an equalizer circuit whose function is to boost or cut certain frequencies to make that loudspeaker produce a flat response over as wide a range as possible. This equalizer is usually packaged as a separate chassis, which is connected either in the system's tape loop or between the preamplifier's output and the power amplifier's input. For reasons of electrical efficiency, it is better to provide the compensation in this way rather than to include it within the loudspeaker as a part of its crossover network.

The equalizer is more than a booster. As stated, it may lower some frequencies while boosting others. It does, however, try to make all frequencies coming from the speaker equal; presumably, this is why it is known as an equalizer.

You are doubtless familiar with tone controls and perhaps with graphic equalizers. In either type of circuit, the user can adjust the sound to suit his taste. The equalizers used by loudspeaker makers cannot be adjusted. If the listener needs an adjustable equalizer, it can readily be added to a system, even when the speaker system's own equalizer is present.

Escaping Bass

Q. I have a problem of bass location in my system. Specifically, the low bass (up to perhaps 55 Hz) does not "come out" in the room where the speakers are. Instead, it appears in the hallway, outside my neighbor's door. The problem does not appear to be one of poor bass response; there is enough response at 30 Hz to rattle the light fixtures. This phenomenon is quite irritating—I did not build my loudspeakers to entertain the roaches in the walls!

Standing outside my neighbor's door, drums and other bass signals

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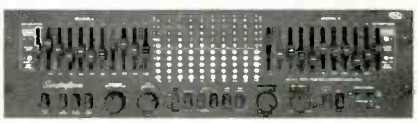

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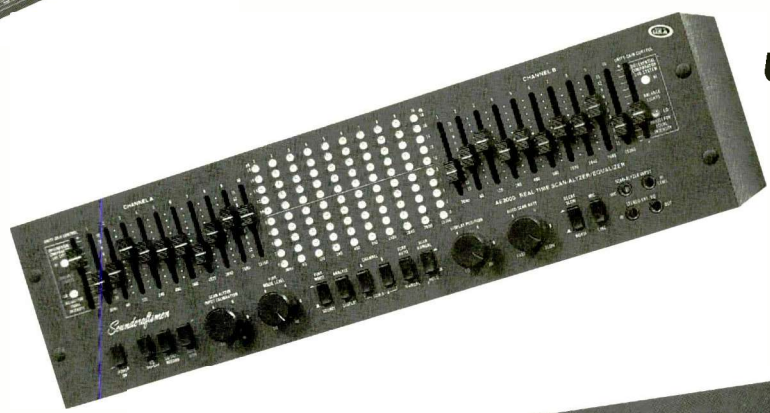

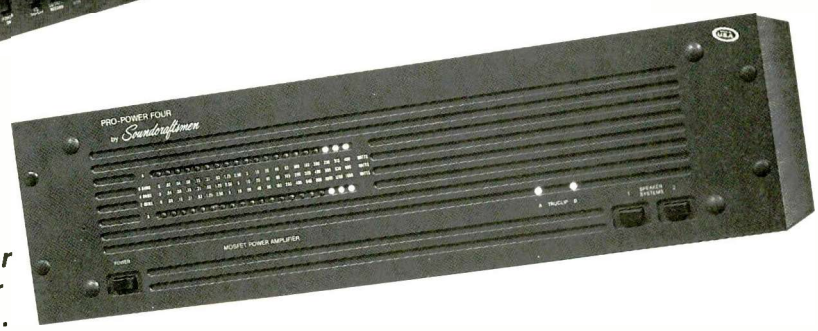

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Standing waves generated by a loudspeaker may be audible outside the room in which that speaker is located.

are very physical. I would really appreciate any information about getting the bass into my room, where it belongs. Structural changes are impossible because the walls are concrete.—Steve Geist, DeKalb, Ill.

A. Your bass problem has to do with what are known as standing waves. Without going into detail, this has to do with the wavelength of the sound being reproduced. The wavelengths of bass tones are often larger than the room in which the loudspeakers are housed. In addition, there are resonances in corridors much like those of organ pipes. Should the hallway have a resonant frequency equal to that of the bass frequency being produced by your system, this sound will be very pronounced in the hall.

Probably your best bet is to close the door of your listening room and then walk around the room while listening to your system. You will probably find that the bass peaks when you stand at a particular point in the room. Perhaps you can locate your loudspeakers in such a way that you can then place your favorite listening chair at that point where the bass peaks and where you can obtain good stereo imaging.

Recommending an Isolation Transformer

In response to a reader's inquiry about TV hum (June 1987), you mentioned the requirements for an r.f. isolation transformer. I have experienced a similar problem myself when interfacing cable TV to professional audio equipment in recording studios. In those installations, great care was taken to assure a clean, isolated ground, which was then rendered useless upon connection of cable TV.

There is an r.f. transformer available from Gemini Industries, 215 Entin Rd., Clinton, N.J. 07014. (Fortunately, this transformer is stocked at my local hardware store, but I have never seen it anywhere else—including cable-TV suppliers.) This device provides galvanic isolation to break ground loops, and it also provides a degree of fault-current protection from lightning and other disasters. Considering the investment most of us have in our gear, ground-fault isolation is certainly worthwhile.—Wayne Kirkwood, Dallas, Tex.

Distortion and Overheating

Q. My receiver puts out 40 watts of power per channel, and my loudspeakers are rated at 40 watts each. When I originally set up the system, I could only turn up the volume control to "4" (on a scale from 0 to 10) before a harsh, pounding sound could be heard. The receiver also overheated very quickly. Recently I moved the stereo to a different location. In doing so, I had to rewire everything. When I turned the system on, none of the previous problems occurred; I could turn up the volume without distortion or overheating. To make room for additional gear, I had to move the system once again, which meant rewiring loudspeaker cables and the various other cables and ground wires. Now my system is as first described: Lots of distortion and overheating. Figuring that the problem had to do with loudspeaker wiring, I attached, detached, and reattached all wires again, but the problems remained. What is going on here?—Steve Vandenberg, Kentwood, Mich.

A. The most likely cause of your problem is a short between speaker terminals, either on the loudspeakers themselves or on the amplifier. Perhaps a single loose strand of wire has "bridged" the terminals. Disconnect the wires once again, checking to see that no fine wire strands remain to short out the terminals. Examine your cables to make sure that *all* strands are tightly twisted—no stragglers, please—and then reattach the wires.

You also must be sure to keep phonograph cables well clear of the loudspeaker cables. In fact, avoid running *any* signals parallel to the loudspeaker cables. The reason for avoiding cable proximity is that, despite the shielding of the low-level audio signal lines, they still have a tendency to pick up magnetic fields from the speaker cables. These signals will produce oscillations, which could be the cause of both your problems.

Defining Distortions

Q. What is the difference between THD and IM?—Thomas Wayne Caldwell, FPO N.Y.

A. To gain an understanding of total harmonic distortion (THD), assume that we are feeding a pure sine-wave signal into the input of the circuit which is being tested. One would hope that this sine wave would be reproduced in the output of this circuit exactly as it appeared at the input, except, perhaps, for a change in amplitude. In practice, however, it won't be an exact copy; the wave shape will change slightly. A departure from a true sine wave indicates the presence of harmonics—even multiples—of the original sine wave's frequency. If the original frequency is 250 Hz, the first harmonic is 250 Hz (because the first harmonic is always the starting frequency). The second harmonic is 500 Hz, the third harmonic is 750 Hz, etc. These harmonics will tend to decrease in amplitude as the harmonic number increases. In some circuits, the odd harmonics will be emphasized more than the even ones.

We talk about "total harmonic distortion" because our usual measurements don't discriminate as to the nature of these harmonics. Rather, the measurement simply expresses *all* of the harmonics of a given frequency in terms of a percentage of the fundamental (the starting frequency, or first harmonic).

Intermodulation (IM) distortion is completely different. Here we are talking about what takes place when two different frequencies are simultaneously fed into the input of a circuit. What we expect to see in the output of this circuit are these same two frequencies. But in addition to the original two frequencies, two "beat" frequencies are generated, one equal to the sum of the original two frequencies and the other equal to the difference between them. We now have four frequencies which can recombine to form all kinds of beats. These additional frequencies will be much lower in amplitude than the first two beat frequencies. In fact, even the first two will have a much lower amplitude than the two input frequencies with which we started.

When we measure IM distortion, we extract all of the added frequencies and express them as a percentage of the two frequencies with which we started.

As with THD, the percentage of IM distortion will be different for different levels of signal input to the circuit being tested.

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Where to buy Polk Speakers? For your nearest dealer, see page 22 .

TAPE GUIDE

HERMAN BURSTEIN

Advice on Tape Spillage

Some of the items in this column have dealt with the problem of tape spillage. A reader offers the following explanation and advice:

Most decks, when not in an auto-reverse mode, use a timer circuit that receives pulses from the take-up hub, keeping the drive engaged as long as it gets a pulse once in a while. At the end of the tape, the take-up hub stops, and eventually the drive disengages. The pulses come either from a rotating magnet operating a reed switch or from a paddle wheel operating a photoelectric sensor. If the take-up hub does not have its own motor, and sometimes even when it does, the hub spindle is driven through a metal-to-rubber contact. Over time, the rubber ages and the metal gets polished, so the metal may randomly skid on the rubber every now and then. (Interestingly, a torque check will still show adequate torque.) Meanwhile, the drive capstan has been pulling tape out of the cassette, though the take-up hub has stopped; thus, tape is spilled. If the hub drive recovers before the timing circuit notices it hasn't received a pulse recently, the loose tape may get pulled back into the cassette. Sometimes, the drive doesn't recover soon enough, and tape spill occurs.

For a mechanically handy person, there are some temporary cures. Cleaning the internal rubber pulley involved, using a rubber cleaner/conditioner (such as Teac RC-2), will help. In some two-motor decks, there are two side-by-side rubber pulleys which can be swapped without disassembly, and this may help as well.—James P. DeClercq, Toledo, Ohio

To this I would like to add a warning: If a deck is relatively new and still under warranty, this warranty may be invalidated if you open the deck. Also, particularly for the novice, there is always the possibility of doing more harm than good by tampering with the deck mechanism.

Mono-to-Stereo Miking

Q. Recently I bought a dual-well cassette deck which has one serious disadvantage: Instead of stereo inputs, it has only a mono mike input which feeds both channels. I plan to do some live stereo recordings. How can I do this with my deck? Neither receivers nor integrated amplifiers provide microphone inputs, and I believe that professional mike mixers are far too expensive for me. Is there a way to incorporate a stereo mike jack in place of the mono jack in my deck, with minor modification of the circuitry?—Amitabha Sarkar, Pullman, Wash.

A. It is not feasible to modify a mono mike jack for stereo use unless you have exceptional knowledge and technical ability. Changing the *jack* from mono to stereo is simple, but adding a second mike channel, involving additional electronic circuitry, is not.

The way to go is to buy a mixer. True, some of their prices go up into the many hundreds of dollars, and even into the thousands, but others are available for much less. For example, you might try Radio Shack or Fostex.

Using Alignment Tapes

Q. I have eight cassette decks, including one in my car, but they are out of azimuth alignment with each other. Hence, if I record a tape on one deck, it may not play well on another. I plan to purchase an azimuth alignment tape and fix all of my decks once and for all. If I purchase an alignment tape from one deck manufacturer, will I be able to use it to align the decks of other manufacturers? Also, is it difficult to align the heads for azimuth on a three-head deck?—Joe Roberts, Wilbraham, Mass.

A. In theory, all azimuth alignment tapes, no matter who the manufacturer is, should be identical and therefore usable on all decks, resulting in compatibility among them. In practice, only those alignment tapes made by *reputable* companies are sufficiently similar to serve the purpose.

To use an azimuth alignment tape on a three-head deck, first align the playback head for maximum output of the tape's test tone. Next, using a signal generator and the same frequency as on the test tape, simultaneously record and play this generator tone, and adjust the record head for maximum output in playback.

Bias Adjustment by Ear

Q. I own a three-head cassette deck that has a user-adjustable bias control. I am a bit confused as to its proper use. Inasmuch as my cassette deck lacks a tone generator, I use FM interstation noise, recorded at about −20 dB, to get as close a match as possible between the deck and the tape. Should I use this procedure with Dolby noise reduction on or off? Usually I use Dolby C.—Nathan Losman, Belleville, N.J.

A. Since you are adjusting bias on the basis of frequency response, you must include in the bias-adjustment procedure all elements of the tape recording and playback system that affect frequency response. Therefore, you should proceed with Dolby NR on—Dolby C, if that is the mode you are going to use in recording and playback.

Let me add that adjusting bias on the basis of FM noise, using your ear to judge when response is flattest, is a recommended procedure. After all, *your* ear will eventually do the listening to program material. Should you find that there is a range of bias-control settings which seem to produce equally flat response, go to the maximum bias in this range, thereby minimizing distortion.

Let me further add that Dolby C NR is generally preferable to Dolby B, not only because Dolby C results in approximately 8 dB greater signal-to-noise ratio but also because, at high recording levels, it results in less tape saturation—and, consequently, less treble loss and distortion.

Dolby B and C Compatibility

Q. I have read in several periodicals about the incompatibility of Dolby B and C noise reduction. These articles indicate that I should expect audibly undesirable results when using Dolby B NR to play Dolby C-encoded tapes, and vice versa.

I do not hear weird effects when playing a Dolby C tape with Dolby B decoding, but I do hear strange modulation effects when I apply Dolby C decoding to a Dolby B tape. Does your subjective listening experience agree with my appraisal?

I believe that Dolby C NR should be

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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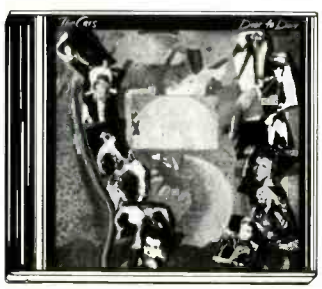

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XAT46 BM

Yes, Type II tapes may have somewhat higher distortion figures than Type I tapes, but not to a bothersome degree.

recommended for almost all taping where the choice is between B and C. The benefits of appreciably greater noise reduction and of headroom extension provided by Dolby C outweigh the disadvantage of exaggerated treble when only Dolby B is available to decode a Dolby C tape.—Sterling Lawrence, Weaverville, N.C.

A. Essentially I agree with you, except that I do not hear a "strange modulation effect" when using Dolby C decoding with a Dolby B recording. This effect may depend upon the particular tape deck one is using.

The consequences of encoding/decoding mismatches are chiefly in terms of treble response. Decoding with Dolby C NR when Dolby B is called for results in some treble loss; the reverse produces treble boost. These consequences are not necessarily undesirable. If they *are* undesirable, judicious use of the treble control in one's audio system can often compensate adequately.

Pad Lifters and Demagnetization

Q. I own a Nakamichi cassette deck. Will the pressure-pad lifter on this or other Nakamichi models prevent proper demagnetization of heads when using cassette-type demagnetizers?—B. Horne, West Lafayette, Ind.

A. To my knowledge, pressure-pad lifters will not have such an effect. If they did, it would be likely that cassette-type demagnetizers would come with warnings about this.

Type I vs. Type II Distortion

Q. When I look at distortion curves for cassette decks, I see that they stay below 1% only to 5 kHz and rise fast after that. Won't this hurt the quality of a recording? Also, I find that Type II tapes sometimes are measured as having more distortion than Type I. Therefore, wouldn't Type I be better for music?—Ken Thorberg, Duluth, Minn.

A. The rise in harmonic distortion beyond 5 kHz or so is not important for two reasons. First, most program material has a substantial drop in energy in the treble range; this tends to reduce distortion, inasmuch as distortion varies with signal amplitude. Second, harmonic distortion on tape is primarily odd-harmonic; therefore, the first major distortion component for, say, 5 kHz would be 15 kHz, which is close to or above the hearing limit of most adults.

Yes, Type II tapes are often measured as having somewhat higher distortion than Type I, partly because of the greater treble boost applied in recording for Type II. However, in tape systems, it appears that harmonic distortion doesn't become bothersome on program material until it exceeds about 3%. The measurements you are talking about usually involve distortion figures of roughly 0.5% to 1.5%. I think you should try a listening test, comparing a Type I tape with a Type II, to ascertain whether you hear a perceptible difference. If you do, then continue to purchase the type which is most satisfactory to *your* ears. If you don't, let your pocketbook be your guide.

Recording Warped Records

Q. I have an unusual problem in recording songs from a warped phono record. My tape deck picks up distortion when the stylus hits the "bump" on the record. When playing the tape, this distortion is audible through the speakers, even though there is no noticeable distortion when listening to the record. Can you explain?—Stanley Terence Cina, Edina, Minn.

A. Record warp produces a frequency that is too low to be audible but is of substantial magnitude. Most preamps, power amps, receivers, and open-reel tape decks can handle the warp frequency without going into noticeable distortion. However, the record electronics of many or most cassette decks *will* be overloaded by such a frequency. The cure is to introduce a high-pass filter between your tape output and the cassette deck; such filters are commercially available.

Automatic Misadjustment

Q. I recently bought a new cassette deck with automatic adjustment of bias, record level, and record equalization and began to retape my LPs and CDs. Later, I listened to a tape made on my old deck, and it sounded brighter than the tapes made with the new deck. I then recorded pink noise from an analyzer/equalizer using the auto-adjustment system, with and without Dolby C NR and at four different levels. To my dismay, in playback I found a 10-dB roll-off from about 10 to

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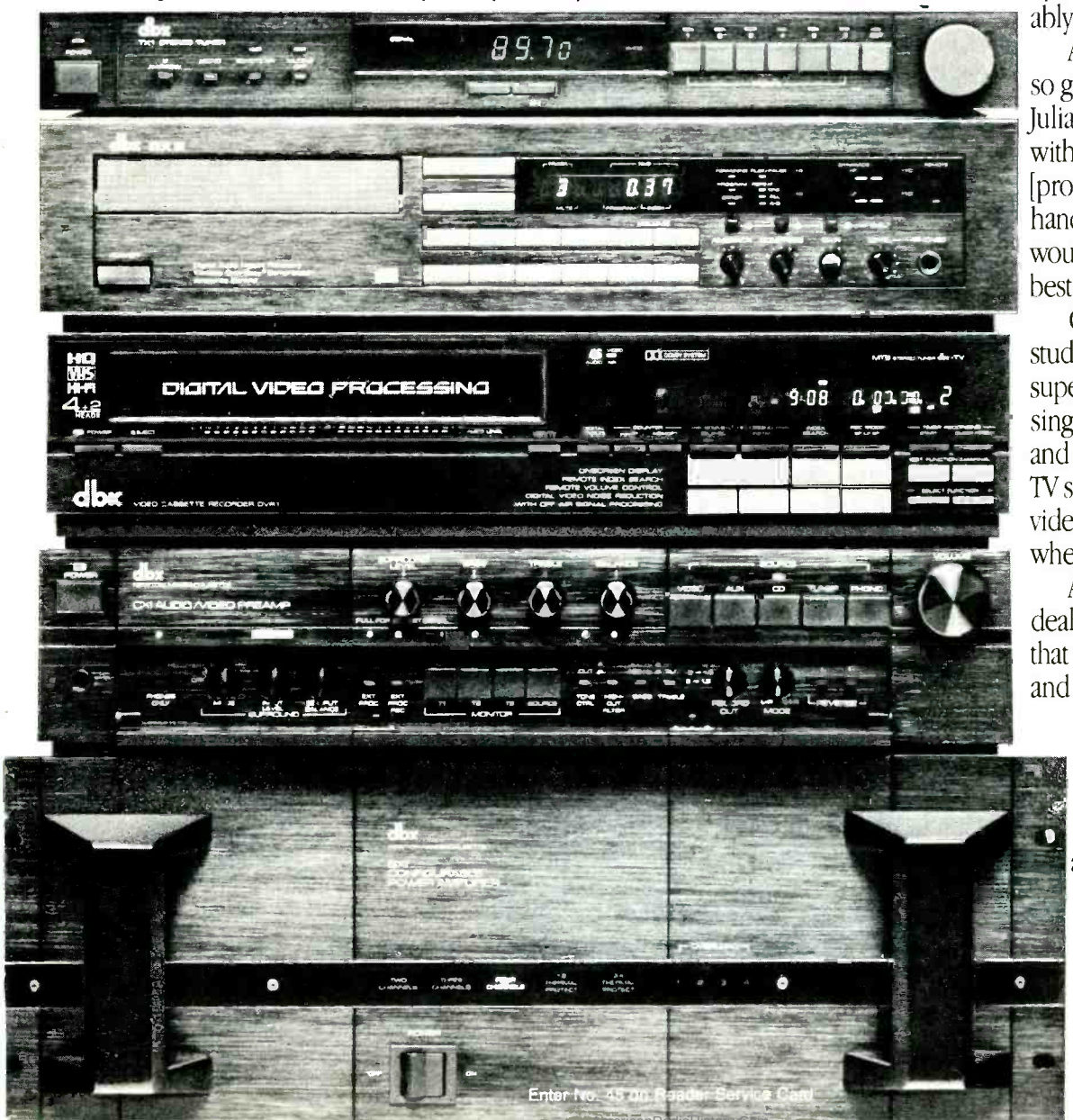

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16 kHz. I repeated the test without the calibration system and found the playback response nearly flat to 16 kHz (the upper limit of my analyzer). I exchanged the new deck for another of the same model and ran the tests again; the results were identical. I got my first unit back and have been recording without the automatic adjustment system. The manufacturer has suggested trying various tape formulations, but this has had no effect. Is there some defect in the deck?—Tim Stevens, San Antonio, Tex.

A. If your automatic calibration system is working properly, you should get results at least as good with it as without it. Considering that you get good results without the system but not with it, it seems there must be a fault in the deck, either in its design or in some internal adjustment for the calibration system. You may have been the victim of coincidence in being dealt two decks that work improperly. Perhaps your second deck came from the same production run as the first, and this run suffered from a design or manufacturing flaw absent from other runs.

I suggest that you take your deck to an authorized service shop and be prepared to show, convincingly and briefly, that it doesn't work properly when the system is on. If you bought your deck recently, it should still be under warranty. If the shop doesn't provide satisfaction, return to the dealer from whom you bought the deck, and have him replace it with another model or give you a refund.

Modernizing an Open-Reel Deck

Q. I have had an open-reel deck for almost 20 years. It is still in good working condition but has an S/N of only 45 dB. I would like to know how to improve it. I think dbx NR is an obvious answer, but I would like to keep my deck compatible with other open-reel decks not equipped with dbx decoding. Would installing modern tape heads be the answer?—Steven Dunn, Hoover, Ala.

A. Modern open-reel decks operating at 7½ ips with quarter-track heads can achieve a signal-to-noise ratio of about 65 dB without the benefit of noise-reduction devices. Inasmuch as your deck can achieve about 45 dB S/N, you are aiming at an improvement of something like 20 dB. I doubt that new heads would do much for you. Modern tapes will help somewhat, but you need a good deal more: Improved electronic circuitry, low-noise resistors in place of the garden-variety sort, and improved low-noise transistors (or, if your deck uses tubes, low-noise tubes). Unless you are talented in this sort of work, I doubt that your project is feasible. The best course is to employ dbx NR. This will add about 30 dB to S/N, resulting in a very respectable ratio of about 75 dB. However, these tapes will not sound their best when played without dbx NR.

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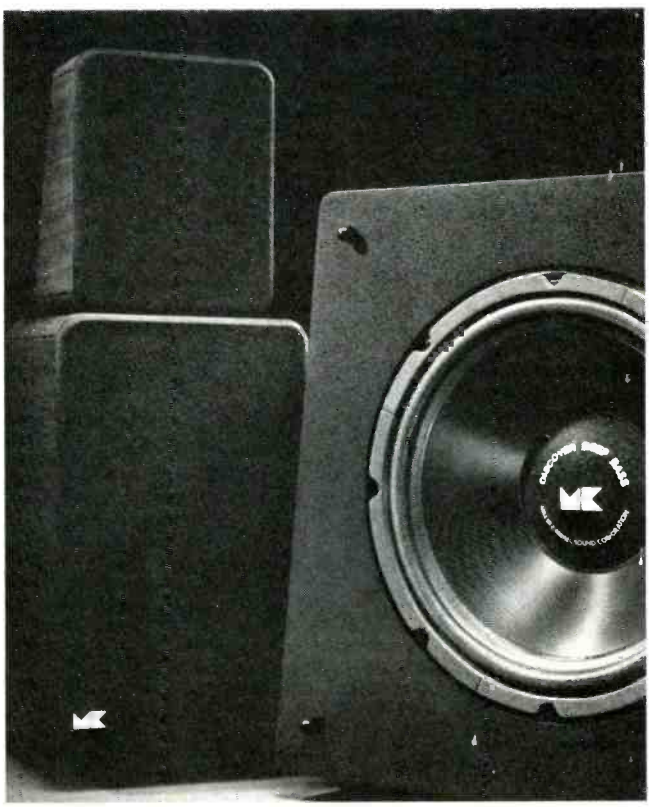

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Designed for both home and institutional use, the CSV52, from Community Light & Sound, is a three-way system rated for frequencies from 40 Hz to 20 kHz. The drivers include a 15-inch woofer with overhung voice-coil, a 6½-inch cone midrange coupled to a short compound horn, and a piezoelectric tweeter on a wide-angle Pattern Control Horn. The speaker is rated to handle 200 watts rms, 500 watts program, and has fuseless overload protection. The units are made in mirror-image pairs, and their midrange/tweeter modules can be rotated 90° in either direction. Price: $615 each.
For literature, circle No. 100

Pioneer Car Stereo

Most car stereo systems offer either a CD or cassette player along with a tuner, but not both. The KEX-M700, while basically a cassette/tuner combination, lets you add a remote CD changer at any time. The cassette section includes auto reverse, Dolby B and C NR, music scan and search, and blank skip. The tuner features 24 preset station memories and automatic memorization of the six strongest stations in a given area. Other features of the head unit are switchable loudness and a built-in clock. The Model CDX-M100 CD changer uses the same six-disc magazines (JD-M100) as Pioneer's home players. It can play programs of up to 32 tracks per magazine and can store programs for up to 16 different magazines. It is controlled from the front panel of the KEX-M700 or by a remote control supplied with the head unit. Prices: KEX-M700 car stereo, $650; CDX-M100 CD changer, $650; JD-M100 magazine, $15 each.
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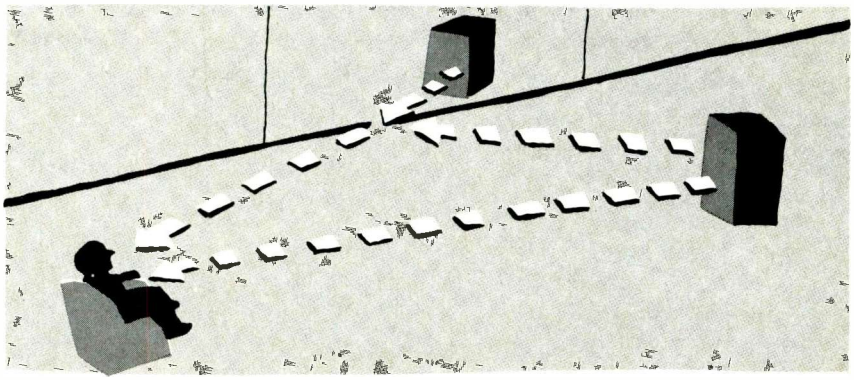
Audio Accessory Connection Case

The Disc-Pak is designed to hold a portable CD player with battery pack, a.c. adaptor, earphones, and up to eight discs. The nylon case is padded to protect the player and the discs and has cutouts for access to controls and jacks. The player's display is visible through a clear flap. Price: $69.95.
For literature, circle No. 101

LEVERAGED TRYOUT



Illustrations: Richard Osaka

Mirror, Mirror

Bang & Olufsen of Denmark, KEF Electronics of England, and the Acoustics Laboratory of the Danish Technical University are working jointly on a psychoacoustics research project whose aim is twofold: To determine the effects of room reflections on reproduced sound, and to discover how to minimize those effects in loudspeakers. The project, called Archimedes, is part of the Eureka research program funded by 19 European countries and the European Economic Community.

How do you study room effects without limiting yourself to the effects of a particular room? One way would be to build a lot of rooms; another would be to keep altering one room's dimensions and materials. However, those approaches would cost far more than Archimedes' $3 million budget.

Instead, the project will be doing it with mirrors—or, rather, taking advantage of the fact that a room's surfaces reflect sound very much the way mirrors reflect light. Speaker images reflected from a wall are sonically equivalent to duplicate speakers just behind that wall. So the Archimedes approach will be to render the wall acoustically transparent and put a real duplicate speaker just where its sonic image would be if the wall were solid. The "room" will have walls, floor, and ceiling of cloth and be erected in the Technical University's anechoic chamber, one of the world's largest (40 × 33 × 27 feet). The "image" speakers will be positioned outside the cloth walls in locations determined by the angles from which real reflections would come.

The signals going to each image speaker will be digitally filtered to simulate the absorptive effects of particular room surface materials and the frequency effects of off-axis reflections. Where necessary, attenuation and delay will be used to simulate greater reflective distances. Each speaker will be individually controllable, allowing the study of individual reflections.

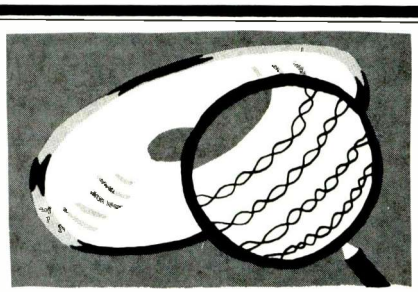
A speaker in a room has many images: Primary (reflections of the direct sound from the speaker itself), secondary (reflections of reflections), tertiary (reflections of secondary reflections), and so on. But only the reflections reaching the listener in the first 1/30 S—the ones travelling about 38 feet or less—affect tone quality and imaging.

Thirty-two speakers are needed for the project. All of them (including the primary speaker) must be identical, with wide bandwidth, linear frequency response, and known directivity. They must also be small enough to fit wherever needed and easy to aim at any angle. To meet these requirements, KEF has built a set of small spherical sound sources using 5-inch coaxial drive units.

The Archimedes project is expected to take three years.

Tempest in a Time-Pot

Stereo sound requires two channels, but Compact Discs have just one data track. Therefore, left- and right-channel signals on CDs are interleaved, with 11.3-μS bursts of left-channel data alternating with equal right-channel bursts. Some CD player manufacturers take advantage of this situation to save costs, using one D/A converter whose output is switched between the left and right channels at that same rate. As a result, there is a performance trade-off: The right channel will lag 11.3 μS behind the left. To prevent this, some players have separate D/A converters for each channel; still others have a single D/A converter but add sample-and-hold circuits to delay the left signal until the right-channel signal can catch up. Some manufacturers



point out that even this small delay is enough to cause an interchannel phase difference of 8° at 2 kHz and 81° at 20 kHz.

But does it make a difference in the home? The speed of sound is about 1,127 feet per second; a time delay of 11.3 μS is therefore equivalent to having the right speaker 0.15 inch farther from you than the left one. In actual listening, the differences in distance will be greater than this.

Live Music in the Lab

Live music and Acoustic Research go back a long way together. In the '60s, they ran live-versus-recorded demonstrations to show how hard it was to distinguish live from properly prepared recorded sound. The results were somewhat predictable (most listeners had trouble telling the live from the recorded sound even when Edison used the technique to demonstrate his cylinder recordings), but still impressive.

Now, AR is using live music for a slightly different purpose. Musicians from Boston's Berklee College of Music are coming to play at the AR labs, so the company's engineers can hear how live music sounds in the spaces where they normally hear recorded music, and so they can measure various aspects of the sound.

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An engineer's experiments are on less of an ad hoc basis than a cook's, but both rely on the art of informed intuition.

Hazard on Hold

If your work involves a lot of telephoning, you probably spend a lot of your time on hold. In theory, a little music in the background would be a pleasant way to show a caller that he or she hadn't been disconnected; in practice, I find it a mixed blessing.

It all depends on what is playing. Easy-listening wallpaper music, which I otherwise dislike, is fine. But radio announcements are distracting (especially Sunbelt weather reports during our Northern winters), and rock is jarring if you're trying to concentrate on something else.

Classical music always starts and ends in mid-phrase. That's frustrating, but I just found a frustration even

worse. The other day, a music-on-hold system played a few bars of a tantalizingly familiar symphony which I just couldn't place. The party I was calling didn't hear it since he wasn't on hold, so he couldn't be of help. Meanwhile, it's been driving me bats: "Da, da, *dee*-da-dah; da, da, *dee*-da-dah . . ." To quote Charlie Brown, "Aaaaaargh!"

Cooking with Cables

The other day, while poaching a bluefish in red wine, it struck me that adding bay leaves and fennel seeds would make it tastier. It did.

Like cooking, engineering relies on the art of informed intuition, but with more emphasis on information. An engineer's experiments tend to be on less of an ad hoc basis than a cook's. The more you know, the more you can predict, and the less time you have to spend "tasting" each circuit's operation to see if it needs spicing up.

When not enough is known about how things perform or what electrical parameters affect performance, engineers gnaw their knuckles in frustration. "I can design an amplifier," an engineer told me recently, "that sounds perfect—until I change the speakers or cables. Then I hear a difference. But the amplifier still measures the same."

We'd expect the sound to change when the speakers do. But as to the cables, there are three possibilities. We can't entirely ignore the possibility that the engineer is fooling himself about what he hears. Human perceptions, while sometimes more sensitive than those of test instruments, are too often less reliable. Those perceptions are influenced by expectations about what will be perceived; people who expect to hear differences between cables sometimes hear dramatic ones, while people who expect the opposite usually hear none.

It could also be that the signal the amplifier delivers into the cable isn't changing but that the cable somehow alters it en route to the speakers. The engineer would then hear a difference from the speaker, at the cable's far end. However, he would probably have measured the amplifier's performance by hooking his test leads to the amp's output terminals, where the signal had not yet gone through the speaker cable. Therefore, his measurements would have missed any alterations that the cable imposed.

Then, there's the third possibility. Assuming that the cables did affect the sound, and that my engineer friend was measuring at the cables' output, his problem may have been not knowing which measurements would explain the cables' sonic effect. Without this knowledge and the information on amplifier/cable/speaker interactions it would yield, he may still be able to build the amp he wants by trial and error—but he cannot engineer one.

The situation is still at the cooking stage, somewhere between guessing what bay leaf would add to the taste and pondering the effects of ground rhino horn on the diner's longevity.

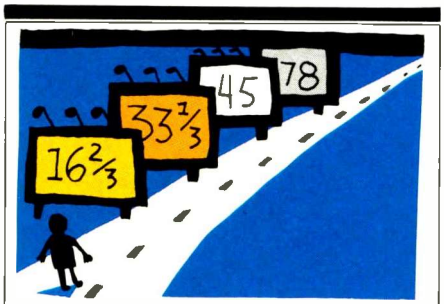
Audio designers can cope with the immeasurable in other ways. But if they can't measure it, they can't engineer it.

Room for ROM

Played through a sound system, non-audio digital data sounds weird at best, and usually downright nasty. So what would you hear if you inadvertently tried to play a CD-ROM disc through your stereo system?

Depending on your player's vintage, you might hear chirpy (and potentially speaker-damaging) noises, but it's more likely that you would hear nothing at all. The "red book" CD Standard suggests (but does not mandate) that CD players mute their analog outputs when playing non-audio discs. According to an article by Barry Fox in the British magazine *Which Compact Disc?*, early players did not have the muting feature, but manufacturers are increasingly incorporating it. Players can't mute their digital outputs; if they did, the data on CD-ROM and similar non-audio discs would have no way to get out. Therefore, amplifiers with digital inputs will need to incorporate the muting feature too.

Illustrations: Richard Osaka



Critical Ages

Certain birthdays seem to trigger critical awareness of one's age. For most adults, birthdays that end in zero do it. For others, the shock of awareness comes at birthdays that end in five, when the next big-zero birthday looms on the horizon.

To audiophiles, however, there are only four critical ages. At 33⅓, you are, at last, long-playing. At 45, you've reached extended play. And by 78, you're a collector's item. But the first of these four ages is less obvious, because it comes before many of us know we're audiophiles yet. It comes at 16⅔, when we finally have some money to buy records and perhaps even our own stereo. Hand anyone that age a telephone, and he or she becomes a talking book.

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BERT WHYTE

DIGIT TALLY

The 83rd Convention of the Audio Engineering Society set new attendance records during its October run at the Hilton and Sheraton Centre Hotels in New York. More than 8,000 people registered on the first day, an indication of the explosive growth of professional audio. There was, in fact, some grumbling that the convention was getting too big, and some didn't like the idea of having exhibits in two different hotels. Since the hotels are virtually next door to each other, this really wasn't much of an inconvenience. Personally, the one thing I didn't like was the lack of a lounge area outside the exhibits, which precluded the bull sessions with audio friends that used to be such an enjoyable part of an AES Convention.

As always at this show, there were daunting numbers of new products from every aspect of audio, and it is quite impossible to cover all of them. As has been true for some years now, digital recording technology predominated, with analog still strong but clearly showing signs of erosion.

Every AES Convention has its star attraction, and I think it safe to say that Sony grabbed the spotlight by introducing their professional R-DAT recorders. Sony's PCM-2500, for studio use, has two chassis, each part approximately 17 inches wide × 4 inches high × 16 inches deep. The top unit houses the tape transport and associated record/playback and indicator circuitry; it weighs 26½ pounds. The bottom unit is a combination power supply and digital input/output interface. The PCM-2500 can record at sampling rates of 32 and 48 kHz. Unlike consumer DAT recorders, it can also record at 44.1 kHz and thus can be used for CD mastering. The interface unit has AES/EBU and SDIF-2 and S/P-DIF output ports which provide direct digital connection to Sony PCM-1610, PCM-1630, and DASH-format digital recorders. After transfer to the PCM-1610/1630 format, editing can be performed on the Sony DAE-1100A. The PCM-2500 has quadruple oversampling on playback, and a digital filter is employed for each channel. Switchable emphasis is provided. Error correction is accomplished via double-encoded Reed-Solomon code. On playback, a green LED blinks when an error has been corrected, and an orange LED blinks when an error has been concealed. Balanced analog line inputs and outputs with XLR connectors are provided. Of course, the PCM-2500 offers all the usual DAT facilities of fast selection-locating via multiple search functions and appropriate subcode and number recording. Maximum recording time is two hours, using a DT-120 metal-particle DAT cassette. The PCM-2500 is available now, at $4,995.

Sony also introduced the PCM-2000 R-DAT recorder. This has really excited recording engineers, including yours truly, because it is a portable unit that permits up to two hours of recording with its rechargeable ni-cad batteries. This little gem is just 8⅜ inches wide × 3 inches high × 10⅜ inches deep and weighs in at 8 pounds, 13 ounces, including batteries! The PCM-2000 has many special features. Transport drive is via four direct-drive motors with servo control. Recordings can be made at sampling rates of 32, 44.056, 44.1, and 48 kHz. Double oversampling with digital input and output filters is employed. As with the PCM-2500, this unit has AES/EBU digital inputs and outputs for direct interfacing with the PCM-1610 and other recorders. It also provides SMPTE/EBU time code. Condenser mikes can be phantom-powered with either 48 or 12 V, and the mike inputs have balanced XLR connectors. Digital audio signals can be synchronized via a word-sync input. The PCM-2000 is quite intriguing. Imagine doing location recording with this lightweight digital recorder and a Blumlein stereo mike, or an M/S, or even a pair of PZMs. The PCM-2000 will be available in the spring at about $7,000.

At the Sheraton Centre, Sony also demonstrated their high-speed DAT contact printing duplicator, which I described in the November 1987 issue. The system really *can* duplicate an 80-minute DAT program in 15 seconds!

Because of the Copy-code controversy, the situation concerning consumer R-DAT recorders is still unresolved, and audio manufacturers are not importing any such recorders into this country. However, it is important to note that professional R-DAT units are not subject to the same constraints and are likely to be more available here. Also in their favor is the fact that they can record at the 44.1-kHz sampling rate; however, direct digital copy-

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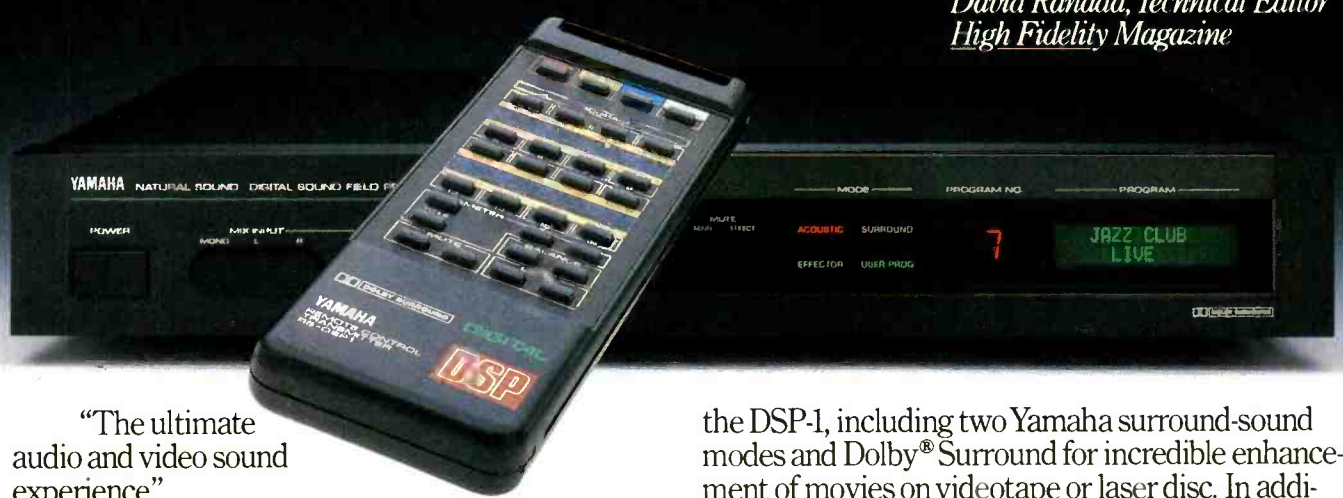

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Sony's light, portable PCM-2000 DAT machine, which can record for up to two hours in the field, has engineers really excited.

ing from a CD machine is still not possible because of copy-prohibit subcode flags in most CDs. It is also rumored that several other companies will enter the professional R-DAT recorder market, among them Nakamichi and Fostex.

While the arrival of professional DAT recorders is of major import, and no one can deny their virtues, they may be a bit too expensive for some recordists. Small studios have found the Sony PCM-F1, in conjunction with a VCR, to be a relatively inexpensive way to get into digital recording. The PCM-F1 is a perfectly respectable system which I have used successfully for several years. At the convention, Apogee Electronics (no connection with Apogee Acoustics, makers of ribbon loudspeakers) showed new anti-aliasing filters which can be fitted into a number of Sony digital recorders, including the PCM-F1. As supplied by the factory, the PCM-F1's filters can produce a rather severe phase shift of as much as 175° at 15 kHz. The new Apogee Electronics filters reduce this phase shift to less than 5°. I understand Apogee will undertake the modification themselves.

Rowland Research, which makes superb high-end amps and preamps, also has a PCM-F1 modification that includes the Apogee Electronics filters along with worthwhile improvements in the analog circuitry. They modified my PCM-F1 in this fashion, and I must say the increased sonic accuracy and cleanness is quite convincing. Depending on what changes are made, the cost can range from about $450 to $800. Turnaround time is on the order of three to four weeks.

Digital recording has had a profound effect in many areas of audio, including microphones. Early on in the digital age, it became obvious that mikes were going to require updating and redesign for better S/N, lower distortion, and other considerations. Brüel & Kjaer have enjoyed great success with their superb condenser microphones, but users have been restricted to the omnidirectional pattern. Engineers have long wanted a mike of this quality with a cardioid pattern, and at the convention, B & K obliged with the Type 4011 cardioid condenser mike. Its frequency response is rated at an amaz-

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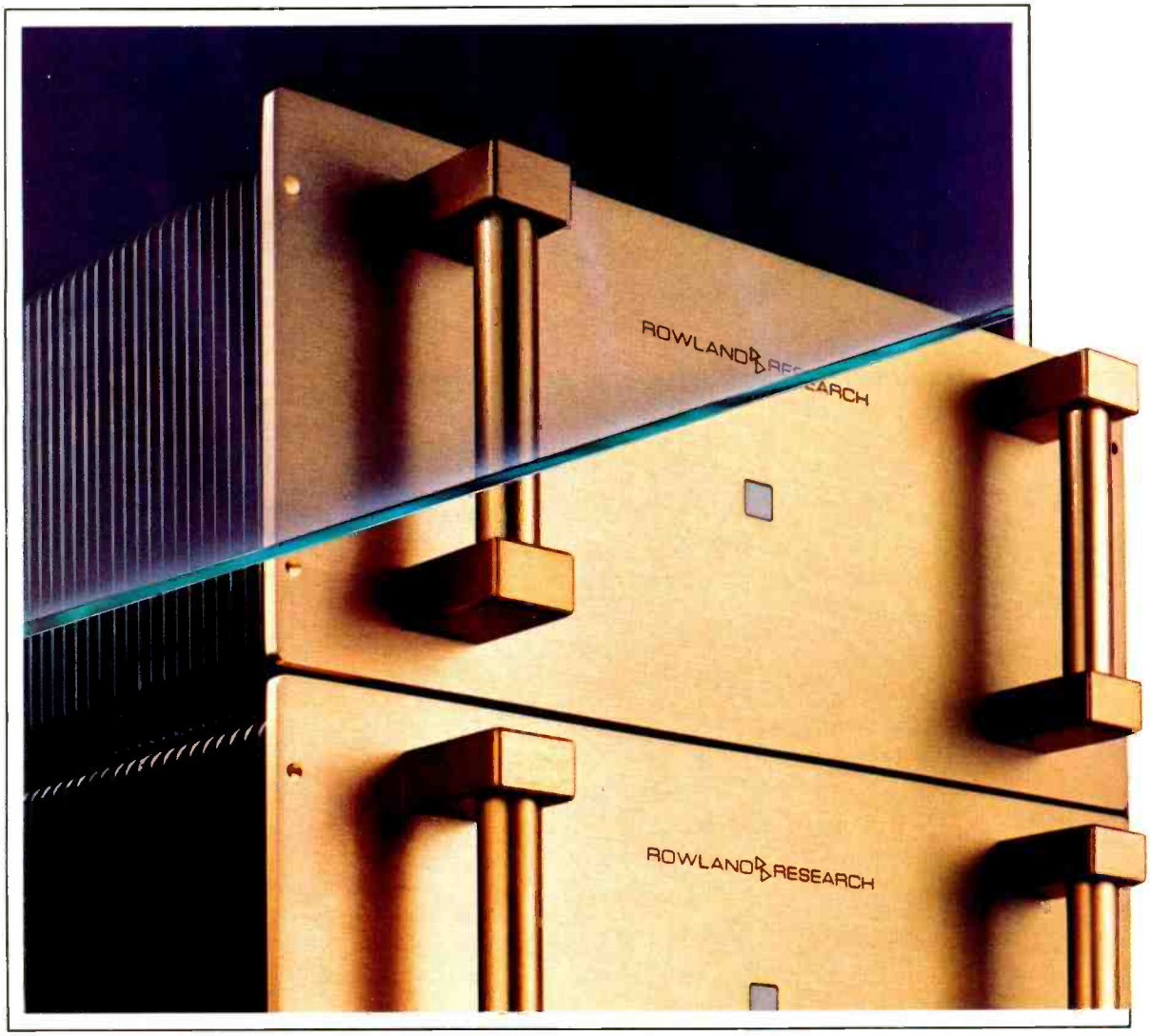

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Digital recording has had a profound effect on mikes, which are being upgraded in various ways.

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Sanken microphones, from Japan, have gained popularity in the past several years. This year, Sanken showed the CMS-7, a lightweight, portable mike with an M/S pattern, designed for use in MTS TV stereo recording and similar applications. With forward-facing cardioid and left/right figure-of-eight patterns, the mike gives good stereo directivity while maintaining compatibility for mono TV sets.

Teldec showed its DMM CD mastering system, which will soon be ready for delivery. The special Neumann lathe and embossing head are not very large or heavy, and since the process does not require a "clean room," the equipment can be installed in any studio or disc-cutting lab. Currently, more than 50% of Teldec's CD production is via the DMM process, and they claim that more than 1,000 CDs are due to be DMM-processed and marketed.

At the AES Convention, RPG Diffusor Systems exhibited Dr. Peter D'Antonio's latest models of his Diffusors and "Abffusors," which are sound-absorbent panels with a claimed rating of 80% at 100 Hz. Concurrent to the AES Convention, *Stereophile* magazine ran a high-end audio show at the close-by Omni Park Central Hotel. In the room in which CSA Audio, a retailer in Upper Montclair, N.J., exhibited, the efficacy of Dr. D'Antonio's Diffusors and Abffusors was demonstrated. This room measured about 60 × 30 feet and had a 10-foot ceiling. Before treatment, it was typical of such a large space, with a lot of slap and flutter echo. Judiciously placed Diffusors and Abffusors corrected these deficiencies, making Duntech Sovereign speakers, driven by Mark Levinson's superb Cello electronics, sound magnificent.

Editor's Note: I have a bone to pick with several exhibitors who took rooms at the Stereophile Show, and this is a problem which surfaces occasionally at the Consumer Electronics Shows as well. It has to do with a certain attitude toward the public in general in the first case and toward the dealer in the second. What I am objecting to is the "scheduling" of presentations some 20 or 30 minutes apart, in the manner of seatings at a fine restaurant. The doors are closed to all "foreigners" in between. In my opinion, this practice is highly arrogant and should be stopped. At one room, people were kept waiting in a stuffy, hot hallway for more than 30 minutes, some 10 minutes beyond the scheduled presentation time. After allowing the throng to seat themselves, the principal speaker proceeded to make a telephone call which lasted a further 10 minutes. In my opinion, it is time to tell these would-be emperors that they aren't wearing any clothes.—*E.P.*

ON RE-DEFINING DYNAMIC RECORDING.

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SHIFTY CHARACTERS

Illustration: Russell O. Jones

Let's continue last month's discussion of filtering, and focus specifically on the workings of digital filters. As we have observed, the analog output signal of a CD player is a pulse-amplitude-modulation waveform. The ultrasonic content of the signal is a series of image spectra which are duplicates of the original spectrum. It is the anti-imaging filter's job to remove these duplicate images, leaving only the original spectrum. The summation of a low-pass filter's sin(x)/x responses to those individual impulses reconstructs the signal's waveform.

Rather than use an analog brick-wall filter to suppress ultrasonic image components after the signal has been converted to analog form, it is possible to process the digitized signal before D/A conversion, using a digital filter. The underlying mechanism used in a digital filter is time delay. Surprised? Don't be. Delay can profoundly affect both analog and digital signals.

For example, a delayed analog signal added back to itself results in a wholly new frequency response—creating a comb-filter response. If a signal is delayed by time T and mixed with the original undelayed signal, cancellations will occur at odd multiples of the frequency f = 1/(2T). For example, a 1-mS delay will produce notches at 500 Hz, 1500 Hz, 2500 Hz, etc. This filtering technique produces no phase distortion whatsoever.

Briefly, this is what happens in a digital audio filter: Each input sample is multiplied by the sin(x)/x coefficient corresponding to its contribution to the filter's overall impulse response. The delayed multiplication products are summed together to produce the "filtered" output sample. Thus, the impulse response of an analog filter is digitally simulated. Let's consider a digital filter's operation in more detail.

Each sample point of a digitally filtered output signal is the sum of many filtered samples from just before and just after the sample point in question. Such time shifts require a delay line. Since the samples are digital, we may use a shift register with output taps after each delay element, as shown in Fig. 1. Input samples enter the shift register, the output of each tap is multiplied by a coefficient associated with the impulse response, and the product is summed with other products to yield the new output sample.

From a spectrum standpoint, the multiple delays yield overlapping notches in which all frequencies are attenuated. In a CD player's digital filter, the delays are specifically calculated to attenuate image spectra above the audio band.

The sum of many such multiplied samples yields low-pass filtered data. To access many such samples, each time a new sample is input, the samples in the shift register are shifted one delay to the right, and the new sum of products is recalculated. Because of the movement of the samples across the shift register, this design is often called a transversal filter.

To recapitulate (and referring again to Fig. 1), assuming that data has already shifted through the filter, the T_1 output sample is equal to the T_1 input sample times the C_1 impulse response coefficient, plus the T_2 input sample times the C_2 impulse coefficient, plus the T_3 input sample times the C_3 impulse coefficient, plus the T_4 input sample times the C_4 impulse coefficient. When the next new sample is entered, the previous samples are shifted one delay to the right to make room for it, and the calculation is repeated. In this example, each sample shifted through the filter requires four multiplications and four additions.

In practice, a number of considerations determine the design of an implemented filter. The analog signal is the sum of the sin(x)/x waveform resulting from each sample. The sin(x)/x waveform extends to infinity in both the positive and negative directions, so theoretically all of the values of that infinite waveform would be required in order to reconstruct the analog signal. (In our example above, only four coefficients were used.) Fortunately for designers of digital filters, we can find a point on the waveform where neglecting any further response results in a negligible error; a filter which disregards the response values beyond such a point is called a finite impulse response (FIR) filter. In some implemented FIR designs, perhaps 24 or 30 samples are summed.

The technique is almost successful; however, when a time delay is used, the signal is mixed with delayed copies of itself, spread over time. To perform this calculation without audible aliasing, the filter must operate at a rate faster than the disc's 44.1-kHz sam-

FIFTEEN YEARS AGO BRITAIN THOUGHT THIS MAN WAS CRAZY.

Fascination with the way things work led Ivor Tiefenbrun astray from a very young age. But in the early seventies, the dark ages of hi-fi, things really took a turn for the worse.

It was a grim time all round. Cordless phones were hard to come by. People wore flares. And even the **experts** still believed that the hi-fi chain started with the speakers and worked down to the turntable.

This understanding dominated the way the industry as a whole designed new systems.

And it drove Ivor to distraction.

Because it was diametrically opposed to his own **opinion**. He believed that the turntable was the most important element.

As **crazy** as it seemed at the time – his reasoning was pretty straightforward. Commonsense really.

To pick up the music the needle follows the record grooves for information stored in the groove walls. What most people don't realise is how intricate an operation this is. Movements so minute, they are measured in microns.

Take a few minutes to watch closely while a record is playing. The process is hypnotic. Because you live in a world where things are measured in inches.

It's when you scale the 'groove world' up to inches that things start to get pretty **hair-raising**.

Suddenly you are in a deep crevice. The walls are undulated. Approaching at an alarming speed is a bobsled. As it hurtles through the passage it has to pick up tiny pieces of information.

The bobsled is, of course, the needle. And to pick up a deep organ note it has to swerve 10 feet 6 inches. For a high violin note it's less than an inch. A difference which may not seem staggering in itself. Until you stop to consider that the needle is travelling 6 miles per second. And that the pivot point of the lever controlling it is four **miles away**.

In these terms you can see how easy it is to miss out on critical information.

And how even the slightest, imperceptible movement can cause the needle to miss out on the more delicate notes.

Ironically, that which gives a piece its musicality.

TOMORROW THE WORLD.

No speakers in the world can bring back lost music. It must be dealt with at its source. The turntable.

A **painfully obvious** idea. Yet the entire industry ridiculed it. Because it pointed out they were wrong.

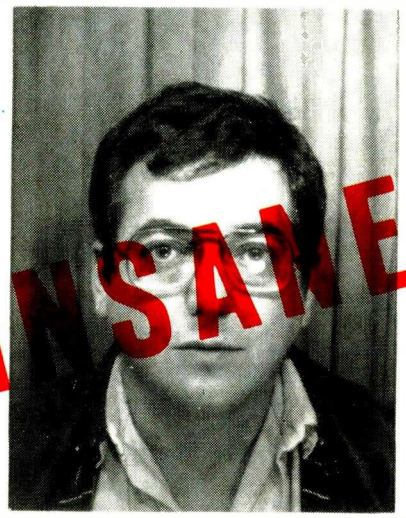
Ivor would have had more luck arguing that the world was round or man would fly.

So he did what Ivor always does when people tell him he's wrong. He ignored them. And quietly set about building a turntable.

The fruit of his labor, was the Linn LP12. And with it he **proved categorically** that the signal source is the most important component in the hi-fi chain.

Apart from revolutionizing the hi-fi industry as a whole, the LP12 has served history well.

As a shining example of the time honoured truth that sometimes things are too **simple** for people to understand.



Ivor Tiefenbrun

Because not only was it the undoubted industry leader in technical terms: it also sounded demonstrably better than any other turntable.

TODAY AMERICA THINKS HE'S CRAZY.

But for some mysterious reason the concept that one turntable might sound better than another was too much for some people to cope with.

Such was Ivor Tiefenbrun's dilemma. He was just a guy who wanted people to calm down and listen to the music.

And when they were too uptight to try it, he behaved in a slightly **deranged** manner. He called hi-fi reviewers who refused to listen 'cloth ears.' They called him a heretic. The score remained fairly even.

But the press love vocal crazies and Ivor was forever giving interviews.

Interviews in which he issued challenges to the hi-fi aficionados, calling on them to explain what the speakers can do about restoring music the needle has failed to pick up.

Their answers spoke volumes about their understanding of hi-fi. The industry leaders told Ivor he was **certifiable**. Out to lunch. **Looney** tunes. Living in Gagaland. Not to mention rather rude.

This upset Ivor. He doesn't like to be thought of as rude.

Alas these Board Room **diagnoses** came too late. Ivor's **insanity** had proved infectious. The industry was in turmoil. Music lovers everywhere, long tired of worshipping false gods, listened to Ivor's turntable and were converted.

Up and down the country naive listeners began to confess. A Vicar here, a Member of Parliament there, even somebody's mother in Shropshire, all heard the difference. Because the Linn proposition is so simple to prove.

Anyone can hear the difference between good and bad hi-fi. All you have to do is listen.

This fundamental belief is at the root of everything we do. And it governs our retailing philosophy.

Comparisons, using a single set of speakers, are a matter of course at all our dealers. And have been ever since the dawn of Linn. No gimmicks. No obligations. Just a straightforward listen.

And whether you compare Linn to a similarly priced system, or one at ten times the price, the results are the same: Time and time again, Linn's superiority rings true.

By the late seventies, the LP12 reigned supreme, yet Ivor still would not rest. Having proved that the turntable was the **critical** component, he then applied his fanatical attention to detail to the problem of the hierarchy itself.

He tweaked and tested, designed and refined. And established that the correct order of the hi-fi chain is, turntable, tonearm, cartridge, amplifier, and speakers.

The rest is, as they say, history.

Now music lovers can choose between a variety of Linn components in the hi-fi chain. And with the recent introduction of the Axis turntable, starting to build-up a Linn system is more affordable than ever before.

Today Linn products are sold in thirty countries. In America Linn are the recognised leaders in specialist hi-fi. And worldwide Ivor is the undisputed protector of the faith.

While the problem of the hi-fi chain has been happily resolved, the larger question of Ivor Tiefenbrun's **mental status** still looms. What's your opinion? Just clip the coupon and send it to your nearest Linn dealer (p. 158). You owe it to humanity.

LINN
HIGH FIDELITY
YOU'VE NEVER HEARD IT SO GOOD.

☐ Yes, this guy is **crazy**.

☐ He's probably **crazy**, but I'm reserving judgement until I get more information.

☐ If you promise he won't be there I'll come in for a listening comparison.

☐ He seems perfectly **sane** to me. (hee hee ho ho ha ha.)

Name

Address

Distributors ■ Audiophile Systems Ltd., 8709 Castle Park Dr., Indianapolis, IN 46256. Tel: (317) 849-7103. ■ Aldburn Electronics, 127 Portland St., Toronto, Ontario, Canada, M5V 2N4. Tel: (416) 863-0915.

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Reserved for purists,

At this level, beyond mere commercial practicalities, Infinity seeks to find its own: The few for whom music is an obsession, for whom price is no object in attaining the absolute perfect re-creation of sound.

The speaker system we've named the Infinity Reference Standard Beta was really built to prove to ourselves, after building the legendary $45,000 Infinity Reference Standard V, that lightning could strike twice in the same place.

We designed the IRS Beta as a true point source, capable of generating an incredible 15Hz to 45kHz response with effortless (and seamless) musicality.

Four 12-inch injection-molded polypropylene/graphite woofers are servo-controlled for state-of-the-art bass reproduction.

A new lower-midrange driver, the Large-EMIM, was created. This push-pull planar driver reproduces the critical frequencies from 70 to 700Hz—that vital area containing most of the musical fundamentals (an area ill-served by virtually all speaker designs, with attendant loss of the natural warmth of instrumental voices).

Two L-EMIMs optimally cross over to an improved EMIM with new high-gauss neodymium magnets and lighter diaphragm, for impeccable midrange transient response and detail.

And an EMIT and SEMIT (Super EMIT) produce the upper octaves and overtones to 45kHz with a transparency and openness that is airy and "live."

In total—a speaker of unprecedented overall musical accuracy. The IRS Beta. A speaker whose performance

extremists, and the obsessed.

can leave you breathless.

Its cost is under $11,000.

We also offer the equally incomparable IRS Gamma and IRS Delta, at about $7,000 and $5,500 respectively. Both are two-speaker versions of the Beta, although the Delta does not include a servo-control unit, which can be added later to upgrade the Delta into a Gamma.

We encourage you to audition the remarkable IRS Beta (as well as the Gamma and Delta) at any one of a select group of Infinity dealers catering exclusively to the audiophile.

To the dedicated—even obsessed—lover of music, it is the stuff dreams are made of.

Infinity®

We get you back to what it's all about. Music.

All of our advances in speaker technology are compiled into a brief presentation booklet called "The Creative Technology of Infinity Speakers, Vol. II." Ask your Infinity dealer for your copy.

With some clever designing, a 24-element filter can be made to do the work of a 96-element filter.

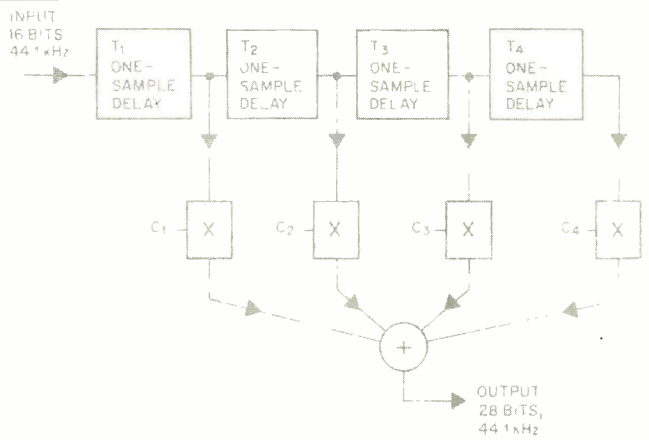


Fig. 1—A transversal filter uses a shift register, coefficient multipliers, and adders to produce a filtered output.

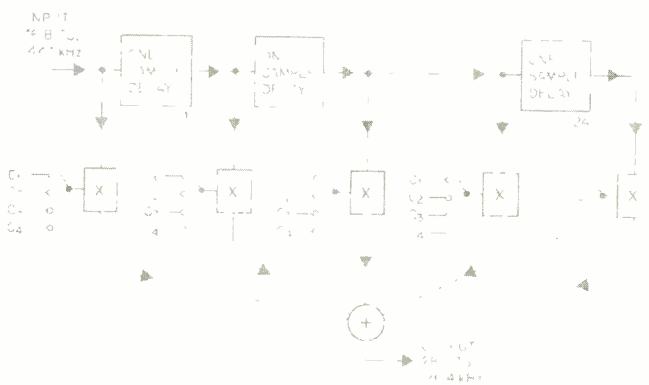


Fig. 2—A practical four-times oversampling transversal filter using 24 delay elements and four sets of coefficients.

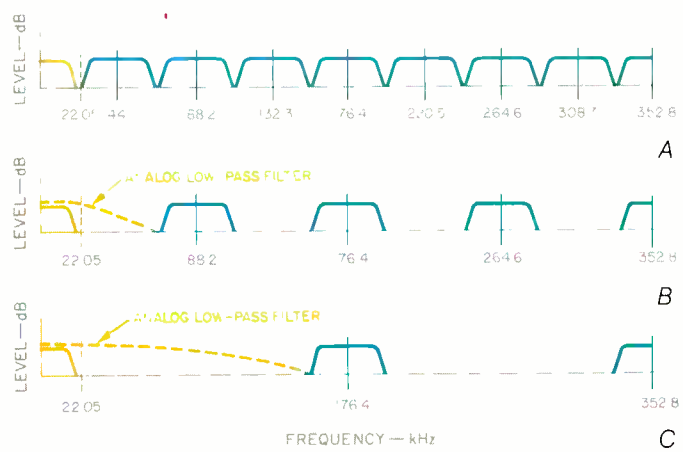


Fig. 3—The D/A converter's "staircase" output originally contains an infinite series of images of the original signal's audio-band spectrum (A). Digital filtering, with oversampling at two times (B) or four times (C) the original sampling frequency, suppresses the images immediately above the audio band. The remaining images are easily filtered out.

pling rate. Additional samples must be created; this technique is often called oversampling.

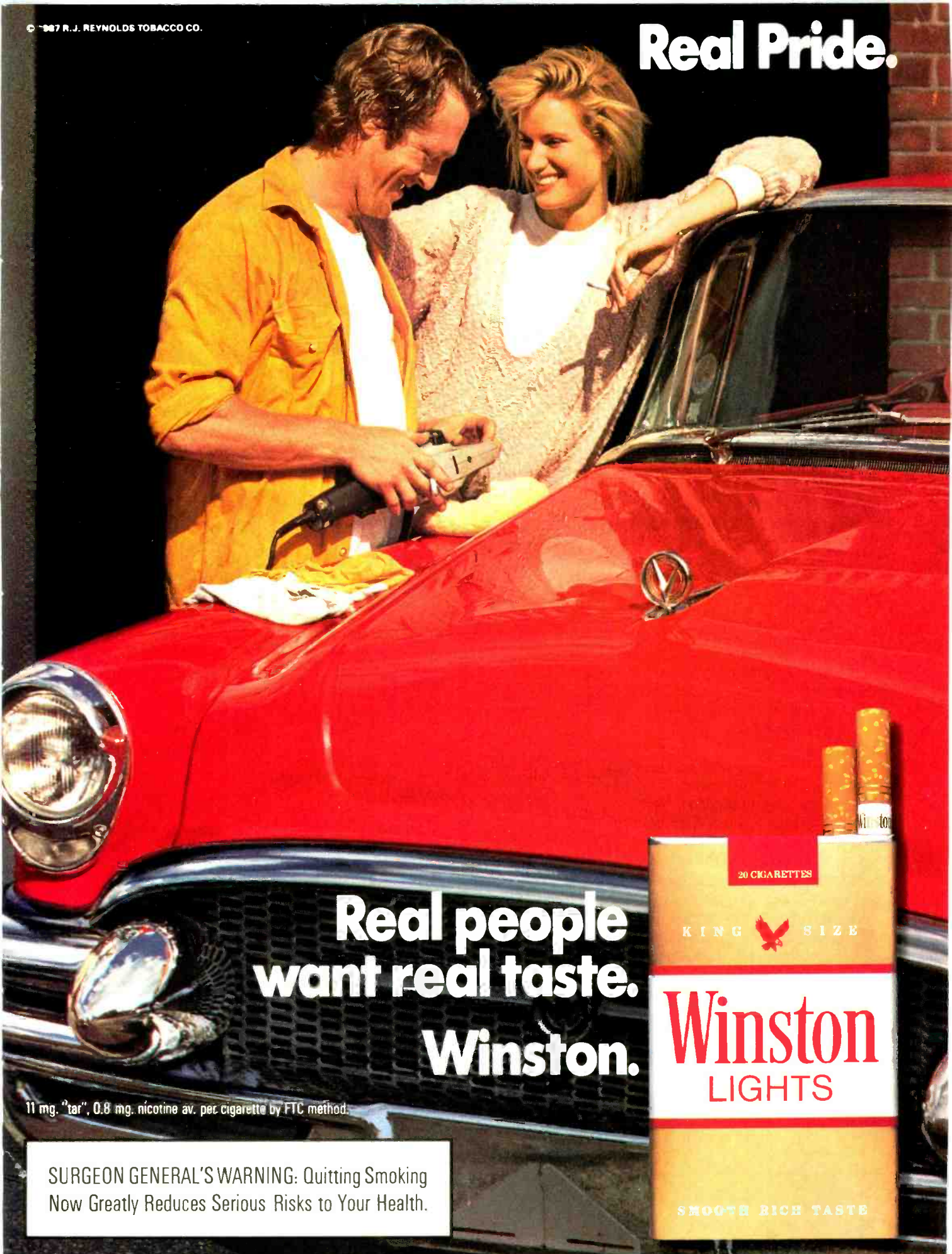
An oversampling digital filter uses samples from the disc as input, then computes additional samples. Because additional samples have been generated, the sampling rate of the signal is greater (perhaps two or four times greater) than it was originally.

To achieve this oversampling, a transversal filter (an inefficient one, as we shall see) could be constructed so that each delay is one-quarter the sampling period. This would result in four times the number of output samples, with the filter calculating three new values for each input sample. This avoids aliasing. To provide enough impulse-response values to permit a good response after summation, perhaps 96 delay elements would be required.

In each sample period, the shift register would input new data four times, but only every fourth sample would be audio data from the disc. The other three intermediate samples would be zero, to reserve places for the extra values to be calculated a bit later. Thus, only 24 of the 96 filter elements would contain non-zero data at this time. The filter would output data at a rate of 176.4 kHz, each new sample being the sum of 24 non-zero multiplications. The filter thus would calculate three new sample values at the locations of the zero input samples. However, this oversampling design is inefficient; the same result can be obtained with fewer delay elements.

A more cost-effective approach is seen in Fig. 2. It shows the architecture of a practical four-times-oversampling digital filter, generating three intermediate samples between each input sample. The filter consists of a shift register of 24 delay elements, each delaying a 16-bit sample for one sampling period. Thus, each sample remains in each element for an entire sample period. During this time, each 16-bit sample is multiplied four times by 12-bit impulse-response coefficients stored in ROM, with a different coefficient used for each multiplication. In total, the four sets of coefficients are applied to the samples in turn, producing four output values per sample. The 24 multiplication products are summed four times during each

Real Pride.



Real people want real taste. Winston.

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Oversampling filters image spectra from the audio band's vicinity, making analog output filtration easy.

period, and the summed products become the output from the filter. The data is shifted one place, and the process is repeated. Four times as many samples are present after oversampling, with new intermediate values calculated by the transversal filter. Therefore, the sampling frequency has effectively been increased four times, to 176.4 kHz.

In summary, as the 16-bit audio samples pass through the filter, the samples are delayed by each of the 24

elements. As a result, after multiplication by the 12-bit coefficients and summation, the weighted average of a large number of samples is generated. The values of the intermediate samples, obtained by the calculation process, determine the filter characteristic; the bands centered at 44.1, 88.2, and 132.3 kHz have been suppressed, as shown in Fig. 3. These broad regions of suppression are the overlapping filter notches referred to earlier. Our filtering goal, removing the image spectra from the vicinity of the audio band, is accomplished.

After the multiplications involved in oversampling, the word length is much longer than the original 16 bits. However, the output word cannot simply be truncated to 16 bits; this could increase distortion. A special rounding-off process, known as noise shaping, is sometimes employed. With noise shaping, a 16-bit digital filter can yield a dynamic range equivalent to that of an 18-bit system. Alternatively, some manufacturers employ those extra bits for bit-shifting, selecting the input to a 16-bit D/A converter from these 18 bits.

Following the digital filter, the data is converted back to analog with a digital-to-analog converter. Finally, the remaining band around 176.4 kHz (in the case of four-times oversampling) must be completely suppressed by an analog filter. This filter follows the converter, just as in players without digital filtering, but it is tame compared to brick-wall filters. Since the remaining band is so high in frequency, we can use a filter with a gentle, 12 dB/octave response and a −3 dB point between 30 and 40 kHz. It is a noncritical design, and its low order guarantees good phase linearity; phase distortion can be reduced to ±0.5° across the audio band.

In this example, we have focused on a four-times oversampling circuit. Many CD players use two-times digital filters, in which the 44.1-kHz sampling rate is oversampled to 88.1 kHz. In such systems, the spectrum centered around 88.2 kHz is prominent and must be filtered out. Because this frequency is closer to the audio band, a sharper analog low-pass filter is required. For example, in some two-times oversampling players, a sixth-order analog filter is used.

A digital filter design is thus an efficient method of accomplishing the task of anti-imaging without resorting to analog brick-wall filters. It alleviates the problem of phase distortion introduced by analog filters. A digital filter, as found in Compact Disc players, can have almost perfect linear phase response.

But what about digital audio recorders? What good is perfect phase linearity at playback, when every disc contains phase nonlinearity introduced by the brick-wall anti-alias input filters of the digital recorder? Well, oversampling can be used for input filters as well. But that's another story. A

NOW TECHNICS LETS YOU CREATE AN AUDIO/VIDEO EMPIRE AND CONTROL IT FROM FAR, FAR AWAY.

Start with the new 100W A/V remote control receiver that puts you in complete control.

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Imagine. Controlling a compact disc player. And a cassette deck. And a turntable. All from across the room.

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The new SA-R510 has also been engineered with a built-in electronic graphic equalizer/spectrum analyzer.** So you can make precise adjustments to bass, treble and mid-range sound. There are even 24 AM/FM station random access presets for instant recall.

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* See dealer for details.
** Equalizer not operable by remote.

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After four years at Hewlett-Packard, we w

In 1983, Dr. Godehard Guenther, President of a/d/s/, issued an injunction to our engineers and designers. "Guys," he said, "somebody's got to come up with a new loudspeaker standard. Let's make sure it's us."

Understand: he wasn't suggesting our existing loudspeakers weren't good. Rather, he was challenging us to address the shortcomings present even in the very best speakers, ours included. Shortcomings made all the more apparent by the sonic demands of the compact disc.

What we sought to build were speakers that didn't sound like a set of drivers stuffed in a box. Our goal was to create speakers characterized by a stable sound stage, pinpoint imaging and sound that seemed to emanate from free space.

It was a tall order. But the technology that has resulted—Unisōn™ . . . *of one voice*—is the kind other speaker makers will be emulating for years to come.

At a/d/s/, we make our own drivers. Our high definition woofers feature new cones, magnets, baskets and voice coil assemblies—painstakingly crafted to eliminate coloration.

We finally had the tools to be as critical as we were inclined to be.

Our first task was to take a long, hard look at the limitations inherent in loudspeaker drivers. That required a powerful "microscope." And, fortunately, we had one—a high-resolution, super-fast computer from Hewlett-Packard, supported by a sophisticated mathematical program of our own devise.

Housed in a specially designed a/d/s/ acoustics laboratory, the computer gave us the ability to generate and analyze driver performance data with an accuracy, thoroughness and detail never attainable before.

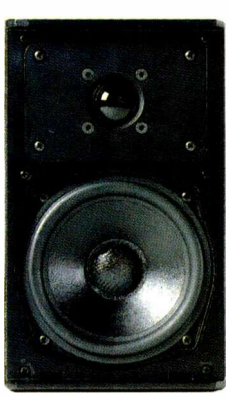
In this veritable mountain of information, acoustic truths resided.

The CM7's 4th-order, 24dB/octave crossover network. Complex, sophisticated and expensive to manufacture, it's a major reason why the speaker produces such a stable image.

If the drivers aren't flawless, no amount of camouflaging will hide the flaws.

One fact was obvious: the traditional materials used to construct woofers, tweeters and midranges —polypropylene, metal, cellulose compounds—were simply inadequate. So we set about to discover new ones ideally suited *at the molecular level* to the jobs they're required to do.

For the domes of our tweeters, we selected a proprietary copolymer that's exceedingly rigid, yet has superb internal damping and freedom from ringing. For the voice coil formers in our midranges, we adopted stainless



High technology enclosure materials enable us to make the new CM7 (left) and CM5 extremely compact without sacrificing interior volume. How compact? Consider that the CM5 measures a mere 9⅝" x 5¾" x 6⅞".

the keyboard of a ere ready for a Steinway.

steel. Strong and non-magnetic, it enabled us to produce a motor quick enough to resolve the finest detail, even at the highest volume level. And so our research went, until our drivers were as perfect as the laws of physics allow.

The crossover network. You don't see it. You shouldn't hear it, either.

When most speaker makers design crossover networks, their primary concern is the interaction of the drivers. We were more ambitious. We sought crossovers that optimize the relationship between the drivers and their enclosure, even with the room in which the system is played.

And we had an advantage: the excellence of our drivers allowed us to use *ideal* crossover points. Using these points, all the fundamental tones of the human voice can be reproduced by a single driver. With the computer, we evaluated countless prototypes of crossovers. A 4th-order network of the Linkwitz-Riley type proved the most appropriate. This type alone yields the response that satisfied our requirements for neutrality and realistic imaging. On a frequency response plot, the crossover points aren't even detectable.

How good it ultimately sounds depends on the box you put it in.

That's why we employed a polymer material filled with an extremely high mass compound to produce the rigid, aurally "invisible" enclosures of our Compact Monitor Series. You'll be amazed by the weight of these little beauties—they're heavy. You'll be floored by the sound.

With its stainless steel coil former and copolymer cone, the Unisōn midrange does something a cone midrange has never done before: span the fundamental range of the human voice—from 200 to 2,000 Hz.

Our tweeters' domes are made of yet another proprietary copolymer, giving them the unique ability to provide smooth, detailed, high frequency response at even the highest levels.

To our ears, our new speakers—the M Series and compact CM Series—offer convincing proof that Unisōn technology does indeed define a new era in speaker performance. All that remains is for you to take ears of your own to one of the dealers listed on the back page of this ad.

The M12 is the instrument on the right.

a/d/s/

Test them for yourself.

Shimek & Co	Anchorage	AK
Great Alaska Sound	Anchorage	AK
Alaska Audio/Video	Juneau	AK
New Lawrence Stereo	Birmingham	AL
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Audio Specialists	South Bend	IN
Stereo Crafters	Terre Haute	IN
Kief's Gramophone Shop	Lawrence	KS
The Sound Shop	Manhattan	KS
SOHO Electric Co.	Overland Park	KS
The Stereo Shoppe	Lexington	KY
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New England Car & Home Stereo	Springfield	MA
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Hunt Audio & Associates	All Stores	MD
Audio Associates	All Stores	MD
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Audio Associates	Rockville	MD
The Great Northern Sound Co.	S. Portland	ME
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Audio King	All Stores	MN
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Sound Systems, Inc.	All Stores	NC
Soundhaus	All Stores	NC
Dacia Audio/Video	Hickory	NC
Electronics Marketing, Inc	Grand Forks	ND
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Hi Tech Stereo & Video	Eatontown	NJ
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Sound Stage Audio	All Stores	NY
Rabson's	All Stores	NY
Longplayer Stereo	Goshen	NY
Auto Sound Systems, Inc.	All Stores	NY
Rosner Custom Sound	Long Island City	NY
Performance Audio Video, Ltd.	Merrick	NY
The Sound Mill, Inc.	Mt. Kisco	NY
Borger's Audio/Video	New York	NY
Cosmophonic Sound Inc.	New York	NY
Grand Central Radio	New York	NY
Leonard Radio, Inc.	New York	NY
Park Avenue Audio, Inc.	New York	NY
Stereo Exchange	New York	NY
Square Deal Radio & TV, Inc.	Patchogue	NY
J.B. Sound Systems, Inc.	Rochester	NY
Audio Command Systems, Inc.	Rockville Center	NY
Sound Concepts, Inc.	Roslyn	NY
Le Sounde	Saratoga Springs	NY
Gordon Electronics	All Stores	NY
Stereo Plus	Tonawanda	NY
Sound Odyssey Inc.	Wappinger Falls	NY
Front Row Sound	White Plains	NY
Adirondack Music, Inc.	Whitesboro	NY
Leonard Radio, Inc.	Woodside	NY
Audio Craft Co., Inc.	All Stores	OH
Stereo Lab	All Stores	OH
Carlin Audio	Kettering	OH
Audio Tech	Lawton	OK
Gramophone Audio & Car Systems	Norman	OK
Contemporary Sounds	Oklahoma City	OK
Chelsea Audio Video	All Stores	OR
The Stereo Plant	Bend	OR
Oregon Typewriter & Recorder	Eugene	OR
Lutz Enterprises	The Dalles	OR
Canlen Audio, Inc.	Bethlehem	PA
Sassafrass Records & Audio	All Stores	PA
The Audio Den	Erie	PA
Listening Post, Inc.	All Stores	PA
The Music Box	Harrisburg	PA
Summit Audio	Kingston	PA
Glick's Audio, Inc.	Lancaster	PA
David Mann Audio	Philadelphia	PA
Soundworks	Springfield	PA
Hi Fi House of State College	State College	PA
DS Audio, Inc.	West Reading	PA
Soundings	Middletown	RI
Audio Warehouse	Charleston	SC
Upstairs Audio	All Stores	SC
Southland Sound	Hilton Head	SC
Audio King	Sioux Falls	SD
Hi Fi House, Inc.	Knoxville	TN
Lindsey Ward, Inc	Knoxville	TN
Modern Music Inc.	Memphis	TN
New Wave Electronics	Memphis	TN
Audio Systems, Inc	Nashville	TN
Don's Hi-Fidelity, Inc.	Amarillo	TX
High Fidelity Inc.	Austin	TX
Brock Audio, Inc.	Beaumont	TX
Marvin Electronics Co.	Fort Worth	TX
Home Entertainment, Inc	Houston	TX
Audio Systems, Inc.	Laredo	TX
Hi-Fidelity of Lubbock	Lubbock	TX
San Antonio Audio Concepts	San Antonio	TX
Bjorn's Stereo Designs	San Antonio	TX
Road Sounds #1, Inc	Temple	TX
Audio Tech	Wichita Falls	TX
Lynn's Audio & Video	Logan	UT
Audioworks Inc.	Salt Lake City	UT
Arrow Audio	St. George	UT
Audio Associates	All Stores	VA
Stereo Types	Charlottesville	VA
Contemporary Sounds	Fredericksburg	VA
Sound Approach, Inc	Newport News	VA
Audiotronics, Inc.	Richmond	VA
Ear Food Find Audio	Winchester	VA
City Stereo	Burlington	VT
Sound Directions	Rutland	VT
Magnolia Hi Fi	All Stores	WA
Stereocraft	All Stores	WA
Huppins Hi Fi and Photo	Spokane	WA
Paulson's Inc.	Tacoma	WA
EME Audio Systems	Eau Claire	WI
Hi Fi Heaven, Inc.	Green Bay	WI
Sound World	LaCrosse	WI
Happy Medium, Inc.	Madison	WI
Audio Elite	Menasha	WI
Flanner & Hafsoos Music Ltd.	Milwaukee	WI
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EDWARD TATNALL CANBY

SPOOLS OF THOUGHT

Illustration: Mary Jo Mazzella

An audiobiography, I find, is entirely too much like paying bills. After considerable effort in many past issues of this magazine, I still find myself some 40 years behind. Just as well! Like antiques, old news is good news, and the older the better, if only for the novelty of it.

It was shortly before I began writing for this magazine in mid-1947 that I took a momentous step forward toward Audio with a capital A—I sallied forth, cash in hand, and bought a *magnetic* recorder. I kept it all of two weeks before I junked it. This wasn't a disc recorder with a magnetic cutting head weighing 4 ounces or so, which was in general use at the time. I was already far beyond that with my ultra-modern wide-range (up to 6 kHz) crystal cutting head, dating from 1940. That crystal head was much lighter too, weighing maybe as little as an ounce (we had not yet stepped down to the gram weight scale). What I bought in mid-1947 was a machine that would record *in a magnetic medium*, the hope of the future and the basis for so much of what we call audio today.

During the years of World War II when I worked in FM in New York City, there were frequent advertisements boasting of a sensational new kind of home sound via wire which would be introduced "after the duration"—in other words, after the end of the war. I insist, positively (by memory), that the product was to be the fabulous Lear wire recorder. You ask Lear now, they'll probably deny it. But that is what I remember, because—after too many dismal experiences with faulty 33-rpm lacquers—I was fascinated by the thought of a recording medium that would just go on and on, maybe even longer than the approximately 15 minutes then possible on a 16-inch professional disc at 33 rpm.

Lear, if it was Lear, kept at it. The "duration" was bound to end sooner or later, and then all these much-advertised products would spring upon the market, full-fledged, and we would all rush out in a perfect frenzy of buying. Nice to think ahead that way! But the war ground more deeply, and rationing got more strict. Only 5 gallons of gas were allowed per week for ordinary car owners' gas guzzlers, left over from prewar days. Even phonograph discs were rationed—you had to turn in an old shellac disc for every new one you bought, as there was no shellac coming from the Far East.

Came the two successive V-days, first V-E and then, in mid-summer 1945, V-J and the end. Buying spree? We were much too busy celebrating. I was stuck in Times Square on that later date along with about a million other people; I recall beginning to tip over, so to speak, under the mass human pressure, but I never made it to the ground. Instead, I remained suspended at a 45° angle, held up by acres of bodies for at least an hour, absolutely helpless. It was exhilarating.

As some remember, nothing *really* happened for the general public for a year and more after V-J Day. It took that long to unwind and untangle the war economy and get the old prewar manufactures back into production virtually as was, years before. New products mostly had to wait. And that included just about everything that might have been called "audio," if that word had been in common use. So it shouldn't be surprising that 1947 was the beginning of practically everything new, advertised and unadvertised.

Where was the Lear? Where was my after-the-duration magnetic recorder? Nary a word! Don't ask me what happened, unless maybe the Lear people discovered jet transportation about then. I don't remember ever hearing about a Lear magnetic recorder again.

Meanwhile, another manufacturer had taken over the idea for a "consumer" recorder of the same sensational type, and presently it appeared, from an outfit already (as I remember) very well known—Webcor. For many of our earlier years, the turntables made by that company were standard fare in thousands of American homes.

Wire recorder? Wow! Sensational! Superlatives are what any gutsy youngster would have employed to express his enthusiasm.

I can see the Webcor wire recorder in my mind's eye, and the sight does not please me. A bilious speckled maroon (well, my eye is prejudiced, after all), just a big, unwieldy suitcase thing, outwardly not unlike the earlier so-called portable phonographs of the Libertyphone persuasion, also Magnavox. (Those phonographs, a.c./d.c. for the big cities that still had mainly d.c. current, were all the rage for college students and the like who kept moving around and wanted a "little" phono-

I instantly discovered that the wire recorder was totally useless for music. Voice was scarcely better.

graph—ugh—to take with them. I rented one in college—d.c.—and I can hear its muffled, boomy sound to this moment. I could just about lift it.)

I do hate to tell you what happened with that wire recorder. Before I get into it, though, I must hastily remind you that on the professional side, *before* tape, there was a workable wire recorder from the Armour people, complete with capstan drive, which did satisfactory things of a useful nature for a while before such early tape machines as the Ampex arrived. Wire recording was wonderfully ingenious. As a matter of fact, it was already an old principle, going back to the famed Valdemar Poulsen, the first person to try to record sound using variable magnetism on a continuously passing magnetic medium. That was at the turn of the century. With some horrendous problems well solved, a professional wire recorder could be, and was, produced. But the consumer product was another matter.

In today's money, the Webcor wire recorder might have cost, at a guess, some $600. That's not hay, and it wasn't then, even if the actual sum was around $50. For me, in my most impecunious period, it was a real gamble, spending such a sum on something brand-new and untried—but I had to have it. Thank Lear for that. Diverted advertising, you might say.

The home-type wire recorder, I immediately found, was fatally flawed in one ghastly respect: It was strictly "reel to reel," with no capstan! That is, spool to spool. It seems to me that the principle was borrowed from the sewing machine; the very fine steel wire was wound on a fairly wide, deeply flanged take-up spool via an oscillating guide that moved it from side to side and thereby, supposedly, kept the winding even and flat inside the spool. It did indeed, for several minutes at a time, when nothing else went wrong. The wire simply slid through a grooved magnetic "head" from the playing-out spool to the take-up spool.

As for the speed, it was constantly changing, never the same from beginning to end of the miles of wire on one spool. Sloppy, to say the least. In spite of the oscillating guide, humps and bumps and overlaps built up inside the spool, making for horrendous wavers and flutters in recording—and creating a second set of the same on playback. I instantly discovered that this machine was totally useless for any kind of music. What disillusion! My very first magnetic recording of a piano, played by my own fingers, came out like a distant flock of bleating sheep. Voice recordings were scarcely better, a confident spoken statement coming out like an announcer experiencing a nervous breakdown.

And then there was the vast frequency range, which must have extended from about 200 Hz far upwards to maybe 2,000 cycles, as we called it. No bass, no treble. Just a fine, distant middle range. And lots of hiss.

Now, the original Webcor was a respectable and reputable firm, though it departed a good while back. (The newer Webcor hi-fi equipment merely took over the old name; it's no relation.) I should say that these faults were common enough in other audio areas of the time, and I expect that the too-hasty urge to get on the market, at a time when designers and parts and supplies were still war-limited, might have had a lot to do with the performance I am describing. Remember the Kaiser and Frazer cars? Same era.

There was worse—a lot worse. As you might guess, the wire speed past the record/playback head varied enormously, depending on the size of the two rolls, like the ribbon spools in an elderly typewriter. Still, about a day after my first dismal try, I began to think further. How about this wonderful new idea of editing? Could you actually take out bits of sound you didn't want?

Well, yes, you could. After a fashion. The wire was remarkably fine—that was its major problem. Also very hard and springy. In fact, it was almost impossible to handle, off the taut spool. Nevertheless, you could, if you carefully held the ends, snip out the offending portion with a pair of scissors—and tie the wire back together in a knot! Outlandish sort of editing, made worse by the springiness, which meant you had to make a very tight knot if it were to hold, instead of springing apart after the first play.

I tried it. It worked, more or less, though the little bumps of the edit knots would hump up the wire on the spool, thus making for pitch inaccuracy. This was the first edit in my history, and one of the first in audio history too, I'm willing to bet.

Woe betide you, though, if your fingers slipped on that fine wire and the ends sprang free. Instant chaos. Both spools, full of steel springiness, would immediately unroll and loosen up. The pitch relationship would be utterly destroyed in seconds, from one end to the other. Can you envision the trauma when *that* happened?

At that age, I was more persistent than I am today. You could call it obstinacy, and you would be right. I had paid my money; the machine was supposed to work. So I kept on coming back for more. I tried splice after splice, with bow knots, bosun's knots, and what-not; I recorded off the air and off my shellac records; I brought in friends to babble sweet nothings at the mike. And then I found another dire fault. The magnetic head recorded mainly on one side of the wire. When, during rewind and replay, the wire inevitably twisted on its own axis, the volume went up and down disconcertingly. All in all, not a very practical recorder.

The final straw came, as I said, after about two weeks of intermittent torture. I figured maybe I could join two "takes" from different spools of wire if the amount of wire on each was about the same, and thus recorded at the same speed. I just wanted to see if I could do *something* useful and new with ths machine. (I was edging towards magnetic tape editing, though I did not know it.) And so came the end. One day, near nervous exhaustion after hours of frustrating effort, one loose spool went flying out of my hands, spewing behind it hundreds of almost invisible coils of springy wire. In grabbing for that one, I dislodged another from a nearby shelf, and it dropped, shedding more shiny coils. In an instant the room was filled with the stuff.

I tried, obstinately, to wind that wire back on the spools, all those hundreds of feet, if not miles. I worked for an hour at least. Then suddenly I had had enough. With a burst of profanity, I flailed my arms around until I had gathered a huge armful of tangled wire and made straight for the nearest wastebasket. Next day, that machine was gone. I forget what I did with it. A

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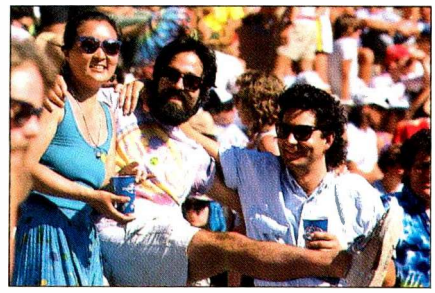


Author Michael Nash (center) enjoying himself with friends at a concert last summer. A typical pair of microphones (opposite page) wears flowers and a Dead sticker.

GRATEFUL TAPERS

An Informal History Of Recording The Dead

MICHAEL NASH

Photography by Philip Gould

"Hey, you down there with the mike," Grateful Dead guitarist Bob Weir calls from the stage. A reprimand in the making? "If you want to get a decent recording, you gotta move back about 40 feet."

"It sounds a lot better back there," chimes in bassist Phil Lesh.

It is August 1971, about the time that live taping of The Grateful Dead began to take root. The Dead are playing the second of two nights at the Hollywood Palladium. And yes, these are words of encouragement—musicians advising their audience where best to record their concert. How do we know it happened? Why, it's all on tape, of course.

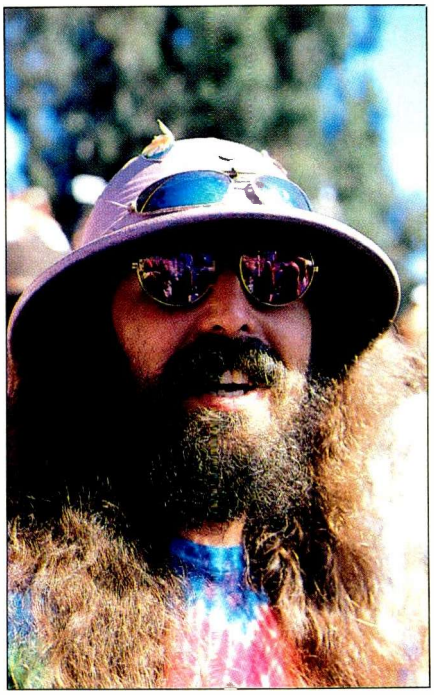
In the 16 years since that Hollywood date, tapers have evolved into an officially recognized and sanctioned group among the fans of The Grateful Dead; they've even got their own designated area from which to make recordings. Their concert habitat—the tapers' section—is a hi-tech sea of sundry microphones; of foam, Plexiglas, and other sound-baffling materials, and of analog and digital recording equipment. All for the purpose of capturing The Dead, and all for free. "Once we're done with it, they can have it" is Jerry Garcia's oft-quoted remark on the subject.

Grateful Dead sound mixer and audio wizard Dan Healy, with the band since their Fillmore Auditorium days in 1965, puts it this way: "Philosophically, we come from a place where the music belongs to everybody. Only the machinations of financial motivation work against that. And it's just not enough. It wasn't what got me here, it hasn't been what's sustained me, and it won't be what will dissuade me."

As for the industry claim that allowing recording results in fewer record sales, The Dead would simply chuckle. "There's never been one shred of proof—none whatsoever—that live recording hurts anything," says Healy. "If anything, it makes it better," he adds, noting that concert tapes have brought the band's music to a wider audience.

The Dead have notched nearly 2,000 concerts on their collective fretboards, probably more than any other touring band in history. And their appeal just continues to increase, especially in the wake of 1987's platinum-selling *In the Dark*, the group's biggest commercial success ever.

THE DEAD...THE DEAD



There may be nothing like a Grateful Dead concert, but a dedicated taper would say that a good recording comes close. And from one good tape, literally thousands may be bred, disseminated through a social network that has spread The Dead's music near and far. Whether one's interest lies in studying the music and its evolution, archiving it for posterity, or reliving those moments when "the music played the band," the tapes are there to fill the role.

Just as the music of The Dead has continually moved forward, so too has the state of tapers' tech. But even before the multitude of high-end microphones appeared, before the days of dbx noise reduction and PCM digital processors, before there even was such a thing as the tapers' section, a lot of field work was being done.

One of the first to record The Dead on tape was Steve Brown, who first saw the group (then known as The Warlocks) in their old Palo Alto stomping grounds back in 1965, an experience he describes as "love at first sound." Working in both local radio and record promotion at the time, Brown continued to see the band over the next couple of years.

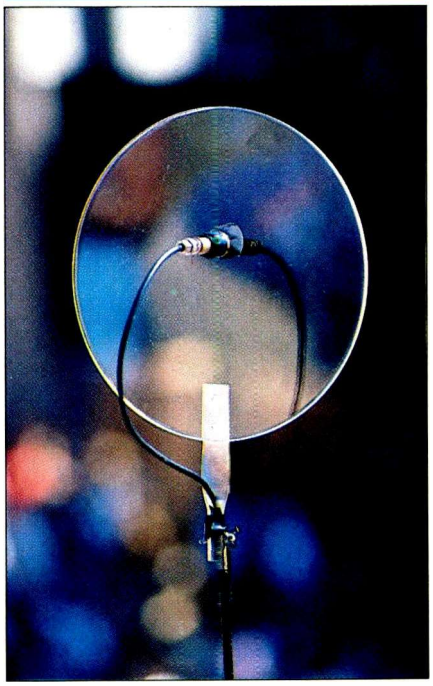
Later, Brown found himself in the Navy, where his job was to make tapes for the on-board entertainment systems of Navy ships stationed in the Pacific. On his free weekends, he would regularly head north from San Diego to catch the shows at San Francisco's Fillmore Auditorium and Avalon Ballroom, including performances by The Grateful Dead. One weekend in early 1968, Brown trotted his Navy reel-to-reel—a Uher 440—up the coast and sneaked it into Winterland, where Cream was playing. He discreetly recorded the show dead center from the first row of the balcony, over which his Uher condenser mike hung in all its monophonic glory.

The next morning, Brown heard that The Grateful Dead was going to play a free concert on Haight Street that day. His deck conveniently at hand, though pretty well depleted of battery power from the Cream show, Brown hit the street; sure enough, the band appeared and began playing. Holding the microphone with alternating hands, Brown was able to record the first four tunes—"Viola Lee Blues," "Smokestack Lightning," "(Turn on Your) Lovelight," and "It Hurts Me Too"—before the battery gave its last gasp.

Within a week, a large number of unassuming sailors throughout the Pacific were listening to a wild and psychedelic version of "Viola Lee Blues" blaring from channel 4 of the Navy's entertainment system. "It's why we lost the war," Brown laughingly surmises.

It turns out that Brown was probably the *only* person to make a tape of the Haight Street show (recorded, for the record, at 3¾ ips on a 5-inch reel, and sounding remarkably good after two decades). So, for anyone who has a dub of those four songs, this is probably where they came from.

A homemade yet effective attempt at improved directionality.



That concert, on March 3, 1968, was the first and last Grateful Dead show that Brown taped, although he did go on to help form Round Records, The Grateful Dead's own recording label, back in the early '70s. During his tenure there, he says, never did the idea of people having live tapes become a negative concern.

A year after Brown made his Dead recording, Bob Menke went to a Blind Faith concert with his older brother. His brother brought along a Craig 5-inch reel-to-reel deck to record the show. They did the same thing at a Crosby, Stills, Nash and Young concert the following summer.

"I kind of liked the idea," Menke remembers. Within a year, he bought a Sony TC-40 portable cassette deck and taped his first show. A few months later, in July of 1971, a radio broadcast of The Grateful Dead closing Bill Graham's fabled Fillmore West brought him his first exposure to the band. He taped the show off the radio and decided the next logical step was to go to a Dead concert, Sony in hand.

In August, Menke taped the first of nearly 200 Grateful Dead concerts he would record over the next 16 years. The result was certainly listenable, though hardly state-of-the-art. But just making a tape in those days was no small feat: The practice was essentially prohibited, as it worried Warner Bros., with whom The Dead had a recording contract. Still, if one was able to sneak his gear in and keep a low profile, there was a good chance of success.

Having graduated to a stereo portable Sony 124 by August 1972, Menke tried out his new unit up front at the Berkeley Community Theater, only to get busted during the first song. Disheartening, but not enough to end his new hobby.

At the time, Menke says, the handful of tapers on the East and West Coasts were using essentially the same equipment, generally Sony portables. As taping bans became more closely enforced over the next couple of years, tapers turned to ingenious means of

sneaking in their recording gear. Tales abound of tape decks strapped to womens' legs or hidden beneath sleeping babies in their carriages, microphones stuffed through bathroom fan vents from the street (to be retrieved inside), and a host of other diversionary tricks to fool security guards. Menke himself would wrap his deck in towels, stuff it into a Boy Scout backpack, and cover it with packaged food. "You always had to keep one step ahead," he recalls.

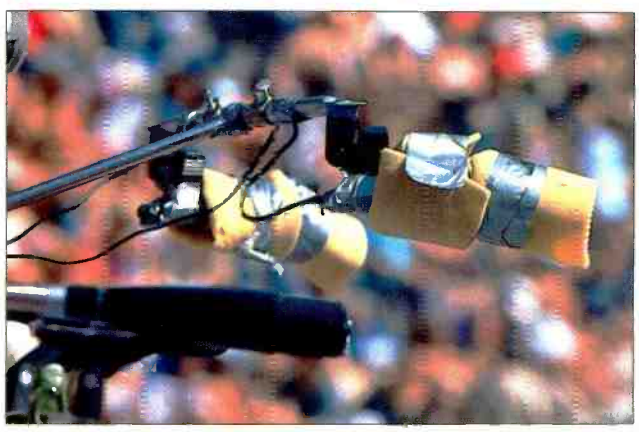
In 1974, Menke began using a Sony 152 recorder; suddenly, he says, "taping became more serious." The 152, equipped with a one-point stereo mike, adjustable input levels, Dolby noise reduction, and equalization that could be switched to match the tape type in use, was a major boon to tapers. Though it was hardly a small deck and definitely more difficult to conceal, soon everyone was buying it, simply because it meant better sound.

And by 1974, better sound was certainly what the Dead audience was hearing, as Dan Healy and sound designer/engineer Ron Wickersham had completed their massive Wall of Sound, an awesome sound-reproduction system involving 641 speakers. Very likely the most ambitious project of its kind (and ultimately too large to continue using), the Wall of Sound represented an exponential leap forward in the quality of concert sound, much to the delight of Deadheads and tapers alike. Practicality and expense aside, the system sounded magnificent.

From late 1974 to early 1976, while The Dead took a break from live touring and pursued various recording and solo projects, Menke and his pals honed their skills by taping the club shows of Jerry Garcia's band and of Kingfish, a group featuring Bob Weir. Victories, such as laying their mikes next to Garcia's stage monitors, were balanced by upsets, such as having their mike cables snipped by a diligent roadie. Menke remembers one particularly good experience during a surprise free show in Golden Gate Park in September 1975. Someone had turned a vocal monitor out from one corner of the stage. Using a mismatched pair of Sony condenser mikes, Menke pointed one at the monitor and the other at the instruments. The result, he says,

Getting the axis of each mike pointed at just the right angle is important in live concert recording because sources are usually fairly far away.

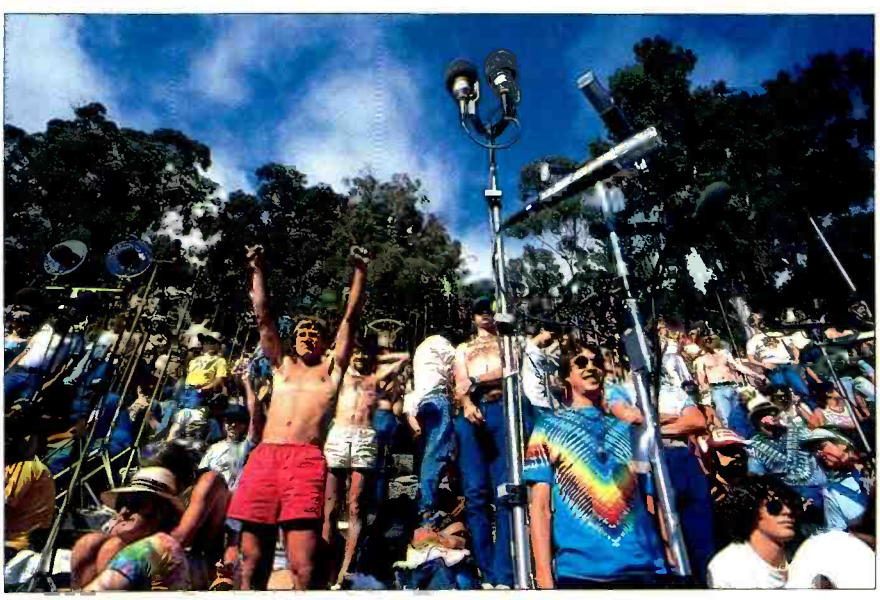
A small forest of expensive high-tech microphones sprouts from the tapers' section at virtually all Dead concerts.



Foam and gaffer tape are regularly used to extend the reach of even directional mikes.

Three Sony TC-D5M portable cassette recorders atop a Nakamichi 450, which has its pot taped to avoid changes in level. Despite the rigors of outdoor use, fairly large sums have been invested in this equipment.

Heavy-duty cabling connects three Sony TC-D5Ms and their mixer, a Yamaha MM-10. Crowd noise takes on a new meaning when you're taping a Dead concert.



"sounds like a board tape, no ambience whatsoever."

When The Dead returned in 1976, the taping population slowly increased. The procession of Sonys moved on from the 152 to the 153 and then the 158, which Menke bought in 1977. He had also acquired improved mikes, Sony ECM-270s and 280s. In addition, he was using high-bias chromium cassettes, which had first appeared in 1971. By degrees, the recorded sound was improving.

In March 1977, while taping a show at Winterland, Menke and his friends happily discovered an a.c. power outlet conveniently located on the first-row balcony floor. Wasting no time, at The Dead's next Winterland appearance in June, they carted in two 10-inch reel-to-reel decks—a Tandberg 10X and a Revox A77—and plugged in. Adding a new pair of AKG D-224E dynamic microphones, which they fastened to a stick and hung over the balcony, resulted in yet another small step forward in good sound. They continued using the reel-to-reels on and off for the next year, with the best results, according to Menke, coming from a friend's December 1978 combination of a Nagra deck and Neumann mikes with external power supplies.

In 1979, Sony introduced the TC-D5, the first cassette unit truly designed for serious field-recording enthusiasts. Far more portable than its predecessor, the 158, the new deck proved to be a boon to the entire Grateful Dead taping scene, and the number of tapers grew even larger. Initially listing at $700, the TC-D5 was no small investment, but it soon became the norm. Menke bought one immediately, replacing it about a year later (as did many others) with a TC-D5M, a newer version with metal-particle tape capability.

Also in 1979, Menke began using a pair of Nakamichi 700 microphones. Condenser mikes outfitted with both cardioid and omni capsules, the 700s, according to Menke, had improved presence in the high end and a better sound from farther back than the AKGs he'd been using. The Nakamichis have remained his choice ever since. Menke also built a passive preamp to add a 6-dB bass boost to the mix, later dropping the unit when The Dead's sound system began to deliver more bass.

THE DEAD...THE DEAD

As the number of tapers continued to grow, so did the difficulty of getting equipment into The Dead's concerts. Of greater import was the growing number of problems regarding certain tapers infringing on the rights of nontaping concertgoers. Early tapers were always careful to maintain a low profile, to get their spots legitimately, and to respect those who didn't care about taping. Unfortunately, as more tapers joined the ranks, not everyone was so courteous. Menke says that the appearance of tripods on the East Coast started to spell trouble. Things were slowly beginning to get out of hand. Meanwhile, he settled in with his Sony/Nakamichi combination.

Jaime Poris, a taping acquaintance of Menke's, was using a similar system but felt there was room for improvement. Poris, an electrical engineer at National Semiconductor, first saw The Dead on the East Coast in 1971 and taped a few shows in '73 on what he calls "lousy portables." In 1979, he moved to California and began taping seriously. Ever since then, he has been experimenting with a broad range of means and methods.

Early on, Poris realized that the best way to decide what equipment to use and how to use it was to just go out and experiment. He began playing with phase and amplitude differences, alternating pickup patterns, and angling his microphones, all in various combinations.

One experiment that caught on for a while was blending three mikes into two channels with a homemade passive mixer while varying the capsules, e.g., two cardioids and one omni. The results, Poris says, compromised the signal-to-noise ratio but still sounded better than the results from two mikes.

In 1981, Poris decided that he and his new taping partner, Jim Olness, were getting too much indirect sound, particularly at indoor shows, where reflection presented a problem. A more directional mike, such as a cardioid, seemed to be a solution, but Poris preferred the sound of an omni. The problem with cardioids, he felt, was that they weren't the same at every frequency; their response pattern changed as they were angled away from the sound source, leading to some coloration. The partners opted to alternate omnis and cardioids and compare results.

Hoping to increase the ratio of direct to reflected sound, they started shaping foam in various forms around the mikes. Anything more than 90° off the mike's axis became attenuated significantly; thus, the crowd noise was muffled and the music was made more prominent. While not sounding completely natural, the results were better than they had been. "Good," Poris says, "but not the solution."

By the following year, Poris and Olness had made further changes in their system. Attempting to improve their Nakamichi 700 mikes, Poris replaced capacitors with better ones, got rid of the transformers altogether, and made separate power supplies, which he hooked up to the capsules via BNC connectors. In the process, the mikes were reduced in size from 9 inches to about 4 inches. The resulting "mini-Naks," Poris and Olness attest, are quieter and definitely better sounding than their precursors.

In addition, Poris also built a new mike preamp, using some high-quality op-amp chips, to replace what he felt was a relatively low-quality preamp in the Sony TC-D5M.

Another step was to improve the tape's signal-to-noise ratio by turning to dbx noise reduction. Poris and Olness purchased a dbx 224, a home unit; then they replaced several capacitors and op-amps and inserted a portable power supply of eight 9-V batteries in the transformer's place. Adding a patch bay, they were able to split the signal into a dbx side and a Dolby side. Adding more patch bays down the line allowed up to 15 additional tapers to plug in.

The microphone modifications, new preamp, and addition of dbx resulted in tapes that sounded appreciably better than previous efforts. Though carting around a dbx unit designed for home use was certainly no fun, it was worth the hassle to get an improved sound. At the same time, Olness and Poris continued to experiment with shaping ordinary foam, and later Sonex, trying to reproduce the music as best they could.

While the serious tapers were developing their craft, the rude behavior of some of the newer tapers became increasingly felt. More poles began to appear, interfering with people's sight lines and their ability to enjoy the show. Some tapers showed up late and moved in on spaces that others had stood in line for hours to get. People were asked not to talk or sing along, so as not to "ruin" the tapes. Although those causing problems were a minority, they were numerous enough to make a difference. More and more complaints were voiced.

By 1984, Healy and the generally tolerant Grateful Dead organization had had enough. The choice they faced was to enforce a total prohibition on taping or find a way to prevent ongoing trouble. The Dead opted for a creative solution and established the tapers' section—a designated area at each show where those so inclined could record the music without having to be surreptitious about it. Suddenly, tapers had rights.

In October 1984, The Dead, via their telephone ticket hotline, began instructing those who wanted to tape to specify that on their mail-order ticket requests. In return, they were sent tickets marked appropriately. This process has been used ever since for facilities with reserved seating; at general-admission shows, a designated section is filled on a first-come basis. Almost invariably, there's been enough space in that section for everyone who wants to tape.

Some old-school tapers were upset at losing their sweet spots in front of the sound board, but overall the tapers' section made things much easier for everyone. Suddenly free from

the need to act covertly, tapers were able to pursue their audio experiments with a new-found sense of legitimacy.

Jaime Poris had been reading articles about Pressure Zone Microphones (PZMs) and decided to give the technique a shot. Though it appeared, Poris says, more apropos to string quartets, he and Jim Olness figured they had nothing to lose.

Their idea involved using a Plexiglas plate to create a hemispherical pickup pattern for the microphones. The mikes were mounted on the plate, facing the flat surface, and sound was reflected back into them. The main advantage was that almost nothing behind the plate got into the mix. The disadvantage was that the bass rolled off depending on the size of the plate.

Starting with a plate of reasonable size, the partners changed the size of the capacitors in the mike power supplies for both the cardioids and the omnis to acquire more control over the bass. Ultimately, they preferred the bass response of the omni capsules and opted for those. The Plexiglas plate, meanwhile, was built with a hinge and operated like a book. In this way, Poris and Olness could adjust the relative angles of the mikes. The resulting tapes, Poris says, "had no coloration, relatively flat frequency response, good bass, and good directionality."

Experimenting further, the two split the mikes 20 feet apart, using two separate Plexiglas plates. The effect, they decided, was significant; the split mikes seemed better suited to the panned signal and resulted in appreciably better imaging. Later, they built larger plates and began alternating the Nakamichi 700s with some capsules made by Knowles—tiny electret condenser mikes often used in telemetry, hearing aids, and surveillance. For their price (all of $25), the Knowles sounded quite good but had some slight coloration in the upper midrange.

At around the same time, Poris also built a peak meter and linked it to the system, allowing Olness to easily read the peaks on his Sony recorder in 3-dB steps instead of settling for the average offered by the deck's VU meters. Poris is currently working on a new microphone preamplifier, with built-in mike power supplies, which will allow him to tailor the bass response in four steps.

While always striving for better results, the two make sure they enjoy themselves in the process. "It's still a lot of fun," a friend observes, "but they take their fun seriously."

If tapers like Poris and Olness are serious about their pursuits, certainly the same must be said of those who have converted to the digital faith, incurring serious costs as they use PCM processors to put digital signals onto portable videotape decks. "The standard joke," says one digital taper, Ross Lipton, "is that when you go digital, you sell your TC-D5 to buy the batteries." Indeed, the four 12-V rechargeable cells that Lipton and his taping partner Chris Hecht use in their phantom power supply go for about $100 a pop.

A thin blanket provides precious little padding beneath recording gear that has been tweaked in every possible fashion.

Three Sony PCM-F1 digital processors and several video recorders, including two Sony SL-2000s.

Digital's first appearance on the Grateful Dead taping scene came in the spring of 1983. Dave Cramer had been taping since 1979, using the standard cassette format and collaborating with Jaime Poris on three-mike blends. Convinced that no other band offered the same incredibly high fidelity in concert as did The Dead, he figured it was worth giving digital a whirl. He rented a Sony PCM-F1 digital processor and a portable Betamax video recorder, powered them with heavyweight ni-cad batteries, and put them to work at a show in Tempe, Ariz.

The difference was huge, Cramer recalls, with a complete absence of tape noise which was most noticeable in the pauses between musical numbers. With great dynamic range, no wow or flutter, and no harmonic distortion from 20 Hz to 20 kHz, it became unquestionably clear to Cramer that digital was *it*.

He soon bought his own equipment even though PCM processors were rather hard to come by at the time. Eventually he sold his Sony processor and bought a Nakamichi DMP 1000, which offered what he felt was a warmer sound. He also exchanged his Beta machine for a top-of-the-line VHS, as that tape format was more readily available out on the road.

With a background in studio engineering, Cramer had tried out virtually every microphone in the book. Ultimately he decided on three Sennheiser 421s—cardioid dynamic mikes—two of which he places in an X-Y configuration with the third slightly behind them and out of phase. Aside from a slight rise in response at 30 Hz, he says the result sounds great.

With a $12,000 investment and 120 pounds of equipment, Cramer's efforts have not been minimal, but he feels they have been worth the results. His sentiments are shared by Hecht and Lipton, who estimate that, between the two of them, they could be driving a BMW for all they've poured into their system. The two began taping together on and off in 1982 after often seeing one another in airport baggage areas in transit to and from Dead shows. In 1985, Lipton bought a digital system. Today they use a PCM-F1, a Sony SL-2000 portable Betamax video recorder, and a variety of high-end micro-

Dialing For Deadheads

One doesn't have to go to every Grateful Dead concert to keep up on the group and their music. For those who prefer to tape the group in the comfort of their own living rooms, there's a radio show to suit the occasion, and for those who want to keep in touch with each other via computer, there's a hackers' bulletin board set up for that purpose. Both are the handiwork of writer and editor David Gans, author of *Playing in the Band: An Oral and Visual Portrait of the Grateful Dead*.

The Deadhead Hour radio show, hosted by Gans, is an audio kaleidoscope of sorts featuring a mixture of high-quality concert tapes, interviews with band members and associated figures, an eclectic sampling of The Dead's source music, up-to-date concert information and other news, and Gans' offbeat sound montages.

Originated by San Francisco's KFOG in 1984, the weekly program not surprisingly, found a waiting audience on The Dead's home turf. Gans music editor at *Mix* magazine and a 15-year veteran of Dead concerts took the reins a year later. Today, in addition to its home station, the show can be found on WMMR in Philadelphia and WNEW in New York.

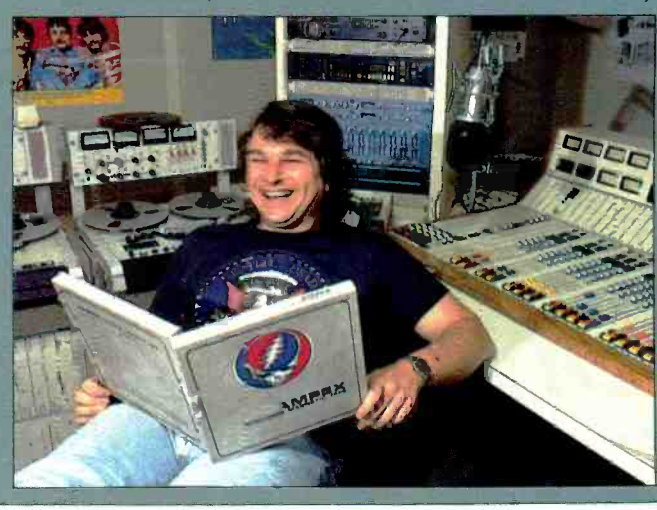
Though he has a vast and varied collection of concert tapes as well as permission to use material from The Dead's own vaults, Gans is not interested in trying to "fake" a Grateful Dead concert on the air. Rather, he uses the hour to offer a kind of community resource to Deadheads, aware that the Dead scene isn't just the music.

Like Dead concerts themselves, no two *Deadhead Hour* programs are ever alike. Shows in the past year have ranged from an evening with bassist Phil Lesh commenting on Charles Ives' Fourth Symphony, a piece he describes as having a major influence on The Dead's early musical philosophy, to *Prairie Home Companion*'s Garrison Keillor performing acoustic versions of Dead tunes with his band, The Wigglers, to a night of The Dead's versions of Bob Dylan songs. Ultimately, Gans hopes to deliver the program digitally via satellite.

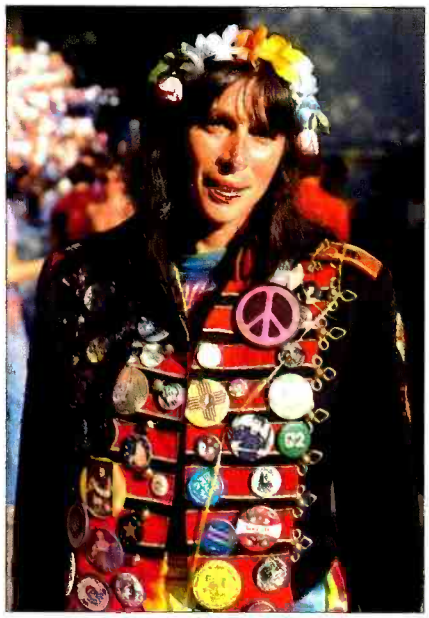
In addition to his role as radio producer, Gans is the cofounder and online editor of the Grateful Dead Conference on a computer network called The WELL. Essentially a hackers' bulletin board, the Conference is a social forum where Deadheads, via computer modems, can wax lyrical statistical, or otherwise about the band. In so doing, they conduct ongoing conversations on a host of related topics and form friendships with people they've never seen.

Both *The Deadhead Hour* and the Grateful Dead Conference serve a uniquely interactive community one not likely to fade away. *M.N.*

(*Editor's Note*: Radio stations and individuals interested in *The Deadhead Hour* can contact David Gans at 484 Lake Park Ave., Suite 102, Oakland, Cal. 94610. Those interested in the Grateful Dead Conference can call The WELL at 415-332-4335.)



Voice of KFOG's *Deadhead Hour*, David Gans has been going to Dead concerts for more than 15 years.



phones which are traded among the members of a taping co-op to which they belong.

Hecht and Lipton feel the tapes they make offer a vastly improved dynamic range, better signal-to-noise ratio, and far more presence in the bass. They also like the fact that video decks have a much faster writing speed than audio decks. Their tape of choice is the Sony Pro-X 500, thicker than the standard Beta tape, and they record at the fastest speed available. Further, unlike audio cassettes, the process of digital transfer ensures that successive copies suffer no generational loss of sound quality or increase in noise.

Last summer at Berkeley's Greek Theater, an outdoor amphitheater considered by many to be the best place to hear The Dead, Hecht and Lipton's group conducted a microphone comparison test. Controlling all variables, they set up three separate pairs of top-quality mikes: Neumann TLM170s, Schoeps CMC 341s, and newly re-engineered AKG 414s. On each of three successive days, they matched the pickup patterns in the respective mikes, using the switchable pattern capability of the Neumanns and AKGs and manually replacing the capsules of the Schoeps. Each pair was placed within a 7-foot range and run into similar units to allow A/B/C comparison.

After listening to the tapes on a reference system, all members of the taping co-op concurred that the Schoeps mikes with the omni capsules sounded best. Hecht felt that the Neumanns still had lots of potential, noting that they had been underpowered. (It turns out that they're not truly compatible with the power supply which had been used for the test.) As a result, Chris built a separate power supply for the 170s. As well, he's working on a new, all-purpose preamp with an active circuit using the SSM chip recommended by Jaime Poris. Eventually he plans to build a series of dedicated preamps, each specifically optimized for a particular set of microphones. He is also planning to field-test a pair of B & K microphones to see how they perform in Grateful Dead concert conditions.

Poris, meanwhile, talks about getting into Ambisonics. Theoretically, Poris says, the idea should result in better imaging. "We've gone as far as we can go with two mikes," he says, but adds that in any thought of a new endeavor, he always considers "the pain-in-the-ass factor. If it's too complicated, forget it."

One next step that everyone in these circles seems to look forward to is the arrival of DAT recorders, if and when they become available and affordable, let alone portable.

"I think a digital cassette is where it's at," Dan Healy says unequivocally. Tapers seem to agree, and eventually DAT may make as deep an impression on the Grateful Dead taping scene as did Sony TC-D5 recorders almost a decade ago. Whatever they use, however, all tapers are quick to attribute their high-quality tapes to one primary source.

"All this would be meaningless without the incredibly high-quality sound we have to work with, the raw sound," Hecht says. "An audio purist, an engineer, would start laughing if you told him that we actually record the sound at a rock 'n' roll concert. It's like, 'Why would you bother?' And most of the time, they'd be right. But at a Dead concert, it's different. This is the best sound system in music today." A

The soundman for The Grateful Dead, Dan Healy, plays on his instrument, the mixing board, during a concert.

Veteran Dead taper Bob Menke, in his Bay Area home, has been recording concerts since 1971.

THE EFFECTIVENESS OF BULK ERASING

HOWARD A. ROBERSON

As many recordists know, we've had a long history of hearty recommendations to use bulk erasing, whenever possible, to ensure the lowest possible tape noise. Because it's been the thing to do for the past 30 years, it may be perfectly reasonable to believe that bulk erasing makes sense today. However, after seeing a number of very strong advertising claims and hearing several tales of woe from consumers, I thought the time was right to examine the performance of bulk erasers.

A bulk eraser, or degausser, is basically an accessory device that radiates a strong magnetic field onto a tape in order to erase it. How much erasure occurs depends on the strength of the magnetic field and on the tape's level of coercivity. The higher the coercivity, the stronger the demagnetizing field required for full erasure—whether that field comes from a recorder's erase head or from a separate bulk eraser.

Much of the higher performance of today's tapes comes from their higher coercivities. High-coercivity tapes require more bias but are also more resistant to self-erasure. Type I tapes have coercivities from around 300 Oe to over 500 Oe for some premium formulations. The Type II coercivities overlap those of the normal-bias tapes, ranging from less than 450 to at least 700 Oe for the recent Type II metal-particle tapes. Type IV formulations have coercivities of 1,000 Oe or more. This results in much greater resistance to erasure, accidental or intended.

I should point out that the stated coercivity for a given tape formulation is the average of all its particles. The tape actually includes particles with higher and lower coercivities, the occurrence of both types roughly following a normal distribution curve. This means that a tape with a 500-Oe rating would probably have some particles with 700-Oe coercivity, and *those* particles would establish the erasing-field strength needed for complete erasure. (I refer readers wanting further explanation to "The Mechanism of Magnetic Tape Erasure" by Peter Vogelgesang in the April 1981 issue of *Audio*.)

It is apparent that the erasing field required for metal-particle tapes is *much* stronger than the field required for many older tape formulations. In fact, with the continuing increase in the coercivity of tapes in general, I had to be skeptical, as I began these tests, at least of the older bulk erasers that had not been designed for such challenges. I noticed on one figure from Nortronics (now The Geneva Group) that the drop in field strength for several bulk erasers is 40% or more for *each*

Illustration: José Ortega

When a tape is rotated through an eraser's field rather than run straight through, demagnetization is made easier.

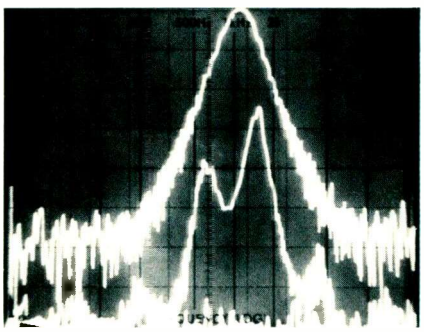


Fig. 1—Comparison of bulk and deck erasure on Maxell XLII-S (Type II) tape. Top: Spectrum analysis of 1-kHz tone recorded at 250 nWb/m. Middle: Same tone after degaussing by Tascam E-2A bulk eraser. Bottom: Same tone after erasure by Nakamichi 582 deck (see text). Scales: Vertical, 10 dB/div.; horizontal, 20 Hz/div.

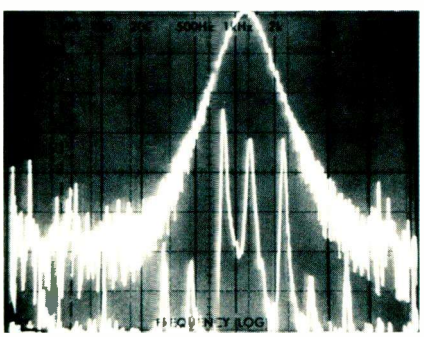


Fig. 2—Spectrum analysis of 1-kHz tone recorded at 250 nWb/m (top) and same tone after degaussing by Lafayette ML-120 bulk eraser (bottom). Scales: Same as Fig. 1.

doubling of distance. (The exact drop will depend on the shape of each eraser's field.) This fact of magnetic life requires that the eraser and the tape be in as intimate contact as possible, and perhaps that the tape be turned over to ensure magnetic saturation on each side.

Measurements

I have an old Lafayette ML-120 bench-type bulk eraser, and I really expected that it would suffer in comparison to newly designed units. I ran tests on it and on the following bulk erasers: The Radio Shack No. 44-233, a hand-held unit which the catalog says can be used for both audio and videotapes; the hand-held Geneva PF-211 video/audio eraser; the bench-type PF-250 Professional eraser from Geneva, and the bench-type Tascam E-2A. Both the Geneva PF-250 and Tascam E-2A have spindles for reel center-holes and adaptors for 10½-inch reels; the PF-250 also has a guide rail for audio and videocassettes.

I don't remember if I ever had any information on the magnetic field generated by my old Lafayette unit. There was no such information supplied with the Radio Shack or Tascam bulk erasers. On the other hand, the Geneva literature lists the surface flux intensity as 2,300 gauss for the PF-211 and 3,000 gauss for the PF-250. The manual with the PF-250 has figures of field versus distance and erasure depth versus signal wavelength. One table in this manual lists the flux intensities required to erase particular tape formulations. Another shows the maximum distances the field would need to reach, either in a single pass or in separate passes on each side, in order to erase common formats ranging from cassette up to 1-inch reels and half-inch videocassettes. The manual also points out that the erasing field in gauss should be 1.5 times the tape's coercivity, all the way out to the maximum distance required for erasure (at least halfway through the tape); this information is reflected in the field-distance table. Obviously, wide tapes may have to be turned over to achieve acceptable erasure. In general, the eraser must be brought as close to the tape as possible; other techniques will be discussed later.

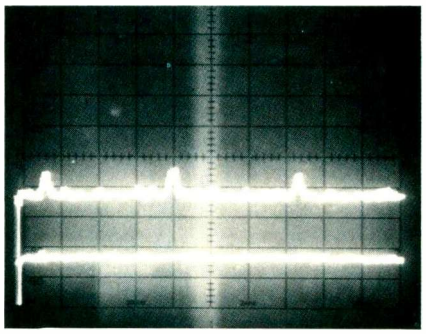


Fig. 3—Amplitude vs. time for playback of 400-Hz, 250-nWb/m tone on Nakamichi EXII (Type I) cassette after erasure by Lafayette ML-120 (top trace) and by Nakamichi CR-7A deck (bottom trace). Scales: Vertical, 10 dB/div.; horizontal, 1 S/div.

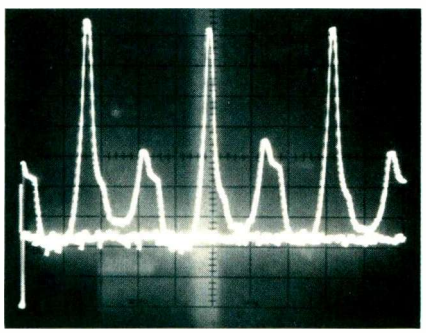


Fig. 4—Same as Fig. 3 but using Nakamichi SX (Type II) cassette.

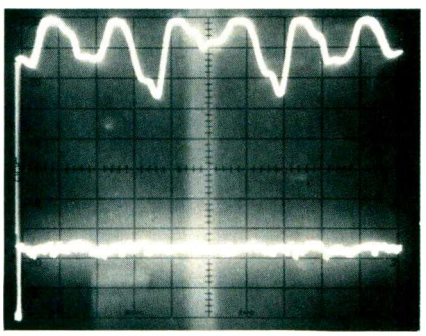


Fig. 5—Same as Fig. 3 but using Nakamichi ZX (Type IV) cassette.

For my first erasure test, I used Maxell XLII-S, a Type II cassette tape, on which I had recorded a 1-kHz tone at a level of 250 nWb/m using a Nakamichi 582 deck. A spectrum analyzer scan (the top trace in Fig. 1) was made of the tone in playback. Then the tape was erased on the Tascam E-2A by passing it through the field, flipping it over, and passing it through again. The middle trace of Fig. 1 shows the degree of erasure, which was rather poor—just 20 dB at one point. After erasure by the 582 deck (bottom trace), the analyzer showed no definite signal, just noise spikes 80 dB down. Figure 2 shows another scan of the 1-kHz tone as recorded (top) and after erasure by the Lafayette ML-120 unit (bottom). The Radio Shack 44-233 did not do as well as either the Lafayette or the Tascam bulk erasers, so it was dropped from the test program. Additional checks with cassette tapes showed that the much older Lafayette was at least as good as the new Tascam E-2A, which was then put aside for the time being.

I realized that the analyzer frequency-scan method was not the best for checking the level of erasure, so I switched to a zero-scan sweep, measuring amplitude over time at the test-signal frequency rather than measuring amplitude versus frequency. I also shifted to a 400-Hz test tone to make degaussing a little more difficult. Figure 3 shows the erasure achieved with a Type I tape (Nakamichi EXII) at 400 Hz for the Lafayette and for another Nakamichi deck, the CR-7A, which proved to be more convenient for these tests. The reference level is at the top of the 'scope's graticle, and the Lafayette trace was raised two divisions for clarity. (The vertical scale is 10 dB/division.) The actual erasure by the Lafayette, therefore, was about 82 dB (close to the noise limit of the analyzer), with the exception of the momentary peaks (more on these later). The erasure by the deck was at least 83 dB; that's about the noise limit of the analyzer.

Figure 4 shows what happened when I tried erasing another tape, the Type II Nakamichi SX, on the Lafayette unit and the CR-7A deck. In playback, there was a strong cyclical variation in the erasure by the Lafayette, with very brief periods of full erasure alternating with periods in which erasure fell to a mere 5 dB. Erasure by the deck, in contrast, was about 77 dB. Figure 5 shows that a metal-particle tape, Nakamichi ZX, almost completely resisted the erasing field of the Lafayette, while the deck managed an erasure of close to 77 dB.

Figure 6 shows the results obtained with the hand-held Geneva PF-211 bulk eraser on Nakamichi EXII, SX, and ZX tapes. A worthwhile improvement in erasure over the old Lafayette is immediately obvious. The residual signal on EXII (Type I) is buried in the noise floor, from which a few residual peaks emerge from the erased SX (Type II). The metal tape, ZX, remained untamed, with 50-dB erasure at best.

The basic test was repeated (Fig. 7) using the Geneva PF-250 bench-type eraser, this time comparing just the SX and ZX formulations. Surprisingly, the PF-250 erased the metal tape more completely than the hand-held PF-211 did, but its erasure of the Type II tape was poorer.

At this time, I considered the fact that bench-type bulk erasers come with spindles on which reels of tape can be easily rotated. When the tape is rotated through the eraser's field, particles from all points around the reel are oriented, at least part of the time, for easy demagnetization. By contrast, when a cassette tape pack is passed straight through a bulk eraser's field, there is a 90° variation in the orientation of the tape particles to the field. Some particles are oriented in the same direction as the field, and others are at angles to it. Figure 8 shows what happened when I rotated the SX and ZX tape packs in the center of the Geneva PF-250's top plate, rather than sliding them along the unit's cassette guide rail. The SX erasure was down into the

Among the bulk erasers examined were Geneva's PF-250, Teac's Tascam E-2A, and Geneva's PF-211.

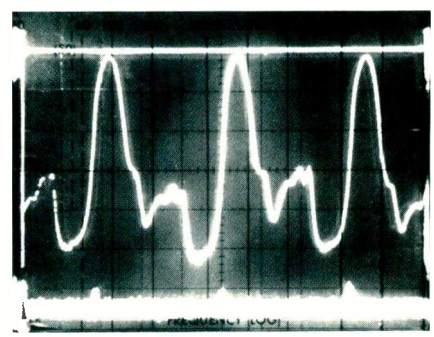
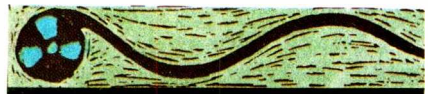


Fig 6—Erasure of 400-Hz, 250-nWb/m tone on three tape types, rotating Geneva PF-211 hand-held bulk eraser. Top trace: Tone before erasure. Middle trace: Nakamichi ZX after erasure. Bottom: Nakamichi SX and EXII, overlapped (see text). Scales: Same as Fig. 3.



No bulk eraser I tried did a good job of erasing metal-particle tapes; cassette decks are much more effective at this.

noise, and the ZX erasure improved to 60 dB or better.

With the hand-held PF-211, it had been natural to rotate the cassette or to do a circular scan of the tape pack; the benefits of this can be seen by comparing the lower traces of Fig. 6 (the PF-211, rotated) with those of Fig. 7 (the PF-250, straight pass). Without some form of scanning, the degree of degaussing varies around the circumference of the tape pack, and the residual noise varies cyclically in playback.

Erasure varies with frequency too. Frequencies lower than 1 kHz or 400 Hz are harder to erase, and so I recorded pink noise on the ZX metal tape to permit seeing erasure across the band and its variation with time. The hand-held PF-211 was scanned around the cassette in a circle. Figure 9 shows that good erasure of this Type IV tape was not possible with the PF-211. The storage 'scope used here allowed me to record the entire range of erasure over time for all frequencies in the audio band. The best minimum erasure was 43 dB at 10 kHz, and the best maximum erasure was 54 dB at 5 kHz—really unacceptable performance at any frequency.

Figure 10A is a simplified representation of a bulk eraser with a spindle for use with open-reel tapes. The poles which supply the erasing flux are oriented so that the lines of flux lie in the plane of (are tangent to) the magnetic particles in the tape's layers. Because of the original alignment of the particles during manufacture, this relationship makes erasure easier. When a cassette is passed straight through these same pole pieces, however (Fig. 10B), most of the tape pack is *not* in good alignment for erasure. At two points, the orientation is very poor for effective degaussing. These poorly erased points are opposite each other in the tape pack, and in playback, the residual spikes might be heard every half-revolution of the pack. Many of the previous figures had the cyclic pattern discussed here, and Fig. 8 showed the great improvement in erasure that is possible with rotation of the cassette pack in the degaussing field. Experiments by R. E. Fayling, of 3M, have revealed that degaussing a tape the hard way, with the tape at right angles to the lines of flux, requires a degaussing field of 2.5 times the tape's coercivity, a field 67% stronger than that needed for degaussing it along the easy axis.

Figure 11 shows the erasure of a 1-kHz tone from a Maxell XL I open-reel tape by the Lafayette and Tascam units. Note that the erasure of this relatively high-frequency tone is a marginal 60 dB and that, with this fairly new tape, the Tascam unit shows no advantage over the old Lafayette. Figure 12 presents the different story resulting when the Geneva PF-211 and PF-250 units were used: Erasure of at least 77 dB was achieved. With the PF-211, I had made a careful, slow spiral scan from the outer edge in to the hub.

TDK SA open-reel tape, an EE type, was used for the final challenge. The Revox A77 recorder I used could erase the 1-kHz tone only 50 dB, although it had achieved at least 77 dB with Maxell XL I. I tried to do a speedy but careful scan with the hand-held PF-211. Figure 13 demonstrates that my spiral was not very smooth or all-covering. The bench-type PF-250 was superior in this test, with complete erasure of over 75 dB (noise limited).

Degaussing Videocassettes

Considering the growing use of Hi-Fi VCRs for audio and the claims of the eraser manufacturers for excellence in degaussing, I also tried the Lafayette and the two Geneva bulk erasers on videocassettes. I made a simple assessment of the erasure of picture and sound in normal (Beta III) mode, using high-grade formulations from BASF, PDMagnetics, Scotch, and TDK. Generally speaking, there was little differ-

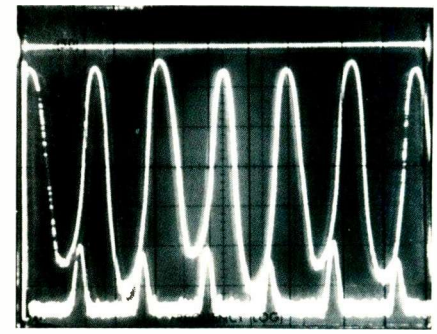


Fig. 7—Erasure of 400-Hz, 250-nWb/m tone on Nakamichi SX and ZX tapes, using Geneva PF-250 bench-type bulk eraser and with tapes moved along its guide rail Top trace: Tone before erasure. Middle: ZX after erasure. Bottom: SX after erasure (see text). Scales: Same as Fig. 3.

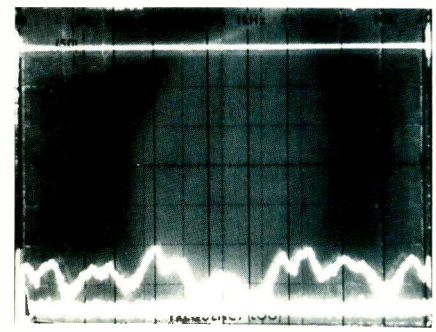


Fig. 8—Same as Fig. 7 but with tapes rotated in magnetic field (see text).

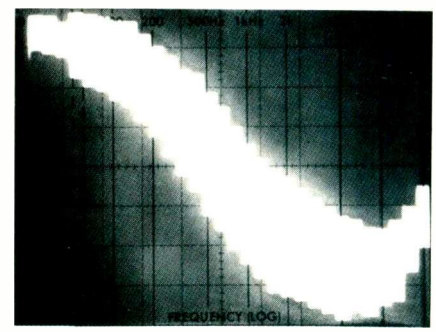


Fig. 9—Erasure of pink noise recorded on ZX tape with Dolby C NR, using Geneva PF-211 bulk eraser. Range of erasure over time in each third-octave band is shown by vertical spread of trace, with maximum erasure at bottom of trace. Vertical scale: 5 dB/div., with −15 dB at top of screen.

ence in erasure from one brand to another. In all cases, the degaussing field was applied to both sides of the videocassette.

The Lafayette was just fair at video erasure and was poor at erasing the sound. When the hand-held Geneva PF-211 was used for a spiral scan over both sides of each tape pack, the erasure was excellent for both video and audio on all formulations.

With the PF-250, I slid the tapes along the guide rail and got good to excellent results on the video and fair to excellent on the audio. When I slid the tapes more through the center of the degaussing area (slightly away from the rail), erasure of both picture and sound slightly improved. The poorly erased portions were cyclic and were time-related to position in the tape pack. I tried rotating the videocassettes on top of the PF-250 but had trouble doing it smoothly. The results were erratic; sometimes the erasure was poor for both video and audio.

The hand-held Geneva PF-211, with a good spiral scan, was able to get a higher effective degaussing field to all sections of the videocassette tape pack than the bench-type PF-250, whether I slid the tape straight through the PF-250's field or rotated the tape pack. In other words, it was less difficult to get easy-axis erasure with the PF-211.

Fig. 10A—Bulk erasure of open-reel tape. For best results, tape reel should be rotated on spindle as it is erased.

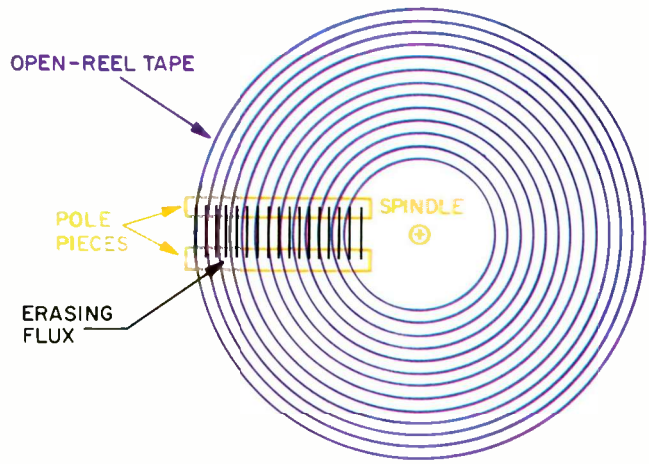
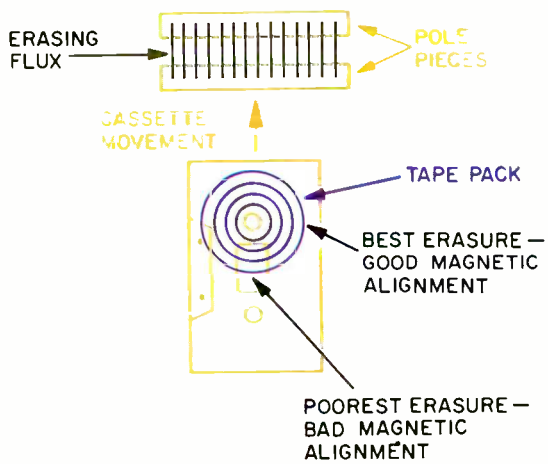


Fig. 10B—Cause of uneven erasure when cassettes are passed straight through degaussing field.



Conclusions and Recommendations

The conclusions I reached after all these experiments emphasize the limitations of bulk erasing (and the limitations of some older tape decks).

Most old and many new bulk erasers cannot adequately erase Type II cassettes, open-reel tapes of the EE type or in the same coercivity range as Maxell XL I, or high-grade videocassettes. *No* bulk eraser I tried did a good job in degaussing metal-particle cassette tape. Claims by *any* manufacturer that an inexpensive hand-held unit will erase "all audio tapes" should be rejected—especially as regards metal tapes.

Older open-reel decks, even if they can record on EE tape, might not be able to erase what they have recorded. Cassette decks are much more successful in degaussing Type IV tapes than even expensive bulk erasers. In general, but particularly for Type II and IV cassettes, erasure is best left to the recordist's deck.

Bulk erasing a tape before recording on it does not seem to improve the S/N of the recording. No matter whether the deck's erase head or the bulk eraser does a better job of degaussing the tape, the residual noise level on a rerecorded tape will stay about the same.

Of the erasers I tested, the hand-held Geneva PF-211 was the best overall, for both audio and videotape. Its price of $54.95 was judged very reasonable for what it can do. Geneva's bench-type PF-250 was the best of the group with EE-type open-reel tapes. Its $400+ price would be a very stiff one for most recordists, but it could be a good investment for someone who does a great deal of taping, particularly on open-reel tapes. Most of the other bulk erasers I tried would be completely acceptable for degaussing lower coercivity open-reel and cassette tapes, but none of the others earn a general recommendation for degaussing of magnetic media.

If you already have a bulk eraser, you should review the technique you use for erasing tapes. For open-reel

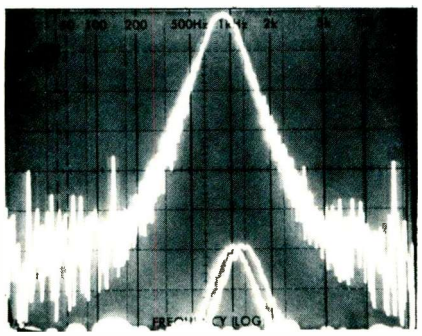


Fig. 11—Erasure of Maxell XL I open-reel tape. Top: Spectrum analysis of 1-kHz tone recorded at 200 nWb/m. Bottom: Same tone after degaussing by Tascam E-2A and Lafayette ML-120 erasers (traces partly overlap, see text). Scales: Vertical, 10 dB/div.; horizontal, 20 Hz/div.

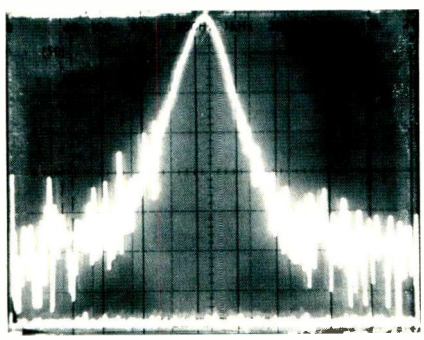


Fig. 12—Same as Fig. 11 but using Geneva PF-211 and PF-250 for bottom (overlapping) traces.

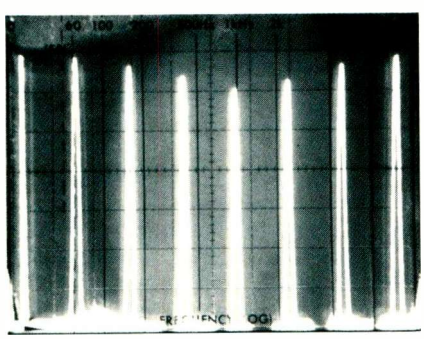


Fig. 13—Amplitude vs time for erasure of 1-kHz, 200-nWb/m tone on EE open-reel tape (TDK SA), using Geneva PF-211. Note unerased sections, caused by failure to scan the tape properly (see text) Scales: Vertical, 10 dB/div.; horizontal, 2 S/div.

tapes, bench-type units with spindles will produce the most even demagnetizing fields, as long as rotation is smooth and slow.

It is also essential that the tape be 2 to 3 feet away from the eraser before you turn the eraser off! Otherwise, if the magnetic field collapse at switch-off occurs at the peak of the line-voltage waveform, you risk leaving a saturated signal on the tape.

When using a bulk eraser for cassette tapes, the best procedure is to wind all of the tape to one end, place the cassette so that its tape pack is in the center of the erasing area, rotate the tape pack at least one complete revolution, and remove the tape from the degausser before switching it off. If the tape is a Type II, repeat the process for the second side.

When operating a hand-held bulk eraser, scan the tape pack, following a slow spiral from one edge of the pack to the other, while maintaining intimate contact with the reel or the cassette shell. Repeat on the second side for higher coercivity tapes. If the hand-held unit is grasped with its erasing poles up, the cassette tape pack can be rested on the flat surface and the tape pack can be rotated. It might even be possible to make a simple fixture to help rotate reels in similar fashion.

With any procedure, of course, it is essential that the maximum field reach all parts of the tape. Keep the eraser as close to the tape as possible. (I've found people tremendously reducing the effectiveness of their erasers by trying to degauss cassettes which were still in their boxes!) To check your erasing technique, record a low-frequency tone (100 to 400 Hz) at a high level (+3 on your deck's meter). Listen to the playback after erasure. If the tone is low in level but steady, your technique is good, but the degausser does not have a strong enough field for that formulation. If the tone varies greatly with high and low levels during playback, the magnetic scanning was not smooth around the tape pack. It is also likely that the erasing field of a hand-held unit will have a particular orientation relative to the handle position: Erasure might be good when the handle is tangent to the tape pack and poor when the handle is perpendicular, or vice versa. To be on the safe side, scan the tape pack twice, holding the eraser the same way each time but rotating the cassette or reel 90° between scans.

If you get marginal degaussing with your present eraser, it is quite possible that the problems will disappear if you use one of the models recommended above.

If you don't have a bulk eraser, you may see little reason to get one now. A number of them, hand-held or bench-type, will not completely degauss many of the tape formulations in current use. It is definitely *not* true that by some magical process bulk erasing will "reduce wear on your recorder," as one exuberant vendor claimed, unless you regularly run tape through the recorder just to erase it.

While it might seem, from all of the above, that there are no reasons to bulk-erase, it offers advantages on some occasions. If you wish to record several individual selections on a used tape, bulk erasure will ensure that old bits of music will not pop through where you paused or stopped recording between the new selections. It is also possible, especially with 4-track/2-channel open-reel decks and also with the semi-pro 4-track/4-channel decks, that recordings made on one machine cannot be erased on another because of head-height discrepancies. Good bulk erasing will allow use of the tape without requiring that the erase head of the second deck match the recorded tracks of the first deck. And users of some professional tape-duplication decks which lack erase heads will find bulk erasing a necessity if tapes are to be recycled.

If you decide to get a bulk eraser, make certain that you can return it if it fails to meet your needs. Follow the recommended procedure given earlier for evaluating degausser performance, trying the higher performance tapes you expect to use. My own investigation showed that most advertising claims are not met and that few manufacturers provide technical data upon which to judge performance. Product information that gives field strength and lists specific media that can be erased, such as is available from Geneva, will help to provide a basis for judging all degaussers.

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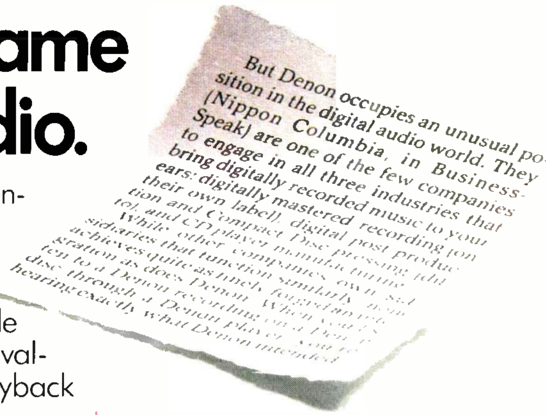
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1

KLYNE SK-5A PREAMP

Manufacturer's Specifications

Bandwidth: MM phono in to line out, 0.5 Hz to 250 kHz; MC phono in to line out, 1 Hz to 150 kHz; line in to line out, 0.1 Hz to 250 kHz.

RIAA Accuracy: ±0.1 dB.

Gain: MC pre-preamp section, selectable, 22, 25, 28, or 34 dB; RIAA amps, 39.4 dB at 1 kHz; dual-phase line amps, selectable, 14, 17, or 20 dB.

Input Characteristics: MM phono, selectable, 0 to 650 pF plus 47 kilohms; MC phono, selectable, 15 ohms to 47 kilohms; tuner, tape, and AUX, 100 kilohms.

Output Characteristics: 300 ohms, direct-coupled; tape output buffered.

Dimensions: 2.5 in. H × 19 in. W × 12.6 in. D (6.4 cm × 48.3 cm × 32 cm).

Weight: 12 lbs. (5.5 kg).

Price: $3,250 in platinum-gold anodized finish; $3,290 in black with metallic gray knobs.

Company Address: 828 7th Ave. S.E., Olympia, Wash. 98501.

For literature, circle No. 90

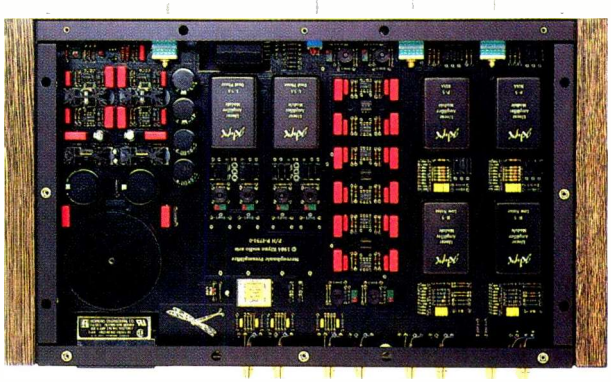
Klyne Audio Arts' SK-5 preamplifier has been in production since about 1984. The latest version, the SK-5A, is of the minimal-frills school, having no tone controls and a minimum of inputs and tape recorder connections.

The SK-5A's outputs are unusual. Each channel has two output jacks of opposite polarity which can be used together, as a balanced-line output, or individually. With this system, one can directly bridge-drive a stereo power amp for higher output power even if the amp lacks internal bridging circuits. This would involve feeding one of the amplifier's inputs from the preamp's normal output and the other amp input from the corresponding inverted output, and connecting the speaker between the two "hot" output terminals of the amplifier. (One such bridged amp would be needed to drive each speaker.) The SK-5A can also be used to drive the two channels of a regular stereo power amp in opposite phase (with one speaker wired out of phase) to reduce peak demands on the amp's power supply. This would involve using the normal output for one channel and the inverted output for the other channel. Using both the normal and inverted outputs for each channel, the SK-5A can also directly drive a stereo power amp that has differential (balanced) inputs. In many cases, balanced operation is such an amplifier's best-sounding mode. With any of these connections, the polarity of both the normal and inverted outputs can be easily reversed, by means of a front-panel "Phase" switch, to get the best sonic results from various program materials.

In all, this is an interesting and useful system that may well show up in future designs.

Physically, the unit is quite attractive, with a platinum-gold anodized front panel and knobs and black-stained oak side panels. A black/gray front panel is also available at a slightly higher price.

The chassis construction is straightforward and simple. It consists of a piece of metal bent to form the sides and front subpanel, a separate bolted-on back panel, and top and bottom covers. A large, double-sided p.c. board takes up the whole interior of the unit. This is one of the most attractive p.c. boards I've seen. The parts layout is beautiful, and I especially liked the Klyne dragonfly logo on the board. First class!



Front-panel controls, from left to right, include a three-position source selector switch, a combination tape-monitor/mono switch (with mono mode available only in "Source" position), the balance and volume controls, and the aforementioned "Phase" switch (which mutes the output when set to its center position). The muting circuitry also operates for 30 S when the unit is first turned on. (The power switch is on the rear panel, as Klyne feels the unit should be left on all the time.) A two-color LED to the right of the phase switch lights up in red when the unit is first turned on or when it is placed in mute mode, and turns green when the turn-on delay ends or muting is disabled.

On the rear panel are Tiffany phono jacks for signal input and output connections, a gold-plated ground post, a small power-on/off rocker switch, and an a.c. input assembly. This assembly includes a line filter, a power fuse, a voltage selector switch, and a three-pin male socket for the a.c. power cord.

Construction and parts quality of this unit are first-rate.

Circuit Description

The main amplifying blocks (the moving-coil pre-preamps, phono preamps, and line amps) are potted and proprietary, and Klyne offers no information on their specific nature. However, I was able to examine block diagrams of the system interconnections and the buffer and power-supply circuitry.

The phono circuitry is quite flexible. Its input gain, input loading, and MC high-frequency roll-off are all selectable via two banks of DIP switches per channel. These switches, which also select MM or MC mode, are mounted on the p.c. board.

Loading is set via the rear switch banks. Input resistance can be set from 15 ohms to 1 kilohm in 11 steps; a 47-kilohm setting, the normal setting for MM cartridges, can also be achieved by opening all switches in these banks. Other resistances between 1 and 47 kilohms can be attained by plugging resistors of the correct value into sockets on the p.c. board. Input capacitance can be set from 110 to 650 pF in five steps or can be switched out altogether.

Selection of MM or MC mode is handled by the first two switches of each bank in each channel. The various MC gain settings are selected via the forward switch banks. There are settings for 22, 25, 28, or 34 dB above the MM gain level. In MC mode, these switch banks also select first-order high-frequency roll-off to compensate for the rising high-frequency responses of many moving-coil cartridges. The −3 dB point of this roll-off can be set from 12 to 50 kHz in 10 steps.

The moving-coil stages are powered by +18 V regulators, one for each channel. The RIAA phono preamp modules have about 40 dB of gain at 1 kHz and are powered by two 18-V regulators, one positive and one negative, per channel. All inputs and outputs are protected by back-to-back zener diode shunts. There is RC coupling between the moving-coil stage and the input of the RIAA stage, and between the RIAA stage's output and the selector switch.

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The p.c. board, with its Klyne dragonfly logo and beautiful parts layout, is one of the most attractive I have seen. First class!

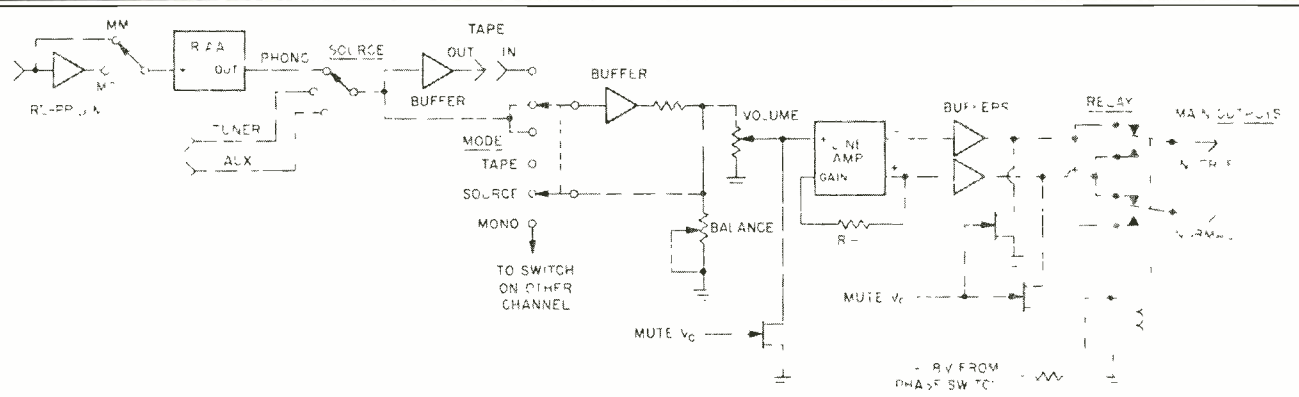


Fig. 1—Block diagram of signal path.

As shown in Fig. 1, signals from the AUX, tuner, or phono inputs pass through the selector and monitor/mode switches to an FET buffer. This buffer circuit consists of a dual N-channel junction FET; one device is a source follower for the signal, while the other acts as a constant current source for the source follower. The source terminal of the follower goes through a resistor to the drain of the current source, with signal output being taken at this point. Since the signal input to the gate of the source follower is at 0 V d.c., the source will be at some positive voltage. The current source has a pot to set the bias or current level through both devices and, consequently, to adjust the voltage drop across the resistor between the source of the follower and the drain of the current source. This pot can be adjusted so that the signal output of the stage is 0 V d.c., eliminating the need for output coupling capacitors to the circuitry that follows. Similar buffer circuits are used for the tape outputs and for both the normal and inverted main outputs. All of the buffer circuits are powered by ±22 V d.c. provided by the separate positive and negative regulators which power each channel's output amplifiers.

The output of the main signal-path buffer goes through a series resistor to the volume and balance controls. Balance is accomplished by connecting the balance control elements as variable resistors to ground in series with resistors from the top of the volume control's elements. The advantage of this arrangement is that the signal does not pass through the nonlinear potentiometer contacts of the balance control elements; this results in potentially better sound and lower crosstalk. A possible disadvantage of this setup is that, as balance is shifted significantly off center, the buffer preceding the attenuated channel's balance control sees a lower load impedance, reducing ultimate input-signal overload capability.

Output of the volume control, which is a very nice laser-trimmed Alps unit, goes through a series resistor into the noninverting input of the line-amp module. A junction FET, connected from this input of the line amp to ground, functions as one of the muting elements controlled by the turn-on time delay and by the "Mute" position of the front-panel polarity switch. The two output phases of the line amp are capacitor-coupled to the inputs of the FET buffer circuits previously described. The outputs of these buffers are applied through a series resistor to a four-pole, double-throw relay (two poles per channel) and then to the normal and inverted signal output jacks. The front-panel phase switch controls power to this relay, which inverts the signal polarity at the output jacks. Provision is made on the p.c. board for capacitor coupling to the outputs, if desired. Two more junction FETs (one per signal phase) are connected on the output side of the series resistors to ground; they function as additional muting elements. Gain of the line amps is adjustable to several values lower than normal by installing supplied resistors in sockets on the p.c. board.

The power-supply circuitry for the SK-5A is quite elaborate. A potted toroidal power transformer feeds a bridge rectifier, developing ±36 V d.c. A pair of zeners across this unregulated d.c. line clamps the voltage. Presumably, this arrangement will blow the line fuse if the SK-5A is plugged into 240 V a.c. while its primary voltage switch is set to 120 V; another purpose would be to clamp transient voltage spikes coming through on dirty a.c. lines. A pair of three-terminal IC regulators reduces this unregulated d.c. to ±28 V. From this point, positive and negative regulators for each channel feed ±22 V d.c. to the line amps and FET buffers. (These and all subsequent regulators are built from op-amp error amplifiers feeding Darlington pass transistors.) The 22-V line feeds positive and negative regulators for each channel to develop ±18 V for the RIAA phono preamps. Each channel's +22 V supply also feeds the additional positive regulator that sends +18 V to the MC pre-preamp stage.

The FET muting elements that precede the line amp and the output-polarity relay are powered by +36 V unregulated and −28 V regulated d.c.

Measurements

In a first quick look at the line section, I found a strange phenomenon. For output voltages above 2 to 3 V, the high-frequency responses above 2 or 3 kHz would drop slightly when the signal had been present for several seconds. This

The phono circuitry is very flexible, with input gain and input loading, as well as MC treble roll-off, all switch-selectable.

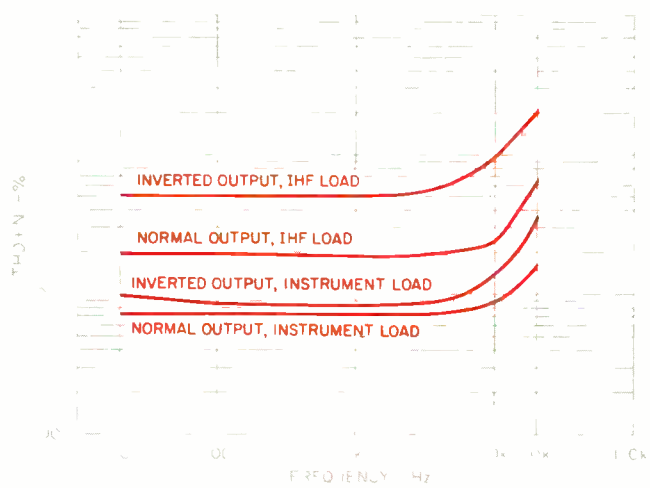


Fig. 2—THD + N for line section at 1 V rms output.

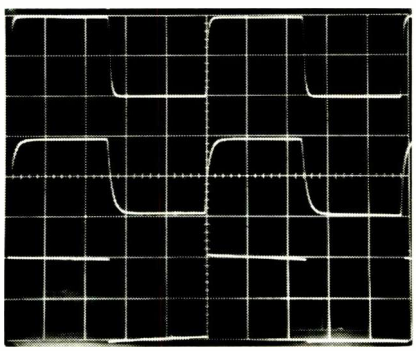


Fig. 3—Square-wave response through line section, with 20 kHz fed into instrument load (top trace), 20 kHz fed into IHF load (middle), and 20 Hz fed into instrument load (bottom). Scales: Vertical, 0.5 V/cm; horizontal, 10 μS/cm for 20-kHz signals, 10 mS/cm for 20-Hz signal.

effect was more severe at higher output voltages. I contacted Klyne and found out that this behavior is normal for the unit and is caused by a biasing network that is signal-level dependent. The manufacturer assured me that this bias network is unbalanced only by sustained high-level signals such as those used in sine-wave testing, when the preamp is made to deliver more than about 3.5 V out, and that virtually no amplifier requires more than 3.0 V to drive it to full power. The bias imbalance, Klyne says, should not occur with music signals when output levels of 1 to 2 V are delivered to the amplifier. I then proceeded with my tests.

First, the line section gain was measured as a function of output loading and of the gain-reducing resistors supplied. With no resistors installed, the gain was 16.56 dB with an instrument load (91 kilohms in parallel with 250 pF) and 16.0 dB with the IHF load (10 kilohms in parallel with 1,000 pF). With 51-kilohm resistors installed, gain with instrument and IHF loads was 14.2 and 13.6 dB, respectively. With 16.4-kilohm resistors installed, gain was 11.0 dB with an instrument load and 10.4 dB with an IHF load. Klyne, in the SK-5A's spec sheet, says the line amp gain is 20, 17, or 14 dB. It turns out that the line amp modules themselves do have a maximum gain of 20 dB, but the gain from line input to line output is reduced to the measured figures by the losses occurring between the selector switch output and the line-amp module input.

Attempts to measure harmonic distortion above 2 to 3 V output were frustrated by THD that crept upward over time at frequencies above 2 or 3 kHz due to the aforementioned signal-dependent bias networks. THD + N was then measured at 1 V rms output; the results are plotted in Fig. 2. The dominant distortion components were low-order second and third harmonics. Of note here is the fact that the normal and inverted channel outputs don't have identical distortion and that the even harmonics don't balance out in the differential connection of the two outputs. To test for interaction between the normal and inverted output jacks when unequally loaded, one output was monitored while an IHF load was applied to and removed from the other jack. The measured output was not affected by the loading of the opposite-polarity output. This simply means that the output amplifiers for the two output phases within a line-amp module

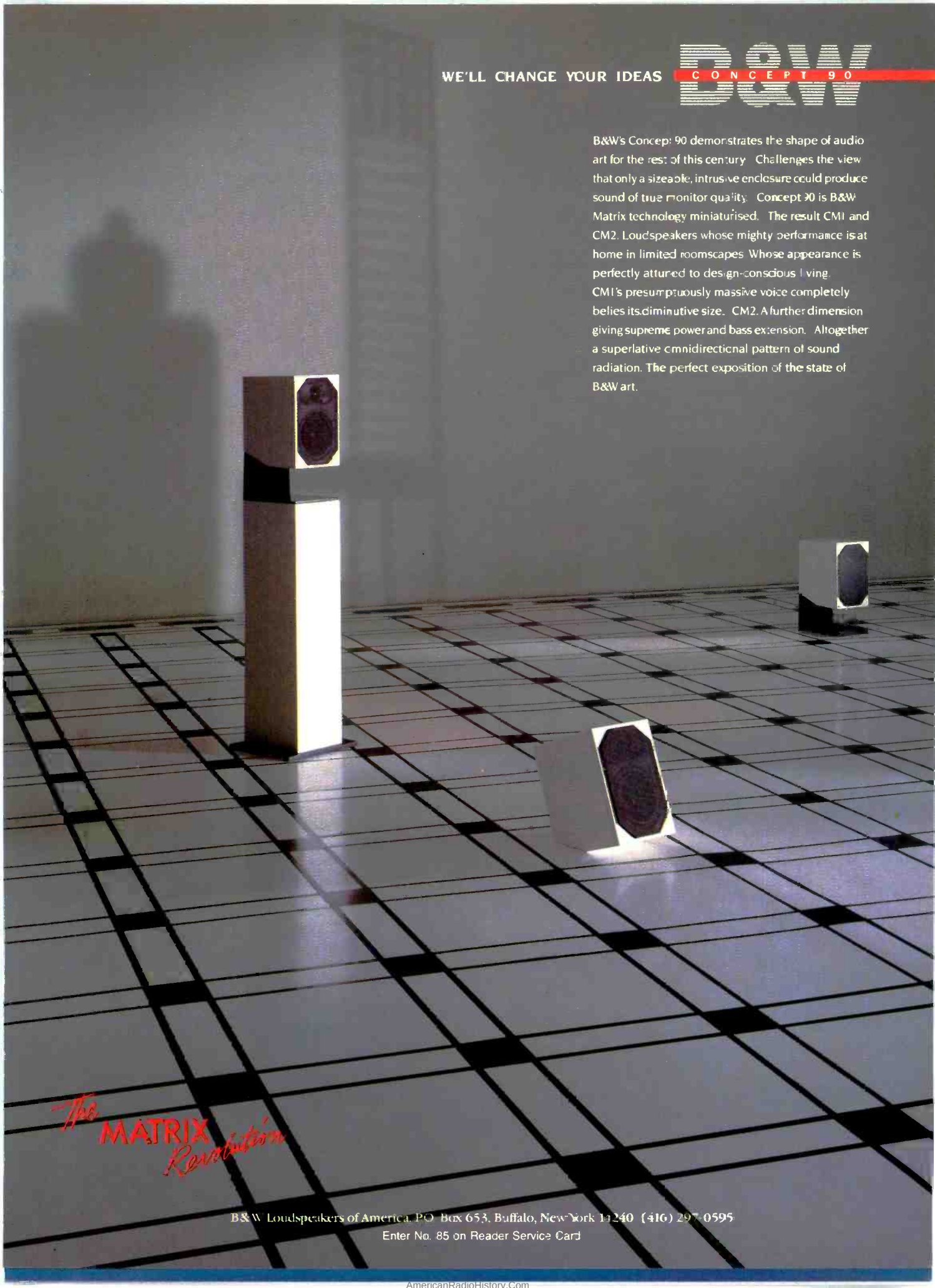
Table I—SMPTE-IM distortion vs. output voltage and loading for SK-5A's normal and inverted outputs.

LEFT CHANNEL

	Instrument Load		IHF Load	
Output	**Normal**	**Inverted**	**Normal**	**Inverted**
2 V rms	0.028	0.06	0.54	0.2
1 V rms	0.015	0.03	0.27	0.1
0.5 V rms	0.009	0.016	0.14	0.052

RIGHT CHANNEL

	Instrument Load		IHF Load	
Output	**Normal**	**Inverted**	**Normal**	**Inverted**
2 V rms	0.006	0.021	0.18	0.51
1 V rms	0.005	0.01	0.09	0.26
0.5 V rms	0.006	0.008	0.045	0.13



Reproduction of records was musically satisfying, with very good definition, detail, space, and harmonic structure provided.

Table III—Phono overload vs. frequency at tape out (left channel).

MM MODE

	Instrument Load		IHF Load	
Frequency, Hz	Input, mV	Output, V	Input, mV	Output, V
20	7.4	8.67	5.8	6.4
50	14.5	9.0	10.9	6.4
100	22.7	9.2	16.7	6.4
300	51.8	9.2	39.0	6.4
700	84.6	9.2	62.5	6.4
1k	97.2	9.2	72.9	6.4
3k	169.1	9.2	120.8	6.1
7k	250.5	9.2	215.5	5.4
10k	470.4	9.0	273.8	4.9
20k	924.9	8.9	353.9	3.1

MC MODE

	Instrument Load		IHF Load	
Frequency, Hz	Input, mV	Output, V	Input, mV	Output, V
20	0.2	9.0	0.15	6.4
50	0.27	9.2	0.2	6.4
100	0.42	9.2	0.315	6.4
300	1.0	9.2	0.76	6.4
700	1.65	9.2	1.22	6.4
1k	1.88	9.2	1.43	6.4
3k	3.5	9.2	2.4	6.2
7k	6.6	9.2	4.2	5.4
10k	9.2	9.0	5.2	4.7
20k	17.5	8.6	6.7	3.0

Table IV—Phono-section noise, referred to input.

Bandwidth	Source Impedance, Ohms	Referred Input Noise, μV LEFT	RIGHT
MM MODE			
Wide-band	100	3	3
Wide-band	1k	3	3
Wide-band	0	3	3
400 Hz to 80 kHz	0	1.28	1.28
MC MODE			
Wide-band	0	0.5	0.5
400 Hz to 80 kHz	0	0.13	0.13
Wide-band	100	0.5	0.5
400 Hz to 80 kHz	100	0.14	0.14

Table V—S/N, phono section.

Mode	Source Impedance, Ohms	IHF S/N, –dB LEFT	RIGHT
MM	IHF	74.8	74.6
MM	0	76.2	76.2
MM	100	76.2	76.2
MM	1k	76.0	76.0
MC	100	70.0	70.0

amplifier of my own design that has 845 triode tubes and develops 100 watts per channel.

A word about my current listening setup: Signal sources and preamps are placed along one wall of my living room. This equipment is connected to the power amplifiers by 30-foot lengths of Monster Cable Interlink Special cable, which has a capacitance of 1,500 pF per channel. The amplifiers are located near the speakers, which flank a corner fireplace, and are connected to them by short cables.

I frequently connect tape recorders, CD players, or phono preamps directly to the 30-foot cables with no intervening preamps. When doing this, I adjust volume at the amplifier end using a dual 50-kilohm external control with 1-meter interconnect cables going to the power amps. The sonic effect of this particular external volume control is detectable but generally quite tolerable.

When I first received the SK-5A, I hooked it up and listened casually for a number of days. I reacted quite favorably to the way it sounded in my system, as did other listeners. Operation of all the controls was flawless, with no clicks, pops, or surprises.

A month or two after running test measurements on the unit, I set it up again in my listening room to find out more about its sonic performance. Record reproduction was musically very satisfying. Definition, detail, space, and harmonic structure were very good, with low irritation levels. I first had the phono section set to moving-magnet mode. (If a phono stage is reasonably quiet, its MM input mode will work with MC cartridges, like the Koetsu, which can deliver 0.5 mV at 5 cm/S.) Gain was just adequate and noise was noticeable (too much), but the sound was as described above. To my amazement, when I set the SK-5A to MC mode with 22 dB of added gain, the sound was substantially the same, though with lower noise, of course. This is the first time I have found the sound as good when going through a unit's MC pre-preamp as when going straight into the MM phono stage. The noise levels in the moving-coil mode were low enough for me—I could hear the noise near the speakers when the gain was set to normal playing levels and the arm was off the record, but it did not intrude when records were playing.

The sound of my tape players was good through the SK-5A's line section. However, when playing CDs through the line section, I found the sound a little less open, darker, and harder than when using the line section of the SP11 or going direct from the CD player (via the 30-foot interconnect cables) into the volume control at the power amps. I can't account for this, as none of the other sources sounded that way when going through the line section.

I really like this preamp, especially the way it enhances my enjoyment of the music on phonograph records. It's well worth a serious audition. *Bascom H. King*

THE END OF THE RECEIVER.

The GTP-500 is the most innovative and logical audio component in years. A superb tuner and preamplifier together on one chassis, completely separate from the power amplifier. This eliminates all the technical limitations of the receiver, assuring uncompromised sonic performance as well as an unrestricted choice of power. And a wireless remote controls the entire system – from your favorite chair or from several rooms in your home. The GTP-500 tuner/preamplifier is shown here with our 60 watt-per-channel* power amplifier. Up to 600 watts per channel are also available. In short, you're witnessing the dawn of a new era. To get the full story, write for our literature and reviews.

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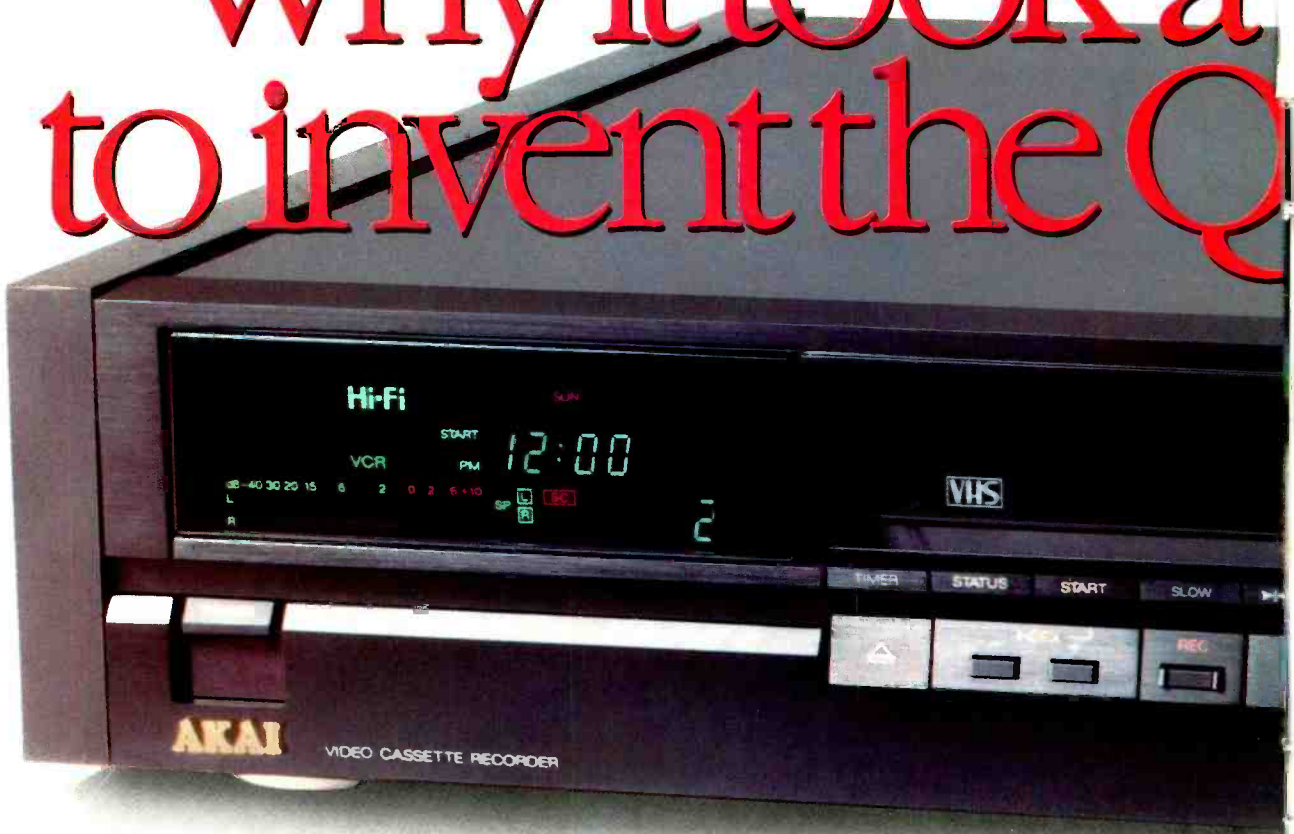
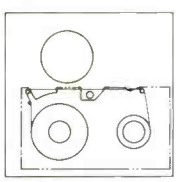
Why it took a to invent the Q

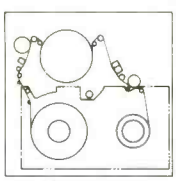


AKAI'S QUICK START: THE MOST SIGNIFICANT ADVANCEMENT IN TAPE HANDLING SINCE THE VHS CASSETTE.

Today's VHS cassettes may give you eight hours of programs. But today's VHS decks make locating those programs a real bore. That's because conventional decks must slowly thread the tape around the head drum every time you go from Fast Forward or Rewind into Play. And slowly pull the tape back into the cassette whenever you return to Fast Forward or Rewind.



Unloading for conventional VCR



Full-loading for Quick Start

Of course, most VCRs have visible scan. But can you imagine scanning through a two-hour movie? Pass the aspirin.

Akai's exclusive Quick Start system gives you fast, fast, fast relief. For the first time, the VHS tape remains fully threaded—even during Fast Forward and Rewind. So switching between functions is more than *five times faster* than conventional VHS decks.

There's more. To make locating programs even easier, Akai searches and scans recorded segments automatically. Best of all, this revolution in tape handling is found not just on our top model—but on every new Akai VCR.

Sound great? Seem simple? Wonder why no one ever did it before?

Akai has over 35 years of experience building tape recorders of all kinds.

WHY IT TOOK AKAI TO PERFECT VHS TAPE HANDLING.

Simply stated, Akai has been building tape recorders for over 35 years. And what is a VCR if not a tape recorder? People may forget that it

hi-fi company
uick Start VCR.

VS-M930U-B

was Akai that built the first home video tape recorder in 1965 and the first lightweight helical-scan portable video tape recorder in 1969. Compared to Akai, even the biggest names in video recording seem like "Johnnies-come-lately."

To invent Quick Start, Akai invented a completely new tape transport with better tape tension control, more precise guide poles and specially conductive fine ceramic tape guides. The entire transport is under the intelligent control of a micro-processor that only years of tape deck experience could develop. The Akai Quick Start Transport. Sure it's simple... when you know how.

AT AKAI, SOPHISTICATION MEANS SIMPLICITY.

Akai, a leader in on-screen programming, now takes ease-of-operation one step further. On our new decks, most programming functions require no more than one touch. Nothing *could* be simpler.

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2

YAMAHA CDX-5000 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: D.c. to 20 kHz, ±0.3 dB.
Harmonic Distortion + Noise: 0.002% at 1 kHz.
Dynamic Range: 100 dB.
Signal-to-Noise Ratio: 115 dB.
Channel Separation: 95 dB at 1 kHz.
Output Voltage: 2.0 V rms.
Number of Programmable Selections: 24.
Dimensions: 17⅛ in. W × 5½ in. H × 16¼ in. D (43.5 cm × 14 cm × 41.3 cm).
Weight: 46 lbs., 3 oz. (19.6 kg).
Price: $2,500.
Company Address: P.O. Box 6600, Buena Park, Cal. 90620.
For literature, circle No. 91

Manufacturers of CD players seem intent upon squeezing the very last bit of performance they can out of the 16-bit, 44.1-kHz sampling format that is the world standard for Compact Disc. And indeed, every time the pessimists conclude that nothing more can be done to improve CD player performance, someone comes along with a major innovation to prove that there is still room for improvement, however modest it may be in audible terms. Yamaha is the latest company to come up with an important technological innovation, which they call "Hi-Bit Technology." This actually comprises not one but two major refinements, both of which have been incorporated into Yamaha's flagship player, the CDX-5000. This is a "heavyweight" product in more ways than one: It tips the scale at more than 46 pounds, making it heavier than many high-powered amplifiers.

The first technical refinement is the use of a Hi-Bit digital filter. This filter performs quadruple oversampling, raising the standard 44.1-kHz sampling frequency to 176.4 kHz so that a wider buffer zone exists between the top of the audio spectrum and the sampling frequencies. Two benefits immediately accrue. First, a gentler analog filter can be used at the final audio stage without affecting phase response within the audio band. Yamaha is not alone in employing four-times oversampling and digital filtering, but their approach to it is unique here. The digital filter, which oversamples by "filling in" between the actual data samples with three additional data values generated by computation, is an 18-bit, rather than the usual 16-bit, ROM. This is the source of the second benefit: Those two extra bits can reduce quantization-error noise and distortion in the audio band by a factor of four.

The Hi-Bit filter, operating with 32-bit coefficients and a 26-bit accumulator, performs with 40-bit accuracy. Therefore, the filter can calculate 192 additions and 192 multiplications for each of the 44,100 CD sample inputs per second, at a clock rate of 16.93 MHz. A total of four 18-bit digital output values is generated for each CD sample. Yamaha tells me that this entire filter circuit is contained on a single LSI of some 49,000 transistor elements!

The second technical refinement, taking full advantage of the first, is the Hi-Bit D/A converter. Since the introduction of CDs, many audio purists have argued that a 16-bit system is inadequate. They reason (correctly, I believe) that when you're dealing with a very loud passage of music—one whose samples are near the top of the available dynamic range—16 bits is enough, but that when the music is at a very low level, 16 bits is not adequate.

Look at it this way: If an actual instantaneous sample is supposed to have a binary number smack between 1111111111111110 (a number whose decimal value is 65,534) and 1111111111111111 (65,535), the error would be 0.5/65,535 at the most! In terms of distortion, this works out to a very low 0.00076% or so. Hardly worth getting excited about. But suppose the music is at a very *low* level—one that requires only the first couple of binary bits near the bottom of the binary number scale to be changed from zeros to ones. For example, suppose the true value of the musical sample is supposed to be midway between a level of 0000000000001110 (equal to our more familiar decimal value of 14) and 0000000000001111 (decimal equivalent of 15). If we try to define this value, then we have to call it either 14 or 15, when it should be 14.5 (for which we have no available binary equivalent). *Now* the maximum distortion is quite substantial—0.5/15, or a whopping 3.3%. No wonder manufacturers don't quote THD for CD players at low levels. All other things being equal, distortion varies *inversely* with output level in CD players. If we had more bits per sample, proponents figure, all music, loud and soft, would be shoved farther away from the least significant bit. Add one more bit, and you cut the errors in half; add a second bit, and you cut them down by three-quarters.

The full-function remote has two features useful for speaker testing, A-B repeat and level controls.

The Hi-Bit D/A converters used in Yamaha's CDX-5000 and some of their other new models are "quasi-18-bit" converters. They cannot decode all 18 bits of the digital filter's output at once, but they can match the dynamic range, S/N, and distortion of true 18-bit decoders most of the time.

The Hi-Bit chip actually decodes just 16 bits at a time. During soft passages, when the two highest (most significant) bits are zero, this D/A converter decodes the lowest 16 bits of the 18-bit filter output. The decoder's action is equivalent to shifting the input digits upward into higher-numbered bit positions, in what is called "floating bit" operation. If the most significant bit is zero, the input bits are shifted up by one position; if the two most significant bits are zero, the input is shifted up two notches.

The instantaneous values of the input samples are therefore made two or four times larger, depending on whether the input was shifted up by one or two bits. If the decoded analog output of the sample has been amplified by a factor of two or four, then that output must be attenuated by the same factor to restore its original amplitude. When this is done, any error in the amplitude (distortion and noise) will

ATHENA. The preamplifier is in many ways the most telling component in the audio chain. All too often technical absolutism results in sound quality that is sterile, unappealing, or aggressive. Yet bad lab performance almost always indicates poor sonic integrity. With Athena, Sumo demonstrates a new balance. A preamplifier that is both a stunning performer in the areas of quickness, linearity, and freedom from overload. Yet a warm, faithful, and exciting reproducer of music.

Athena represents the culmination of a major effort at Sumo. As such, it sets new standards for dynamic headroom and freedom from overload. Utilizing high voltage power supply rails, passively linearized circuitry, and a high current toroidal transformer, Athena can faithfully reproduce music at levels far in excess of the peak output of signal sources. As a result, compact discs display dynamic range without high end pain. And complex passages come through intact and unstrained.

Sonic purity in Athena is enhanced both by careful component selection and the exclusive use of pure Class A circuitry. Low noise 1% metal film resistors and metalized polypropylene capacitors are used throughout. Components are mounted on a military grade glass epoxy printed circuit board. And all external connections are made via gold plated input and output jacks. Further, a bypass function allows the user to totally remove the high level section of the preamp from the signal path. When selected, this provides both direct line-drive for high level sources (such as a CD player), as well as direct phono out.

At various times and for various products, we hear the words powerful, impactful, detailed, delicate, accurate, transparent, smooth, natural and a variety of other flattering adjectives. But one word is repeated more frequently than all the rest, and it is that for which we have strived above all. Musical. Athena is above all gloriously musical.

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The "quasi-18-bit" D/A converters used here are designed to cut distortion and noise, especially in low-level passages.

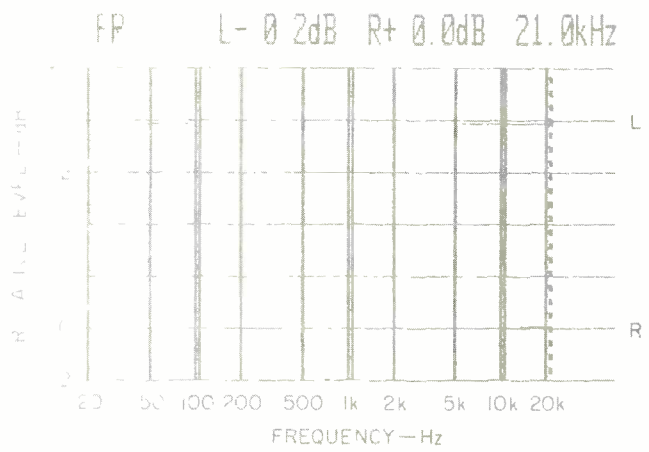


Fig. 1—Frequency response, left (top) and right channels.

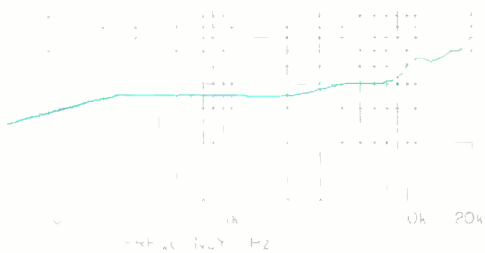


Fig. 2—THD + N vs. frequency.

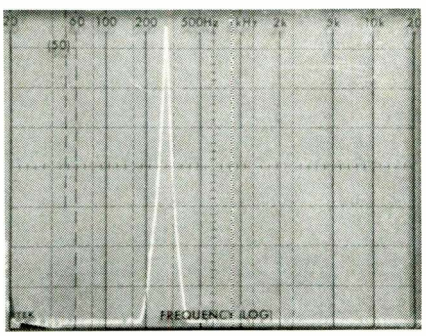


Fig. 3—Spectrum analysis of reproduced 20-kHz test signal from 0 Hz to 50 kHz.

be *decreased* by the same factor. Theoretically, after the entire process has been completed, the reduction in noise will be 6 or 12 dB, and distortion will be reduced to one-half or one-fourth its previous value. These two results are equivalent to those that would be obtained if an *actual* 18-bit D/A converter had been used; hence the designation of the Yamaha 18-bit converter as "quasi."

Naturally, when either or both of the most significant bits are occupied (as during a very loud passage), all the digits must be shifted back where they belong. At the same time, the attenuation that was used in playback to decrease the amplitude of the recovered analog signal to its proper level has to be switched out of the circuit.

Aside from circuitry innovation, the CDX-5000 offers a host of features designed to make use of the player easy, convenient, and reliable. A 44-key remote control permits operation of all functions except drawer open/close, including 20-bit digital volume control. A double-floating suspension system isolates both the disc tray and the laser pickup assembly. The pickup assembly offers extremely high-speed access to a given track: Well under 1 S from one track to the next and, by my stopwatch, not much more than that from an outer track to an inner track.

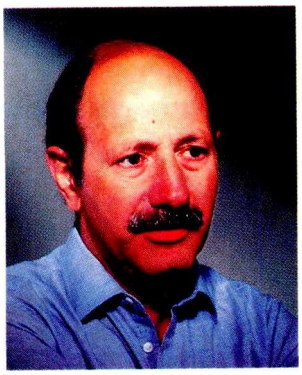
In addition, the CDX-5000 employs a triple-beam laser pickup, dual-transformer shunt-regulated power supplies, discrete circuit configuration, and photo-optical coupling between the digital and analog sections. It features direct-access programming of up to 24 tracks (or index points), four-way repeat play, random play, and a "calendar" display that shows the numbers of the tracks available on a disc (or in a program) and those that remain to be played. The unit can be turned on, and play can be started, by means of an external timer.

Control Layout

As you can tell by its weight and dimensions, the CDX-5000 is large and rather bulky. The disc tray, at the left, occupies only a relatively small portion of the front panel. Beneath the drawer are a "Power" switch and buttons for "Space Insert," "Index," and "Random Play." The display area, to the right of the disc tray, shows track and index numbers, three time modes (elapsed track time, elapsed disc time, or remaining disc time), location of the laser pickup (shown on a ruler-like scale numbered from 1 through 24), operating status of the machine, and, by means of a vertical bar-graph, the setting of the digital volume control.

Under the display area are the buttons needed for program commands, for repeat play, and for altering the display modes. Below these are numbered buttons used in programming and for direct access of tracks and index points. Along the bottom edge of the panel are the "Open/Close" button and various operating buttons such as "Play," "Pause/Stop," and the fast-forward and fast-reverse keys for moving ahead or backwards to another track or within a given track. The stereo phone jack and a rocker switch for controlling volume level are at the extreme right of the panel.

The rear panel, in addition to its gold-plated output jacks, has a digital output terminal that can be used with external D/A converters.



"It's no trick to make a great speaker when price is no object."

Andy Petite, chief designer, Boston Acoustics

"It is a far greater engineering challenge for speaker designers to build a great-sounding speaker for $200 than $2000. When cost is no object, they can include whatever they need to get the quality they're looking for.

"However, that kind of quality doesn't always filter down through their product line. At Boston Acoustics, we take pride in designing *every* system to measure up to the highest standards. To show you what I mean, let's look at our newest model, the T830 tower system.

"We designed the T830 to deliver exceptional performance at a very reasonable price, and did it by making knowledgeable and intelligent choices. We custom-designed all three of its drivers: an 8" high-compliance woofer, 3½" midrange and 1" dome tweeter. No compromises here.

"The midrange and tweeter are ferrofluid cooled for greater power handling capacity. The diaphragms of all three drivers are made of copolymer. Although it is more costly than conventional materials, we used copolymer because of its structural uniformity and immunity to atmospheric changes.

"We make all these drivers under our own roof, using specialized machinery and jigs that we've designed or adapted ourselves. This helps us maintain consistent high quality, *and* save through efficiency.

"For the enclosure, we used the same dense, non-resonant structural material as in our highest-priced system. To keep the cost down we used wood-grain vinyl instead of costly wood veneer. It looks rich, and makes absolutely no difference in sound quality.

"More important than what we put into our systems is the quality of sound that comes out—and how that matches your expectations.

"From our very first product to our latest, audio critics have appreciated what we've accomplished—delivering demonstrably high performance at truly affordable prices. Here's what Julian Hirsch said about the T830 in *Stereo Review:*

> *'In all measurable respects, the Boston Acoustics T830 delivered outstanding performance. Few speakers we have tested have had such a flat frequency response or such low distortion, for example, and most of those were considerably more expensive... we were enormously impressed.'*

"When *you* compare the T830 against similarly-priced systems, you'll also find it sounds better in a number of ways. More musical, smoother, its imaging more precise. And it can play louder without distortion.

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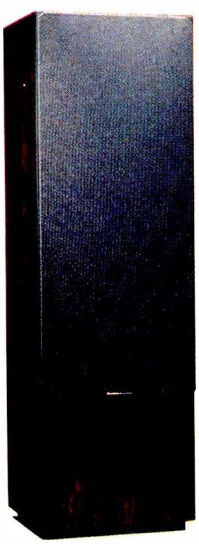

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Weighted S/N measured an even 100 dB, and separation was a very high 98 dB at mid-frequencies.

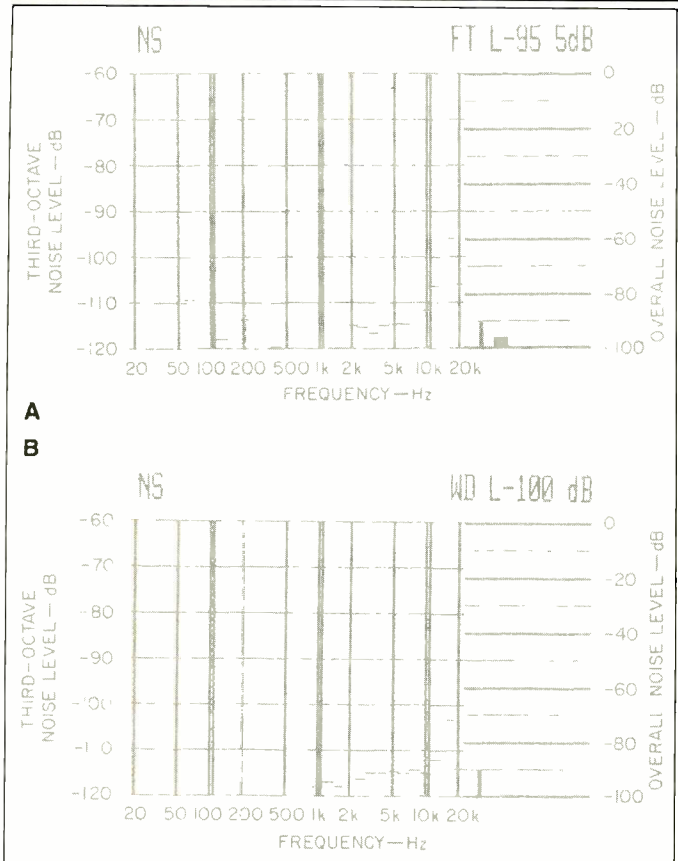

Fig. 4—S/N analysis, both unweighted (A) and A-weighted (B).

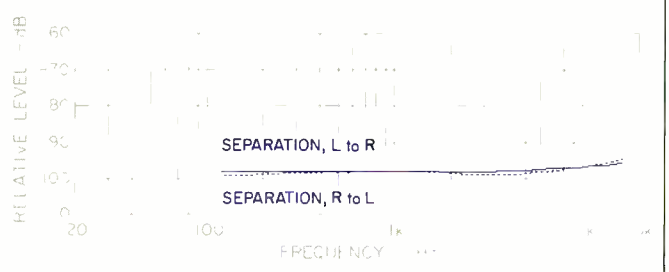

Fig. 5—Separation vs. frequency.

Measurements

The incremental performance improvements which Yamaha claims for this machine were immediately apparent as I began my lab measurements. As Fig. 1 shows, response was flat right out to 20 kHz, within only −0.2 dB for one channel and with absolutely no roll-off for the other. Harmonic distortion at maximum recorded level at 1 kHz measured 0.0035%. This in itself is not that unusual; what *is* remarkable is the fact that even at 20 kHz, THD + N was only 0.007%, with no low-pass filter of any kind inserted in the measurement path. These results are plotted in Fig. 2. Their significance is further shown in Fig. 3, a spectrum analyzer plot of a 20-kHz signal as reproduced by the CDX-5000. The sweep is linear and extends from 0 Hz to 50 kHz. The only signal visible is the desired 20-kHz output. Gone is the usual "beat" frequency at 24.1 kHz that has been typical of most CD players—even those that employ oversampling and digital filtering. If there are any spurious products above or within the audio band, it is fair to say that they are at least 80 dB below maximum signal output, since that is the dynamic range of the spectrum analyzer's display. In fact, a reading of 0.007% THD (for the 20-kHz test signal) actually works out to a dB value of −83.1!

Figures 4A and 4B show, respectively, unweighted and A-weighted signal-to-noise ratio. Overall weighted S/N measured an even 100 dB, and unweighted S/N measured 95.5 dB. Stereo separation was very high too, as shown in Fig. 5. At mid-frequencies, separation was 98 dB, decreasing only very slightly (to 96 dB from left to right and to 95 dB from right to left) at 16 kHz, the highest frequency in the CD-1 test disc that I use for making these measurements. Dynamic range, measured as THD + N (expressed in dB) for a −60 dB signal, plus 60 dB, added up to exactly 100 dB. Wow and flutter was below the limits of my test equipment.

Further evidence of the benefits derived from Yamaha's Hi-Bit technology came when I measured ouput linearity. At 90 dB below maximum recorded level, linearity was still accurate to within 0.3 dB. This is the best linearity figure I have ever obtained for a CD player. Even the very finest machines usually begin to show departures from linearity at −70 to −80 dB. I also measured pre-emphasis/de-emphasis accuracy and found it to be within ±0.3 dB over the frequency range from 125 Hz to 16 kHz. CCIF-IM (twin-tone) distortion was only 0.001% at maximum recorded level and remained almost as low—0.0012%—at −10 dB. Output voltage for maximum recorded level was 2.18 V at the left channel and 2.18 V at the right.

Figure 6 is a 'scope photo of a 1-kHz square wave as reproduced by the CDX-5000. The result is as good as I have observed from any CD player tested to date, and much the same applies to the unit-pulse signal shown in Fig. 7. Both 'scope photos are typical of those obtained from CD players that employ oversampling and digital filtering. In this respect, at least, I could not detect any difference between Yamaha's Hi-Bit digital filter circuitry and the more usual digital filtering employed in other players.

Figure 8 is the Lissajous pattern produced when I fed the 20-kHz output from the left channel to the vertical input terminal of my oscilloscope while the 20-kHz output from the right channel was fed to the horizontal input. No ellipse is

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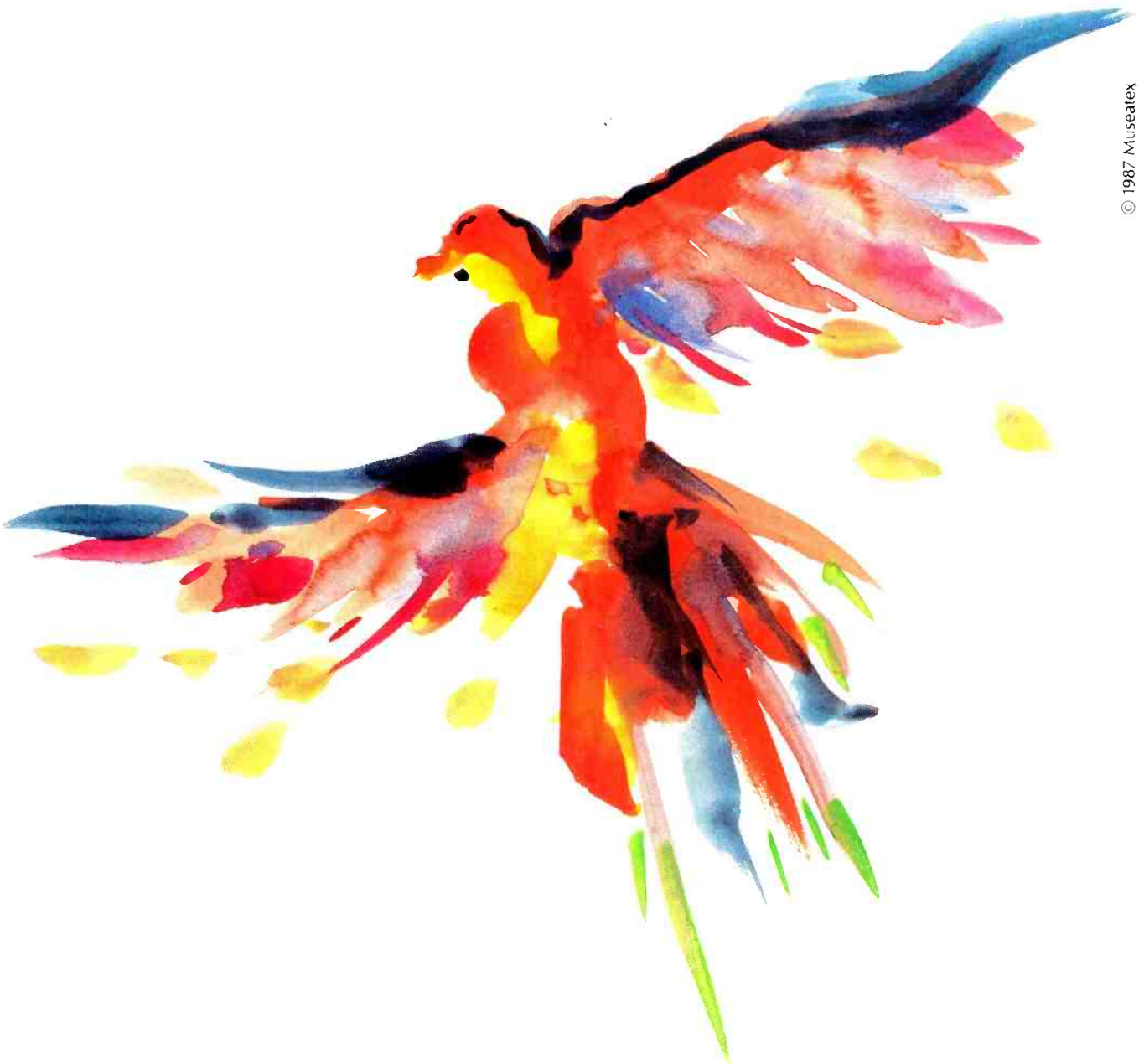

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Admittedly, $2,500 is a lot to spend on any player these days, but at least the CDX-5000 offers really new technology in return.

visible, indicating that the two output signals are perfectly in phase, with no time delay between them. This is the result I generally get when a CD player employs separate D/A converters for each channel, with timing compensation.

There was no evidence of mistracking and certainly no instances of muting when I played through the three types of defects on my Philips "defects" test disc. The CDX-5000 also did very well with all but the most severely scratched and damaged discs that I keep around for checking tracking ability and for assessing error detection, correction, and interpolation. The sophisticated double-floating suspension system was very effective, making the player extremely resistant to external shock and vibration.

Use and Listening Tests

The CDX-5000 is very easy to program and use. The sample in my possession, one of the first available in this country, was supplied without an owner's manual, but that did not in any way slow me down. Nomenclature on the panel is very clear, and it takes only a few minutes to become familiar with all the features and control functions.

As for this player's sound quality, it was, very simply, superb on a wide assortment of discs. If there is anyone out there who still has doubts about CDs and CD players, I earnestly suggest that you listen to the CDX-5000.

If $2,500 is a bit steep for your pocketbook, you might want to listen to Yamaha's CDX-1100, which has a suggested price of just under $1,100. According to Yamaha, this unit is very similar in design to the flagship CDX-5000, using the same Hi-Bit quadruple-oversampling digital filter and the same twin quasi-18-bit D/A converters. Yamaha states that the major differences are a slightly longer access time from innermost to outermost tracks and a single-floating suspension system instead of the double system used in the CDX-5000. (This may account, at least in part, for the fact that the lower priced unit is nearly 15 pounds lighter.)

Could I perceive a difference in sound quality between this unit and some of the other well-designed high-end players I have tested? Most of the time, no. Once in a while, a given disc seemed to offer slightly more transparent sound, especially during low-level passages. I particularly looked for such passages so that I might see if the Hi-Bit floating-point D/A converter really cleans up these sounds to the degree that Yamaha claims. In a very few instances, I thought I could hear a difference, a lessening of the "edginess" that I could sometimes detect during quiet musical intervals when I turned up the volume control on my amplifier. The Glenn Gould recording of the Bach "Goldberg Variations" (CBS Masterworks MYK 38479) was one disc in which I could hear an improvement. If you've heard this recording, you know that Gould's low-level murmuring or singing can be heard along with his playing; when I listened to the recording on the CDX-5000, that vocal accompaniment seemed more lifelike than ever, as if Gould were adding his vocal presence right in my listening room.

Admittedly, $2,500 is a lot to spend on any CD player these days, but for some, the extra cost may well be worth it. At least one will be getting some really new technology and not just upgraded electronics in an old package.

Leonard Feldman

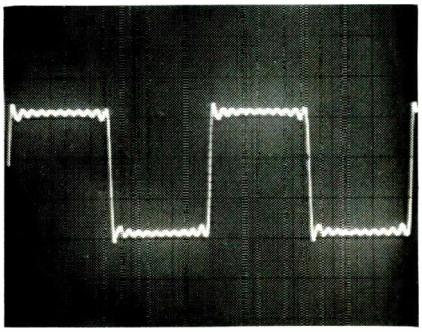

Fig. 6—Reproduction of a 1-kHz square wave.

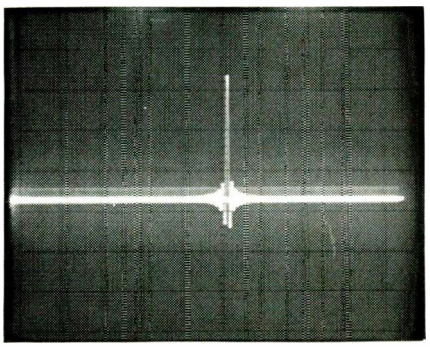

Fig. 7—Single-pulse test.

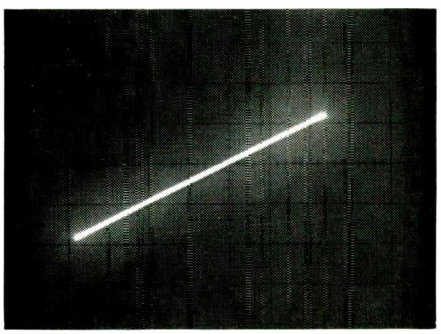

Fig. 8—Interchannel phase comparison at 20 kHz. Straight line indicates absence of interchannel phase error.

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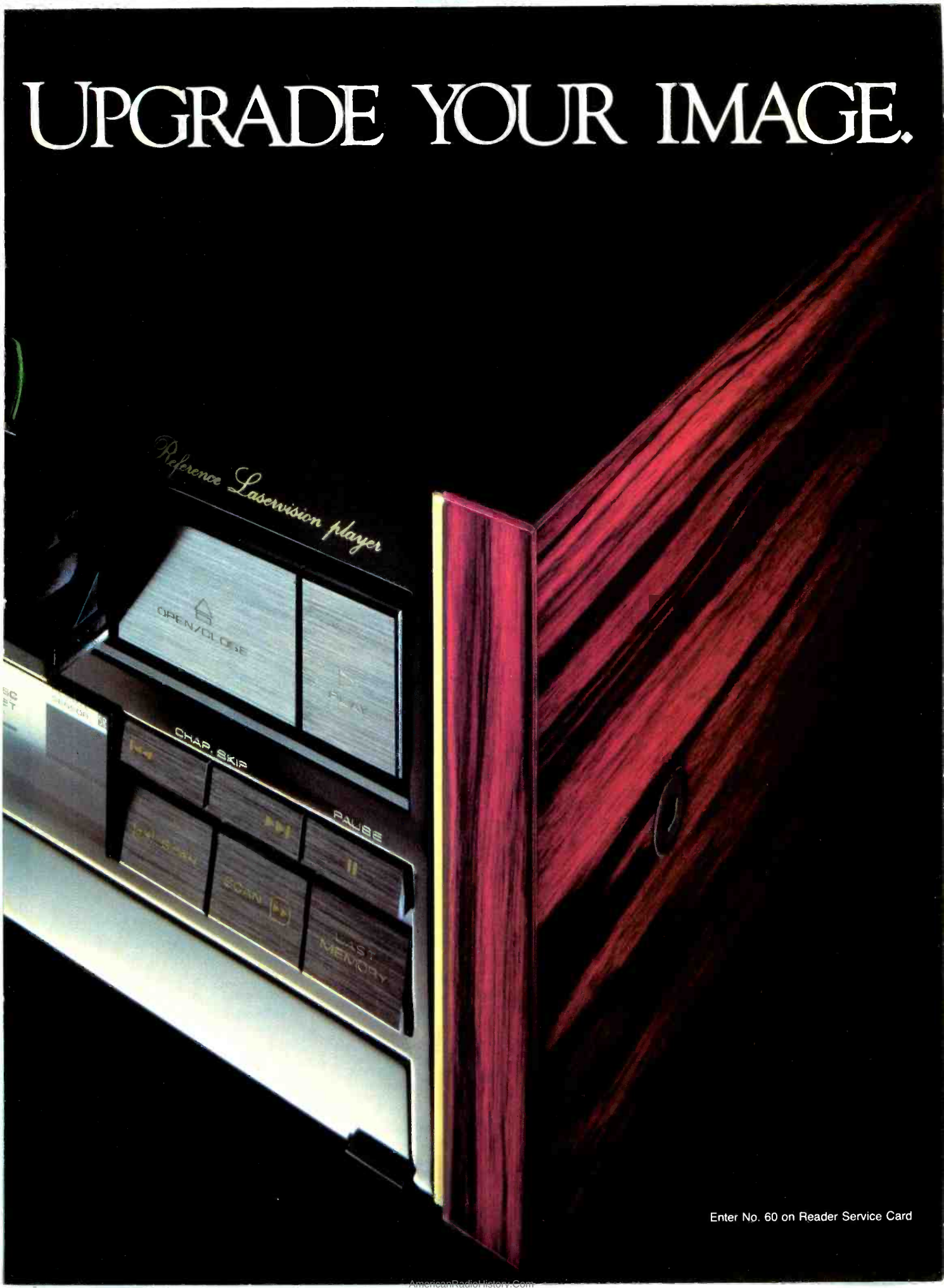

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HARMAN/KARDON CITATION TWENTY-THREE TUNER

Manufacturer's Specifications

FM Section

Usable Sensitivity, Mono: Normal, 10.8 dBf; Hi Q, 14.7 dBf.

50-dB Quieting Sensitivity: Normal mono, 15.2 dBf; Hi Q mono, 19.1 dBf; normal stereo, 36.5 dBf; Hi Q stereo, 40.4 dBf.

S/N: Mono, 84 dB; stereo, 75 dB.

THD at 1 kHz: Normal mono, 0.06%; Hi Q mono, 0.2%; normal stereo, 0.08%; Hi Q stereo, 0.2%.

Stereo Separation at 1 kHz: Normal, 55 dB; Hi Q, 35 dB.

Capture Ratio: Normal, 0.75 dB; Hi Q, 1.75 dB.

Alternate-Channel Selectivity: Normal, 65 dB; Hi Q, 75 dB.

Adjacent-Channel Selectivity: Normal, 5 dB; Hi Q, 30 dB.

I.f. Rejection: 90 dB.

AM Rejection: 70 dB.

Image Rejection: Normal, 75 dB; Hi Q, 85 dB.

Spurious-Response Rejection: 115 dB.

SCA Rejection: 70 dB.

Output Level: 1.0 V.

AM Section

Sensitivity: 12 μV/m.

Alternate-Channel Selectivity: 60 dB.

Image Rejection: 45 dB.

I.f. Rejection: 65 dB.

S/N: 55 dB.

General Specifications

Dimensions: 17⅜ in. W × 2¾ in. H × 14⅝ in. D (44.1 cm × 7 cm × 37.2 cm).

Weight: 15 lbs. (6.8 kg).

Price: $595.

Company Address: 240 Crossways Park West, Woodbury, N.Y. 11797.

For literature, circle No. 92

Harman/Kardon does not designate a new audio component as part of their prestigious Citation series unless there is really something special about it. Their recently introduced Citation Twenty-Three AM/FM tuner merits the designation on many counts. Physically, the tuner is extremely attractive, with its softly rounded buttons, understated indicator lights, and low silhouette. But it's what lies behind the tastefully designed front panel that really impressed me.

To the best of my knowledge, the engineers at H/K worked on the Twenty-Three for the better part of two years. The result is a tuner that is ideally suited for those areas where the FM dial is populated by a great many signals—and that means just about every major city in the United States. Two innovative design features make this so: A novel type of narrow i.f. mode and an unusual fine-tuning circuit.

Many tuners offer two i.f. modes—a wide one that can be selected when there is no interference and a narrow one that uses sharp band-pass filters in an attempt to improve rejection of adjacent-channel interference. Unfortunately, such sharp filters also introduce phase and amplitude errors that often decrease separation and increase distortion. The Citation Twenty-Three provides two i.f. modes too: A conventional wide mode and another that H/K calls "Hi Q." The circuit details remain secret (H/K is waiting for patents to be granted), but I can reveal this much about it: Instead of filtering the "edges" of a desired bandwidth, the Hi Q circuit

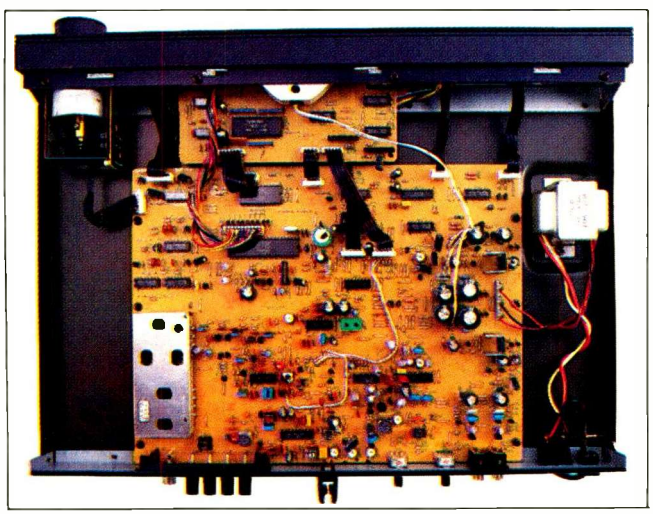
To reduce interference, an unusual feature lets you fine-tune off a station's center frequency by 25 kHz in either direction.

employs a phase-locked loop (PLL) that locks onto the FM carrier itself, isolating the center frequency of the desired listening band and then limiting the allowed bandwidth to the maximum deviation caused by the incoming modulated signal. By limiting the PLL's tracking range to just slightly more than the modulation range (approximately 80 kHz on either side of the carrier's center frequency), only the signal needed for good separation and relatively low distortion is passed through to the rest of the i.f. system and on to the quadrature detector. Because the PLL circuit does not employ resonant (tuned) elements, no phase shift is introduced; thus, stereo music signals and the 19-kHz pilot signal associated with stereo transmission retain correct relative phase.

The second innovative feature incorporated in the Twenty-Three addresses one of the disadvantages of quartz-locked, frequency-synthesized tuning—the lack of latitude in tuning to the actual center frequency of the received signal. Harman/Kardon's engineers have solved this problem with an analog fine-tuning circuit that allows you, when in Hi Q mode, to tune away from the assigned center frequency by as much as 25 kHz in either direction. This can further improve adjacent-channel rejection and eliminate interference. Such tuning flexibility is also important if you subscribe to cable FM, since cable operators are not always as careful as broadcast stations when it comes to frequency allocations and accuracy.

Control Layout

At the left end of the front panel are the "Power" button (with built-in indicator LED), a "Memory" button for setting station presets, and a button that's used, like the shift key on a typewriter, to enable you to store 16 AM and FM stations (in any combination) with only eight actual preset buttons. The preset buttons, in a horizontal row, are labelled with two sets of numbers (1 through 8 above the buttons, 9 through 16 below). When one of these preset buttons is pressed, an LED glows at its top or at its bottom, depending upon whether the "shift" key has been pressed or not. An infrared sensor above the seventh preset button responds to commands from the supplied remote control, which duplicates most of the front-panel functions.



At approximately the center of the panel is a display area that shows signal strength of a received station (graded from 1 to 5), the selected AM or FM frequency, stereo reception, and the status of the fine-tuning feature. The "Hi Q" button is just below the display area; pushing it activates the narrow-mode circuitry described above as well as the fine-tuning circuitry, controllable by means of a small rotary knob next to the "Hi Q" button. When you use the fine-tune knob, an arrow in the display shows if you have tuned above or below the frequency indicated by the numeric display. If you tune to another station, the Twenty-Three automatically cancels the fine-tune setting, since the new station might not require fine tuning. (Even if it did, the fine-tuning direction required for one station would not necessarily be optimal for another.)

Farther to the right are an interstation "Mute" button, AM and FM band selector pushbuttons, a mono/stereo button, a "Seek" button, and a large tuning knob. When "Seek" is pressed, rotating the knob in either direction causes the tuning circuits to scan across the band and stop at the next strong signal. When "Seek" is released, the knob tunes linearly, with displayed frequencies changing gradually as you turn it.

The rear panel of the Citation Twenty-Three is equipped with 300- and 75-ohm FM antenna terminals, AM antenna terminals (to which the supplied pivoting AM loop can be attached), variable and fixed output jacks, and an unswitched a.c. convenience outlet. A control near the variable output jacks is used when adjusting output level, and a second small control adjusts muting threshold (the level of signal that will overcome the interstation muting circuit if muting has been activated at the front panel).

Measurements

Usable mono sensitivity in the normal (wide) mode measured slightly more than 11.0 dBf, while maximum signal-to-noise ratio for strong mono signals reached 84 dB, exactly as claimed by Harman/Kardon. Stereo threshold was set at about 32 dBf; below this level, reception automatically switched to mono. At 65 dBf, S/N in stereo was 75 dB, as claimed, but if I increased generator output beyond that point, S/N improved still further, reaching a maximum of 79 dB at 80 dBf. Figure 1 shows how mono and stereo noise varied with increasing input signal strength. Notice, too, the excellent limiting characteristics of this tuner, as indicated by the top curve, labelled "Audio Output." Virtually full limiting is reached by the time input signal level approaches 10.8 dBf, the rated level for mono usable sensitivity. Few FM tuners deliver fully limited audio signals at such low r.f. input levels.

In the Hi Q (narrow) mode, mono usable sensitivity was around 18 dBf, a bit higher than in normal mode. However, with strong signal inputs, mono S/N readings were the same in Hi Q as they were in normal mode, so I am not presenting a separate graph for those results.

Total harmonic distortion plus noise for a 1-kHz modulating signal in the normal mode reached 0.05% in mono at 65 dBf, decreasing further to 0.043% at 80 dBf. Stereo THD in

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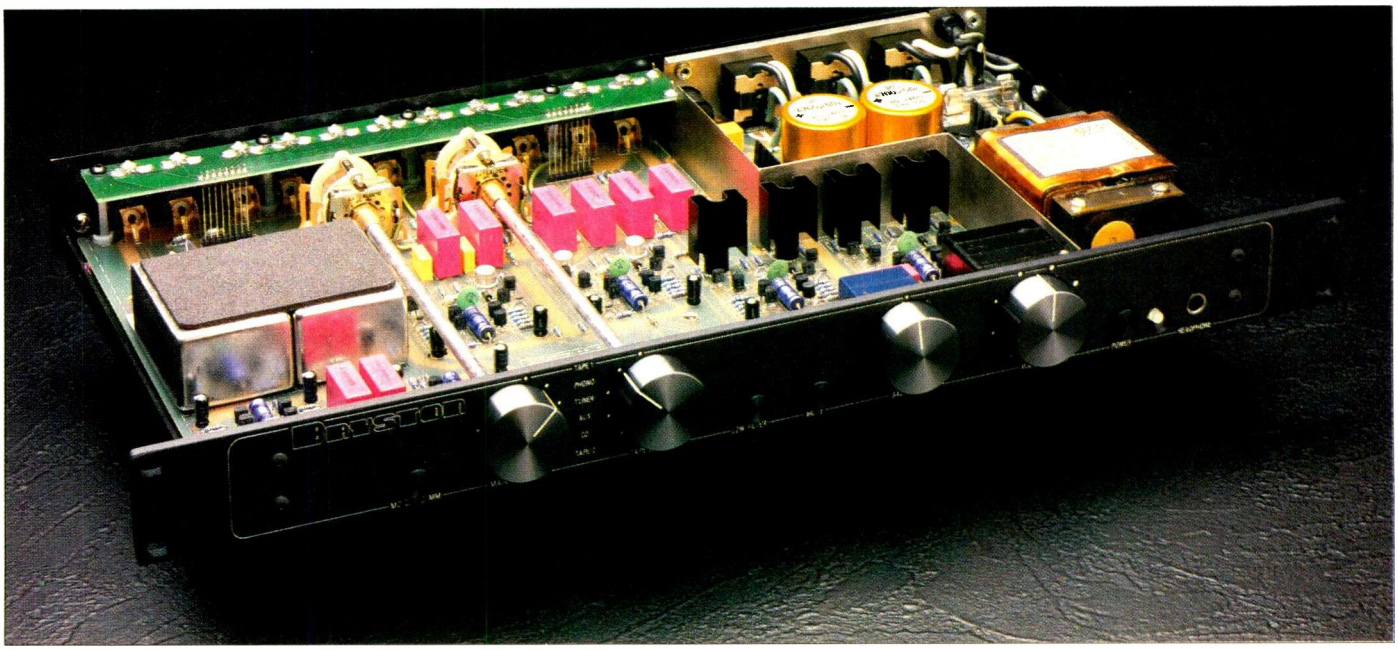

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The test result of 32 dB for adjacent-channel selectivity really made me take notice; it's the highest I have ever encountered.

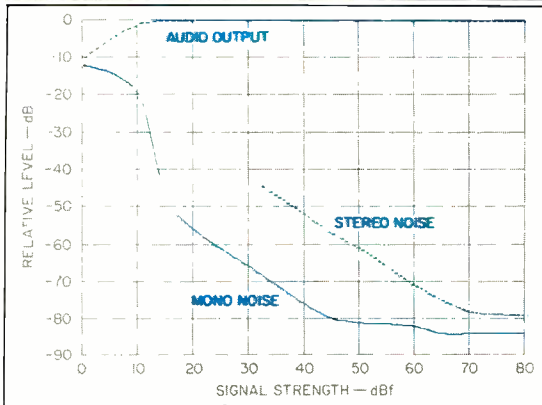

Fig. 1—Mono and stereo quieting characteristics, FM section. Note excellent limiting characteristics; see text.

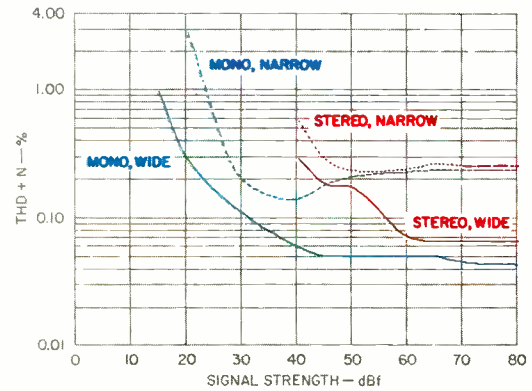

Fig. 2—THD + N vs. signal strength for normal (wide i.f.) and Hi Q (narrow i.f.) modes, FM section.

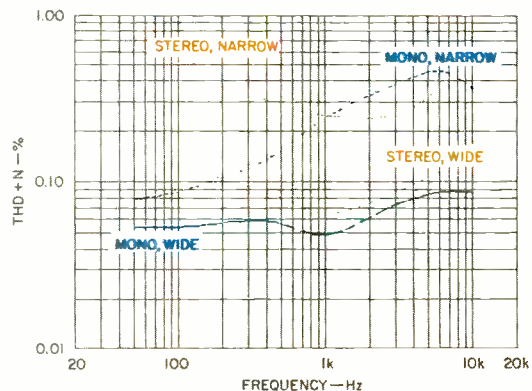

Fig. 3—THD + N vs. modulating frequency for normal (wide) and Hi Q (narrow) modes, FM section.

this mode was almost as good, with readings of 0.065%. When I switched to the Hi Q mode, distortion increased, as might be expected. That's one of the penalties of greater selectivity, no matter how it is achieved. In Hi Q mode, THD in both mono and stereo hovered around the 0.25% mark with strong signals applied. Figure 2 shows how THD varied as a function of input signal level for mono and stereo signals and for both the normal and Hi Q operating modes.

Figure 3 shows how THD + N varied as a function of modulating frequency for mono and stereo in both operating modes. Because the unit I tested exhibited a fairly high amount of unsuppressed subcarrier output, I was unable to obtain an accurate reading for THD at 10 kHz in the stereo mode. Any test setup with sufficient bandwidth to measure 20 kHz, the second harmonic of 10 kHz, would also measure the 19-kHz subcarrier components. The result would be inordinately high "distortion" readings that are not really harmonic distortion at all. This problem does not occur when measuring distortion at lower frequencies, because the IHF/EIA/IEEE Tuner Measurement Standard, which requires distortion measurements only at modulating frequencies up to 6 kHz, prescribes the use of a band-pass filter whose cutoff points are at 200 Hz and 15 kHz. (To obtain 10-kHz readings, I take this band-pass filter out of the signal path.) In any case, in the normal mode, mono THD remained well under 0.1% at all frequencies, and stereo THD rose to no more than 0.11% at 100 Hz and to 0.12% at 6 kHz. In the Hi Q mode, mono THD remained under 0.1% at low frequencies, increasing to 0.48% at 6 kHz; in stereo, THD was 0.52% at 100 Hz and 0.38% at 6 kHz.

With the tuner set to the normal mode, stereo separation (Fig. 4) measured in excess of 55 dB at mid-frequencies, dropping to 51 dB at 100 Hz and to 40 dB at 10 kHz. When the Hi Q circuit was activated, separation decreased (middle trace of Fig. 4), but it was still a very adequate 39 dB at 1 kHz, 41 dB at 100 Hz, and 29 dB at 10 kHz.

Figure 5 shows separation at 5 kHz, the difference in height between the tall spike at the left and the smaller spike contained within it. It also shows the crosstalk components produced at the output of the unmodulated stereo channel in the presence of a 100%-modulated, 5-kHz signal on the opposite channel. The two fairly large components near the right of the photo are sidebands surrounding the smaller residual 38-kHz subcarrier component. It was these unusually large out-of-band components that prevented me from getting a meaningful stereo THD reading at 10 kHz. Although these components will certainly not be audible, they shouldn't be this large, since they could affect Dolby recordings made off the air. I discussed this situation with engineers at H/K; they informed me that my sample was from a small, first-production pilot run and that the problem—which they too had discovered—has since been corrected.

Perhaps the most significant measurement which I can report is the Twenty-Three's adjacent-channel selectivity in the Hi Q mode. The 32-dB value I obtained really made me sit up and take notice; I have never measured a tuner that did as well. Most tuners, even when measured in the narrow i.f. mode, rarely achieve values of even 20 dB; those tuners that don't have a narrow mode generally do not exceed 5 to 10 dB. This unit's excellent 32-dB reading accounts for its

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The Twenty-Three clearly merits the Citation label, something that's never been awarded lightly by the Harman/Kardon management.

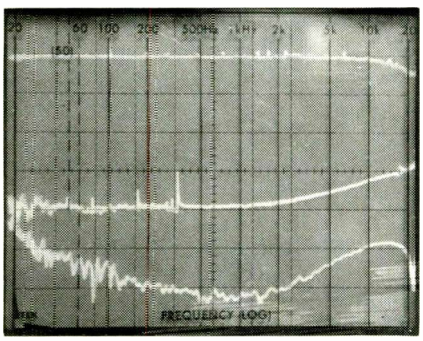

Fig. 4—FM frequency response (top trace) and separation vs. frequency for Hi Q mode (middle trace) and normal mode (bottom trace).

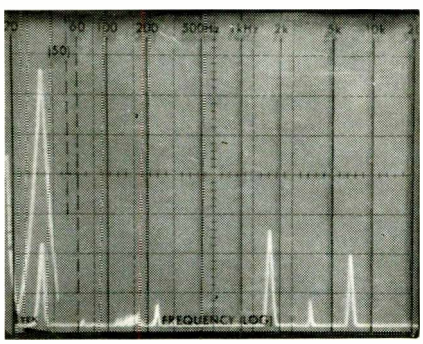

Fig. 5—Separation and crosstalk components for a 5-kHz modulating signal, plus subcarrier and sideband components. See text. (Vertical scale: 10 dB/div.)

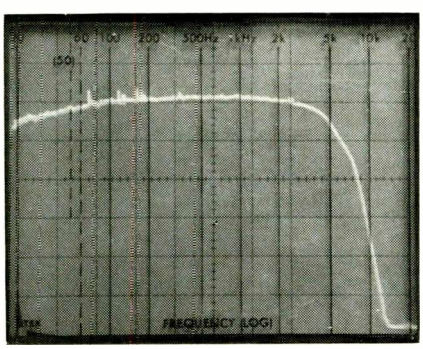

Fig. 6—AM frequency response.

ability to single out an incoming signal even when a stronger signal is only 200 kHz away.

Alternate-channel selectivity turned out to be 63 dB in the normal mode and 78 dB in Hi Q, almost exactly as specified. Other measurements, such as image, i.f., and AM rejection, also came to 1 or 2 dB above or below the manufacturer's specified value. Because of the limitations of my test equipment, I can't confirm the claimed spurious-response rejection of 115 dB, but I can attest to a figure of at least 100 dB. Equipment limitations also prevented my measuring capture ratio down as low as the Twenty-Three's rating of 0.75 dB in normal mode. The best I've ever been able to measure (again, probably owing to the test gear) is 1.0 dB, and that's what I obtained in this case. Capture ratio in the Hi Q mode was a bit poorer, closer to 2.0 dB, but that's still a very acceptable value.

Harman/Kardon obviously paid some attention to the AM circuitry in this tuner too. The AM frequency response, seen in Fig. 6, shows that the 6-dB roll-off point occurred a bit above 5 kHz. That's almost an octave higher than I usually measure on AM/FM tuners and receivers, even if it's not quite "high fidelity." Having been favorably impressed by this measurement (it's always a surprise to find a tuner with AM response above 3 kHz), I decided to devote a bit more time to the AM section. I measured AM sensitivity (via the external antenna terminals) of 15 μV, S/N ratio of exactly the 55 dB claimed, i.f. rejection of 67 dB, and distortion of under 0.5% for mid-frequency modulating signals.

Use and Listening Tests

There is a station near the bottom of the FM band in my area (near New York City) that I had always suspected was either overmodulating or simply putting out a distorted signal. With the aid of the Citation Twenty-Three, I was able to prove that the problem was overmodulation. In the Hi Q mode (which permits no more than 80 kHz deviation even if a station modulates beyond its allotted 75 kHz), I could clearly detect the kind of distortion that arises from severe overmodulation. There's also a fairly strong station in my area that has prevented me from receiving a weaker station coming from mid-Connecticut whenever I've used a frequency-synthesized tuner. With the aid of the Twenty-Three's fine-tune and Hi Q features, I was able to off-tune ever so slightly, just enough to maintain distortion-free reception of the weaker station while eliminating just about all traces of the previous interference.

Even in the absence of reception problems to address, the Citation Twenty-Three is without a doubt a very good-sounding tuner. The range of muting adjustment is very broad, from about 30 dBf to 65 dBf. I don't think anyone would ever set it at its maximum point, though, unless one wanted only the very strongest stations to come through.

I guess the highest compliment I can pay to this component is to say that it definitely deserves the Citation label, a designation that has never been awarded lightly by Harman/Kardon's management. The Twenty-Three is both great to look at and great to listen to. With tuners like this around, perhaps a few more stations in each listening area will clean up their act in an effort to match its fine performance.

Leonard Feldman

Photography by Ken Wyner

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4

SANSUI CD-X901 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 4 Hz to 20 kHz, ±0.3 dB.
THD: Less than 0.0025% at 1 kHz.
S/N: 108 dB.
Dynamic Range: 96 dB.
Output Levels and Impedances: Unbalanced outputs, 2 V/5 kilohms; balanced outputs, 2 V/600 ohms; digital output, 0.5 V peak to peak/75 ohms; headphones, 45 mW maximum with 32-ohm load.
Number of Programmable Selections: 20.
Power Requirements: 120 V, 50/60 Hz, 35 watts.
Dimensions: 17 11/16 in. W × 3 7/8 in. H × 16 in. D (44.9 cm × 9.8 cm × 40.6 cm).
Weight: 23.1 lbs. (10.5 kg).
Price: $1,400.
Company Address: 1250 Valley Brook Ave., Lyndhurst, N.J. 07071.
For literature, circle No. 93

After several years of concentrating on "rack systems," Sansui has finally come home. By this I mean that they have designed a group of components reminiscent of the Sansui of old, a company dedicated to state-of-the-art technology and superb-sounding audio equipment. To differentiate the new high-end products from the components found in their rack systems, Sansui has dubbed this new line the "Vintage" series. The CD-X901 CD player, without a doubt one of the finest looking and best sounding players I have tested, definitely belongs in Sansui's Vintage category. It is the equal of some of the most highly regarded CD machines available.

Like other top players, the CD-X901 features random-access programming of up to 20 selections, access to any track or any index number within a track, audible music search, music scanning (automatic play of of the first few seconds of each track), various repeat-play modes, and a wireless remote control that duplicates just about all of the functions found on the front panel. Beyond all of that, Sansui has added a digital output terminal for those who prefer using a separate D/A signal processor. There is also a pair of XLR balanced-output connectors (in addition to the usual unbalanced phono jack outputs) for those who have amplifiers or preamplifiers with balanced inputs. I should mention that one integrated amp in Sansui's Vintage series, the AU-X901, does, in fact, have balanced inputs. It would therefore be an ideal choice to use with this player, in terms of both functional compatibility and styling.

Control Layout

The all-black front panel of the CD-X901 is similar in layout to that of several other full-featured CD players. At left is the "Power" switch, a "Timer" switch (used if the player's power cord is connected to an external timer), a smooth-gliding disc drawer, and an "Open/Close" pushbutton. A large display area near the center of the panel includes both a numerical readout for the track being played and a "music calendar." The calendar is a grid of numbers from 1 to 20 that shows all the tracks on a disc or the tracks that have been programmed; as each track is played, the indicator light for that track is extinguished. Many other indications of player status are also provided, including a display of the repeat-play mode in use, if any, and displays of elapsed or remaining time for the current track or for the entire disc. The time-display modes are called up by a "Time" button below the display.

To the right of the display area are the numeric keys, plus "Set" and "Cl" (clear), used for programming and for direct access of a desired track or index point. Farther to the right are the "Play," "Pause," "Music Scan," and "Stop" keys, as well as two search keys marked with left- and right-pointing arrows. Along the lower edge of the panel are the buttons for repeat play, the "Time" button, a "Check" button for verifying programs, a "Spacing" button (which inserts a 4-S space after every selection, for taping), a pair of "Index" buttons, and a pair of buttons labelled "AMPS" (Automatic Music Program Search) which move the laser pickup forward or back to the start of the next or the previous tracks. At the lower right corner of the panel is a stereo phone jack and its level control.

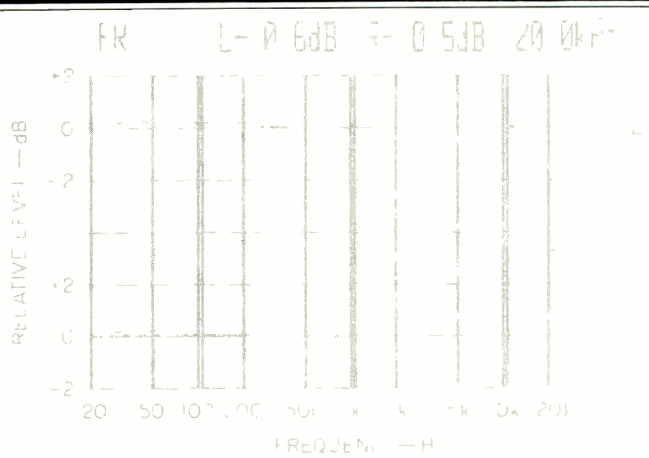


Fig. 1—Frequency response, left (top) and right channels.

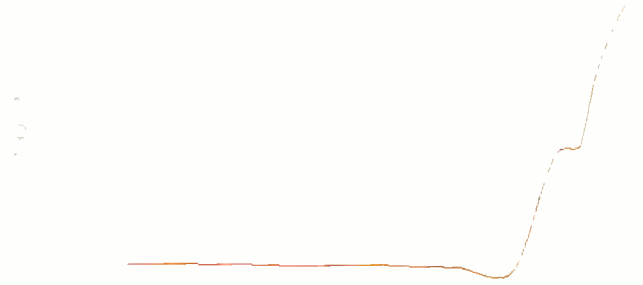


Fig. 2—THD + N vs. frequency at maximum recorded level.

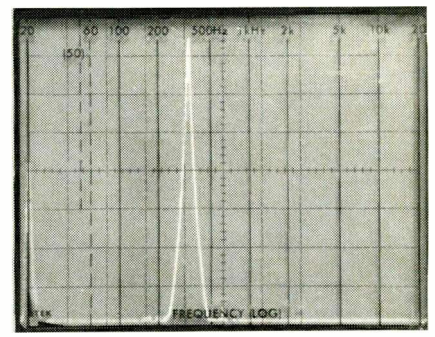
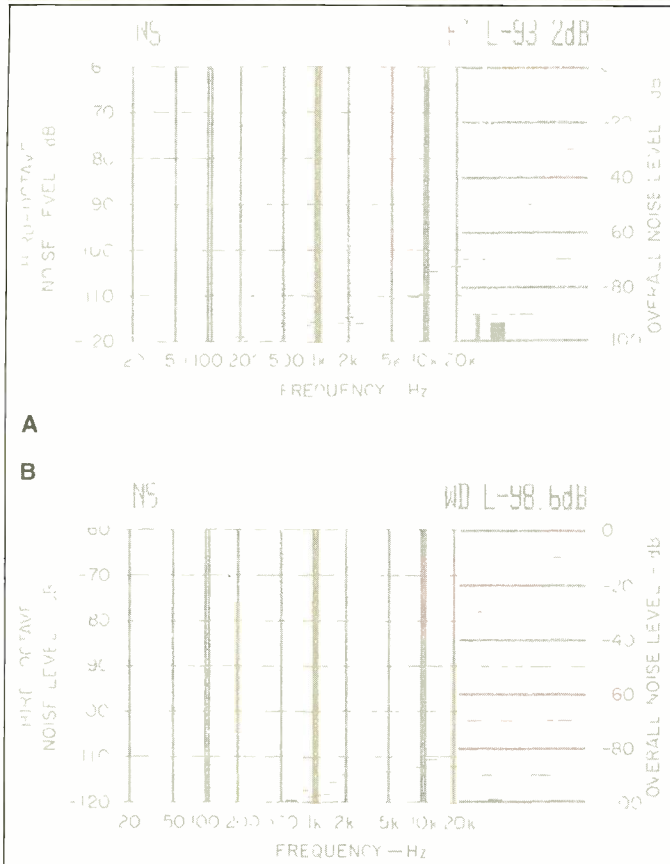


Fig. 3—Spectrum analysis of 20-kHz test tone; sweep is linear from 0 Hz to 50 kHz. Vertical scale: 10 dB/div.

THD + N at 1 kHz was an excellent 0.0035%, and at higher frequencies I found the figures to be even more impressive.



A

B

Fig. 4—S/N analysis, unweighted (A) and A-weighted (B).

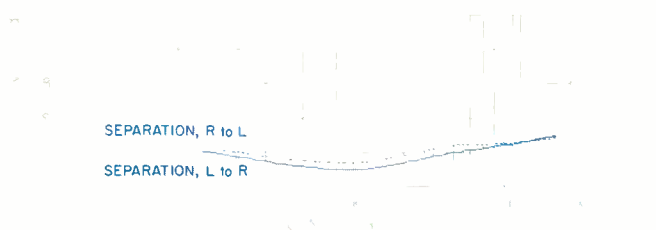


Fig. 5—Separation vs. frequency.

The rear panel is equipped both with unbalanced, phono-tip output jacks and with the balanced XLR-type output connectors mentioned earlier. Also on the rear is the single digital output jack and an associated on/off swtich that must be placed in the "On" position if you intend to use that jack. Sansui even thought of including a chassis ground terminal on the rear panel. I wish other makers of CD players would include one, as several times I've found that grounding the chassis of a CD player to the chassis of a preamp or amplifier can actually reduce background noise and hum.

Measurements

Figure 1 is a plot of frequency response using the EIA-approved CD-1 test disc. At 20 kHz, response was down only 0.6 dB for the left channel and only 0.5 dB for the right channel.

Figure 2 is a plot of THD + N versus frequency. At 1 kHz, THD + N measured 0.0035%, an excellent figure. Even more impressive, however, were the THD + N readings at higher frequencies. No band-pass filters were used to make these measurements, so a reading taken at 20 kHz includes any and all out-of-band products, regardless of whether they constitute harmonic components, "beats" between the sampling frequency and the reproduced frequencies, or anything else. Largely due to beats, many CD players I've tested have exhibited THD + N levels of well over 1% when subjected to this type of "open-ended" bandwidth measurement. The Sansui unit yielded a reading of only 0.030% for this test, indicating that it has superbly linear D/A converters, optimally designed digital filters, and well-designed post-D/A analog filtering.

This excellence is further confirmed in Fig. 3, which shows a spectrum analyzer's linear sweep from 0 Hz to 50 kHz. The tall spike represents a 20-kHz output signal as reproduced from the test disc. The dynamic range in this display is greater than 70 dB, so the fact that there is only the very beginning of an additional spike (just barely visible behind the "n" in "Frequency") above the 20-kHz test tone, and the fact that there is no spike in the in-band region to the test tone's left, confirm my THD + N reading of roughly 0.03% at 20 kHz.

Figures 4A and 4B show the distribution of noise appearing at the output of the player when the "minus infinity" or "no signal" track of my test disc was played. Overall unweighted signal-to-noise ratio was 93.2 dB, and A-weighted signal-to-noise ratio was 98.6 dB. I am somewhat at a loss to understand how Sansui arrived at a 108-dB specification for S/N.

On the other hand, I measured a much higher dynamic range capability for the CD-X901 than the manufacturer specified—104 dB as against 96 dB claimed. Here, the disparity may well be due to a difference in the way the measurements were made. I recently switched to the method suggested in the proposed EIA Standards for CD player measurement. It stipulates using a special dithered track on the CD-1 test disc and comparing the output of a −60 dB recorded signal with the output of dithered noise only, expressed in dB. To this difference is added the initial −60 dB.

Linearity was measured two ways: With and without dither

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You'll have to go some distance to come up with a CD player that matches the sonic standards of this "vintage" component.

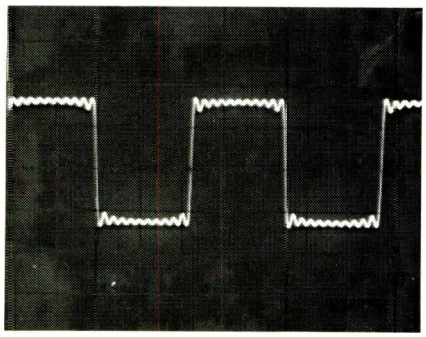

Fig. 6—Reproduction of a 1-kHz square wave.

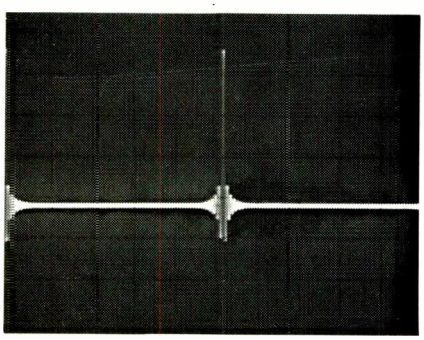

Fig. 7—Unit-pulse test.

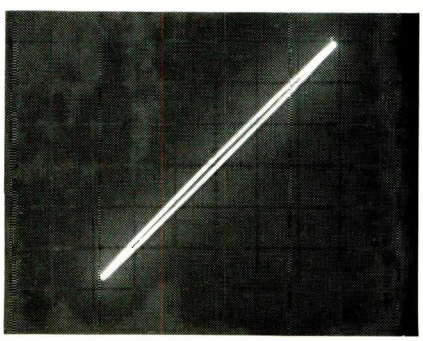

Fig. 8—Interchannel phase comparison at 20 kHz. Slightly elliptical shape indicates small phase error (see text).

added. Without dither, linearity was accurate all the way from 0 to −80 dB, with an error of 2 dB at −90 dB (the output read −88 instead of −90 dB). Using the dithered test signals, accuracy down to −80 dB was still maintained within 0.1 dB, but at −90 dB the error was 3 dB. The result of the undithered linearity test is considerably better than what I have measured from most CD players in the past; as to the dithered test, I have no basis for comparison, having begun to use it only recently. (See "Dithered Linearity CD Test Signals," which accompanied my review of the Technics SL-P1200 player in the December 1987 issue.)

Stereo separation (Fig. 5) was the best I have ever obtained for any Compact Disc player. While most units have exhibited a decreasing separation at higher frequencies, the CD-X901 achieved separation of approximately 95 dB even at 16 kHz, which is the highest test frequency used in this measurement.

The 1-kHz square wave shown in Fig. 6 and the unit pulse shown in Fig. 7 are typical of what I have observed from CD players that use digital filtering and four-times oversampling. The symmetrical-looking horizontal ripples in Fig. 6 should not be interpreted as "ringing." Rather, they are simply the result of "missing" higher-order harmonic components above 20 kHz that would be required to faithfully depict a square wave at this frequency. The square wave shown in Fig. 6 is as good as any I have seen reproduced by a CD player.

Figure 8 is the Lissajous pattern obtained when 20-kHz signals were fed to the vertical and horizontal inputs of my test oscilloscope. A straight line would indicate absolutely no difference in phase between the two signals. The very slightly elliptical shape of this display shows that there may be a phase error of a few degrees, probably caused by some minor and audibly insignificant difference in the phase characteristics of the player's left and right analog output stages.

Use and Listening Tests

At the time I tested the CD-X901 in my lab, I had two other high-end machines on hand, and I used them to make listening comparisons. The other units were my own Sony CDP-650ESD reference player and the "professional" Technics SL-P1200. I regard these two players as especially good-sounding units. The Sansui CD-X901 equalled both of them, reproducing highs with exceptional clarity and delivering awesome bass energy.

I recenty obtained the two-disc Telarc release of *Liza Minnelli at Carnegie Hall* (CD-85502). If you want to hear what live sound can be like, as reproduced on well-engineered CDs, I urge you to play these discs on a unit such as the CD-X901. Close your eyes and it won't be too hard to imagine that you are in the audience. There's not the slightest hint of "canned" sound from this CD player when reproducing well-made CDs.

These days, properly produced discs aren't all that hard to find, but you'll have to go some distance to find a player that comes up to the sonic standards of the CD-X901. It's nice to have Sansui's engineering efforts directed once again to such "vintage" products. Welcome home, Sansui, we've missed you! *Leonard Feldman*

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5

SENNHEISER MKH 40 MICROPHONE

Manufacturer's Specifications
Directional Pattern: Cardioid.
Acoustic Operating Principle: Symmetrical pressure-gradient.

Transducer Type: Condenser.
Frequency Response: 40 Hz to 20 kHz.
Sensitivity (Open-Circuit Voltage): 25 mV/Pa (8 mV/Pa with 10-dB attenuator), ±1 dB.
Nominal Output Impedance: 150 ohms, balanced.
Minimum Load Impedance: 1 kilohm, 600 ohms minimum to 130 dB SPL (140 dB SPL with attenuator).
Equivalent SPL: 12 dBA rms (16 dBA with attenuator) per DIN 45-500; 21 dBA peak (26 dBA with attenuator) per CCIR 468.
Maximum SPL for Less than 0.5% THD at 1 kHz: 134 dB (142 dB with attenuator).
−3 dB Roll-off: 40 Hz, 12 dB/octave with low-cut filter off; 120 Hz, 6 dB/octave with low-cut filter on.
Power Requirements: 48 V, ±4 V, 2 mA; phantom powering as per DIN 45-596.
Power-Supply Options: MZN 16-P48U a.c. supply for two microphones; MZA 16-P48U battery supply for one microphone, with switchable 20-dB pads and 20- (flat), 80-, and 140-Hz filters.
Supplied Accessories: MZQ stand holder; MZW 41 wind and pop screen; foam-lined carrying case.
Dimensions: 1 in. diameter × 5⅞ in. L (2.5 cm × 15 cm).
Weight: Approximately 3½ oz. (100 grams).
Prices: Microphone, $839; MZN 16-P48U a.c. supply, $345; MZA 16-P48U battery supply, $339.
Company Address: P.O. Box 987, Old Lyme, Conn. 06371.
For literature, circle No. 94

Sennheiser, a German firm, manufactures a wide variety of dynamic and condenser microphones, headphones, wireless microphone and headphone systems, and related electronics. The designation "MKH" refers to their line of studio condenser microphones, each of which employs what the company calls the "RF Principle." Instead of applying a high d.c. voltage to the capsule, about 10 V of 8-MHz r.f. bias is applied from a low-noise oscillator. The capacitance variations of the capsule modulate the oscillator, and this modulation is translated into an audio signal. Since the capsule is a capacitor, the impedance of its 8-MHz output is low compared to the audio-frequency output of an equivalent d.c.-biased microphone. Sennheiser says that this renders the MKH microphones less susceptible to popping and sputtering noises caused by high humidity, thus making them suitable for outdoor use. The MKH line includes an omnidirectional, a figure-eight, and a cardioid mike, short and long shotgun models, and a special-purpose omni unit which features flat response down to 0.1 Hz. All of these microphones, except for the last, feature very low noise levels.

I've had some previous experience with the MKH mikes; it came in 1980, when I was refurbishing the 1970-vintage RCA console in the Grand Tier broadcast booth at New York's Metropolitan Opera House. The console inputs came from a number of short MKH-416 shotgun mikes hung 40 feet above the orchestra and stage. (This was low, compared to the reported 100-foot proscenium height!) The MKH shotgun mikes yielded excellent audio in spite of their long distance from the performers, and the very long cables between the mikes and the power supplies in the booth did not impair that quality.

The appearance of the MKH 40 is best described as "understated." The satin-black cylindrical housing is quite plain, save for the flat surfaces along two-thirds of its length. These surfaces serve the practical functions of providing secure mating to the swivel mount and acting as a "panel" for the 120-Hz filter and output attenuator switches. The microphone is very lightweight compared to many other professional condenser microphones.

The specifications for the MKH 40 indicate that it has a very wide dynamic range, uniform frequency response at all useful pickup angles (e.g., a polar pattern independent of frequency), and low distortion. According to the published frequency response curves, it also is flatter than the MKH cardioid that came before it (MKH-406) and has lower noise. It is recommended by the manufacturer for digital recording and, like the MKH-406, is said to be appropriate for outdoor as well as indoor use.

The MKH 40 requires external phantom powering; not wanting to gamble on introducing noise from a lab power supply, I opted for the battery supply, MZA 16-P48U. This was a good choice because it includes a 20-dB attenuator and response-shaping filters—flat (20 Hz) plus 80 and 140 Hz positions—which supplement those on the mike. The power-supply switches offer flexibility in recording and are an advantage in any live concert setting where you can't access the mike to make changes. At $678 for a pair, these battery supplies are a bargain, at least compared to one that I've tested which cost in excess of $1,000.

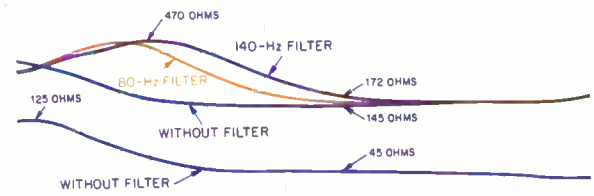

Fig. 1—Impedance vs. frequency. Top three curves show effects of power-supply filter switches; actual impedances are approximately 100 ohms less than shown due to use of isolation transformer in this test. Bottom curve, made direct into test gear with power-supply filters off, is same for all mike filter and attenuator switch positions.

Measurements

Readers of my previous reviews will recall that my tests include measurements of impedance, frequency response (both axial and at various angles off-axis), and (for condensers) noise level. With all of the switch selections available on this microphone and power supply, it was not practical to conduct all of these tests for every switch setting. Therefore, I planned the tests so as to sample all settings but minimize the total number of tests.

The curves of impedance versus frequency, in Fig. 1, give some idea of the maze that would result from trying every switch setting for every measurement. The bottom curve is the impedance of the direct output from the battery power supply into an unbalanced test circuit, with the supply's filter switched out (that is, with the switch at its "20 Hz" setting). All possible settings of the microphone's filter and attenuator switches were checked, with no effect on the result. Impedance at 1 kHz remained near the rated value of 50 ohms, and the low-frequency peak remained at 125 Hz. This peak will not cause appreciable loading with most low-impedance inputs rated at 150 to 250 ohms.

For the upper three curves, which show the effects on impedance of changing the power-supply filter settings, a transformer was used for isolation from the test jig. (This was done because the instructions for the power supply warn against unbalancing the output, as was done for the bottom curve, even though no error was apparent.) The transformer added about 100 ohms to the impedance values, and this should be mentally subtracted from the values shown.

Unlike the filter and attenuator in the microphone, the filters in the battery supply did cause a considerable change in impedance at low frequencies. However, the maximum value probably remains below about 400 ohms, which most microphone inputs can easily tolerate.

Next, I measured on-axis frequency response, with all filters and attenuators switched off, at three distances from

This mike's noise is so remarkably low that it can pick up sounds that are too quiet to be heard by an unaided ear!

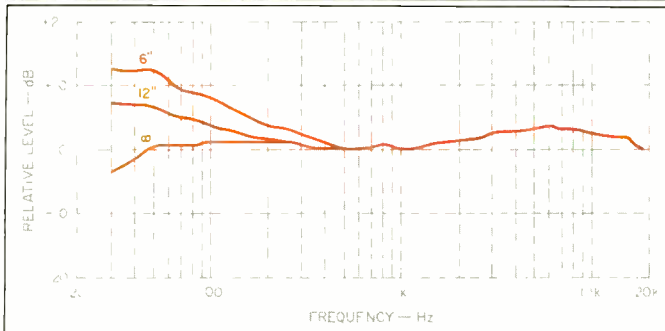

Fig. 2—On-axis frequency response at three distances with microphone roll-off and power-supply filters switched out. (0 dB = −36 dB re: 1 V/Pa)

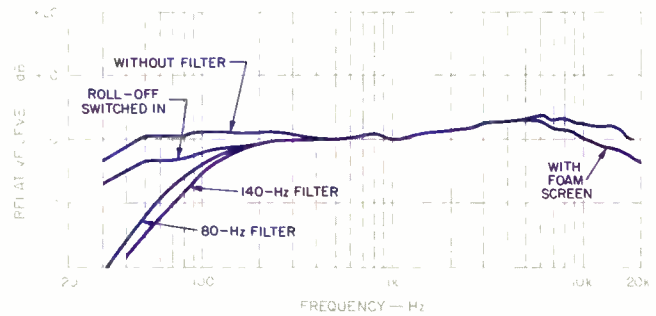

Fig. 3—On-axis frequency response at infinite distance for different filter settings. Microphone roll-off as noted.

my sound source (Fig. 2). Readers of past reviews will recall that this unique source, whose driver has a 2-inch-diameter piston, can be used for accurate measurements from 30 Hz to 20 kHz at distances as close as 6 inches. These response curves reveal proximity effects which closely match those of an ideal cardioid microphone. The low-frequency response is probably flat above 30 Hz at some distance between 1 foot and infinity (1 meter would be a good estimate). Thus, when the MKH 40 is used at any distance closer than 3 or 4 feet, the bass boost should be equalized out, unless you desire it as a special effect.

The next test measured the effects of the various filters upon axial frequency response at infinite source distance (Fig. 3). This data will assist in selecting the desired filter when the microphone is used close to the source or when noise attenuation is desired. Unfortunately, the filters are not ideal for proximity-effect reduction since the curves in Fig. 2 are not precisely the inverse of the curves in Fig. 1. My recommendation is to use the mike's roll-off filter and switch the power supply (if used) to 20 Hz for distances of 1 or 2 feet, and to use external equalization for closer distances. The 80- and 140-Hz settings will be more useful for noise reduction when recording sound sources that have no low frequencies. Note the significant attenuation at the high-frequency end of Fig. 3 when the foam windscreen is in place. This windscreen should not be used without some thought as to its sonic effect.

The axial frequency response curves show a rise above 1 kHz; this rise reaches 3.5 dB in the region from 4 to 6 kHz. The curve given on the microphone's catalog sheet indicates a flat trend with a ±2 dB tolerance envelope. In contrast, the instruction booklet accompanying the microphone shows a curve which rises about 2 dB and a tolerance envelope that extends to +4 dB. I assume that the information in the instruction booklet is more accurate.

The sensitivity, with the attenuators in the microphone and power supply switched out, is −36 dBV/Pa. My rule of thumb is that an unamplified microphone should have a sensitivity of at least −60 dBV/Pa so that contemporary mixing boards will not add noise to its signal. Thus, the MKH 40 has more than 20 dB of additional output available, which may be used to advantage in picking up low-level sounds. With loud sounds, however, such as full orchestra at loudest level or closely miked instruments, it will probably be necessary to switch in the attenuators on the microphone, power supply, or mixing board. According to my test results, these attenuators do not introduce any frequency discrimination.

The polar pattern was assumed to be the same in all planes of rotation, and one set of curves was drawn to represent the entire family of polar responses. The pattern was also assumed to be symmetrical in the half-plane not tested. Figure 4 shows the results: The polar pattern is quite uniform from 0° to 90° at 10 kHz. It is probably uniform out to 15 kHz at 60°, so an X-Y stereo pair angled at the recommended 120° will have uniform frequency response for all sources within its included angle. The rejection at 135°, about 14 dB at 1 kHz, is good. The rejection at 180° is acceptable, averaging about 15 dB. The manufacturer's data in the form of a polar pattern indicates about 14 dB rejection at 135° and more than 25 dB rejection at 180° up to 1 kHz. I do not count this as an important difference because the measurement is difficult, and significant differences between laboratories are possible.

The noise test revealed a remarkable feature of this microphone: It can pick up sounds that cannot be heard by the unaided ear! Figure 5 shows the equivalent sound pressure level of the microphone's own noise, measured via ⅓-octave band filters, with the microphone in a sound-retardant box. The measurement was troubled by a strange lump at 75 Hz, yet I could hear no sound outside of the box at such a low frequency and level. By listening to the input and

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Listening confirmed that the small bass roll-off is insignificant, but it also revealed a bit of extra brightness.

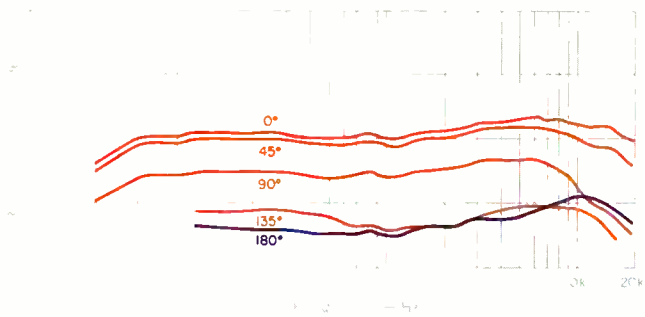

Fig. 4—Frequency response vs. angle for plane wave, with microphone roll-off and power-supply filters switched out.

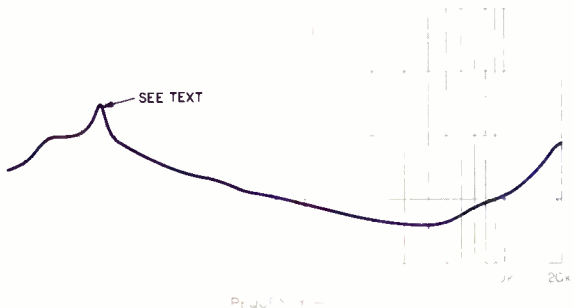

Fig. 5—Noise spectrum (third-octave bands) with microphone attenuator, roll-off, and power-supply filter switched out.

output of the filter in this band, I deduced that the lump was the sound of distant traffic, "tuned" by the natural resonance of my frame building. The SPL of this sound was 5 dB, which is 25 dB below the normal threshold of hearing at this frequency! The overall noise level was in agreement with the rated 12 dBA. The MKH 40 is therefore well suited to pickup of musical sources at low sound levels, but a very quiet location is needed. In many locations, even seemingly quiet studios, I expect this mike will reveal noise.

I found that the 9-V alkaline battery in the power supply measured 7.69 V after 12 hours of continuous operation. Rated battery life is 20 hours, and the battery test light is calibrated at 6.5 V. This compares to 200 hours for a consumer-type electret mike with integral battery. To be safe, a fresh battery should be installed prior to any critical recording session.

Use and Listening Tests

Using my low-noise microphone amplifier, I compared the Sennheiser MKH 40 to another condenser microphone with a wide frequency range, a Nakamichi CM-700 electret. The CM-700, a premium consumer-grade microphone, sounded very hissy in a quiet room, whereas the MKH 40 reproduced the room noise with no audible hiss. Very impressive!

Clipping level with close, loud speech was seen on a 'scope to be approximately 134 dB, as rated. Vibration noise pickup was less than with the CM-700, and magnetic hum pickup was lower too. On the other hand, the MKH 40 had somewhat more "pop" sensitivity with its windscreen mounted than the Nakamichi did. With voice as a source, the Sennheiser sounded identical to the Nakamichi at angles from 0° to 135°. This was quite remarkable, as the Nakamichi has exceptionally uniform polar response because of its small diameter (16 mm, compared to 25 mm for the Sennheiser).

I loaned the Sennheiser mike and battery supply to my associate Jack Shaw, who used them in recording piano and voice on videotape for a cable TV show. He reported that the resulting tape sounded "clearer, cleaner, and had less room noise than a tape made with the Nakamichi." However, after a few selections were recorded, the battery supply became noisy, and he had to switch to the Nakamichi. Later, I sprayed the battery contacts with contact cleaner, and the noise ceased

I had the good luck to be able to record a concert which featured 18 brass and percussion players from the Philadelphia Orchestra, plus pipe organ and large choir. The concert took place in the United Methodist Church in Haddonfield, N.J. An AKG C-422 polydirectional stereo condenser microphone is permanently flown about 16 feet above the place where musicians perform in this church. In order to make a good comparison between the Sennheiser and AKG mikes, I mounted an X-Y pair of MKH 40s on a tall Shure S-15 stand, which raised them to a level only about 2 feet below the C-422.

I had to position the Sennheisers for an included angle of 90° to match that of the C-422. The AKG, which is normally set for figure-eight (Blumlein) stereo, had to be set for cardioid patterns to match the Sennheisers. There was thus a potential sacrifice in stereo perspective, because the included angles were less than the usual 120° recommended for crossed cardioids.

Not having a 4-track recorder on which I could tape the outputs of these mikes simultaneously, I used two cassette machines from Aiwa, the AD-F990 and the AD-3700, with metal-particle tape and Dolby C noise reduction. Because the 990 has the HX-Pro headroom-extension system but the 3700 does not, I switched the units at intermission, to record with each mike on each machine.

The tapes were auditioned on two systems. One, in my home listening room, includes modified and equalized Altec 604C duplex studio monitors housed in large sealed boxes. In audio quality and stereo perspective, the tapes made

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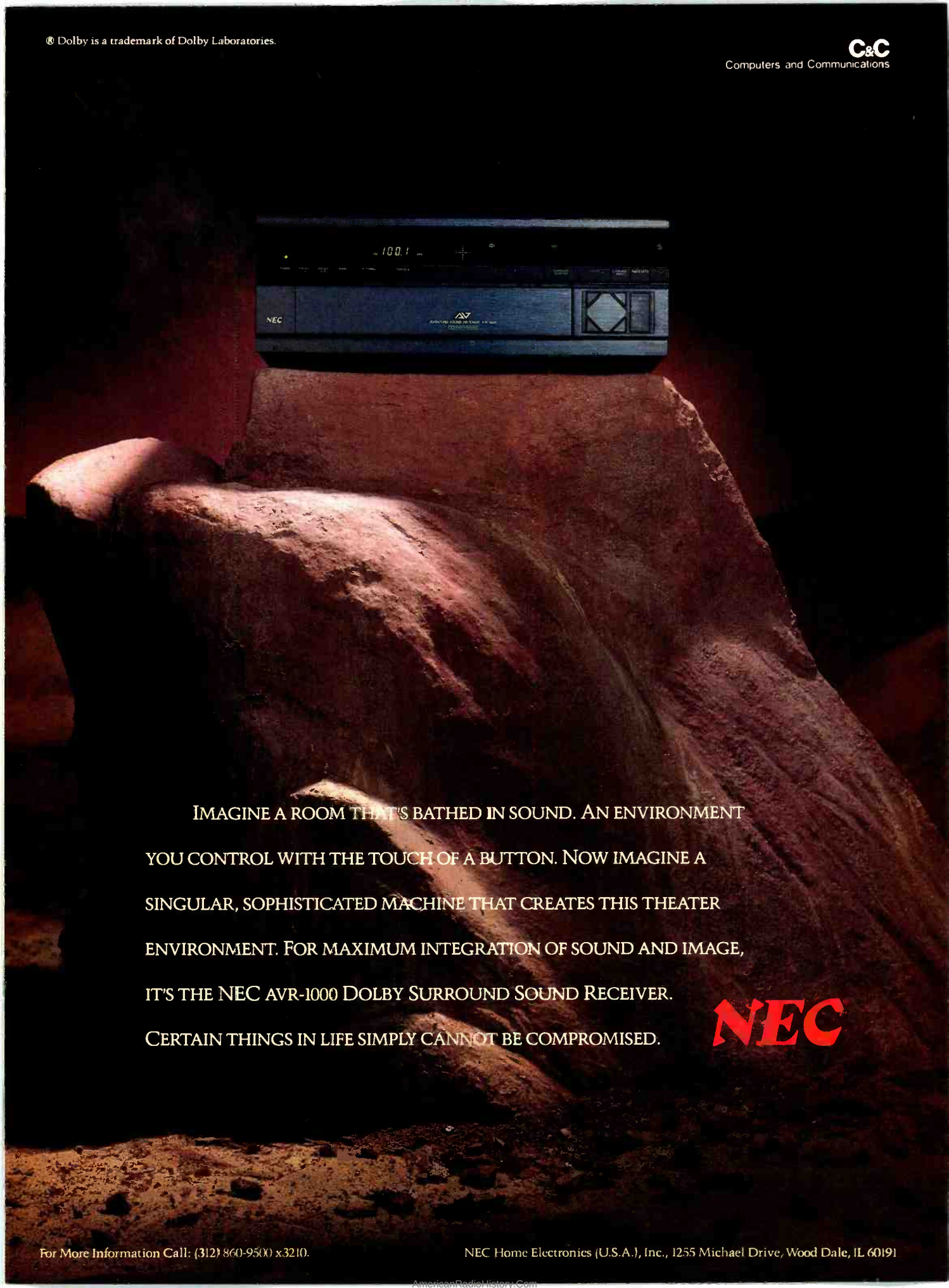

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Recordings made with the Sennheiser will require no additional EQ to match the response balance of commercial recordings.

with the MKH 40 mikes sounded almost identical to those recorded with the C-422. The bass notes of the organ sounded exactly the same on each tape, proving to me that the slight measured roll-off the Sennheiser is insignificant. The C-422's response is very uniform from 20 Hz to 20 kHz. The sound of trumpets and cymbals was slightly brighter with the Sennheiser, indicating that the measured brightness was not an artifact. I should note that some commercial recordings do sound a little bright on my system, whereas the many recordings I've made using the AKG sound neutral.

The second listening test was conducted in the living room of my friend Walter Harris, using three Klipsch horns. (Yes, I did say three.) Mr. Harris is an engineer who has known Paul Klipsch since PWK made his first horns 43 years ago. I was treated to a videotape of a visit to the newly assembled Klipsch Museum, conducted by the master himself, but that is another story. The Klipschorn was reviewed by Richard Heyser in the November 1986 issue, and a visit with Klipsch was described in the August 1980 issue. The center horn of Mr. Harris' system is a model which does not require placement in a corner, whereas the left and right horns are the corner types described by Heyser. In keeping with Heyser's results, I found that the sound of tympani was better on the horns than on my direct-radiating 15-inch speakers and that it held up very well at higher playback levels (100+ dB). At first, the stereo perspectives seemed astoundingly wide, because the speakers, as recommended by Klipsch, were set along the long wall of the room. The speakers subtended a 90° angle at the listening position, compared to 60° in my own listening room. However, a very even spread of sound was maintained.

In the bass, both microphones sounded identical. In the treble, the MKH 40 sounded neutral, whereas the C-422 sounded a little dull; trumpets and cymbals sounded brighter with the Sennheiser. Referring to Fig. 4 in Heyser's Klipschorn review, I see a gentle downward trend in the speaker's response from 1 to 15 kHz, as compared to my Altecs, which are equalized to measure flat to 10 kHz and to be 5 dB down at 15 kHz. Obviously, Klipsch has adjusted the response to sound well balanced with commercial recorded material. I confirmed this by playing a few CDs. This leads to the conclusion that recordings made with the Sennheiser will have response balance comparable to that of commercial material, without additional EQ.

At the risk of repeating a statement from a previous review, I find that an X-Y pair of MKH 40 microphones is an excellent portable substitute for the reference AKG, which is more often permanently flown than used on stands, and which costs more. The Sennheiser's 122-dB dynamic range makes it suitable for use with digital or dbx-encoded analog recording systems.

Jon R. Sank

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I don't know who wrote the owner's manual for this FM-only British tuner, but whoever did must have been conforming to an unusual set of specification standards. I couldn't make head or tail of the specs found in the booklet supplied with the 3140; fortunately, the U.S. distributors of this fine-sounding unit from Creek Audio Systems were able to supply the specs listed above.

Having said all that, I must admit that a great deal of thought went into the design of the Creek 3140. As is true of many car stereo tuner circuits, this home component employs a form of automatic stereo "blend" so that, as signals become progressively weaker, the tuner makes a gradual transition from stereo to mono rather than switching noisily between them.

The tuning indicator, mono/stereo switching, and the blend and muting functions are controlled by signals derived from three reception parameters: S/N, detuning, and overall signal strength. The frequency display is digital, calibrated in 100-kHz increments, but the 3140 does not have frequency-synthesized tuning. Thus, if a signal is not precisely on a standard station frequency (a problem with many cable FM signals), the unit can still be tuned accurately.

Muting is gradual, but still fast enough to make the tuning knob appear to operate like a clickless rotary switch, as the

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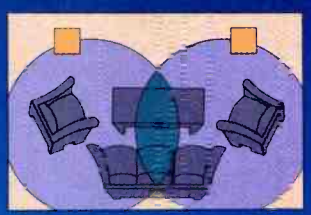
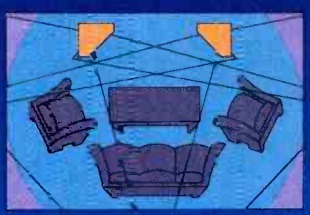


Since conventional speakers radiate primarily *direct* sound, stereo is heard in only part of the room.



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My measurements for this tuner aren't the best, but that's not the full story. The sound was excellent, and imaging was realistic.

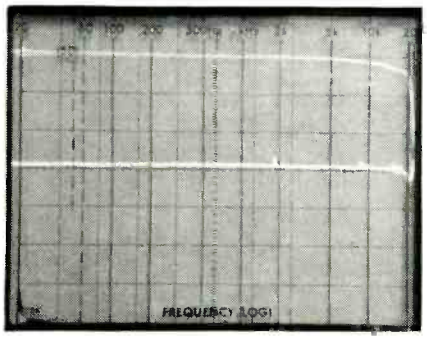

Fig. 5—Frequency response (top trace) and separation vs. frequency. Note how separation is maintained across band; see text.

was similarly constant, but about 5 to 6 dB lower, in narrow mode). Such uniformity of stereo separation is something I have never seen in any tuner before. Most tuners give up a good deal of their separation at the low and high frequency extremes; I suspect that some competitors would like to know how Creek managed to avoid this. Anyone who could combine this uniformity with a higher separation figure would really have something to patent!

Capture ratio measured 1.2 dB for the wide i.f. mode and 3.0 dB for the narrow mode. Selectivity was 32 dB for the wide setting and 85 dB for the narrow. AM suppression was exactly 50 dB.

Use and Listening Tests

The understated appearance of the Creek 3140 is in sharp contrast to the emphasis its designers have placed on accurate tuning, accurate frequency response, and adaptability to all sorts of reception environments. Though the lab results fall short of the best I have ever encountered, as I have noted more than once, measurements don't always tell the full story. Separation of 30 dB is enough to provide realistic stereo imaging, and 0.27% distortion in the FM stereo mode is low enough so as not to detract from the otherwise excellent sound of a properly transmitted FM broadcast. What's more, unlike many other imports from the "mother country," this one carries a quite reasonable price tag. I do take exception to one statement made by Creek in the owner's manual: "Our philosophy is to design products with facilities which benefit the user rather than the reviewer. . . ." I say, old chaps! What makes you think we reviewers aren't users—and listeners too? Pip, pip, and cheerio!

Leonard Feldman

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INFINITY 9 KAPPA LOUDSPEAKER

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Far too often, advances in high-end audio simply bring greater sophistication and greater expense. Indeed, as top audio designers focus on equipment whose price is no object, the end result is often a product that most audiophiles can only dream about. The Infinity 9 Kappa speaker system is a major exception.

The 9 Kappa can hardly be called cheap; after all, a pair of these speakers does cost $2,698. Nonetheless, in designing the 9 Kappa, Infinity took advantage of the lessons learned in building the $45,000 IRS Series V and the new Beta, Gamma, and Delta group; as a result, the 9 Kappa introduces new driver and crossover technology at a much more affordable price. It also offers overall performance superior to that of the older Infinity RS-1B—a loudspeaker system I liked enough to use as a reference for several years.

The Technology

The Infinity 9 Kappa is a floor-standing speaker system measuring 59½ inches high, 21½ inches wide, and 8 inches deep. Its frequency response is rated at 29 Hz to 44 kHz, ±3 dB. It uses six drivers aligned vertically on its front panel; the bandwidth of each has been carefully limited to optimize performance in a given area of the frequency spectrum. These front-panel drivers include a SEMIT supertweeter, an EMIT tweeter, a 3-inch polypropylene dome upper midrange, a 5-inch polypropylene/graphite dome lower midrange, and two biampable 12-inch polypropylene/graphite woofers which are adapted from those used in the Infinity IRS. In addition, to provide added ambience in the overall radiation pattern, the 9 Kappa has a rear-firing EMIT tweeter, and there is back (or bipolar) radiation from the 3-inch upper midrange driver.

There simply isn't space to go into all of the technical details regarding these drivers, but it is worth noting that the new SEMIT and EMIT have much lower mass than the EMITs Infinity has used in the past and seem to produce a "faster" and more detailed sound. The new 5-inch polypropylene/graphite speaker operates from 90 to 700 Hz and ensures an exceptionally smooth transition from the bass to the midrange—an area where I heard difficulty in the RS-1B. Further, the woofers have exceptionally stiff, lightweight cones and heavy, rigid cast frames.

The crossover is an advanced, passive five-way design, with crossover frequencies at 90 Hz, 700 Hz, 5 kHz, and 10 kHz. Taking note of the latest high-end wisdom about passive components, it uses polypropylene capacitors, hard-soldered connections, high-purity wire, and low-noise potentiometers. On the rear of the speaker are level controls for each driver except the woofers, allowing exceptionally flexible tuning of the system to match a given room and amplifier.

The cabinet does more than give this very large speaker system the appearance of being relatively small and attractive; it also shows exceptional attention to edge diffraction and boundary reflections. The speaker grille is mounted on short rods that allow it to stand off the surface of the speaker cabinet, and it does not spoil the dispersion of sound with internal ridges that can limit the sense of air and the quality of imaging.

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The 9 Kappa's speed and detail are very apparent in the upper midrange/treble, affecting every aspect of musical performance.

Sound Quality

Admittedly, whenever an expensive new speaker system comes onto the market, it's likely to have new drivers and to be accompanied by impressive claims about its technology. Few new speakers, however, pay off as well as the 9 Kappa in terms of improved sound quality. This becomes clear when the speaker's performance is examined in detail.

The top octaves combine exceptional detail with an excellent feeling of openness and air. Infinity's previous EMIT designs have performed well in this area, but they have not approached the speed and openness of ribbon designs. The 9 Kappa outperforms even the older Infinity IRS in this area. It rivals the most expensive ribbon speakers and outperforms every electrostatic I know of.

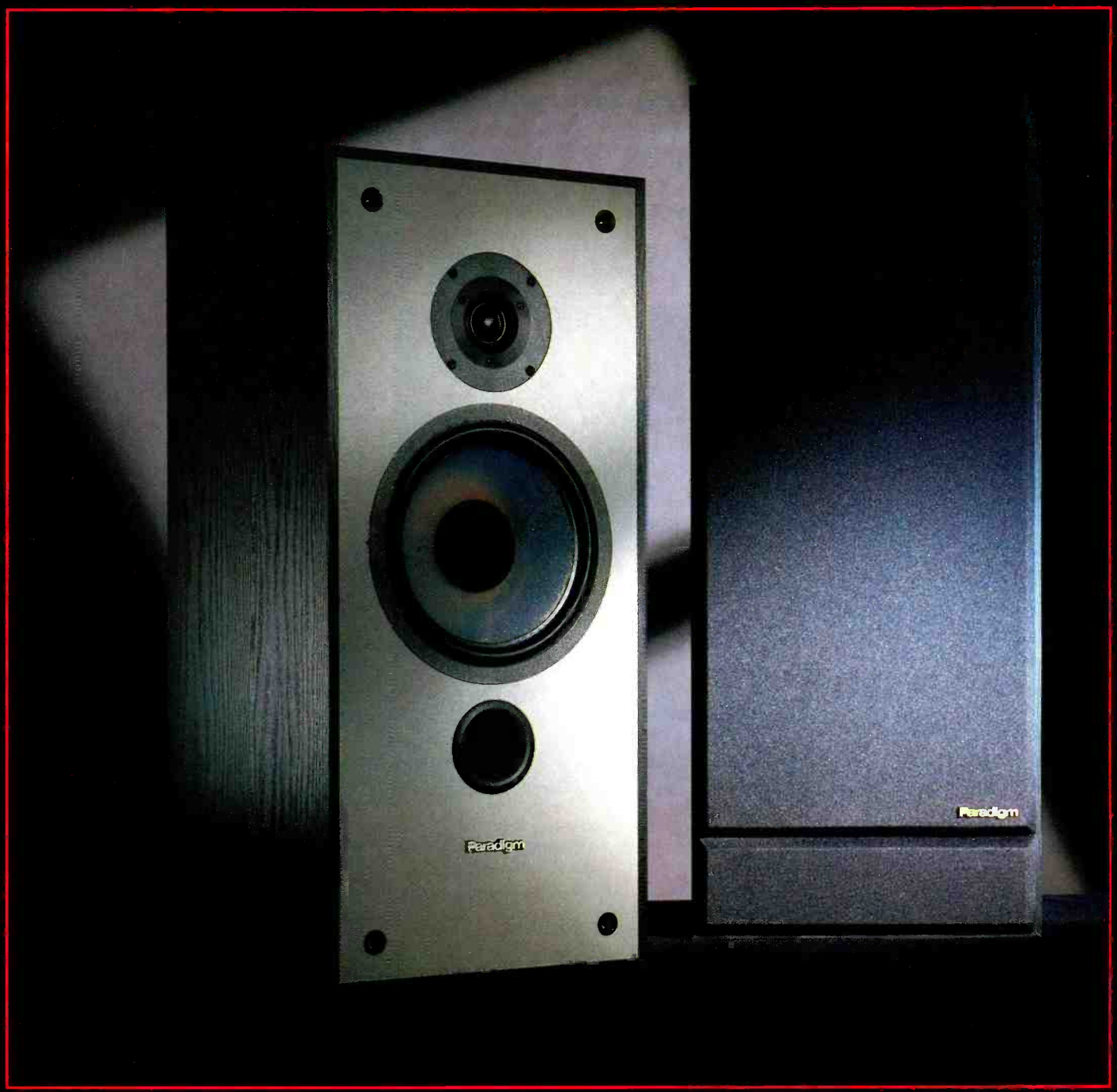
The strengths of the changes in Infinity's EMIT design become even clearer in the upper midrange/treble, the area between about 5 and 12 kHz. The 9 Kappa's strength of speed and detail is much more apparent in this region and affects virtually every aspect of voice and instrumental performance. The overall transparency is surpassed only by the most expensive ribbon speakers and by Infinity's latest IRS speaker, which uses a larger array of EMIT drivers. This transparency and superior resolution does come at a cost: It exposes any weaknesses in the electronics and source material used with the 9 Kappa. It also, however, sets the music free when you do have top-quality components and material.

The Infinity 9 Kappa does reveal some integration problems in the midrange, relative to a few top competitors. The best electrostatics and ribbon speakers seem slightly flatter and more natural in terms of overall cohesiveness and integration of the midrange, and several top-ranking cone systems are equally good. Nevertheless, there are no apparent discontinuities, and the midrange is still smooth and natural.

In the lower midrange and upper bass, the 9 Kappa errs on the side of life and excitement and avoids the slight "suck out" that exists in this region in many speakers—including the RS-1B. Further, careful adjustment of the mid-bass control allows you to get the natural warmth of instruments like the cello without overpowering the lower midrange. Few speakers can really reproduce the lower strings and woodwinds in a musically convincing form, and the 9 Kappa is one of them.

The upper and middle bass is very good. There is just a slight touch of overemphasis with proper adjustment of the mid-bass control, and this is not unpleasant with most music. Although the 9 Kappa has a relatively moderate capability to reproduce true deep bass and seems to begin losing some of its definition and detail around 60 Hz, its deep bass has surprising power and

....remarkable!



par.a.digm (par'adim) *noun: serving as an example or model of how something should be done.*

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Most speakers will favor a particular type of music and listening level, but the 9 Kappa is credible with virtually anything.

speed, considering the size of the 9 Kappa's enclosure. Most important, the power and frequency range of the bass are good enough to match the detail and extension of the 9 Kappa's treble without masking the midrange's detail. Most speakers, regardless of price, tend to favor one frequency extreme over the other. The 9 Kappa is a true full-range speaker.

With a good high-current amplifier, the 9 Kappa is capable of sufficient dynamic range to suit any lover of full-range orchestral music, grand opera, and heavy metal. Unlike many speakers, it also offers consistent performance from soft passages up to very loud ones. There is no sense of strain at high level, no loss of low level, and no shift in timbre.

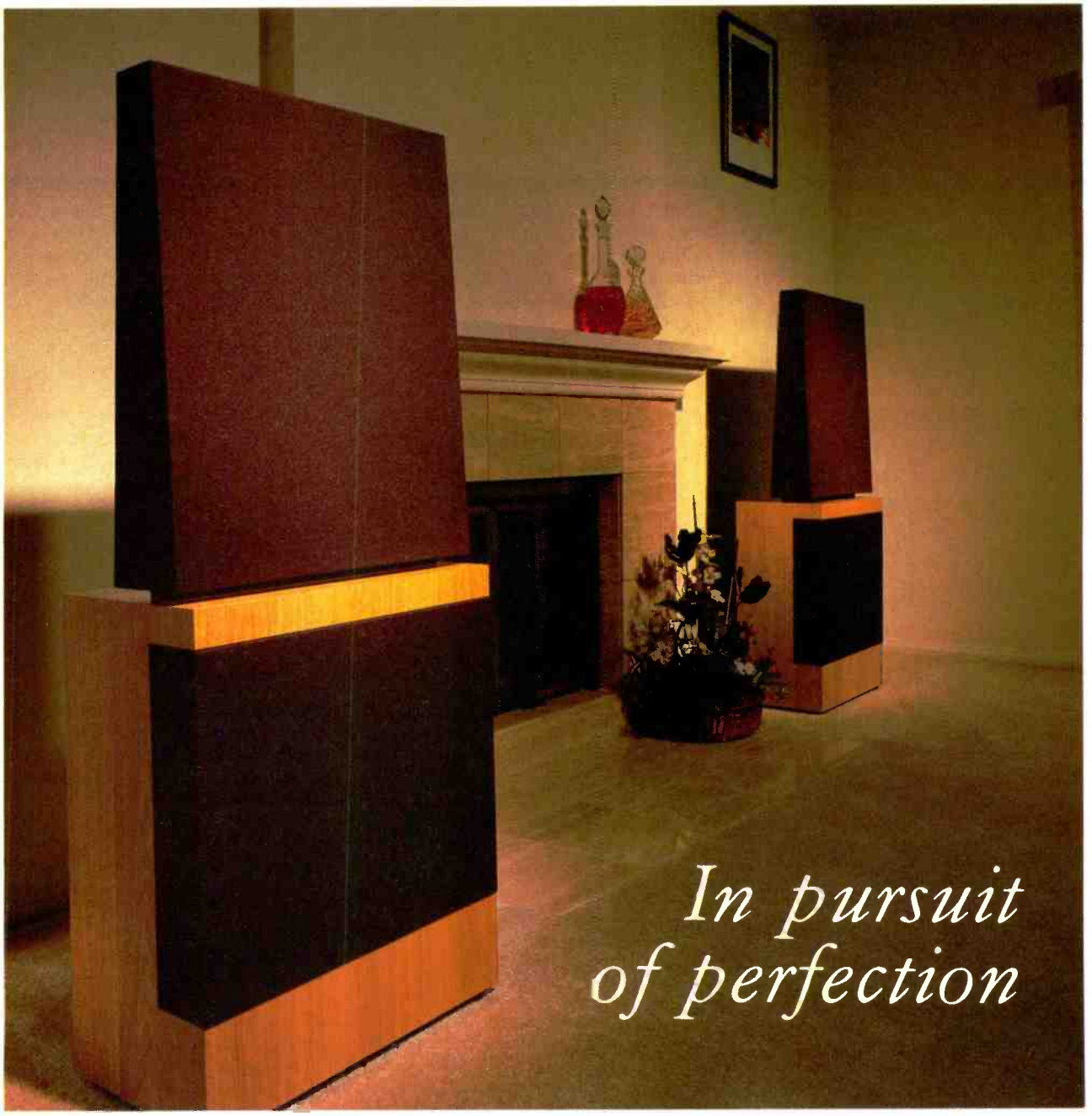
Imaging is excellent—stable and naturally detailed from left to right without any loss of center fill. The image appears to extend beyond each speaker, to the left and right. The sound stage does not seem to "cluster" around each speaker, and depth is good to very good. The adjustments on the rear of the 9 Kappa allow you to vary the overall timbre and dynamics from "front row" to "mid-hall," although the apparent imaging will be determined largely by the miking of the original recording.

In terms of overall integration, the 9 Kappa meets a test most speakers fail: It sounds equally natural at moderate and high listening levels, and does equally well with solo vocals, chamber music, small jazz groups, choral music, and full orchestral music. If this test sounds easy, try it. The vast majority of speakers perform better at one listening level than another and make performance compromises that favor one type of music over another. The 9 Kappa is one of the few systems that offer musically credible reproduction with virtually any good source material.

Human Engineering and System Considerations

The Infinity 9 Kappa is relatively easy to place. Although it is definitely a "big speaker," it still is small enough to fit into most real-world listening rooms. It does benefit from every inch of space you can give it, relative to rear and side walls, but it performs well at distances as short as 3 feet from a room boundary. While bass performance is sensitive to placement relative to corners and the rear wall, the 9 Kappa was much easier to place than any true dipole speaker I've encountered, and relatively small adjustments in position were usually adequate to smooth the sound of the bass.

The imaging is broad and smooth in a wide range of listening areas, particularly if the speaker is parallel to a smooth rear wall surface or just slightly angled so that each speaker is aimed at a point about 2 feet behind the listening position. You can easily use a wide couch or several chairs at the



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I am more than a bit impressed by the Infinity 9 Kappa. Audiophiles are likely to agree that it offers exceptional value.

listening position and still get an excellent sound stage, and the sound stage will remain acceptable over an even wider area. The driver configuration is also well chosen; the drivers are high enough to overcome the effects from most furniture and floor surfaces, and they provide a good vertical image without the need for major floor-surface treatment.

The speaker's rear adjustments are flexible enough to be useful without disturbing system cohesion or the balance between the drivers. In fact, I would strongly recommend setting every control except the mid-bass control somewhere between 11:00 and 12:00. The flat settings (around 2:00) sound too bright and hard in all but very absorbent rooms. As for the mid-bass control, I advise careful reading of the owner's manual and careful and prolonged experimentation. The mid-bass is an area where room problems are very apparent to the ear in terms of giving music too much or too little warmth. The 9 Kappa gives you the flexibility to get exceptional realism if you simply take the time to do it right.

The only practical problem you are likely to encounter is that you really will need a high-current amplifier if this speaker's bass performance is to equal its performance in the upper octaves. There is a switch that allows you to safely use lower current amplifiers—or those that can't survive low impedances—but the use of this switch has a cost: A loss of bass performance and overall system balance. Consult your dealer, or Infinity, to make sure that your power amplifier is fully compatible with the 9 Kappa.

Summing Up

I'm more than a little impressed with the 9 Kappa. It truly is much better than the Infinity RS-1B—although the RS-1B has been highly competitive with most other speakers and cost more than twice the price of the 9 Kappa. It is an extraordinarily open, natural, and dynamic full-range speaker system which offers the life and power that rock and jazz lovers like while preserving the realism and natural musical tone necessary to please voice and chamber music lovers. Its excellent, open dispersion ensures that it delivers this performance over a wide listening area, and it is stylish, to boot.

A few other speakers may offer more in terms of deep bass power and extension, overall smoothness and integration of the musical spectrum, or sound-stage size and impact. Even the most demanding audiophiles, however, are likely to agree that the Infinity 9 Kappa offers exceptional value as a high-end product. It is also an impressive demonstration that years of work in developing demanding and expensive high-end products *can* pay off in providing superior benefits to the audiophile at a substantially lower cost.

Anthony H. Cordesman

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NEW RECORDING ARTISTS

Audio Talks With David Bradshaw and Cosmo Buono

A Message From Audio's Publisher

This is the first in a series of publisher's presentations that will spotlight noteworthy artists new to the recording medium. At the same time, they'll help repay a debt we on the business side of **Audio** *feel we owe musical performers. After all, without such dedicated men and women, neither hi-fi equipment nor our magazine would exist.*

Our premier presentation is an interview with duo pianists David Bradshaw and Cosmo Buono, whose recording of Liszt's Operatic Transcriptions and Fantasies was recently released on cassette by In Sync Laboratories. The producer is E. Alan Silver, the man responsible for the many award-winning Connoisseur Society records of the 1960s and '70s.

Included is a schedule of upcoming recitals by Bradshaw & Buono. And to commemorate the debut of "New Recording Artists" in **Audio's** *pages, In Sync is offering the duo's Liszt cassette, digitally mastered and duplicated in real time on TDK high bias tape, to readers at half price. Details appear below.*

—Stephen Goldberg

What special requirements must duo pianists meet?

Bradshaw: They should be compatible. There was an American duo piano team that used to take separate trains to concerts; I don't think this makes for good relationships. Also, their method of playing the piano should be the same. If one person has a high finger method and the other has a pressure touch where the fingers are on the surface of the keys, they're never together. The person striking the key from above gets there a little bit later.

Buono: If one person is basically intellectual and the other person is a very emotional player, it would be difficult to have a cohesive performance. I think musical temperaments have to be rather similar. That's not to say you don't get different ideas. We do, and that's one of the joys of chamber music, that you get more than one opinion on something.

Can you describe the differences between four hand playing done on a single piano and two piano playing?

Bradshaw (rear) and Buono

Buono: With two pianos, you're a good distance apart so the ensemble becomes more difficult. With four hands, usually we have to get out of each other's way because composers don't take into account that you're playing right next to each other.

Bradshaw: Well, sometimes they do, but they do it for personal reasons. Schubert liked to play with the pretty ladies, so if he could cross a hand over theirs or they could cross a hand over his, it gave him a little more contact.

On this recording, you perform pieces written for both configurations, yet you chose to play them all on two pianos.

Buono: We felt these particular works would be more effective on two pianos because Liszt requires a color, almost an orchestral texture in a lot of his piano writing, and the brilliance you can get with two pianos you can't always get with four hands.

Bradshaw: Liszt was very practical. If Liszt only had one piano to write for and two pianists, that's what he would do. We felt in this case he'd like the larger sound of the two instruments. The major work on the recording, the 'Ad Nos' Fantasy, was written simultaneously for two pianos, piano four hands, organ and pedal piano. Liszt wanted this work performed, and he was going to make it available to every combination he could think of.

Where was your new recording made?

Buono: In a delightful hall in Tarrytown [NY]. It's a hundred years old, and people from Mae West to Sophie Tucker to Rachmaninoff have been there. The acoustics are very good, and it's a very comfortable place to play.

Bradshaw: The only problem we ran into was that, it being largely a wood hall, you could hear things from outside. Traffic and airplanes weren't so much of a problem, but the birds were. We had to wait until they went to sleep.

You've been categorized as Romantic pianists. Why do you think, after being eclipsed for some time, Romanticism is again becoming popular?

Bradshaw: I think it's because an audience wants to feel something when they come to a recital. I think there have been a number of artists over a long period of time who've been more technicians and less emotional in their playing. While there's

NEW RECORDING ARTISTS

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*** Other appearances in Tokyo, Kobe and Kyoto

***Exact dates unavailable at press time

nothing wrong with that, when the majority of people are playing like that I think the audience feels a little starved.

I gather the current trend toward Romanticism pleases you.

Buono: I think it suits our temperaments very well. We love the classical composers as well, but there's something about the highly emotional music of Romanticism that does click easily for our particular temperaments.

Bradshaw: The piano was idealized—and idolized—in the late Romantic period. Pianists were stars then. Composers were really writing for miniature orchestras when they were writing for two pianos around that time. The color aspect is very interesting to us.

Buono: Another aspect of our work as a team is that, while we play standard repertoire, we also look into masterpieces that have been neglected—such as this Liszt recording. It's fun for us, because how often do you get to premiere a piece, either in recital or on recording, by such a major composer?

This is a first recording for the two of you. Is it a first as well for these Liszt compositions?

Buono: Of the Operatic Transcriptions, yes. The Fantasy has been recorded on the organ, but the two piano version is something new.

You've both performed separately, have you not?

Bradshaw: Yes, but no longer.

Is it easier, harder or just different playing as a team?

Bradshaw: It's harder to perform together because the music is just as difficult as the solo music so you have to work just as hard to learn it, and then you have to rehearse together all the time. We find if we don't rehearse three times a week we lose some of our rapport. The best inspiration you get is what we call inspiration of the moment, which usually happens in a concert hall. You want to be able to give in to that, but that means—I hate to use this word, but I can't think of anything better—something mystical happens. If I decide to make a crescendo someplace or an accelerando, he's got to feel it at that moment or we won't be together.

In terms of your training, who or what do you feel was most important in influencing your development?

Buono: I think one of the most important things is that both of us were brought up by teachers, specifically Alton Jones, who emphasized individuality, who really demanded that we find our own way. If we were having a musical problem, they wouldn't say, "This is the one way you have to do it." They encouraged creative thought, and I think that's very important in any kind of artistic endeavor.

Bradshaw: Many teachers believe you've come to them to learn how they play everything. That can be very valid, and it can be very helpful. But I think you need to be pretty far along and have some ideas of your own, otherwise it might stop you from thinking. I remember one very difficult musical problem in a lesson with Alton Jones at Juilliard. I really thought I'd done everything I could, but he thought I hadn't, so he said, "I'll give you suggestions for this problem. I'll give you 12 of them." Of course, that left me in the same position I'd been in; I still had to go home and make up my own mind. I thought he was a little cruel at the time, but now I'm very grateful. I can think for myself. I can figure out my musical problems, and things do change in my attitudes toward certain pieces from year to year.

STING RAYS

Photograph: ©1986, Ebet Roberts

. . . Nothing Like the Sun: Sting
A&M SP 6402, two LPs.

Like a Japanese paper flower slowly unfolding underwater, Sting's musical development spreads delicately and deliberately as we watch and listen. . . . *Nothing Like the Sun*, a two-disc collection of 12 new songs from this ex-Policeman, displays his extraordinary intelligence and sensitivity and his ability to make arrangements do double-duty by both carrying his melodies and underscoring his lyrics. Besides all that, it sounds great.

Sting often reaches back to his jazz training, coloring a lush and moving melody with a splash of Branford Marsalis' rich, golden saxophone ("The Lazarus Heart") or deftly sound-painting a cut with the smoky hues of a '50s detective movie ("Sister Moon"). As coproducer (with Neil Dorfsman) and arranger, Sting has a masterful way with aural textures, using synthesizers which dance up like a cold wind against a bank of darkly militaristic drums ("They Dance Alone") or placing a beautiful solo acoustic guitar against a distant, swirling, synthesized mist ("Fragile").

As a composer, Sting has an inclination toward melodies that are captivatingly lovely and toward sophisticated rhythms colored by a wide range of influences; on this album, one can hear light hints of Latin phrasing and instrumentation and the faint afterimage of the reggae sound that brought The Police to prominence in the late '70s. Sting has also included a couple of rockers here, and he handles them with authority.

As a lyricist, Sting is master of the striking image, employing a wide range of literary references, both familiar and arcane, and an impressive vocabulary. His songs are often deeply, provocatively political ("They Dance Alone"), but he can also blithely leap into a love song, tucking tongue in cheek to come up with a treasure-trove of pop clichés ("We'll Be Together").

Sting, the performing artist, is a force to be reckoned with. His distinctive voice is a perfect instrument for the range of emotions he puts it through, tender and vulnerable one minute ("The Secret Marriage"), ragged and rocking the next ("We'll Be Together"). As an instrumentalist, Sting works wonders with the bass, giving it a big, thick texture like prehistoric tar bubbling up from the LaBrea pits ("Straight to My Heart") or laying down a clean, solid line which anchors a cut with weight and authority ("The Lazarus Heart"). He also whips out a spiffy guitar for "Fragile" and "History Will Teach Us Nothing."

Gathered around Sting for this superb album are some shining stars of the pop and jazz worlds—Eric Clapton, Mark Knopfler, ex-partner Andy Summers, Gil Evans, Branford Marsalis, Mark Egan, and Rubén Blades. They all help make . . . *Nothing Like the Sun* something you'll be wanting to hear for a long, long time to come.

Paulette Weiss

In Concert: Billy Joel
Columbia CK 40996, CD.

Sound: B Performance: B

Scooting under the raised skirts of the Iron Curtain in the summer of '87, a caravan of semis emptied their contents into huge Soviet state theaters, transforming them into Western-style concert halls for a series of perfor-

Editor's Note: With this issue, we have made a change in our "Rock/Pop Recordings," "Jazz & Blues," and "Classical Recordings" departments. Heretofore, each of those departments contained LP reviews only, and CD reviews—for all types of music—were presented in one additional section. However, since increasing numbers of new releases are coming out in both formats, we no longer believe the separation is warranted. Therefore, in this and all future issues, each of our music-review departments will expand to cover both CDs and LPs; the separate "Compact Discs" department will no longer run. In the heading of each review, we will indicate the format that has been auditioned for that review, and the catalog number given will be for that format. We hope these changes will make our review departments more useful than ever. Let us know what you think!—*E.M.*

mances by Billy Joel. This digitally recorded CD (also available as a specially-priced double LP) documents that tour.

The transitions between the 16 songs on *In Concert* are seamless, as if all were recorded at one show. The production quality is lush and full, with special attention given to capturing the vocals of Joel and the backup singers. The digital process crisply asserts the high end of the sound spectrum; at times the snare drum is actually *painfully* present.

After the a cappella "Odoya," an untranslated folk song briskly performed by a Soviet men's chorus, Joel and band slam into "Angry Young Man" and "Honesty." The introduction of each song is translated for the audience by a Russian interpreter; Joel makes the best of this disjointed form of communication, eliciting assenting cheers and delighted laughter with almost every remark. But when he gets to "Allentown" and tells the crowd that the song is about young Americans whose misery has caused them to doubt that living conditions will improve if they keep hanging on to the Party line ("Maybe that sounds familiar," he suggests), he is answered by dead silence. On the other hand, when he asks the crowd if they like The Beatles, the thunderous reaction opens the gates for a version of "Back in the USSR" that is faithful, nearly lick for lick, to the original. Joel takes off on piano to finish the last third of the show, which has built up in tempo through "A Matter of Trust," "Only the Good Die Young," and "Big Shot." The disc ends with "The Times They Are A-Changin'," which Joel says had been running through his head throughout his visit.

It's frustrating to find that the package doesn't include any printed particulars about the tour. With so much care given to the production of this disc, it seems odd that details about when, how, and why this historic event came to pass have been entirely left out.

Susan Borey

Alex Chilton

High Priest: Alex Chilton
Big Time 6047-1-B, LP.

Sound: B Performance: B

It's easy to think of Alex Chilton's time with The Box Tops, the Memphis-based quintet that scored seven Top 40 hits between 1967 and 1969, as something like a past life. The smooth, honey-coated sound of "The Letter," so perfectly in step with the white-soul affectations of the late '60s, seems pretty far removed from the eccentric music with which Chilton currently keeps a small cadre of fans enthralled. But there's really no difference, at least from Chilton's point of view. He's always done just what pleased him, making no concessions to trendiness or commercialism.

High Priest (no doubt a satiric reference to Chilton's influence on a generation of side-stream bands) is like a jukebox whose discs were assembled by chance rather than by design; it's a weird collection of tunes that hang together just because they're found in one place. The cuts are mostly covers of obscure yet remarkable songs that seem to have been dug out of record store bargain bins. Chilton revamps Carole King's "Let Me Get Close to You" as if he's not sure he means it, but is very convincing on two straight blues songs, Guitar Slim's "Trouble Don't Last" and his own "Don't Be a Drag," appropriated from a Jimmy Reed tune.

All the cuts have been recorded live in the studio, with minimal overdubs. Produced by Chilton, the mix cleanly captures a live feel while skirting the pitfalls of live recording; there's no boominess or ragged integration of instruments with Chilton's voice, whose tone alternates between sarcastic and sweet. Chilton plays most of the guitar and piano parts, with a competent, groove-nailing collection of sidemen featuring what he calls a jazz-oriented horn section. There's no showboating, no solos for their own sake.

Icehouse's *Man of Colours* has some pretty moments, but mid-tempo sludginess afflicts almost every one of its mushy little songs.

High Priest is roots rock at its quirkiest, but Chilton comes off like a credible connoisseur rather than a flaky gagster. In his musical kaleidoscope, if nowhere else, it seems perfectly appropriate to have a song about the personal habits of the Dalai Lama preceded by a Carole King tune and followed by a standard version, in Italian, of "Volare." *Susan Borey*

Discreet Music: Brian Eno
Editions EG EEGCD 23, CD.

Day of Radiance/Laraaji: Brian Eno
Editions EG EEGCD 16, CD.

Sound: B Performance: B

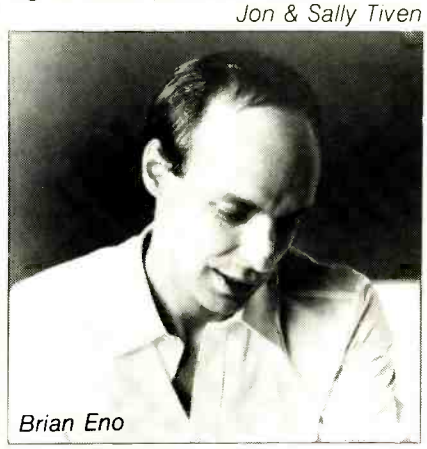
Brian Eno has managed to make a career out of being elusive, mysterious, and moderately musical without having to bow to the normal conventions of the music industry. Eno doesn't make conventional records, yet many of the records he's produced (most notably for U2 and Talking Heads) have reached the masses. His own records are another story: He is a conceptual visionary of sorts, alternating between vocal long-players and ambient-type instrumentals. These two CD issues are examples of the latter, and are not exactly what one would term his most dynamic works.

Day of Radiance/Laraaji, by far the more enjoyable of these two works, is a musical statement based on synthesizers, delay lines, and Eno's trademark production "treatments." The recording dates from 1980 and is a little on the crude side, though it will have its appeal to those who favor music that doesn't intrude.

Discreet Music, on the other hand, is more of an intellectual exercise using (again) delay lines to juxtapose musical phrases within a given composition, one upon the other, transforming the original material into something completely different. Perhaps it would be more interesting if we were more familiar with the original works. And maybe in 1975 this was highly engaging. But in the light of digital technology, *Discreet Music* seems more like a footnote to Brian Eno's career than a major step forward.

What we need, more than these rereleases, is a new Eno album with vocals, if he has anything to say to the pop marketplace in 1987. One has to be a major-league Eno fan to be waiting for these particular CDs.

Jon & Sally Tiven



Brian Eno

Man of Colours: Icehouse
Chrysalis OV 41592, LP.

Sound: B+ Performance: C–

If you like Simple Minds but find them too rhythmically complex, then you'll love Icehouse, a sound-alike whose name could just as well have been Simpler Minds.

Man of Colours, the fifth album by the Australian soft-rockers, is almost uniformly gray. Mid-tempo sludginess afflicts virtually every one of its mushy little songs, although "Crazy," the lead single, does make an effort to fight a bit before it, too, ultimately succumbs. Neither do the lyrics offer much interest, though they are, for the most part, innocuous, working on a slow death.

The album has some pretty moments, as on the title cut, which features some tinkly chimes and a haunting, somber melody. Another song, "The Kingdom," proffers lovely images of loneliness without despair. Yet for an album supposedly inspired by Andrew Wyeth, *Man of Colours* is strictly paint-by-numbers. *Frank Lovece*

La Bamba: Various Artists
Slash 25605 2, CD.

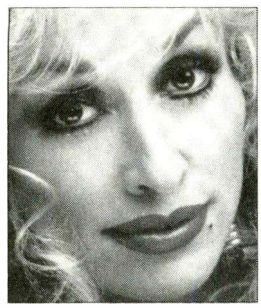
La Bamba—the movie—brings the candle-brief life of rocker Ritchie Valens to the silver screen. *La Bamba*—the recording—brings a nostalgic evocation of his musical milieu to the silver disc (and to the black vinyl LP as well).

Valens died in 1959 at the age of 22 in the plane crash that also killed Buddy Holly and The Big Bopper. At the time, with two certified hits under his belt ("La Bamba" and "Donna"), he was well on the road to becoming the first Hispanic-American rock star.

On this recording, Los Lobos attempts to capture the joyous spirit and innocence of the young rocker at a time when rock itself was young. Other modern artists fill in for Valens' contemporaries, among them Marshall Crenshaw, who revs up his horn-rims for a credible stint as Holly; Howard Huntsberry, who does a fair Jackie Wilson, and—bless his ever-rocking heart—Bo Diddley, who steps back 30 years to portray himself.

Even if you are totally unfamiliar with the original versions of these 12 cuts, you will certainly recognize that the ar-

COMPACT DISCLOSURES



You know she's the tops. Now you're about to discover new sides of DOLLY PARTON on her multi-faceted Columbia debut recording, "Rainbow." From the passionate duet with Smokey Robinson,* "I Know You By Heart," to "Red Hot Screaming Love" (composed by Mike Chapman), Dolly dazzles in every color of the musical spectrum. "Rainbow" appears on CD this January.

This man might not look so tough but nothing can stop him from taking "...The Hardline According To Terence Trent D'Arby" straight to the top. Manhattan-bred, London-fed TERENCE TRENT D'ARBY debuted this album at No. 1 on the British charts and went platinum in less than three weeks. Look for the CD this month.

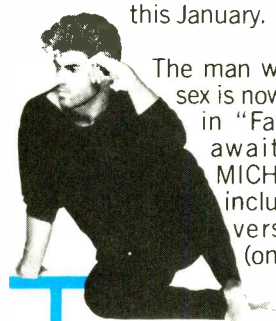
"Music is a wonderful way to bridge whatever cultural and language gaps exist. Music just is, and through it I hope to make a connection with the people in the Soviet Union," said BILLY JOEL on the eve of his Russian tour this fall. The concerts were so successful it took Kremlin connections to get tickets. "КОНЦЕРТ," the recording that puts glasnost back into the concept of *live* debuts on CD this month.

DOLLY PARTON HEADS FOR A POT OF GOLD

GEORGE MICHAEL PUTS FAITH OVER SEX

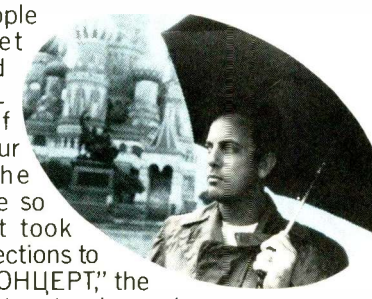
TERENCE TRENT D'ARBY HARDENS HIS LINE

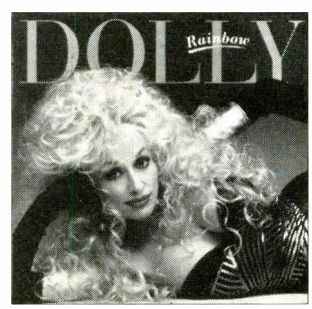
BILLY JOEL SIMPLY KONNEKTS.

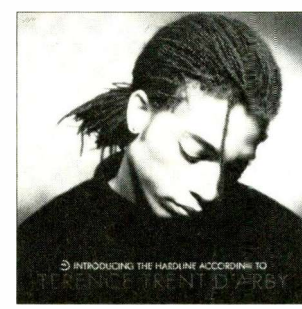


FAITH

The man who wanted your sex is now finding release in "Faith." The long-awaited GEORGE MICHAEL solo album includes the controversial hit single (one of three that went gold in 1987), plus "Hard Day" and of course, the title song. Michael has promised a debut solo U.S. tour, but not until July. CDs get the "Faith" this month.







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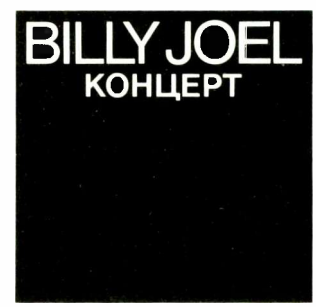

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COMPACT disc DIGITAL AUDIO

*Appears courtesy of Motown Record Corporation.

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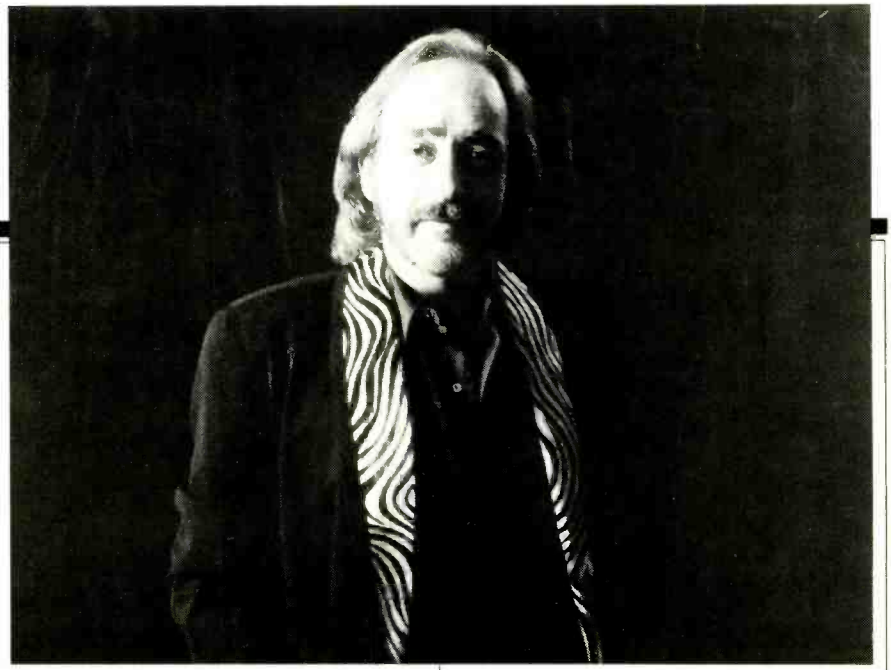
Dave Mason's 1970 release, *Alone Together*, remains a sensational album on CD. In fact, far more nuance now shines through.



rangements and the overall feel emanate from somewhere in the past. If you do remember the originals, direct comparisons are inevitable. Affectionate homage is paid here, as the distinctive sounds of the original artists are re-created down to Buddy Holly's characteristic vocal hiccup.

The sound of the Compact Disc is quite good, but this must be qualified: The producers' goal, ironically, was to accurately reproduce the artfully muddied arrangements of the 1950s, so many of the instrumentals are purposely lacking in clarity. Reverb is a constant presence, used to fatten up electric guitar runs, to smooth out sassy saxes, and to soften and spread vocals. Listen to "Come On, Let's Go," "Crying, Waiting, Hoping," and the rave-up "Ooh! My Head" for prime examples of that smeary, blended quality that characterized much material of this era. On the other hand, the extraordinary clarity of digital audio shows up in such selections as "We Belong Together" and "Donna," where vocals are crisp and intimate and delicate background instrumentation is faithfully reproduced. Silences between (and within) cuts are as clean as they get. Especially impressive is the abrupt, knife-edged ending of Bo Diddley's "Who Do You Love" (which here is produced by its author, the great bluesman Willie Dixon).

It's great to hear the old, honey-rich electric guitar riffs, the steady, predictable percussion, and those terrific shoo-be-doo-bop's and ooh-oooh's from the backup vocalists. Still, the heart within me cries out for the originals, scratchy and worn as they are by now. Yet this particular collection of songs is not to be found in one convenient package elsewhere, and the individual original recordings will be difficult to gather up. This oddball Compact Disc is therefore recommended for neatly bringing together and reproducing some excellent music of the past, and for reminding us of the briefly blazing talent that was Ritchie Valens.

Paulette Weiss

Terence Trent D'Arby

Introducing the Hardline According to Terence Trent D'Arby
Columbia BFC 40964, LP.

Sound: B+ Performance: B+

Terence Trent D'Arby is an American soul singer who went to England and became a platinum-seller on the basis of a fantastic single, his good looks, and an extensive media campaign. Soul music isn't quite as fashionable in the United States as it is in the U.K., so whether D'Arby will be able to duplicate his success here is an open question, but one thing is for certain: Although not consistent, Terence Trent D'Arby's debut album contains two of the finest tracks to be released in any year.

Those tracks are "If You Let Me Stay" (his first single) and "Wishing Well," both quite danceable in a post-disco sort of way. D'Arby's vocal tone is a bit skinny, and his pitch isn't always right on—in fact, some of his improvs on the otherwise stirring version of Smokey Robinson's "Who's Lovin' You" could have been a little more exact. But D'Arby delivers some earnest vocal performances even on the marginal material. Admittedly, D'Arby could use a little help in the songwriting department (he wrote everything here, except for the Robinson tune), but he still shows a great deal of promise. With keen direction, he could become a major force in contemporary music.

Jon & Sally Tiven

Alone Together: Dave Mason
MCA MCAD-31170, CD.

Dave Mason's *Alone Together*, now on CD, remains a sensational album. At the time of its release, in 1970, Mason had a lot to prove. It was his first solo work since leaving Traffic to escape the imposing shadow cast by Steve Winwood. *Alone Together* was designed to put the spotlight squarely on Mason.

The eight songs on the album are all quality items; not one is a weak link. Songs like "World in Changes," "Only You Know and I Know," and "Shouldn't Have Took More than You Gave" quickly became staples of the early FM rock scene, and they sound just as classy today.

In its CD release (and at a budget price too), *Alone Together* survives beautifully. From the first strains of "Only You Know and I Know," the brilliance of the acoustic guitar and the spectacular separation are obvious. The separation, much improved over

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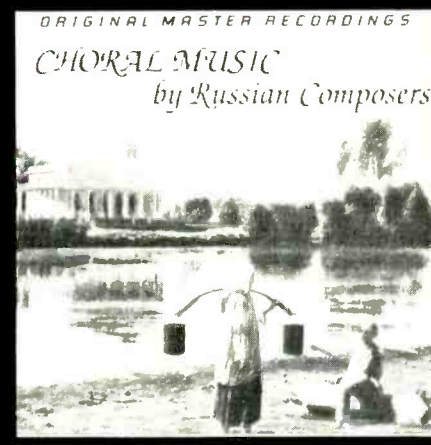

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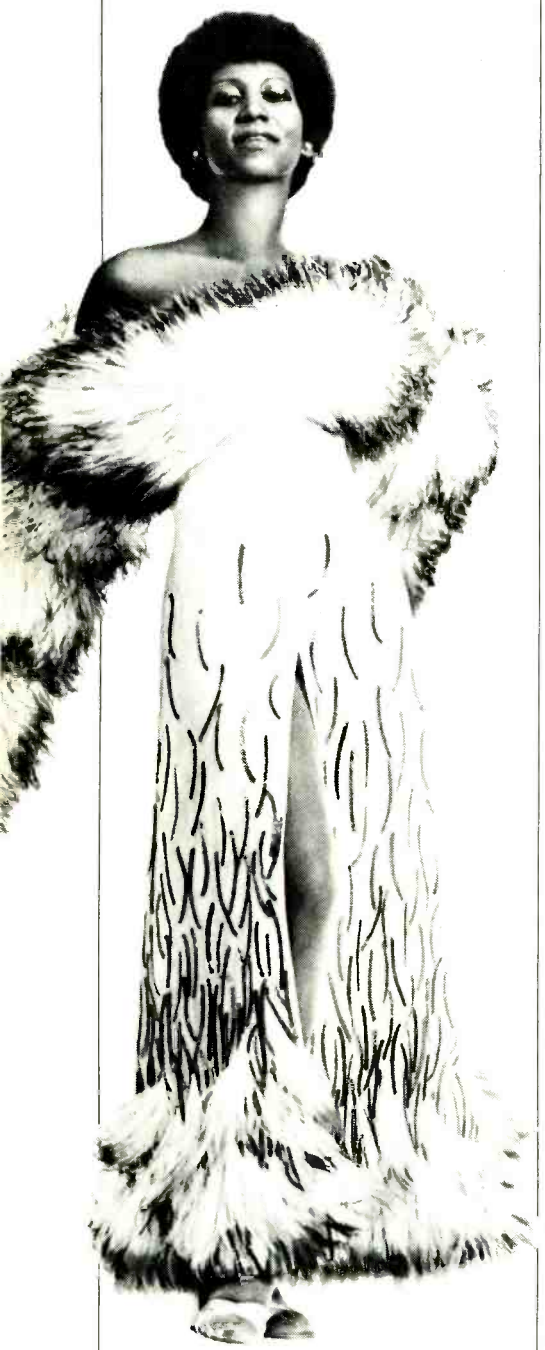
If you want to revel in Aretha Franklin's wondrous voice, these CDs are worth having—though the sound won't knock your socks off.

the LP, allows far more nuance to shine through, particularly the contributions of the tambourine and overtones of the acoustic guitar. Those first few seconds set the tone for the entire listening experience. It is lovely.

One complaint: I realize that with budget pricing something's very likely to give with the packaging, but surely it is not too much to ask that the list of players from the original album sleeve be included. And one more thing: No, the Compact Disc does not have the look of the original release's marbled vinyl. Really now, what do you expect?

Michael Tearson



Thirty Greatest Hits: Aretha Franklin
Atlantic 81668-2, two CDs.

Sound: B Performance: B+

Amazing Grace: Aretha Franklin
Atlantic 906-2, two CDs.

Sound: B+ Performance: A

Aretha Franklin is, in my view, the greatest female singer to emerge from the 1960s soul scene. Her voice galvanized and synthesized a music that had become jaded by imitators: The Beatles at worst were nasal copycats, and The Rolling Stones' Mick Jagger . . . well, more than a few people think he could hardly *sing* at all.

Atlantic Records, for which Miss Franklin cut the definitive body of her work from 1967 until 1975, has released the first CDs of that epoch: *Thirty Greatest Hits* and *Amazing Grace*. Both are double-CD sets, with a sticker price of around $25 each. Are they worth it? Well, yes, if you want to revel in the wonder of Aretha's voice (particularly on *Amazing Grace*) or allow yourself to be seduced by the groove of some of the hits. But no, if you were expecting that the CD sound would blow your socks off.

Throughout both sets, one marvels at the vibrant eloquence of Aretha Franklin's vocal style. The intrinsic simplicity of the instrumental accompaniment, so ably directed by producer Jerry Wexler, belies the complex emotions that the singer brought to her material. A writer herself, Miss Franklin not so much sings a song as transforms it into a personal experience. In doing so, she lifts it up—and the listener right along with it.

On the *Thirty Greatest Hits* package, the sonic quality is occasionally disappointing. Many of Atlantic's original masters were destroyed in a fire several years ago; consequently, some of the tapes used for *Thirty Greatest Hits* are second-generation copies. By using a Cello Audio Palette to re-equalize the tapes and a Studer 820 for the digital transfer, engineer Stephen Innocenzi has matched the various recordings, some of which were indicating oxide wear. Thus, this package of hits does have an overall cohesiveness that other such compilations occasionally lack.

Be that as it may, *Thirty Greatest Hits* is not without problems still. On some of the original recordings the vocals were cut "live," while others involved ping-ponging, drop-ins, and overdubs. The digital technology lays bare the original process and, consequently, some of Aretha's 30 hits sound better than others. Overall, the CDs seem to have less impact on my sensibilities than I recall the original records having, and there are several instances when vocal distortion becomes a distraction, most noticeably on "The Weight." Fortunately, the performances themselves remain unsullied.

Amazing Grace is an apogee in Aretha Franklin's career. Recorded live in 1972 with the Reverend James Cleveland and The Southern California Community Choir on two consecutive nights at the Missionary Baptist Church in Los Angeles, it is simply thrilling. Unfettered by commercial considerations, the setting affords Miss Franklin the opportunity to achieve a sort of blazing vocal ecstasy as she gives full throat to the kind of material which was her prime influence when she was growing up. *Amazing Grace* remains an undimmed effort, the testament of an extraordinary artist to a power which blessed her with greatness. Rarely had her voice been recorded so truly as on this occasion, and certainly never since.

If there is a choice to be made between the two sets—and both are to be recommended, for different reasons—then perhaps *Thirty Greatest Hits* is the one to go for. It is a substantial representation of the Aretha Franklin hit-making aggregate at its most potent. Fifteen of the 30 titles were number-one R&B hits, and all were major pop-crossover successes. If you are more interested in the artist at the peak of her vocal and professional power, then *Amazing Grace* should enthrall you. In the long run you may find it the more satisfying of the two sets.

Michael Aldred

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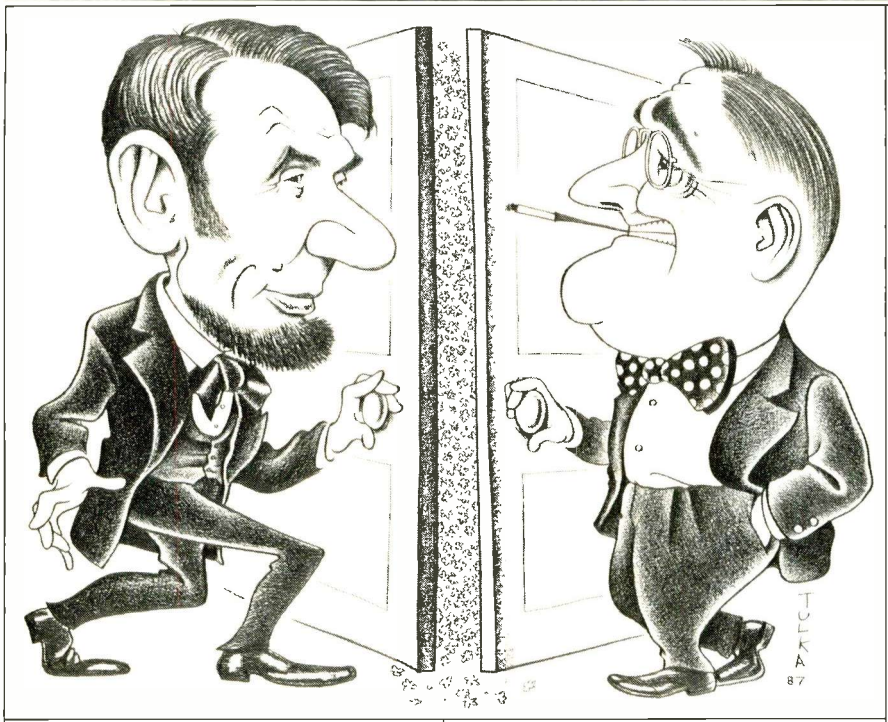

Illustration: Rick Tulka

Hindemith: When Lilacs Last in the Dooryard Bloom'd—A Requiem for Those We Love. Atlanta Symphony Orchestra and Chorus, Robert Shaw; William Stone, baritone; Jan DeGaetani, mezzo-soprano.
Telarc CD 80132, CD.

This big 1946 semi-oratorio by the German composer, recently arrived in America, sets to music a Walt Whitman text in memory of the assassination of Abraham Lincoln. The work, a memorial to Franklin Roosevelt, was commissioned only weeks after FDR's death by Robert Shaw, then at the beginning of his career. At the time he was leading the Collegiate Chorale in New York.

The death of FDR caused an incredible shock throughout the world, even surpassing the trauma of the Kennedy assassination that more of us now remember. The death of Lincoln, also at a vulnerable moment after a long and gruelling war, produced a trauma that was remarkably similar—hence the choice of the Whitman text.

The Hindemith work, then, should be well known, coming from a major composer on a timeless theme with an outstanding poetic text. But there is, by my count, only one other current recording of it—and that from Germany. True, the work is big, but it is not really difficult for the performers. Neither is it unduly complicated for the listener. As oratorios go, in fact, the piece is relatively economical to produce and, for that matter, to record.

As you listen to this CD, you will perhaps understand why the work isn't more popular. Somehow, the well-written music does not live up to the extraordinary emotional impact of Whitman's words, nor to the two tragedies that are its highly emotional subject matter. The lack would seem to be basically in the composer's personality and his professional viewpoint toward composition. He liked to think of himself as a musical engineer/designer, so to speak, a craftsman who could turn out immensely skilled and polished music, on order, to fit every need. He distrusted (as did many) the 19th-century idea of the artist as cosmically inspired and full of temperament. In his days of peak popularity after World War II, Hindemith did, in fact, turn out immense amounts of practical music, covering just about every topic and for every going instrument, and most was done on order for a specific group.

Unfortunately, more than craftsmanship is needed in order to live up to the text and to the powerful emotions of these two joined occasions, the deaths of FDR and Lincoln. As you may suppose, this is an earnest, thoughtful, beautifully built piece but not deeply passionate. Listening casually, ignoring the words, your mind may stray. Too much alikeness, not enough stark drama. But if you follow Whitman closely (a booklet of the text is included), you will feel differently. In this case, the text dominates the music.

The DDD recording is very good for the somewhat thick texture of much of the music, and the CD format really shows its value—all 12 sections of the piece are neatly indexed, on one unbroken CD side.

Edward Tatnall Canby

Mozart: Sonatas for Fortepiano and Violin, Vol. 2. Malcolm Bilson, fortepiano; Sergiu Luca, violin.
Nonesuch 79155-1, two LPs.

Malcolm Bilson's numerous past recordings on the so-called fortepiano have indicated a somewhat tempestuous personality which at times can play a very rough *allegro* when the going gets fast. But the man is a good musician and knows what he is doing with Mozart. On this recording, Bilson seems to have conquered a lot of the

Editor's Note: With this issue, we have made a change in our "Rock/Pop Recordings," "Jazz & Blues," and "Classical Recordings" departments. Heretofore, each of those departments contained LP reviews only, and CD reviews—for all types of music—were presented in one additional section. However, since increasing numbers of new releases are coming out in both formats, we no longer believe the separation is warranted. Therefore, in this and all future issues, each of our music-review departments will expand to cover both CDs and LPs; the separate "Compact Discs" department will no longer run. In the heading of each review, we will indicate the format that has been auditioned for that review, and the catalog number given will be for that format. We hope these changes will make our review departments more useful than ever. Let us know what you think!—*E.M.*

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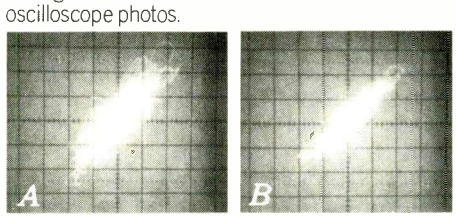

A. Lissajous pattern showing spatial detail (L-R) (L+R) ratio from an LP record.
B. The same instant of music but taken from the CD version. Note the decreased (L-R) content, as shown by the narrowed trace.

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André Previn conducts the two Prokofiev works with smooth fluency, and the Los Angeles Symphony is at its best.

high-speed roughness in favor of better, more relaxed phrasing and shaping. As for Sergiu Luca, the violinist, he is a perfect accompanist, subordinating his music where the piano leads, blossoming out with the occasional full violin melody. Good Mozart.

Also, good annotations. If you still don't realize what genius means, consider what Stanley Sadie's notes tell us about Mozart's K.379 in G. Some 20 minutes long, this piece was composed between the hours of 11 and 12 p.m. for a special performance the next day. Because the time was short, Mozart wrote out only the violin part. The piano part, complete but never played before, was simply retained in his head as he composed it. Talk about computer memory! He played it out of his head before a fancy audience the next day. Sadie has collected a lot of good info such as this in his notes, including a splendid discussion of the effect of the two instruments' technique on music in different keys, and the matter of tuning, not then uniformly in modern tempered pitch so that each key had its special sound.

Fortepiano? This is the name for the pianos used from the beginning through the early 19th century, quite different in sound from our big ones. They very clearly are preferable for the music written for them, or on them. Bilson uses a modern copy—the old ones are mostly beyond repair.

Edward Tatnall Canby

Prokofiev: Alexander Nevsky Cantata; Lieutenant Kijé Suite. Los Angeles Philharmonic Orchestra, Los Angeles Master Chorale, André Previn; Christine Cairns, mezzo-soprano.
Telarc CD 80143, CD.

Here are two historic film scores by the man who showed us that film music, like the celebrated scores composed for living ballet, need never compromise. "Kijé" dates from 1933—so soon after film music first was possible! "Nevsky" came not long afterwards, just before World War II broke forth. That film, directed by the famous Sergei Eisenstein, is one of the all-time film masterpieces, and its use of music—chorus and solo voice as well as orchestra—for dramatic impact is perhaps the most effective ever. Both of these scores were converted by Prokofiev into works of pure music, with "Nevsky" retaining the ever-present chorus of the original.

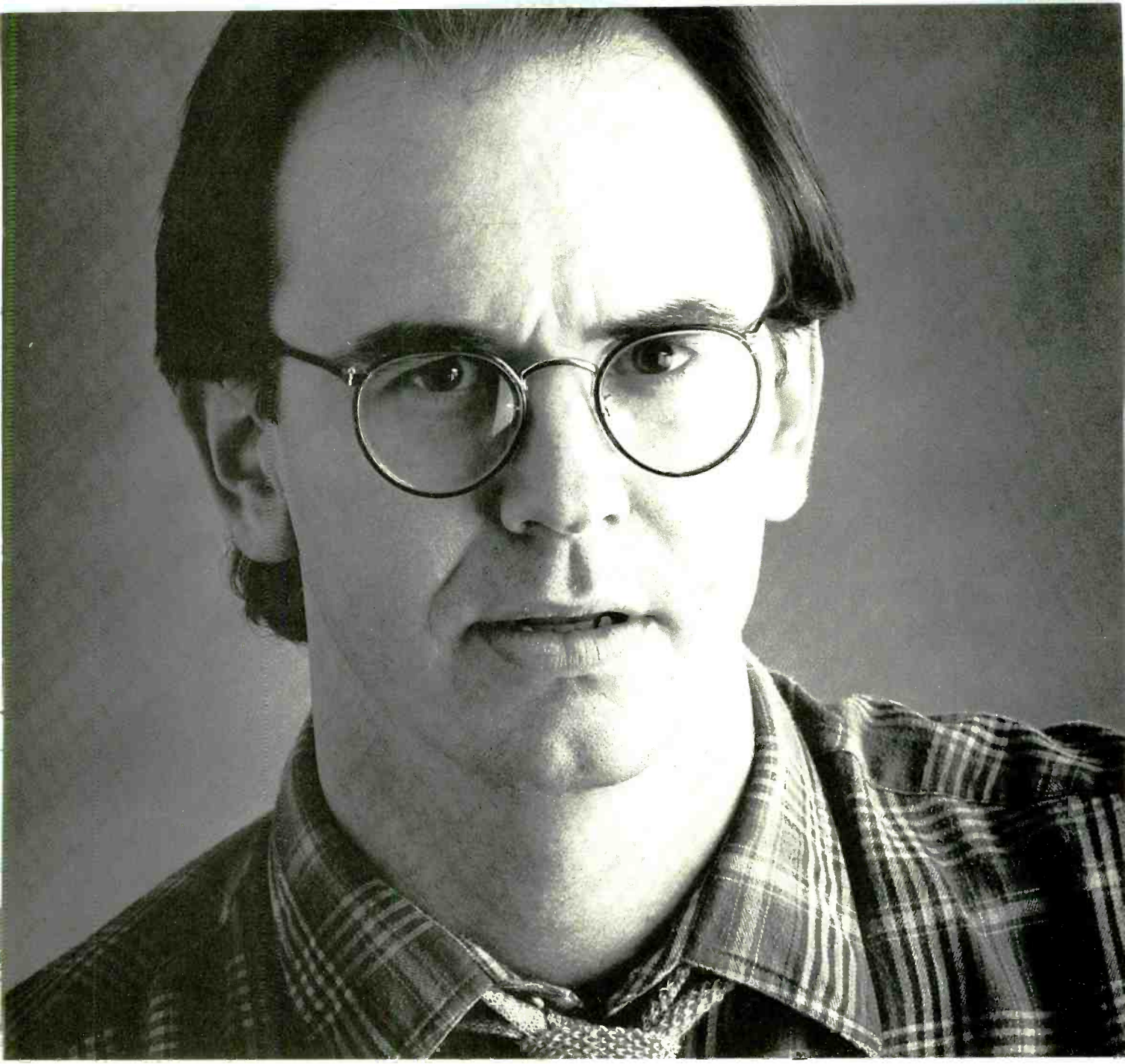
There's more to this recording, but this part must be brief. It is the first CD to be recorded via Colossus, the new all-digital surround-sound system developed by Lou Dorren and Brad Miller. Unfortunately, the multi-channel results are not yet measurable for this critic's ear—the consumer equipment is still to come. But, as noted in my August 1987 "Audio ETC," the thoughtful development of a comprehensive approach to multi-channel digital sound demands that the professional side of such a system, plus a backlog of musical repertory, be developed before there is any move toward wholesale industry conversion—whether on audio discs, video, or film. All in good time.

These performances of the two Prokofiev scores are well worth having, quite aside from the potential resurrection of four-channel. André Previn conducts with smooth fluency, a bit slowly (compared to the memorable originals) and with plenty of expression, and the Los Angeles Symphony is at its usual and ever-surprising best. It is a fine, youthful-sounding group of skilled musicians, never jaded or overworked in the playing. As for the chorus, it is very "California," if I dare say so, full of unblended professional-type vibrato, the men's segments not well in tune, the women letting go full blast on every high note. These singers seem more interested in the sound they make than in the meaning of the music. Still, most listeners will enjoy. It's only we purists who must complain. (But go see the original film of "Nevsky" and listen to *that* chorus. Then you will see what I mean.) *Edward Tatnall Canby*

Guitar Concertos: Kazuhito Yamashita, guitar, with the Chamber Orchestra of Leoš Janáček.
RCA Red Seal CD 5914-2-RC, CD.

Sound: A+ Performance: A+

The flash of young Japanese guitar phenomenon Kazuhito Yamashita may be anachronistically modern, but it sure spices up the prospect of yet *another* program of Giuliani, Vivaldi, and Carulli concertos. With grace and skill, Yamashita (23 at the time of this recording) races through these chestnuts at breakneck speed, and they're better for it.



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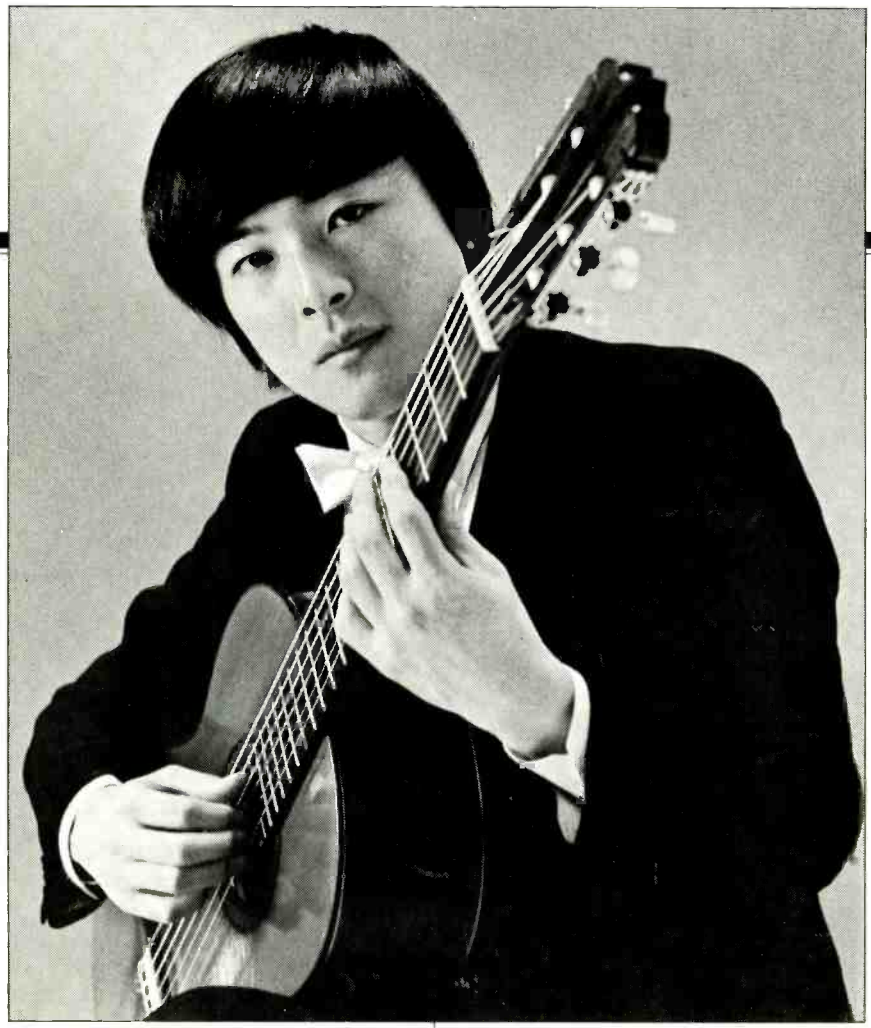
Kazuhito Yamashita brings a brilliant and flawless technique to these guitar chestnuts, and the result is stunningly vital.



Yamashita's technique is brilliant and flawless—warm, round, and crisp—with a dynamic sense perfectly adapted to the special demands of the guitar concerto. The music is sumptuously recorded, with excellent balance between the soloist and the fine Janáček Chamber Orchestra, and the fidelity is superb (as it is on the LP too, by the way).

Yamashita's *Guitar Concertos* reinterprets the past with a more contemporary image and pace, and the result is stunningly vital. I'd put this disc in the running for classical guitar recording of the year. *Michael Wright*

The Piano Music of Arnold Bax, Volume 1: Eric Parkin, piano.
Chandos CHAN 8496, CD.

In a quick moment or two, a couple of things about this CD, the first in a series, are clear. First, it is a very fine and expansive digital recording of a German Bösendorfer piano. Second, the music is played by a pianist who is utterly fluent in the musical language of Bax. From a British point of view, the combination is indeed just about ideal for this composer.

But who is Bax? That would be a typical American question. He is one of the numerous English composers, major and minor, who worked from the end of the Victorian era on through the Edwardian and then onwards, modestly modifying their early late-Romantic styles through the 1940s and beyond. There is much fluency in all this music, and we know the biggest names—Elgar, Vaughan Williams, Holst, Walton—all of them remaining steadfastly outside the jazzy, snazzy modernism of the rest of the Western world (except for Walton's early and nose-thumbing "Facade"). Many another, even unto Delius, flourished in England but remained either unknown or unpopular over here. Bax is one of them. He is an out-and-out turn-of-the-century Romantic, in spite of considerable dissonance and some mild mysticism. In his music are constant reminders of that thick, fruity English harmony that hits the American palate as just too much, too lush, like an overlarge serving of whipped cream. Not a lot of this in Bax, but it is there.

Bax was enormously prolific. And, like so many who are endless writers of music, he lacked restraint and self-judgment—he goes on and on. One aches for conciseness, but on this disc it is present only in three little songs for piano. The two big sonatas included here range ever so expertly over the Romantic keyboard, from sweet mysteries to joyful, all-out blasts of sound—terrific piano technique, and gorgeously played! I had to stop from sheer boredom and indigestion before the second was finished. Curious phenomenon. *Edward Tatnall Canby*

Alan Hovhaness: Saint Vartan Symphony, "Artik" Concerto for Horn and Strings. National Philharmonic Orchestra of London, Alan Hovhaness. Members of the Israel Philharmonic, David Amos; Meir Rimon, horn.
Crystal CD802, CD.

Alan Hovhaness is a unique figure in music. A craggy-faced and imposing individual, like some Armenian saint out of history, he is actually American born and trained, all in the Boston area. Armenians in this country have a strong connection to their Middle East traditions (like plenty of other peoples!), and this man inevitably wanted to write "Armenian" music out of that background. What seems to have been a very academic and conservative training, on the other hand, was not exactly useful for such an un-Bostonian idea. So Hovhaness, tossing out a lot of his earlier "Western" music, in effect invented his own Armenia—that is the way I see it. Armenian scales, tunes, atmosphere, and lots and lots of historic stuff—just like Sibelius and his Finnish legends. But the musical language is basically academic Boston in its details—old-fashioned conservatory Boston, at that, circa 1915. This means classroom-type fugues and solemn hymns in a chord language on a par with Grieg, Sibelius, and the American MacDowell.

By some miracle, out of this stodgy background and a natural feel for much more contemporary instrumentation, Hovhaness has invented a unique and oddly contemporary kind of music, if one puts aside the elaborate Armenian story lines, though they are interesting and might heighten your mood as you listen. In effect, this is Armenian "minimalist" music, alloyed with the same kind of Indian music that later

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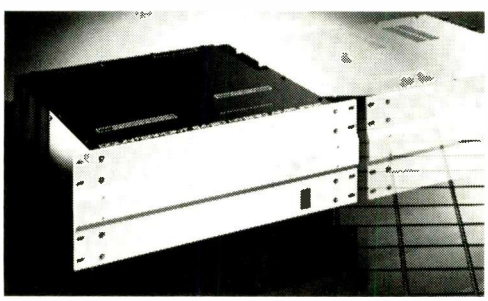

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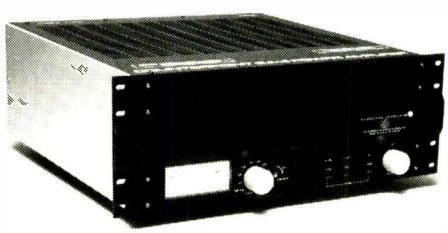

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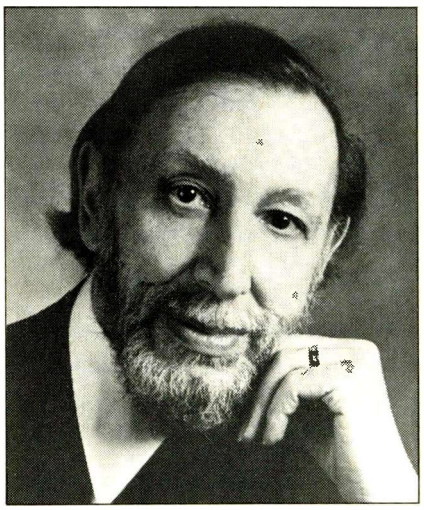
Alan Hovhaness has come up with a unique and oddly contemporary music in spite of a rather stodgy academic background.

appeared here with such artists as The Beatles. The outward material is conventional Western, but the way the music goes is strictly Eastern. Actually, it doesn't go anywhere, not even the fugues and the hymns, but it is wonderfully colorful.

One must take Hovhaness, then, a lot more seriously than the Boston-type sound you will initially hear in his music. He is no copycat, in spite of the conventional chords. What he does with such almost banal material is unique, if in the long run (as on this CD) rather confined and unvaried. Very decidedly worth hearing.



Equally good playing is provided by the London orchestra and the Israeli group; the two are well balanced, showing no untoward differences in the hall sound and microphoning. It could be the same recording session—maybe it was. Musicians travel everywhere, to paraphrase Emily Dickinson. *Edward Tatnall Canby*

Liszt: Piano Concerto No. 2; Prokofiev: Piano Concerto No. 3. Royal Philharmonic Orchestra, Witold Rowicki; Janis Vakarelis, piano.
MCA Classics 6204, LP.

Here's a typical contemporary mélange: The pianist is Greek, the orchestra solid English, and the conductor—well, who can be sure? He's given a mere listing of his name in the liner notes. But the disc itself has two more-than-adequate performances, each very much in the "right" style for the music, and the digital sound on LP is the best from Britain. This MCA release is part of a Royal Philharmonic series inspired by the orchestra itself and run entirely by the orchestra players.

In his training, this young (under 40) pianist, Janis Vakarelis, quickly became internationalized and is Greek, perhaps, only in basic temperament. He is good. The Liszt concerto is somewhat of a problem piece in that its cyclical format pounds into us a series of chords that becomes a bit too much. This is the most persuasive version of the music I've heard. Vakarelis is a natural-born Romantic with a precise sense for the Liszt idiom, which too

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Ruth Laredo shuns flashy showmanship and instead stresses the splendid melancholy of this Chopin.

easily can become bombastic, hiding the solid worth. He has it exactly right here, neither too little nor too much. I felt that maybe I'd have to revise my thoughts on this piece, if it can come forth as persuasively as this.

The very different Prokofiev is a standard contemporary virtuoso piece, often murdered by pianists who practice exhibitionistic speeding. If badly handled, it easily shatters into billions of glassy fragments—not good for the ear. Again, Vakarelis shows a mature and lively musical sense, never at all giving way to the usual show-off temptations but, even so, demonstrating how easy it all is for him.

As for the Royal Philharmonic, it is typically current-British, which means that it responds with care and enthusiasm to a host of different conductors and soloists without a trace of commercial-style boredom. The fact that this recording is the group's own homegrown project probably makes things that much better—it sounds that way.

Edward Tatnall Canby

what you really need, especially on repeat playings.

In this leisurely (somehow) all-Chopin disc, the truer Chopin is everywhere evident—not so much a flaming concert showman as a person for the intellectual music salon. These pieces are predominantly ruminative and introspective, with flashes of brilliance that are always contained and never loud merely for loudness' sake. In a way, it is an exalted kind of background music, for ears that can understand the music's profundity even through quiet conversation.

There is only one of the standard contest showpieces here, and Laredo puts this one at the beginning of side two, not as a flashy starter. The rest of the menu is mainly the waltzes, mazurkas, one nocturne, and one étude—the genuine mainstream of Chopin's work. Listening here, I find I might prefer Artur Rubinstein's seasoned and marvelously intense versions, which carry over the authentic, late 19th-century tradition into our day; Laredo is of the

Chopin: Ruth Laredo, piano.
Nonesuch 71450-1, LP.

Ruth Laredo isn't that old, but she is a wholly mature, thinking pianist as well as a brilliant enough technician when the occasion calls for brilliance. Listening to music in your living room, this—and not flashy showpieces—is present generation, a bit on the neo-Romantic side, with lots of pedal and a more relaxed and noticeable rubato, as the fashion now goes. She never overdoes, she subordinates the accompaniments sometimes almost to inaudibility and stresses the splendid melancholy of the Chopin songs. It's good listening. *Edward Tatnall Canby*

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SARAHNADES

Brazilian Romance: Sarah Vaughan
CBS MK 42519, CD.

On her most recent release, *Brazilian Romance*, a collection of 10 romantic songs produced by Sergio Mendes and arranged by Dori Caymmi, vocalist Sarah Vaughan comes to us in a Brazilian setting. Interestingly, despite the samba-esque feel, many of the accompanying musicians are top-flight American players. Included are George Duke, keyboards; Alphonso Johnson, bass; Tom Scott, Lyricon and tenor sax; Hubert Laws, flute, and Ernie Watts, alto sax.

The musical parts of *Brazilian Romance* are beautifully arranged. However, with a full string section used on nearly all of the songs, the overall feel is one of constant lushness, and in time this becomes tiresome. It might have been wiser to include three or four songs in which the singer was backed by only the small rhythm section—especially in light of the fact that this section (Carlos Vega on drums and Paulinho Da Costa on percussion, in addition to Johnson and Duke) is so very good. These guys must breathe in unison.

Sarah Vaughan is a musical vocalist, that is, in an ensemble setting, among four or five instrumentalists, her voice seems to blend in as another instrument. Understand, she enunciates meticulously and delivers her lyrics cleanly, but her voice remains musical. Lyrics seem secondary when you listen to Sarah Vaughan play with a melody, reaching down into her rich lower register and then climbing easily back up to dance with the strings and flutes. On this recording, the vocal should be more up-front. Only on "Love and Passion," the vocal duet with Milton Nascimento, does it receive the prominence that it should.

The Compact Disc version of *Brazilian Romance* is excellent. The music was recorded on the Mitsubishi X-850 32-channel digital system and mixed down to Sony's PCM 1630. The resultant sonic clarity supports the use of the digital domain. Listen to how honestly the instruments—especially the guitars, flutes, and strings—are recorded, specifically on the opening track, "Make This City Ours Tonight," as well as on "Love and Passion" and "Obsession."

If you like jazz/pop with a strong Brazilian feel, you will fall right into *Brazilian Romance*. Yes, Sarah Vaughan is a bit overshadowed by the lush string arrangements and deep vocal placement, but one of the greatest voices in music could never be completely undone by such circumstances.

Hector G. La Torre

Live from Chicago—An Audience with the Queen: Koko Taylor and Her Blues Machine
Alligator 4754, LP.

Sound: B Performance: B

Koko Taylor, the most famous living blueswoman in the world, has always occupied a unique niche among her contemporaries. Try to name another major blues star who doesn't play an instrument. Fortunately, Taylor has always toured with groups that could be counted on for straightforward, no-frills Chicago bluesmanship. The sidemen on this set are no exception.

An Audience with the Queen, Taylor's fifth album for Alligator, was recorded live at a club date, but it is essentially a greatest-hits package.

Editor's Note: With this issue, we have made a change in our "Rock/Pop Recordings," "Jazz & Blues," and "Classical Recordings" departments. Heretofore, each of those departments contained LP reviews only, and CD reviews—for all types of music—were presented in one additional section. However, since increasing numbers of new releases are coming out in both formats, we no longer believe the separation is warranted. Therefore, in this and all future issues, each of our music-review departments will expand to cover both CDs and LPs; the separate "Compact Discs" department will no longer run. In the heading of each review, we will indicate the format that has been auditioned for that review, and the catalog number given will be for that format. We hope these changes will make our review departments more useful than ever. Let us know what you think!—*E.M.*

Vol. 48.2 kHz No. 16 Bits

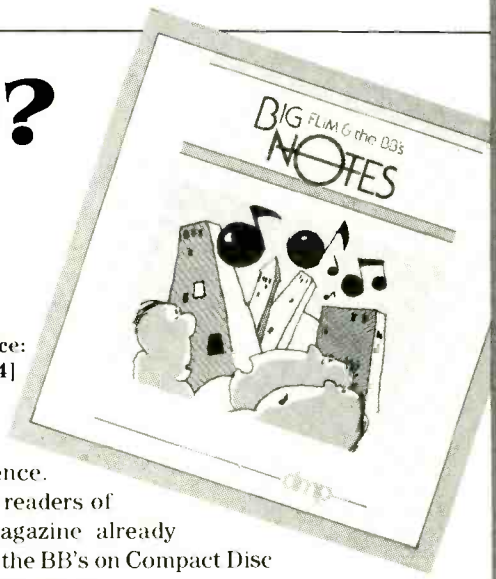
dmp NEWS

FLIM & THE WHO?

- **1987 #1 Jazz CD, Flim & the BB's, "Big Notes"**
- **1986 #1 Jazz CD, Flim & the BB's, "Tunnel"**
- **1985 #1 Jazz CD, Flim & the BB's, "Tricycle"**

Once again the readers of *Digital Audio* magazine have named Flim & the BB's the year's best jazz Compact Disc recording group. And once again jazz legends and Grammy winners alike were over-passed by this band of digital diehards.

Who are Flim & the BB's anyway? They're a band of leading session musicians who gather once a year in dmp's studios to push the digital domain to its limits with their unique jazz/pop/classical compositons. They've been recording digitally longer than any other band [over ten years]. Amd they compose with the extra-wide dynamics of the Compact Disc and dmp's advanced recording technology in mind.



1987 Reader's Choice: "Big Notes" [CD-454]

Hear the difference. Find out what the readers of *Digital Audio* magazine already know: why Flim & the BB's on Compact Disc is number one year-after-year.

And while you're at it, check out their new CD "Neon" from dmp. It's their first disc using our new rack of Class-A, discrete electronics. And it's characterized by the same sonic wave fronts and delicate silences that have endeared the BB's music to their following.

"Neon" is what the great names in jazz will be up against next year.

MANFREDO'S FESTS

"A breakthrough . . . both fresh and enthusiastic . . . it's good to see that Manfredo is back."

George Shearing led the way in his praise of Manfredo Fest's Brazilian jazz recording "Braziliana" on dmp. Now here's what the reviewers are saying:

- "The veteran pianist revels in his bossa nova roots, captured here in ultra digital detail . . . an hour-plus Latin treat."
  Billboard

- "Fest treats his estimable pallet of colors tastefully on piano and is captured brilliantly by dmp's technical mastery."
  BuZZ

- "This spectacular recording is an overdue blend of technology and Brazilian music . . . It's wonderful to see Manfredo hit paydirt."
  Focus

- If there was ever a Goose Bump CD, this one is it. Forget theatrics, this is good, solid, close your eyes and float down the Amazon, music."
  A.J. Aguilera

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Cutting through the dervish percussion of *Exploded View* is Steve Tibbetts' guitar, a cathartic wail of siren choirs and scorching melody.

There are a few new songs, yet they don't stray far from familiar source materials. Taylor's growling, declamatory singing owes little to the so-called "classic" female blues singers. Even compared to such major influences as Bobby Bland and Muddy Waters, she's not a singer of great subtlety. Yet few singers have the primal force to deliver such rockers as Louis Jordan's "Let the Good Times Roll" with similar ferocity. As for the sidemen, they may be little-known figures, but guitarists Michael "Mr. Dynamite" Robinson and Eddie King trade some good mainstream licks.

This record doesn't measure up to Taylor's last effort, *Queen of the Blues*, which featured such hotshot guest artists as Albert Collins and Son Seals. I'd get that album first, before scheduling *An Audience with the Queen*.

Roy Greenberg

Tirami Su: Al DiMeola Project
Manhattan MLT-46995, LP.

Sound: B+ Performance: B+

Guitarist Al DiMeola is off in a new direction once again, exploring the nooks and crannies of Latin rhythms on *Tirami Su*. Actually, this is more a compendium of DiMeola's recent styles: There is flamenco-like acoustic guitar on "Rhapsody of Fire," New Age atmospherics on "Arabella," and speedo fusion on "Song with a View" and "Song to the Pharoah Kings" (written by Chick Corea).

Al DiMeola

Several cuts feature José Renato's vocals (he sings some Brazilian lyrics, some nonsense syllables); these are mixed in the background rather than the foreground and sound a bit odd. Other than that, sound and production are excellent. Listen especially closely to the panned parts in the exciting "Beijing Demons" and to the instrumental overlays of "Maraba."

In many ways, *Tirami Su* is DiMeola's most sophisticated and balanced work to date, with the old criticism about nonstop blazing scales finally put to bed. On the other hand, it is also more contemplative than his previous albums, which means that it lacks a bit of the excess and excitement which made DiMeola's early works so appealing.

Michael Wright

Exploded View: Steve Tibbetts
ECM 1335, CD.

Sound: B+ Performance: A+

Exploded View—a perfect name for a recording that detonates like a fission bomb and rebuilds the world in a new form. On this roaring maelstrom of an album, Tibetan monks moan through subharmonic feedback drones. The dervish percussion is like a global drum choir, as Marc Anderson and Marcus Wise play the rhythms of India, Africa, and Morocco with one mind. And through it all is the sound of Steve Tibbetts' guitar, a cathartic wail of siren choirs and scorching melodies.

Tibbetts belongs to a lost generation of musicians, the ones who grew up listening to the progressive and underground sounds of the '60s and early '70s and were left in the cold when the music went corporate. On *Exploded View*, Tibbetts' first album in three years, the guitarist continues to compose a personalized music filtered through his emotions, his guitar pyrotechnics, and his studio experimentation. Playing with the same musicians he's worked with since his first self-produced recording in 1977, he leaves nothing out, and yet it all works.

Unlike the more contemplative meditations of his first two ECM recordings (*Northern Songs* and *Safe Journey*), *Exploded View* most recalls *YR*, Tibbetts' ground-breaking 1979 recording. Like *YR*, *Exploded View* journeys through carefully wrought landscapes, with urgent acoustic guitars giving way to screaming feedback, the steady gurgle and throb of percussion, and the plaintive cry of Claudia Schmidt.

Recording in his home studio, Tibbetts gets an astounding clarity of sound that is well served by this CD. Tablas and congas have never had a more visceral punch, their sharpness defining and punctuating Tibbetts' sustained electric lines and the resonance of his acoustic guitar. Some tape hiss is revealed when you crank it up loud—and that's the only way to listen to this record—but the quality of Tibbetts' acid-jazz quickly displaces any technical shortcomings.

John Diliberto

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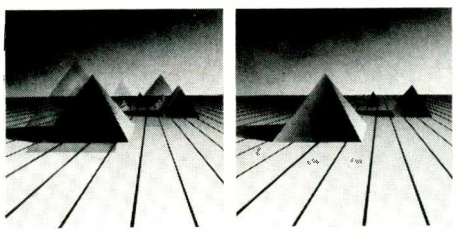

distortion are left behind. Or, as *High Fidelity* magazine put it, *"...clean, noise-free sound out of weak or multipath-ridden signals that would have you lunging for the mono switch on any other tuner."*

Ovation magazine observed that the circuit, *"...may well mean the difference between marginal reception of the station signals you've been yearning to hear and truly noise-free reception of those same signals."*

Audio magazine called it, *"An FM tuner breakthrough."*

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When Bob switched back and forth, most listeners had difficulty distinguishing between the straightwire CD player and the TX-11a's over-the-air AM stereo reception! Many could tell no difference at all!

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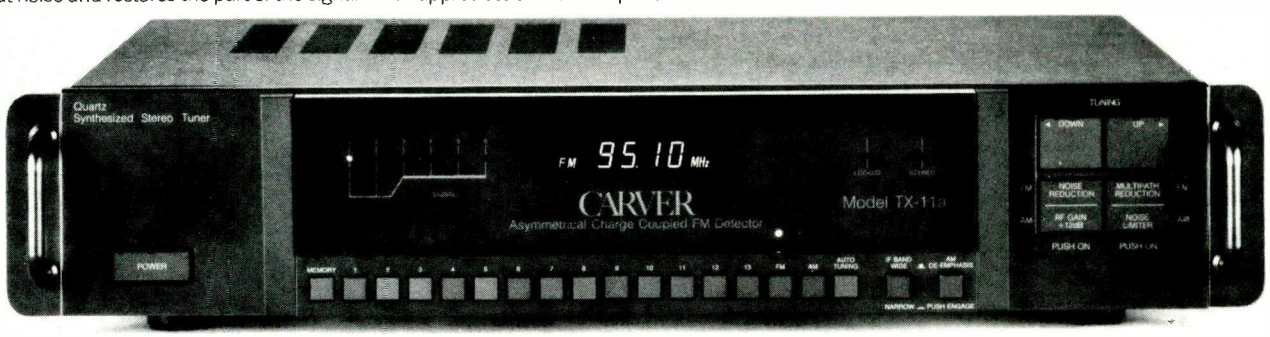

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We often think of trumpeter Yank Lawson in terms of his blasting, powerful style, but he has a melodic and reflective side as well.

Yank Lawson Plays Mostly Blues
Audiophile AP 221, LP. (Available from Audiophile Records, 3008 Wadsworth Mills Pl., Atlanta, Ga. 30032.)

Sound: A Performance: A–

All the players on this recording first got together while appearing in two different jazz festivals in Georgia last year. With very little rehearsal or advance notice, these seasoned veterans, most of whom have had extensive band experience and years of studio recording activity, turned out an album of excellent classical jazz.

Headed by powerful trumpeter Yank Lawson (reunited with his old Bob Crosby teammate, bassist Bob Haggart), the musicians do their stuff on mostly blues or blue-ballad tunes, some old numbers and one or two relatively new ones.

We often think of Yank Lawson in terms of the powerful, blasting trumpet style he's been using since the mid-'30s, but he also has a melodic and reflective side, as his solo on Johnny Mercer's "Summer Wind" shows. This tune also gives a fine demonstration of trombonist George Masso's worth as a musician. Bob Haggart's famous ballad "What's New" is served up bossa nova style by Al Klink's swinging tenor sax. There's plenty of Johnny Mince's fine, woody-toned clarinet and some good Knocky Parker on piano, especially on "Blues My Naughty Sweetie Gave to Me." *Frank Driggs*

At the Dark End of the Street: James Carr
Blueside FL 6008-1, LP. (Available from Upside Records, 225 Lafayette St., Suite 1109, New York, N.Y. 10012.)

Sound: C+ Performance: A

Calling a performer "The World's Greatest Soul Singer," as the jacket of this album proclaims, is to invite immediate debate, especially when the performer in question is the largely forgotten James Carr. Be that as it may, one listen to *At the Dark End of the Street* will convince soul and blues fans that Carr must be counted among the best. When he wails and pleads and cries his way through a song, its lyrics become universal truths.

Carr's brief career ended when the Goldwax label folded in 1969, and his records have been unavailable in this country for years. Carr would have remained a footnote in soul music history not for writer Peter Guralnick's championing of Carr's recordings. Guralnick, who also penned the liner notes for this album, cryptically reports that the Memphis-born singer is still alive, although his recording days appear to be over because of a "crippling paralysis of spirit," whatever that may mean. No matter. These recordings reveal everything of real importance about James Carr.

Carr invests every phrase with a feeling of passion barely kept in check. He sings intuitively, without calculation; that his performances are so affecting is the best measure of his success.

The title track has inspired performances by dozens of singers, ranging from Aretha Franklin to Linda Ronstadt. Carr's own covers are especially effective. After you hear him perform The Bee Gees' "To Love Somebody," the original recording will never sound quite the same again.

At the Dark End of the Street makes a strong argument that '60s soul isn't dated; it's classic. *Roy Greenberg*

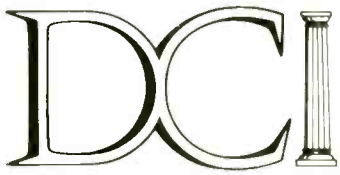
We Begin: Mark Isham and Art Lande
ECM 1338/831 621-2, CD.

Sound: A Performance: C+

This is a case of the master following the footsteps of his student. Art Lande is a gifted pianist and composer who, in the mid-'70s, led a distinctive jazz

James Carr

This announcement appears as a matter of record only.



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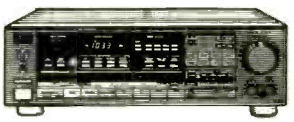

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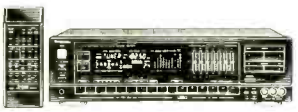

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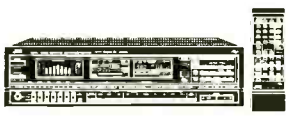

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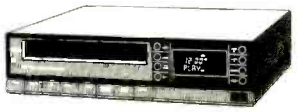

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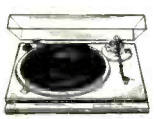

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Bernard B. Lacy
VP/Circulation

Mark Isham's New Age music dominates *We Begin*; what little piano one can hear is buried underneath a wash of synthesizers.

ensemble called Rubisa Patrol. That group featured a journeyman trumpeter named Mark Isham. After a few critically acclaimed albums for ECM, Lande dropped out of recording while Isham made his name as an expressive synthesist on Windham Hill with albums like *Vapor Drawings* and *Film Music*.

We Begin is a reunion of sorts, only now Lande is playing Isham's New Age synthesizer music instead of his own knotty jazz explorations. Unfortunately, the album is weaker for it. There's nothing here to indicate Lande's musical personality. What little piano one *can* hear is buried in a wash of synthesizers.

Although both artists are credited with synthesizers, it's Isham's personality that emerges. Epic ballads like the title track pulse with his synthesizer swells. "Ceremony in Starlight" is a mysterious soundscape of electronic temple bells, muted trumpet in deep reverb, and plucked strings with the sparest of piano parts. "The Melancholy of Departure" pulls itself apart with an insistent machine-shop rhythm that crushes Isham's somber, sustained trumpet lines like a metal press. "Surface and Symbol," on the other hand, is an airy space walk. A slowly spinning rhythmic orbit provides a vessel for Doppler trumpet effects, spare and resonant piano, and an insistent stereo-delayed cymbal.

Despite some engaging compositions and the spacey improvisations of "Surface and Symbol," *We Begin* is a lost opportunity. It wastes the reunion of two distinctive artists by playing away from the strengths of Lande. And despite the four years since *Vapor Drawings*, it breaks little new ground for Isham. *We Begin* is a slow start.

John Diliberto

In the Tradition: Wendell Brunious **GHB 194,** LP. (Available from GHB Records, 3008 Wadsworth Mills Pl., Atlanta, Ga. 30032.)

Sound: B+ Performance: B+ to C

This recording is too much of a mixed bag of younger players coupled with older ones pretty much past their prime. I doubt that I would have reviewed it except for two very important facts: Its leader comes from a major family of latter-day New Orleans musicians (his father was the late John Pickett Brunious), and the younger Brunious plays trumpet in the classic, traditional jazz style of his forebears.

In jazz, it is highly unusual for a young performer to resist his own generation's peer pressure to either become a modern-jazz stylist or a rhythm-and-blues or soul musician. Perhaps Wendell Brunious could not have resisted anywhere else but in New Orleans, where the older style of jazz (still called New Orleans or Dixieland) is practiced by young and old alike and is still somewhat in demand. I like the way this trumpeter plays, with a strong, sure lead. In time, I think, he will become an outstanding soloist.

As it stands, this recording represents a pleasant example of a group of diverse players ranging from trombonist Louis Nelson (over 80 years old) and pianist Jeanette Kimball (in her 70s), down through British clarinetist/saxist Sammy Rimington, bassist Frank Fields, and drummer Barry Martyn (all in their 40s), to young Brunious (in his early 30s).

I have no idea what kind of "draft" Wendell Brunious might feel from other players of his generation—including the far more famous Marsalis brothers and the Dirty Dozen Brass Band, for example—but I for one am glad to see a talented young player narrow the ever-lengthening gap that has existed in music since the end of World War II, when modern jazz or R&B seemed to be the only way to go. Traditional jazz has so much to offer musically. It needs the youth and vitality of a dozen players like Wendell Brunious to bring it back to life.

Frank Driggs

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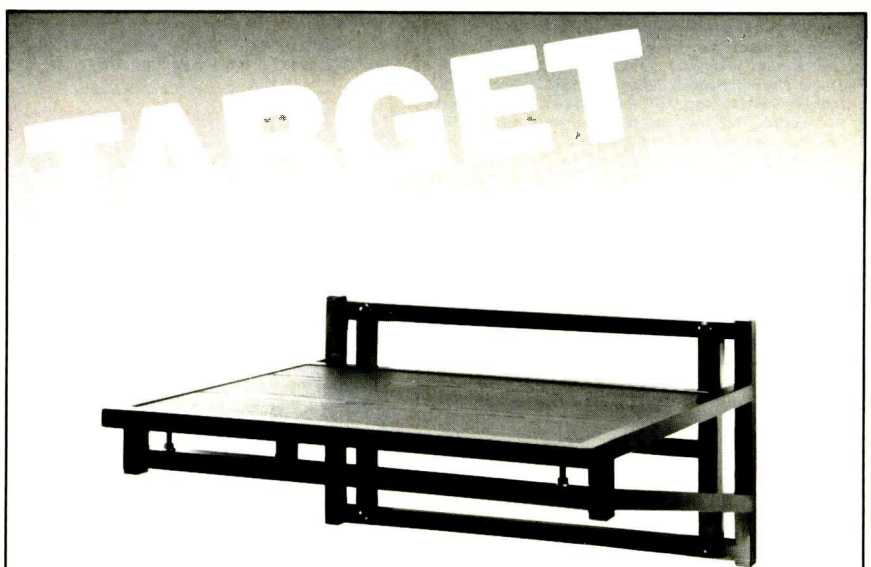

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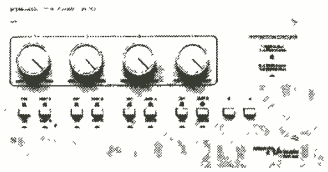

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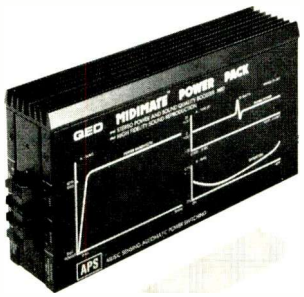

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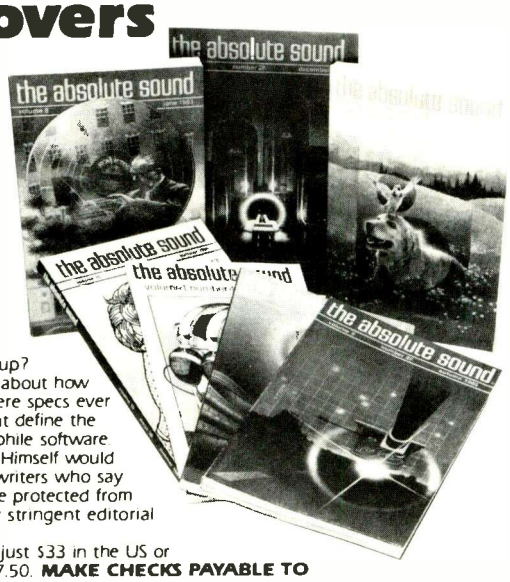

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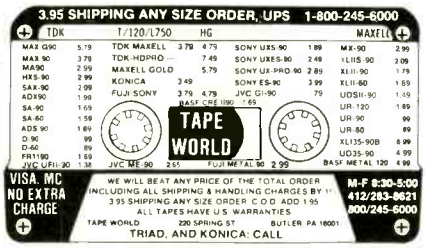

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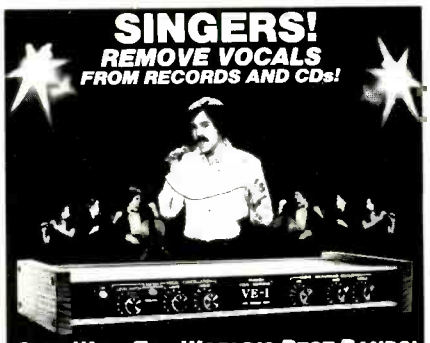

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