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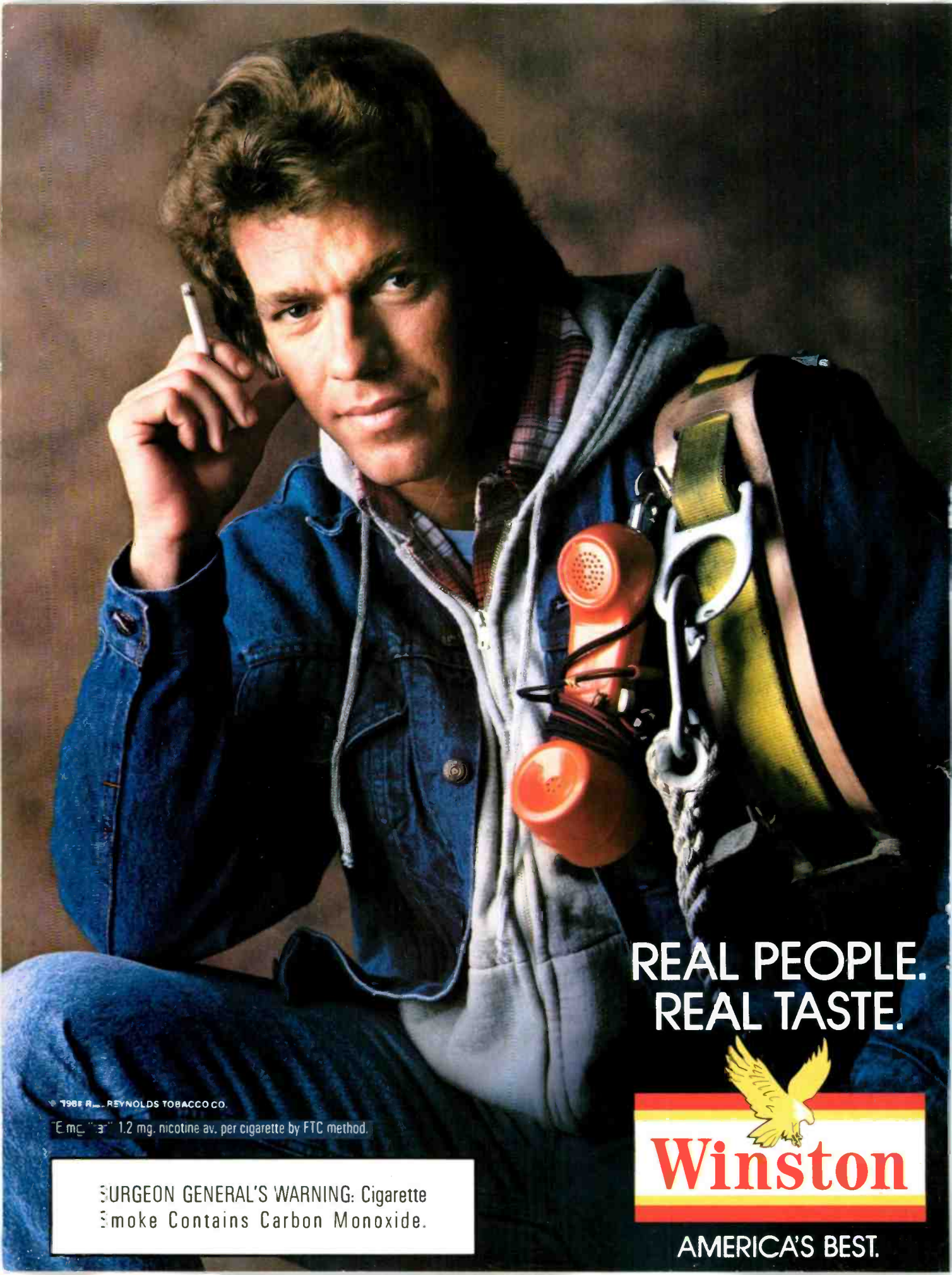


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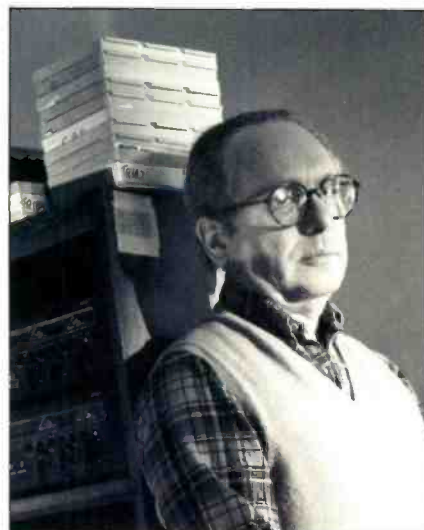
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The Cover Equipment: Well Tempered turntable and tonearm with van den Hul MC-One cartridge.

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# TAPE GUIDE

HERMAN BURSTEIN

## PCM Error Correction

*Q. I own a VCR and may purchase a PCM unit for recording audio with it. How seriously do tape dropouts affect recording? Does the PCM processor have error correction and concealment facilities?—Charles Roberts, Springfield, Mo.*

**A.** According to Sony, its PCM units contain error-detection and error-correction circuits. Dropouts can be a problem, more so at the slower video-cassette speeds. However, I understand that when high-quality tape is employed, the problem occurs so infrequently as to be a minimal hazard to good recording.

## Avoiding Saturation

*Q. Please tell me the best way to copy a CD onto a cassette so as to minimize saturation of the tape during musical peaks.—James G. Bennett, Cincinnati, Ohio*

**A.** First establish the maximum safe recording level, as indicated by your deck's record level meter, for the tape you will be using to copy CDs. (This is relatively easy if your meters are peak-reading, as is usually the case. If they are average-reading, as is the case for true VU meters, the task is more difficult, because the meters may understate transients by anywhere from roughly 10 to 20 dB.) Also take into account the deck manufacturer's recommendations. For example, the owner's manual might say that you can safely record Type II tapes up to a level of +3 dB; your own experience with a particular brand of tape might show that this is just about right, or that you can safely go a couple of dB or so higher, or that it is best to stay close to the 0-dB mark.

Next, play the loudest passages of your CD, with the deck in record mode; observe and adjust the record level so that the meter doesn't exceed the safe point, which is typically about 3 to 5 dB above 0 VU. If this is too tedious, sampling the CD on a random basis by using the fast-forward control may tell you what you need to know.

If you employ dbx noise reduction, the signal-to-noise ratio is so great—typically 80 dB or more, and occasionally over 90 dB—that you can afford to sacrifice a few dB of S/N by deliberately underrecording by a few dB for safe-

ty's sake. Even with Dolby C NR, which ordinarily achieves S/N of 70 dB or more, you can follow pretty much the same course to avoid saturation.

One more thought: Maximum output level of a CD player is very close to 2 V. If you have access to an audio generator that can deliver about 300 to 400 Hz at 2 V, feed this signal into the CD input jack of your receiver (or pre-amplifier or integrated amplifier). Put the deck into record mode, and adjust the record level control so that the record level meter doesn't exceed the maximum safe point. Put the record level control at this setting when recording CDs.

## Chide Remarks

On a subject that very much bears repeating, reader Bob Katz of New York City writes:

*I read your comments in the October 1987 issue regarding a reader's cleaning misadventure with isopropyl alcohol. While I doubt that the 70% isopropyl solution damaged the individual's heads, there is a very good reason why the sound quality deteriorated. The reason lies in the other 30% of the solution. All 70% isopropyl solutions available in drugstores contain glycerine or other lubricants to aid their intended use as rubbing alcohols. To prove this, put a small amount of 70% alcohol on a counter; after it dries, there will be a smooth, soapy residue. It is this deposit which gets onto the head and guide surfaces, causing the capstan to slip, and it can even get into the head gap. If the 30% of the solution were pure water, there would be no problem in using 70% isopropyl. That is why 91% (or 99%) isopropyl is always recommended for cleaning the components contacted by the tape.*

*By the way, grain alcohol (190 proof) leaves no deposits and is perfectly acceptable for head cleaning. However, vodka is not good for cleaning because the flavorants and charcoal that are frequently added for taste can leave a deposit.*

Prosit.



**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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## Measuring Speaker Impedance

*Q. How can the nominal impedance of a speaker be determined with a d.c. ohmmeter? Speakers are usually described as having a nominal a.c. impedance.—Name withheld, San Leandro, Cal.*

A. To measure the impedance of a speaker at some given frequency, you need a source of that frequency, an a.c. voltmeter, and a variable resistor having a low ohmic value, somewhere in the range of the expected speaker impedance. This is in addition to the ohmmeter you have already mentioned. The resistor is connected in series with the speaker, and this series combination is connected to an audio amplifier. The frequency source is then fed into the amplifier at some level which can provide a convenient reading on the voltmeter. Loud levels are not necessary and would only be annoying to listen to. The value of the variable resistor is adjusted until the voltage developed across it exactly equals that of the voltage developed across the speaker terminals.

You then disconnect the resistor and measure its value with the ohmmeter. This resistance value will be equal to the impedance of the speaker at the particular frequency used for the test.

## Binaural Sound

*Q. What is binaural sound? As I understand it, microphones are placed where a person's ears would be, and a stereo recording, preferably on tape for maximum separation, is made. This is played back through headphones, in order that an accurate image, as would be heard if actually present, is received. Is this correct?—Name withheld, San Leandro, Cal.*

A. You seem to have a good understanding of binaural sound. Mikes are mounted in a dummy head where a person's ears would be. When properly done, a model of the external human ear is actually present on the head. This gives us the proper front-to-back filtering at high frequencies, plus the presence peak which is produced in our own hearing mechanism. The output of the mikes is fed into a tape recorder in the conventional way. Sound is reproduced through a set of good phones, optimally at the same relative sound level as was "heard" by

the microphones. When done correctly, the effects are astounding, much better than most of the quadraphonic systems that I have heard. When properly processed, good speaker-based quad can even be recovered from these binaural tapes, but the effects are not as good as with phones.

Some tricks in playback equalization are required when binaural material is played through loudspeakers. These have to do with the reduction of the presence peak introduced by the head and external "ear." (Editor's Note: For a more detailed discussion of binaural sound, see "A History of Binaural Sound" in the March 1986 issue.)

## Tone Quality and Speaker-Cabinet Finish

*Q. I have a pair of speakers which are finished in walnut, but I want to refinish them in a painted polyester and lacquer. Will doing this distort or change their tonal qualities?—Shane McGinnis, Morgan City, La.*

A. Speaker enclosures are designed to be rigid. They must not vibrate because, if they did, they would radiate unwanted sound along with the desired sound from their cones. The effect of this added output would be to color the sound that you hear. Because adding a new finish will not change the rigidity of the enclosure, it will not affect the sound quality produced by your loudspeaker system.

## Distortion on Phonograph Records

*O'Neal Douglas' problem with inner groove distortion ("Audioclinic," November 1987) may not be a problem with his cartridge or tonearm. The problem could be caused by a dirty stylus, which can lead to severe mistracking. If he always listens to an entire record side, by the time the stylus has reached the inner grooves, it has accumulated 15 to 20 minutes worth of dust and dirt. The problem is exacerbated by playing a record which has been poorly cleaned or by using an album or stylus that is still damp from cleaning.*

*After much experimentation, I have found that I get the best results from using a dry brush on the stylus. In extreme cases, however, I do use a drop of fluid to remove encrusted residue. Similarly, I use a dry, or almost*

*dry, record-cleaning brush and make sure that the disc is thoroughly dry before playing. Also, if you keep the dust cover on your turntable, your records will seldom need more than a quick once-over with a brush.—David Delisle, St. Paul, Minn.*

## Deterioration of Nonpolarized Electrolytics

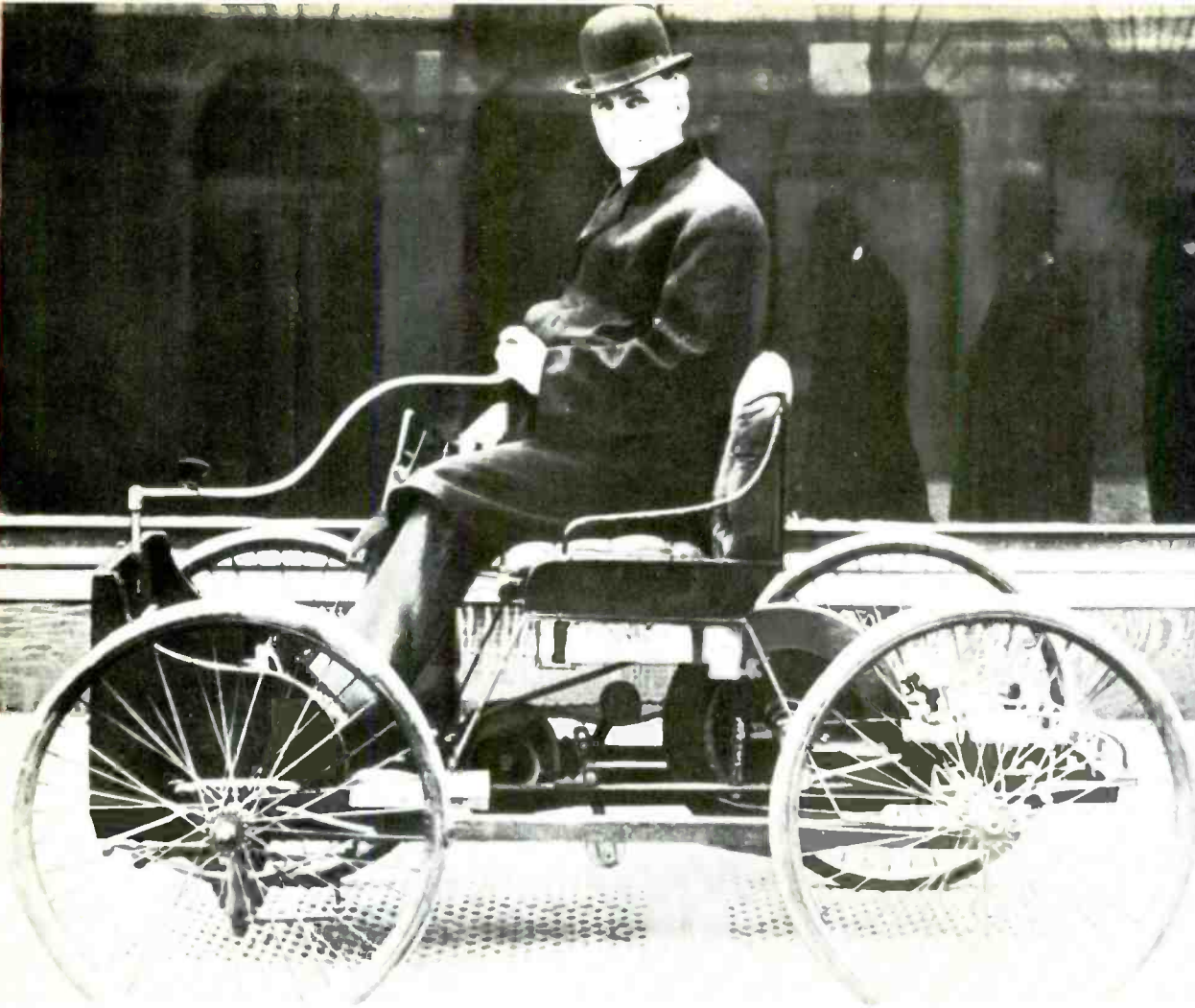
*Q. I have wondered for some time about the possible deterioration of the nonpolarized electrolytic capacitors used in loudspeaker crossover networks. I understand that ordinary electrolytics have a finite shelf life but that they can be rejuvenated by subjecting them to polarizing voltage. Is this the case with the nonpolarized units? What would be the audible warnings of deterioration?—Kenneth Beers, Jr., Trenton City, Ohio*

A. I have not noticed deterioration of any nonpolarized capacitors in crossover networks I have owned. If you believe that the characteristics of a midrange driver or tweeter have changed, it is certainly possible that a change in capacitance values might be the cause. I would think that the values of such capacitors would decrease. In the case of the tweeter, this would probably mean the high-pass cut-off frequency would increase. In the case of a midrange or woofer, more highs would be fed into it as the value of the associated capacitor decreased in value.

You are right about shelf life of electrolytic capacitors that are not in service. In the case of the nonpolarized units, they will be in service whenever you use your loudspeaker systems. Capacitors of this type are nothing more than two electrolytic capacitors back to back, with two terminals of the same polarity wired together. The two free terminals would both be opposite in polarity from the first two. When a.c. is applied to a nonpolarized capacitor, one portion of it will charge while the other conducts. Their roles reverse with each reversal of the input waveform's cycle. A

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362228. George Michael—Faith. (Columbia)



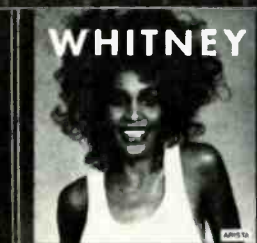
364695. Wynton Marsalis—Baroque Music For Trumpets. (CBS Masterworks)



366443. Various Artists—Good Morning Vietnam. (A&M)

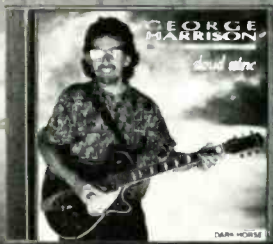


361402. Tiffany. (MCA)



356154. Whitney Houston—Whitney. (Arista)

# A Sound Investment



365494. George Harrison—Cloud Nine. (Dark Horse)



366716. Robert Plant—Now and Zen. (Es Paranza)



365186. James Taylor—Never Die Young. (Columbia)



364018. Foreigner—Inside Information. (Atlantic)

354449. U2—The Joshua Tree. (Island)

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

339226. Gershwin: Rhapsody In Blue, more. Thomas, Los Angeles Phil. (Digital—CBS Masterworks)

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

343665. Debussy: La Mer; Nocturnes—Michael Tilson Thomas. (Digital—CBS Masterworks)

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

344184. Copland: Billy The Kid/Rodeo Ballets—Slatkin, St. Louis Sym. (Digital—Angel)

344622. Anita Baker—Rapture. (Elektra)

345199. Beethoven: Overtures—Bavarian Radio Orch., C. Davis. (Digital—CBS Masterworks)

346544. Kenny G—Duotones. (Arista)

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

347492. Glenn Miller Orchestra—In The Digital Mood. (Digital—GRP)

347567. Gershwin's Song Book & Other Music For Piano Solo—Leonard Pennario. (Angel)

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

348458. Dvorak: Cello Concerto—Yo-Yo Ma; Maazel, Berlin Philhar. (Digital—CBS Masterworks)

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

355164. Vladimir Horowitz Plays Favorite Encores. (CBS Masterworks)

355172. Ravel: Rapsodie Valse/Pavane/Albarada, etc.—Previn, Royal Phil. (Digital—Angel)

348649. Pachelbel Canon & Other Digital Delights—Davis, Toronto Chamber Orch. (Digital—Fantone)

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

349134-399139. Beethoven: Sonatas Piano & Violin, Vol. 2—Stern, Istomin. (Digital—CBS Masterworks)

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

350587. Kathleen Battles Sings Mozart. (Angel)

352534. Halst: Planets—A. Davis, Toronto Symph. (Digital—Angel)

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

354514. Jody Watley. (MCA)

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

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

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

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

355362. Whitesnake. (Geffen)

355578. Hanson: Symphony No. 2 ("Romantic"), Barber: Violin Concerto. Oliveira, Slatkin, St. Louis Sym. (Digital—Angel)

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

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

356667. Heart—Bad Animals. (Capitol)

357640. Wynton Marsalis—Standard Time. (Columbia)

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

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

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

357368. Hiroshima—Go. (Epic)

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

365825. Billy Ocean—Tear Down These Walls. (Arista)

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

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

358127. Kronos Quartet—White Man Sleeps. Valens, Ives, Bartok, etc. (Digital—Nonesuch)

359927. Debbie Gibson—Out of the Blue. (Atlantic)

360016. Spyro Gyra—Stones Without Words. (Digital—MCA)

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

361048. Diane Schuur and the Count Basie Orchestra. (Digital—GRP)

361139. R.E.M.—Document. (I.R.S.)

361147. Rodgers And Hammerstein's Carousel. Barbara Cook; Samuel Ramey. (Digital—MCA Classics)

367102. Joni Mitchell—Court and Spark. (Asylum)

358929. Elton John Live In Australia. (MCA)

358937. Handel: Music For The Royal Fireworks—Yehudi Menuhin, Royal Philharmonic Orchestra. (Digital—MCA Classics/RPC)

359018. Pat Metheny Group—Still Life (Talking). (Geffen)

359075. Aerosmith—Permanent Vacation. (Geffen)

359695. Sarah Vaughn—Brazilian Romance with Milton Nascimento. (Columbia)

359711. Brahms: Piano Quartet, Op. 25—Murray Perahia, Members Of The Amadeus Quartet. (Digital—CBS Masterworks)

361170. Yes—Big Generator. (Arista)

361279. World's Greatest Overtures—Strauss, Suppe, more. (Digital—Pro-Arte)

## Classics of the 50's, 60's and 70's

138586. Bob Dylan's Greatest Hits. (Columbia)

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

231670. Janis Joplin's Greatest Hits. (Columbia)

244459. Santana's Greatest Hits. (Columbia)

246868. Jim Croce—Photographs & Memories—His Greatest Hits. (Sajca)

256560. Cat Stevens Greatest Hits. (Columbia)

260638. Chicago's Greatest Hits. (Columbia)

269365. The Band—The Best Of The Band. (Capitol)

286914. Fleetwood Mac—Rumours. (Warner Bros.)

287003. Eagles—Their Greatest Hits 1971-1975. (Asylum)

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

292243. Jackson Browne—The Pretender. (Asylum)

292284. James Taylor—Sweet Baby James. (Warner Bros.)

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

308049-398040. Creedence Clearwater Revival Featuring John Fogerty—Chronicle. 20 greatest hits! (Fantasy)

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

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

341073. A Decade of Steely Dan. (MCA)

342501. The Byrds Greatest Hits. (Columbia)

351957. Yes—Fragile. (Atlantic)

343657. Chuck Berry—The Great Twenty-Eight. (Chess)

345157. Jethro Tull—Aqualung. (Chrysalis)

346445. Beach Boys—Made In U.S.A. (Capitol)

348110. Buddy Holly—From Orig. Master Tapes. (Digitally Remastered—MCA)

349803. Van Morrison—Moondance. (Warner Bros.)

350645. Rolling Stones—Sticky Fingers. (Rolling Stones)

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

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

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

364935. Traffic—John Barleycorn Must Die. (Island)

367102. Joni Mitchell—Court and Spark. (Asylum)

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359075. Aerosmith—Permanent Vacation. (Geffen)

359695. Sarah Vaughn—Brazilian Romance with Milton Nascimento. (Columbia)

359711. Brahms: Piano Quartet, Op. 25—Murray Perahia, Members Of The Amadeus Quartet. (Digital—CBS Masterworks)

361170. Yes—Big Generator. (Arista)

361279. World's Greatest Overtures—Strauss, Suppe, more. (Digital—Pro-Arte)



## DAYS OF WIRE AND WORKSHOPS



Illustration: Michael A. Donato

**W**hat was it like in the early days of hi-fi—which were the early days? Double take? Not for those who were there. The time, for instance, which I spent in a tiny place called the Electronic Workshop, the first of that name. That was very much in the “early days.”

Recently I ad-libbed for an entire Saturday afternoon on this very subject (and on some more recent days) before a group from the L.A. section of the AES, mostly young people working in the hub of the audio universe, which centers on the local smog. As you may guess, all was up-to-date—every word I said, and they said, was recorded on a DAT cassette machine of remarkable compactitude. In this fashion, our historical vista of the “early days” was neatly expanded right past our present front edge.

How can we put a date upon our beginning? As I’ve often noted, the term “high fidelity” was already common in the middle ‘30s, and many of the basic elements were already astonishingly well advanced by then—mikes, amps, speakers, FM, even stereo discs. Nevertheless, I have no doubt as to when we really began. It was just as soon as we could after WWII. Which means 1947 (when this magazine first appeared) and, give or

take, a good hunk of 1948-50. Those were our real “early days.”

Before that time, before the war, there were components galore available to the savvy consumer, bits of excellent fi here and there. But the public audio chain was still fragmented except in the few esoteric labs and the equivalent. Thus, practically nobody heard good sound, the end product. Missing links; better call them bottlenecks. But once we recovered from war, in that brief period from 1947-50, we closed up the vital gaps, pried open the bottlenecks (the LP did it for a major area in 1948), and at last, mixing metaphors, brought the entire audio chain together for the general consumer in a reasonable form. Nothing perfect. But we did at last produce a real hi-fi sound—rational, affordable, obtainable—for the home living room.

We had newly dedicated people, too. Like myself. And those who avidly “consumed” hi-fi in their homes. Of course there also was many a skilled hobbyist in his lab, not to mention throngs of engineer pros who suddenly saw Opportunity opening wide. In those special days, all of us sensed the beginnings of a new whole out of the fragments of the past, a whole new system, growing past the old home radio and phonograph toward much

higher sound quality and diversity. It could be a dynamic thing, and soon was, perhaps paralleling (speaking of consumption) the food industry in all its interlocking action. From the farmer’s seedling to the homeowner’s mouth. From live calf to veal parmigiana. This, I say, was our consuming inspiration in our first days and years! It kept us enthusiastic and inspired our new customers.

If the term “high fidelity” was old in the 1930s, “hi-fi” as a contraction came only in those postwar years, as a convenient monicker for everything we had to offer. I was amused in 1953 to find it already in France—where it was called “hee-fee.” Easier for the French tongue. Our own new terminology seemed to get more inaccurate and confusing as we joined battle with our enemies in lo-fi. For a long while, we sold what we called Separate Units, as opposed to one-piece lo-fi, the standard consumer audio. “Separate units” was loaded with sarcasm. The hated old-style radios and phonos were scornfully labelled “commercial.” Weren’t we out to be commercial too? As soon as we could?

The distinctions did hold some truth, needless to say, while we struggled to get our business started. But we were equally scornful of mass-produced audio, merely reflecting the fact that we could not yet manage mass production ourselves!

True, the sonic quality of most old-type equipment was indeed held down to a remarkably rigorous low standard, the public being quite willing. No bass, or merely boomy bass; no highs, deliberately muffled for a smooth-as-butter sound that hid multiple distortions as well as most musical tone quality and all the sibilants of speech. It was a useful system. Great industries had been built upon it; the big outfits saw no reason to change. There was indeed a vested interest in this mediocre, if serviceable, audio. Thanks to success, it was both commercial and mass produced. What else?

So it followed that we, in our new and high-minded quality consciousness, were strictly noncommercial, which really meant “not like *them*.” And perforce, we were also far from being mass-produced, like *them*. It was the terminology of envy, if you ask me.



Why is it that the simplest ideas are always the hardest to explain?

Ivor Tiefenbrun had already turned the hi-fi industry on its head once before. You'd think they'd have been ready for him this time.

With the Linn LP12 turntable he'd set a new standard for the industry to strive for.

No longer were they **flummoxed** by the idea that listening is the only way to judge a turntable.

No longer was Ivor shunned at the annual American trade shows.

They wined him. They dined him. They called him the Analogue Guru of Glasgow.

But no one could understand a word he was saying. Needless to say, the **confusion** was entirely mutual.

From Ivor's point of view there were two main **enigmas**.

Why was it that Americans were buying loudspeakers without direct listening comparisons? And, why do they change the rules of ice hockey after every inning?

Realising that it would be easier to solve, he started with the first **question** first.

Ivor knew that, to change this situation, he would have to bring the industry on board with him.

So he told them a wee bit about his Isobarik DMS loudspeakers and asked them to have a listen.

But they were too **baffled** by the Isobarik's radical design to sit down and listen. No one could understand why there was a second bass unit hidden inside the cabinet.

Which certainly didn't stop them from questioning it.

In fact, they had a field day. Some people even took them apart and tried to put them together again. Which was an unmitigated disaster since, in order to work, they must be kept airtight.

But it was a good lesson learned.

When the Sara 9 loudspeakers were introduced few people bothered to try and carve them up.

Instead they contented themselves with plotting frequency response graphs.

These graphs confirmed Ivor's earlier **hypothesis**. Namely, if you feed a signal into a loudspeaker, it will produce a sound.

## THIRTEEN YEARS AGO

## THIS MAN CREATED A

## LOUDSPEAKER IN HIS OWN IMAGE.

The one drawback these graphs have is that reading them gives you absolutely **no clue** as to what the sound actually sounds like.

Only one research method exists for doing this. In Scotland we call it 'listening.' Ivor begged them to try it. His critics found this suggestion highly irregular.

Ivor knew that if he wanted them to understand his feelings of anguish and **frustration** he would have to 'speak their language.'

"Having people misunderstand your life's work is like watching your favourite linebacker miss the convert in the bottom of the ninth when the bases are loaded."

## IT BECAME THE MOST

## MISUNDERSTOOD PRODUCT

## IN THE INDUSTRY.

To which everyone nodded politely before asking to see how the new Nexus loudspeaker performed in **anechoic** conditions.

**Exasperated**, Ivor explained the acid test he applies when comparing loudspeakers.

(The steps outlined in the next three paragraphs are perfectly safe and may be conducted in a softly lit room.)

Only one pair of loudspeakers should be in the room at the one time. Otherwise, when one pair plays, the other

pair will vibrate and the sound will be **distorted**.

Once everything is set up, sit down.

Listen.

Consider the performance of the loudspeaker. This may be done over a cup of coffee, or, if you prefer, tea.

Musical qualities are the only sensible criteria for judging hi-fi.

So, ask yourself qualitative questions like, do all the musicians seem to be playing together? Are the bassline and melody easy to follow?

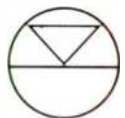
Anyone can hear the difference between good and bad hi-fi. All you have to do is listen.

This fundamental belief is at the root of everything we do. And it governs the design of all our turntables, tonearms, cartridges, amplifiers and loudspeakers.

Equipment comparisons, using a single set of speakers, (see paragraph 28) 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.

These days it seems incredible that anyone ever questioned something so overwhelmingly obvious.

But, as Ivor often says, "When you have more than three bases to run on the seventh down you can't afford to risk a penalty for **frosting**."



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HIGH FIDELITY  
YOU'VE NEVER HEARD IT  
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- I found the chapter on anechoics most fascinating. Please send me product literature on the entire Linn range.
- I can't quite work out what to do with this coupon. What do I fill in if I never want to hear from you again?

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**Even before World War II, components galore were available to the savvy consumer, but the chain had missing links.**

Yes, our early products—what with big vacuum tubes in quantity, large resistors and capacitors, clumsy “pilot lights” for illumination, quantities of twisted wire and hundreds of soldered connections—were necessarily hand-made. Not really mass-produced, like the deliberately simple audio of the big, old outfits. (Look at the bottom of any old radio or phono of the day.) We were stuck with quality; that was our business. And the circuit complexities, on an uncompromisingly macro scale, were formidable. Hi-fi, at that point, was definitely unminiaturized. It was assembled by hand, many hands, in all its complexity.

Now this is where I came in. With my usual happenstance luck, I discovered a brand-new little hi-fi “factory” only a couple of blocks from my home in New York City. It was in a storefront on upper Bleecker Street, the Village, maybe 10 or 15 feet wide, going back into a dark, narrow interior. *This—a factory?*

Indeed it was, and set up to mass-produce an excellent and fairly revolutionary power amplifier—the Electronic Workshop’s A-20-6, designed by the late Howard Sterling, an electrical engineer from Columbia University with a brilliant, if high-strung, audio mind.

That little factory personified early hi-fi. Others may have been bigger, a few maybe less cluttered, but all shared the awful problem and challenge: How to make reliable, consistent products out of the enormously clumsy and intractable raw material of hi-fi. Most particularly, the big, hot tubes, the fat capacitors and, below, beneath the chassis “floor,” a hideous jungle of twisted wire, solder, inextricably tied into masses of resistors and all those tube connections. There was even an aesthetic conflict: Neat, parallel wiring made a pretty sight, but was it always the shortest route between two points? Not in that situation! How could you produce even two units remotely the same, out of such intricacy?

Nevertheless, hi-fi built itself, in the early days, upon this very basis, somehow teaching each individual assembler to put the mess together step by step, connection by connection. Not easily imaginable, I think, for today’s consumer, tinkerer, or audio engineer. So much is now prefabricated and virtually robotized. But I saw it in all its

fascination, and even tried a few solder joints myself. What an art! To this day, my solderings are mountainous and mostly confined to electric light or toaster problems. I have an awe, still, of those who can neatly solder up dozens, hundreds of connections and then turn the power on without an explosion.

The Electronic Workshop was a hive of activity from morn until midnight. The pay must have been a pittance, but the employees scarcely ever went home. There were little work stations in every corner, crowded with pieces of amplifier and tomato cans full of parts. The floor was a mass of leavings, bits of wire, globules of solder, stray elements unidentifiable. And everybody *talked!* I was fascinated and never learned so fast, even if a lot of it was hokum. Today, I feel that at that point I was within the very germ cell of high fidelity in the making, the concentrated early essence of our whole movement. Other essences there surely were. But none more essential.

I was then in my first years with this magazine, and very conscious of it, though naive in the technicalities of our business. I was, you recall, a record reviewer, classical. My official business was music. But audio, of sorts, had been injected into my reviews well before. My box-type review format in *The Saturday Review*, each week, had a separate column marked “Engineering” next to the one called “Performance,” and I expect I was the first to set things up that way.

So, of course, everything I was learning, right or wrong, went straight into my record reviews and into “Audio ETC,” when that came along. In turn, the kids at the Electronic Workshop respected me as a sort of odd co-worker, and soon I was spending vast amounts of time there, eagerly swallowing up all the latest in audio gossip. Plenty of other audio people streamed in and out, and the high talk never ceased, if the soldering often did.

In time, my happy status led to further connections—thank goodness not financial. I was given the loan of one of the big amplifiers and other goodies. The A-20-6 became central to my fi. (I also owned an Austin A-40, but it was definitely not an amplifier.) The amp was a real beauty for its day, however—big, heavy, with impressive

oversized tubes (6L6GA) and two monumental black steel boxes at the ends, two super-transformers for power and speaker output, both state of the art. That, I know, was basic to the Sterling design and had much to do with the quality of the output. Transformers were a serious hi-fi concern then, one of the major weak links in standard commercial radio and phono equipment (even the most expensive). I quickly learned to look down on those small metal boxes that stood on top of cheap P.A. equipment or in the far inner corners of expensive standard consoles. This amp was out to upgrade that weakness and surely did.

I think, too, that Howard Sterling’s design emphasized a (relative) simplicity—that is, compared to other high-quality audio amps. Was *that* a virtue! But simplicity in hi-fi was not very simple. I marvel that my Workshop A-20-6 did not go up in smoke or quit, so far as I remember.

Sterling was a near-genius in design but a poor organizer and a worse shop manager. He did both, with only one partner, an equable soul named Alan Sobel, who later worked for Zenith TV and was rumored, long ago, to have a “flat screen” non-tube TV system in hand. Zenith didn’t, and Al moved on to found his own company, Waveforms, also with Sterling. Al kept things reasonably calm at the Workshop; Howard Sterling was mostly on the verge of hysteria amid the flying solder. The place was a madhouse, if ever so stimulating. In time, Sterling designed me what came to be called the Canby Monster, a control system for my home activities—God knows which, at this point. It was delayed and delayed (I kept changing my mind), and all I can remember of the final debacle was that somehow the tone controls got wired into the main volume. We had an enormous fight, and that ended the Monster.

The A-20-6 did well and a good many were made, but chaos finally prevailed, at least financially. A lawyer served me with papers to reclaim the loaned equipment, the place shut down, the heady conversation ceased, and all was lost. I was desolate. A piece of my life fell away.

I owed a great deal to that Electronic Workshop, and it wasn’t money. **A**

# The AR Expert

**Name:** Mark Nazar

**Occupation:** Chief Engineer

**Years with Teledyne Acoustic Research:** 7

**Objective:** Design quality into AR products

**Q.** When you're designing a loudspeaker, what do you think is most important in terms of quality to the consumer?

**A.** You always have in mind how the system will be utilized out in the field. What kind of environment is it going to be put into; what kind of amplifiers; what size of amplifiers it may be driven with. You start to design the loudspeaker itself with that in mind using high temperature adhesives and different assembly techniques to ensure the longevity of the product. Once we are certain all of the individual components will contribute to a good reliable product, we can start to concentrate on the most important aspect of the design: sound quality.

Sound quality is such a multi-faceted type issue. There are so many different elements involved. You have the loudspeaker drivers themselves and all of their associated elements — the cones and coils and adhesives and everything else. You have cross-over networks and they have a variety of components that make them up as well and we have established certain guidelines and specifications for all of those components. And then there are cabinets. We're learning more and more about the reradiated effects of the cabinets after they start to resonate. We're using the resonance dissipation grooves on the inside of the cabinet to help control these effects as well as acoustic blankets which help control reflections off the grill frame, etc. That in turn helps to give more precise imaging characteristics. All of these design elements are considered and refined until a close approximation of the final product is arrived at. Once we reach that point the product is completed using the ultimate measuring device, the human ear. Once extensive listening sessions are complete, the final hurdle for every system is the AR power test.

**Q.** Explain how Acoustic Research does the power testing.

**A.** Our power test is configured to be representative of typical amplifiers that you can find out in the marketplace. What we do is take a loudspeaker and we assign it a value. Say we want the loudspeaker to carry a 100 watt rating. Going into the power test, we calculate what

voltage the amp will be running at in order to deliver 100 watts to the speaker. We multiply that by  $2\frac{1}{2}$  times to assign a peak power rating for the test itself. A 100 watt rating on a loudspeaker will actually be driven at 250 watt peaks. We set the system up in the power test room and the amplifier is calibrated to clip 10% of the time using an actual music album that was also carefully chosen for its energy content. It provides a typical energy spectrum where most of the energy is fed to the midrange units. The bulk of long sustained type energy is fed through the bass units and typical energy spectrum is fed to tweeters found on a wide variety of music albums on the market.

The test is set up and it is run for 500 hours continuously. The product must withstand the test. It must pass in good order without any failure whatsoever. If there is a failure, we'll go back into the system to determine what was the failure mechanism and make the appropriate changes until the system will pass the test. What this had led us to is a very small reject rate or failure rate out in the field due to excess of power being fed to the speakers. It is generally said that when we put a power rating on a

loudspeaker, that's really what it will do. Some other manufacturers may rate their loudspeakers in peak watts which is kind of unfair because the consumer doesn't really know what peak watts means. He sees peak watts and he says — 100 peak watts; that means I have 100 watt amplifier — no problem. And they go and they wail on their loudspeakers and break them.

**Q.** Characterize Acoustic Research loudspeakers in the "quality designed in" concept.

**A.** Acoustic Research loudspeakers have been designed over a long period of time when you look at the company, because we learn continuously and that knowledge is passed from one person to another so it always builds. So today's Acoustic Research loudspeakers really represent the best total package loudspeaker value we have been able to design in our 34 year history. It includes everything we've been talking about. It's quality, longevity, it's everything; it's good looks, integrity — the whole package.

Loudspeakers are much more complicated devices than people really understand. So many think it's an art. It is an art, but there's a lot of good engineering common sense in a loudspeaker as well. And you have to keep pushing forward with the technology to keep the quality level up.

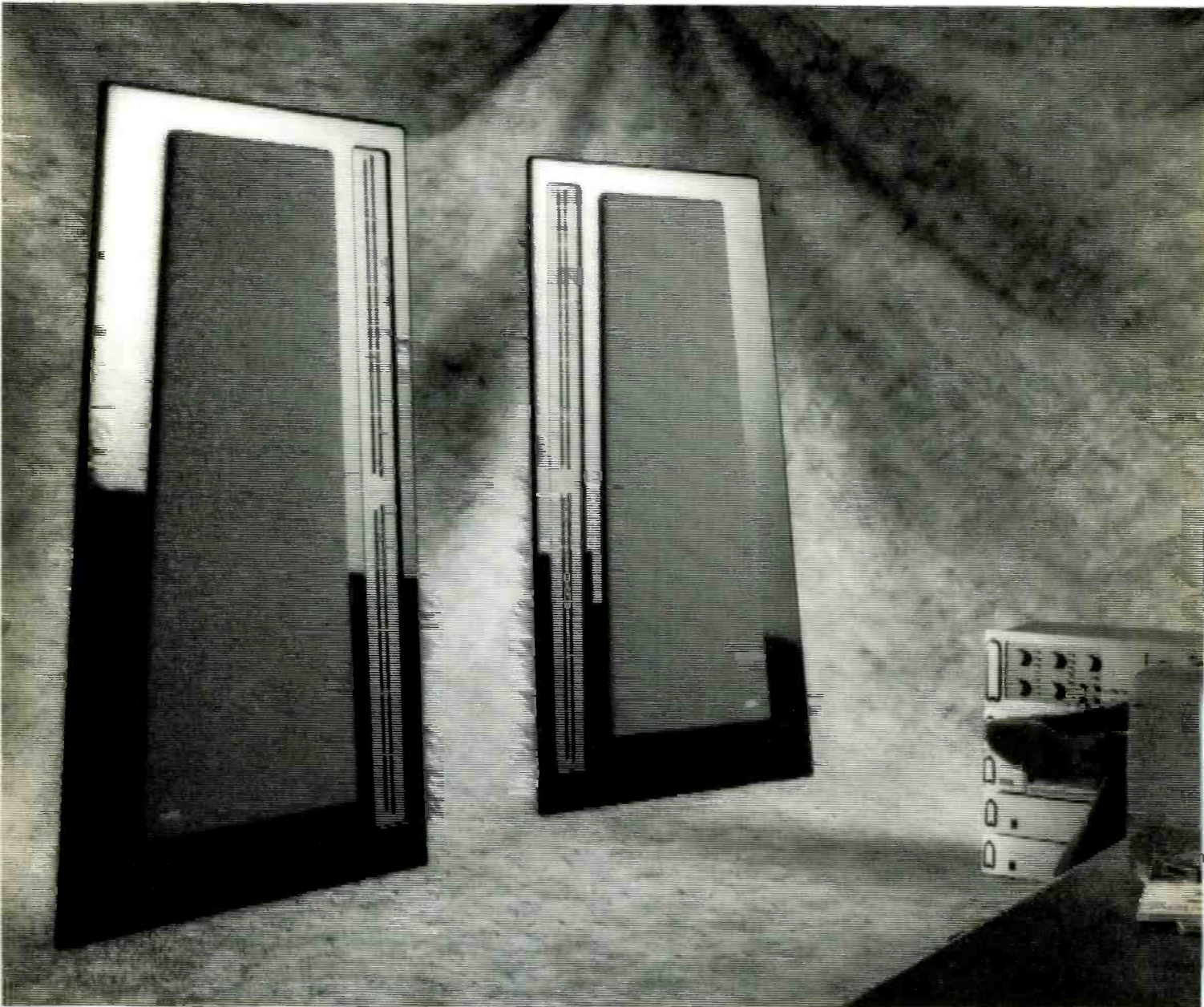


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# Amazing.



## *How it works.*

*A brief conversation with Bob Carver:*

*Q. How can The Amazing Loudspeaker put out so much powerful, extended bass?*

*A. Brute force. A total of 8 subwoofers, each with 4 times the excursion of regular bass drivers for a total displacement (area times excursion) of almost 2000 cubic inches. The low frequency 3dB point is 18Hz!*

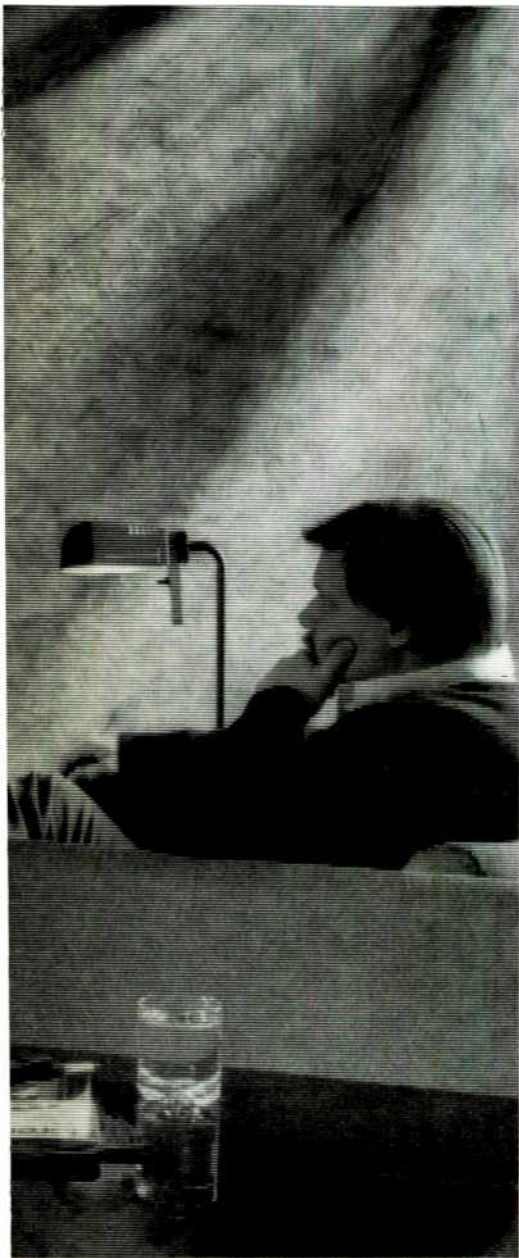
## *Q. Why use a ribbon driver?*

*A. Because the sound of a ribbon is nothing short of glorious! Free of individual driver anomalies and crossover problems, the Amazing Loudspeaker's extended line source driver delivers a majestic sonic image that literally floats in 3-dimensional acoustic space. Simultaneously, it reproduces an amazing amount of musical detail that's simply unmatched by any point source driver.*

POWERFUL

Distributed in Canada by: **evolution**  
technology





*This is not a typical speaker ad. Because The Amazing Loudspeaker is anything but a typical speaker:*

This isn't even a typical Carver ad.

True, the Amazing Loudspeaker breaks so many conventional speaker rules — and succeeds so spectacularly at it — that we're tempted to fill this ad with a litany of hertz, watts and exotic buzz words the way our competitors' ads do.

*"Its overall sound is spectacular, its bass performance surpasses that of almost any other speaker one might name."*

STEREO REVIEW

Because there's bound to be quite a story behind a speaker that's 5½ feet tall and yet just 1½ inches thick. Especially when Bob Carver has a hand (or rather two hands, both feet and a year or so of lab time) in its creation.

But ingenious design is only our means to an end. The beginning of a dramatic awakening that will re-define for you the very essence of music.

*"The image is as wide, deep and multi-layered as I have ever heard. Only Infinity's \$35,000 Reference Standard impressed me more."*

Henry Hunt  
The Fidelity Editor  
HOUSTON POST

The Amazing Loudspeaker can etch a sonic image so detailed you can almost see rosin drift from a bow onto the polished surface of a violin.

It can brighten your listening room with the sheen of a #4 drumstick on a Ziljan hi-hat cymbal. Or darken it with the smokey midnight growl of a battered baritone sax.

*"It solves certain design problems and achieves certain sonic results with a simplicity and flair that can only be called, well, amazing."*

Peter Aczel  
THE AUDIO CRITIC

It can stun your senses and rearrange your furniture with thunderous salvos of tight, perfectly controlled low bass.

It can meticulously separate every instrument and vocal on a dense, multi-track mix and project each in sharp relief at precise points across the sound field.

In short, the Carver Amazing Loudspeaker restores what time and reading too many speaker ads often takes away:

Sheer wonder.

*"It's price is ridiculously low for what it does and... what comparable products cost."*

Ingrid Ursch  
STEREO REVIEW

We have merely touched on the highlights of this truly amazing loudspeaker. We'd be happy to send you more information including reprints of several great reviews.

However, if your immediate interest is the sensation of a listening room melting away to reveal the crystalline clarity of pure music, you need only visit your nearest Carver dealer.

Your amazement will begin when you discover just how affordable the Carver Amazing Loudspeaker really is.

**CARVER**

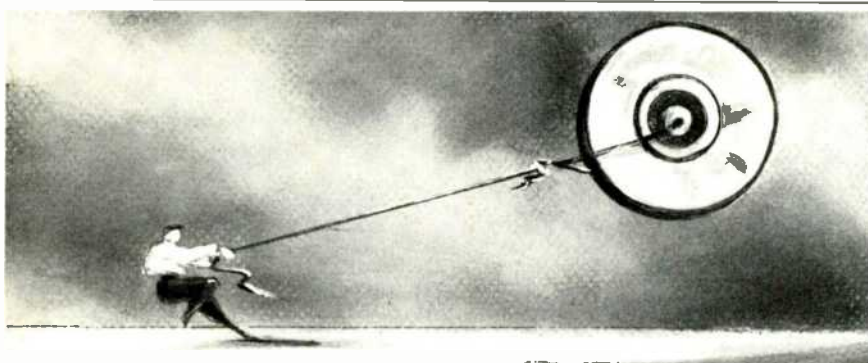
ACCURATE

MUSICAL

*Q. But aren't ribbon drivers inefficient?*

*A. Not when designed with enough magnetic field strength. Each Amazing Loudspeaker ribbon uses 30 feet of high energy magnets in a special focused field gap. At 82dB efficiency, that's almost twice as efficient as any other ribbon that goes down to 100Hz. Our M-101 power amplifier yields peak SPLs exceeding 106dB; up to 110dB with an M 1.5! More than ample to deliver a symphonic orchestra's sonic power, fifth row center.*

## CD IT YOURSELF



### Comes the Revolution

The R-DAT system may soon have a strong new competitor—the Compact Disc. Ever since CD first appeared, major electronics companies around the world have sought a way to make discs that could be recorded and, preferably, erased for reuse. About a year ago, Philips announced that they were making progress toward that goal, but on April 21, Tandy Corp. announced that they had developed a practical system called THOR-CD (for Tandy High-Intensity Optical Recording). Further, Tandy is prepared to license the system to other companies for production of recorders and blank discs. While other optical recording systems are already on the market, their discs cannot be played on standard CD and CD-ROM equipment. Tandy estimates that THOR-CD audio recorders could be available in 16 to 22 months, and could cost perhaps as little as \$500. Computer data (CD-ROM) recorders would come about a year later.

Little technical information about THOR-CD is yet available. However, Tandy did announce that the system uses a dye-polymer material—an approach which has also been pursued by other labs. According to *Business Week*, Tandy later admitted that THOR-CD is based on technology licensed from Optical Data Inc. in Beaverton, Ore., but with "a secret ingredient to the sauce." The biggest challenge, Tandy's Dr. Joel Finnegan told me, was giving the disc sufficient reflectivity to meet CD Standards. Asked how many times the discs could be erased and rerecorded, Robert McClure, president of Tandy Electronics

Manufacturing, said that tests had been going on for some time, but, "We have not yet found a cycle limit." As to disc prices, McClure said that THOR-CD "is a relatively inexpensive process, but we don't know the yield yet." He did say discs are "expected to be less expensive than alternate digital audio formats, including DAT."

THOR-CD was greeted with mild to great enthusiasm, but it still has some hurdles to clear before we can buy Compact Disc recorders at Tandy's 7,000 Radio Shack stores, or elsewhere. The first hurdle may be opposition from the Recording Industries Association of America, which has been fighting DAT ever since that medium was announced. The fact that home DAT machines can't record with CD's 44.1-kHz sampling rate—to keep them from making bit-for-bit clones of CDs—has not mollified the RIAA. They will probably be even more unhappy about a digital format that will *have* to be recorded at 44.1 kHz to remain compatible with existing CD players. Recordable CD will, however, overcome the record industry's unspoken objection to DAT: If recordable CD swamps DAT, the industry won't have to invest in new equipment to produce prerecorded digital tapes.

Competition from other CD-recording systems could prove a problem, too. Tandy is apparently not prepared to make their own recorders and is therefore dependent on other companies to produce THOR-CD equipment. If Philips isn't too far behind Tandy in developing recordable CDs, they're likely to produce their own system rather than license THOR. The Japanese

electronics industry also seems likely to go with a Japanese-developed system, if one arrives soon enough, instead of licensing one from the U.S. And offhand, I know of no U.S. company with both the capacity and the inclination to produce home recorders of any type. This doesn't mean that several CD-recording systems could not coexist: Blank discs would be incompatible with recorders built for other systems, but all recorded discs would be playable on any of the hundreds of millions of CD players now in use.

The remaining competitor, of course, is DAT. Will audiophiles who want digital recording buy DAT now (assuming it's unleashed in the U.S. market) or wait for recordable CD? Digital tape offers the advantages of about 50% longer recording time, greater compactness, and more convenient handling. Another advantage is that it's already in production and will reach the U.S. market as soon as the political climate allows.

In the car, DAT's easier handling and turtle-like protective cassette may give it the edge over CD, although some experts worry about the effects of moisture and dust on DAT mobile decks. For portable recording, DAT's compactness may prove decisive. And, of course, DAT already is in production.

The list of Compact Disc's advantages, however, is even longer. Recordings, players, and (if Tandy is right) blank media are likely to remain less expensive than their DAT equivalents, though the gap between them may narrow. Compact Disc playback equipment and recordings are everywhere you look, while DAT players and recordings are just trickling onto the market. (And while CD recorders are probably at least two years away, it could be as long as another year before we can buy DAT recorders in the U.S.) Optical discs are inherently more durable than tapes, but the DAT cassette may prove better protection against accidental damage. Discs have more space for liner notes. And for interactive or computer-data uses, discs will always offer faster access than tapes do.

*"Is the tide coming in or going out?"*

*"I don't know. The last thing I remember is you turning up the stereo."*

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Ears can indeed be trusted more than measurements, especially if you're not measuring the right thing.



### TV for the Blind

Just listening to television, you can follow most of what's going on—but not everything. To the blind, fight scenes are meaningless sequences of thumps and gunshots, Western chases mere flurries of hoofbeats (though the music often tells what's happening), and long documentary sequences are often just interludes of music. But now, thanks to a new Descriptive Video Service, some programs will gain more meaning for the sightless and for those with limited sight.

The new service will broadcast oral descriptions of scenes and action over the little-used Second Audio Program (SAP) channel which accompanies stereo TV broadcasts in this country. According to *The New York Times*, approximately 9.2 million TV sets with stereo and SAP decoders are already in use in the U.S., and another five million may be sold this year. The Descriptive Video system was developed jointly by Boston's WGBH television, the Public Broadcasting System, *American Playhouse*, and the Washington Ear, a reading service that provides narrations for blind theatergoers at Washington's Arena Stage.

Descriptive Video accompanied January's broadcast of "Strange Interlude" on *American Playhouse*, over PBS stations in nine cities, including Boston, Cleveland, Dallas, Milwaukee, New York, and Washington, D.C. More DVS broadcasts are planned.

### Small Amplification

Just after my February column appeared, I got a letter from Dr. Richard Small of KEF amplifying something I'd quoted him as saying. ("We cannot hear distortion" had been his comment). He writes:

"We do, of course, hear distortion products caused by . . . nonlinearity. What we do *not* hear is the distortion *rating*, typically a figure obtained from THD or IMD testing with sine waves at maximum (just below clipping) level. We usually listen to music or speech at levels lower than this (but sometimes higher; i.e., clipped).

"Some distortion mechanisms are 'memoryless'; others are more complicated. Some cause distortion to increase with level; others (e.g., crossover distortion) cause it to decrease.

"So ears can indeed be more trustworthy than ratings or measurements, particularly measurements of the wrong thing. Good ears will give consistent results in double-blind testing, and I believe (as do most sensible engineers) that such consistent judgments will always have a basis that can be verified by an appropriate measurement.

"This doesn't mean that THD measurements (for example) are useless. They can be very helpful. But, like all measurements that are reduced to a single number (such as reverberation time), a lot can be hidden in the process."

### The 10k-Chip Barrier

Until the IC era, the same circuit components were available to both small and large manufacturers. That's still true for most components, including those standard integrated circuits available off the distributors' shelves. Large companies, however, can also afford to make or order custom-made ICs. According to an engineer at one such firm, a custom IC isn't cost-effective unless you can use at least 10,000 of them. For him, that's no barrier. But for small companies with short production runs, it's pretty much out of the question.

Admittedly, some small, high-end manufacturers avoid ICs for other reasons, feeling that they don't sound as good as discrete, preferably hand-picked, components. But even those companies might be able to use custom ICs in *control* circuits, if they could afford to buy enough of them.

They may, in fact, be able to use them fairly soon. *Electronics* magazine has reported on a number of new systems to speed up the cycle from circuit design to chip production—and in capital-intensive industries, faster tends to be cheaper, hence more practical for smaller orders. This won't erase the price difference between ICs made in small quantities and those produced on a massive scale. But it should whittle that difference down enough to make custom ICs available to companies that once couldn't afford them.

### Cheep Trills

Birds don't chirp on schedule, which makes them hard to tape. The time-honored approach is to set a recorder running and shut it off when the bird song or the tape runs out, whichever happens first. That's the easy part—then you must laboriously edit out the long breaks between bird songs.

Sound-activated tape decks minimize the editing, but they usually take so long to get rolling that they miss the first note or two. If you could predict what the birds would do, you could make the deck start just *before* the signal reached its input. Failing that, you'd get the same effect if you could keep the signal from reaching



the deck's input until after the tape got up to speed. That's how Dr. Stephen Nowicki, of the Rockefeller University Field Research Center in Millbrook, N.Y., is doing it. After his mikes pick up a birdcall, the signal is split between sound-activation circuitry, which starts the tape, and a digital delay line, which does not feed the signal into the deck until the tape has reached full speed.



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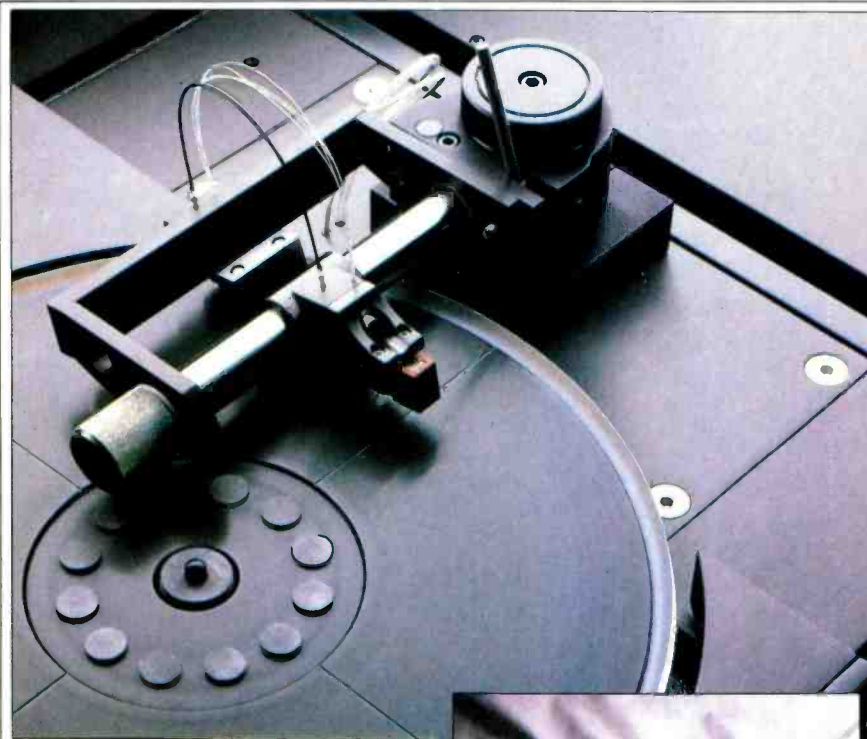
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**Where to buy Polk Speakers? For your nearest dealer, see page 26.**

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BERT WHYTE

## SYNERGETIC SPINNER



**F**rom a purely musical viewpoint, the vinyl LP is still the "mother lode," a repository of great music, of music familiar and music obscure and esoteric. A great amount of this music may never be recorded anew or transferred to CD. To make it short, my interest in state-of-the-art record players is in mining the vinyl treasure vein and optimally enjoying the great music inscribed in record grooves.

John Bicht heads up Versa Dynamics and is the engineer and designer of the extraordinary Model 2.0 record-playing system. He is a man of many parts, with impressive credentials in the audio field and in high-tech mechanical engineering. Bicht lived in England for some years and, among other things, was responsible for the highly regarded Mission 774 LC pickup arm and subsequently helped in the development of several Mission loudspeaker models. He devoted 18 months of original research to an innovative turntable design that incorporated many novel features.

Temporarily disenchanted with the hi-fi business, Bicht got involved with the development of such diverse mechanical engineering devices as an



electric taxi and an emergency exit door for the Hong Kong subway trains. About four years ago, he set up Versa Dynamics in Warminster, Pa. and began the research that culminated in his Model 2.0 record-playing system.

When Bicht installed the 2.0 in my audio system, we had a chance to discuss his design philosophies and to critique some well-known turntables. We got along famously because we quickly found ourselves in total agreement on one cardinal point: That in all audio equipment, but most especially in record players, spurious and unwanted resonances are the deadly, implacable, omnipresent enemy of good sound quality. Thus, it came as no sur-

prise that the suppression or elimination of resonant coloration was Bicht's overriding consideration in designing the 2.0 player.

The Model 2.0 is indeed an integral system, with three major components working together synergetically. These three parts are an air-bearing turntable and an air-bearing, lateral-tracking pickup arm; a control box fitted with electronic circuitry and pneumatic elements, and an air-compressor unit.

The main structure of the turntable chassis is made of a laminate of end-grain balsa wood and aluminum sheet. A pair of the laminated structures are bonded to each other, with a sheet of a high-hysteresis polymer between them, and this provides constrained-layer anti-resonant damping. The entire turntable chassis is treated for six hours in an industrial oven, in four separate operations, each using different epoxy adhesives. The result is an inert chassis of great rigidity.

The turntable platter is also a laminate, of cast aluminum with an acrylic top plate, with constrained-layer damping. When struck with a fingernail or pencil, this very inert platter does not exhibit ringing.

One of the most novel features of the 2.0, and a major contribution to its high performance, is a precision air bearing. This bearing is similar to that used in inertial navigation satellites, and it is quite large, being 4 inches in diameter. High-pressure air (about 28 psi) and pre-loading vacuum for stabilization are fed to the bearing from a quarter-horsepower remote compressor! This type of air bearing has immense rigidity, with a stiffness in all directions exceeding 100,000 pounds to the inch. It also is critically damped in all axes, helping prevent fundamental platter resonances. Incredibly, the operating clearances on this air bearing are 250 millionths of an inch!

Low-level vacuum is ported through the bearing, to inner and outer gaskets on the turntable platter, to provide record hold-down. While vacuum hold-down is a significant help in reducing resonant coloration, studies have shown that even with a low-level vacuum, dust particles can be imbedded in the surface of the record in contact with the hard platter, thus causing impulse noises. Therefore, the 2.0 has a



The Onkyo TA-RW490.  
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## TO MAKE THE JOURNEY SHORTER—

For most people, the so-called dubbing cassette deck is an example of frustration in action. That's because the promised convenience is more often offset by poor results.

To correct this, the new Onkyo TA-RW490 is a fundamentally different design. Rather than follow the conventional approach of adding an inexpensive playback-only transport to an existing deck, Onkyo combined two high quality decks in one chassis. This gives the TA-RW490 performance advantages unavailable anywhere else. And gives you the benefit of uncompromised sound quality.

Each two motor, auto reverse transport can record either simultaneously or sequentially. So you can make two recordings at once. Or one continuous recording up to four hours long.

The TA-RW490 is the first dubbing cassette deck to feature

Dolby HX Pro. This innovative system enhances a tape's ability to handle the extreme dynamic range that occurs when recording from today's demanding digital sources.

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The turntable's design simply exudes "high tech," and its performance lives up to its appearance.

novel dust-imbedded mat, made of a proprietary material that has a very low yield strength. Dust particles up to 0.01 inch (about two or three times thicker than a human hair) are imbedded in the mat rather than in the PVC of the record. At the same time, the mat's high modulus of elasticity prevents resonance and vibration in the record.

A 400-pole motor is rigidly attached to the turntable chassis, with the platter driven via a flexible urethane belt. The motor is driven by a proprietary microprocessor-governed synchronous system, and motor speed is independent of line frequency since its signal is derived from a quartz crystal. Motor wires and air hoses extend through the chassis base in a 6-foot umbilical cord which connects to the control box.

In the 2.0's air-bearing lateral-tracking arm, the design goal was again the elimination of resonances. The typical low-frequency resonance is avoided by using a stubby arm structure shorter than 3 inches. Thick wall construction in the arm and magnesium headshell reduces high-frequency resonances. The arm is connected to a high-pressure air bearing, and 45 pounds of air are supplied to the bearing from the compressor. While the air bearing has near-zero friction and is free to rotate and slide along a precision-machined shaft, it has enormous rigidity. It is also critically damped radially, with the headshell and headshell mount precision lapped to provide rigid coupling. The entire arm structure swings forward 90° to a magnetic stop to allow record changes. It then is pushed back to the playback position, where it encounters a very powerful neodymium magnet to hold it rigidly in place. Cueing of the arm is via a manual lever. Easy-to-perform adjustments are provided in the arm for height, VTA, cartridge tilt, tangency, and tracking force. For these adjustments, no alignment gauge is needed other than a tracking-force gauge. All signal wires are van den Hul silver. Gold-plated RCA phono connectors and a five-way ground connector are provided on a plate at the rear of the base-plate.

The chassis/turntable/arm is isolated from structure-borne vibration and feedback through a four-coil compression spring system which gives a 2.5-

Hz resonant frequency in both lateral and vertical modes.

The front panel of the control box has switches for system power, for 33 $\frac{1}{3}$ - and 45-rpm speed, and for the platter motor and record vacuum. The motor switch handles vacuum via a relay in the remote compressor. This quarter-horsepower compressor is a heavy-duty professional unit and must be remotely located; thus, 50 feet of air and vacuum hose are supplied. A noise-reducing enclosure greatly reduces compressor noise, and shock-mounting of the entire compressor unit reduces floor vibration.

A black-lacquer turntable enclosure is standard, with rosewood and teak as options. The turntable unit measures 18 $\frac{1}{2}$  inches wide  $\times$  17 $\frac{1}{2}$  inches deep  $\times$  9 $\frac{1}{4}$  inches high, the control box is 6  $\times$  17  $\times$  4 inches, and the compressor is 22 $\frac{3}{4}$   $\times$  10 $\frac{1}{8}$   $\times$  12 $\frac{1}{8}$  inches. In spite of its complexity, the Model 2.0 can be assembled quite easily, and the turntable and arm are supplied mounted on the chassis/base. So, it is really just a matter of connecting wires and hoses, mounting the phono cartridge, and then making adjustments.

Mounting the phono cartridge is quite straightforward, and the various adjustments are user-friendly. The VTA adjustment is simple to execute and can be made during playback.

With the 2.0, I used the Cello Choroale moving-coil phono cartridge, the Ortofon MC3000 moving-coil cartridge with its companion transformer, and the Shure Ultra 500 moving-magnet cartridge. Cello cables connected the output of the turntable to the MM and MC modules in the Cello Audio Suite preamplifier, to the Cello Performance amplifiers, and to the Duntech Sovereign loudspeakers.

The Versa Dynamics 2.0 simply exudes "high tech"—even when you're just looking at it—and its performance is fully up to its appearance. Now, I've had quite a number of pretty fancy and expensive pieces of record playback equipment over the years. I thought that certain combinations gave me the best sound one could expect from a vinyl LP. However, in terms of degree of fidelity, accurate retrieval of recorded information, and newly revealed "musicality," the 2.0 quite simply exceeds by a wide margin anything I

# THE ADCOM GFP-555 PREAMPLIFIER



A remarkable combination of exceptional performance, flexibility and value.

The GFP-555's musical performance is outstanding—by any measurement or listening criterion. For example, *Stereophile*\* calls it "one of the most satisfying preamps around in terms of overall tonal balance. . . You can go back to it after a few weeks and still feel it to be basically right; it reveals most associated equipment as more colored than itself."

At the same time, the GFP-555 is surprisingly affordable. Again, from *Stereophile*\*: "It is unclear from close examination why it should cost only \$500. . . it outperforms several competitors from the \$2500 bracket."

Here are just a few examples of how we did it. The GFP-555's gain path includes the most innovative state-of-the-art linear amplifiers ever used in high fidelity components, and is simple and direct from input to output.

The speed of the gain stages is almost fifty times faster than CD or LP signals. And the noise and distortion measurements are incredibly low. Direct coupling makes possible a frequency response from below 1 Hz to beyond 400,000 Hz.

Superb construction, incorporating regulated power supplies with large filter capacitors, provides superior performance no matter how widely the musical signal or AC line voltage may fluctuate.

As for flexibility, you can listen to any source while taping from another. There's an unusual number of inputs and outputs, plus adjustable phono gain and capacitance.

If you'd like the full story of this remarkable preamplifier and the review from *Stereophile*\*, please write. Of course, the fastest way to hear its demonstrably superior combination of sonic performance, flexibility and value is to visit your nearest Adcom dealer.

\*Vol. 9 No. 7 (Nov. 1986)

## ADCOM®

11 Elkins Road, East Brunswick, NJ 08816 201-390-1130

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Pointe Claire, Quebec H9R 4X5

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LPs played on the 2.0 were very nearly sonic mirrors of the master tapes from which they were made.

have ever used. I believe that the principal reason why records sounded so dramatically cleaner, more open, and transparent, so much closer to the music when played on the Model 2.0, is Bicht's almost obsessive attention to the suppression and elimination of resonances. He has addressed them in


the suspension, the platter, the chasis, the arm, the headshell, and even in the record itself. And while his vacuum hold-down system also helps alleviate resonance problems, he has ensured that it does not itself cause ticks and pops by imbedding dirt in the record's undersides during play; his clever

dust-imbedment mat, I assure you, works as claimed!

So much sonic "sludge" is gone in playback with this system that what is left is just the "sound" of various phono cartridges. In other words, if an MC cartridge has a resonant peak in the high frequencies or another cartridge is bass-shy, whatever its characteristics, you'll be able to discern them "loud and clear" and with nothing camouflaged by an overlay of resonances. Whether an MC or MM phono cartridge is used, tracking is quite precise at the stipulated stylus tracking force. Of course, if a record is badly overcut, even the 2.0 can't rectify that!

I played LPs from the earliest days. I still have a lot of the original Mercury discs engineered by Bob Fine. All I listened to were revelatory experiences in terms of resolution, bass response, cleanness of sound, and dynamic range. Some of the most striking sound, however, was produced by direct-to-disc material from Sheffield and my own recordings for Crystal Clear. Fortunately, on a number of my recordings I have either tape masters or first-generation copies of them, so I was able to compare the LPs with the tapes. Although I still preferred the tapes, mostly for their superior dynamic range, the discs made from these tapes were very nearly their sonic mirror when played on the 2.0.

Perhaps the most convincing experience was when I played some recent state-of-the-art Direct Metal Mastered discs from Teldec. While I greatly admire this brilliant advance in disc technology, I have felt that they sounded a little too bright. Played on the Model 2.0, the DMM recordings were magical—no brightness or high-frequency exaggeration, just the cleanest, quietest, most musical sound I've ever heard from a vinyl record!

This ultimate expression of high-tech record playback doesn't come cheap. At \$11,500, the 2.0 system is not going to set sales records. Also, it is not likely to appear in most dealers' showrooms, so you might write to Versa Dynamics (P.O. Box 3062, Warminster, Pa. 18974) if you want more information. Understandably, however, the 2.0 will find appreciative customers in the professional audio world and in the laboratories of record companies. 

## Part one: Monster speaker cables.

# Technology you can hear.

It's likely you've heard Monster speaker cable technology recently.

On the latest albums by the Thom Rotella Band, Hiroshima, and Diane Schuur & The Count Basie Orchestra. The powerful musical score of *Empire of the Sun*. Or the acclaimed classical recordings of the Telarc Digital label.

Audio industry professionals rely on Monster speaker cable for the most accurate reproduction possible of the audio signal.

It's their choice.

Now, Monster technology can do the same for your favorite records, tapes, and CDs in your sound system at home.

Consider Powerline® 2 and 3. A Magnetic Flux Tube design and advanced windings prevent frequency-dependent current lag common to ordinary cable. And faithfully maintain the phase integrity of the signal.

Discover new Powerline 2 Plus. Its improved construction, including a special Bass Control Conductor and dual-gauge wire networks, delivers sonic performance rivaling the very best of the high-end cables.

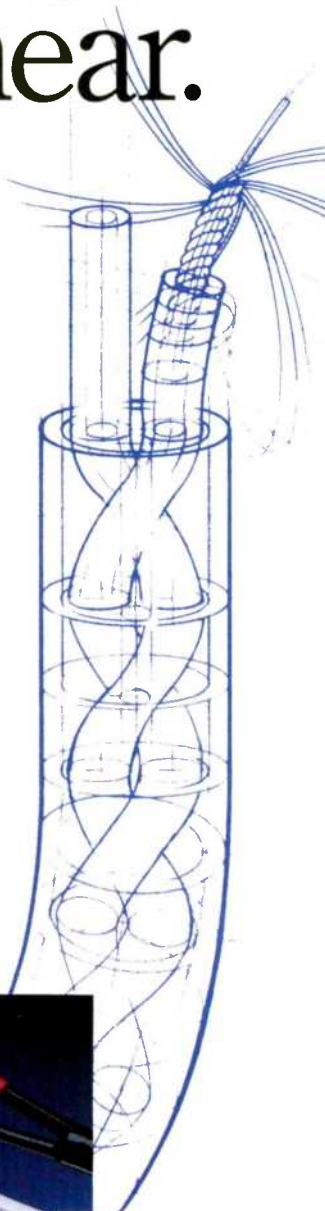
Experience the M-Series™ M1™. The most accurate speaker cable ever built, M1 encompasses all the audio technology Monster has developed over the years. Separate multiple-gauge wire networks for greater accuracy, depth, and power. Sophisticated windings for a dramatic reduction of signal smearing, or distortion. And MicroFiber™ dielectric to lessen the intertransient noise that generates audible harshness and signal loss.

With M1, the delicate interrelationships of frequency and time are preserved. And music is reproduced with a transparency and musicality that must be heard to be believed. Of course, these technical descriptions don't mean much if the sound isn't right, for you. So we invite you to compare different cables in listening tests of your own.

We ask just one thing of you. Listen with an open mind. And let your ears be the judge.

It's your choice.

**MONSTER CABLE**  
Technology You Can Hear.



....remarkable!



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

Every once in a great while a product comes along that offers performance which rises above the current variety of clever designs and marketing hype. When this occurs the new level of performance achieved can be readily heard by both the ardent audiophile and the novice listener.

Paradigm is a breakthrough loudspeaker that

provides a level of musical truth that simply must be heard.

Oh yes, the price for such glorious performance? Well . . . that's even more remarkable.

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*music . . . above all.*

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# If you think custom sound has to be complicated and exorbitant, this will come as a shock to your system.

In the past, if you wanted phenomenal sound tailored to your car, you drove to your local autosound dealership, where you were confronted by such a bewildering array of choices that you briefly considered making do with a Walkman.™

Eventually, of course, you selected your components and left your car with the dealer, who installed over the next several days a battery of amps,

equalizers, networks, switches and other exotic what-nots in your trunk.

The net effect was to reduce your cargo space to a size barely large enough for an attache case. And your bank account by a sum of money that would fill the attache case.

But let's recognize one thing: You drove away with an absolutely sensational sound system.

That was then. This is now.

a/d/s/, the company that pioneered high performance car audio, has created autosound's latest and most refined concept.

Using newly developed a/d/s/ components based on a unique multi-channel architecture, you can now configure a 2, 4 or 6-channel system of superior sound quality more simply, quickly and affordably than you thought possible.

We direct your attention to the a/d/s/ 6-channel, 300-watt, satellite-subwoofer system and its two advanced pieces of electronics. The PH15 Power Plate amplifier has the capacity to drive two front speakers, two rear speakers and two subwoofers. It's the industry's first single-component 6-channel amplifier.

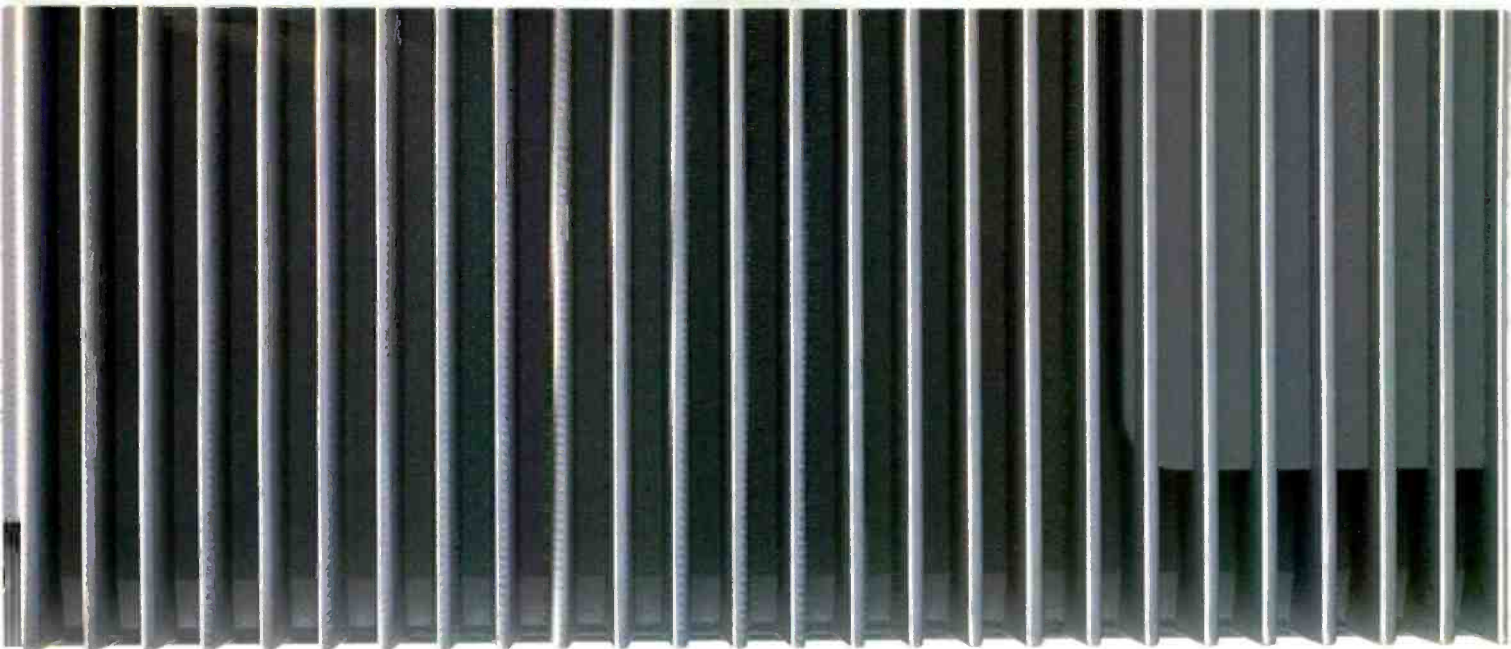
And if the PH15 is the muscle of the system, the 642CSi Electronic Signal Processor is its heart. A 6-channel programmable electronic crossover network, the 642CSi splits music into highs, lows and very lows, then routes the signals left and right to the appropriate amplifier channels. It also features interface circuitry that makes an a/d/s/ system compatible with virtually any head unit, including the AM/FM cassette that comes in the best cars today.

That means the \$750 or so you would have plunked down for a new head unit can be applied instead to the system itself or to the purchase of an additional source—a CD player, say. Either way, you come out ahead.



The a/d/s/ 642CSi defines system architecture. It makes any a/d/s/ system compatible with the head units that come standard in today's cars and those that come off autosound dealers' shelves.





The 6-channel PH15 amplifier is a finely finished dynamo that produces 300 clean watts of power. Whether you choose a 2, 4 or 6-channel a/d/s/ amp, you'll be getting a high-current amp that stands as the state-of-the-art in its class.

**For speakers, nothing less than the acknowledged best.**

a/d/s/ loudspeakers have long been the speakers of choice in the finest autosound systems. Among the signs of recognition they've garnered are 10 "Product of the Year" Awards from *Audio Video International*.

The a/d/s/ 320i was the first speaker to do for the car what the best home speakers do: project an accurate, stable stereo image.

The a/d/s/ 300i, *Audio Video International* 1988 Speaker of the Year, is an extraordinarily smooth speaker that prompted this from *Car and Driver*:

"... the high end systems made by a/d/s/ have reached the status of modern classics."

And for speakers that reach down to the very fundamentals of music—to notes you feel as well as hear—a/d/s/ offers the long excursion, low distortion S7 subwoofer.

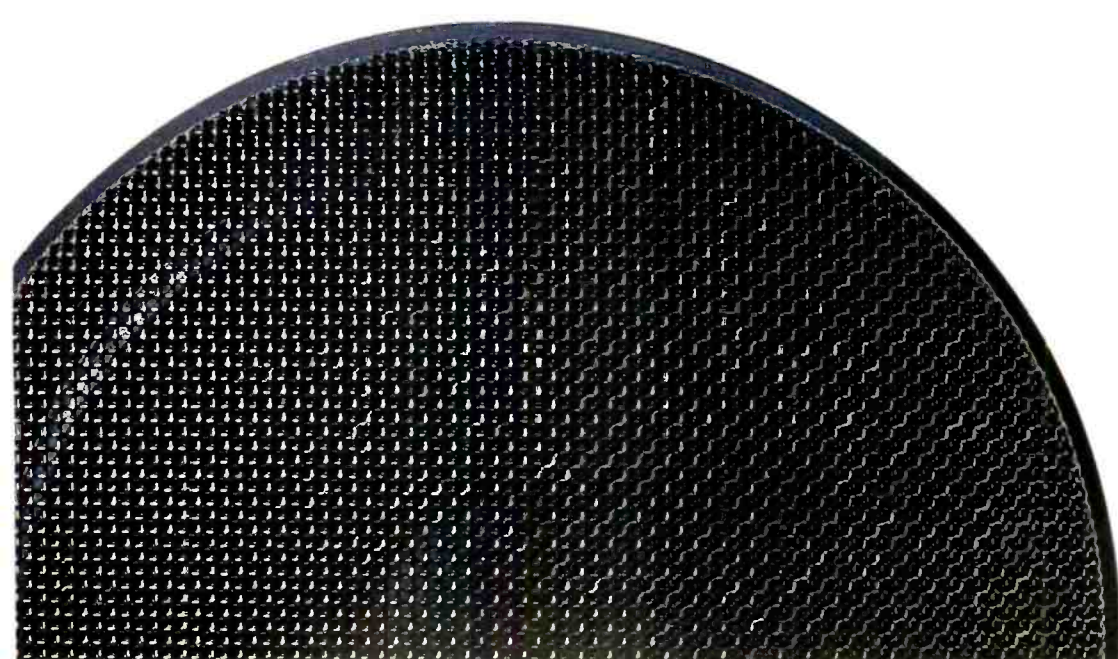
**The sound is superb, no matter how many channels you choose.**

With 2, 4 and 6-channel amplifiers that deliver unadulterated power, and with a range of speakers capable of noteworthy impact and realism, a/d/s/ can help you create precisely the system your needs define.

Because a/d/s/ systems require fewer components and are simpler to install, the total cost of creating a sound system of convincing accuracy and gut-satisfying power is significantly reduced.

If none of this comes as a shock to your system, why not visit your a/d/s/ dealer for a demonstration.

a/d/s/



The a/d/s/ 320i is universally heralded as the finest automotive loudspeaker ever created. No other car speaker has won more awards for performance and design.

# If you think custom sound has to be complicated and exorbitant, anyone here will happily disabuse you of the notion.



It took as many as 8 separate components in a conventional custom sound system to approximate the performance of this 300-watt, 6-channel sound system

Sound Distributors	Huntsville	AL	Hi-Fi Buys	All Locations	GA	Martin Motor Sales	New York	NY
Lou's Stereo	Mobile	AL	Hilo Audio	Hilo	HI	Ultrasmith Systems	New York	NY
Car Stereo Shop	All Locations	AL	Island Sound	Honolulu	HI	Autotech Sound Effects	New York	NY
Jerry's Audio Exchange	Phoenix	AZ	Spencer Sound Systems	Coralville	IA	Square Deal Radio & TV	Patchogue	NY
Classic Car Sounds	Tucson	AZ	Good Vibes Sound	Chicago	IL	The Sound Concept	Rochester	NY
Dealer's Car Stereo	Los Altos	CA	Chicago Speakerworks	Chicago	IL	Sound Concepts	Roslyn	NY
Franks of Berkeley	Berkeley	CA	Columbia Audio/Video	All Locations	IL	Le Sounde	Saratoga Springs	NY
The Whistle Stop	Covina	CA	Autobahn Services	All Locations	IL	Autosound Consultants	White Plains	NY
Haas Auto Stereo	Culver City	CA	Music In Motion	All Locations	IL	TRC Auto Sound & Security	White Plains	NY
Stereo Vision	Encinitas	CA	Soundpro	Carmel	IN	Leonard Radio	All Locations	NY
Autometics	Gardena	CA	Good Vibes Sound	Lafayette	IN	Auto Spec	Manhasset	NY
Radio Lab	Glendale	CA	California Sound	Wichita	KS	Audio Designs	Hicksville	NY
Century Stereo	All Locations	CA	Mike's Audio	Baton Rouge	LA	Car Tunes	All Locations	NY
Speakerworks	Orange	CA	Creative Car Stereo	Ashland	MA	Auto Spec	Huntington	NY
Auto Sound Specialists	San Carlos	CA	Trolley Stereo	Belmont	MA	Auto Concepts	Eastchester	NY
Autohaus Automotive	Hayward	CA	Sound Trak Audio	Brockton	MA	Chelsea Audio Video	Beaverton	OR
Crazy Stereo	Lawndale	CA	Tweeter Etc	All Locations	MA	Goodman Radio Co	Bryn Mawr	PA
Auto Stereo Warehouse	Los Angeles	CA	Natural Sound	Frammingham	MA	Sassafrass Records & Audio	All Locations	PA
Sound Factor	All Locations	CA	AutoTronics Unltd	Stoneham	MA	Listening Post	All Locations	PA
Rodeo Auto Accessories	N. Hollywood	CA	Northeast Security & Stereo	Saugus	MA	Car Fare	Chestnut Hill	PA
Perfect Sound	Porterville	CA	Rich's Car Tunes	Watertown	MA	Island Audio	Warwick	RI
Paradyme Consumer	All Locations	CA	Beaconwood Motors	Watertown	MA	Soundings	Middletown	RI
Electronics			Great Northern Sound Co	All Locations	ME	Tweeter Etc	All Locations	RI
Electronic Dreams, LTD	San Clemente	CA	Car Stereo Systems	MD	MD	Rogers Stereo	All Locations	SC
Radioman	San Diego	CA	Gramophone, Ltd	Lutherville	MD	Cartunes	Knoxville	TN
Lajolla Audio	San Diego	CA	Car Sound	All Locations	MD	Dalworth Stereo	Dallas/Ft Worth	TX
Peter's Auto Stereo	San Francisco	CA	Gramophone	Birmingham	MI	Earmark	Addison	TX
Pan Auto Sounds	San Mateo	CA	Stereo TV Village	Burton	MI	Music Systems	El Paso	TX
Marin Auto Stereo & Alarm	San Rafael	CA	Classic Stereo Ltd	Grand Rapids	MI	Custom Car Stereo	Houston	TX
Safe & Sound	Santa Monica	CA	Future Sound	Ann Arbor	MI	Home Entertainment	All Locations	TX
AdvanceMobile	Santa Monica	CA	Audio King	All Locations	MN	San Antonio Audio Concepts	San Antonio	TX
Kar Tunes Auto Stereo Alarm	Seaside	CA	Independence Audio	Independence	MO	Custom Sounds	Austin	TX
Installations Unlimited	Torrance	CA	Soundroom	All Locations	MS	Arrow Audio	St George	UT
Stereo Showcase	All Locations	CA	Ideal Acoustics	Starkville	MS	Audio Associates	All Locations	VA
Car Fidelity	All Locations	CA	Carolina Car Stereo	Charlotte	NC	Car Stereo Systems	All Locations	VA
Custom Audio Video	W. Hollywood	CA	Dashboard Stereo	All Locations	NC	Don's Car Stereo	Lynchburg	VA
Radioactive Video	W. Los Angeles	CA	Car Stereo Unlimited	Fayetteville	NC	Greg's Auto Radio	All Locations	VA
Tranasonic TSS	Walnut	CA	Audio Designs	Burlington	NC	Auto Sound of Virginia	Richmond	VA
Paris Audio	All Locations	CA	Atlantic Audio	Wilmington	NC	Go Ho Auto Audio	All Locations	VA
Walnut Creek Auto Radio	Walnut Creek	CA	Autobahn Sound Systems	Lincoln	NE	Magnolia Hi Fi	Seattle	WA
Madjacks	All Locations	CA	Tweeter Etc	All Locations	NH	Hi Fi Heaven	Green Bay	WI
Perfect Sound	Hanford	CA	Zippo's Car Stereo	Belleville	NJ	Flanner & Halfsoos Music Ltd	Milwaukee	WI
Listen Up Audio/Video	Denver	CO	Soundworks	Cherry Hill	NJ			
Carston Stereo	Danbury	CT	Atlantic Stereo	E Brunswick	NJ			
Audio Design	Fairfield	CT	Auto Audiophile	Ft Lee	NJ			
Autofidelity	Glastonbury	CT	Perfection Plus	Paramus	NJ			
Auto Sound, Ltd	Greenwich	CT	The Rolling Tone	Ramsey	NJ			
Installations Unlimited	Milford	CT	Rand's Camera & HiFi	Toms River	NJ			
Moonroof	New Haven	CT	Samm Sound Distributors	West Caldwell	NJ			
Audiocom	Old Greenwich	CT	Car Audio Systems	Reno	NV			
Tweeter Etc	All Locations	CT	TCl Autosound & Security Ltd.	Bronx	NY			
Sound Advice	All Locations	FL	Rabson's	All Locations	NY			
Audio Advisors	The Palm Beaches	FL	Phil's Auto Radio	Brooklyn	NY			
Cartronics of America	Miami	FL	Sound Approach	Commack	NY			
Sensuous Sound Systems	Tampa	FL	Sounds Great	Albany	NY			
The Audiohouse	Vero Beach	FL	Rogers Stereo	Freeport	NY			
Car Tunes	Atlanta	GA	Hi-Way Hi-Fi	Ithaca	NY			
Audio Warehouse	Savannah	GA	Bruckner Auto Radio Sales	Jackson Heights	NY			
Auto Radio	All Locations	GA	Auto Sound Plus	Latham	NY			
			Cosmophonic Sound	New York	NY			

The above is a partial dealer listing

For more information, visit an authorized a/d/s/ dealer. Or phone us, toll-free, at 1-800-345-8112. (In PA, the number is 1-800-662-2444.)

**a/d/s/**

## SINGULAR IDEAS



Illustration: Betsy Everitt

Okay, I'm serving notice: I'm sick and tired of hearing snide comments about single-beam pickups in CD players. Sure, in a world beset by problems (acid rain, holes in the ozone layer, rain-forest defoliation, mutually assured destruction, fast-food croissants) it might not seem like much, but a person has to put his or her foot down somewhere. And I'm putting mine down on single-beam pickups.

Well, not on the pickups themselves, but on the widespread belief that three-beam pickups must be better than single-beam designs—apparently because, well, they have two more beams. Friends, it ain't necessarily so. Let's review the principles behind a hypothetical, generic, single-beam design; I think you'll agree that the method is both clever and elegant, and a great way to read the 3 billion or so pits precisely arranged on the spiral track of a Compact Disc.

As I've discussed in previous columns, the optical pickup in a CD player must focus on, track, and read that data spiral without touching the disc itself, using only light to achieve its ends. The objects of concern on the disc are the pits, which carry the encoded data. Via their height and reflec-

tivity, they modulate the intensity of the light beam shining on the disc surface, thus allowing the data to be recovered. To achieve sharp focus on the data surface and to properly achieve intensity modulation from the pit height, it is necessary to use a laser as the light source. A laser light is monochromatic (composed of a single frequency) and coherent in phase. As we'll see, the latter is vital in implementing phase cancellation in the reflected beam, and hence in reading disc data.

The optical components of a one-beam design are shown in Fig. 1, along with the photodiode array used to generate tracking and focusing signals and to read the data signal. A laser diode is used to generate the laser light. A monitor diode (not shown) is placed next to the laser diode to control power to the laser; it compensates for temperature changes and prevents thermal runaway. The monitor diode conducts current in proportion to the laser's light output. In other words, it stabilizes the semiconductor laser's output.

The next part of the optical system, a semi-transparent mirror, angles the laser light toward the disc surface. A collimator lens follows the mirror (or, in some designs, precedes it). Because

the laser diode is placed at the focal point of the collimator lens, the lens makes the divergent light rays parallel. The final piece of optics in the path to the disc is the objective lens; it is used to focus the beam on the disc data surface, taking into account the refractive index of the polycarbonate substrate. The objective lens focuses the laser beam into a convergent cone of light whose main spot is about 800 micrometers in diameter on the outer surface of the disc's transparent polycarbonate substrate. The refractive index of the polycarbonate substrate is 1.55 and its thickness about 1.2 millimeters, so the spot is narrowed to 1.7 micrometers at the reflective surface—slightly wider than the pit width of 0.5 micrometer, and comparable in width to the wavelength of the light itself.

The data encoded on the disc now determines the fate of the laser light. When the spot strikes land (the smooth intervals between pits), the light is almost totally reflected. When it strikes a pit (seen as a bump by the laser), whose depth in the transparent layer is about one-fourth the laser light's wavelength, destructive interference and diffraction cause less light to be reflected. Hence the reflected light reads the pits as they fly past.

The intensity-modulated light beam returns through the objective lens and the collimator lens to strike the angled mirror surface. It passes through the mirror and then through a wedge lens. The wedge lens splits the beam into two beams, which are adjusted to strike an array of four horizontally arranged photodiodes. The outputs of all the photodiodes (D1, D2, D3, and D4) are summed to provide the data signal, which is demodulated to yield audio data and control signals.

Ironically, reading data is the (relatively) easy part of a pickup's job. The tasks of keeping the pickup in focus and on track take a lot more work. To maintain tracking and focus within tolerance, a servo system is required. A servo is an electromechanical device, similar to a motor, in which an input electrical signal controls the mechanical motion. In a CD player, the servo's job is twofold: To move the objective lens along the optical axis in response to vertical disc motion, thus maintaining focus, and to move the lens per-

**Ironically, reading data is the easy part of a pickup's job; the tasks of keeping in focus and on track take a lot more work.**

pendicularly to the optical axis to maintain tracking.

Consider the problem of tracking: On a CD, the track pitch—the distance between adjacent laps of the pit spiral—is 1.6 micrometers; that is too fine a tolerance for any mechanical tracking system, if the system is to be cost effective. What is required is an automatic tracking system which uses the laser light itself to keep the pickup's data beam on track.

In a single-beam design, the diodes

generate error signals for auto tracking. When the laser spot strikes the center of the pit track, a symmetrical beam is reflected. If the laser beam wanders from the pit track, interference creates asymmetry in the beam, resulting in an intensity difference between the two split beams, as shown in Fig. 2. As the beam moves off-track, one side of the beam encounters more reflective land; as a result, less interference occurs on that side of the beam, and reflected light is more intense

there. Thus, the split beam derived from that side is more intense, and the photodiode's output is greater. Either photodiode pair D1/D2 or D3/D4 generates a greater signal from the increased laser light. The difference between the pairs produces an error signal to keep the pickup on track.

Aging or soiling of the pickup could cause the reflected beam to become increasingly asymmetrical. This asymmetry would generate a constant offset in the primary tracking-correction signal, causing the pickup to remain slightly off-track. To prevent this from occurring, a second tracking-correction signal is generated. A low-frequency (e.g., 600-Hz) alternating voltage is applied to the coil that controls the tracking. The output signal from the four photodiodes is thus modulated by the alternating tracking-correction signal. As the pickup wanders off-track, a deviation in the tracking-correction signal occurs in the modulated signal. When the modulated signal is rectified, a drift-free tracking-correction signal is produced. This is used to correct the primary tracking signal with a d.c. voltage. The data signal from the four photodiodes is thus always returned to its maximum value.

The other problem is maintaining focus: Disc warpage and other irregularities can cause vertical deviations in the disc data surface; these can place the data out of the pickup's depth of focus. If the pickup didn't compensate, it would lose the ability to distinguish the phase difference between pit height and land. Tolerance is approximately  $\pm 0.5$  micrometer.

Auto focusing is accomplished by the four photodiodes. As shown in Fig. 3, when correct focus is achieved, two sharp images are located between photodiode pairs. When focus varies, the focal point of the system is shifted, and the split beams draw closer together (when the disc is too far away) or farther apart (when the disc is too near). The difference between diode pairs D1/D3 and D2/D4 forms a focus-error signal,  $(D1 + D4) - (D2 + D3)$ , which is used to maintain the focus of the servo-driven objective lens. Of course, in practice, the four photodiodes must simultaneously perform all three tasks of data reading, tracking, and focusing.

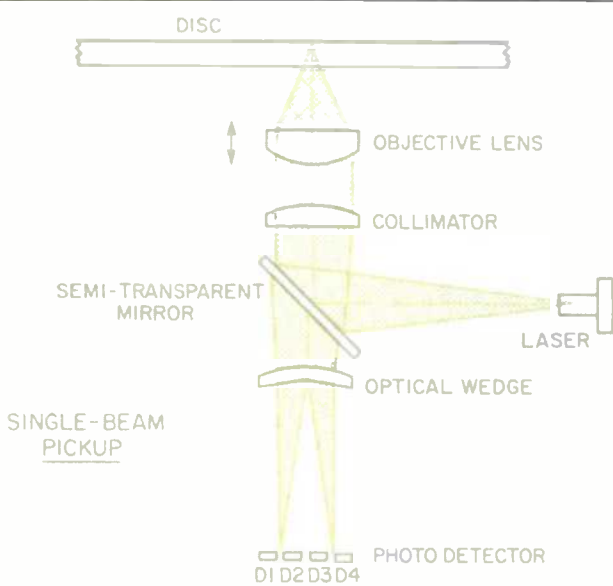


Fig 1— Layout of a single-beam pickup for a CD player.

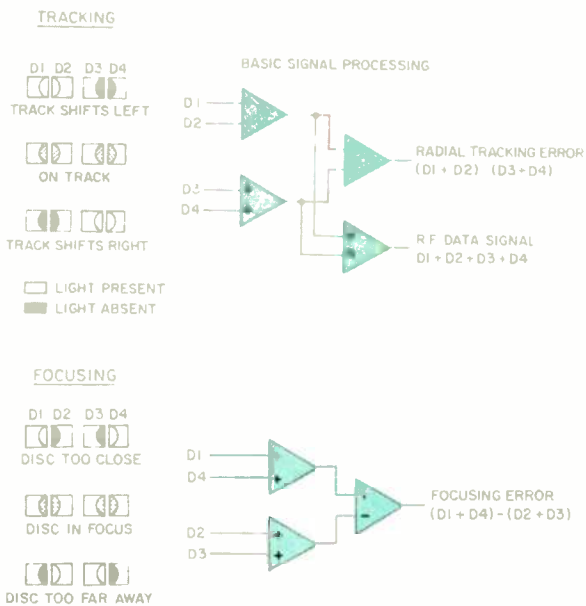


Fig. 2— Tracking control system for a single-beam pickup

Fig. 3— Focus control system for a single-beam pickup.

MATRIX  
801

WE'LL CHANGE YOUR IDEAS **SERIES 2**

B&W's Model 801 – the recording industry's Reference Standard Monitor – was the inspiration for innovation. Dramatic developments in technology and enclosure design have lit the fuse. B&W's Matrix 801 Series 2 personifies the state-of-the-art ten years on. This magnificent successor sets the new standard for professional and home user alike. With no commercial compromise. Rich in Matrix technology, 801 Series 2 registers accurately even beyond audibility. Phenomenal sound. Clean and utterly uncoloured. Outstanding imagery with tight unbooming bass. An instrument destined to occupy a special place in world esteem.



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Since single-beam pickups have only one moving part, wear is minimal, and their reliability is high.

Although single-beam pickups can be mounted on a linear sled (which is mandatory for three-beam pickup designs), most are mounted on a pivoting arm which describes a radial arc across the surface carrying the data. A coil and permanent magnet are mounted around the pivot point of the arm.

When the coil is energized, the pickup may be positioned anywhere on the pit track and its position corrected by the auto-tracking system. The objective lens is provided with a coil and a permanent magnet for displacement in the direction of the optical axis, for purposes of auto focusing.

Whatever the particulars, it should be clear that single-beam pickups are relatively simple mechanisms. And that is precisely their advantage over the more complex three-beam designs. In the final analysis, both perform the same function, and in terms of traditional specifications such as frequency response and channel separation, there is no sonic difference between the two. However, there are engineering advantages which may favor the single-beam pickup. The optics in a three-beam design are inherently more complicated; there are at least five components (objective lens, collimator, diffraction grating, cylindrical lens, and beam splitter) compared to the four components in a single-beam design (objective lens, collimator, optical wedge, and semi-transparent mirror). In addition, the three-beam design requires several critical adjustments, including secondary-beam and diffraction-grating alignment (the two extra beams are used for tracking), as opposed to the single adjustment of the photodiode assembly's horizontal position in a single-beam design.

A three-beam design is also more complex from a mechanical viewpoint. As noted, a single-beam design can be mounted on a single pivoted arm, which describes an arc across the disc surface; since there is only one moving part, wear is minimal and reliability is high. A three-beam design requires a linear sled mechanism because the tracking beams must stay in a fixed position relative to the pit track. For all these reasons, it can be argued that single-beam designs are more robust and may provide more reliable data readout with fewer tracking errors, especially over the long run. Still, three-beam designs predominate, probably because manufacturers believe consumers think them superior.

Ultimately, pickup performance must be evaluated on a player-by-player basis, and it is important not to let prejudice cloud that evaluation. As consumers become more knowledgeable, single-beam pickups may stage a comeback. In fact, there are signs that this is already happening: At least one major manufacturer has decided to switch back to the single-beam camp. Now, about that perplexing fast-food croissant problem. . . . 

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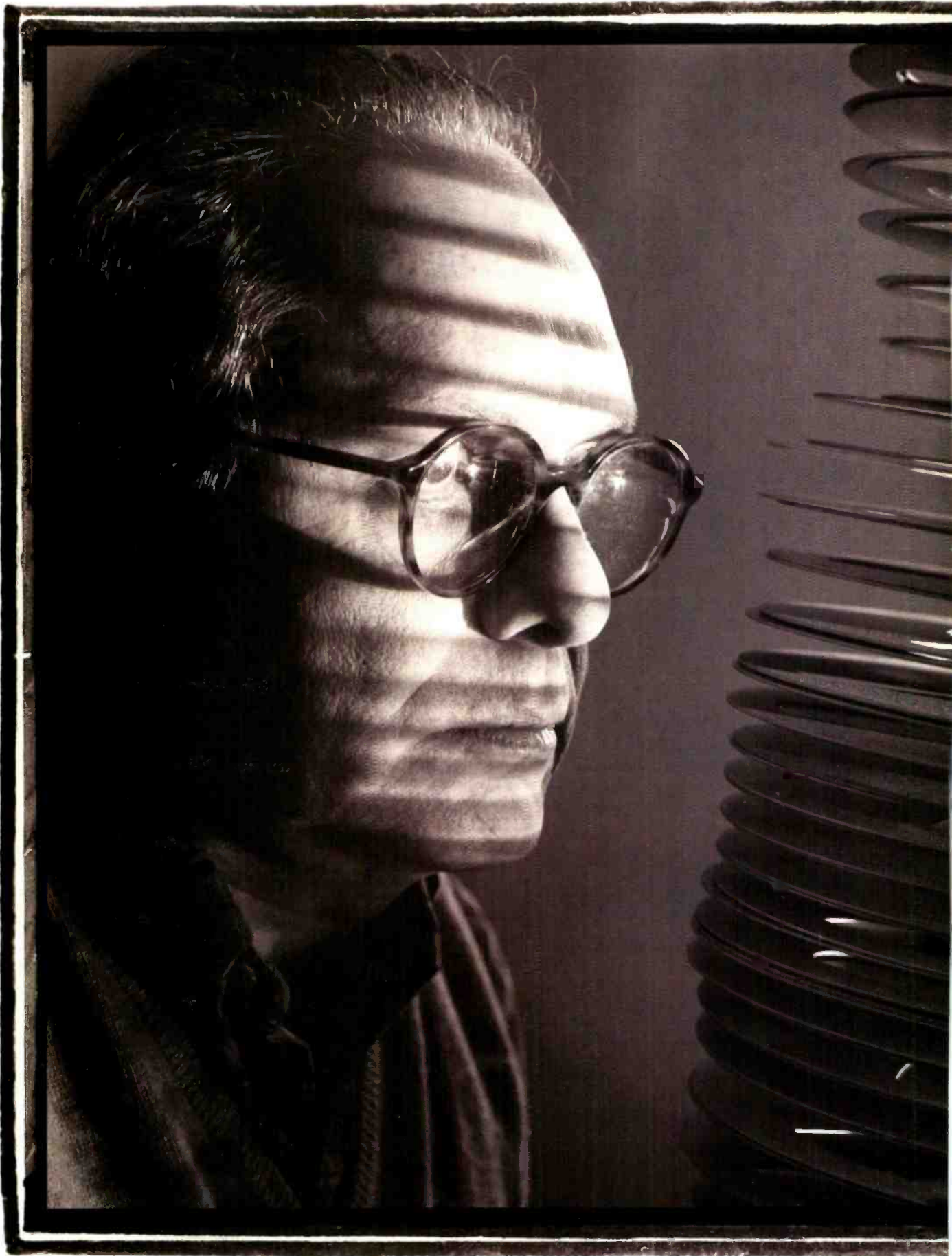
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PHOTOGRAPH: ROBERT LEWIS



E. Alan Silver

# The Connoisseurs' Selection

**C**lassical music lovers have been applauding E. Alan Silver's recordings for more than a quarter-century. When Silver founded Connoisseur Society in 1961, he brought what is perhaps the ideal background to the primarily classical record company: A former musician, his first job in the record business had been listening to test pressings to determine if their surfaces were quiet enough. Later, during four years of consulting work, Silver and his partners produced records for several firms; they were responsible for three or four dozen titles that launched Kapp's classical division. Then came Connoisseur Society, which soon became well known for the caliber of artists it attracted and for the high quality of its discs. Silver's recordings on the Connoisseur label won him a bushel of honors, ranging from France's *Grand Prix du Disque* to a couple of Grammy nominations.

In the late 1970s, when the record business softened, the veteran producer switched formats and began mastering real-time cassettes on the In Sync Laboratories label. Recently, he has added luster to his catalog with historical restorations, made primarily from 78s, of great performances dating as far back as the late 1920s. Two recent releases of which he's particularly proud feature one of the century's greatest cellists, Emanuel Feuermann, playing at Carnegie Hall shortly before his death in 1942. *D.L.*

*You've recorded a great deal of piano music over the years. Has this been simply a matter of personal taste?*

Yes, it has. It's also a matter of what we could afford and what I felt I knew best. I was a pianist, and I felt that if I heard something that was good, my judgment was accurate enough so that others would agree. I felt comfortable working with pianists.

*Many of them were young and virtually unknown. The Brazilian pianist João Carlos Martins was in his mid-20s when you recorded him, wasn't he?*

Right. He was 25.

*Did he have any reputation at all?*

He came here, played with the Washington National Symphony, and got spectacular reviews. We went to find him—on the basis of the reviews—to hear what this was about. And we missed him, by days. We didn't know where he was. We didn't know how to reach him or who his manager was, so when he disappeared he was just gone. But two years later, we heard about him again, and this time we jumped. I loved his playing and asked him if he would record. He was young, he was interested, it wasn't a very hard

David Lander

**A** record has a better chance of helping a young talent than a live recital does; it can present a performer in the best possible light.

thing to arrange. But we wanted to make something that would be a little more glamorous than a single record. *So you did the entire "Well Tempered Clavier." Do you remember how long it took?*

We did it in 12 weeks.

*You were marketing your records through Book of the Month Club at the time. Could that kind of an outfit sell enough records by a young unknown to make such a venture worthwhile?*

They had trouble [with the selection]—not a lot of trouble, but they didn't make a lot of money on it. Whether that was because the artist was young, I don't know. I think it was just the repertoire; "The Well Tempered Clavier" simply doesn't have that big a market. We did it pretty cheaply. We didn't cut any corners, but we were efficient. Even at that, we were using half-inch, 30-ips tape.

*Connoisseur Society used that technique from the outset. How did that come about?*

I wanted to do the best recordings possible. One of the major problems in those days was noise. If it wasn't record noise, it was tape hiss. So I asked around. I'm not an engineer, but I respect engineers and have a sense of those people who are talented, so I asked. And I got in touch with a few very bright people, one of whom was the son of Béla Bartók—Peter Bartók, who was then already a well-known audio engineer, a very nice man and very smart. He recommended using wide-track tape at 30 ips. There were some people recording half-inch three-track, so the half-inch tape was around, but they were generally doing it at 15 ips. The result was definitely quieter—7 to 8 dB quieter—though it wasn't the 15-dB improvement I thought it might be. But it sounded low. Because the modulation noise—the hiss—had a different characteristic, it was smoother. Overall, the tape sounded really lovely.

*You were cutting 12-inch discs at 45 rpm as well, weren't you?*

We decided to try cutting the records at 45 rpm to get better fidelity on the discs. It was a wonderful idea technically but a bad move commercially.

*Because the discs lacked playing time?*

I don't think that was the problem. Peo-

ple were confused by it. You know, it's as simple as turning the speed switch, but nobody thought about doing that for a 12-inch record. They didn't want to bother.

*Did you make parallel 33s at the beginning?*

Not at the beginning, but eventually we did. We also had mono, so we had three configurations: Mono 33, stereo 33, and stereo 45. It was expensive, but we didn't want to give up the 45s. However, when Book of the Month Club was involved with us—they went along with us and issued 45s as well—we saw [that 45s accounted for] only about 8% of the sales. I was being pushed by a lot of friends in the business to give up the 45s, so I did. For 8% it just didn't seem worth it.

*How many 12-inch 45s did you make in all?*

I don't remember the exact number, but quite a few—maybe 30.

*When did you make the shift from records to cassettes?*

We decided to go into the tape business in 1978. There was a severe downturn in the record business, and we got hit, as did other people. Although a lot of records were sold, it was all *Saturday Night Fever* one year and Elvis Presley the other. The general catalogs were suffering, and all we had was general catalog. With my brother, I formed a new company called In Sync Laboratories, and I licensed, really from myself, the Connoisseur catalog.

*Now you've gone to CDs. How many do you have out?*

We have about 130 cassettes, and 20 items were out on Compact Disc. We're not really in CD ourselves. Those 20 items we licensed to Nippon Phonogram, the Japanese division of Philips, which manufactures and sells them in Japan. We once imported them for sale in this country, but no longer do.

*Let's talk a bit about your duplicating process.*

We decided to go into real-time cassettes because it seemed to be the very best way to make them. It also gave us double control of the quality. We tried high-speed duplicating and got some very good results, but there was no way we could match even what could be done with a home recorder. We checked out a bunch of cassette decks and narrowed it down to two or three. The one we finally chose, the Nakamichi 582, gave us as close a match to the master as we had ever heard. The 582s are still being used. They're still flat out to 20,000 Hz. One of the things that attracted us was that you could align each deck externally—from the front panel, like you would on a professional tape recorder—for every piece of tape you put into it. Every tape that comes off those machines has been individually aligned.

*What are your feelings about the new DAT format?*

I think it's an exciting prospect. I'm more interested in it than the major companies are, because I have more to gain. I'd like to duplicate DAT cassettes. As soon as the decks are around, I'll definitely get into it.

*During the last few years you've put out some interesting historical material that underwent sonic restoration. Just what kind of processing was involved?*

What you primarily need for historical restorations, I suppose, are clean recordings. It's hard to find masters, so you generally start with a shellac disc. You play it back with what you hope is the appropriate playback curve with a 78 stylus, one of perhaps many different sizes and shapes [you've tried in order] to see which is the quietest and cleanest in terms of distortion. Using the correct stylus is part of the restoration. Reducing noise can be done in dozens of different ways. The way we did it was with notch filters, so you take as little of the musical content out as possible.

*What frequencies do you filter out?*

It depends. You have to do it by ear. It can be anywhere from, say, 5,000 to 9,000 Hz. You may also want to filter out noise from the 78 cutting devices, which would be down low.

*Have you come to the conclusion—as so many others have—that there's more music on those 78s than initially met the ear?*

Recording on half-inch tape at 30 ips was definitely quieter, about 7 to 8 dB quieter. Overall, the tapes sounded really lovely.

Yes, I have observed that, and frankly I came to that knowledge late. I wasn't aware how much there was on them. Your most recent discovery was some unreleased concert material of the late cellist Emanuel Feuermann. That was quite by accident, wasn't it? Yes. I was just prowling around the [Mannattan] neighborhood near where

I live, and I went with a friend up to a cafe where jazz musicians play. I was introduced to the woman in charge of hiring these jazz people as somebody in the classical record business. She said, "My father was a classical musician." Her father was Emanuel Feuermann. I got very excited, and I said, "Is there anything that has not been re-





Cutting 12-inch records at 45 rpm was a wonderful idea technically but a bad move commercially, because people were confused by it.

leased by your father that could be released or that you would like released?" And she led me to the acetates at Lincoln Center, recordings of two of her father's concerts dating from 1940 and 1941. It was just that simple and that much of a coincidence. Right here in the neighborhood. I didn't even know Feuermann had a daughter, or whether any of his family was alive.

**What shape were the acetates in?**

Very, very good, except for one of them—the Bloch "Schelomo." Someone had done a really bad number on it. It had been gouged, scratched; it was virtually unplayable. We put coins on top of the arm and salvaged all but about four and a half minutes of it. The rest we had to take from an earlier taping that was done by the [Lincoln Center] library at half speed with very, very heavy splicing. But we got it all. *These acetates that had found their way into the Lincoln Center library—how did they happen to be made in the first place? Was it normal practice to record concerts in those days?*

A lot of concerts were recorded. Feuermann was playing with the National Orchestral Association at the time these concerts took place—they were at Carnegie Hall. Carnegie had a house recording setup. It didn't belong to Carnegie Hall, but they had agreed to let a company known as the Carnegie Hall Recording Corporation do recording inside the house.

**Were these things made for archival purposes?**

Strictly that, yeah.

**Do you know what the setup was? Did they just put a mike in front of the soloist?**

It sounds like they did that, but it's hard to know. They were doing mono recordings and probably didn't want to muck up the stage with lots of mikes. It doesn't sound like multi-miking.

**Are you doing any original recordings now?**

I've been doing original recordings.

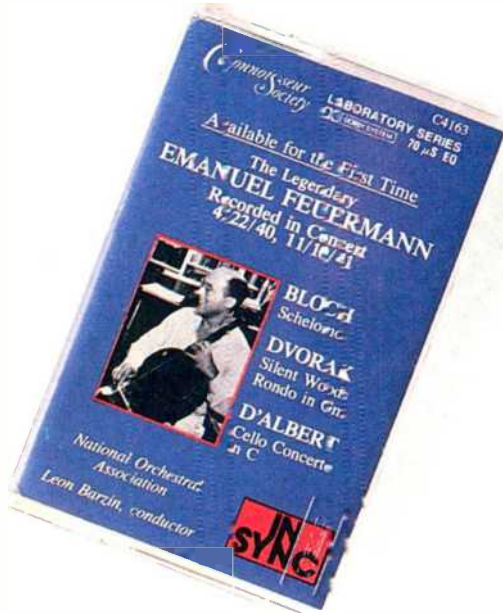
but at such a slowed-down rate it amounts to only one or two a year. We used to do five to eight a year. I'm trying to get back to doing more. **What kind of sessions do you hope to be producing?**

Things like I did in the past. More piano recordings, more violin, more string quartets. I never did much, really, with string quartets, but I love them. **You've recorded several artists from behind the iron curtain. Did political problems ever enter into your relationships with them?**

Yes, there was some difficulty with the violinist Wanda Wilkomirska. The first recording we scheduled with her was late in 1968. She was supposed to be here sometime in September, and about two or three weeks before that, the Russians moved into Czechoslovakia. Well, the visa we had for her was suddenly cancelled because Poland was part of the Soviet bloc. I was despairing. Here we had this recording set up, I had hired people. I had money laid out—and I wanted to make the recording. So I called Immigration, and they said, "Well, we're very sorry, but this comes from upstairs. No Soviet or Soviet bloc artists are going to be permitted in." So I spoke to my lawyer, and he said, "Why don't you go down there and talk to them personally? Tell them you're a small American businessman and that by depriving you of her work they're hurting an American small business." I went down to the immigration office and pleaded that I needed this artist for my business. They listened, and they asked—very gruffly, I thought—"How many days is this recording supposed to take?" I said, "We're supposed to do it in four evenings." They said, "Just a moment," and then they came back. "Okay. She can come for five days." So she did. We knocked it out, and she went right back home. Interesting, the reason they permitted it.

**Interesting, too, that they cancelled her visa in the first place. The Russians are at war with the Czechs so a Polish artist suffers.**

Well, there's a lot that you and I don't know. Now, Wanda was not a political person, and I knew nothing about her except that she was a violinist from Poland. Her husband was a journalist. Later she and her husband divorced,



Real-time tape  
duplication seemed  
to be the very best way  
to make cassettes, and  
it gave us double control  
of the quality.

and I found out a little bit more about him. While it has nothing to do with the recording sessions, it's conceivable our government knew. Her husband's name was Rakovski. He's the Vice Premier of Poland now.

**And he had been a journalist?**

Look, we have actors that become President. It has nothing to do with that. Who is to know who's political? Wilkomirska was married to a top Polish politician—or at least someone who had the potential. Whether our government was aware of that I have no way of knowing. She became a dissident and left Poland permanently, but her husband was a very important man.

**In that case it was our government that intervened. Have there been instances where their governments have caused problems for you or your artists?**

There was quite a problem with the Russian pianist Oxana Yablonskaya. I was looking for new artists, I think it was in the late '70s. My former wife said there was a Russian pianist who had won the Rio de Janeiro competition in 1965, a joint first-prize winner, who had a beautiful tone. There was no way of hearing her, but I figured maybe this Yablonskaya had some records in the Soviet Union. So we asked representatives of the state-run record company, Melodiya, who were here in the United States, if we could get any information. Did she record, and so on? "No, there are no recordings. In fact, we don't know of any pianist named Yablonskaya." That was a bit puzzling. After all, she was a first-prize winner; they had to know her. Well, we asked a manager in New York who was working with other Soviet pianists to check it out on his next trip and see if he could find out where she lived, who she was. He came back and said he had checked, but there really was nobody by that name; we must have the name wrong. So we dropped it. Well, about a year later, in a *New York* magazine listing of concerts for the week, there was a lady's face—Yablonskaya at Carnegie Hall. We didn't have the name wrong; we had it absolutely right. She was Jewish. She had applied for an exit visa, and they had made her a non-person. You know, you read about that and you don't believe it. Well, this really happened. They said she didn't exist. But she was there.

**They let her out to perform here?**

No. She had by this time gotten out. She had asked for a visa two years before we had asked about her, and they had taken her job away. She had to sell her piano for money to live. She was just waiting for an opening to get out of the country with her son. And when she finally got out, friends helped her get a manager in New York, and the manager presented her at Carnegie Hall. She had records, by the way. Melodiya had made records of her. We got them later.

**As a record producer, your fortunes depend to a large extent on critics. If they pan one of your performers, either in concert or on disc or tape, you can be hurt. Just how good are today's music critics?**

I think most reviewers are pretty good, but I do have a bone to pick. Reviewers very often review their best friends. I don't think that's right. The best friend may be one of the finest artists around, but I think the reviewer should be like a judge and disqualify himself or herself. I don't know why that's not done.

**It's always struck me that the career path of a young classical musician is incredibly complicated. A writer, for example, needs a typewriter, ribbons, and paper, none of which costs much. But a violinist may have to rent a recital hall and pay musicians to accompany him or her. All this, of course, to get reviewed and attract the attention of managers.**

Foundations and the government should provide for young performers. A young performer, let's say a very good talent, plays in New York—they all want to play in New York, they all need the imprimatur of Carnegie Hall, *The New York Times*, and so on. And let's say he or she plays wonderfully. Now let's say, case one, the reviewers don't like this kind of playing—and we're assuming a good performance. The artist has taken his or her money, laid it out, played, and it comes to

nothing because the reviews are useless, they're bad. Or let's say the artist comes and is nervous—it happens—or isn't feeling well and doesn't play as well as he or she is able. The reviewers, justifiably now, give bad reviews. Same result. Others can't afford to play, though they may be talented and worthwhile artists. Or they play wonderfully, but only one reviewer shows up because it's a crowded schedule. And the reviewer that day had a fight with his or her spouse, or was sick, and had a poor seat at the concert and panned it. Nothing to do with real feelings or the performance, but the same result: The artist is not helped. And Carnegie is not cheap, publicity is not cheap. You're talking about many thousands of dollars.

If, on the other hand, you make a recording of a young performer with talent, this has a much greater chance of helping him or her. If the artist plays badly, you can cancel the recording and do it another day. If the artist makes mistakes because of nervousness, you can edit the mistakes out. You can give the best possible picture of a performance. Then you don't send review copies just to the three *New York* dailies, but to 75 reviewers around the country. Now you have the possibility—through the recording medium—of 75 reviews, and maybe 20 will actually be written. Out of the 20, maybe five reviewers will murder the artist and 15 will love him or her. That's useful for a career. Then you take the recording and send it out to the radio stations, and maybe 100 classical stations will program it once, and maybe 10 or 20 will program it 10 times, and a public begins to hear that artist. So the recording medium offers young performers a great advantage, something that supplements a Carnegie Hall appearance and in some cases can replace it. The recording industry can be a great help to the live music industry if it gives young performers of merit an opportunity to be heard. I plan to do recordings of more young artists because I think it's important that young talent be nurtured, and this is a way of doing it. You give them a showcase, a chance to be heard by many, many people. It must be heartbreaking to play a concert in a major city and not have it work for you. **A**

# SIMPLE CONSTRUCTION

RICHARD J. KAUFMAN

## Build An Active Filter

**Y**ears ago, one mark of a premium amplifier was the presence of filter switches labelled "Scratch" and "Rumble." These were supposed to eliminate the noise of rumble from the turntable and scratches on records, as well as hiss on tape and static on FM broadcasts. Unfortunately, the circuits were usually simple affairs, with gentle roll-offs of 6 dB/octave. If they removed enough of the noise to be worth using, they removed too much of the program material to be desirable. Active filters make it possible to use a much steeper rate of roll-off so that the filter is effective without degrading the signal's frequency range unnecessarily.

Probably the most useful circuit that can be constructed by an amateur in the course of a weekend, the active filter also lends itself to use in crossover networks. Rather than splitting the highs and the lows with passive networks in the speaker system, active networks perform the task with low-level signals from the preamp. The high- and low-frequency signals are separately amplified and then fed to the woofer and tweeter. The many advantages of this approach—including lower distortion, greater effective power (due to splitting the spectrum between different amplifiers), and more accurate results (due to the absence of interaction between the filter and the speaker, which is inevitable with passive networks)—outweigh its greater cost.

The basic building blocks for second-order high- and low-pass active filters are shown in Fig. 1. The filter frequency (F) is determined by the following formula:

$$F = \frac{1}{2\pi RC}$$

The damping factor (d) determines the "flatness" of the filter's response. If it is too low, the filter will have poor transient response. If it is too high, the filter's cutoff will be too gentle for most applications. A damping factor of 1.414 is usually optimum for a second-order filter. Because some component values depend on the desired damping factor, it is best to first select those components (the capacitors in the low-pass and the resistors in the high-pass circuits) and then to select the other components according to the desired frequency. The resistors in the negative feedback loops (labelled "2R") are not critical, and they can be replaced with a short when maintaining minimum d.c. offset is not necessary.

### A Modern Infrasonic Filter

While second-order filters are an improvement over the first-order scratch and rumble filters of days gone by, higher order filters offer better performance. Not many more parts are needed, so you might as well make the extra effort. Figure 2 shows a third-order infrasonic filter, the successor to the rumble filter. Such a filter will eliminate the very low-frequency record-war and tonearm-resonance signals. These signals can rob your amp of power and can force the speaker voice-coil out of the magnet gap, reducing its distortion-free power-handling capability. Such problems can be so severe that the new IEC modification of the RIAA Standard for phono equalization calls for a roll-off of 12 to 18 dB below 20 Hz. Most phono sections do not provide this. The circuit in Fig. 2 effectively cuts infrasonic noise, and the improvement will be clearly audible. (Note that the damping factor for a third-order filter is 1. This is due to



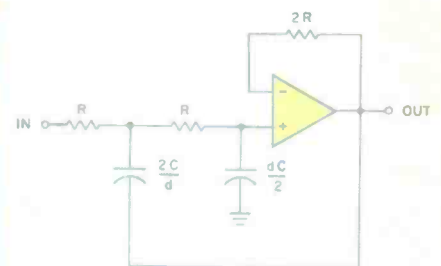
# JCTION PROJECTS



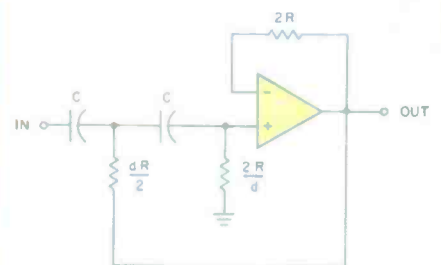
the interaction with the extra first-order filter stage that has been added to the circuit.)

## An Asymmetrical Crossover Network

One case where a second-order filter is useful is in an asymmetrical filter. This filter, used for speaker crossover networks, works by subtracting the output of a filter from the main signal. You can start with either a high-pass or low-pass filter and derive the complementary response. Such a network's response is of constant magnitude and is linear in phase, resulting in perfect transient response. Unfortunately, the complementary response (the one derived by subtraction) rolls off at a rate of 6 dB/octave, regardless of the order of the filter used, and has a bump near the cutoff frequency that grows progressively larger as the order of the filter is increased (Fig. 3). For this reason, only the second-order asymmetri-



LOW PASS



HIGH PASS

Fig. 1—Basic, second-order low- and high-pass active filter circuits (see text).

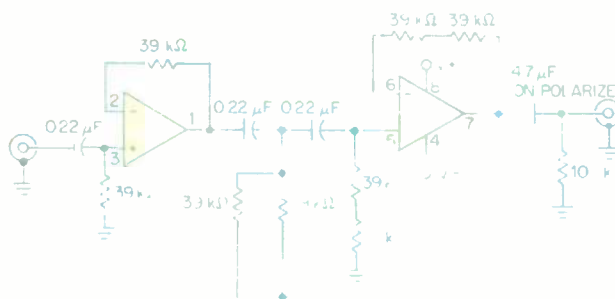


Fig. 2—A third-order infrasonic filter with a roll-off of 18 dB/octave below 20 Hz. The IC used is a dual op-amp, such as the TL072.

cal filter is really practical. To make things even worse, the phase difference between the high and low signals is such that the drivers must be very close together, relative to the wavelength at the crossover frequency, or the advantages of linear phase thus will be lost.

For very low frequencies, close speaker spacing is easy to achieve, and I have found that such crossovers give very good results for subwoofers whose crossover point is in the range from 100 to 200 Hz. Figure 4 shows a crossover that has worked very well for me in this application. The crossover frequency for the component values shown is 112 Hz. By changing the values of the two 100-kilohm resistors (R1 and R2) that feed into pin 5 of IC1B, it is possible to change the crossover frequency; for example, the crossover point will become 165 Hz.

I find it works better to use the sharper filter (12 dB/octave) to keep the high frequencies out of the subwoofer and to use the milder filter (6 dB/octave) for the high-pass section, at least with the set of drivers I have tried. A low-pass filter should be used for the bass, and the complementary response will be the high-pass response. Since the high-pass response will then roll off at 6 dB/octave, the main speakers' response should extend an octave below the crossover frequency. In other words, if your crossover is set at 165 Hz, then your main speakers should have a low-end response that extends down to at least 83 Hz.

### The Linkwitz-Riley Crossover

The problem with third-order crossover networks is that, although they provide very good pressure response, the phase difference between the signals results in very uneven response distribution in the vertical plane. This is also a problem with the asymmetrical filter discussed above. A fourth-order filter will have both outputs in phase at the crossover frequency, making driver placement less critical and yielding much better vertical dispersion.

The classic fourth-order Butterworth filter, while having a flat power response, does not give a flat pressure (voltage-summing) response. In a reverberant field such as a home listening room, flat pressure response is required. It can be obtained with a type of filter popularized by Siegfried H. Linkwitz. Unlike the classic Butterworth crossover, in which the filters' responses are down by 3 dB at the crossover point, the Linkwitz filters' responses are down by 6 dB at the crossover frequency. The high- and low-pass re-

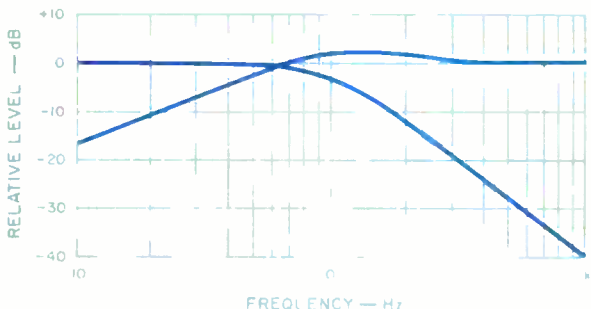


Fig. 3—Response of an asymmetrical crossover network. Note the differing slopes of the low- and high-pass sections, and the response bump near the crossover frequency.

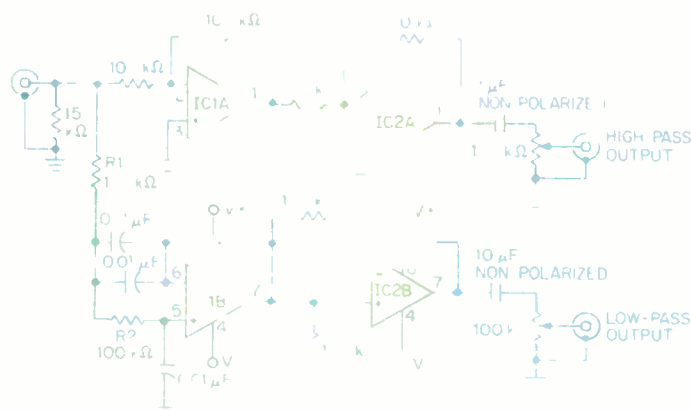


Fig. 4—An asymmetrical subwoofer crossover. Its crossover frequency, 112 Hz with the component values shown, can easily be altered (see text).

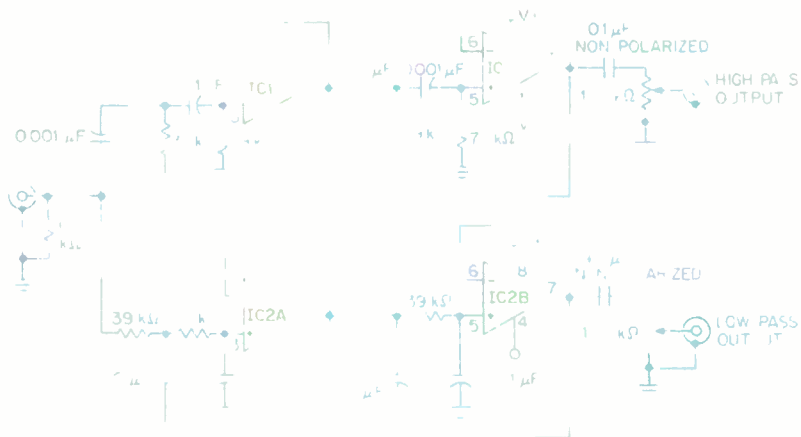


Fig. 5—A fourth-order Linkwitz-Riley crossover, configured for a crossover frequency of 2.8 kHz.



sponses are in phase at crossover, resulting in a wide vertical dispersion. Transient response of these filters is quite good. Due to the phase requirements, only even-order Linkwitz filters exist.

Figure 5 shows a fourth-order Linkwitz-Riley crossover for a frequency of 2.8 kHz. The crossover frequency can be changed by altering the value of the resistors and capacitors, using the following formula:

$$F = \frac{1}{2\pi\sqrt{2} RC}$$

The 78-kilohm resistors can be made up from two 39-kilohm resistors in series. The filters' roll-off rate is 24 dB/octave, which means the upper frequency speakers can be crossed in much lower (and the woofer crossed in much higher) than would normally be the case. For example, this crossover can be used with many tweeters that would have to be crossed in at 5 kHz or higher (even with a second-order crossover) because of their power-handling difficulties at lower frequencies. Problems due to beaming by the woofer at higher frequencies are also eliminated by the sharp roll-off. Until digital filters become readily available, this will probably remain the filter of choice for high-performance active crossovers.

### Construction Tips

Op-amps should be FET-input devices, such as the LF353, TL082, or TL072. The latter device is preferred, though the others will give adequate performance. Pinouts are the same on all three chips and therefore are interchangeable.

Capacitors used for active filters should be plastic-film or silver-mica types. Metallized polyester is acceptable, as is Mylar. Polypropylene and polystyrene capacitors are even better, but it is arguable whether the difference is audible. The output capacitors should be nonpolarized: Plastic-film types, though not readily available in the specified sizes, are preferable; electrolytic caps are acceptable. Again, it is debatable whether the difference can be heard. If you are worried about a possible degradation in sound, electrolytic caps can be bypassed with film or silver-mica capacitors of smaller value. The tolerances for capacitors and resistors should be 5% or better, though 10% will not seriously degrade performance.

Any power supply delivering between  $\pm 6$  and  $\pm 18$  V will work. The power requirement per op-amp is less than 50 milliamps. ▲

Adding this high-blend  
circuit to your tuner  
cleans up noisy stations  
but doesn't kill the  
stereo effect.



## Build A High-Blend Control

**S**tereo reception of FM is all too often marred by hiss and birdies, bleeps and howls that disappear when the tuner is switched to mono mode. These noises, caused by multipath reflections, affect the multiplexed (L - R) signal, while the harder mono component of the signal remains noise-free and undistorted. Although switching to mono does result in listenable reception, doing so amounts to throwing away the proverbial baby with the bath water: The noise is primarily above 5 kHz, and the portion of the audio spectrum that allows stereo to give an illusion of directionality lies mostly between 500 Hz and 2 kHz.

What is needed is a way to blend only the high-frequency sounds to mono, leaving the midrange unaffected, to provide an adequate degree of stereo separation. Why such a feature is not found on more mid-priced tuners and receivers is a mystery—the parts for a simple high-blend control would cost the manufacturer less than a dollar. The parts will cost you only slightly more.

The schematic of a simple high-blend control is shown in Fig. 1. The circuit is placed between the tuner and the preamplifier, or in the tape-monitor loop when using a receiver. The capacitor should not be ceramic; Mylar, metallized polyester, and silver-mica, however, are all acceptable types. The value shown, 0.001  $\mu$ F, begins blending the right and left channels above 3 kHz when used with a preamp having 50 kilohms input impedance. If your unit varies from this standard value or interference is especially bad in your location, you may want to use a differ-

ent capacitor value. A larger capacitor lowers the frequency at which blending occurs. A higher impedance will require a smaller capacitor, and vice versa. I suggest that you experiment to find what value capacitor will provide optimum blend while maintaining adequate separation with your equipment.

The switch is necessary to disable the blend control. The potentiometer, which is optional, controls the maxi-

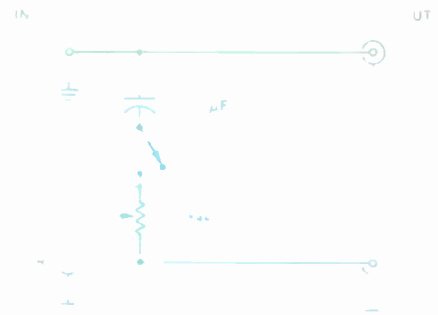


Fig. 1—A simple high-blend control. The potentiometer is optional (see text).

mum amount of blend that will occur. Thus, separation can be maintained at a higher value when noise levels are not as severe. Finally, you should mount all the parts inside a metal project box to prevent hum and noise pickup.

For some people, this high-blend control will make it possible to listen to their favorite stations in stereo. Even if the stations you normally listen to wouldn't benefit by the addition of a blend control, more distant—and perhaps more interesting—stations will become listenable. ▲

# 1

## WELL TEMPERED TURNTABLE

### Manufacturer's Specifications

**Drive System:** Belt.

**Motor Type:** 24-pole synchronous.

**Speeds:** 33 $\frac{1}{3}$  and 45 rpm.

**Dimensions:** With optional dust cover, 19 in. W x 15 $\frac{1}{2}$  in. D x 7 in. H (48.26 cm x 39.37 cm x 17.78 cm).

**Weight:** Approximately 38 lbs. (17.3 kg).

**Price:** Without arm, \$975; with Well Tempered arm, \$1,695; dust cover, \$120.

**Company Address:** c/o Transparent Audio Marketing, Rte. 202, Box 117, Hollis, Maine 04042.

For literature, circle No. 90

After Bill Firebaugh had designed the Well Tempered tonearm, he decided to apply some of his ideas on viscous damping to the design of a turntable. The absorption of energy from external vibrations is something that most turntable designers are concerned about; however, most of them concentrate their efforts on reducing vibration problems in the low-frequency range. They do this by using a suspension system employing strategically located springs. The compliance of these springs is chosen so as to resonate with the mass of the turntable at some very low fre-

quency, usually below 10 Hz. A suspension of this type tends to reduce the effects of outside vibrations and shocks on the reproduced sound.

One way of reducing vibration effects is to use very compliant springs to suspend a relatively low mass. Other designers use less compliant springs but make the suspended mass very large, which tunes the system to the same range. In this case, however, the Q is usually higher, so some method must be used to damp the springs.

*Continued on page 62*



## WELL TEMPERED TONEARM AND VAN DEN HUL MC-ONE CARTRIDGE

### Manufacturer's Specifications

#### **Tonearm**

**Type:** Pivoted, with adjustable cartridge mount and viscous damping.

**Pivot-to-Stylus Distance:** 9 in. (22.9 cm).

**Overall Length:** 11 $\frac{3}{8}$  in. (28.9 cm).

**Effective Mass:** 10 grams.

**Arm Tube:** Stainless steel, sand-filled.

**Price:** \$720.

#### **Cartridge**

**Type:** Medium-output moving coil.

**Stylus:** Van den Hul Type I.

**Cantilever:** Boron rod.

**Output:** 0.45 mV for 5 cm/S at 1 kHz.

**Tracking Force:** 1.5 grams recommended; 1.3 grams minimum.

**Estimated Vertical Compliance:** 20  $\times$  10<sup>-6</sup> cm/dyne.

**Mass:** 7.3 grams.

**Recommended Arm Mass:** 6 to 12 grams.

**Load Impedance:** 15 ohms minimum.

**Frequency Response:** 20 Hz to 20 kHz,  $\pm$ 0.75 dB.

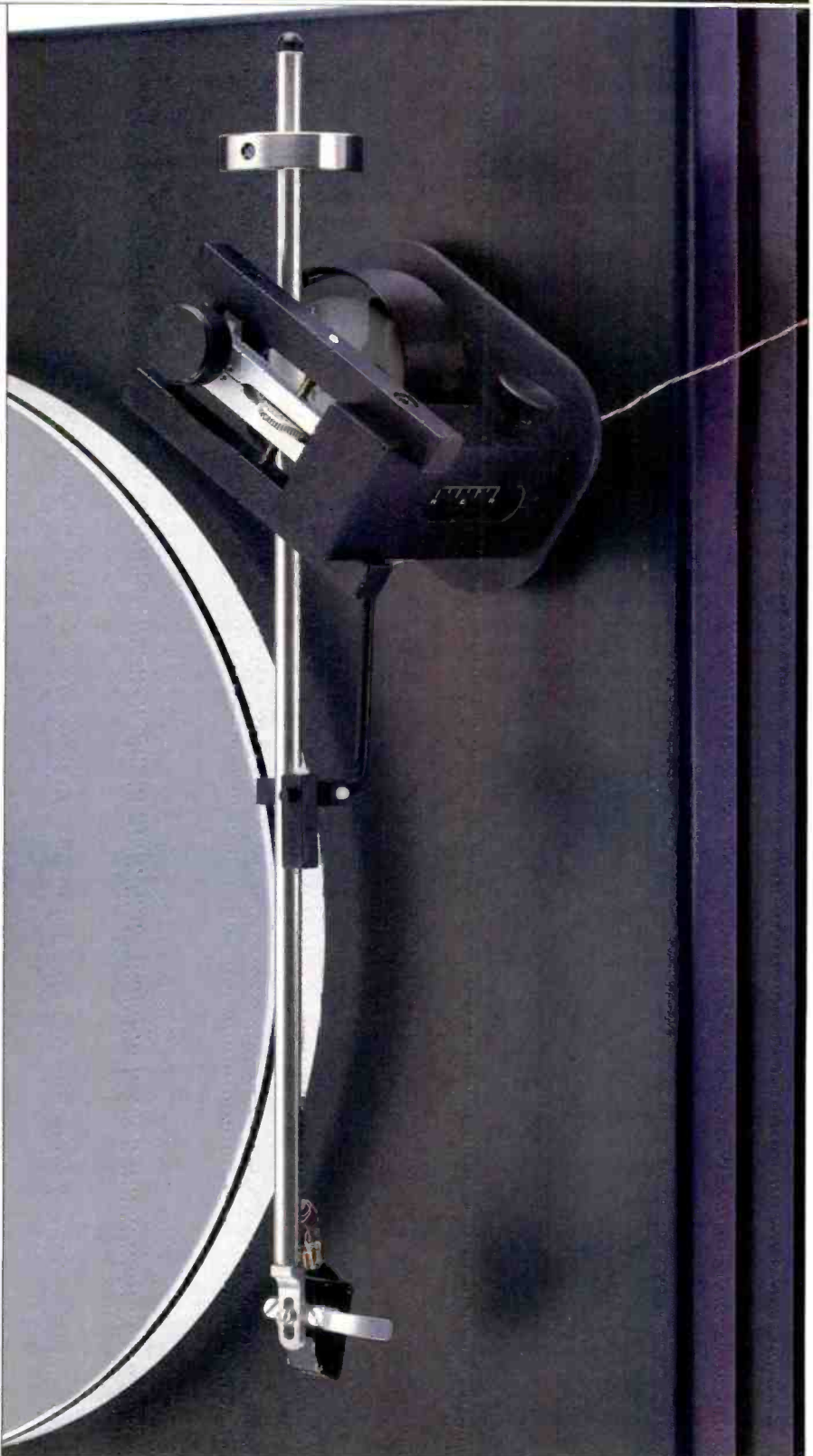
**Channel Separation:** 40 dB at 1 and 10 kHz; approximately 20 dB at 20 kHz.

**Price:** \$1,075.

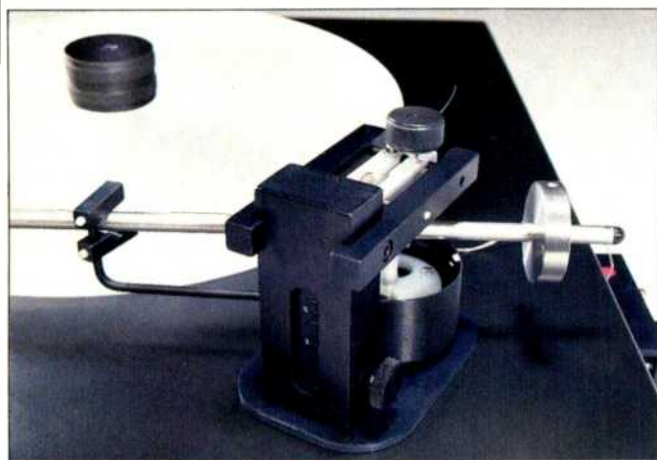
**Company Address:** c/o Transparent Audio Marketing, Rte. 202, Box 117, Hollis, Maine 04042.

For literature, circle No. 91

One of the pleasant things about doing technical reports for *Audio* magazine is being able to investigate, in detail, the products of some very innovative minds. Most of the improvements in sound reproduction from phonograph records is due to certain individuals' dissatisfaction with the state of the art. Each of them looked at the way



The arm produced a subdued "deh" or "dah" when tapped, a sign that it would not introduce much coloration.



things were being done and said. "There must be a better way." Their improvements either found their way into others' products or spurred their colleagues to even greater innovation. We have all benefited from the work of people like Lou Souther, Ivor Tiefenbrun, Alastair Robertson-Aikman, Bernard Jacobs, Dave Fletcher, John Michell, Bruce Thigpen, Steve McCormack, Herbert Papier, Joe Grado, A. J. van den Hul, and others. (If I have left anyone out—and I most assuredly have—I can always blame the Editor!)

The Well Tempered tonearm is the result of the innovative thinking of Bill Firebaugh, and even its appearance is radical enough to win him the "Iconoclast of the Year" award. He started his quest for the perfect record player by taking apart his early AR tonearm, designed by Ed Villchur (there's a name I missed). As Firebaugh told me, "I had burned my bridge. I had no tonearm now. There was no turning back!"

He liked the AR's viscous-damped vertical bearing, but he found himself adjusting it too often and decided that there must be a way to make it more consistent. As a mechanical engineer for a large aerospace company in Southern California, he had the background to tackle a job like that, but, as often happens during a quest for perfection, the trail he took resulted in something very far removed from the original AR design.

When Bill came to my lab from Los Angeles to set up his turntable and tonearm (with the van den Hul MC-One moving-coil cartridge), I asked him if he had ever seen the Gray Professional tonearm, which was made in the 1950s for broadcast studios. He said he had only heard about it. I had owned one, and I described to him the problem of keeping the viscous-damped bearing adjusted. The Gray used a single half ball at the bottom of the tonearm post; the half ball was seated in a matching cup which contained viscous fluid. The glitch was that the arm used to settle, push the viscous fluid out of the way, and allow the ball to come in direct contact with the cup, thus negating the fluid's damping effect. The Gray had to be adjusted by pulling the tonearm up and holding it while the viscous fluid slowly settled back down toward the bottom of the cup. Thus, you needed a good deal of patience to complement your dedication to quality sound! The Well Tempered tonearm eliminates this tedious adjustment problem by suspending the bearing so that it never settles down into the viscous fluid. (If I had thought of that years and tears ago, I might still have my old 16-inch Gray!) But there are other features of the Well Tempered that make tonearms of yesteryear the quaint curiosities they are.

The MC-One is a moving-coil cartridge made by A. J. van den Hul, and it incorporates his patented stylus design, which is shaped to trace the difficult high frequencies pro-

## MEASURED DATA

### Well Tempered Tonearm

Pivot-to-Stylus Distance: 9.375 in. (238 mm).  
 Pivot-to-Rear-of-Arm Distance: 3.0 in. (76 mm).  
 Overall Height Adjustment: 1.25 in. (32 mm).  
 Tracking-Force Adjustment: 0 to 6 grams  
 Tracking-Force Calibration: None, separate gauge required.  
 Cartridge Weight Range: 3 to 12 grams.  
 Counterweights: 20.9-gram aluminum and 61.5-gram steel.  
 Counterweight Mounting: Direct to armtube, with nylon set screw.  
 Sidethrust Correction: Caliper dial varies string-pivot spacing.  
 Pivot Damping: Viscous fluid in large cup.  
 Lifting Device: Aluminum finger lift attached to cartridge.  
 Headshell Offset: Cartridge offset adjustable in mount; no headshell.  
 Overhang Adjustment: Slots in cartridge mount.  
 Bearing Type: Armtube suspended by two strings.  
 Bearing Alignment: Adjustable pivot point.  
 Bearing Friction: Viscous fluid in cup.  
 Lead Torque: Very low.  
 Arm-Lead Capacitance: 25 pF, left and right  
 Arm-Lead Resistance: 1.1 ohms, left and right.

External Lead Length: None supplied.  
 Structural Resonances: 550, 1200, 3800, and 4900 Hz.  
 Base Mounting: Single hole.

### van den Hul MC-One Cartridge

Coil Inductance: 120  $\mu$ H, left and right.  
 Coil Resistance: 15.7 ohms, left and right.  
 Output Voltage: Left, 0.10 mV/cm/S; right, 0.11 mV/cm/S.  
 Tracking Force: 2.0 grams recommended.  
 Recommended Load Resistance: 40 ohms or more.  
 Response to Load Capacitance: Unaffected by normal input capacitance.  
 Cartridge Mass: 7.25 grams  
 Microphony: Very low  
 Hum Rejection: Excellent.  
 Rise-Time: 11  $\mu$ S.  
 High-Frequency Resonance: 33.3 kHz.  
 Low-Frequency Resonance: 10 Hz (in Well Tempered tonearm).  
 Low-Frequency Q: 1.67 (in Well Tempered tonearm).  
 Polarity: Plus, for CD-4 standard.



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Threshold products are engineered by Nelson Pass, styled by Rene Besne, and handcrafted under their supervision in the U.S.A.

The vertical bearing design ensures equal up and down motions when the tonearm is tracking vertical warps.

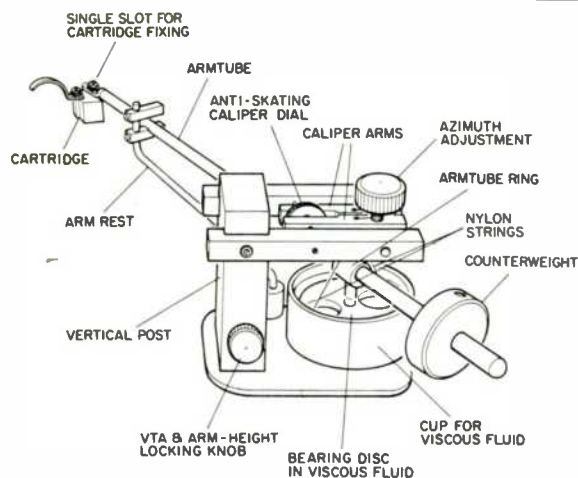


Fig. 1—The Well Tempered tonearm, showing the locations of various design features.

duced by the chisel-shaped styli used in cutting records. While this stylus is available for license by other cartridge manufacturers, most of them opt for a simpler, generic stylus with a long-ellipse contact area.

### First Impressions

By its very appearance, the Well Tempered tonearm is different from any other arm. The main bearing is suspended by two nylon strings and sits in a bath of viscous fluid. Aluminum, stainless steel, and various types of engineering plastics are used in the arm's fabrication. The main armtube is one continuous piece, from the cartridge fixing point to the end which holds the sliding counterweight.

I usually check for bearing integrity by holding the main arm post in one hand while trying to pull, push, and twist the armtube. The design of the Well Tempered arm precludes this, since the bearing is free to move in the viscous fluid. I did tap the armtube, and the sound varied from "deh" (as in delicious) when tapped at the cartridge end, to a very subdued "dah" (as in "ah! That's nice!") when tapped near the pivot. This test told me that the amount of sound coloration introduced by the armtube would indeed be very low.

The finish is black and natural stainless steel and is very good quality. The lack of a headshell is also unusual; the cartridge must be mounted by a single screw to an aluminum extension fitted into the end of the armtube. There are no conventional calibrations anywhere on this tonearm, with the exception of a scale on the main arm post which can be used to set the VTA of the cartridge. The caliper-like device used to set the sidethrust or anti-skating force is something I have never seen before on a tonearm.

### Features

As I describe various features, you can refer to Fig. 1, a line drawing of the Well Tempered tonearm. The first thing to notice is that this is basically a unipivot design. Most uni-

pivot bearing designs hold the armtube from below, but this arm is unique in that the pivot, while below the armtube, is suspended from above by strings. The exact position of the main bearing is somewhere near the center of the nylon bearing disc, which is suspended by two nylon strings; it is not fixed in position, as is true with ordinary unipivot designs. The exact position of the horizontal bearing is affected by the azimuth adjustment, while the vertical position will be affected by the height of the cartridge used and the VTA setting. With most cartridges, the vertical bearing center can be positioned slightly above the record surface. This causes the stylus to move up and down equally when tracking vertical warps, which is desirable.

The nylon disc, which has two large holes in it, sits in a bath of viscous fluid that just covers its surface. This viscous fluid provides excellent damping, especially at the usual low-frequency resonance caused by the mass of the tonearm and the compliance of the phono stylus. A short aluminum post extends upward from the nylon disc and connects to a thin but wide aluminum ring with a hole in it. The armtube is securely fastened in this ring. The armtube, which is 0.256 inch in diameter and 0.010 inch thick, is made from 0.250-diameter stainless steel tubing and is 11½ inches long. It is filled with fine-grain sand to damp out any resonances and weighs about 23 grams, including the cartridge fitting and end cap.

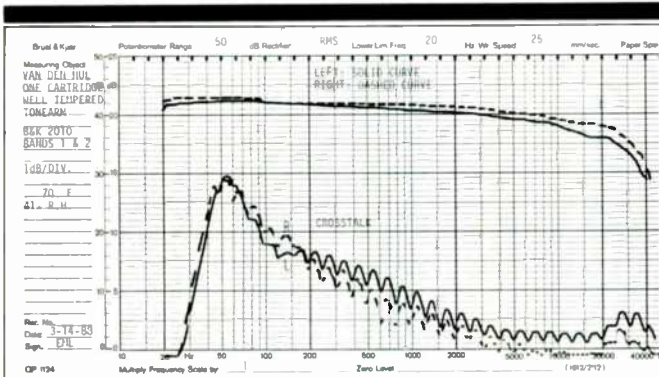
The phono cartridge mounting is by a single screw, since the fitting at the end of the armtube is about ¼ inch wide and has only a single slot. This is a trade-off: The rigidity of the cartridge mounting has been compromised to keep the effective mass of the tonearm low. The aluminum finger lift is attached directly to the cartridge, through the cartridge's remaining mounting hole. Of course, this can be eliminated, if desired, to keep the effective mass as low as possible, but since there is no other easy way to raise and lower the tonearm, I left it attached.

The offset adjustment for the phono cartridge is made by rotating the cartridge on its single mounting screw. The offset angle and the overhang are set by using a plastic template which slips over the turntable spindle. The overhang is adjusted by rotating the whole tonearm base around the main pillar, which fits up inside the large, rectangular vertical post.

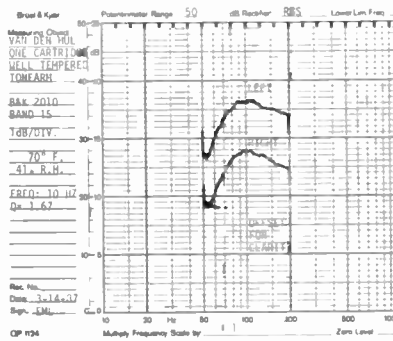
Many interdependent adjustments must be made to get all this right. As mentioned before, the vertical azimuth, which is adjusted by turning the knob directly over the armtube, affects the position of the horizontal bearing; it also affects the overhang. The sidethrust correction is adjusted by turning the caliper dial, which can be seen sticking up between the vertical post and the azimuth knob. Turning this dial varies the distance between the two aluminum caliper arms to which the nylon strings are attached, thus adjusting the sidethrust correction. Even at the minimum setting, with the beams close together, there is some sidethrust force because of the way the strings are attached. I found this setting worked best with the van den Hul cartridge.

Loosening the knob at the bottom of the vertical post allows you to set the proper tonearm height for the cartridge chosen; it also is used to adjust the VTA. The adjustment must be made by sliding the tonearm up and down by hand.

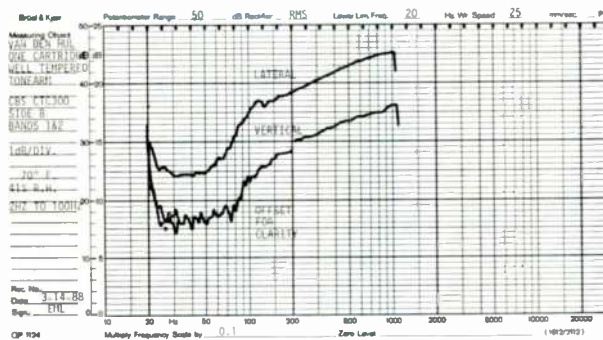
The van den Hul cartridge and Well Tempered arm had a distinctive sound that correlated well with the results of my measurements.



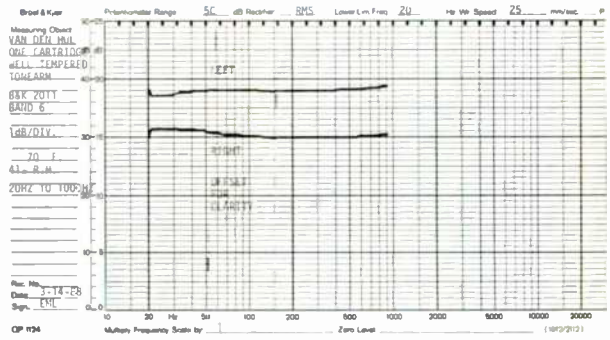
**Fig. 2—Frequency response and crosstalk of the van den Hul MC-One phono cartridge in the Well Tempered arm, using B & K 2010 test record.**



**Fig. 3—Low-frequency tonearm cartridge resonance is at 10 Hz. Its Q is 1.67, which is very good. (Curves offset for clarity.)**



**Fig. 4—Response to vertical and horizontal modulation from 2 to 100 Hz (slow sweep). Note that arm cartridge resonance is almost completely damped. (Curves offset for clarity.)**



**Fig. 5—Slow sweep from 20 Hz to 1 kHz, to check for structural resonances in the arm. Resonances can be seen but are very subdued. (Curves offset for clarity.)**

A calibrated scale on the arm post (not shown in Fig. 1) can be seen through an opening on the side of the rectangular vertical post. The scale is marked from +3 to -3, with zero in the center. Once at the proper height, a line can be drawn on the post in line with the zero. (The arm's height may cause interference with some turntables' dust covers.)

Vertical tracking force is adjusted by sliding one of the two supplied weights along the rear of the armtube. The counterweight should be as close to the pivot as possible, so choose the heaviest practical weight. The circular counterweight should be locked by the nylon set screw. A separate tracking-force gauge must be used, since there are no calibrations on the armtube or counterweights.

Gold-plated connectors are used at the cartridge end of the fine Litz-wire phono leads, which exit the armtube just in front of the armtube ring (visible under the rear horizontal bar). These leads are twisted together and have plenty of slack, so they can be dressed for lowest lead torque. Two

gold-plated phono sockets and a five-way binding post for grounding are mounted to an extruded aluminum channel, which can be attached on the rear of the turntable base.

### Measurements and Listening Tests

The correlation between the technical measurements and the written comments made by members of the listening panel seems to be very good. The combined "sonic signature" of the Well Tempered tonearm and van den Hul cartridge was different enough from that of the reference system to make this easy. Remember, the reference system is not intended to represent the ultimate goal to match; only live sound could serve that purpose. The sound of the system being evaluated can be judged better or worse than the reference, but that is not its purpose. The reference merely acts as a point from which the listening panel members can rate the systems from 0 to -5 and make comments about the sound as they perceive it for each of the 12

# TAKE OUT T



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The low crosstalk figure helps account for the good imaging of this arm/cartridge pairing.

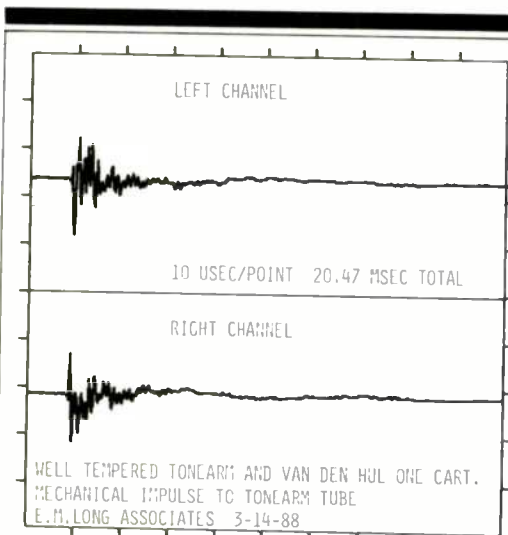


Fig. 6—Output vs. time of arm cartridge when mechanical impulse was applied to arm tube, with arm floating.

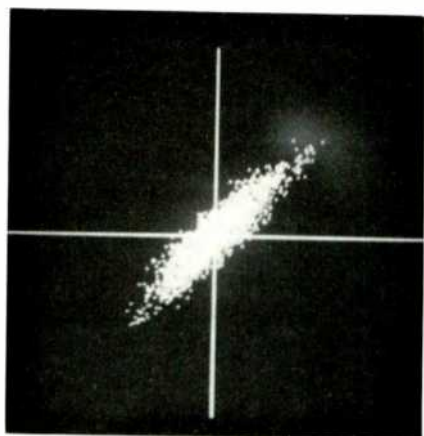


Fig. 8—Interchannel phase, using pink noise from B & K 2011, band 7.

musical selections played. The reference system should be a very good one—and it is—but its main value comes from the fact that it is a known, measured, and repeatable quantity. The rating and comments can be looked at in light of these measured differences.

All panel members commented that the reference system sounded sharper on the sounds of cymbals, brass and string overtones, etc. Figure 2 shows the amplitude versus frequency response of the WT/vdH combination. There is an apparent roll-off of the higher frequencies, which would account for these comments. These remarks were not negative in tone: some wrote "smoother highs on cymbals," "sonorous," etc. The crosstalk measurement usually indicates very distinctly the high-frequency resonance of the

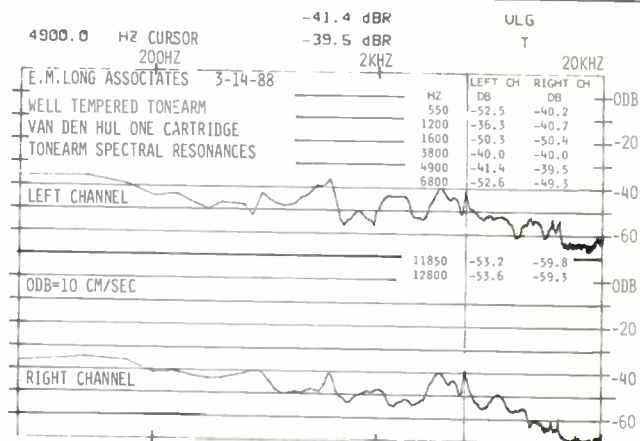


Fig. 7—Spectral output of the energy is in the middle register, which could add to perceived brightness. (averaged) of arm cartridge due to 16 mechanical impulses applied to arm tube. Most

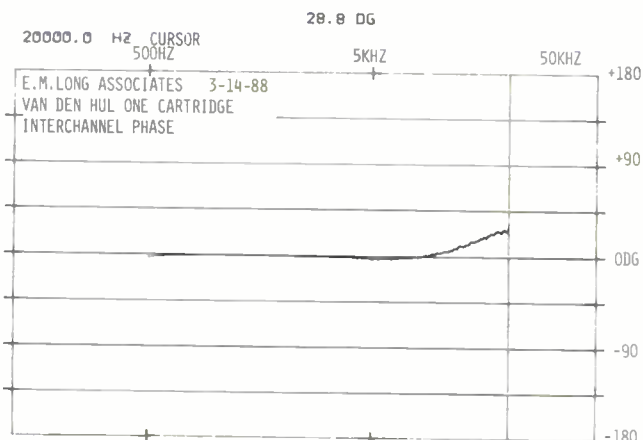


Fig. 9—Interchannel band 7, pink noise. Phase difference at 20 kHz is 28.8° (4.0 μS).

cartridge, but it is barely visible for the van den Hul, being somewhere in the region around 30 kHz. This means that the resonance is well controlled, which is good. I made other tests for this, and determined that the high-frequency resonance is at 33.3 kHz. The amount of crosstalk is very low, which helps account for the good comments made about the imaging of this arm/cartridge combination. Comments about the balance of the sound being "forward" might be explained by the shape of the curves, which show more output in the fundamental range of instruments and voice, but other data correlates with this as well.

Figure 3 is the left- and right-channel response from 5 to 20 Hz, with the curves offset for clarity. It shows the low-frequency resonance caused by the effective mass of the

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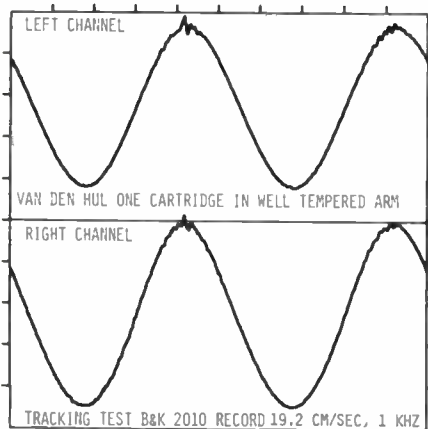
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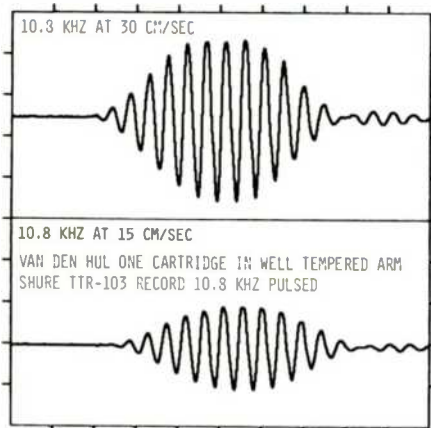
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The ability of this arm and cartridge to track high-level mid-frequencies proved exceptional.

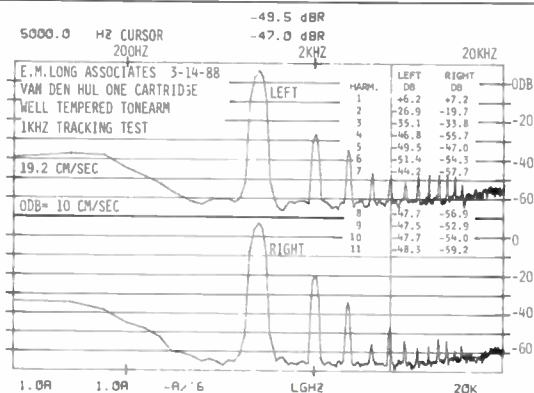


**Fig. 10—Tracking of arm/cartridge with 1-kHz test tones at 19.2 cm S (B & K 2010), a level most cartridges find difficult to track. A small jitter is visible at the top of the waveform.**

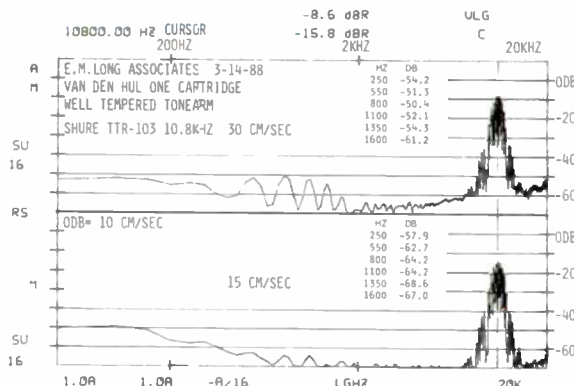


**Fig. 12—Output from 30- and 15-cm S, 10.8-kHz pulse test, using Shure TTR-103 test record.**

Well Tempered tonearm interacting with the compliance of the stylus of the van den Hul cartridge. The resonance is at 10 Hz and is very "well tempered" or damped by the viscous fluid at the pivot of the tonearm. Other tonearms with damping near their pivots have not shown results as good as this. The quality of the bass is excellent with this arm and cartridge. One panel member said it provided "tighter" sound, while the overall comments and ratings indicate a tie with the reference system. Figure 4 shows the combination's response from 2 to 100 Hz for lateral and



**Fig. 11—Spectral analysis of the cartridge output when reproducing the 19.2-cm S signal of Fig. 10. The fifth harmonic (at the cursor position) is 0.19% in the left channel and 0.20% in the right.**



**Fig. 13—Spectral analysis of distortion from signals shown in Fig. 12 (average of 16 samples at each level). The level at 250 Hz is 0.2%, which is very good. Output at 30 cm S is +8 dB above the 10-cm S, 0-dB reference level.**

vertical groove modulation. The resonance is more apparent in the lateral mode, which indicates that the damping is greater in the vertical plane of tonearm movement.

Figure 5 shows the response of the Well Tempered tonearm/van den Hul cartridge combination to a slow sweep from 20 to 1,000 Hz. Any resonant "rattles" caused by loose fittings will show up during this test. There are very tiny indications of resonances, especially in the right channel, but nothing really severe.

Figure 6 shows the WT vdH's response to a mechanical

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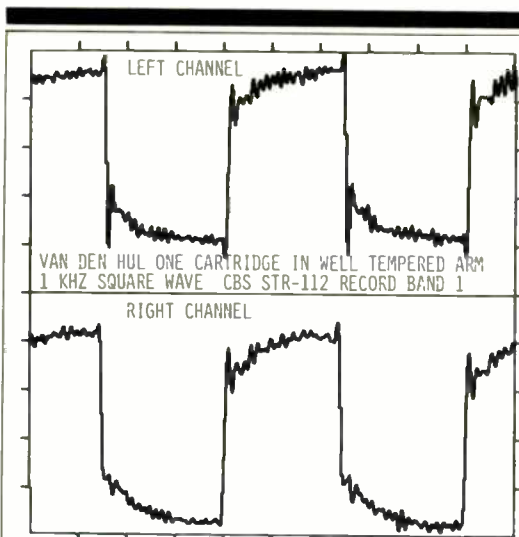
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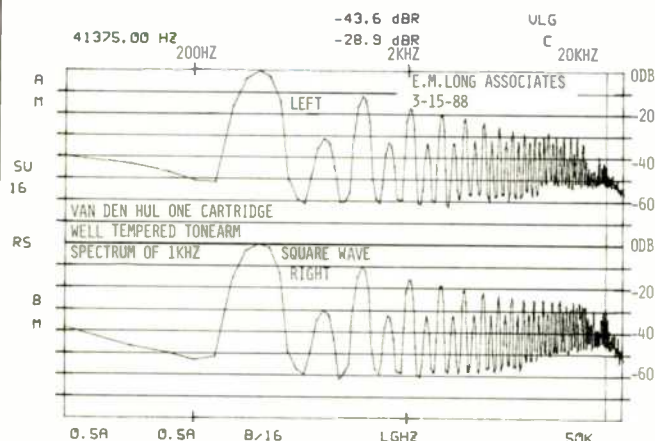
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Some listeners liked this pairing very much. It was very precise, dry, and analytical, and tied the reference for clarity.



**Fig. 14—Output from 1-kHz square wave, using CBS STR-112 test record.**



**Fig. 15—Spectral analysis of 1-kHz square wave (STR-112).**

impulse. The internal damping of the tonearm is good: The output decays rapidly without showing any serious delayed reflections. Figure 7 shows the spectrum of the response to an average of mechanical impulses applied to the tonearm. Some panel members commented that the sound of individual violin and orchestral strings was "brighter"; this might be due to the fact that the Well Tempered tonearm shows more energy in the range between 3.5 and 5 kHz. Energy around 1.2 kHz may also have been partly responsible for male voices sounding "bright" and "forward" to some panel members.

Figure 8 shows the left-channel versus right-channel output when playing a recording of pink noise. A perfect match between channels would result in a 45° straight line. Figure 9, which shows the phase versus frequency response for the same recording, indicates that the interchannel phase

difference occurs mainly above 5 kHz. This interchannel difference appears to be trivial: The panel members rated imaging performance the same for the tested arm/cartridge combination and the reference system.

The ability of the WT/vdH combination to track high-level middle-register signals (Fig. 10) is very good, if not exceptional. The 19.2-cm S, 1-kHz signal is very difficult to track, and the performance of this combination puts it in the company of some of the best arm/cartridge pairings. The spectrum produced by this tracking test (Fig. 11) indicates that the third and fifth harmonics, especially in the right channel, will cause the sound to be perceived as being a bit bright, which correlates well with most of the comments from the listening panel.

Figure 12 shows the output due to a 10.8-kHz tone burst. There is a little compression at the top of the 30-cm S burst which could affect the sound of high-level high frequencies. In this regard, however, the rating and comments of panel members about the sound of cymbals, for instance, put the WT/vdH slightly above the reference system. The spectrum produced by the 10.8-kHz tone burst (Fig. 13) is a very good indication that this arm/cartridge combination does not produce a lot of low-frequency modulation garbage which can cloud the sound of loud passages that include high-level, high-frequency sounds.

Figure 14 shows the output produced when playing a 1-kHz square wave. The rise-time of the van den Hul cartridge is extremely fast but well damped. This damping also correlates well with the amplitude versus frequency response (Fig. 2), which shows a gentle roll-off above 20 kHz. I thought it might be interesting to see the spectrum produced by this 1-kHz square wave (hence Fig. 15). Calculating such spectra for each tonearm/cartridge combination might prove valuable for reference and to indicate their tonal balance.

## Conclusions

At the end of a long and detailed discussion of the measurements and sound quality of a combination such as this, I am supposed to say something pithy and concise so you won't have to read through all the details. It isn't easy in this case. Some of the panel members liked the WT/vdH very much, and I must admit that, on a lot of program material, it was very precise, dry, and analytical. It was judged slightly better than the reference system on strings, guitar and piano as well as for general clarity; it was judged not quite as good on voice, bass, rock, and for spaciousness. The two systems tied on brass, drums, and full orchestra, as well as image stability.

You can't accidentally damage the stylus by dropping the tonearm because it takes about 1 s to fall from a horizontal starting position. The Well Tempered arm can tame cartridges that require good damping. The height of the arm base, however, may cause problems with some turntables unless the dust cover is removed.

I found the high-frequency tracing capability of the van den Hul stylus to be excellent, and I never lost my temper while using the tonearm. For the rest of the conclusions and comments of the listening panel, you will have to read the report.

*Edward M. Long*



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# The suspension of the Well Tempered turntable reduces motor and platter vibrations more than it does external ones.

Continued from page 48

Firebaugh decided to take a different approach. The Well Tempered turntable has what I would call moderate mass, but it has no springs. Instead, it sits on four rubber feet which are fastened to the bottom with screws. Rather than fight the battle of trying to tame the tendency of suspended turntables to rock up and down, side to side, or both, Firebaugh decided to tackle the problems caused by bad-tempered vibrations above the seismic region. He has applied his "well tempered" viscous damping techniques to the motor bearing and the main turntable platter bearing.

The motor is a 24-pole a.c. type that is highly modified. It has a new thrust bearing at the bottom, upon which the motor shaft rests. The bottom of the motor is mounted in a heavy, lead block which Firebaugh refers to as a "brick." Sometime back, there was a flurry in audiophile circles about the taming characteristics of bricks (of this or that material) when placed on amplifiers, CD players, etc. Perhaps that is the connection, but this brick is really beneficial since it gives tremendous stability to the motor.

Stability is very important in this case, because the motor of the Well Tempered turntable is completely separate from the rest of the machine and is connected to it only through the belt; it needs the mass to remain in position. The shaft of the motor turns in a bath of viscous fluid which smooths the rotation and reduces the tendency of the a.c. motor to "cog." The turntable platter shaft also runs in a bath of viscous fluid, and this tempers the rotation of the platter and helps reduce flutter.

## First Impressions

The translucent white platter sitting on the three-tiered, satin-black base certainly gives the Well Tempered turntable a striking appearance. The turntable and base are one piece, unlike most other designs, and I must admit that I wondered how it would do during the usual shock tests. When I saw that the motor was completely separate, I

## MEASURED DATA

PARAMETER	MEASURED*	COMMENT
Speed Accuracy	0.3% fast	
Speed Stability	±0.21%	Very good
Wow, DIN Unwtd.	0.16%	Very good
Wow, DIN Wtd.	0.12%	Good
Flutter, DIN Unwtd.	0.13%	Very good
Flutter, DIN Wtd.	0.02%	Excellent
Wow & Flutter, DIN Unwtd.	0.24%	Very good
Wow & Flutter, DIN Wtd.	0.14%	Good
Short-Term Drift	±0.15%	Very good
Rumble, Unwtd.	-66.8 dB	Excellent
Rumble, Wtd.	-81.8 dB	Excellent
Suspension Resonance	Not applicable	No suspension

\*Measured with one twist in drive belt; see text.

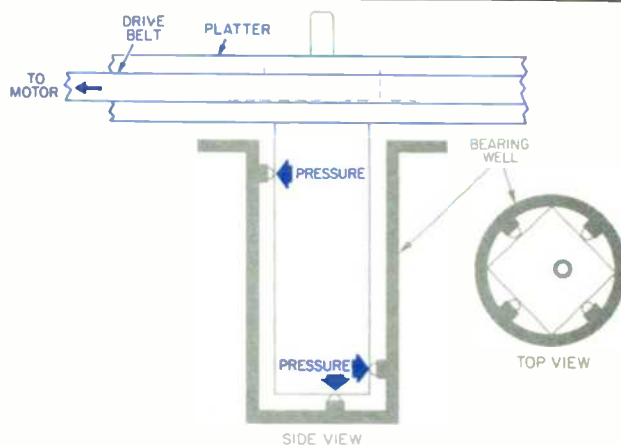


Fig. 1—Cross section and top views of the turntable shaft bearing. Tension on the drive belt presses the thick shaft against the thrust bearings on the sides of the shaft well.

remembered having seen the same technique on some early disc-cutting turntables. This approach was taken because some of the early, high-torque motors required to turn the massive cutting turntables had excessive vibration. Good ideas of the past have a way of returning, and, although this motor has very little vibration, separate mounting has to help.

Mounting a tonearm—other than the Well Tempered arm—to this turntable will not be a trivial task. There is no separate mounting board, and the base is solid in this area, except for a hole precut to fit the Well Tempered tonearm. The turntable cannot be ordered precut for other arms (Firebaugh has not yet tested the table with any), and I am certain that changing to a different tonearm later would not be easy.

I also noticed that the drive belt seemed thinner and narrower than most of the other belts I have seen. Firebaugh recommends putting a single twist in the drive belt, between the motor pulley and the turntable platter, and this looks a little strange at first.

## Features

The base of the Well Tempered turntable is part of the turntable and not a separate entity, as it is on most other turntables. It measures 19 inches wide, 15 $\frac{3}{8}$  inches deep, and 5 $\frac{1}{4}$  inches from the bottom of the rubber feet to the top of the center spindle, which is the highest point. When the record clamp is in place, the total height is about 5 $\frac{3}{4}$  inches. With the Well Tempered tonearm, which is higher than most, the height with the clamp is 7 $\frac{1}{2}$  inches. The table weighs 26 pounds without the motor, which is completely separate. The base is solid and consists of three pieces of medium-density fiberboard, each 1 inch thick, plus two



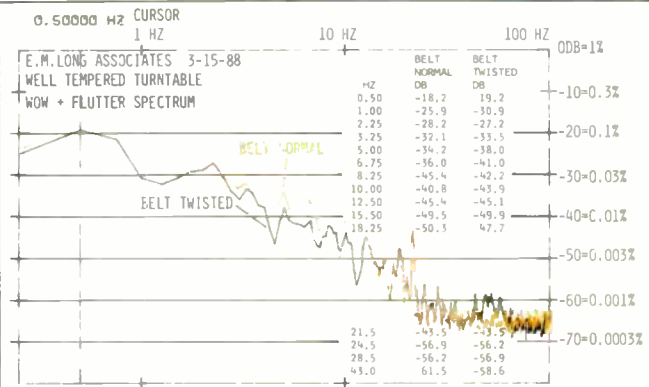
Instead of riding in the usual sleeve bearing, the shaft is pulled by the belt against diagonally opposed thrust-bearing pads.

layers of damping material between them. The rounded edges on the base, and the satin-black finish, give it a very nice appearance. A 5¼ × 5¼-inch cutout on the left side of the base allows for the motor, which sits in this area. Four soft rubber feet are fastened to corners of the lead brick to which the motor is mounted.

The main bearing well is made of black Delrin. The body of the well is 2.89 inches deep and 1.492 inches in diameter. It has a collar, 1.75 inches in diameter and 0.10 inch thick, with a "V" notch that must be pointed toward the motor when it is installed in the mating hole in the turntable base. Instead of the usual sleeve bearing in the spindle well, there are two Teflon thrust-bearing pads at the top, on the side facing the motor, and two near the bottom on the side away from the motor (Fig. 1). The drive belt pulls the spindle shaft against them! It is a weird experience to have the turntable platter move down against the base when pressure from a record cleaning brush, for instance, is applied on the right side. The one-piece record spindle/platter shaft is pressed into a hole in the center of the main platter. It has a half-inch-diameter shaft with a flat bottom which turns on a bearing at the bottom of the main bearing well. The upper part, which fits into the platter, is 0.725 inch long and 0.75 inch in diameter. It has a 0.980 × 0.125-inch lip that carries the weight of the platter and keeps the spindle shaft in place. The top section of the spindle has a diameter of 0.287 inch to fit the record hole.

The 11.5-inch diameter turntable platter is made of solid, translucent acrylic and has a 0.75-inch diameter hole in the center for the metal spindle shaft. There is a recess, 4.085 inches in diameter and 0.050 inch deep, to accommodate the extra thickness of a record at the label area. The platter is 0.915 inch thick at the edge and is machined in such a way that the surface is dished down toward the center to allow an LP to be pulled down by the record hold-down clamp. The clamp is 1 inch high and 1.75 inches in diameter, with two knurled rings for better gripping. The design of the record clamp is very clever, although it can be used only with the Well Tempered turntable. Inside its center hole is a recessed #10-32 hex-head bolt which mates with #10-32 threads inside the spindle. When you turn the clamp on the spindle, it rotates down and pushes the record against the turntable, making it easy to adjust the force to the amount desired.

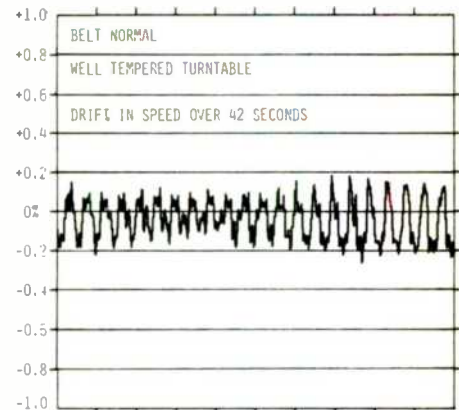
The separate 24-pole a.c. motor weighs about 2 pounds. It has been highly modified with a new thrust plate and the addition of viscous fluid inside the motor bearing. The motor mounts to a 0.25-inch thick, 4.5 × 4.5-inch soft iron plate that provides excellent shielding of the motor's magnetic field. The motor is mounted on the 10-pound lead brick and is sandwiched between the steel top plate and the brick by two long screws. A pushbutton a.c. power switch is mounted on the top plate. The 5-foot a.c. power cord exits from the bottom of the brick. The motor pulley, which is force-fitted to the motor shaft, is made of Delrin and has two steps, for 33⅓ and 45 rpm. Speed change is accomplished manually by moving the belt to the proper step on the pulley. The motor has good torque and accelerates the turntable from zero to full speed in 1.5 S. When the power is turned off, the turntable platter comes to a full stop in 2.5 S. The drive belt



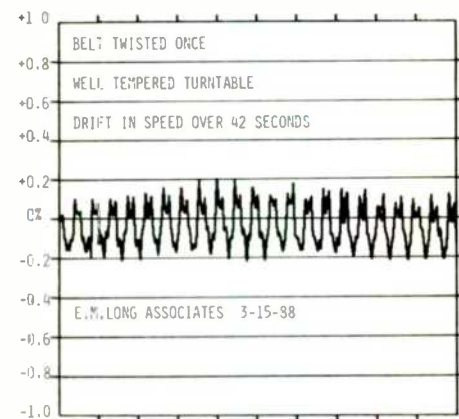
**Fig. 2—Wow and flutter spectrum, from 0 to 100 Hz. Note the improvement in performance with the belt twisted (see text). The arm/cartridge resonance with the van den Hul**

**MC-One cartridge and Well Tempered tonearm is at 10 Hz. This resonance, which is normally visible in such plots, cannot be seen due to the arm's high damping.**

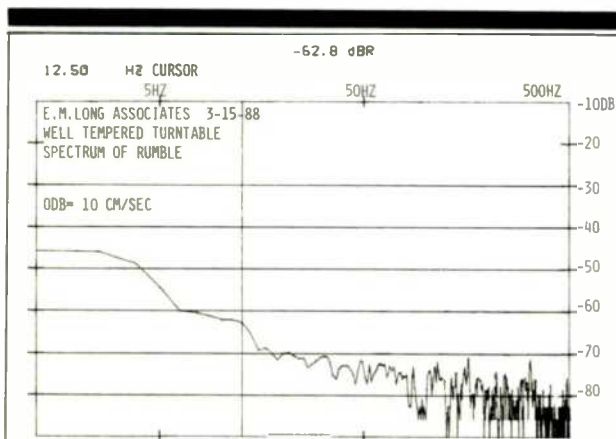
**Fig. 3—Speed drift over 42-S period, with no twist in belt. Cyclic variations at 1.8 S, or 0.56 Hz, are related to the rotational speed.**



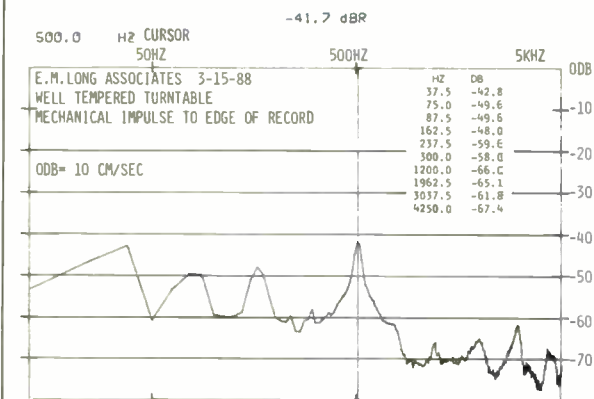
**Fig. 4—Same as Fig. 3 but with belt twisted.**



The separate motor housing is a revival of a good idea from the past, when it was used on disc cutters.

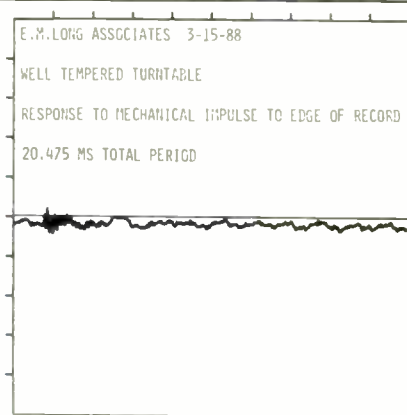


**Fig. 5—Rumble spectrum.** Due to the well-damped arm resonance, the output is extremely low.

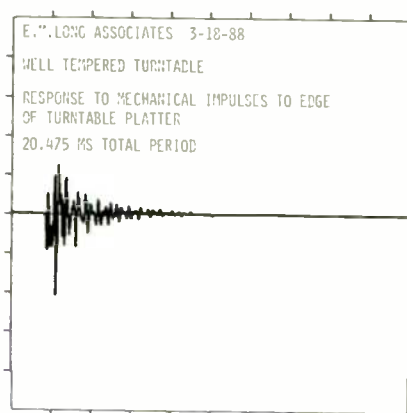


**Fig. 7—Spectrum to 5 kHz** of output from a series of 16 mechanical impulses (averaged) applied to edge of a stationary record, with stylus resting in groove.

**Fig. 6—** Output vs. time for mechanical shock applied to edge of a stationary record, with stylus resting in groove.



**Fig. 8—** Output vs. time for mechanical impulse applied to edge of the turntable platter, measured with accelerometer on the platter's edge.



is thinner than usual, only 0.0135 inch thick and is 0.125 inch wide. It wraps around the outside edge of the platter and the motor pulley.

### Measurements and Listening Tests

Bill Firebaugh tells me that, during the design and testing of the Well Tempered turntable, one time he accidentally put a single twist in the drive belt while putting it over the motor drive pulley. He didn't notice this right away and continued testing. The wow and flutter measurements were lower than usual, and when he looked at the turntable, he saw the twisted drive belt. Firebaugh reasoned that perhaps the twist in the belt made it come off and go back on the platter

more smoothly as the platter rotated. It seemed to him that the reproduced sound from records, particularly piano music, was more realistic. To check this out, I listened to some piano music with and without a twist in the drive belt. I think Firebaugh is right; I found that the piano sounded better with one twist in the belt. (I don't know if this would work as well with other belt-drive turntables because I haven't had the chance to try it.)

Figure 2 shows the wow and flutter spectrum with and without the belt twisted. The level below about 10 Hz is lower with the belt twisted, except at 2.25 Hz. There is more output in the range from around 50 to 60 Hz, but it is extremely low in both cases, and the flutter readings listed

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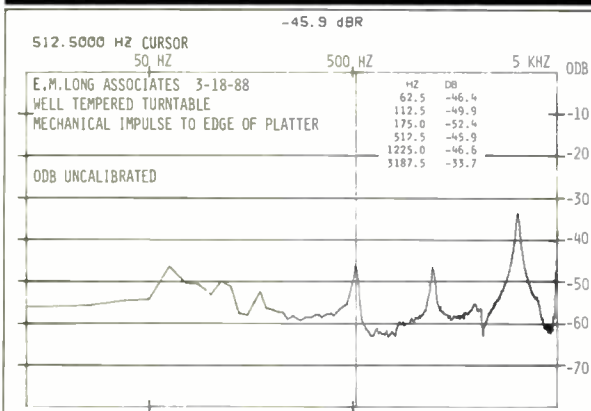
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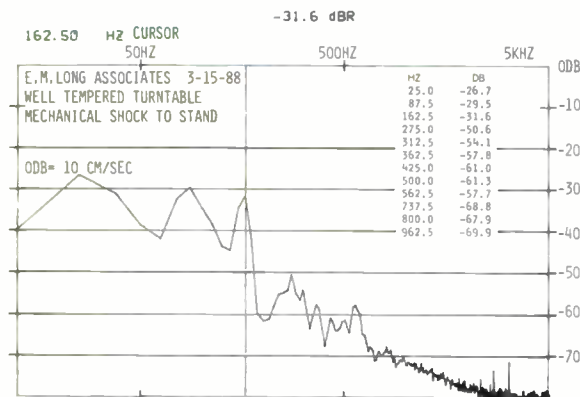
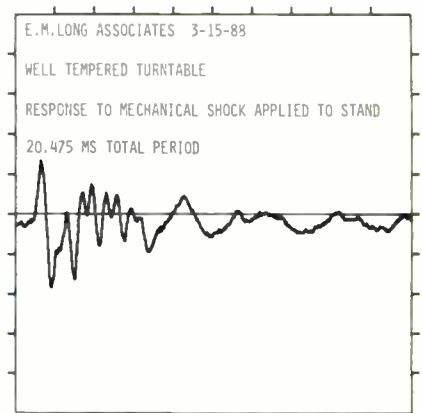
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Twisting the drive belt may seem to be a strange idea, but it did improve both the sound quality and the measured performance.

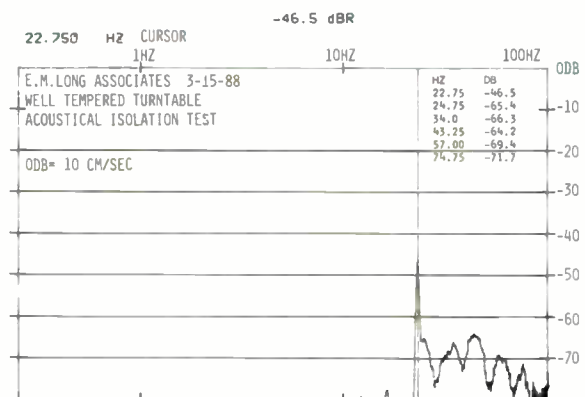


**Fig. 9—Spectrum to 5 kHz of the vibrations caused by mechanical impulse applied to edge of the turntable platter (16 impulses, averaged).**

**Fig. 10—Output vs. time for mechanical shock applied to heavy stand on which the turntable rested.**



**Fig. 11—Spectrum to 5 kHz of the vibrations caused by mechanical shock applied to turntable stand (16 impulses, averaged).**



**Fig. 12—Spectrum to 100 Hz of the vibrations from an acoustic field of 100 dB SPL at the surface of a record. Stylus is resting in a groove near the middle of the record. Acoustic isolation is excellent.**

in the Measured Data table, which would be affected by the output in this range, are excellent. During the listening evaluation, I put a twist in the drive belt and left it that way. Comments from members of the listening panel indicate that they thought that the sound of the piano was a little better with the Well Tempered turntable than with the reference system: "Sustained chords were very steady" and staccato passages "very precise."

With the belt normal, the variation in rotational speed for 33 1/3 rpm (Fig. 3) looks a little strange, since it is not consistent. However, if you compare it with data from reports I have done on other turntables, you will see that the greatest and smallest variations in speed on the Well Tem-

pered turntable are comparable to results from some of the best units tested. Figure 4 shows that the speed also varies with the belt twisted and that there is a smaller variation over the 42-S period measured. That, too, is comparable to some of the best tables.

The rumble spectrum (Fig. 5) shows something I have tried to emphasize in past reports: That the tonearm/cartridge resonance is one of the major contributors to rumble as well as to wow and flutter. The mass of the Well Tempered tonearm, and the compliance of the van den Hul MC-One cartridge used during my evaluation of the Well Tempered turntable, resonate at 10 Hz, but the Q of this resonance is very low, due to the arm's excellent damping. In



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The wow & flutter and rumble spectra show how turntable performance gains from well-damped arm/cartridge resonance.



other words, when this resonance is excited by rumble or wow, there is very little output. Figure 5 shows very little rise in output around 10 Hz because of this. Look at Fig. 2 again and you will see that, at 10 Hz, there is also very little indication of the tonearm/cartridge resonance. This means that if I took only readings from a meter while testing for rumble or wow, I would get lower readings when the tonearm/cartridge resonance is well damped (as it is in this case) than I would if I used a poorly damped tonearm/cartridge combination. The turntable would be rated better or worse depending upon the arm/cartridge combination used to test it. That is why I show the *spectrum* of the rumble and the wow and flutter. Although the tonearm/cartridge resonance must be considered as affecting the overall quality of the sound, when trying to rate the turntable by itself—with respect to rumble or wow—the amount of output around the tonearm/cartridge resonance should be ignored. I purposely played a recording that always seemed to have more than a normal amount of rumble and asked the panel to comment on the background rumble. Their response was that the Well Tempered turntable, with the Well Tempered tonearm/van den Hul cartridge combination, produced a little less rumble than the reference system, whose tonearm/cartridge resonance is less well damped.

Figure 6 shows the output produced when a mechanical impulse was applied to the edge of a stationary record, with the stylus of the van den Hul cartridge resting in a groove near the middle of the record. The output is very low, and since it dies out quickly, it is also very well damped. Figure 7 shows the spectrum of the output caused by 16 mechanical impulses. The main output is at 500 Hz; this could affect the sound, especially that of voices. During the listening evaluation, some panel members said the sound was "bright" and "forward" for the Well Tempered turntable and "clearer" for the reference system when reproducing voices. Energy peaks at 1200, 1962.5, 3037.5, and 4250 Hz might also be related to the rather consistent comments about the Well Tempered turntable being "bright" on most program material. I wanted to determine whether the energy around 500 Hz was due to the resonance of the acrylic turntable platter, so I

made a large number of tests using an accelerometer. The result of one of these tests is shown in Figs. 8 and 9. The output versus time for a mechanical impulse applied to the edge of the platter is shown in Fig. 8; the result is similar to that seen in Fig. 6, albeit at a higher level. The level of the tests with the accelerometer is uncalibrated, so only the shape of the envelope and the spacing of the up-and-down undulations is of interest. Comparing the spectrum shown in Fig. 9 to that in Fig. 7 will yield some useful insights about the resonant modes of the platter. Peaks of energy around 500, 1200, 2000 and 3000 Hz can be seen in both figures. When a record is clamped to the Well Tempered turntable, the output at all but the 500-Hz peak is reduced considerably, but some energy is clearly finding its way into the reproduced sound.

Figure 10 shows the output over 2.05 S for the Well Tempered turntable when a mechanical shock was applied to the heavy test stand upon which it was resting. The results are good, considering that there is no suspension and that the turntable has only four rather ordinary rubber feet. I think that excellent damping of the Well Tempered tonearm/van den Hul cartridge resonance is responsible for this. If a different tonearm/cartridge combination were to be used, the results might well be worse. The spectrum of the output due to 16 mechanical shocks applied to the test stand is shown in Fig. 11. The greatest output is in the range below about 170 Hz, with major peaks at 25, 87.5, and 162.5 Hz.

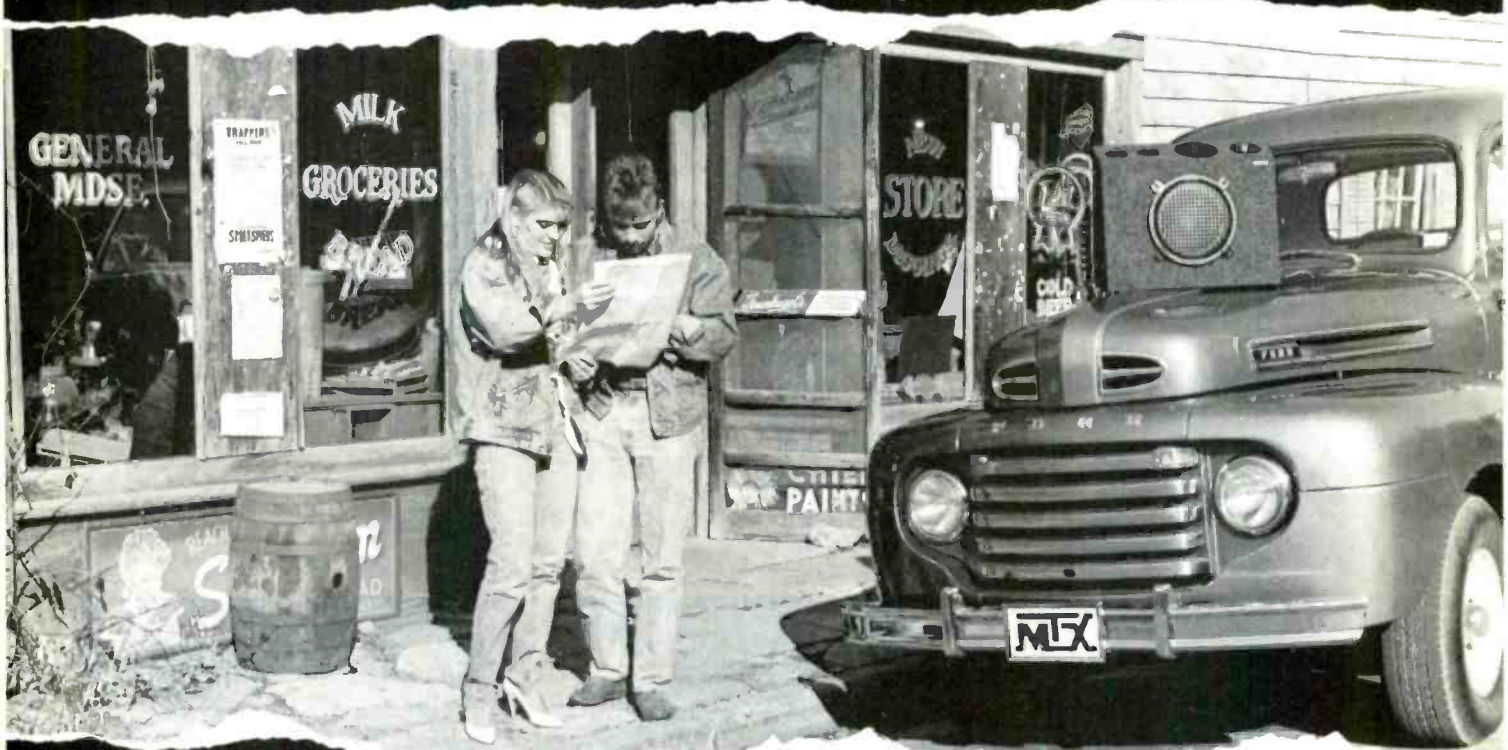
Figure 12 shows the spectrum of the output due to a 100-dB SPL acoustic field at the surface of a record. The stylus was resting in a stationary groove while the acoustic signal was slowly swept from 20 to 100 Hz. The output is very low, which indicates that acoustically induced feedback should not be a problem.

### Conclusions

I must admit that, although I hope you will read my entire report on the Well Tempered turntable, this is the part I usually jump to when I read other reviews. The Well Tempered turntable produced excellent results in both the technical measurements and the listening sessions. Some panel members, but not all, preferred the sound of the Well Tempered system (which included the Well Tempered tonearm and the van den Hul MC-One cartridge) to that of the reference system. For those characteristics of a turntable which can affect the sound quality, without direct reference to the tonearm/cartridge combination, the Well Tempered turntable did very well. The pitch is very steady, the torque is high enough so that the speed remains constant during soft and loud passages, and the immunity to mechanical shock and acoustical feedback is very high. The Well Tempered turntable's unusual design, with the motor separate from the main body of the turntable, provides excellent isolation of mechanically transmitted vibrations. However, it is also something to consider when thinking about mounting or transporting the turntable. Such innovative design ideas may raise questions in your mind, as they did in mine, but they seem to work very well. If you are after a high level of sound quality, you should check out the Well Tempered turntable. I think you will like it.

Edward M. Long

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# 2

## ONKYO T-9090II FM TUNER

### Manufacturer's Specifications

**Usable Sensitivity:** Mono, 10.3 dBf; stereo, 12.8 dBf.

**50-dB Quieting Sensitivity:** Mono, 15.8 dBf; stereo, 37.2 dBf.

**S/N:** Mono, 95 dB; stereo, 85 dB.

**THD:** Mono, 0.009%; stereo, 0.02% (both wide i.f. mode).

**Frequency Response:** 30 Hz to 15 kHz, +0.5, -1.0 dB.

**Alternate-Channel Selectivity:** 95 dB (super-narrow mode).

**Adjacent-Channel Selectivity:** 45 dB (super-narrow mode).

**Capture Ratio:** 1.0 dB.

**Image Rejection:** 100 dB.

**I.f. Rejection:** 100 dB.

**AM Suppression:** 60 dB.

**Separation:** 55 dB at 1 kHz, 33 dB from 70 Hz to 10 kHz (both wide mode).

**Output Level:** 0 to 1.5 V.

**Power Requirements:** 120 V, 60-Hz a.c.

**Dimensions:** 18<sup>5</sup>/<sub>16</sub> in. W x 4<sup>1</sup>/<sub>16</sub> in. H x 15<sup>1</sup>/<sub>4</sub> in. D (46.5 cm x 10.3 cm x 38.7 cm).

**Weight:** 18.7 lbs. (8.5 kg).

**Price:** \$749.95, including wood side panels.

**Company Address:** 200 Williams Dr., Ramsey, N.J. 07446.

For literature, circle No. 92





No, this is *not* a replay of an earlier review. When I evaluated the Onkyo T-9090 back in 1985, I gave it high marks and assumed that its performance was about as good as current technology would permit. Well, advances in technology never end, and that remarkable tuner's successor, the T-9090II, represents so much more than a cosmetic face lift that I felt it was worth evaluating and measuring. Most of the features on the original version have been retained, and additional features have been incorporated for convenience and compatibility with FM cable systems.

The T-9090II FM-only tuner has substantially improved selectivity over the previous model, owing to entirely new i.f. filters. It also has a more sophisticated Automatic Precision Reception (APR) system that allows you to program preferred reception modes along with station presets. The modes selected by the APR system include r.f. stage gain (distant/local), i.f. bandwidth (wide, narrow, or super narrow), stereo/mono, high blend, and antenna A or B. Although the APR system works automatically to provide the best field strength, lowest distortion, and lowest noise for each captured station, the above-named modes can be overridden if you wish.

Two antennas can be connected to this tuner. These may be two conventional FM antennas or one FM antenna and one cable FM connection. During tuning, each antenna input is sampled continuously, and the better signal is automatically chosen. This type of "diversity" reception can yield clear local signals from antenna A, for example, while antenna B can be oriented toward a more distant city that may provide weaker (but still usable) signals. Alternatively, antenna A might be used for over-the-air FM reception; and antenna B could be connected to a cable television feed for simulcast FM soundtracks of stereo pay-TV movies or music channels.

The remote supplied with the T-9090II allows complete control over most front-panel functions. It can even drive the motorized potentiometer that controls level at the variable output jacks. Preset stations can be sampled for 5 S each, and timer preset tuning (with an external timer) can be used to select preset stations in a predetermined order for unattended recording.

The T-9090II tunes in 50-kHz steps during automatic scanning, but manual adjustment is also possible, via the front panel, in 25-kHz steps. A multi-function fluorescent display shows station frequency, in MHz, to three decimal places. A linear scale shows relative r.f. input signal strength in 10-dB steps, and a numeric indicator also can show r.f. strength in dBf. The same numerical indicator can be set to show the signal threshold for scan tuning.

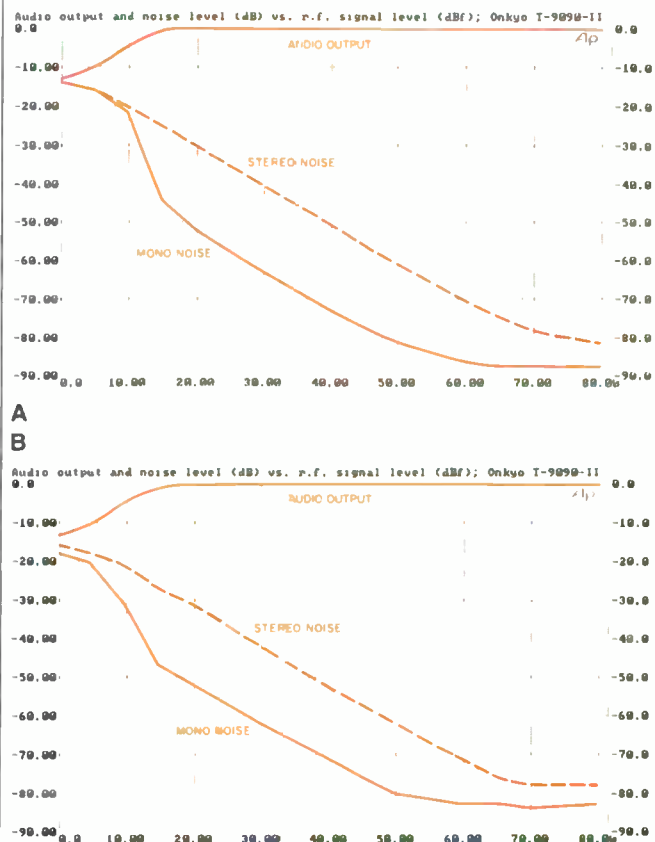
### Control Layout

The on/off pushbutton is at the lower left of the front panel. To its right, along the lower edge of the panel, are a "Shift" button and 10 numbered buttons for setting or recalling up to 20 preset station frequencies (numbered 1 to 10 or, in combination with the "Shift" button, 11 to 20). Just above these are eight smaller keys for setting the scanning threshold (17, 27, or 37 dBf), displaying signal strength in dBf, initiating preset scanning, switching between manual and automatic modes, tuning up or down, storing memory pre-

sets, and calling up "Auto Memory" mode. The latter automatically finds stations which can be received satisfactorily. It then stores them in order of ascending frequency, starting from the currently tuned frequency and whatever memory position you select.

On the right half of the display panel, a number of indicator lights show the various tuning modes selected manually or by the APR system, as well as muting status, stereo reception, and center-tuned status. Below them are 20 small, numbered indicator lights for the station presets.

Nine additional pushbuttons and one knob are at the right end of the panel. The five buttons in the top two rows select local or distant receptions, the i.f. bandwidth, high blend, stereo or mono, and antenna A or B. The remaining buttons control FM muting, restore APR operation after any of its settings have been overridden, indicate the next station to be selected during external-timer operation, and switch timer-controlled station selection on and off. The small rotary knob controls the output level for the variable output jacks on the rear panel.



**Fig. 1—Mono and stereo quieting characteristics for wide (A) and narrow (B) i.f. modes.**

Onkyo's T-9090II tuner automatically selects whichever of its two antenna inputs has the better signal.

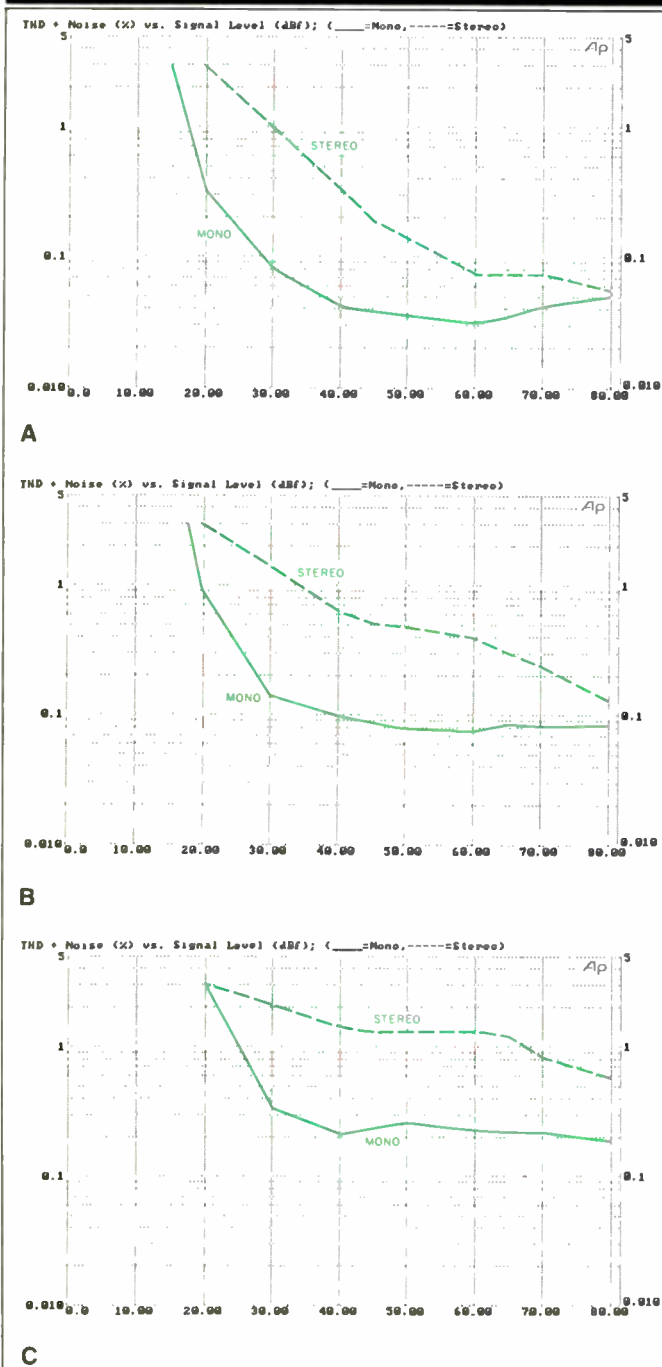


Fig. 2—THD + N vs. signal strength at 1 kHz for wide (A), narrow (B), and super-narrow (C) i.f. modes.

In addition to the two coaxial (75-ohm) antenna inputs and the fixed- and variable-level output jacks on the rear panel, there are two more jacks, labelled "V" and "H." These jacks can be connected to any oscilloscope's vertical and horizontal inputs for observing and minimizing multipath problems by antenna reorientation. For those who use flat, 300-ohm, twin-lead transmission lines from their antennas, Onkyo supplies 300/75-ohm matching transformers.

### Measurements

In testing this tuner's quieting characteristics (Figs. 1A and 1B), I measured 12.0 dBf of mono usable sensitivity in the wide i.f. mode; this increased slightly, to 11.5 dBf, in the narrow mode. Stereo usable sensitivity was 20 dBf in the wide mode and 18 dBf in the narrow mode. Because no substantial difference in quieting characteristics occurred between the narrow and the super-narrow modes, no graph is shown for the latter. In mono, 50-dB quieting was achieved with 18 dBf of signal input in the wide i.f. mode; the same level of quieting was reached in the narrow mode with only 16 dBf of input signal. In stereo, the 50-dB quieting point was reached with a signal level of 39 dBf in the wide i.f. mode and 35 dBf in the narrow mode.

Best signal-to-noise ratio that I was able to read was 87 dB in mono (at 65 dBf) and 81 dB in stereo (at 80 dBf), using the wide i.f. mode. Outstanding though they are, these figures fall somewhat short of Onkyo's claims. I suspect that they are limited by the residual noise inherent in my FM generator. (I have never been able to measure better than 88 dB or so with this instrument.)

Figures 2A, 2B, and 2C show THD + N versus signal strength. Lowest distortion for a 1-kHz modulating signal was, of course, obtained with the wide i.f. mode (Fig. 2A). Under these conditions, THD + N was only 0.035% in mono (for a 65-dBf signal) and 0.056% in stereo (for an 80-dBf signal). At 65 dBf, stereo THD measured 0.075%. The narrow mode yielded readings that were still below 0.1% in mono and just over 0.1% in stereo for strong, 80-dBf signals (Fig. 2B). Under conditions of extreme interference from adjacent channels, the super-narrow setting might be justified. This is true even though THD + N (for a 65-dBf signal) was more than 0.2% in mono and reached the 1% level in stereo in this mode (Fig. 2C).

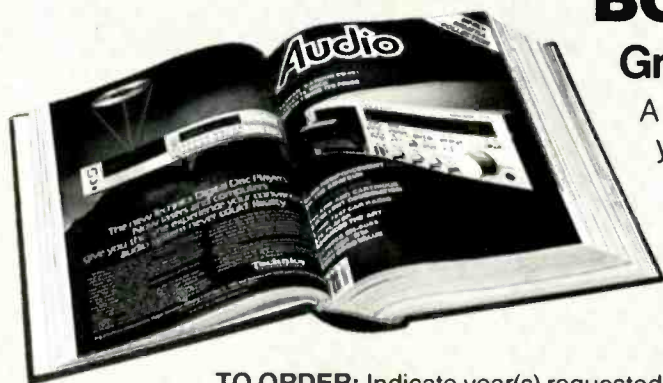
Plots of THD + N versus frequency, for a strong r.f. input signal, are shown in Fig. 3A (mono) and Fig. 3B (stereo). In each case, the bottom curve represents results obtained using the wide i.f. mode, the middle curve using the narrow mode, and the top curve using the super-narrow mode.

The audio generator output of my Audio Precision test gear can be equalized using a wide variety of curves. To measure frequency response of the Onkyo T-9090II, I simply used a 75- $\mu$ S *pre-emphasis* curve on the modulating audio signals. (This is the reciprocal of the de-emphasis characteristic required in FM tuners sold in the U.S.). In the response plot (Fig. 4), I have expanded the vertical scale to 2 dB per division. The response curve shows a superbly flat characteristic from 20 Hz to 10 kHz with a roll-off of a bit more than 1.0 dB at 15 kHz.

Separation versus frequency (Fig. 5) is plotted for all three i.f. bandwidths. At 1 kHz, separation ranged from over 50

# Audio

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I couldn't second-guess this tuner. It picked the best mode settings for every station I tried.

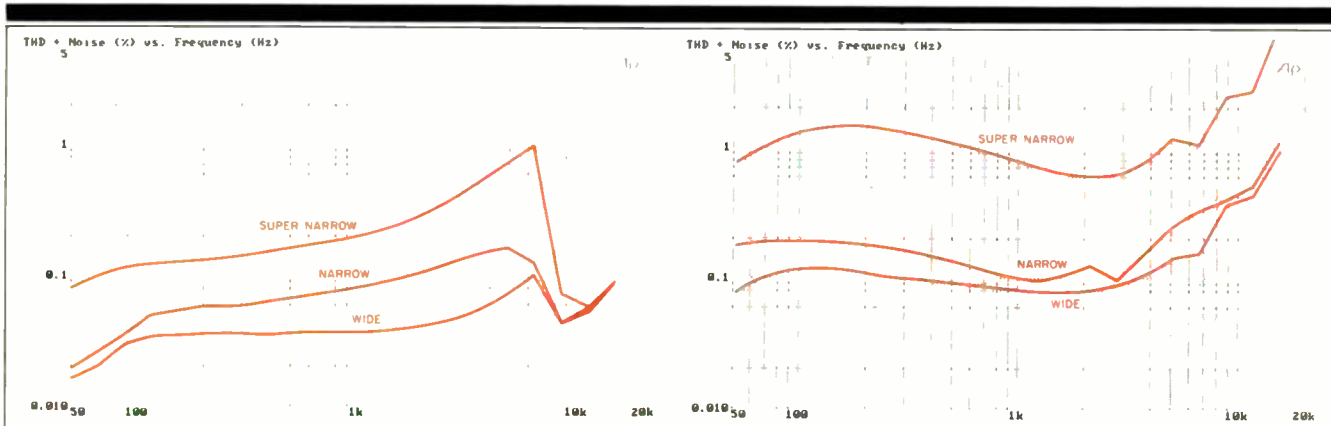


Fig. 3—THD + N vs. modulating frequency for mono (A) and stereo (B).

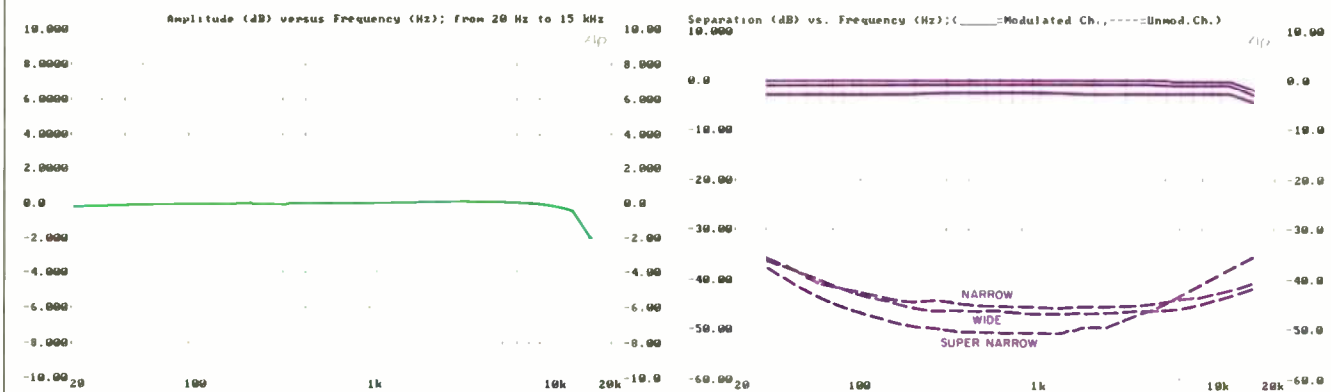


Fig. 4—Frequency response. Note vertical scale of 2 dB/div.

Fig. 5—FM frequency response (top curves) and separation vs. frequency (bottom curves) for all three i.f. modes.

dB to 45 dB, depending on the bandwidth setting. The solid curves represent the output of the modulated channel, and the dashed curves show the output of the unmodulated channel. Surprisingly, the *middle* dashed curve was obtained with the tuner set to the wide i.f. mode. The top dashed curve was plotted using the narrow mode, and the bottom dashed curve was made with the super-narrow mode. It's interesting to note that, at mid-frequencies, the best separation was obtained with the tuner set to where one would expect the worst separation! The effect of the super-narrow bandwidth is realized at higher frequencies, but even then, separation at 10 kHz remained nearly 40 dB in this mode!

The super-narrow i.f. setting, while minimally affecting stereo separation, does have a rather marked effect on crosstalk and distortion, as shown in Figs. 6A and 6B. In these spectrum analyses, the sweep is linear, from 0 Hz to

50 kHz. In Fig. 6A (wide mode), you can see that the crosstalk products to the right of the main 5-kHz signal are much smaller in amplitude and more free of modulation noise than they are in Fig. 6B (super-narrow mode).

I measured a capture ratio of 1.0 dB in the narrow mode and 1.5 dB in the wide mode. Image, i.f., and spurious rejection were all better than 100 dB. In the super-narrow mode, alternate-channel selectivity was an outstanding 95 dB and adjacent-channel selectivity was greater than 40 dB. In the wide mode, alternate-channel selectivity measured 38 dB. AM suppression was 62 dB, better than the manufacturer's claim.

#### Use and Listening Tests

I tried, repeatedly, to second-guess the APR system built into this "intelligent" unit, but with no success. I tuned to several stations of varying quality and manually tried to set

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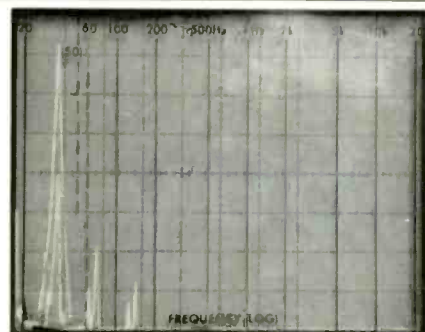
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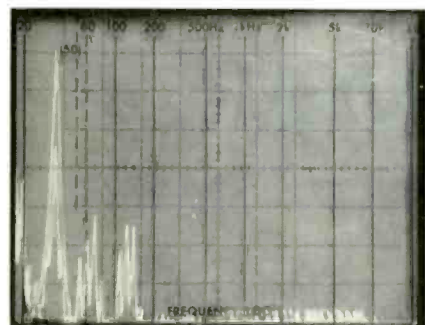
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**Audio** The Equipment Authority

For all its improvements, the T-9090II costs little more than Onkyo's earlier version, despite the rise of the yen vs. the dollar.



A



B

Fig. 6—Separation and crosstalk components for a 5-kHz modulating signal, plus subcarrier and sideband components, for wide (A) and super-narrow (B) i.f. modes.

up listening conditions that were contrary, in one way or another, to what I thought the APR system would have chosen. Each time I pressed the APR button, the system selected a set of operating conditions that yielded better results than those delivered by the conditions that I had chosen. In short, the APR system works—you can trust it completely.

To check out the two-antenna diversity reception capability in my metropolitan New York area, I hooked up a multi-element outdoor antenna to one antenna input and an indoor dipole to the other. I was able to rotate the outdoor antenna to favor some distant Connecticut stations, while the indoor dipole was oriented toward the major, powerful stations in my area. Sure enough, when I set the tuner to automatic scanning, it switched back and forth between the two antennas exactly when it should have, and my total station count reached an astounding 58! There's no way I could have picked up this many usable signals from a single antenna, unless I rotated the antenna as each new signal was tuned in. Even at that, I probably would have missed some, since a single antenna might well have been rotated so far "off course" for certain signals that the scanning threshold would have overlooked them completely.

If you check out the T-9090II for yourself, don't be put off by its elaborate display area. True, there are an inordinately high number of indicators, but in this case, they are not there just for ornamentation. Each light really provides you with useful—perhaps even essential—information about the status and mode of the tuner's operation. If you are as much of an FM fan as I am, and if you are blessed with a couple of FM stations that really care about the signals they transmit, this is definitely a tuner worth considering.

On a practical level, I am amazed to see that the price of the T-9090II, for all its enhanced features and higher performance, is not much more than that of the earlier Model T-9090—and this in the face of the steadily rising value of the Japanese yen against the dollar. Obviously, Onkyo's talents apply not only to FM design engineering, but to production efficiency as well.

*Leonard Feldman*



## NEW RECORDING ARTISTS

## James DePreist Wants To Lead The Oregon Symphony To Greatness

In 1980, James DePreist migrated westward with the hope of turning an unknown regional ensemble into a world class orchestra. He didn't really want to move to Portland, he confesses, but "when I came here and guest conducted the Oregon Symphony, I was impressed with the serious attitude on the part of the board of directors toward building a first-rate orchestra."

DePreist conducts the Oregon Symphony on its first recording, *Bravura*, released by Delos last September. Another Delos disc, which features Rachmaninoff's Second Symphony, followed last spring, hard on the heels of its predecessor considering the orchestra made its recording debut at the age of 92.

It's no surprise that the orchestra's first recordings were made during DePreist's tenure. He seems a savvy cross between artist and businessman. In fact, his background may uniquely suit him for the post of music director of an undercapitalized orchestra far from America's cultural meccas. Nephew of noted contralto Marian Anderson, as a young man he played drums in a jazz band, earned a degree in Economics at the prestigious Wharton School and studied at the Philadelphia Conservatory.

When DePreist took over the Oregon Symphony, wages for musicians ranged as low as \$9,000 a year. Since the performers had to hold other jobs to make ends meet, the orchestra did not have first claim on their time, and they rehearsed in the evening. Because the Civic Auditorium, where they performed at the time, saw frequent use, they were unable to rehearse on its stage.

With the board's cooperation, as retirements occurred, DePreist immediately began luring "fresh and vigorous" players with offers of better salaries. In his second year, he also began a long process of bringing the ensemble, which then included 82



James DePreist

musicians, up to battalion strength. Noting the largest variant in an orchestra's size is its string section, he reports he's been presiding over "orderly" growth by adding one string player per season.

1985 was a watershed year for the Oregon Symphony. That was the season it moved to the Arlene Schnitzer Concert Hall in Portland's new Performing Arts Center. Now that DePreist's goal of "rehearsing on the stage where we play our concerts" was met, major raises for the players were also justified. "If you're going to raise salaries, you want to do that in a context that is also going to enable you to take advantage of the best efforts of the musicians," the *maestro* points out. "And you can't do that if you're rehearsing after everybody has worked all day at other jobs."

By the time the Oregon Symphony made the move to Schnitzer Concert Hall, every player was making more than \$20,000 a year, no great sum to be sure, but a far cry from what they earned when DePreist arrived.

Salaries are the biggest item in an orchestra's budget, and as the Oregon Symphony's size and salary scale rose, so did its deficit. DePreist and his colleagues on the business side mounted a grass roots campaign to get more area residents involved in helping fund the orchestra. A first priority, he notes, was demonstrating to these people that it was, in fact, *their* orchestra.

The Willamette River, which runs through Portland and divides east from west, "is a psychological as well as a geographic barrier," according to DePreist. Since affluence and culture tend to cluster to the west, it was decided that the time had come for the orchestra to cross the river. A Los Angeles company that owned a major shopping center east of the Willamette was contacted and agreed to underwrite a summer concert at the mall's skating rink. It was the Oregon Symphony's debut in that part of town, and the first time many people heard the ensemble.

The orchestra has also performed at a series of waterfront concerts, which have attracted as many as 50,000 people. And it now plays at the Oregon State Fair in Salem, some 60 miles from Portland. "These are things that are musically significant, but what they do in terms of identifying the orchestra with the community is of far greater importance," DePreist affirms.

The fact that the community does indeed identify with the Oregon Symphony is evident from the results of one of DePreist's fund-raising programs. He devised the idea of selling "Symphony Shares," had certificates printed entitling their bearers to the satisfaction that comes from supporting their orchestra and offered them to the public for a dollar each. Some 35,000 have been sold.

"Building an orchestra is more than what you do on the podium," says James DePreist *con brio*.

## RED HOT BROWN



**The CD of JB (Sex Machine and Other Soul Classics):** James Brown  
Polydor 825 714-2, CD.

**The CD of JB II (Cold Sweat and Other Soul Classics):** James Brown  
Polydor 831 700-2, CD.

Sound: A — Performance: A

It's no secret that James Brown is one of the *heaviest* cornerstones of popular music. Anyone who ever nailed a groove or created a funk-inspired stage presence has drawn on some memory of James Brown or one of his emulators. But unlike most pop patriarchs, Brown is still making music, and he is doing so near the cutting edge of his art, recording and performing for what will soon be a third generation of fans.

In a word, this pair of CDs is great. They're not really a set, in terms of either chronology or continuity of the types of songs selected, yet they belong together as a two-part primer on soul. Neither one is strictly a greatest hits album, with titles skimmed off Top Ten lists, nor do they strive to show the historical breadth of Brown's output by showcasing the salient phases of a career that has already brought forth hits selling more than 40-million-plus records. The producers of these digitally

remastered discs have instead presented a mixed bag of the best-known and the obscure, the historically necessary and the musically irresistible. The sound quality is impressive. The vocals have a super-live feel, and the horn section, crisp and sassy, sounds like it's bouncing off your ears.

*James Brown: The CD of JB* hops back and forth in time, opening with three riveting grooves from the early '70s, "Doing It to Death," "Super Bad," and "Soul Power." The latter features Bootsy and Catfish Collins, brothers who'd later join George Clinton's Parliament/Funkadelic stable. "Please, Please, Please," a cut from Brown's first professional recording session that went on to become his first million-seller, is here, as is "Think," a funky remake of Brown's third million-selling song (the original version can be found on *CD of JB II*). Incidentally, Brown had a third smash with this song when he overdubbed a different vocal onto the backing track. In 1966, Brown hit with the dramatic, busily orchestrated "It's a Man's World." The CD features a previously unknown version of this song that had been recorded two years earlier: its spare accompaniment and Brown's compelling vocal make it doubly powerful.

Up until 1964, Brown's stock in trade was the ballad, and classics such as "Bewildered" and "Prisoner of Love" are included. In the summer of 1964, however, Brown headed in a new, funkier direction, gradually turning his horn section into an insistent tool for new heights of rhythmic counterpoint. "Out of Sight," one of his first songs to reveal this new sound, is here, along with "Sex Machine," "The Payback," and the rhythmic wonder of "I Got the Feelin'." Also among the 18 sterling cuts are "Papa's Got a Brand New Bag" and "Maybe the Last Time," which The Rolling Stones loosely copied a year after its release.

*CD of JB II* is another superb collection of the same order. With the 14 songs in chronological order this time, it focuses on upbeat tunes and traces the evolution of the JB groove, from 1959's "Good Good Lovin'" (which presaged the idiosyncratic syncopation that led to funk) through the 1976 scorcher "Get Up Offa That Thing." Included are the live show-stopper "I'll Go Crazy," "Night Train," on which Brown played the drum track while recording the vocal, and hot tracks from the late '60s such as "Cold Sweat" and "Say It Loud—I'm Black and I'm Proud," which some historians claim was written by Brown at the insistence of the Black Panthers.

The 12-page booklets of liner notes that accompany these CDs are among the most comprehensive, informative, and entertaining I've ever seen. For each song, they include particulars on session personnel, recording and release dates, highest chart positions, and elucidating blurbs that feature obscure facts, spicy rumors, and soulful editorializing. Slightly missed is a complete JB discography, but it would probably need half a book on its own.

Susan Borey

**One Lord, One Faith, One Baptism:**  
Aretha Franklin  
Arista ARCD16-8497, CD; AL11-8497, LP.

Sound: B+ Performance: B

Before Aretha Franklin was "discovered" by John Hammond, she had achieved a certain amount of fame and success singing with her father, the Rev. C. L. Franklin, one of the best-



known pastors of his day. Even though she would reach a greater number of people recording pop records under the auspices of Jerry Wexler and Clive Davis, Aretha would periodically return to her roots and record gospel LPs. On this album, there's a lot of preaching, but there's even more good music. All you heathens out there can simply program your CD players to skip the sermons and go straight to the singing, which is always first-rate—and sometimes even better than that.

Aretha's usual powers are stirred to greater heights when she sings with other great singers. Here she is joined by Joe Ligon (of The Mighty Clouds of Joy) and Mavis Staples (of The Staple Singers, now signed to Prince's label—look out!), and these people really sing. Our favorite cuts are "We Need Power" and "I've Been in the Storm Too Long," but there are plenty of other exciting musical moments.

Those who go the vinyl route will find a sound quality not too different from that of the CD. The album was not a studio effort but was actually recorded inside a Baptist church. Some of the nuances of the performances could have been better captured if all the benefits of isolation booths and modern technology had been utilized. However, one doubts that these kind of performances could have occurred in

a recording studio, so it's hard to take Aretha to task for making the album this way.

Aretha always sings great. While some of her recent material has not been worthy of her, you can't say that about the songs here. The genre may not please all tastes, but this album is the closest the Queen of Soul has come to making "art" instead of "product" in a long time. *Jon & Sally Tiven*

**Cher**  
**Geffen GHS 24164-1, LP**

Sound: B-      Performance: C+

Cher has always been a vocalist of limited range. However that fact is acknowledged on this album of high-gloss, high-tech pop; the singer doesn't try to stretch beyond her abilities, and thus her performance is actually quite impressive. Best of all, it isn't Vegas.

Cher's best moment comes with "We All Sleep Alone," the song Jon Bon Jovi and his partners Richie Sambora and Desmond Child wrote and produced for her. Ironically, this production team is also responsible for the song that comes off least effectively, an overwrought, overbearing, overblown remake of "Bang Bang." This one goes beyond schmaltz, but it is fun in a perverse way.



Michael Bolton, Jon Lind, Peter Asher, and Desmond Child (by himself) each produce other tracks on *Cher*. It is interesting to note that the album was recorded in 11 different studios, with at least two used on every track. Still, it has a consistent sound, a big, arena-sized sound that oozes big-bucks production. The result is apt support for Cher's good vocal work, though the album does require high volume to be heard at its best.

Cher's brand of tortured styling has never been my cup of tea, and nothing here changes that. Still, one must respect work that is as solidly planned and executed as *Cher* is.

*Michael Tearson*



**The Light of the Spirit: Kitaro**  
**Geffen 2-24163, CD**

As one of the leading exponents of the New Age style, Kitaro has been popular with Western as well as Japanese listeners for quite some time now. Previously, all of his U.S. albums were rereleases of those already available in Japan. *The Light of the Spirit* marks his first release made specifically for America. Though he began the project using the 32-track digital recorder at his home studio, Kitaro finished it at Fantasy Studios in Berkeley, Cal., with overdubs by American musicians plus production help from Mickey Hart and Grateful Dead Productions.

New Age, like most musical styles, encompasses a broad range, from "arty" to "commercial." On this album, Kitaro aims for the middle of the spectrum, giving us a kind of pop/New Age synthesis. *The Light of the Spirit* is filled with pop/rock hooks which repre-

*The Light of the Spirit* is filled with rock/pop hooks, Kitaro's conscious attempt to appeal to a broader audience.

sent Kitaro's conscious attempt to create an album for the American market and to appeal to a broader base of listeners. As well, the music reflects the influence of American performers, particularly The Grateful Dead. Kitaro and The Dead seem to have formed a mutual admiration society of sincere artis-

tic appreciation, and they freely acknowledge the two-way influences. But the most notable pop innovation on this album is the use of a wordless female voice in the title track, something strongly reminiscent of Pink Floyd's *Dark Side of the Moon* period. The sweeping synthesizer gestures of

"Howling Thunder" also seem very much influenced by Pink Floyd; there's even a thumping heartbeat in the transition to "Journey to a Fantasy."

New Age composers frequently incorporate the sounds of nature in their music. But in *The Light of the Spirit*, Kitaro uses them only occasionally for color and atmosphere, not as major features of the musical structure. At the start of "In the Beginning," sleigh bells rise out of total silence, then fade away with a Doppler shift—a neat touch. As the sleigh bells fade almost into inaudibility, Kitaro starts the main melody with a flute-like synthesizer color, while the sounds of ocean waves and sea gulls fade in. Synthetic crickets (or tree frogs) occasionally rise to the top of the mix in the title track.

Though the disc originated as a digital 32-track tape, I discovered as I dug through the credits that the tape went through an analog stage during mix-down and was reconverted to digital for the two-track stereo master. The credits refer to the use of Meyer Phase Compensation Filters to feed a Sphere analog mixing console. In any event, the sound is clean and spacious.

If you are looking for profound revelations about the nature of the human spirit, you probably won't find them on this disc. What you will find is pleasant, well-crafted music that portrays the relaxed, balanced mind of an artist at peace with the world. *Steve Birchall*

**Anything Goes:** Cast Album  
Epic EK-15100, CD.

**West Side Story:** Original Cast Album  
Columbia CK-32603, CD.

**Name:** Original Cast Album  
Columbia CK-03000, CD.

**The Sound of Music:** Original Cast Album  
Columbia CK-32601, CD

**Show Boat:** Barbara Cook, John Raitt, William Warfield, Anita Darian  
Columbia CK-02220, CD.

The dearth of new American musicals seems to have inspired some of the record companies to go back to the vaults and to give us a veritable avalanche of remastered, digitally revived show albums on Compact Disc. Brief comments will suffice, since none of these recordings is new.

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Due to digital remastering, every number from the 1962 revival of *Anything Goes* shines with a new clarity.

for they're perhaps the best things in the score. This is the kind of achievement that enables you to understand why Stephen Sondheim considered Rodgers and Hammerstein his spiritual forebears.

Finally there's *Show Boat*, a studio recording with Barbara Cook, John

Raitt, William Warfield, and Anita Darian. "Life Upon the Wicked Stage" has a fresh crispness in this nicely produced CD, but the highlights, now as then, are surely "Can't Help Lovin' Dat Man" and "Bill."

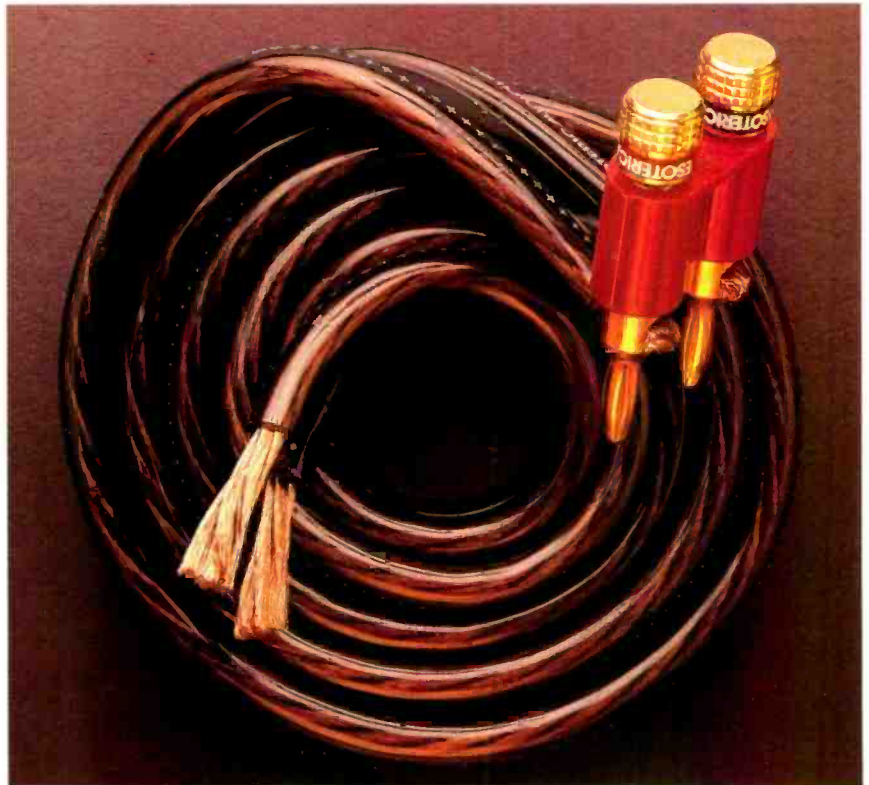
This trove of CD rereleases is welcome indeed!  
Donald Spoto

There was a 1962 revival of Cole Porter's *Anything Goes*, and everything went into it. The casting was superb, though the singing/actors in the main roles are now mostly forgotten (save for Hal Linden). No matter: "I Get a Kick Out of You" and "Let's Misbehave" still make you wonder how Porter could do it (and how he got away with it). Every song and dance number shines with new clarity here.

*West Side Story* was, as they say, a landmark. On this CD you can hear why, as if for the first time. "Something's Coming" has a fresh urgency; "Maria" seems not at all incredibly naive but heartbreakingly possible; "Cool" crackles with unspent anger; "Tonight" and "I Feel Pretty" float through your veins. Isn't this, with *Candide* (the original 1956 version), Bernstein's greatest contribution to American musical theater? Oh, I suppose part of it is that *West Side Story* was "my time," but it's hard not to imagine it being for everyone, at least after listening to this disc.

*Mame* is almost 20 years old, and it's never seemed younger. Did you miss the syncopations of "The Letter" or the luscious counterpoint of "My Best Girl" first time around? Put this on and you're in for a treat. Come to think of it, Angela Lansbury's due for a major revival as a singing actress along about now: Why not *Miss Marple Sings and Solves*?

It seems to me that *The Sound of Music* has been unduly neglected, unduly disparaged by detractors. On this CD it is nicely rehabilitated. Skip the too-familiar "Climb Ev'ry Mountain" (maybe the silliest lyrics ever penned). Instead, attend to the snappy satire of "How Can Love Survive" and "No Way to Stop It"—wondrously sung by Marion Marlowe, Kurt Kasznar, and Theodore Bikel—and to the gently affecting "An Ordinary Couple." These three songs were excised from the film. Pity.



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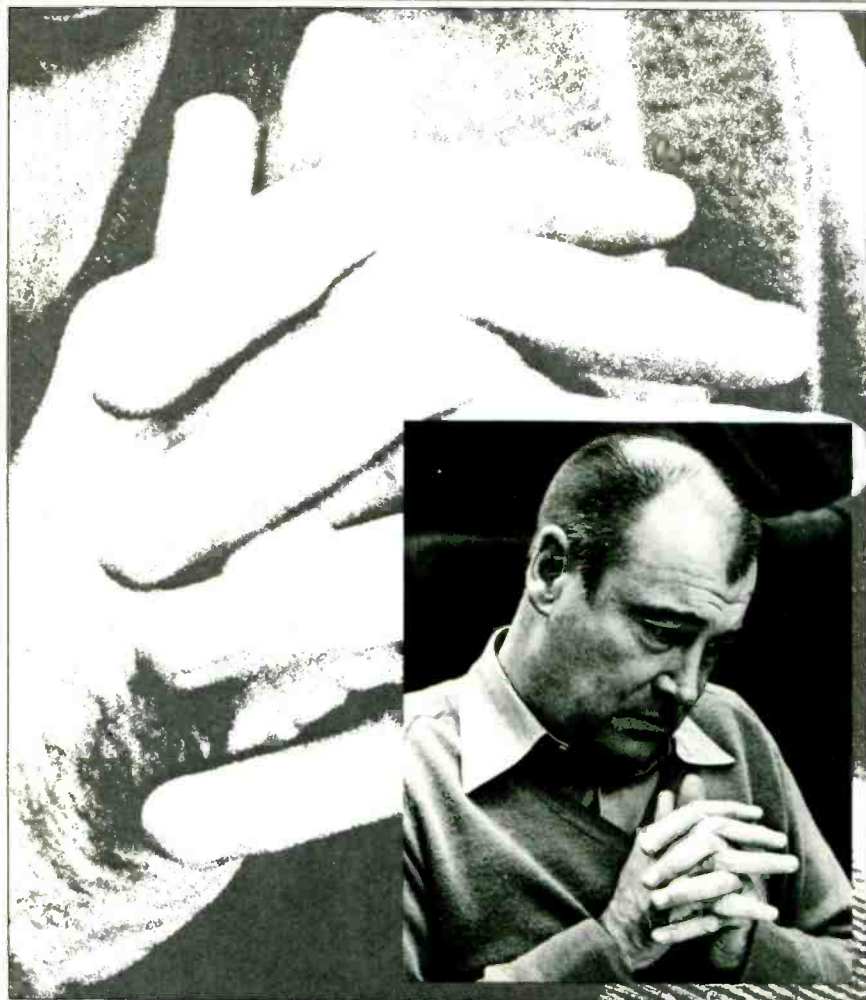
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## IN THE HANDS OF A MASTER



**Moeran: Symphony in G Minor; Overture for a Masque.** Ulster Orchestra, Vernon Handley. Chandos 8577, CD.

Thankfully, sheer market success has set aside that incessant sniping once directed at English music. The labels responsible for this remain, of course, British, by and large, but we must also applaud those U.S. distributors and retail buyers with the vision and interest to see that the albums get before the public. Thanks, then, to Chandos, the Essex-based "small" large label, and to its American distributor, Harmonia Mundi, for pushing on with the good work.

But that effort would be wasted on a spate of merely worth-hearing-once repertoire. Not so the work of Ernest John Moeran (1894-1950). He was

roughly contemporaneous with the now-popular Gerald Finzi, and draws his highly personal flavor from marked influences by Walton, Sibelius, Delius' sterner side, and not unexpectedly, the indefatigable Ralph Vaughan Williams. Now don't take Vaughan Williams' effect on Moeran to mean that the younger composer followed down the deeply rutted path of English folksong, pentatonic tonal language, and convivial, thumping tunes as the double bar nears. Moeran is his own man, and a fascinating one, compositionally. Although he is as entranced by the indefinable or mystic in his quieter moments as were Delius and his good friend Arnold Bax, Moeran benefits from a firmer formal backbone than those two. In fact, parts of the G-minor symphony, fashioned over the course of 11 years, are as magnificently orga-

nized—and the big moments as cannily set up and exploited—as seemingly more formalist northern European symphonies. Not once does a quote from one of the composer's beloved Norfolk or County Kerry tunes pop up as if the dashing pen had momentarily lacked for ideas and grabbed at the first hummable melody that came to mind. The music is much less dour and somber than parts of Sibelius, yet it's infused with the same wondrous palette of colors drawn from all the choirs of the orchestra. Nor is there quite the division into woodwinds, brass band, strings, and "other ranks" that Elgar, Stanford, and Walton—all already elder statesmen, for Moeran—often opted for. There is a radiance to almost every hue Moeran strokes into his broad symphonic canvas.

The quite beautifully balanced Chandos recording, done by the familiar family trio of Ralph, Brian, and Philip Couzens, does marvelous things with the sonics. Appropriately, the miking is slightly distant, favoring orchestral blend and balance and letting through the generous space of Belfast's Ulster Hall, but it never lacks detail or point. A brilliant technical capture of a rewarding work in its first CD recording.

The "Overture for a Masque" was committed to paper during World War II at Walter Legge's urging and was destined for the entertainment of the troops just prior to the turning point in the hostilities. If this performance gives us a clue as to how it came off 4½ decades ago, when it made the rounds in the U.K., there were some thoroughly cheered and roused servicemen dotted across England. As outdoorsy and sprightly as an orchestral piece can be, its 9½ minutes sweep by quickly, and the listener is tempted to repeat it right off. This is delightful stuff, and it is well and idiomatically brought off by Handley and his good bunch in Belfast.

*Christopher Greenleaf*

**Bartók: Concerto for Orchestra; Music for Strings and Percussion.** New York Philharmonic; BBC Symphony Orchestra, Pierre Boulez. CBS MK-42397, CD.

There is compound interest in this CD reissue! The original "Concerto for Orchestra" recording represented per-

Photograph: Jean-Pierre Armand

haps the highest point achieved by CBS quadraphonic SQ technology in which, startlingly, the entire Philharmonic Symphony was laid out on risers in a huge circle—or was it an octagon?—with the conductor, Pierre Boulez, in the center. As mentioned in one of my columns, this was inside-out quadraphonic at its most extraordinary. The effect, at least on the master tapes, must have been quite marvelous and musically of great interest as an experiment in purely recorded sound, not like any conceivable live performance.

For a moment I wondered whether this CD comes from a tamer, alternative stereo version. Not really possible! No conceivable stereo miking could have turned that orchestra back to its normal configuration, though it is approximated on this CD and probably was in the "plain stereo" version on LP. Whether we have SQ coding in this disc is an interesting question. Depends on the procedure used—but I'd give it a 50% likelihood. Imagine, a CD in SQ! Moreover, the BBC recording of "Music for Strings and Percussion" comes from the time when they might well have tried a bit of SQ along with EMI—who knows?

Still more to wonder at. This was multi-mike recording of the sort CBS used at the time. Pure-minded audio engineers, of course, now throw up their hands in horror at the very

thought. *In this case* (and some others), I beg to disagree. For contemporary music, especially a concerto for orchestra, which features extensive solo and small-group playing as a contrast to the whole orchestral ensemble, multi-mike mixdown is absolutely fascinating.

In its extreme form, the technique puts each instrument or grouping at an equal distance from the listener. All of them are quite close, as in chamber music, but the sound is immersed in a concert-hall liveness. In actual performance, this is impossible. A hundred players, *all 10 feet away*? Yet it can be done in recorded form and often reveals many details of the music itself that, given good taste in the recording, can be immensely challenging for the ear. I was first impressed with this somewhat surreal way of doing things when London's early "Phase 4" technique was applied to numerous well-known classics. It is a similar effect, taken into digital, that you will hear on this CD, in the concerto and, apparently, also in the BBC recording (though, I assume, it was not played in surround sound). The effect is present in both, which is as it should be.

Maybe in days to come CBS will expand its Bartók concerto into the full-surround 3-D in which it was actually played in the flesh.

Ah, yes—the performances! Top rank. The often steely Boulez is always

best in recent or contemporary music. These are, among numerous other recordings, two of the very finest, i.e., most communicative, versions. I remember only the Fritz Reiner Bartók concerto at Chicago (also on CD) as a match for Boulez.

A final note—the extreme contrasts in volume in both these works are at last fully accommodated on CD. Where the LP cutting was desperately hard put to maintain an intact groove, the dynamic span is definitely on the master tapes, and at last can be heard as it was intended—and played.

Edward Tatnall Canby

**Vivaldi: The Four Seasons, Op. 8, Nos. 1-4.** The Amsterdam Guitar Trio. RCA 5466-2-RC, CD.

Sound: A Performance: A

**J. S. Bach: Brandenburg Concertos Nos. 2, 3, 5, and 6.** The Amsterdam Guitar Trio.

RCA 6546-2-RC, CD.

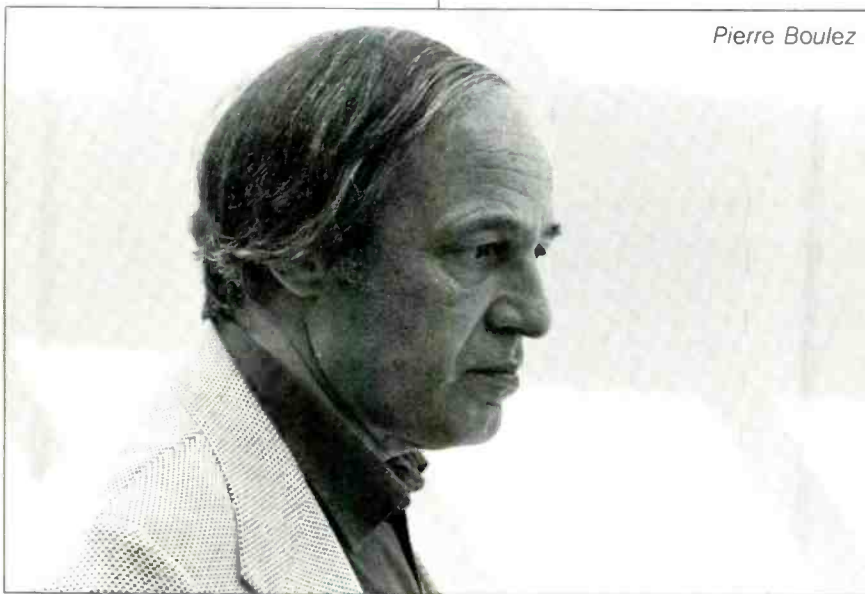
Sound: A Performance: A

Forget angels with harps; the seraphim and cherubim now play three guitars and sound like the Amsterdam Guitar Trio performing Vivaldi's "The Four Seasons" and Bach's "Brandenburg Concertos."

What's amazing about this ensemble—Helenus de Rijke, Johan Dorrestein, and Olga Franssen—is that they avoid the common trap of sounding like three individual guitarists. The trio achieves the cohesion of a finely honed playing unit (albeit a very human and musical one), the members responding to each other with contrasting nuances of coloration and sensitive dynamic interplay. Their enthusiastic arrangements yield performances reminiscent of that special chemistry displayed by the legendary Presti-Lagoya duo.

Both "The Four Seasons" and the "Brandenburg Concertos" are good choices for this instrumentation, as the original, fairly simple chamber voicings translate well to the guitar's range. Further, these works are familiar enough to be popular with a wide audience and welcome in a novel context. Vivaldi's "Spring" and "Winter," with their exciting arpeggio effects, are especially effective, and the infectious Brandenburg No. 3 bounces along con-

Pierre Boulez



Sir Charles Mackerras' new recording of Mozart, with a bow to the original tempos, takes a fresh look at two great symphonies.

*spirito*, proving again why it's such a perennial favorite. The addition of harpsichord continuo to Brandenburg No. 5 provides a nice change of pace, its brightly percussive sound perfectly complementing the softer guitars.

The trio uses three standard guitars and plays with a sweet, round tone that

is digitally and flawlessly recorded close-up, to fully capture their mellow sound. Minimal room presence allows your speakers or headphones to create the ambience. In a word, everything about the Amsterdam Guitar Trio's performance of these Baroque gems is heavenly. *Michael Wright*



**Mozart: Symphony No. 36 in C Major, K.425 ("Linz"); Symphony No. 38 in D Major, K.504 ("Prague").** The Prague Chamber Orchestra, Sir Charles Mackerras. **Telarc CD-80148, CD.**

This is Sir Charles Mackerras' second recording of Mozart symphonies for Telarc, and once again he is on the podium with the Prague Chamber Orchestra.

New musicological research has revealed that performance practices in Mozart's time were somewhat different from what they are today. Apparently, the tempos in certain movements of various Mozart symphonies were considerably faster than those we have become accustomed to in present performances. Sir Charles decided to follow the tempo markings of the original manuscripts. Thus, in his performance of the Mozart Symphony No. 36, the brisk tempos of the third-movement "Menuetto" may seem a little strange to people who are familiar with this work. Similarly, the finale in Symphony No. 38, marked "Presto," is indeed taken at a really frenetic pace. It is a tribute to the Prague Chamber Orchestra that they can traverse these passages so rapidly while maintaining good articulation and delineation.

Engineer Jack Renner used two of the new Brüel & Kjaer 4003 omnidirectional microphones on the 35-member orchestra. He has achieved a splendid balance between the players and the very spacious acoustics of Prague's Hall of Artists. String definition is particularly good, important because Sir Charles employs the old practice of strings *divisi*, that is, with the second violins seated to his right.

Sir Charles' new recording, with a bow to the original tempos, provides us with an interesting and refreshing view of these wonderful symphonies.

*Bert Whyte*

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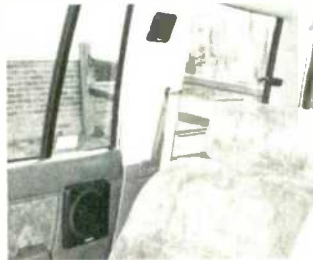
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**Good photos required.** If you're proud of your Boston Acoustics car system, let's see it in photos showing installation details, like those shown at left. Black & white is preferred, though color is acceptable. Either way, we'll need the negatives as well as the prints. Please, no Polaroids or slides.

**The fine print.** Every contest must have its rules and requirements. We've kept ours simple:

- (1) All speakers must be Boston Acoustics, of course.
- (2) Send your photos and negatives plus the following information to Installation Contest at the address below: Your name, address and telephone number • Year, make and model of your vehicle • Dealer name and address • Salesperson and installer • Brands and models of all components in your system.
- (3) All decisions will be made by Boston Acoustics and will be final.
- (4) All material submitted becomes the property of Boston Acoustics.
- (5) This contest is open to all residents of the U.S.A. and Canada, except employees of Boston Acoustics, Diamandis Communications, Inc., and their families.
- (6) This contest is void where prohibited by law.

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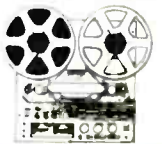
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**Just Pickin':** Freddy King  
**Modern Blues Recordings MB2LP-721**, two LPs. (Available from Modern Blues Recordings, P.O. Box 248, Pearl River, N.Y. 10965.)

Sound: A – Performance: A –/B +

Viewed strictly as a bluesman with roots in Texas and Chicago, Freddy King (no relation to Albert, B. B., or the record label) would probably not top the list of most well-known blues guitarists. But when seen in the light of his influence, King's stature is considerable. It's easy to understand why he was such an inspiration to early British blues freaks like The Yardbirds and The Rolling Stones when you listen to his playing on *Just Pickin'*. This two-LP set replicates two of King's early-'60s all-instrumental albums for Cincinnati's King Records and captures many different aspects of his incredible sound.

King possessed a pop sensibility that translated traditional material into a more broadly accessible form, as

evidenced by the chart success of his "Hide Away" and "San-Ho-Zay." Specifically, King transformed blues (especially in the instrumental idiom) into the emerging rock 'n' roll genre just as his contemporaries The Ventures and Duane Eddy did with their musically simplified versions of late-'50s pop, jazz, and country.

On the first half of this set—taken from 1960's *Let's Hide Away and Dance Away With Freddy King*—his mildly distorted, solid-body Les Paul rocks in a rhythmically varied boogie mode that could be described as "the blues meets The Ventures." In addition to the famous "Hide Away," hot spots include "Sen-Sa-Shun" (a cut which has the same riff as "Got My Mojo Workin'"), the treble-to-bass finger-picking of "Side Tracked," the countrified cha-cha of "Heads Up," and a sexy dance tune à la Bill Black's Combo, "Swooshy."

The second part of this set, *Freddy King Gives You a BONANZA of Instru-*

*mentals* (1965), features King in a more countrified mood. Using a hollow-bodied Gibson, King combines his blues with a Duane Eddy-like reverberated twang. The rockabilly sound is really effective on his version of the TV-show theme "Bonanza." Also check out "Manhole" (with chords and riffs similar to those on "Green Onions"), the slow jazz with improv on "The Sad Nite Owl," the country-rock ballad "Freddy's Midnite Dream," and the curious country-swing remake of "Remington's Ride."

Unlike most King repackages, which use King Records' 1969 "electronic stereo" tapes mixed back to mono, *Just Pickin'* has been digitally remastered from the original two-track mono album masters and is in mono. Because both master tracks are identical, buzzes and clicks were eliminated by relying on the best track available. The result is a wonderfully noise-free, full sound (without the phase cancelling and thin presence heard elsewhere) that almost achieves the fidelity of a CD. While King's guitar is boldly out in front of the mix, don't be disappointed when you find the rhythm section muddily congealed in the background. That's the way it was originally recorded, and King's guitar is, after all, the point of the record.

Freddy King's *Just Pickin'* brings the legend to life—sounding better than ever before. It offers an excellent look at a seminal figure who bridged the gap between blues and rock 'n' roll.

Michael Wright

**Secrets of the Beehive:** David Sylvian  
**Virgin 90677-1**, LP.

Sound: B + Performance: A

David Sylvian keeps no secrets from his listeners on *Secrets of the Beehive*; it's one of the most intimate and revealing albums since John Lennon's *Plastic Ono Band*. Sylvian was the singer and principal writer for the sophisticated British techno-pop group, Japan. His solo recordings have followed a more personal, spiritual direction which is refined on *Secrets*. It's a subtle album of emotional atmospheres wrapped around narrative stories. Unlike Japan's hook-laden pop, the melodies on *Secrets of the Beehive* quietly insinuate themselves like distant mem-

ories set in austere, mostly acoustic arrangements. Sylvian's rich, slow-motion baritone—like Bryan Ferry without the mannerisms—emerges as if from your inner thoughts.

He's almost painfully introspective, opening the psychological underbelly on "Boy With the Gun," a harrowing tale of a boy who goes on a shooting rampage. "I'm the Lord, I'm the key, I'm the wisdom, listen to me," sings Sylvian from the interior of the boy's psychological morass. The gentle folk-jazz arrangement, anchored by Danny Thompson's earthy bass, is laced with David Torn's vaporous guitar lines and Ryuichi Sakamoto's string underpinnings.

Songs of alienation, isolation, and hope permeate Sylvian's psyche. "Orpheus" portrays him as the heroic loner seeking a link to the world. "Let the Happiness In" is a song of hope in the storm. Rather than wallowing in self-pity, it becomes an uplifting, ennobling song of triumph, lifted by the quiet strength of Sakamoto's brass, Brian Gascoigne's string arrangements, and Mark Isham's solitary trumpet.

With its austere arrangements, thoughtful solos, sonic cues which drift like shortwave radio transmissions, and laughing children's voices, *Secrets of the Beehive* weaves a private world. Jazz players like Torn, Isham,

and Thompson, and the gentle percussion of Sylvian's brother and ex-Japan member, Steve Jansen, give *Secrets* a small-club ambience—smoky and full of possibilities. Sylvian's melodies linger long after the record is over, and the insights and details mount with each listening.

John Diliberto

**The Next Day:** Leni Stern  
**Passport Jazz PJ-88035, LP; PJCD-88035, CD.**

Sound: A- / B+      Performance: A-

Finding a distinctive voice in traditional jazz isn't the easiest thing, but with *The Next Day*, guitarist Leni Stern seems to be making strides in that direction.

*The Next Day* finds Stern in a much more mellow mood and with a more assertive, confident presence than on her last LP, *Clairvoyant*, as she coaxes delicately bent, round, and bluesy tones from her solid-body Telecaster. Even though the tunes have a familiar quality to them, they're all composed by Stern (except for the ubiquitous "Blue Monk," which features nicely fingerpicked intervals). This is classic, small-combo jazz; hot improvisations are controlled by song structure and are never self-indulgent. Pick cuts include the smooth and sinuous "Ran-dee Sue" and "Motian" with its slightly



Leni Stern

phased, distorted edge and great drumming and bass effects.

Studio ace Hiram Bullock's production is tight and clear, with Stern at center stage and the band close in on either side, much as if you were listening from the front table at a club. Note-worthy too are the stellar band members who all get a chance to blow: Bob Berg on sax, Harvie Swartz on bass, Paul Motian on drums, Larry Willis on piano. You'll get great sound from both the LP and the CD.

Whenever a woman emerges in a male-dominated business like instrumental jazz, the temptation is strong to make gender an issue. Since Stern's husband (Mike Stern, ex-Miles Davis sideman) is an accomplished guitarist as well, the angles multiply. But that's all beside the point. Looking past biology and biography to the music, Leni Stern's *The Next Day* provides a very satisfying classic jazz experience.

Michael Wright

**Strange Meeting:** Power Tools  
**Antilles New Directions 90727-1, LP.**

Sound: B-      Performance: B+

**Second Sight:** Marc Johnson's Bass  
**Desires**  
**ECM 1351, LP.**

Sound: B+      Performance: C+

Power Tools and Marc Johnson's Bass Desires occupy two of the more



David Sylvian

With fine blues material, a top-flight band, and good production, the stirring voice of Johnny Adams soars.

interesting points along the electric-jazz spectrum. Both try to find a balance between composition and spontaneity.

For Power Tools, that balance tilts heavily toward free improvisation, which makes sense given the group's background as a power-jazz trio. Drummer Ronald Shannon Jackson, bassist Melvin Gibbs, and guitarist Bill Frisell have played everything from the airy jazz of Jan Garbarek to the fury of Cecil Taylor, with several stops at funk and rock in between.

*Strange Meeting* explodes with the kind of dark intensity that marked Lifetime, the original Tony Williams group with John McLaughlin and Larry Young. Like Lifetime, Power Tools uses funk and rock grooves as launching pads. Like some fireworks extravaganzas, they're spectacular to watch but don't always go in the right direction. On "Unscientific Americans," for instance, there's a lot of sound and fury, but little said. "Wolf in Sheep's Clothing" and "Wadmalaw Island" are turbulent themes, with Frisell playing his heavily processed guitar into ricochets of sound as Jackson and Gibbs alternately dodge and deflect the musical bullets. Jackson is a master at playing



odd polyrhythms and punctuations while still maintaining a center. Gibbs' twangy funk bass sometimes pierces the flights of Frisell's guitar with its treble interjections.

Frisell also appears on *Second Sight*, the second album by Bass De-

sires. It's another all-star group, with Frisell, bassist Marc Johnson, guitarist John Scofield, and drummer Peter Erskine. With these artists, I expected more fire. Even the more rocking pieces like "Crossing the Corpus Callosum" and "Thrill Seekers" have a restraint that goes past good taste and into missed opportunities.

The contrast between Frisell's sheets of sound and Scofield's pointillistic frenzy, exploited so well on the first Bass Desires record, never quite jells here. I admire Johnson for keeping a rein on his own ego and not making the album one bass solo after another, but the music has an insularity that is difficult to penetrate. This is especially disappointing after the first Bass Desires album. There, whether performing originals or John Coltrane's "Naima," the group tapped a spirit and power that smoldered with passion and intellect.

*John Diliberto*

**Room With a View of the Blues:**  
Johnny Adams  
Rouner 2059, LP.

Sound: B+ Performance: B+

Johnny Adams has a stirring blues voice and a distinctive style, but on this album, he's got much more: A top-flight band and a fine selection of material. Led by Mac "Dr. John" Rebennack, the ensemble performs nine songs that sound like they were written specifically for Adams (although most weren't). The result is an entirely satisfying blues-with-rhythm album, a showpiece for not only Adams but all the players (particularly guitarists Walter Washington and Duke Robillard). The rhythm section of David Barard and Herman Ernest III is not to be neglected either (note their sensitive change of groove in "I Don't Want to Do Wrong").

Producer Scott Billington went for a natural sound, using considerably less reverb than he has on other productions. The performances carry themselves without artificial sonic enhancement, and there's plenty of breathing room for the instruments and voice. Adams soars in this kind of setting, and fans of late night club bluesers will find it easy to immerse themselves in the lush, warm sound of *Room With a View of the Blues*. *Jon & Sally Tiven*



Marc Johnson's Bass Desires

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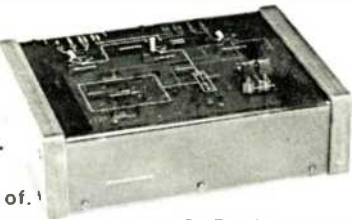
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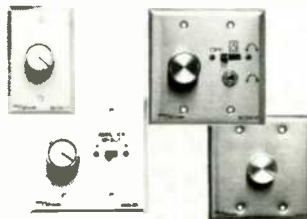
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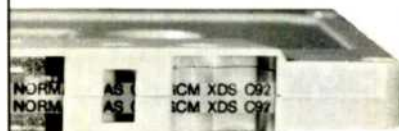
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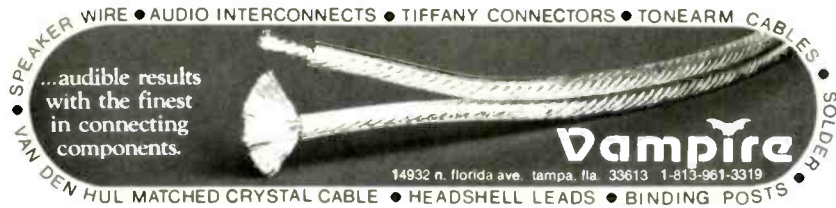
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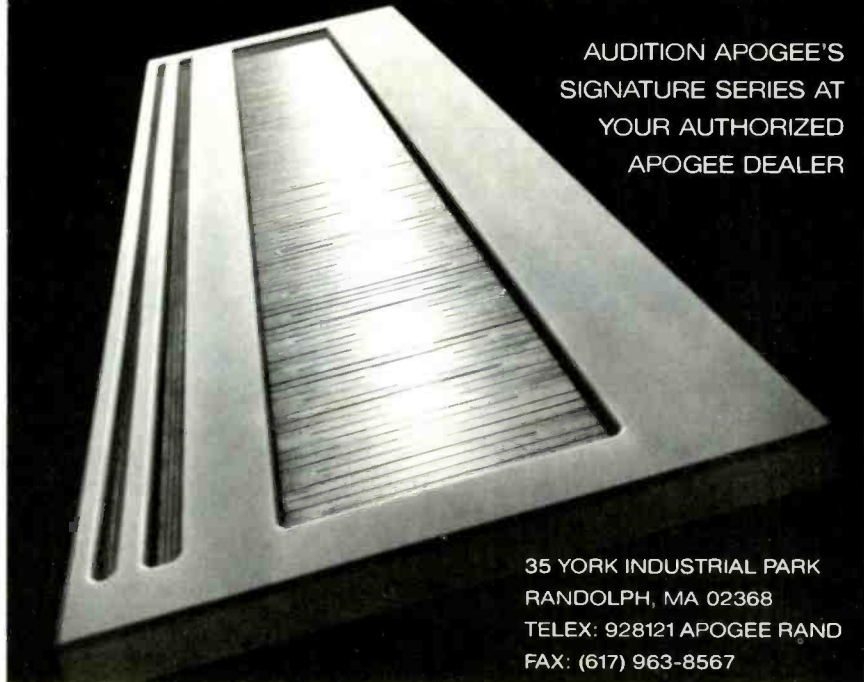
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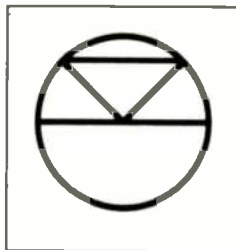
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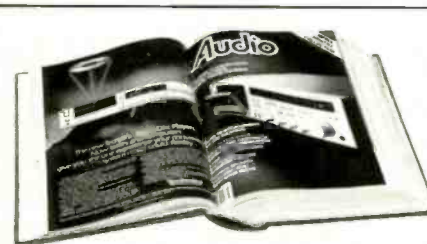
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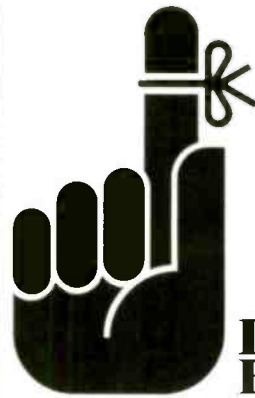
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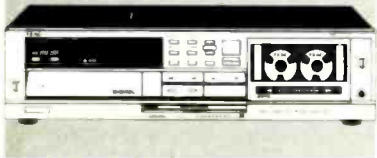
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