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Matthew Polk's Magnificent Sounding New SDA 2A

SDA 2A
$499.00 ea

Digital Disc Ready

Matthew Polk stands proudly alongside the latest version of his Audio Video Grand Prix Award Winning SDA 2A

"The Magnificent Sounding New True Stereo SDA 2A Again Demonstrates the Genius of Matthew Polk"

This revolutionary speaker is the most extraordinary value in high end audio!

Matthew Polk's magnificent sounding new 3rd generation SDA-2A incorporates many new advances pioneered in his top-of-the-line Signature Edition SRSs. It achieves stunningly life-like musical reproduction which would be remarkable at any price but is simply extraordinary at $499. each.

Polk's Revolutionary True Stereo SDA Breakthrough

The magnificent sounding new SDA-2A incorporates Polk's revolutionary True Stereo SDA technology. This patented, critically acclaimed, Audio Video Grand Prix Award winning breakthrough is the most important fundamental advance in loudspeaker technology since stereo itself. In fact, the design principles embodied in the SDAs make them the world's first and only True Stereo speakers.

Why do Polk SDAs always sound better than conventional speakers? As illustrated in diagram 1: when conventional loudspeakers are used to reproduce stereo both speakers are heard by both ears which causes a form of acoustic distortion called interaural crosstalk which cuts down stereo separation, obscures detail and interferes with the proper reproduction and perception of imaging, and spaciousness. As illustrated in diagram 2: Polk SDAs are designed so that each speaker is only heard by the one correct ear (i.e. left channel/left ear, right channel/right ear), like headphones. The result is dramatically improved stereo separation, detail and three-dimensional imaging. In order to accomplish this (see diagram 3) each SDA incorporates a separate set of drivers which radiates a special dimensional (difference) signal which cancels the undesirable interaural crosstalk distortion coming from the wrong speaker to the wrong ear. High Fidelity called the results "Mind Boggling".

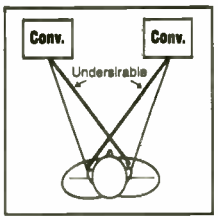
The Most Extraordinary Value in High End Audio Today

The new SDA-2As, like all the current SDAs, incorporate the latest 3rd generation SDA technology developed for Matthew Polk's Signature Edition SRS and SRS-2 including 1: full complement sub-bass drive for deeper, fuller, tighter and more dynamic bass response; 2: phase coherent time-compensated driver alignment for better focus, lower-coloration smoother, clearer, more coherent midrange and improved front-to-back depth and; 3: bandwidth-optimized dimensional signal for smoother high-end and even better soundstage and image. The new SDA-2A is the finest sounding and most technologically advanced speaker ever produced at its extraordinarily modest price. It sounds dramatically better than speakers from other manufacturers that cost 4 times as much and more and is, at $499 ea., truly the speaker of your dreams at a price you can afford.

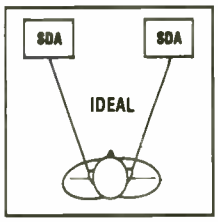
"Breathtaking...a new world of hi fi listening." *Stereo Buyers Guide*

The spectacular sonic benefits of SDA technology are dramatic and easily heard by virtually anyone. Reviewers, critical listeners and novices alike are overwhelmed by the magnitude of the sonic improvement achieved by Polk's SDA technology. One famous reviewer remarked that after hearing the SDAs his wife said that she heard such a dramatic improvement in the sound that *she* insisted that he replace their current speakers.

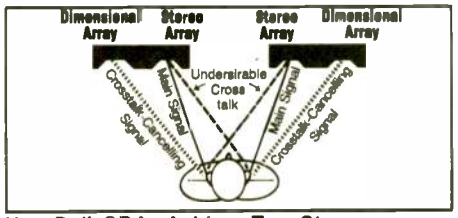
"The result is always better than would be achieved by conventional speakers..."
Stereo Review Magazine



Conventional Speakers Reproducing Stereo
When conventional speakers reproduce stereo, both speakers are heard by both ears which reduces stereo separation, obscures detail and interferes with proper imaging.



Only Revolutionary Polk SDAs Reproduce True Stereo
Only Polk SDAs reproduce True Stereo by allowing each speaker and signal (L or R) to be heard by only the correct ear (like headphones) which results in dramatically improved stereo separation, detail and three-dimensional imaging.



How Polk SDAs Achieve True Stereo
Each Polk SDA incorporates a special extra set of drivers which radiates a difference signal which cancels the undesirable signal going from the wrong speaker to the wrong ear, (interaural crosstalk distortion) resulting in True Stereo reproduction.

"Mindboggling, Astounding, Flabbergasting"
High Fidelity Magazine

All Polk's SDAs, including the new 2As, produce a huge lifelike three dimensional sonic image which will amaze you. You will hear for the first time instruments, ambience and subtle musical nuances which are present on your recordings but masked by the interaural crosstalk distortion produced by conventional speakers. Stereo Review said, "Spectacular...literally a new dimension in the sound...the result is always better than would be achieved by conventional speakers". High Fidelity said, "Mind Boggling...Astounding...Flabbergasting...we have yet to hear any stereo program that doesn't benefit". With SDAs every instrument, vocalist and sound becomes distinct, tangible and alive; allowing you to experience the spine tingling excitement, majesty and pleasure of live music in your own home.

Other Superb Sounding Polks From $85. to $1395. each

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"You owe it to yourself to audition them" *High Fidelity*

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Where to buy Polk Speakers? For your nearest dealer, see page 158.

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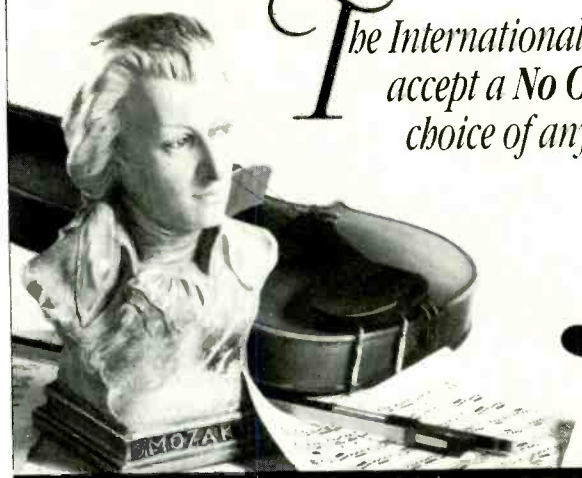

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Write Selection Number Here: C VLS39 (ZS)

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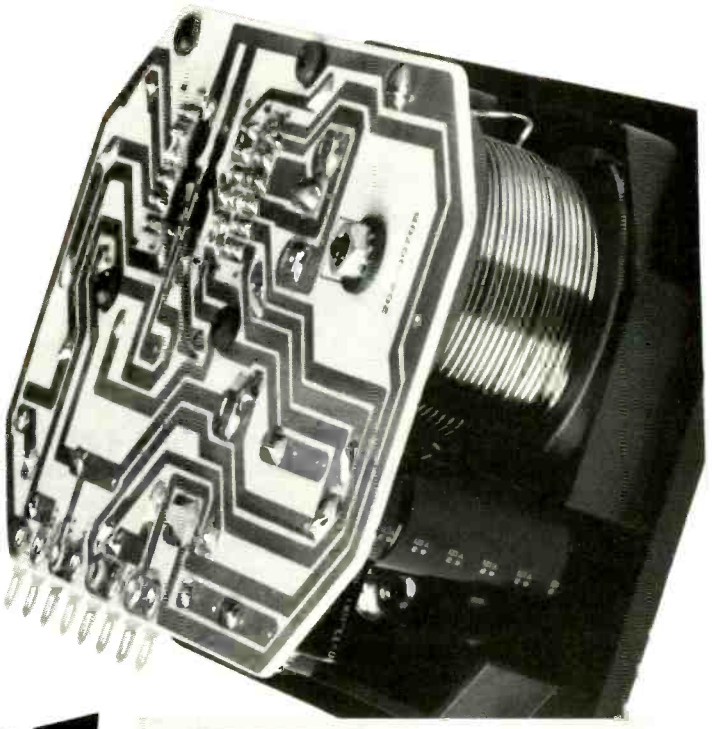

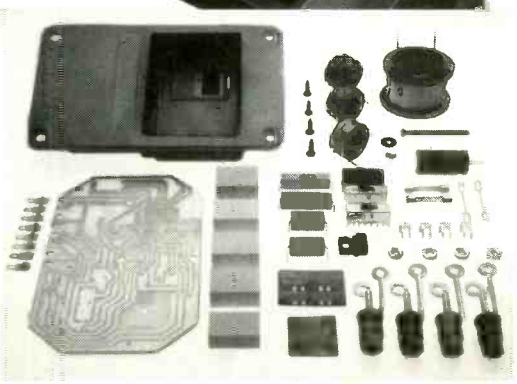

▲ A different breed of crossover. All components are computer-grade and mounted on 'military spec' epoxy circuit board. ADS' superior drivers allow the use of this better, more efficient crossover design.

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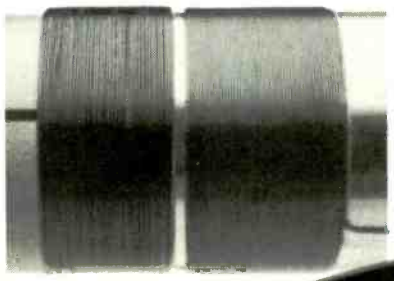
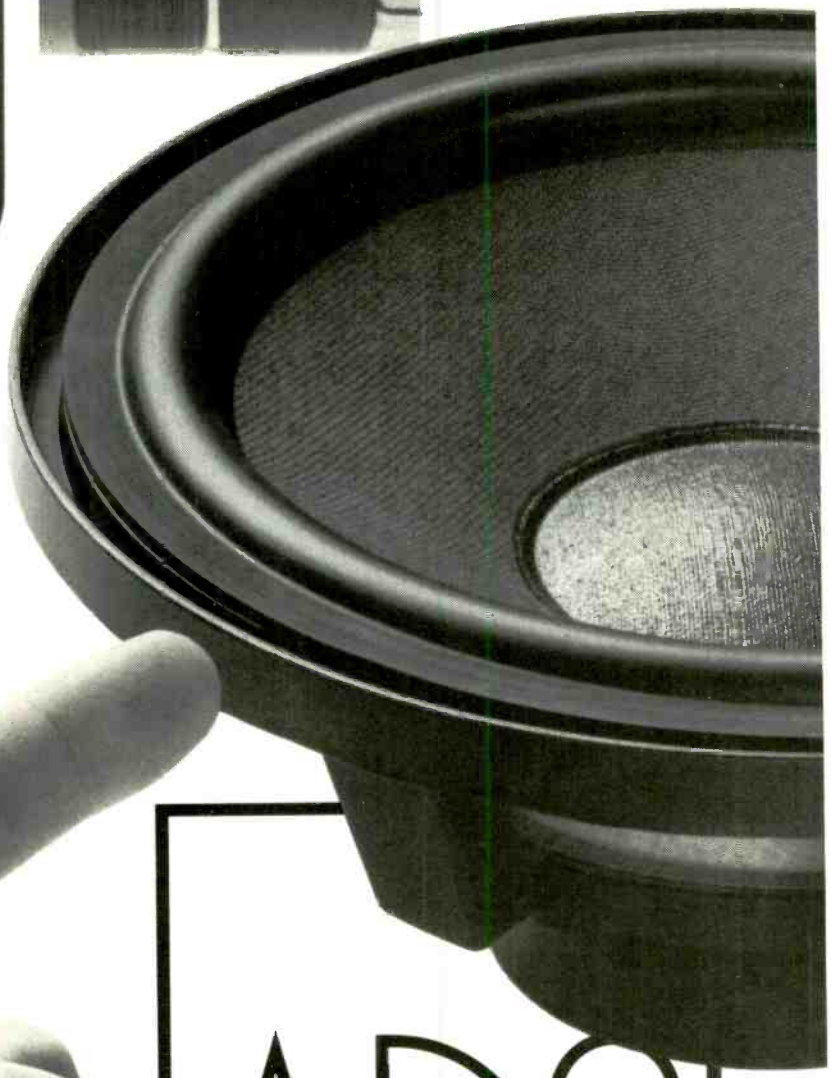


◀ Typical voice coil on left. ADS version on right. Smooth, tight windings and long voice coil mean accurate transients, low distortion. Coil always remains under amplifier control. Translates the full dynamics of digital source material.



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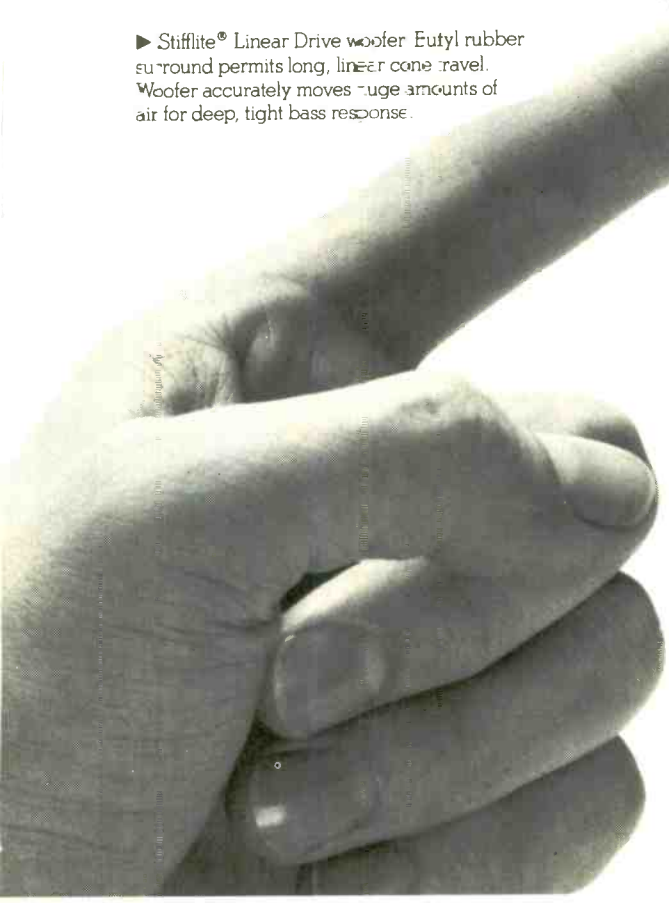

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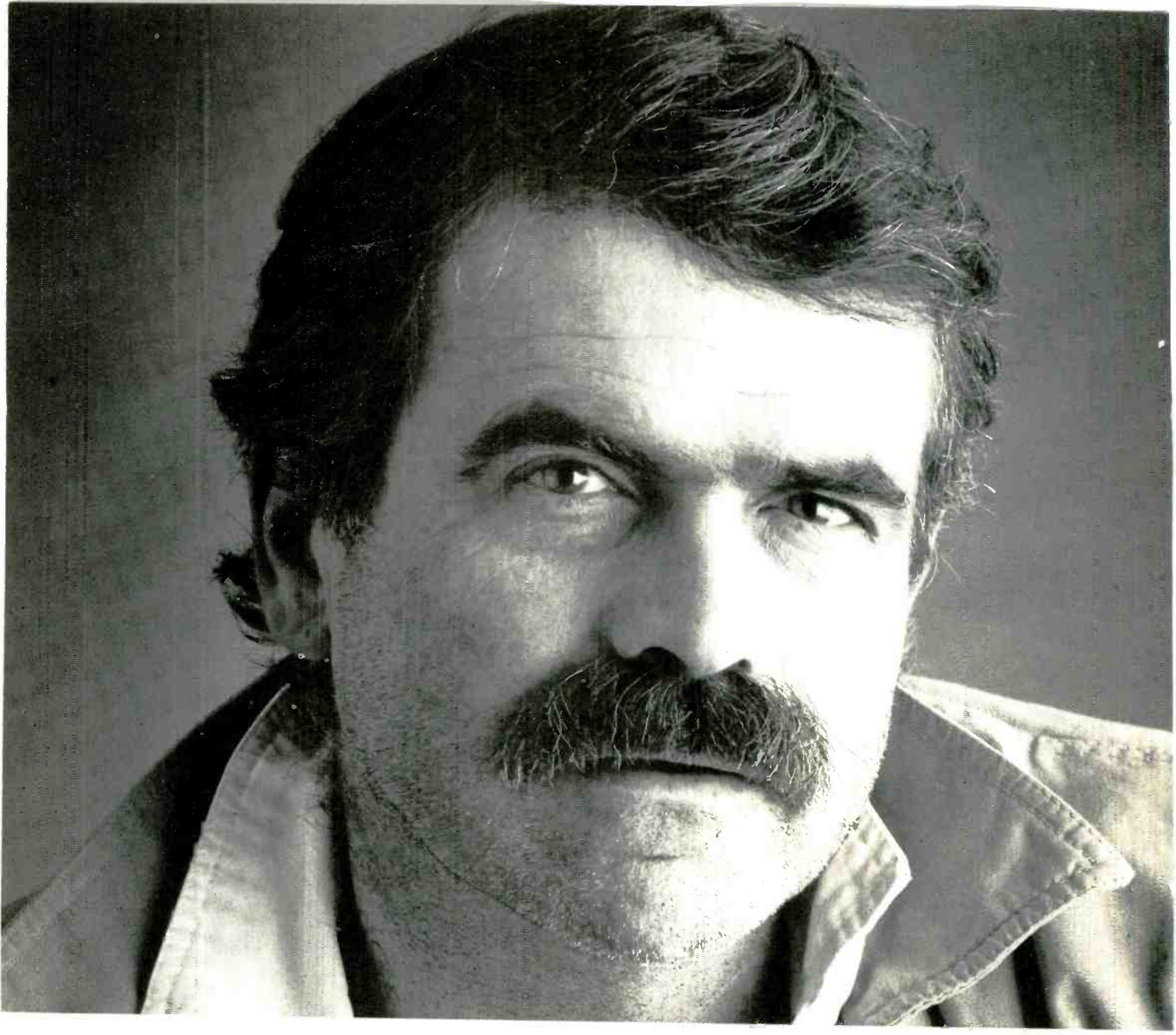
For more fascinating details on ADS speakers, see your local ADS dealer. If you don't know who he is, call us at 800-824-7888 (in California, 800-852-7777) operator 483.



"Will Those Speakers Work With My CD?"

The introduction of the compact disc player has created a lot of confusion and false information.

At KLIPSCH,® we think you deserve to know the truth: any *good* loudspeaker or amplifier will work with a CD.

The virtues of a CD are really quite simple. You get a more durable "record," so to speak. That is, scratches become a thing of the past. And you get tremendous increases in dynamic range. Now what does that mean?

Simply stated, the expanded dynamic range of a CD allows you to hear *lifelike* musical surges. Loud portions of music are closer to the loudness of the original performance; quiet portions are more realistic too. And you should know that dynamic range provides the *emotional* qualities of music. Which brings us to the purpose of this message.

Since our first model in 1943, KLIPSCH Loudspeakers have delivered more dynamic range than any other loudspeakers made. We had a love for dynamic range before most companies knew what it was.

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DONALD ALDOUS

MASTERFUL REMASTERING

Illustration: Michael A. Donato

The BBC recently purchased a 26-part series for radio called *Jazz Classics in Stereo*, to be broadcast in the U.K. in half-hour portions every Sunday afternoon. You may ask, "What's noteworthy about that?"

Simply that the material, covering the vintage jazz years from 1917 to 1947, was all reprocessed by Australian broadcaster and sound engineer Robert Parker using a system that some audiophiles have called an audio miracle.

All the music used—ranging from Jelly Roll Morton, Henry Allen, Bix Beiderbecke and Bessie Smith, to Louis Armstrong and Duke Ellington—was meticulously transferred to tape from original 78s, using a mixture of electronic gadgetry and ending up with digital remastering.

Parker, born in Australia and now living in Sydney, worked in Britain for some time. He spent 20 years trying to find a technique that would give a convincing type of "stereo spread," free from serious surface-noise problems and capable of folding back into "perfect mono" when required by the user.

So-called "stereo-enhanced mono" arouses the ire of most golden-eared listeners, but Parker's latest system is a quantum leap forward in this area. He describes his work as "a subjective balancing act for the transfer engineer, juggling opposing factors such as high-frequency response and surface noise on the one hand, and deep bass response and rumble on the other."

To my critical ears, he has succeeded impressively. Detailed information on Parker's methods of reprocessing is unlikely to be issued by him, but we do know that he bought one of the first Sony PCM F-1 digital encoders. He found that better results could be obtained by re-recording old 78s onto videotape using the F-1 than was possible using ordinary quarter-inch tape at 15 ips. Then it was just a step to transfer from videotape direct to broadcast transmitters, LP, or standard cassette.

Parker's system for cleaning up old 78s involves several pieces of equipment. First is a Packburn Audio Noise Suppressor, designed originally by hi-fi addicts Tom Packard and Richard Burns to remove the annoying clicks and surface noise on early shellac discs. The suppressor, it seems, samples both walls of a mono groove and feeds the signals into a monitor. The monitor evaluates which wall has the least random noise on it, then switches from one groove wall's output to the other's in order to dodge the clicks embedded in the surface. The "laundered" signal from the suppressor is fed through a combination of high- and low-pass filters and a specially designed, variable-threshold Dolby B NR circuit, plus a graphic equalizer to compensate the tonal balance for the limitations of early '20s recording.

Stereo enhancement is then added. This begins with an Orban stereo synthesizer which splits the mono sound into five overlapping spectra that can be positioned as required over the stereo "stage." Then reverberation is added to make the recording sound more "live" than the early studios' acoustics allowed. Finally, the processed signal is recorded as a PCM digital signal onto videotape.

If you have experimented with surround sound using multiple loudspeakers, try again with a Parker recording, as his method of synthesis involves a degree of out-of-phase signal being recorded; on replay these sounds are reproduced mainly from the rear speakers. Even on a simple stereo system, the sound quality of these classic jazz discs has an ambience and a stereo spread that would be unbelievable to the old jazz enthusiasts who bought the 78s when first issued.

Where can you get these recordings? RCA in Australia has already issued two LPs. The second volume, containing some of the most acclaimed Ellington 78s (all Victor originals) is RCA (Australia) VPL.1. 0436. The impact of this material has to be heard to be believed. (*Editor's Note*: A number of American labels also have plans to reissue vintage Duke Ellington, on CD, using cleanup processes somewhat different from Parker's, and we eagerly await them.) RCA Australia is planning to issue a couple of additional records in this series using the Parker process. Volume 3 will cover Glenn Miller and Al Bowlly, and Volume 4 Benny Goodman. If these are not imported to the U.S., write to RCA Records, Strathfield Plaza, The Boulevards, Strathfield, 2135, Australia.

Parker's own records are released on ABC/Festival 0307017 and on cassette 0357618. Details are available from ABC Shop, Post Box 10000, Sydney, Australia. We understand, too, that BBC Records & Tapes, The Langham, Portland Place, London, W1A 1AA, U.K., will be issuing discs from their broadcasts of the Robert Parker remasters.

Undoubtedly, this technique heralds a new sound era. For a generation of young jazz lovers who may have rejected the classic items because of the poor sound quality of the scratchy 78s, it represents an exciting advance.

TAPE GUIDE

HERMAN BURSTEIN

Correct Recording Level

Q. My question deals with setting the right recording level to obtain the widest and flattest frequency response with my cassette deck, a Nakamichi BX-300. The instruction manual and Audio's *review of the deck indicate that response of 20 Hz to 20 kHz is achieved at a −20 dB recording level. Is that the level at which I should record? If so, won't this result in a poor signal-to-noise ratio?*

I took a crash course in recording engineering a couple of years ago, and the instructor told us, "Record as high as possible without distortion" so as to achieve a high S/N ratio. I have been following this advice. However, I don't know if I'm getting flat response from 20 Hz to 20 kHz, because Nakamichi's manual for another model says, "The cassette recorder's response depends upon recording level. The louder the program becomes, the more likely it is that high frequencies lose clarity and brilliance."

So it seems that −20 dB is the preferred recording level. Should −20 dB be the lowest the meter reads? The average? Or the highest?—Ariston B. Malolos, New York, N.Y.

A. The industry has settled on −20 dB as the recording level for testing a deck's frequency response. If you are interested in recording test tones and maintaining flat response throughout the audio spectrum, record at the −20 dB level. However, if you are interested in recording music and other program material, record (with your deck) at a level several dB above zero. The Nakamichi instruction manual states that recording level should be such that program *peaks* read about +8 dB for metal-particle tape and about +5 dB for other tape types.

The reason you can record at a higher level with program material than with test tones is that normally such material has a substantial decline in energy as frequency rises. This decline pretty much offsets the tendency toward tape saturation with rising frequency, which is due largely to the treble boost applied in recording. Test tones, by contrast, are fed into the deck at a constant level throughout the audio range, and the treble boost applied to them saturates the tape unless recording level is reduced.

The level at which you can record program material without losing treble response depends on the nature of the material and on the type and brand of tape you are using. Hence, experimentation is advisable. Trust your ears. Try copying and comparing with a phono record or with FM interstation noise (the de-emphasis provided by the FM tuner reduces acoustic energy in the treble in a way comparable to the treble decline in program material). It may be wise to provide a safety margin of a few dB when taping live music or other material with a very wide dynamic range, as in the case of many CDs.

Wavy Tape

Q. I have been using a very high-quality cassette tape brand for about seven years, and only recently did I have any question as to its performance and reliability. After playing a short segment of a not often-used cassette, I removed it from the deck and noticed that the top and bottom edges of the tape were quite wavy. This can spell disaster unless I can eliminate the cause of the waviness.—Ora Troyer, Alburtis, Pa.

A. If the problem of tape deformation has occurred only with one cassette, the cassette is probably to blame, owing to faulty internal guides or other components. However, if waviness occurs in several cassettes, the tape deck is apparently at fault. Improper tape tension, a faulty pinch roller, or other factors affecting a tape's progress could be responsible; excessively fast and insufficiently smooth winding speed might also cause tape deformation. The thinner the tape, the more easily is it deformed. For example, C-120 would be more easily deformed than C-60.

Cassette Deck or VCR?

Q. I want to make high-quality dubbings of cassettes. I was planning to buy a second cassette deck, but recently listened to a hi-fi VCR and was impressed. Perhaps I should buy this instead. What is the dynamic range capability of a good cassette deck? Can I expect better audio quality from a hi-fi VCR?—Michael J. DeVoge, Conneaut Lake, Pa.

A. A cassette deck with Dolby C NR achieves a weighted S/N ratio upwards of 70 dB; one with dbx NR gets into the 80s and perhaps up to 90 dB or so. Hi-fi VCRs can also achieve S/N ratios in the 80s. I suggest you listen both to a high-quality cassette deck and to a hi-fi VCR to ascertain whether there are significant differences to your ears.

Excessive Bias

Q. My cassette deck has a bias control, and with all the brands of tape I have tried, the best results are obtained with bias set at minimum. Even so, I sometimes find that there is a treble loss. Could you tell me what is wrong?—Andy Warren, Miami, Fla.

A. There probably is a misadjustment *inside* your deck in the direction of excessive bias. A competent technician should be able to remedy this easily by adjusting the internal bias control, if there is one, or by using a resistor of proper value to reduce the bias suitably. If he makes the adjustment correctly, you should be able to obtain best results with most tapes when the external control is set about midway.

By any chance, do you have your deck set for the wrong tape type? If you are using Type I tapes but have the deck set for another type, bias will be excessive. Some decks provide for automatic bias-setting according to holes in the cassette shell. If your deck is of this type, it may be misfunctioning in this respect.

Which Deck for Dubbing?

Q. I have a good two-head deck and a better three-head deck. Which should I use for playback? Which for recording from existing tapes?—Joseph P. Bumbas, West Mifflin, Pa.

A. In theory, the better deck should be used for playback in order to minimize noise, which is usually most intrusive in playback, and maximize high-frequency response. However, theory isn't always confirmed by practice, and so it is wise to experiment. First try the three-head deck for playback and the other for copying over a brief stretch of tape. Using the same side of the same

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cassette, reverse the roles of the two decks. Now you have two copies on the cassette. Play both and note whether you can hear a difference. If so, decide which version you like better and use the record/playback procedure which yields that result.

What's Wrong with C-120s

Q. Why is there a general prejudice against C-120 tapes? Even the manufacturers seem ashamed of them. I have used Sony C-120s for over 12 years with fewer than 10 failures in hundreds of cassettes. For lectures, conferences and speeches they are invaluable. Sony has just discontinued all C-120s in Canada. They claim that C-120s do not sell well. Without any advertising, it's a wonder that they've been able to sell any at all in the past 15 years.—Jeffrey Asher, Montreal, Que., Canada

A. The prejudice against the C-120 appears to stem from its greater tendency to foul up mechanically, develop print-through, and exhibit distortion compared with the shorter C-90, C-60, and C-46 tapes. You may have had better luck than average with respect to fouling, possibly because of the deck you are using. Further, the other problems would be less worrisome for speech than for music reproduction. In my own case, I found the C-120s not as clean-sounding as the others. However, with time everything in the tape field has improved, and it could be that today's C-120s are substantially improved over yesteryear's.

It would be interesting to get other readers' reactions on the subject of C-120 performance.

Cassette History

Q. When was the cassette, developed by the Philips Co. of the Netherlands, first available to consumers? Could Philips have manufactured a four-channel cassette deck? Whatever happened to the Elcaset?—Tony Perkins, Los Angeles, Cal.

A. The date I have for introduction of the cassette deck to consumers is 1963. Philips probably had the technology to produce a four-channel deck, but such was not the intention. Stereo was then pretty much the thing—having been introduced in 1958—and has essentially remained so; four-channel never really got going and, except for a flicker here and there, has essentially died.

Rapid advances in cassette decks and tapes tended to make the 3¾-ips Elcaset superfluous, and the powers behind the cassette format were very strong. Further, there was an important lesson to be learned from the four-channel experience, where several systems were simultaneously on the market: If a new development is to succeed, it is vital that the audio industry join forces in presenting it in a single format. Look at the trouble AM stereo is having because of the several competing systems on the market. (Thank you for nothing, FCC!)

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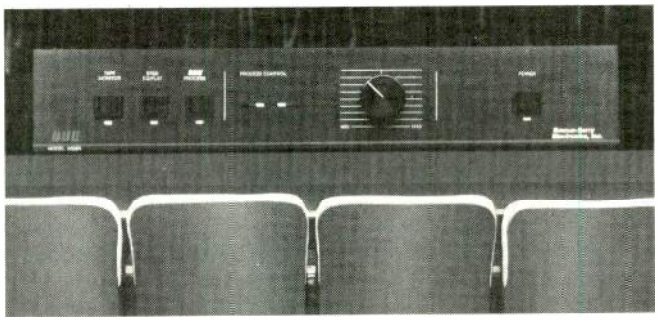

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AUDIOCLINIC

JOSEPH GIOVANELLI

Radio Reception in a Phonograph

Q. I was about to play a record. When I touched the cueing lever, I heard something from the speakers, so I turned up the volume to hear it more clearly. To my surprise, I was picking up a local radio station—and my tuner was not even connected. I let go of the lever, and the signal disappeared. I touched other parts of the turntable and got no signal. Is this common? Why does it happen?—Carol Hilton, Milwaukie, Ore.

A. What you have described is a common occurrence (if I can judge from the mail I receive). Although this unwanted radio reception can occur in various parts of the audio system, the phonograph input circuit is the most common part. In order to raise the tiny voltage from a phonograph cartridge to a level suitable to drive a loudspeaker, an enormous amount of amplification must take place. Couple this to the fact that solid-state devices are capable of rectifying a.c. signals, and you have an elementary "detector." (You may have constructed a "crystal set" at one time or another, or at least read about solid-state-rectifier radios.)

In the case of a phonograph circuit, a small amount of radio-frequency energy enters it and is rectified. The pulsating d.c. is amplified, and you hear the radio signal.

By touching the cue lever, you act as the receiving antenna. It is probable that this lever (in your system, at any rate) is not at ground potential. Thus, the signals introduced to this part of the phonograph can be capacitively coupled into the phono preamplifier.

You are probably quite close to a broadcast station. If this were not true, I do not think you would have experienced this phenomenon.

Damaging a Ribbon Microphone

Q. My ribbon microphone has a quarter-inch phone plug. I inadvertently plugged it into the headphone jack of my cassette machine while intending to plug in headphones. I started to record, and heard a high-pitched noise coming from the microphone. Not realizing what was happening, I stopped and started the recorder a couple more times.

In order to determine if the mike was still working, I plugged it, along with a non-abused one, into the mike inputs of the recorder and recorded the sound of a kitchen radio. I watched the meter needles, and observed that the mike I suspected was damaged caused its associated meter needle to deflect more slowly and possibly not as far over as the needle on the other channel. I then reversed the mikes and found that the slower needle moved to the opposite channel. I cannot hear any difference in audio quality from one mike to the other. Of course, I only recorded voice. Did I damage my mike?—Terry F. C. Jang, Vancouver, B.C., Canada

A. The fact that the mike works at all should be some consolation, and is perhaps a small miracle. I know of three ways to wreck a ribbon microphone. The first is to drop it; the shock, together with the air rushing against the ribbon, will cause it to break. The second is to blow directly into it (as all too many poorly trained sound men do in an effort to hear "noise" from the loudspeaker); it's better to tap lightly on the mike's grille. The third way is to drive it as one would drive a loudspeaker or headphones, since this deflects the ribbon beyond its normal limits. The ribbon stretches, unfolding some of its corrugations to the point where they cannot refold again. If this has happened, the ribbon's rest position will no longer be centered in the area of maximum magnetic flux. This means that when it is again used as a microphone (and not a tweeter), it will produce less output than it would have if the ribbon were located in its proper part of the gap. Additionally, because the ribbon is very thin (perhaps one ten-thousandth of an inch), it may tear partway. This can significantly change its impedance, causing changes in frequency response.

If the deflection is great enough or continued for a long time, the ribbon will actually break; no usable output can then be expected from it. Fortunately, you didn't get that far. The only way you will know if your mike is damaged to the point where it cannot produce satisfactory recordings is to make one, using suitable "live" sources, and compare it to a recording made with a microphone that you know is not damaged.

Remember that ribbon microphones don't produce a great deal of signal to begin with. Reducing the output any further will degrade your system's noise figure by making noise from your microphone preamplifiers relatively more of a problem.

Dirty Contacts in a Dry Climate

Q. I live in a dry, desert environment in southern California. All of my stereophonic equipment develops a common and quite annoying problem: Rotary controls (such as volume) become "scratchy," and switches often fail to make proper contact.

In the case of both rotary controls and switches, the problem appears to be the result of some sort of buildup on the contacts; repeated rotation of the controls or activation and deactivation of the switches seems to temporarily solve the problem. The same condition crops up again, however, after a period of non-use.

The problem seems to be common in the equipment of my friends living in this same climate. Interestingly, I do not experience the same problems with equipment in my second home in Florida, where it's more humid.

I have tried commercial electrical switch/control spray cleaners; all have had only a temporary effect. Are such conditions to be expected in a dry and dusty climate? Could it be corrosion? Does anything short of periodic and expensive replacement of all affected switches and controls offer possible elimination of the problem?—David A. Coup, Calexico, Cal.

A. You already know that you can clean your controls (temporarily) with contact cleaner, rather than having to replace them. There are many good contact cleaners available. I use one which is a bit off the beaten path, but it has an advantage over some cleaners in that, in addition to cleaning the contacts, it covers them with a thin film which appears to keep oxidation low. I refer to WD40, often used as a lubricant for light machinery such as typewriters. I use this to clean TV tuner contacts, where the wrong cleaner can

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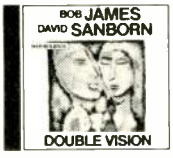

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cause serious misadjustment of the oscillator.

I am not a chemist, but I naturally tend to think of corrosion in terms of water combining with oxygen. I wonder if, in desert climates, there is an alkaline content to the air. If so, can this be in sufficient strength to corrode contacts? Perhaps some readers who are more qualified than I am will take time to share their experiences with us.

Transient Clicks

In response to the item titled "Transient 'Click' on Turnoff" in the July 1986 "Audioclinic":

I used to have the same problem with my amplifier. One day I turned the unit off; it produced an irritating click followed by some buzzing. At first I thought there was a fault in the amp itself. While disconnecting it from the rest of the system, I noticed that a ground had slipped off. I reconnected it, and, presto, the problem was remedied. Apparently my amplifier had no place to discard "extra" electricity when I turned it off.

A simple but effective ground that I have used is the center screw of a wall outlet's face plate.—Mark Townsley, Huntsville, Ala.

I don't pretend to fathom how the loss of a ground could cause transient clicks. Many systems suffer from such clicks; perhaps publishing this letter will elicit more observations.

Power Failure While Recording

Q. What can be done if the power fails while you're making a recording? This has happened to me numerous times.—Steve Dusik, Franconia, N.H.

A. One solution is to use a portable recorder; a number of models are capable of making fine recordings. I do not know if any will automatically transfer to battery power should the a.c. power be interrupted—in many, I know, attaching the line cord disconnects the batteries, rendering such a transfer impossible. If that is the case, you might wish to make the whole recording under battery power whenever power outages seem likely (during storms, for example).

You might be able to solve your problem by using an "uninterruptible power supply" (UPS), a device made to enable computers to continue functioning during power interruptions not longer than perhaps 30 minutes. Typically, these devices are made to come on line within a few microseconds after a power failure has occurred. Batteries inside the device provide the backup power. Of course, voltage supplied by batteries is d.c. (and only 24 V), but inverter circuitry inside the UPS turns that into the 117-V a.c. that home audio gear requires.

I am using a UPS as a backup as I write this on my word processor. My reservation is that the waveform produced by many of these units when operating on their internal batteries is not a good sine wave. Also, with the equipment I use, AM reception is interfered with when the UPS supplies a.c. from the power line rather than from internal batteries. I think that most or perhaps all such interference could be eliminated by plugging a good LC power-line filter into the outlet on the UPS. The line cord between such a filter and the UPS outlet should be kept short so that the cord will not itself become a radiating antenna.

UPS devices are available in sizes to handle various wattages; order one which can handle the power that your equipment draws from the power line. The one I happen to use is made by Lumitrol, 110 Bi-County Blvd., Farmingdale, N.Y. 11735. Check with a good computer dealer.

Another Look at Phase Inversion

Q. In the November 1985 issue, you gave a non-answer to a question about phase-inverting preamps.

You do not hook both amp cables to the "inverted phase" outputs. Instead, you hook one channel to its "inverted phase" and the other to "normal phase" output. Then you reverse the speaker wires for one channel.

This setup is explained in the Yamaha C-70 owner's manual: "The left and right channels of the power amp are operated out-of-phase, greatly reducing the demands of low-frequency signals on the power supply. This can dramatically improve bass reproduction on many power amps."

I have used this arrangement with three different power amplifiers. In each case, the bass was more natural and effortless with the inverted-phase hookup than when connected in the normal way. This hookup also made for a sweeter sounding high end.

One caution, though. This setup won't work with Polk SDA speakers. You don't get wraparound sound from both channels!—John McCutcheon, Walloon Lake, Mich.

A. Whether my earlier reply was an answer or non-answer depends on whether you're considering absolute or relative phase inversion.

Your helpful information concerns the somewhat special case of preamplifiers which can invert one channel relative to the other, in order to squeeze a bit more bass power out of an amplifier. There are few such preamplifiers.

My original answer concerned the more general case of preamplifiers which invert the phase of both channels: The two stereo channels emerge at the output in phase with one another, but opposite in phase (or, more properly, opposite in polarity) to the way they came in, inverting the signals' absolute phase. There are many such preamps and amps, because any component with an odd number of circuit stages will behave this way (amps or preamps with even numbers of circuit stages won't).

There is a body of opinion which holds that it is important for the sound waves reaching the listener to have the same absolute phase as those reaching the microphone that was used for recording, in which case it would be important to know which components in the system did or did not invert. If the preamp does invert phase in this manner, one can compensate by using a power amplifier which also inverts, or by reversing both sets of speaker leads. However, since there's no way to know how many circuit stages a signal went through between the microphone and master disc, there's no way to tell which way to set your system's polarity to duplicate that of the original sound. If the recording was made (as most popular recordings are) from a multi-track master tape, different portions of the signal may have different polarities in the final mixdown. Phase-inversion switches are available as accessories, and some components have them built in so that one can see how a given record sounds with either polarity.

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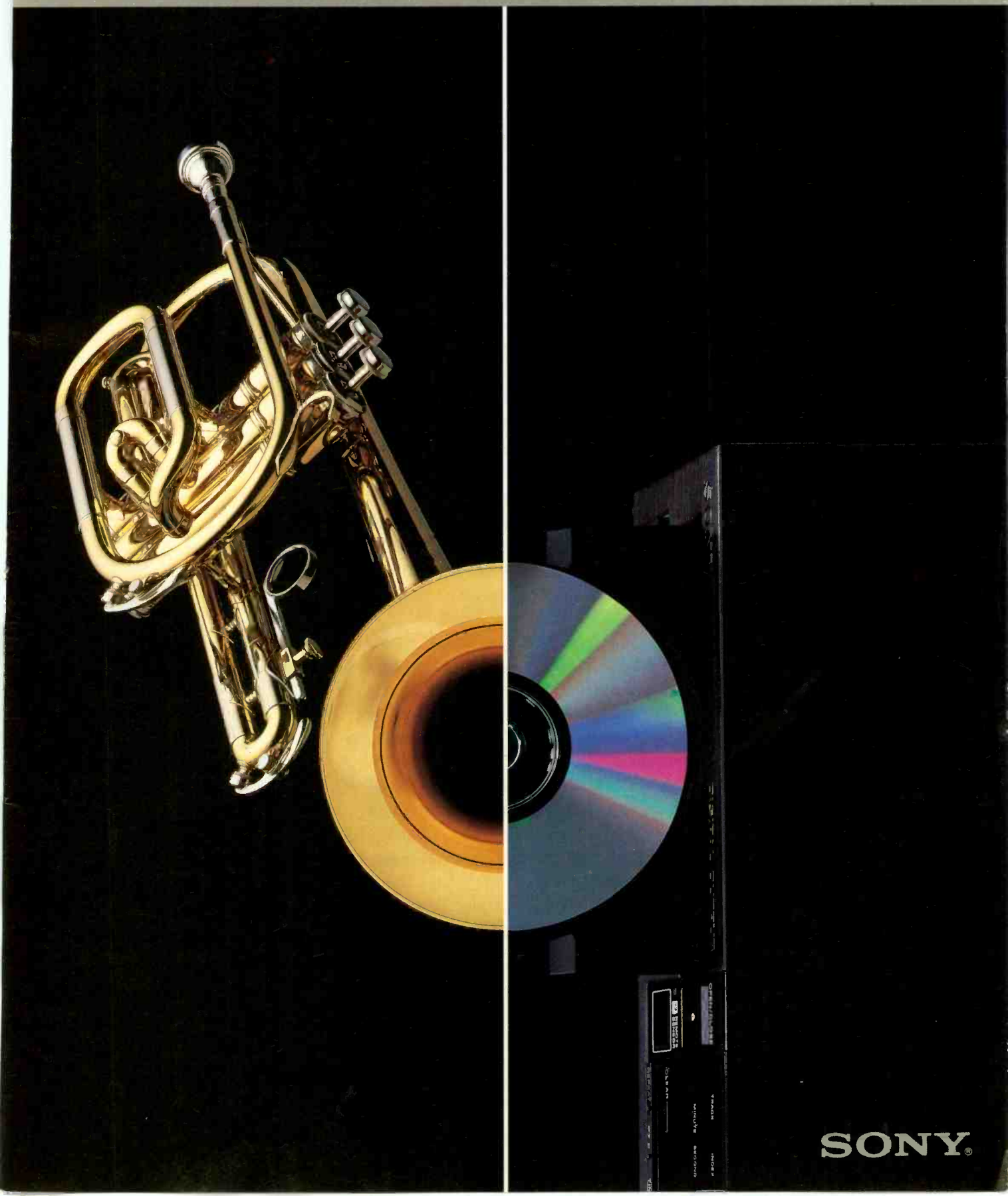

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These are the ES Digital engineers from Sony.

Engineers who refuse to compromise between technology, convenience and price. Engineers who use their technical expertise as an expression of personal creativity, as they work further to narrow the gap between music and technology.

These are engineers whose successes have been measured not just in state-of-the-art technology, but in award-winning products. Including the industry's first digital PCM recorders, Compact Disc players and signal processing components.

Each ES digital component stands as a benchmark of uncompromising quality. Because each represents an engineer's dream– an achievement of a lifetime spent in pursuit of a musical reality.

The Sony ES Digital Series. Dedicated by the select few... to the select few who are truly dedicated.

CDP-520ESII
The Most Affordable ES Series Player

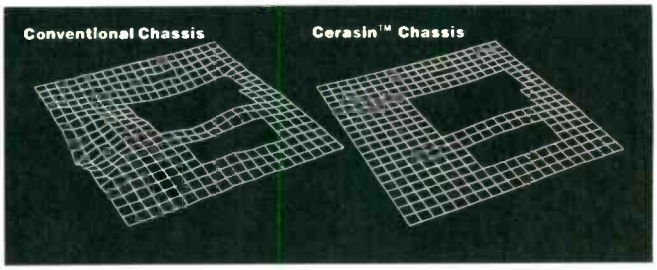
With a wide selection of playback options, including full programmability and multi-function infrared remote control, the 520ESII incorporates the most sophisticated technology of any CD player at its price.

Technology like a unique, single-clock Unilinear Converter with 96th order digital filter that eliminates "beat" frequencies found in typical multi-clock oversampling designs; Envelope Differential Detection Servo control that "freezes" the laser pick-up when no tracking signal is present; and a high-speed Linear Motor that's built on a Cerasin™ chassis, to dramatically lessen the effect of both internal and external vibration on player performance.

"I tried to not only lower the amount of internal vibration, but also find ways to reduce the effect of external vibration on the player's overall sound. To resist external vibration, we developed a ceramic and polyresin base material, along with a high-rigidity chassis. Then, to limit internal resonance, we created a new high speed linear motor drive system to replace the conventional gear-drive mechanism.

After completing our computer analysis and listening tests, we knew we had achieved an optical device that was properly isolated from both types of vibration. We were amazed at the improvement in sound, especially the vividness and transparency."

Yukio Onoe—Manager, Digital Engineering



Modal analysis comparing vibration patterns of conventional chassis and Sony Cerasin™ chassis.

"The new Sony CDP-520ESII is an excellent example of the state of the art in CD players . . . unquestionably a top contender in a crowded field, besides being a very good value for the money."
—Julian Hirsch, *Stereo Review* (U.S.A.)

CDP-620ESII
Elegant as the State of the Art

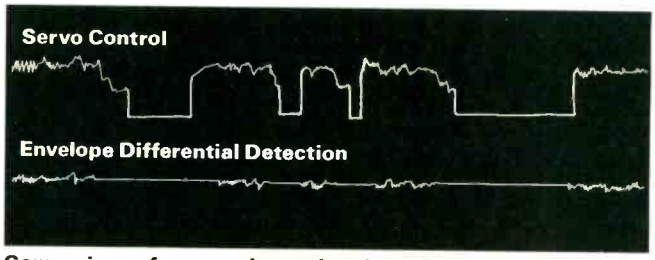
The CDP-620ESII represents a new direction in Compact Disc player design, offering enhanced display features, one-touch Direct Music selection, and the convenience of remote control programming and line-out volume control. Yet the CDP-620ES's elegant operation never overshadows its awesome technical and sonic capabilities.

Dual D/A Unilinear Converters and digital filters eliminate undesirable interchannel phase delay characteristics; the Linear Motor with Cerasin™ chassis minimizes internal and external vibrations; a new Optical Transfer circuit isolates digital data from noise generated in the analogue stage; and the remarkable Envelope Differential Detection Servo Control system maintains disc tracking under difficult playback conditions.

"Despite our success with all types of test discs, I was repeatedly frustrated in my attempts to design a tracking system that could play back badly scratched or defective discs without audible dropouts or mistracking.

Finally, we determined that an improvement in servo response would help to eliminate track jumping and skipping under poor conditions. So we designed a new servo detector that instantly 'freezes' the movement of the laser pickup when no RF signal is present. This provides faster recovery from large errors, and when listening, fooled even us into believing that the 'missing data' was still there!"

Yukio Onoe—Manager, Digital Engineering



Comparison of servo voltage signal recovery response between conventional servo control and Sony's Envelope Differential Detection system.

"The Sony 620ESII is a magnificent piece of technology, inside and out... I'd put the CDP-620ESII in a time capsule as a representative of this century's best engineering!"

—Ken Pohlmann, *Digital Audio* (U.S.A.)

CDP-650ESDII
The "Reference Standard" of an Industry

The remarkable construction and unprecedented performance of the CDP-650ESDII have garnered it more international acclaim than any other CD player of its time. It's also the world's first player to offer a digital output port, so that music "data" can be interfaced directly with other digital components of the future. And, of course, the most advanced Sony digital technology ever developed has been incorporated into every aspect of the 650ESDII's overall design.

But, there are other subtle, yet important, touches. Such as an annodized copper chassis that holds magnetic radiation to a minimum. Low impedance solid copper busbars to offset electrical noise. Special insulation feet and high-compliance rubber bushings to reduce shock and insulate the player transport. And, the entire analog and digital circuitry is internally isolated via an Optical Transfer stage that avoids hardwiring to keep mutual interference at a minimum.

"In our research, we normally put the digital data through the D/A converter then the analog circuits. But when I tried to feed the data directly to the amplifier, I was surprised to hear music that seemed constricted and harsh. Therefore, it became very important to solve this problem so we decided to isolate the digital signal from the player's analogue section by transferring the data through optical means."

Yukio Onoe—Manager, Digital Engineering

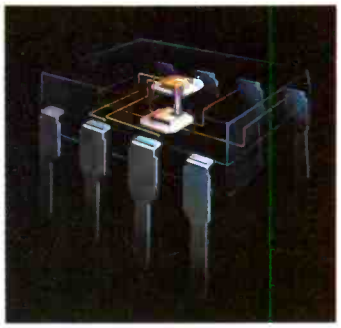


Illustration of Optical Transfer device that eliminates hard-wired connections between the analogue and digital circuitry stages.

"Sound quality of the CDP-650ESDII is absolutely magnificent. Until I can be shown that a better sounding CD player exists, I'm going to consider this model my new standard of reference."

—Leonard Feldman, *Audio* (U.S.A.)

SDP-505ES
The Next Step in Digital Sound Reproduction

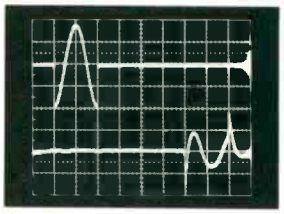
In the future, every high-fidelity component will offer the benefits of digital sound reproduction. The SDP-505ES takes the next step as the world's first digital surround processor designed for consumers. It features five different digital delay modes, including Dolby Surround Sound.™ The 505ES also offers independent left and right channel adjustment between 0 and 90 m/secs, a built-in "pink noise" generator for level calibration; three delay memory presets and a built-in rear channel stereo amplifier.

The heart of the SDP-505ES is a new CXD-1079 digital signal processing IC, which creates a true digital delay line that is ideal for high definition reproduction of surround sound and ambience effects. Unlike analogue delay units, this is achieved with a 44.1 kHz sampling rate and full 16 bit linear quantization—the identical parameters as the Compact Disc system. As a result, the same wide dynamic range, low distortion, and uniform frequency response have been realized.

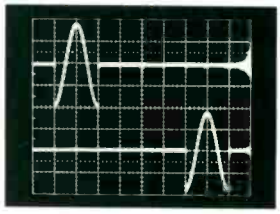
"In designing the delay line, I concentrated my efforts on the system's ambient noise level. During quiet passages, I wanted full attention to be focused on the front 'center stage,' so that even the ringing of a tiny bell would be both dramatic and startlingly realistic. To do this, it was imperative to reduce the ambient noise to the vanishing point. I knew this could only be accomplished through digital signal processing of the delay effect."

Teruhisa Ide—Assistant Manager, ES Group

Analogue Delay



Digital Delay



Input/output waveform comparisons between conventional analogue delay line and Sony digital delay processor.

"Absolutely top rate . . . dead quiet, extremely low distortion . . . the sense and illusion of concert hall listening is dramatically increased . . ." —Bert Whyte, *Audio* (U.S.A.)

"Oh! The sound. Magnificent. The 650/703 has a clarity and definition unsurpassed by any current player."
—Which Compact Disc (U.K.)

DAS-703ES
The Digital Component of the Future

The DAS-703ES is an outboard digital converter that employs four different sampling rate systems to decode not just Compact Discs, but PCM processors and future PCM broadcasts and digital audio tape (DAT) recorders.

Because the 703ES performs its tasks without the restrictions imposed by chassis size, signal path integration, and heat generation, it can reproduce each of these digital sources with more depth, detail, and imaging than was ever before thought possible.

"I wanted the listener to be able to picture the entire sound field; the opera singer on the stage; the pianist's keyboard action; or the location of the soloing musician in a jazz ensemble. This should be the essence of digital audio, whether the sounds are direct or reflective; strong or delicate in nature. In most CD players we discovered that even a small amount of noise or phase misalignment can destroy this sonic balance. So, we used tremendous care in developing an outboard D/A converter that would overcome these limitations. For if the data on the disc is 'perfect,' then the D/A converter should strive for that same perfection.". . .

Hiroshi Masaoka—Manager, ES Product Development

"Its sonic performance is unsurpassed among similar consumer (and even professional) products . . ."
—High Fidelity (U.S.A.)

PCM-601ESD
Enter the World of Digital Recordings

The PCM-601ESD is the newest member of the most renowned family of digital recording processors. It provides 14 or 16 bit recording capability, along with Optimum Video Condition (OVC) circuitry to help correct for tracking and dropout errors.

The 601ESD is the industry's first consumer digital processor to offer a unique input/output interface. This allows both direct decoding of digital output-equipped CD players and serial data transmission between components.

"In analogue audio, each waveform is processed knowing the potential for sonic degradation. Since the dream of the recording engineer has always been to maintain consistently high performance through every link of the reproduction chain, the goal should always be keeping the music information digital, from the microphone to the speaker, without any analogue processing being introduced. The digital I/O port is the first step from the digital mixing session to the listening room."

Hiroshi Masaoka—Manager, ES Product Development

CD Model	CDP-650ESD II	CDP-620ES II	CDP-520ES II
System	Unilinear Converter	Unilinear Converter	Unilinear Converter
Filter	Digital, Oversampling	Digital, Oversampling	Digital, Oversampling
Drive Mechanism	Linear Motor	Linear Motor	Linear Motor
Random Music Sensor (RMS)	20 Selection Programmability (Also Via Remote)	20 Selection Programmability (Also Via Remote)	16 Selection Programmability
Automatic Music Sensor (AMS)™	99 Tracks	99 Tracks	99 Tracks
Index Search	99 Subcodes	99 Subcodes	99 Subcodes
Shuffle Play	Yes	Yes	—
Repeat Modes	1, A-B, All, Program, Shuffle	1, A-B, All, Program Shuffle	1, A-B, All, Program
Auto Delay	Yes	Yes	—
Full Function Remote Control	Yes (W/Direct Access)	Yes (W/Direct Access)	Yes (W/Direct Access)
Line-Out/Volume	Yes (Also Via Remote)	Yes (Also Via Remote)	—
Headphone Output (W/Level Control)	Yes	Yes	Yes
Subcode Output	Yes	Yes	Yes
Digital Output	Yes	—	—
Timer Switch	Yes	Yes	Yes
Concentrated Display	Time/Track/Program Mode	Time/Track/Program Mode	Time/Track/Program Mode
Music Calendar	20 Selections	20 Selections	—
Frequency Response	2-20,000 Hz, ± 0.3 dB	2-20,000 Hz, ± 0.3 dB	2-20,000 Hz, ± 0.3 dB
Harmonic Distortion	Less than 0.0025% (1 kHz)	Less than 0.0025% (1 kHz)	Less than 0.0025% (1 kHz)
Dynamic Range	More than 96 dB	More than 96 dB	More than 96 dB
Stereo Separation	More than 95 dB (1 kHz)	More than 95 dB (1 kHz)	More than 95 dB (1 kHz)
Interchannel Phase Shift	None	None	Less than 45 degrees (20 kHz)
Wow And Flutter	Below measurable limit	Below measurable limit	Below measurable limit
Access Time	Less than 1 second	Less than 1 second	Less than 1 second
Line Output	0.05 V-2 V rms; load impedance 10 k ohms	0.05 V-2 V rms; load impedance 10 k ohms	2 V rms; load impedance 10 k ohms
Headphone Output	28 mW at 32 ohms	28 mW at 32 ohms	28 mW at 32 ohms
Power Requirements	120 V, 60Hz; RM-D502 Remote Commander two "AA" batteries	120 V, 60Hz; RM-D502 Remote Commander two "AA" batteries	120 V, 60Hz; RM-D302 Remote Commander two "AA" batteries
Power Consumption	16 W	16 W	15 W
Dimensions	430 mm (W) x 80 mm (H) x 365 mm (D); 17 x 3¼ x 14⅜	430 mm (W) x 80 mm (H) x 335 mm (D); 17 x 3¼ x 13¼ inches	430 mm (W) x 85 mm (H) x 336 mm (D); 17 x 3⅜ x 13¼
Weight	9 kg (19 lb. 14 oz.)	8.8 kg. (19 lb. 7 oz.)	6.8 kg (15 lbs)
Supplied Accessories	RM-D502 Remote Commander; 2 "AA" batteries. Disc Cloth; Connecting Cables (pr)	RM-D502 Remote Commander; 2 "AA" batteries. Disc Cloth; Connecting Cables (pr)	RM-D302 Remote Commander; 2 "AA" batteries. Disc Cloth; Connecting Cord (pr)
Warranty	"Limited" 3 years, parts/labor	"Limited" 3 years, parts/labor	"Limited" 3 years, parts/labor

	PCM-601ESD
System	PCM encoder/decoder
Modulation	PCM system using NTSC video signal
Audio Channels	Two channels
Sampling Frequency	44.1 kHz
Format	Conforms to EIAJ consumer 14/16 bit linear quantization
Digital Input	Yes
Digital Output	Yes
Optimum Video Condition (OVC)	Yes (with LED Indicators)
Emphasis	Time constant 50m/sec, 15m/sec
Level Indication	Peak program meter with peak hold
Frequency Response	5 Hz-20 kHz, ± 0.5 dB
Harmonic Distortion	Less than 0.007% (14 bit) Less than 0.005% (16 bit)
Dynamic Range	More than 86 dB (14 bit) More than 90 dB (16 bit)
Stereo Separation	More than 80 dB
Wow and Flutter	Below measurable limit
Input Level/Impedance	250 mV/50 k ohms (Line In) 1 V p-p/75 ohms (Video In) 0.5 V p-p/75 ohms Digital In)
Output Level/Impedance	250 mV/10 k ohms (Line Out) 1 V p-p/75 ohms (Monitor Out/ Video Out) 0.5 p-p/(Digital Out) 0.9~0.003 mW (Headphones)
Power Requirement	120 V 60 Hz
Power Consumption	29 watts
Dimensions	430 mm (W) x 85 mm (H) x 385 mm (D) 17 x 3⅜ x 15⅛ in
Weight	6.0 kg (13 lbs. 4 oz)
Supplied Accessories	Video Connecting Cables (2), Audio Connecting Cables (2), Digital Connecting Cables (2)
Warranty	"Limited" 3 years, parts/labor

	DAS-703ES
System	Digital-to-Analog (D/A) Converter
Format	Sampling Rates: 32 kHz, 44.056 kHz, 44.1 kHz, 48 kHz
Channels	Two Channels
Demodulation	16 Bit Linear
Frequency Response	5-20 kHz, ± 0.5 dB (44.1 kHz sampling rate)
Harmonic Distortion	Less than 0.004% (1 kHz; 44.1 kHz sampling rate)
Dynamic Range	More than 95 dB (44.1 kHz sampling rate)
Stereo Separation	More than 90 dB (1 kHz)
Line Output	0-5 rms; load impedance 10 ohms; Output impedance 100 ohms (fixed or variable)
Headphone Output	0-14 mW at 32 ohms
Digital Input	0.5 V p-p, ± 20%; impedance 75 ohms
Digital Output	0.5 V p-p, ± 20%; impedance 75 ohms
Power Requirements	120 V, 60 Hz
Power Consumption	25 W
Dimensions	430 mm (W) x 105 mm (H) x 410 mm (D) 17 x 4⅛ x 16⅛ inches
Weight	11.5 kg (25 lbs. 6 oz.)
Supplied Accessories	Audio connecting cables (2) Digital connecting cable (1)
Warranty	"Limited" 3 years, parts/labor

	SDP-505ES
System	Digital Surround Processor
Sampling Frequency	44.1 kHz
Format	16 bit linear quantization (EIAJ)
Surround Mode	Dolby Surround/Presence Delay/ Matrix/Hall/Simulated
Memory Presets	3
Delay Time	0-90m/sec, (0.1m/sec steps, L/R channels independent)
Frequency Response	Surround Out 20 Hz-20 kHz, ± 0.3 dB, Center Out 10 Hz-100 kHz, ± 0.3 dB
Dynamic Range	More than 90 dB (A network)
Harmonic Distortion	Less than 0.008% (1 kHz, 3V, presence delay mode)
Power Output	14 watts per channel, both channel driven continuously into 8 ohm from 40 Hz-20 kHz at no more than 0.2% total harmonic distortion
Input Level	250 mV (Line In)
Input Impedance	50 k ohms (Line In)
Output Level	Front Out 250 mV Surround Out 250 mV Center Out 250 mV (Low) 1.7 V (High)
Power Requirement	120 V 60 Hz
Power Consumption	100 watts
Dimensions	430 mm (W) x 86 mm (H) x 350 mm (D) 17 x 3⅜ x 13⅞ In
Weight	7.7 kg (17 lbs)
Warranty	"Limited" 3 years, parts/labor

	SS-505AV (Optional)
System	Surround Speakers
Driver Size/Type	Woofer 4¾ inches cone, (shielded) Tweeter 1 inch dome, (shielded)
Power Handling Capacity	Nominal 50 watts, maximum 150 watts
Frequency Response	50-20kHz
Dimensions	255mm (W) x 150mm (H) x 225mm (D) 10⅛ x 6 x 8⅞ inches
Weight (Per Speaker)	4.5 kg (9 lbs 15 oz)
Warranty	"Limited" 3 years, parts/labor

SONY.
THE LEADER IN DIGITAL AUDIO.

Sony Corporation of America
National Operations Headquarters, Sony Drive, Park Ridge, New Jersey 07656

H-6217
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IVAN BERGER

MUSIC AND MUTABILITY

Illustrations: Teresa Anderko

Genuine Synthesis

It's a surprisingly short step between digital sound production and reproduction. Some synthesizers can already digitize natural sounds, analyze them, alter their sound patterns to yield sonic mutations, or combine them with others to produce hybrids. Given pre-digitized sounds on CD, home audio systems with digital-to-analog conversion, and computing power that grows ever less expensive, it's just a matter of time until our stereo systems become capable of such audio genetics.

Back in 1969, long before all these revolutions in digital audio and low-cost computing, I wrote a piece for *Esquire* predicting that "the hi-fi system of the not-so-distant future" would include a piano-like synthesizer with a video "music stand" to display the musical score as it played (a feature of several modern synthesizers). I also predicted that it wouldn't *re*produce music at all.

Instead, it would *produce* music, using that same synthesizer. What the system played would not be audio recordings of the music's sound, but data recordings of the sound's makeup—instructions from which the synthesizer could re-create that sound. The user would be able to reprogram the synthesizer's response to those instructions, so as to electronically transcribe music written for one instrument to sound as if it were being played by another (there are already synthesizers which can store and substitute sounds this way, or so I understand). The user would also be able to dial in tempo changes, and even changes in hall sound. The ultimate (an idea I added in a later article) would be "personality modules" that mimicked human personalities, so one performer's interpretation, or even voice, could be substituted for another's. (Teresa Brewer sings "Carmen"? Janis Joplin as Medea? Furtwängler conducts Varese? Hmmm . . .) With appropriate sensors, you might even get your system to respond to your baton as you conducted.

The dark side is that any musical perversions you could cook up temporarily at home (Alvin and The Chipmunks sing Ned Rorem . . .) could be cooked up just as easily, and stored on record for all time, by equally perverted record producers—and they'd have the facilities first. But given time, and the general trend of professional computing power to drift into our homes, we'll eventually be able to undo all that stuff too.

Thunder Strike

More than a year ago, Telarc announced a forthcoming CD of Ferde Grofé's "Grand Canyon Suite." The orchestral parts were recorded by Erich Kunzel and the Cincinnati Pops back in 1983, but the disc has not yet appeared. The problem is that Telarc's CDs are all-digital, on principle, and the company could find no suitable digital recordings of Grand Canyon thunder. They've sent out several thunder-chasing expeditions with portable digital taping gear, but without usable results so far.

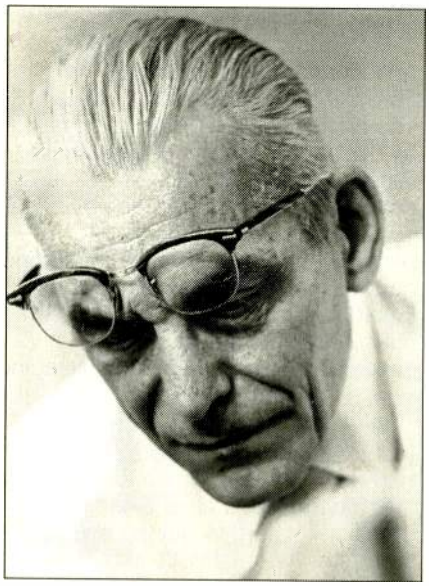
When I first heard this, I thought that the thunder, instead of striking, had gone out on strike. It turns out that the problems have been more prosaic: It's hard to get the sound of thunder without rain. It's almost as hard, these civilized days, to get it without noise from traffic, airplanes and people; at the Grand Canyon itself, this proved impossible. Moreover, thunder comes with lightning—and that can interfere with recording gear.

Anyone out there have a good, quiet, digital thunderstorm? Or know how to start a storm on cue? Telarc would probably like to hear from you.

Fright to the Finnish

Radio apparently still has the same kind of power to catch the listener's imagination that it had when Orson Welles broadcast a radio play of H. G. Wells' *The War of the Worlds* in 1938. As Edward Tatnall Canby has pointed out in some recent columns, that broadcast convinced thousands of listeners—chiefly those who tuned in after the opening announcements—that Martians had landed and were conquering the world.

Last December, a radio play about nuclear war engendered similar mass hysteria when it was broadcast in Finland. According to a Reuters dispatch in *The Washington Post*, switchboards were jammed with calls and health centers treated listeners for shock, despite reminders during the drama (as well as before and after) that it was all fiction. The *Post* story mentioned that the play, *The Next War*, was written in the U.S. and won awards as the best American radio play of 1984.



Coda: A. Stewart Hegeman

Noted audio designer A. Stewart Hegeman died on August 19 at the age of 72.

The man whom everyone called Stew was brilliant, salty, warm and cantankerous, intellectually stimulating, and a lot of fun to know. He never had his name on a big company, and did his most important work before the current era of designer-as-hero. But his work was important nonetheless.

He was one of the first to advocate bandwidths beyond the proverbial "20 to 20,000." The original Citation amplifier line, which he designed for Harman/Kardon, popularized the concept and practice of ultra-wide-bandwidth amplification; compare the bandwidth figures given in our October Directory with those of the early '60s, when the Citation line appeared, and you'll see one of his legacies.

Another Hegeman legacy is the phrase "a straight wire with gain," which summed up his amplifier philosophy—since adopted by many amplifier makers and parroted by even more. It's flattering to have one's words prove so true that they become clichés, but Stew was more annoyed than flattered by it.

His omnidirectional "ice cream cone" tweeter of the 1950s demonstrated the importance of wide-dispersion speaker design and inspired AR's dome tweeter. "One of his great contributions to the field," says AR founder Edgar Villchur, "was making people understand that you couldn't judge a speaker by its on-axis response alone—that a speaker had to be judged by its response *and* its dispersion."

Stew pioneered in many other areas: In the 1950s, he designed laminated-cone speakers, one of the first stereo preamps, and some of the first transistor audio components; he also helped produce limited-edition audiophile discs (Westminster's Lab Series). In the '60s, he designed the first Dynatuner—so good it was produced for 15 years—and the Citation line. Later he produced speakers, amps and preamps under his own name; two of his later omni speakers are still being produced, by Morrison Audio in Toronto.

This list of accomplishments is not complete. Stew didn't keep lists of bygone triumphs or even mention them; even his wife only learned recently, by accident, that he had been commended for his defense electronics work in World War II.

Like most good audio designers, Stew was more interested in music than in audio per se. He liked to listen to it, record it, and make sure it was reproduced as well as possible. Stew was also active in the Catgut Acoustical Society, a group researching the design of stringed instruments. He will be missed.

CD Graphics

The prospects of graphics on CD are looking up. Many new players include subcode outputs which can feed data to graphics adaptors; Toshiba and Sony will probably be first on the market with the adaptors themselves. The standards allow for a palette of 4,096 possible colors, of which only 16 can be used at once. The display, consisting of 288 × 192 picture elements (pixels), is visibly cruder than broadcast TV (340 × 340 on the screen of a good modern TV set), or even a VCR at slow speed (240 × 340). According to *JEI*, a Japanese trade magazine, about 2,000 such images can fit onto a CD along with the music. (Presumably, there will be fewer images on most recordings, which are shorter than the CD's 75-minute maximum.) The images will change every 2.25 seconds or so, more like a fast slide show than TV.

Bowing Out

Two long-familiar names in home audio won't be making home audio anymore. Crown International of Elkhart, Ind. has discontinued its home high-fidelity product line in order to concentrate on its professional and commercial microphone and amplifier products. Heath, of Benton Harbor, Mich., has discontinued all its audio products except a half-octave real-time spectrum analyzer, though it will continue to make computers and other kits.

I'll miss both companies. The first audio-equipment catalog I ever saw was Heath's, and the first separate amp and preamp I ever owned were Heath's gold-finished W-5M and WAP-2. The W-5M was, as I recall, the amp that broke the dollar-per-watt barrier, back in the '50s (it was a massive 25-watter too). The WAP-2 preamp's phono-equalization stage had adjustable turnover and roll-off controls so one could match the many record equalization curves used in those pre-RIAA days. Since I still have many of those old records, I wish I also still had that preamp—though, since it took its power from that long-gone amplifier, I'd need some way to power it.

When I got into tape recording, I longed for a big Crown deck, more portable and affordable than the Ampex 350—but not quite affordable enough for me, alas.

Both companies followed unusual routes into home audio. Heath started as an aircraft company, making the Heath Parasol in both kit and factory-built form. In World War II they made defense electronics, then shifted to civilian electronic kits. Crown originally made tape recorders for use by missionaries engaged in gospel broadcasting, then enlarged their market.

ADCOM®
POWER AMPLIFIERS
HIGH CURRENT, HIGH PERFORMANCE

The modestly-priced amplifiers that deliver price-no-object sonic performance.

ADCOM POWER AMPLIFIERS.

These high-power, high-current amplifiers easily and accurately interface with virtually any speaker system available today (perhaps even tomorrow)—including some troublesome exotic types whose impedance falls as low as 1 ohm.

GFA-535

GFA-545

GFA-555

Before we tell you about Adcom's amplifiers, there are a few facts you should know about amplifiers in general.

Amplifiers vary enormously in two related areas: how accurately they present the audio signal to the speakers, and how well they interface with the complex electrical load presented by many speakers. The latter is probably the least understood of all the factors affecting the ultimate sound in a given stereo system.

All the specifications that describe an amplifier's performance—including our own—are laboratory measurements made with standard purely resistive loads. These measurements provide relative benchmarks, but do not fully predict an amplifier's performance with any particular speaker system.

The importance of high current.

The standard 8-ohm impedance at which an amplifier's output power is normally referenced may not even be close to the actual moment-by-moment impedance presented by a given speaker under typical operating conditions. That is, with a music signal driving a speaker.

A speaker with a nominal rating of 8 ohms can actually present the amplifier with a load anywhere from almost 60 ohms to less than 2 ohms, depending on the frequencies it is handling at any given moment.

But even when operating well within normal limits, an amplifier's output circuit interacts with the speaker's impedance variations to affect, for better or worse, how the music sounds.

As speaker impedance falls, increased current is drawn from the amplifier output stage. In fact, many amplifiers, when pushed to very high levels and very low impedances, reach a point where their protection circuitry had better shut them off... or their output transistors will self-destruct.

Which brings us to Adcom.

Despite their affordable prices, Adcom's amplifiers were conceived and designed to be compared with "esoteric" price-no-object amplifiers.

The flagship of this new generation is the GFA-555. Throughout its development, we subjected it to comparative blind listening tests against highly-regarded amplifiers priced up to nine times higher.

Although some listeners reported hearing subtle differences among all the amplifiers, none heard anything to suggest that the Adcom amplifier was priced much lower than the others.

When a production model of the GFA-555 was tested by Stereophile magazine (Vol. 8, No. 4), the results were even more gratifying:

"It is so clearly superior to past amplifiers in the low- to mid-priced range—not to mention most amplifiers two to three times its price—that I can unhesitatingly recommend it for even the most demanding high-end system.

"... it rivals any transistor power amplifier in its price class that I have heard—including high-powered receivers or amps with trick power supplies—at any price."

Why Adcom amplifiers sound better than those more expensive amplifiers.

High current output stage.

The GFA-555, GFA-545 and GFA-535 all use multiple high-current discrete output transistors, each capable of handling large amounts of current. In the GFA-555, for example, 16 such devices are used, providing a capability of more than 20 amperes into low impedance loads.

The GFA-545 and GFA-535 use 12 and 8 of these devices, respectively, and achieve high levels of current capability that few amplifiers with comparable power claims have been able to deliver up to now.

Transient capability—which differentiates the demands of music from conventional test procedures—is greater than 800 watts into 2-ohm loads with the GFA-555. The GFA-545 and GFA-535 also produce considerably more dynamic power than their continuous power measurements would suggest. And the continuous power is always there whenever you need it, not just for milliseconds. All Adcom amplifiers are designed to remain stable, without glitches or oscillation, under virtually any operating condition.

No matter how complex a load it presents, no speaker made yesterday, today—or probably even tomorrow—should be a problem for Adcom amplifiers.

Well-regulated, high-current power supplies.

Adcom amplifiers use custom-designed transformers that provide especially tight regulation and a minimum of interchannel crosstalk, vibration, hum, or noise. The GFA-555 and GFA-545 use expensive toroidal transformers, which are noted for their higher performance capability. The GFA-535 uses two transformers, one for each channel, in order to provide some of the benefits of toroidals without the additional cost.

The power supply in all three models is designed with separate rectifier bridges and specially-designed filter storage capacitors. The GFA-555 has a total capacitance of 60,000 microfarads, the GFA-545, 40,000; the GFA-535, 27,200. This high capacity provides tremendous reserves for high dynamic power demands. (As an informal but impressive way of experiencing these reserves, you can unplug the AC line cord of an Adcom amplifier while your system is operating, and the music will probably continue for several seconds.)

This rugged, efficient and stable power supply is extremely important, and is largely responsible for maintaining low distortion down to very

low frequencies—and for performance that remains relatively unaffected by fluctuations in AC line voltages.

No current-limiting protective circuitry.

The only protection needed against short-term overloads is power-supply fusing.

To protect against long-term overloads that can cause overheating, a thermal circuit breaker shuts down the amplifier when the heat-sink temperature reaches 75 degrees C. When the temperature drops, normal operation resumes automatically.

Advantages of direct coupling.

Coupling capacitors can be responsible for a variety of subtle signal distortions. Some manufacturers minimize the problem by using special and expensive capacitors. By direct coupling of the input and output of the circuitry, Adcom eliminates the need for such capacitors, and thus eliminates the problem at the source.

No protective output coil.

Most amplifier designs have protective coils in their output circuits to prevent spurious oscillations under typical load/signal conditions. But these coils are responsible for most amplifier/speaker interface problems. They introduce frequency-response irregularities and lower damping factor.

And when the amplifier is connected to high-capacitance loads, such as electrostatic speakers and some esoteric cables, the coil resonates to produce the oscillations they are supposed to prevent.

This is another problem Adcom solved by the direct coupling of the output. The damping factor remains high at all frequencies, phase shift is kept low, and sonic performance into difficult loads—particularly electrostatics—is improved.

Simple gain path throughout.

The gain path is simple and direct, with a minimum number of components, each of high quality, from input to output. This means less waveform distortion and less phase shift. Further, Adcom power amplifiers use only discrete circuit elements rather than integrated circuits. This allows for total flexibility in selecting individual elements and calibrating them for optimum performance at every stage. Functionally, the input circuit uses a differential-input transistor pair, followed by a single voltage-gain transistor. Both active elements in this stage are class-A biased, using very sophisticated double-regulated active current sources. This current supply is unaffected by variations in the power supply or signal.

This circuit design provides pure Class A operation for the input and second gain stages, resulting in low noise, low distortion and low DC offset voltages.

Instantaneous distortion alert.

The instant that any form of distortion—THD, IM, TIM, SID, etc.—exceeds 1 percent, a front-panel LED illuminates.

The highly accurate indicators are activated by unique circuitry that monitors the activity in the internal feedback loop.

Final word.

If you are looking for a new amplifier, appreciate the need for considerable power, understand the importance of high-current capability—and know great value when you hear it—you'll certainly want to compare the Adcom amplifiers to any others, at any price!

When you do, you'll hear for yourself that higher cost does not necessarily mean better performance. And like many other music lovers, you're likely to prefer any of ours purely on their own sonic terms—sight unseen and price unknown.

Anything less is a compromise.

SPECIFICATIONS:

AMPLIFIERS	GFA-555	GFA-545	GFA-535
Power output, watts/channel, continuous, both channels, 20 Hz-20 kHz, <0.09% THD:			
8 ohms	200	100	60
4 ohms	325	150	100
Bridged, mono, 8 ohms, 20 Hz-20kHz,<0.25% THD:	600	n/a	n/a
Bridged, mono, 4 ohms, 20 Hz-20 kHz,<0.25% THD:	850	n/a	n/a
Signal-to-noise ratio A-weighted, full output:	>106 dB	>106 dB	>106 dB
Input impedance:	22kOhms	22 kOhms	22 kOhms
Input sensitivity: for rated output:	1.85 volts	1.3 volts	1.0 volt
for 1 watt:	130 mV	130 mV	130 mV
Damping factor (20 Hz-20 kHz):	>130	>130	>130
Dynamic headroom (at 4 ohms):	2.3 dB	2.6 dB	3 dB
Voltage:	120V/60 Hz (Available in 220V/50Hz on special order)		
Dimensions:	17 x 7 3/8 x 11 1/2" D. (432mm x 187mm x 292mm D.)	17 x 5 1/2 x 12 1/2" D. (432mm x 140mm x 318mm D.)	17 x 3 1/4 x 12 1/2" D. (432mm x 83mm x 318mm D.)
Shipping weight:	35 lbs. (15.9 kg.)	27 lbs. (12.2 kg.)	22 lbs. (10 kg.)
Optional rack mount adaptors:			
Black:	RM-7	RM-5	RM-3
White:	RM-7W	RM-5W	RM-3W
Silver:	RM-7S	RM-5S	RM-3S

Cover photo: GFA-555 with optional RM-7 rack mount adaptors

ADCOM®

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

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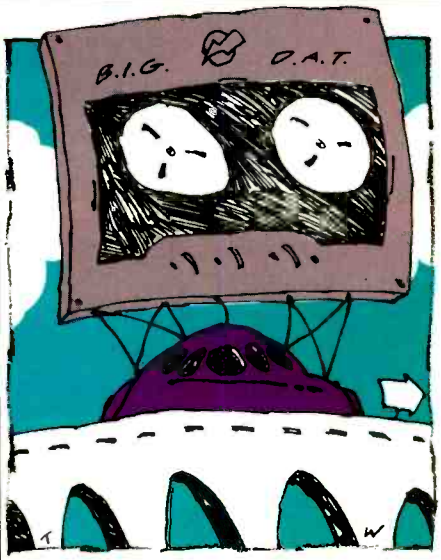
Pointe Claire, Quebec H9R 4X5

Adcom products are available with white or silver front panels on special order. Shown: GFA-545 with GFT-555 AM/FM-stereo tuner and GFP-555 preamplifier with white front panels

IVAN BERGER

DON'T WAIT FOR EIGHT



Illustrations: Thomas H. Waters

More Media?

We already have AM, FM, cassette, and (if we're ahead of the Joneses) CD in our cars. There may be more formats to come.

Digital Audio Tape (DAT) is an obvious prospect. I've heard rumors that DAT transports will be easier to fit into a dashboard (unlikely, judging from the two rotary-head R-DAT transports I've seen, though stationary-head S-DAT could be a different story). And the tapes' combination of compact size with two-hour recording time, not to mention the magic of the "digital" label, should appeal to consumers.

A less obvious contender is 8-mm videocassette. Sony already has such a system for the car, designed, naturally enough, to play video. However, some 8-mm VCRs with PCM soundtracks can put PCM where the video tracks normally go, for 24 hours of audio. That's enough for a long trip; by the time you finish the tape, you're so far from the beginning that you can start it over without getting bored. As usual, though, there's a catch or two. First, 8-mm probably won't sound as good as DAT, since it encodes the sound with a lower sampling rate (32 kHz instead of 44.1 or 48 kHz) and with half as many bits.

Second, 24 hours is a lot of time to fill. There are few single works that long (Wagner's Ring Cycle excepted). Not many performers or composers have 24 hours worth of stuff that you'd want to listen to straight through (Wagner's Ring Cycle not excepted), and no record company in its right mind would be likely to issue such a tape. It would be hard for a record company to find 24 hours worth of individual selections that would appeal to a large audience. (How about every Top 40 tune of the rock era? Nah, that would require the cooperation of too many record companies.) Recording 24 hours of one's own favorites would entail more than 24 hours of work and therefore won't appeal to many people. (Come to think of it, even DAT's two-hour recording time poses these problems, albeit on a smaller scale.)

A third, more serious problem for 8-mm might be software incompatibility. Even if the tapes contained only audio, they would have to be formatted to fit the video standards of the countries for which the tapes and the VCRs were made. Hence, 8-mm PCM music tapes made for use in the U.S. (which uses 525-line pictures in NTSC color format) wouldn't play on machines made for use in those foreign countries which use 625-line pictures with PAL or SECAM color—for one thing, 625-line machines run at a different speed.

While it would be possible to make PCM audio tapes for each standard, as is now done for videotapes, I don't think that's very likely. There's less incentive in audio, where the tapes sell for less and there are more competing media.

More on Magazines

The basic pros and cons of magazine-loading CD players for the car (or home) are pretty well known by now. On the plus side, both single- and multi-disc magazines protect discs against dirt and damage. Single-disc magazines make loading simpler—no need to open the jewel box; just shove it in—and multi-disc magazines make changers possible. On the negative side, the magazines are an extra expense. And unless both your home and car players use the same magazines, you'll have to unload the discs from each one's magazine to use them in the other player.

This brings us to some minor points. Finding a given set of six discs on a shelf is probably easier than finding a single, skinny jewel box. On the other hand, though multi-disc magazines are chunky enough to stand upright on an ordinary shelf, they're too thick to fit into the single-disc slots of most CD cabinets.

The cost issue may disappear. Yamaha hopes that record companies will sell CDs in the Yamaha single-play cassette instead of the standard jewel box, and the prices projected for multi-disc magazines are about the same, per disc, as most storage devices I've seen.

In magazines, the discs will become divorced from their liner-note booklets. Though some listeners won't care about that, Sony has a rather clever solution—a 10-booklet wallet that stays with you in the passenger compartment while your 10 discs ride in the trunk. Pioneer's solution is simpler—they may expand the slipcase for their magazines to include a pocket for the notes.

Bass Canard

One of the myths about car stereo is that you can't get good bass in a car "because the car's interior is too small." There are two ways to refute this.

The better way is to take the skeptic to your car and let him hear your mighty bass. If your system's bass is, alas, nonmighty, or the doubter's skepticism is so extreme that he won't admit to what he's hearing, try the second way. Point out that there's plenty of good bass inside a woofer cabinet—and that's a lot smaller than your car.

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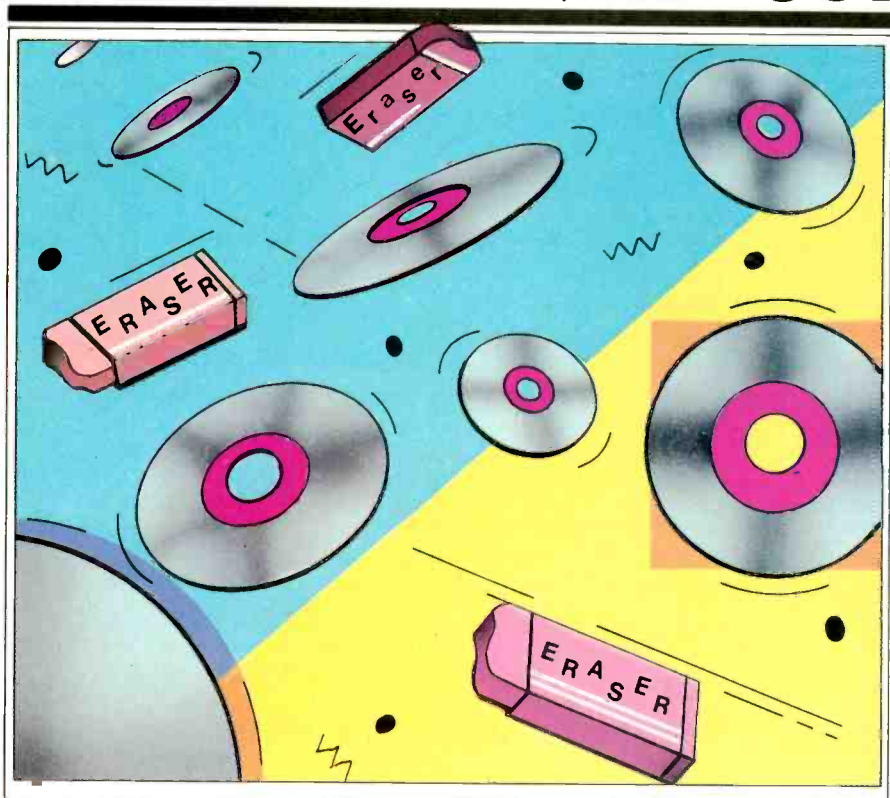


Illustration: Zoë Brotman

Okay. Better sit yourself down. Take a few deep breaths and try to relax. This won't be easy for either of us. You know that expensive CD player you just bought, the player you spent three months shopping for, the player that cost you $500? I'll try to break this to you gently: It's a piece of obsolete junk.

Well, not exactly—but they've come up with something better, a new and improved CD. Specifically, it is a recordable/erasable disc which uses a combination of vertical magnetic recording and laser optics. Its name: Magneto-Optical Disc (MOD). The boys in the prototyping laboratories have these MOD things up and running, and their market introduction is only a matter of time . . . .

Magnetic storage has been around for well over a half-century; it's a great way to record and erase data but it suffers from some basic problems such as medium and head wear. In addition, magnetic storage has hitherto used longitudinal recording, in which the magnetic particles are laid flat on the medium; this limits the density of particles and hence the amount of information stored in an area.

Optical storage is a newcomer whose longevity (of medium and pickup) and data density are powerful assets. Thus far, only read-only optical media such as CD have been widely commercialized. That's because the optical properties of materials are not as easily changed as their magnetic properties.

Magneto-optical storage promises to merge the record/erase properties of magnetic materials with the high density and contactless pickup of optical materials, using a number of very clever technological tricks.

Fundamentally, MOD recording is the same as any magnetic recording, except that vertical (sometimes called perpendicular or VR) recording is used. In a vertical medium, magnetic particles are placed perpendicularly to the tape surface; this allows much greater particle density and shorter recorded wavelengths, and hence greater recording density. Vertical recording actually becomes more robust as recording density increases; as the cylindrically shaped particles are packed more tightly, they must be made thinner, which increases their magnetic strength.

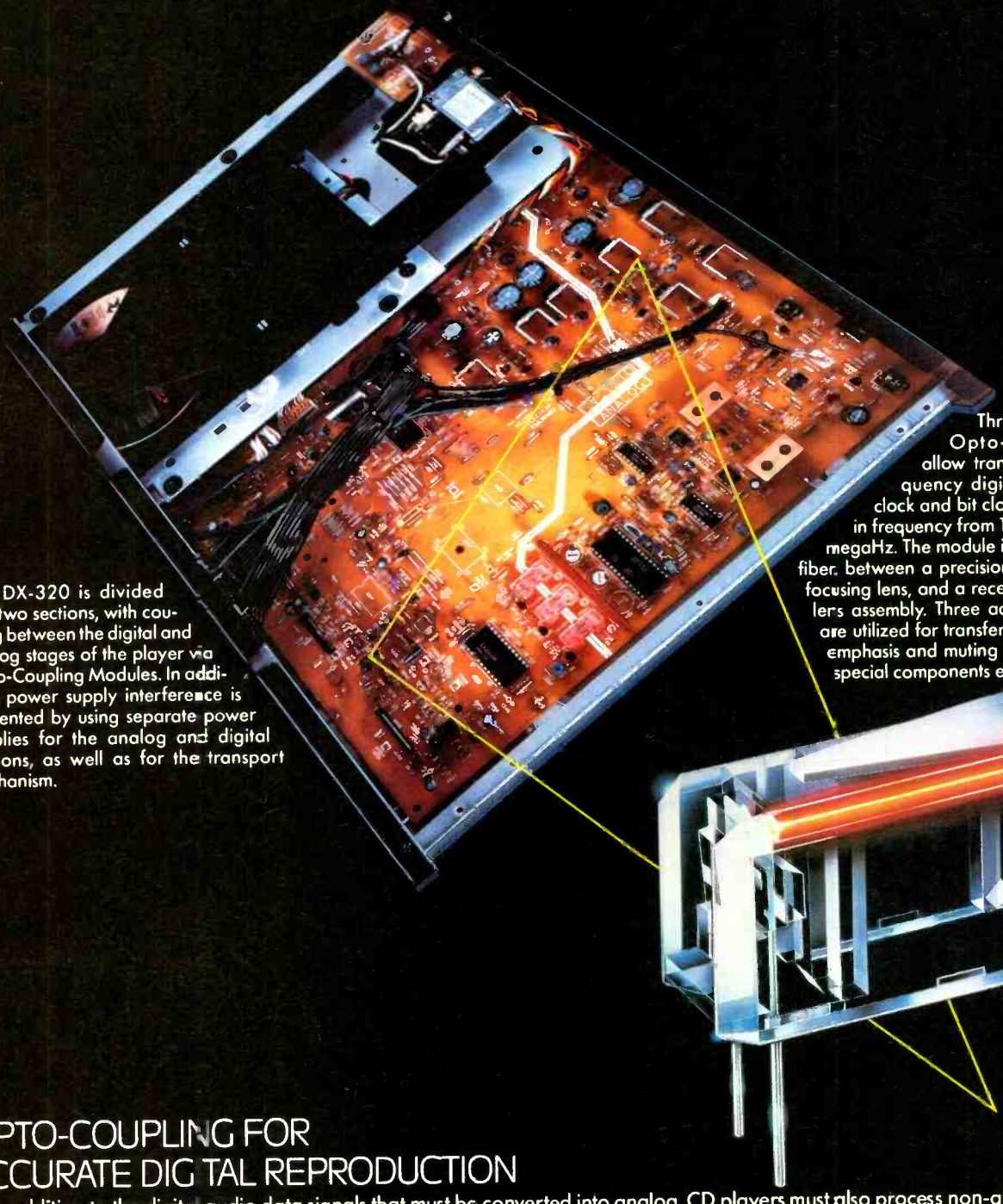
However, this great recording density is underutilized by conventional magnetic heads. Their recording flux fields cannot be focused sufficiently; in other words, the recorded area is far larger than necessary. This is where optics, plus a nifty trick, are introduced. In a MOD system a magnetic field is used to record data, but it is about a tenth the strength of conventional recording fields. By itself it is too weak to affect the orientation of the magnetic particles. However, the process utilizes a unique property of magnetic materials: As they are heated, their coercivity suddenly drops close to zero at their Curie point. In other words, at that temperature (about 200° C) the magnetic particles are easily oriented by a weak field.

A laser beam, precisely focused through an objective lens, is used to heat a minute spot of magnetic material to its Curie point. At that temperature only those few particles on that minute spot are affected by the magnetic field from the recording coil, and a very high-density recording results. As in any digital magnetic storage, saturation recording is used. In the case of MOD recording, the aligned particles are reverse-oriented perpendicularly, as shown in Fig. 1.

The funny part is this: We don't really use the magnetic information itself. You see, reading the data from the MOD uses another trick: The Kerr (or Faraday) effect, which characterizes—take another deep breath—the rotation of the plane of polarized light as it passes through a magnetized material. What this boils down to is that the reverse-oriented regions will reflect laser light differently from the way the unreversed regions do. To read the disc, we shine a focused laser on the disc and monitor the angle of rotation of its reflection (about 0.3°), as shown in Fig. 2. An optical analyzer (such as a polarizing beam splitter) distinguishes between the rotated and unrotated light, and converts that information into a beam of varying light intensity. Data is then recovered from that modulated signal.

To erase data, a reversed magnetic field is applied to the MOD along with the laser heating spot, as shown in Fig. 3, and new data is written. Both erasure and recording can be accom-

BEYOND CONVENTIONAL AUDIO



The DX-320 is divided into two sections, with coupling between the digital and analog stages of the player via Opto-Coupling Modules. In addition, power supply interference is prevented by using separate power supplies for the analog and digital sections, as well as for the transport mechanism.

Three high speed ONKYO Opto-Coupling Modules allow transfer of ultra high frequency digital audio data, word clock and bit clock signals which range in frequency from 176.4 kiloHz up to 4.32 megaHz. The module incorporates an optical fiber between a precision LED light source and focusing lens, and a receiving photo-diode and lens assembly. Three additional opto-isolators are utilized for transfer of left/right clock, de-emphasis and muting signals. Together, these special components eliminate DSI.

OPTO-COUPLING FOR ACCURATE DIGITAL REPRODUCTION

In addition to the digital audio data signals that must be converted into analog, CD players must also process non-audio digital data. During this conversion, Digital Signal Interference (DSI) occurs due to noise transfer between the various digital and analog stages, through printed circuit board wiring, and common ground lines. These non-audio data signals can actually interfere with the digital to analog conversion, resulting in Digital Signal Interference. This noise contributes to the harsh sound characteristics often attributed to digital reproduction.

In order to prevent DSI from appearing at the player's outputs along with the music signal, we found that it was necessary to completely isolate the digital and analog blocks of circuitry from each other electrically. This was made possible by the development of ONKYO's exclusive Opto-Coupling Module.

This new technology prevents DSI by utilizing specially designed high speed fiber optics that convert the digital data signals into beams of light. This eliminates the transfer of noise between the digital and analog stages. The result is honest, accurate musical reproduction with none of the harsh characteristics often attributed to conventional CD players.

Artistry In Sound

ONKYO®

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Magneto-optical storage promises to merge the record/erase properties of magnetic media with the high density and longevity of optical systems.

plished in one pass, as with conventional magnetic media.

A MOD disc would retain the protective properties of other optical media, with the recording layer sandwiched between a transparent substrate and a protective layer. The laser light would shine through the substrate, using refraction to put surface dust and scratches out of focus with respect to the interior data. Although several magnetic materials could be used, the ultimate selection will be based on orientation properties and long-term stability. System designers are currently researching amorphous thin-film magnetic materials with coercivity of about 2,500 oersteds.

An important aspect of any recording medium is its compatibility with media from other recorders. To achieve this within the high tolerances of a MOD, blank discs will be manufactured with prerecorded nonerasable addressing. The method, called hardware address sectoring, uses a grooved disc in which address information is physically formed in the groove and detected by light-beam reflection. Using this system, any MOD player will automatically track both address and data information contained on any MOD disc. By superimposing the hardware-addressing information on the recorded data signal, playing time (75 minutes) is not sacrificed.

The optical head and magnetic coils of a MOD system will require sophisticated engineering both in terms of their own design and in terms of the hardware and software to control them. In addition, a complete signal-encoding chain will have to be contained in every player. However, much of the hardware can be borrowed from CD technology; also, MOD emulates the CD format's sampling rate and word length. Which brings us back to that playback-only device which you recently purchased . . . .

Okay. I know you're feeling pretty despondent. Your new CD player will soon be outclassed, and—oh no!—what about all those discs you bought? Well, here's some good news. The MOD system would be upward-compatible with the CD. Because much of the electronics are identical, all MOD players could also play CDs, in the same way that a cassette machine can record tapes or play prerecorded ones. They could share a common optical head, and even the difference between CD and MOD would be automatically detected, owing to the differences in reflectivity.

Go ahead and buy as many CDs as you want; they will remain just as they are—the medium for prerecorded optical reproduction. Of course, if you want to record MODs or play already recorded ones, you'll need a MOD recorder. While many people will certainly get one, I suspect that CD players will keep going strong, just as another great prerecorded software transport, the turntable, has persisted.

Naturally, you still might be harboring some anger toward the manufacturing companies and their habit of constantly improving on their self-proclaimed perfection. In that case, you'll enjoy the MOD/CD-versus-DAT battle they'll create for themselves. These two recordable/erasable digital audio formats should make good competitors. MOD, combining the best of magnetic and optical storage, would appear to have the advantage. For example, a DAT cassette will undergo deterioration after 200 erasures, whereas a MOD disc probably could be erased/recorded more than 10^8 times without difficulty. Of course, if (unlike DAT) MOD is given the ability to record—not just play—at a sampling rate of 44.1 kHz, it would probably destroy DAT with a single laser zap.

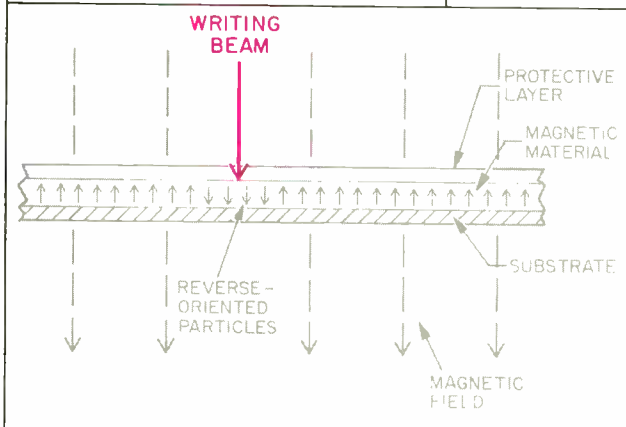

Fig. 1—Recording a Magneto-Optical Disc (MOD).

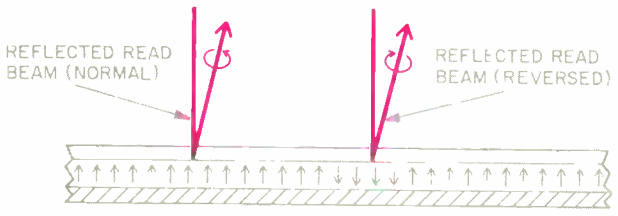

Fig. 2—Reading a MOD.

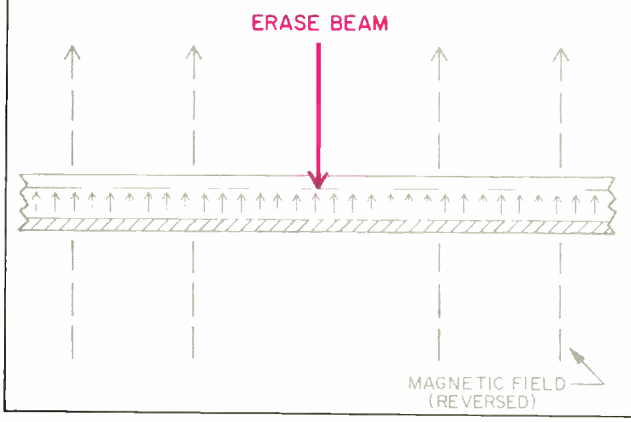

Fig. 3—Erasing a MOD.

BEYOND CONVENTIONAL AUDIO

THE ONKYO INTEGRA DX-320 WITH OPTO-COUPLING
THE SOUND IS NO ILLUSION

The Integra DX-320 Compact Disc player is the first of ONKYO's new generation of CD players to incorporate our unique Opto-Coupling digital signal processing system. Conventional CD players transmit digital data internally via printed circuit board wiring, which interacts with analog audio signals to produce Digital Signal Interference (DSI), resulting in an audible "harshness" in the music.

Specially designed high speed Opto-Coupling modules in the DX-320 transfer the digital audio and other data signals to the analog output stage via fiber optics, preventing DSI. The result is noise-free, life-like reproduction with none of the harsh sound characteristics often attributed to other CD players. This remarkable new technology can only be found in the ONKYO DX-320.

Double oversampling and digital filtering greatly improve phase and harmonic accuracy. A fully programmable wireless remote control includes memory selection, phrase capability, and indexing for maximum convenience.

Our unique transport design incorporates ONKYO's exclusive Poly-Sorb, a rubber-like compound that improves isolation by absorbing extraneous vibrations, eliminating skipping and mistracking.

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AM AMPLIFICATIONS

Illustration: Tim Parker

Of course AM radio is not limited to a top of—to use old radio terminology—5,000 cycles! Our infelicitous usage of the English language for technical matters is still something else. Whoever invented that inaccurate term "limited"?

Unlike a yardstick or its modern equivalent, the meter stick, a "limit" in broadcasting is a technical term that is far from simple. Our units of measurement are always being refined to ever more incredible accuracies (did you notice that our figure for the speed of sound in air has been revised again?), but a limit, and notably in broadcasting, is emphatically *not* a unit of measurement. We do not chop off our signals the way a butcher whacks through a hunk of beef. Most audio-signal qualifications are, shall I say, negotiable. They operate much as does the all-too-human flesh when a buxom lady gets herself into a not-so-buxom evening gown. You give a little push here and something pops out there. This is not to say that limits are unprecise! Eventually either the gown splits or the flesh abrades. Similarly, the broadcast signal can go just so far, in various alternative ways, before it simply goes *too* far. I hope that I hear at least a hundred radio and TV engineers solemnly intoning "amen."

True, we don't seem to have any limits anymore, FM or AM or what have you. The expectation, even so, is that not too many evening gowns will split so it shows. If that happens, the government will be back to help with a refitting.

These somewhat fulsome remarks (one of my favorite words, fulsome—it is so very positively negative) are occasioned by a mini-storm of correspondence concerning John K. Mitchell's letter to this mag printed in my department in the July 1986 issue. Yes, Mr. Mitchell made a linguistic boo-boo, no two ways about it. No, AM broadcast, again, is *not* "limited" to 5 kHz. But an awful lot of people think so and have been thinking so for more than a half-century, which means there is sense to the thought, if not accuracy.

I haven't communicated with Mr. Mitchell and would not, in any case, have "edited" and corrected what was, I must remind you, a letter, not a commissioned column. The importance and interest of his letter had to do with his personal experience, notably in early Bell Labs hi-fi demos and in the equalization of telephone lines back in the '30s for improved frequency response and noise characteristics—including the frantic attempts to meet Major Armstrong's requirements for FM. You will note that Mr. Mitchell was a telephone man, not a broadcaster. Presumably he remained so, even though he is broad-minded enough to read our honored publication.

I can't help thinking of what is popularly called a Freudian slip, though that term has a sexy context when rightly used. Mr. Mitchell unintentionally reversed the two halves of AM, broadcasting and reception. Just like millions of us. Such slips, you see, reveal more than they say in literal terms. And more truthfully. Freudian slips can be embarrassing! They're not merely revealing, but more true than accurate, if you see what I mean.

I do like the engineering mind because it is so unlike my own. I have letters on AM broadcasting from a number of chief engineers in AM stations now actively on the AM air. Admirable precision! I am given the exact and precise FCC rules, chapter and verse, specifically Part 73.44, section (a), (1), that govern, or did govern, AM emanation in the U.S. My inclination, needless to say, is not to quote them. (Indeed, I *will* not! If you are a good engineer, you can find them for yourself, especially if you work in an AM station.) Break them at your own risk; it is now a matter of cooperation among competitors, which is to say, the rules are more important than ever.

But the AM engineers are unanimous, and rightly, I am sure, in ascribing the base problem with AM fidelity to poor receiving sets, over these many years. I might suggest privately that some of the broadcast negotiables over the half-century—those involving amplitude modulation—have been stretched to the splitting point by quite a few broadcasters. But that tends to be changing as plain old hi-fi—clean, noise-free, wide-range—becomes not only more and more appreciated by the large public, but more and more available in every medium we know.

In a word, before we go onward, AM is now cleaning up its act. This, of course, in spite of the enormous dead weight of pop music and its freight of semi-deliberate distortion and "limits," both in the recording/broadcasting

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Most of our audio-signal qualifications, such as limiting, are negotiable. We don't chop off signals the way a butcher whacks through a hunk of beef.

and in the reception. I do think that AM is on the move and perhaps would be even without the challenge of AM stereo, which must compete directly with all the highly perfected forms of stereo we now can provide.

There is a ring of truth to these engineering claims that the fault in AM quality has always been in the receivers we have had. Without a doubt, the "limits" do allow a very creditable AM broadcast signal to go forth—*if* we will put aside the unfortunate matter of interference, which was one major reason, almost the basic reason, for FM in the first place. Interference arising from nature as well as from the jammed-up, overcrowded AM band we've inherited. Interference from a million thunderstorms and almost as many man-made noise sources. Interference from unwanted stations the world over. Increase the selectivity and you cut down the bandwidth—a trade-off that was unavoidable until the genius of FM gave us our cake to eat *and* to have. AM was a mess even after the great reforms that launched broadcasting back in the '20s. We inherit, rigidly, most of that mess today, and we can do no more than play around the edges when it comes to eliminating the more hideous parts. Unless, of course, we start all over again. Fat chance of *that*. But we can—and do—send out a superior AM signal now and then. The limits remain negotiable. They always have been.

Yes, I have an AM radio. Tubed, ancient, table-top. I leave it fixed to a New York news station 100 miles from my home. Most days that station is clear (with background hiss) but sometimes, instead of New York, I get Toronto, even louder. Vagaries of nature—Toronto's news instead of Manhattan's. Either way, this old set (with miniature tubes and a coil antenna which responds nicely to a finger touch) is able to reproduce sibilants quite clearly; it is *not* limited to 5,000 cycles, or 5 kHz, and its dynamic speaker with the big electromagnet is surprisingly clean. Yet in the evening, and in the morning until an hour after sunup, it is useless, bringing in dozens of distant stations one on top of the other. And at the slightest thought of a thunderhead I am blasted by explosions. Indeed, I use this AM radio as a convenient lightning indicator when in doubt about my expensive hi-fi. It is sensitive up to 50 miles or so and always warns me loudly of a storm. I then pull the hi-fi plug in a hurry. Our rural power lines are all above ground.

One correspondent mentions an early Scott AM/FM tuner in which, he says, the AM component is of unusually fine quality. This would be H. H. Scott, Herman Hosmer. The reasoning behind it was good: It was designed to receive AM/FM simulcast stereo (left channel via one transmitter, right channel via the other) in the years before the present FM stereo system was launched, after unconscionable delay (and compromise). The AM section

E. H. Scott built some fabulous AM receivers prior to WW II. One model logged broadcasts from both New Zealand and Paris.

was built to come as near as possible to FM quality so that the two stereo channels would not be unduly different in sound. Interesting. This would account for quite a number of excellent AM receivers in the '50s and early '60s. Since then, AM in our fancier home equipment has been pretty much unused, with inevitable deterioration. A few years ago I found that my old AM table-top was easily superior in its reception to that of a new, top-line AM/FM tuner. The development money and the manufacturing cost in that new model, and in too many others, went into the FM segment.

If you have a *very* old AM/FM tuner and can fix it up with AM specifically in mind, you may find you had a bargain back then, well back into the tube era. You might want to experiment with current AM, just to find out what these modern-day AM broadcasting engineers are actually doing. WDAF in Kansas City, Mo., for instance, is one of dozens of AM stations that now feel strongly about transmitting a quality AM signal.

Perhaps the most exciting correspondence on this general subject came from an amiable curmudgeon who was kind enough to make copies of a whole series of Scott factory newsletters dating from as far back as March 1935. This was the other Scott, E. H., who built fabulous AM radio receivers (component and console) in the prewar years. My friend has a Scott of this vintage which astounds when heard today.

Now here was an AM receiver! With 23 tubes (different numbers in later versions), it was an all-wave model for reception the world over, as was then popular in expensive radios—my 1934 Midwest with a mere 16 tubes was a lesser example of the type. I used to listen to Hitler "live" on that one. This new Scott model (he had been in the business for a good many years) was announced in March 1935. It was evidently extraordinarily sensitive and had a continuous selectivity/bandwidth control from very sharp to broad. There is a remarkable account of an all-night DXing session apparently *on the broadcast band* which logged clear signals from Paris to New Zealand. Wide-open, one Scott model's overall response was essentially flat, radio and audio, to 16 kHz. All this, mind you, in early 1935.

What astonished me most, though, was the Scott newsletters' liberal use of the term *high fidelity*, back in 1935—and the specs definitely warranted it. Scott even refers to "other" high-fidelity radios that weren't worthy of the term but used it anyway. So our history moves back still further.

No FM in the 1935 Scott. Not so much as a mention, though FM was already under demo in those years. Scott probably knew, but he seems to have been an AM genius who knew what AM could do, in receiving as well as broadcast, and was out to prove it. He did that, for sure. A

BERT WHYTE

2001: A SOUND ODYSSEY

The seven drivers of the Duntech Sovereign 2001 are symmetrically mounted, top to bottom, to maintain the symmetry of its radiation patterns at all frequencies.

I have been listening to loudspeakers and evaluating them, both personally and professionally, for more than 40 years. During that time, I have heard countless numbers of speakers of every size and shape, operating on every design principle devised by the mind of man. Thus, I am familiar with the infinite baffle, the closed box, and ducted, ported, and vented enclosures. I have auditioned a vast array of back-loaded horns, corner horns, and exponential horns. My ears have heard the blandishments of electrostatic, planar magnetic, ionic, and plasmatronic speakers. You name it, I've heard it!

Over the years, I have encountered some really weird and bizarre loudspeaker designs, many of which were obviously put together by inventors who blithely tried to circumvent the laws of physics. My experience, and just plain common sense, help to put some of the basic qualities and aspects of loudspeakers in their proper perspective. For example, no matter how cleverly a small loudspeaker is designed—even if it employs psychoacoustic trickery—you can't get a big sound out of a small box. In the words of my dear friend, the late Rudy Bozak, "There is no such thing as a miniature 30-Hz wavelength!" Years of listening make for a very discriminating ear, as well as a highly developed degree of cynicism. Perhaps I should not have made my reference the live musical experience. Be that as it may, I have diligently pursued that ever-elusive sonic dream—a loudspeaker accurate enough to present and sustain a true replication of the concert-hall listening experience. This will probably remain a fantasy, but a really close approach to the ideal would be rewarding.

For some months, I have been conducting exhaustive listening tests and making a most comprehensive evaluation of a major new loudspeaker, the Duntech Sovereign 2001. Duntech International is an Australian company originally founded in the United States; their products are imported by W & W Audio (4821 McAlpine Farm Rd., Charlotte, N.C. 28226). John Dunlavy, who heads up Duntech, is a brilliant and innovative engineer and physicist whose speaker designs have always incorporated interesting new technology. This Sovereign loudspeaker is unquestionably his magnum opus, an engineering tour de force which far transcends the boundaries of current loudspeaker technology.

John Dunlavy has wanted a flagship speaker for his company ever since I met him in 1976. Over the years, he has pursued this goal, and when he moved his operation to Australia, such a speaker was still a high-priority project. A few months ago, I got an excited call from John, telling me that he had discovered a new breakthrough in measurement technique that would enable him to develop the advanced technology that he had always wanted to incorporate into his "world class" loudspeaker.

Understandably, this new measurement technique is proprietary, but Dunlavy has indicated that it involves the use of Fast Fourier Transform analysis coupled with the Time Delay Spectrometry techniques developed by *Audio* Senior Editor Richard C. Heyser. Duntech's measurement technique provides a means of accurately characterizing both amplitude and phase response, along with the level of diffraction distortion, by examining the transfer characteristics implied by the shape of a step-function pulse reproduced by the loudspeaker. Dunlavy emphasizes that almost all of his speaker measurements are made at a distance of 3½ to 4 meters, a more realistic listening position than the usual 1-meter measurement distances. The great advantage of the new technique is that every parameter of speaker performance can be measured over the entire audio spectrum during the first few mS of the test. Dunlavy says that, even though this time period is very brief, the test is entirely free of any room reflections or boundary effects and is, in fact, analogous to an anechoic condition.

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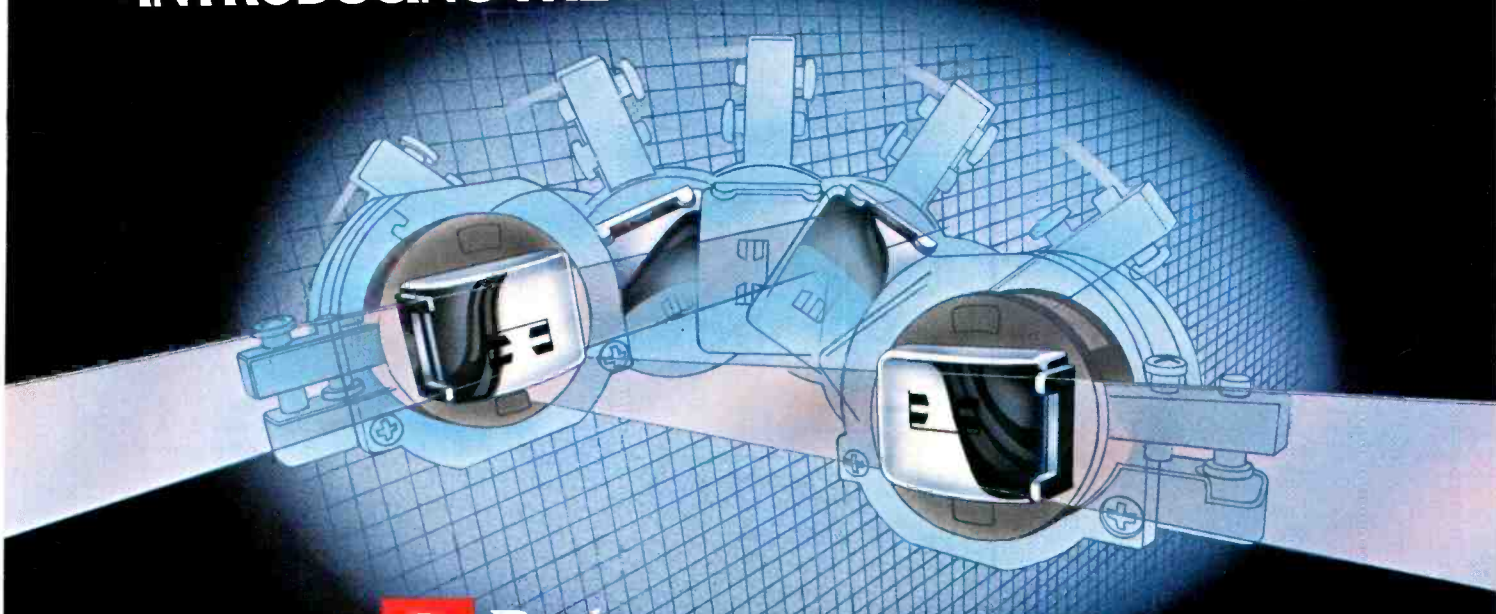

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It is obvious that this is a most extraordinary loudspeaker that probably deserves recognition as a landmark design.

The Sovereign is a monolith of imposing and heroic proportions: It is 74 inches high, 14 inches wide, and 32 inches deep. The enclosure is fabricated from a special, high-density, laminated "custom wood" and ultra-high-density particleboard more than 1½ inches thick. With this massive, anti-resonant construction, each Sovereign weighs a rather breathtaking 376 pounds!

Seven high-power drivers are used for each Sovereign in an unusual configuration. A dome tweeter, 20 mm in diameter, is mounted so that it is at ear level of a seated listener. Vertically arrayed above and below the tweeter are 75-mm midrange dome drivers. Above and below these are 177-mm mid-bass cone drivers, and 305-mm cone woofers are mounted above and below the mid-bass units to complete the driver complement. Duntech claims that this symmetrical arrangement of drivers creates point-source radiation at all frequencies, along with perfectly symmetrical radiation patterns. The mid-bass, midrange, and tweeter drivers are surrounded by special, highly absorbent, 1-inch-thick organic felt, a method of eliminating diffraction for which Duntech has a U.S. patent. All of the drivers are path-aligned (time-collimated) to obtain a propagation error of less than 20 mS at a distance of 4 meters along the geometric axis of the speaker.

Dunlavy is an acknowledged expert in the field of wave-guide and antenna theory, and holds more than 34 patents on antenna design. He told me that the Sovereign basically operates as an acoustical analog of wave-guide and antenna theory; its mid-bass and woofer drivers are mounted in special sealed enclosures whose design is derived from these electromagnetic theories. The enclosures use special damping materials of variable density to achieve an optimum Q of 0.7, thus assuring accurate pulse response down to the lowest frequencies.

The Sovereign's crossover network is a computer-derived minimum-phase type of great complexity, configured to provide the optimum crossover frequencies and proper roll-off slopes without the necessity of bi- or triamplification. Crossover frequencies are 300 Hz, 2 kHz, and 6 kHz. This crossover uses massive air-core inductors, constructed of oxygen-free copper wire of very large cross-section. Input to the crossover is through large-diameter, gold-plated, five-way Tiffany binding posts. The imposing size of this loudspeaker is matched by its ability to handle a full kilowatt of power for 10 mS over the entire audio spectrum!

From the foregoing, it is obvious that the Sovereign 2001 is a most extraordinary loudspeaker, and probably deserves recognition as a landmark design. There are, of course, many factors that affect the performance of a loudspeaker. It also must be noted that

Listening to the Duntechs for the first time can be a bit overwhelming, due to the emotional impact of their sheer musicality.

some people argue that good objective measurements are not always equated with satisfactory subjective listening experiences. On the other hand, certain speaker parameters *are* generally accepted as indicative of high quality, and correlate well with subjective impressions. Dunlavy has documented his tests with an extraordinary series of oscilloscope photos. His Sovereign loudspeaker does, indeed, reproduce a square wave, one with a very good shape, with barely 1 dB of overshoot and no ringing on the top. Furthermore, he shows square waves of 200-, 400-, and 800-μS width. His tone bursts are very symmetrical, with virtually no ringing at the end of the burst. His 'scope photos of THD indicate less than 0.3% for second and third harmonics, at 90 dB SPL, at all frequencies from 50 Hz to 10 kHz. THD at 30 Hz at 90 dB SPL is a quite impressive 1.5%.

While we are talking numbers, I'll list some other pertinent specifications. Frequency response, measured on-axis at 3½ meters, is ±2 dB from 27 Hz to 20 kHz. Now, this is under the anechoic conditions of the new Duntech measurement technique. In a typical listening room, the response is nearly flat to 20 Hz, and is down only 9 dB at 16 Hz. The Sovereign loudspeaker that was sent to me is a production prototype; between 400 Hz and 7 kHz, its response was an incredible ±0.5 dB! Measured on-axis at 3½ meters, phase response is less than ±30° from 50 Hz to 20 kHz. The Sovereign has a nominal impedance of 4 ohms. The impedance curve is very flat, varying from 3 to 4.5 ohms. The Sovereign is a fairly efficient speaker, rated at 90 dB SPL for 1 watt at 1 meter.

Now that I've covered the anatomy of the Sovereign and revealed its vital statistics, it is time for general impressions, assorted ruminations, and, of course, an assessment of its sonic performance.

First off, as I've said, this speaker is *big!* However, its bulk is trimmed by its clean, simple lines, and it is so beautifully finished it is really quite elegant. The pair of Sovereigns I have are veneered with a richly grained, light-toned American walnut. The grille is a welded aluminum frame that rigidly pressure-fits with the enclosure. Ever aware of diffraction distortion, Duntech has lined the inner reflecting surfaces of the frame with acoustic foam. The frame is covered with a black, acoustically transparent cloth.

In case you've been wondering what all this massive magnificence and super-sonics costs, the Sovereigns in standard American walnut or African rosewood sell for a rather lofty $12,999 per pair. The speakers are also available in a wide variety of exotic woods, like Brazilian rosewood and palisander, for $15,000 per pair. The price includes direct air shipment to the consumer; a special arrangement with the

The Sovereign projects a huge presence, with a sound stage that extends laterally beyond the boundaries of the speakers.

air freight company provides for unpacking the crates, moving these 376-pound beasts into your listening room, and even removing the crates!

Needless to say, it is nice to have a muscular pal around when you start to position 376-pound speakers. The Sovereigns should be kept within 16 to 19 inches from the wall behind them: otherwise, you will attenuate the magnificent bass response. I had the Sovereigns angled so that the axis of the tweeters crossed in the middle of my head when I was seated in my listening position.

The first time you listen to Sovereign loudspeakers can be a bit overwhelming because of the emotional impact of their sheer musicality. This is particularly true when listening to large-scale symphonic music. In a tumultuous, triple-fortissimo passage of a Mahler symphony, the Sovereign projects a huge presence: The sound stage extends laterally beyond the boundaries of the speakers, and the depth of the sonic image makes you sense the size and acoustic character of the hall. Instrumental localization is very well defined, with the point-source radiation of the Sovereigns preserving the proper vertical and horizontal perspectives of the orchestra.

I listened to a great variety of music on the Sovereigns. In addition to the symphonic music, I played a lot of opera and oratorios, chamber music, solo vocal and instrumental recitals, organ music, jazz, and big-band music. The Sovereigns reproduced all of this with equal facility. Whether it was the delicate strains of a string quartet, the soaring sweetness of a great soprano voice, the floor-shaking thunder of organ pedals, the coruscating high frequencies of a ride cymbal, the brazen blare of French horns, the sharp explosive transients of tympani, the visceral impact of a concert bass drum, the searing trumpet of Wynton Marsalis, the piano filigrees of Horowitz, or even the raucous squawk of a fuzz box, the Sovereigns reproduced them all with breathtaking verisimilitude. Imagine a loudspeaker with the transparency and transient attack of the best membrane-type speakers, a speaker that can plumb the most subterranean depths of low frequencies, a speaker that can reproduce the harmonics and overtones of high strings with silken sweetness, a speaker that remains utterly clean, even at 120 dB SPL! These are among the qualities which characterize the Sovereigns.

As you might expect, the Sovereigns are notable for cleanness and tremendous reserves of dynamic range. No matter how great the dynamic range of the music, it was always reproduced without the slightest sense of strain. On a London/Argo CD of Mendelssohn organ works (414420-2), there is a thunderous, 19-Hz pedal tone that the Sovereign reproduces with awesome power and authority. Similarly, on a Philips

....remarkable!

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

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The Duntechs engender tremendous confidence; you know they are capable of dealing with the most demanding material.

CD of the Saint-Saëns Third Symphony (412619-2), the second movement has a 16-Hz pedal tone, and the Sovereign literally lets you feel its mighty pulsations. I played a piano tape Ray Dolby had sent me, recorded with his new Spectral Recording System. The SR system is capable of a dynamic range of over 100 dB. For the first time ever, I was able to play some triple-fortissimo piano chords at live listening levels without breakup. This was an amazing feat for the Sovereign, and the realism of the piano was staggering.

The smoothness, openness and transparency of the reproduced sound, as well as its warmth and musicality, were what I had anticipated, given the point-source radiation of the Sovereigns. String sound was extremely smooth and natural; the string quartets sounded as if they were seated in my listening room. The Sovereigns reproduced high strings with ravishing beauty and compelling naturalism. Equally good was the very extended, well-defined low-frequency response. An example of this could be heard on the London CD of Mahler's Third Symphony (414268-2). The opening fanfare for eight French horns was magnificently full-bodied and brazen. Shortly thereafter, there were some very low-frequency bass drum strokes, played at very low level. On the Sovereigns these were heard with much detail, with the skin tone and timbre perfectly preserved. Another striking example of the resolution capabilities of the Sovereigns is with a CD from Digital Music Products, *New York Cats Direct* (CD-453). The second track has some awesomely high-level, very low-frequency synthesizer tones which are reproduced cleanly down to their lowest fundamentals.

No, phonophiles, I haven't abandoned the venerable vinyl disc. Using the magnificent SME Series V arm on a VPI HW-19 MKII turntable, plus the Shure Ultra 500 cartridge, I have been getting the best record reproduction I've ever gotten, from some of the top DMM recordings. The Sovereigns are certainly compatible with vinyl!

In summation, it must be said that the Sovereigns are very expensive loudspeakers, but if you can afford them, I believe you are incontestably getting the best. The speaker is mercilessly revealing and is not tolerant of inferior equipment. In the months I've used these speakers, I haven't been able to fault them in any respect. Above all, they give you a feeling of freedom, and they engender tremendous confidence because you know they are capable of dealing with the most demanding, highly dynamic program material. John Dunlavy claims that the Sovereigns are the most technically and musically accurate speakers in the world. After living with these magnificent speakers, I'd have to say that their performance makes a very strong case for his statement.

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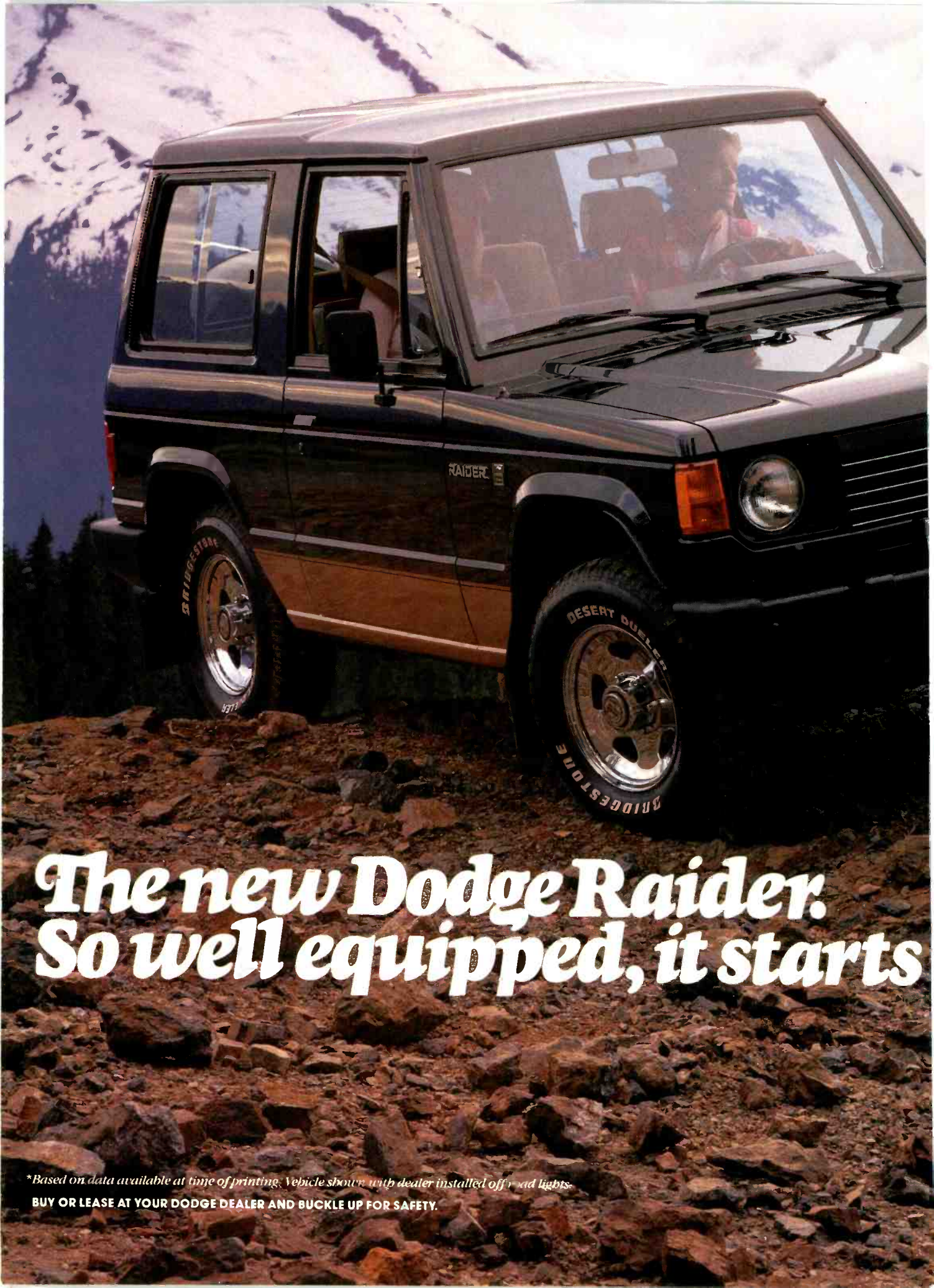

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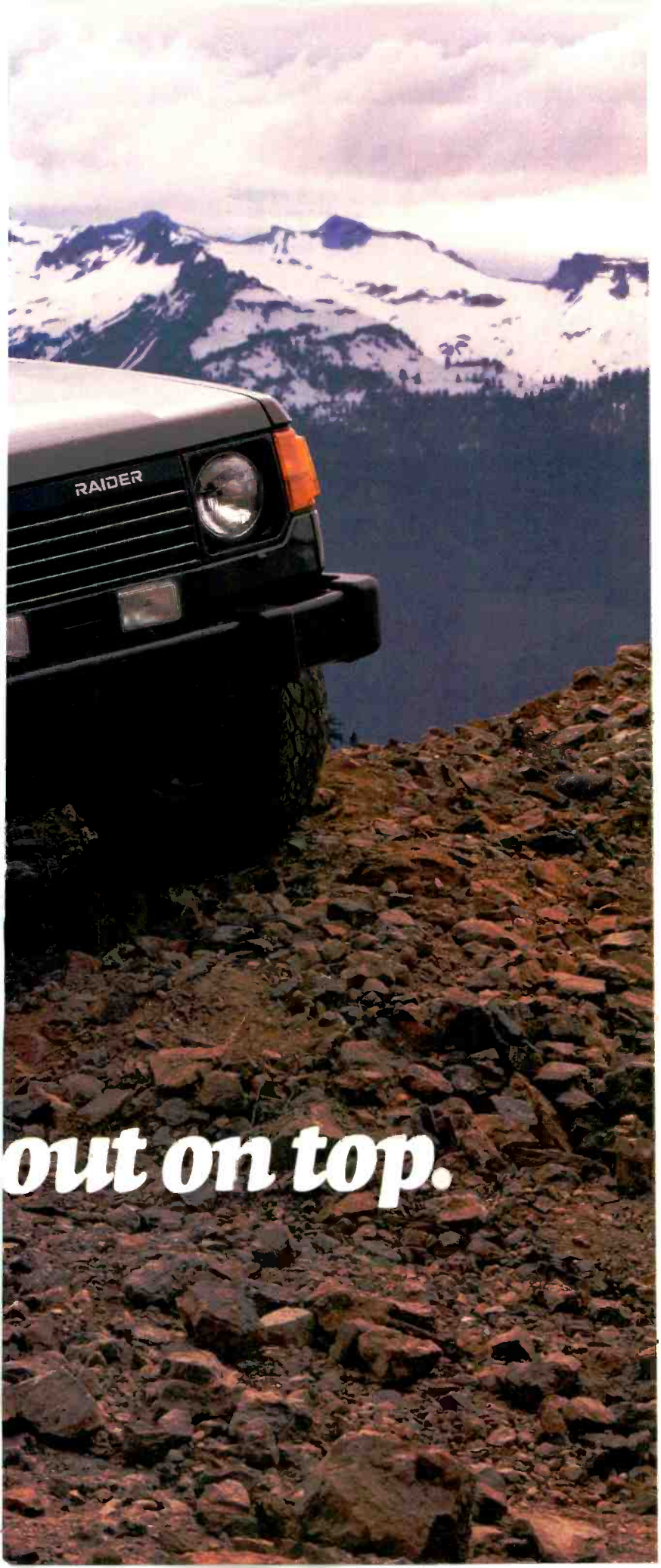

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Jerry Leiber & Mike Stoller

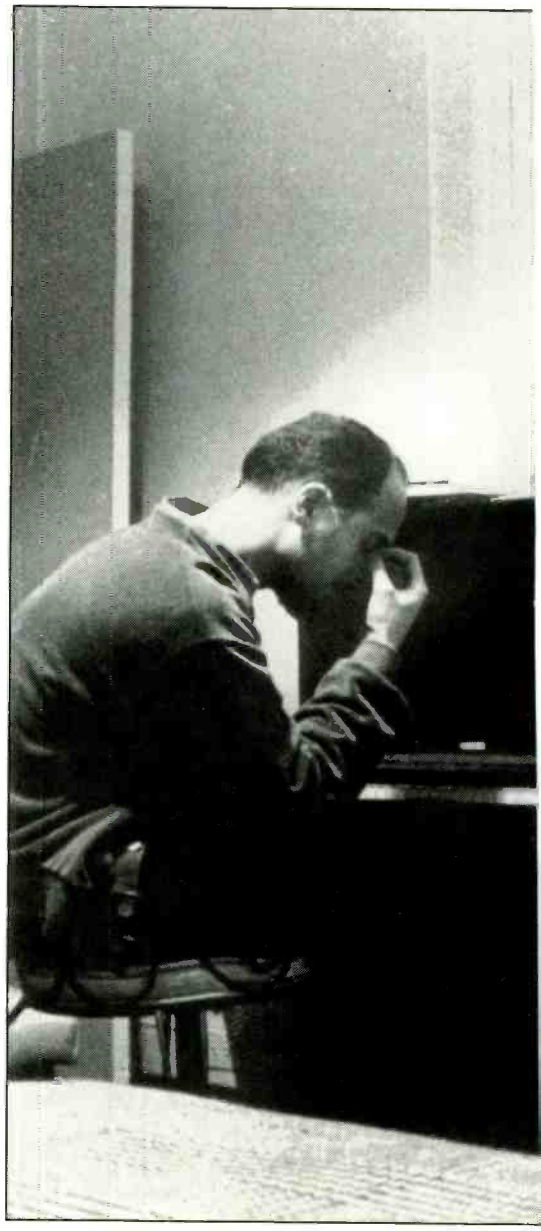
The First Independent Producers—PART I

"Kansas City" is a rhythm-and-blues classic. To this day many people assume it's a traditional song, presumably passed on among itinerant black singers who emerged from the South to sing in the honky-tonks, turpentine camps and shantytowns of the American Heartland. In fact, it was written by two young Jewish fellows, lyricist Jerry Leiber and composer Mike Stoller. This pair had so well absorbed the black culture they loved that they were able not only to add to it, but to help it merge and meld with white influences to produce a new sound—rock 'n' roll. The first record they produced, with Big Mama Thornton in 1952, was their own "Hound Dog," a song whose path epitomized rock 'n' roll's genealogy—from black R&B to mainstream rock popularity, via the "cover" of a white performer, in this case Elvis Presley. The duo went on to write many songs directly for Elvis, including "Jailhouse Rock"; that's Mike playing piano in the film's famous title-song production number.

After tiring of seeing their songs misinterpreted by other producers, and after getting burned with their own short-lived record company in the early '50s, Leiber and Stoller joined Atlantic Records as the industry's first-ever "independent producers." Indeed, the term was coined for them. There they wrote and produced some of the best and funniest rock 'n' roll records for The Coasters, and produced some of the most advanced and beautiful pop records to date for The Drifters. Also during their Atlantic days, their mentor Lester Sill discovered a teenage wiz-kid named Phil Spector, and convinced the duo to take him on as their apprentice.

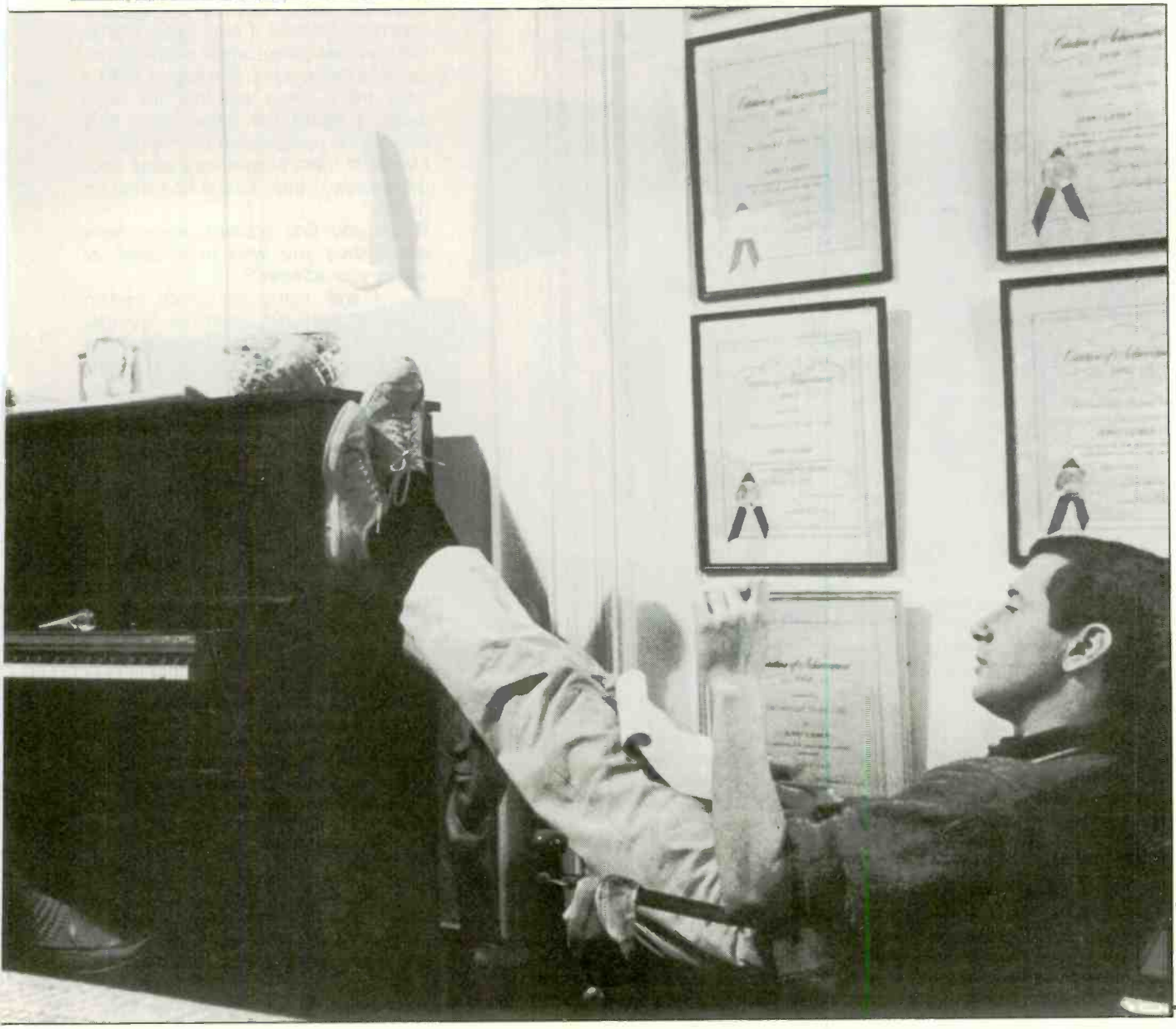
At United Artists in the early '60s, Stoller and Leiber produced pop classics such as The Exciters' "Tell Him" and Jay and The Americans' "Only in America." They worked with the best of the Brill Building songwriters: Doc Pomus and Mort Shuman, Ellie Greenwich and Jeff Barry, Carole King and Gerry Goffin, Cynthia Weil and Barry Mann. When they started another record company, Red Bird, in 1964, they had great success with classic "girl groups" such as The Shangri-Las and The Dixie Cups. As they tired of this sound they moved on, creating Peggy Lee's mid-life crisis epic, "Is That All There Is."

Just middle-aged now, Leiber and Stoller already have more than two lifetimes of accomplishment behind them. They are now writing for Broadway, and for what may be their second golden age. But this begins with two hip kids back at Fairfax High in Los Angeles.—*T.F.*



Photograph: Robert Lewis

Yesterday and today: Mike Stoller and Jerry Leiber as they look today, and as they were in 1959 while at work in Leiber's East 79th Street studio.



Photograph: Courtesy of Leiber & Stoller

Photograph: Courtesy of Lou Krefetz

Leiber and Stoller with Lester Sill, Modern Records national sales promotion manager, who introduced them to "everyone in the business," and Lou Krefetz (front), sales manager for Atlantic, c. 1956 in front of the Melrose Avenue, Los Angeles, offices of Atlantic, ATCO, and Cat Records.

Photograph: Courtesy of Leiber & Stoller

With Miss Peggy Lee, c. 1975, in the A&M Records studios in Los Angeles.

Let's talk about how you got together.

J.L.: I was writing songs with a drummer, and going to Fairfax High School in Los Angeles. The drummer lost interest and suggested I call Mike Stoller, whom he had worked with in a pickup dance band. I called Mike. He said he was not interested in writing songs. I said I thought it would be a good idea if we met anyway.

Mike, you were really into jazz and modern classical at that time, no?

M.S.: I was a very big modern jazz fan, really. At the time Jerry called me, 1950, I was very into Charlie Parker and Thelonious Monk and Dizzy. And through modern jazz I got interested in Stravinsky and Bartók. When I lived in New York—before I moved to California when I was 16—I used to hang out on 52nd Street.

Didn't you take piano lessons with James P. Johnson?

M.S.: I did when I was 10 or 11, four or five lessons. That was my earliest love, boogie-woogie and blues piano. But the thing that cemented our relationship was when Jerry showed me his lyrics and I saw that they were blues in structure. Most of them had a 12-bar structure—a line, then ditto marks, then the rhyming line. So it wasn't difficult for me to relate to it and go back to my first love, which was Pinetop Smith and Meade Lux Lewis, and Albert Ammons.

Jerry, you were more rhythm-and-blues oriented?

J.L.: Boogie-woogie, rhythm and blues. I was working in a record shop on Fairfax Avenue after school. But actually I was exposed to boogie-woogie when I was a little kid in Baltimore. My mother had a grocery store just on the border of the black ghetto. She had many black customers.

It seems like an almost fateful encounter. You were both heavily into black culture.

M.S.: We were, but my background was a bit different. I went to an interracial summer camp, which was very unusual in those days. Starting in 1940, I went there every summer for eight years. I heard the older black kids playing the upright piano in the barn. A couple of them played very good boogie-woogie. I tried to emulate what I'd heard.

When you first started, were there songwriters you tried to emulate, or whom you admired?

J.L.: I was trying to imitate certain styles, sounds that I heard on records. Some of the writers I was imitating, I found out later were actually the performers.

Jerry Wexler said in an interview that he supported the separation of black and white music into pop and rhythm-and-blues charts because he felt that created more opportunity for black artists. How do you feel about that?

M.S.: I never thought about it that way. I always felt that it was sad, in the early days, especially, that artists like Ray Charles and Lloyd Price and Big Mama Thornton weren't exposed to a wider audience.

J.L: If they had had exposure on the major stations, then Georgia Gibbs wouldn't have been able to make all those covers of all those great records by Ruth Brown and LaVern Baker.

M.S.: And Pat Boone, who was covering Fats Domino records and Little Richard records . . .

J.L.: . . . wouldn't have happened. If Richard was played on all the Top 40 stations, nobody could have sold another record of anything he made. Could anybody cover Elvis Presley?

M.S.: The point is that today people are still buying and listening to Little Richard, Fats Domino and LaVern Baker.

Their later writing It was much more

wasn't so spontaneous as the early compositions were. complex, more deliberately worked out.

Nobody is buying their songs in a cover version by Pat Boone. Nobody wants to hear a Georgia Gibbs record or The Crew Cuts' record [of The Chords' original "Sh-Boom"]. What I imagine Jerry Wexler meant was that within a smaller and separate pool you could support more new fish. But I think the black fish in that smaller pool were being denied an ocean in which they could have very well survived.

Let's talk about how you two worked together as songwriters.

J.L.: Often, in the early days, I'd stalk around Mike's room. There'd be an upright piano against one of the walls. I'd just walk around and smoke and mumble, and he'd jam until I got struck by some notion. Then I'd start yelling some kind of line. If Mike dug it, he would pick it up somewhere. Sometimes Mike would yell out lines too.

M.S.: It was like spontaneous combustion, like Jackson Pollack. You threw a lot of paint at the canvas. I would just play riffs and Jerry would shout lines, almost like automatic writing.

Mike, it's been said you had an almost encyclopedic grasp of musical styles, and that you could throw out ideas from everything you'd digested over the years.

M.S.: I think that's somebody else's description.

J.L.: I think it's true, but I don't think he was conscious of it. We used to use shorthand after a while, sort of make signs. I'd say, "More Fats" [Domino], or "more Richard" [Little Richard], or "more Amos" [Milburn], or "more Charles" [Ray Charles]. These were signals for different pianistic styles. If I was talking about Toussaint [Allen Toussaint], it meant New Orleans.

M.S.: But we're talking about the way we *used* to work. Our mode of working has changed through the years, and also the type of work that we do has changed.

J.L.: The songs for the Peggy Lee album were written in a different way. For a number of songs, the lyrics came first, and Mike set them to music.

M.S.: On others I wrote the music first and then Jerry wrote the words.

J.L.: So it wasn't the same kind of spontaneous combustion that occurred with the early writing. This [later] stuff was much more complex. Much more deliberately worked out, structurally.

M.S.: The early things were almost written as if they were improvisations.

It sounds like a process of maturation, eventually reaching a more traditional method of writing.

M.S.: We've talked about the kind of music which brought us together, the thing that really got us going, the propelling force—different styles of black music. But at the same time, we were not unfamiliar with . . .

J.L.: . . . many other forms . . .

M.S.: . . . George Gershwin's music, and Rodgers and Hart, and so on. There's a thing we used to say to each other; we said that what we wrote were records and that these records were like newspapers or magazines in that they'd last for a month and then they'd be gone.

J.L.: We didn't think we were writing songs that would last.

M.S.: All the standards had already been written, we thought. We were writing songs that we loved and that we were *compelled* to write. But we didn't think they had any lasting value.

You didn't think you were in the league of someone like Cole Porter?

J.L.: Absolutely not. We never thought we were.

M.S.: The type of music that we write now is different.

J.L.: It requires different kinds of working habits.

Is it not as much fun now?

J.L.: No, it's not as much fun. And yet, it is sometimes, finally, more gratifying.

Is it a better product?

J.L.: Different. I hope it's better. We play what we feel are some of the finest songs that we have ever written and some people say, "You know what? You'll never write a better song than 'Hound Dog.' " The people we admire most and the people we want to be most admired by are our fellow songwriters. I remember Johnny Mercer coming up to me one day and saying, "Kid, you finally wrote a good song." It was "Is That All There Is" [for Peggy Lee]. I think that was the greatest compliment I've ever received.

M.S.: That's out of a different tradition than our earlier work. It no longer holds my attention to work in the format of the traditional three- or four-chord blues that we used to work in. So I choose to write something other. At *that* time I was absolutely happy with the basic colors in my paint box.

Let's pick up now with the chronology. Lester Sill was the guy who . . . .

J L.: Lester was the national sales promotion man for Modern Records. He introduced us to everybody—the Bihari brothers of Modern Records; the Mesner brothers, who owned Aladdin, and Ralph Bass.

M.S.: Lester took us to New York and introduced us to Ralph, who was with King and Federal Records. Ralph then moved to California and we started to work with him out there.

How did you meet Lester?

M.S.: Jerry was selling records in Norty's Record Shop after school . . . .

J.L.: Lester came in one afternoon to check the sales on certain records. We got to talking. He asked me what I was going to do with my life, and I told him I was interested in becoming a songwriter. I sang him some lyrics. He was very encouraging.

M.S.: He introduced us to a disc jockey named Gene Norman. Gene ran a series of concerts called Just Jazz, like Norman Granz's Jazz at the Philharmonic. But he also had an annual blues jamboree at the Shrine Auditorium. He gave us the names of the artists who were going to appear at his 1950 blues jamboree and he told us where they were staying. Jerry and I went down to the Dunbar Hotel to see artists like Wynonie Harris, Percy Mayfield, Helen Humes and so on. We had one song performed at that concert—"Real Ugly Woman," and Jimmy Witherspoon sang it. It was our first public performance. What a thrill.

When you went around to the record companies with Lester Sill, would you play piano and sing to demonstrate the songs?

J.L.: We would play and sing our songs to the record company owners, and if they were accepted we'd teach them to the artists.

Let's talk about "Kansas City." Wasn't it first titled "K.C. Loving"?

M.S.: It was written for Little Willie Littlefield. We called it "Kansas City" but Ralph Bass came to us and said, "You know, 'K.C.' is the hip thing, so I'm going to change the title of your song to 'K.C. Loving.' " We said, "Okay. Just put it out!"

It's so authentic-sounding, but different; it's not just a 12-bar blues.

M.S.: Actually it *is* a 12-bar blues, but it's a *melodic* one, as opposed to a

They planned their sessions so they'd know what to left to look for but the magic that comes when it's all

traditional blues melody, which is basically just a series of inflections. I wanted to write something that—if it was played on a trumpet or a trombone—people could say was a particular song, instead of saying, "That's a blues in E flat." I wanted something you could listen to instrumentally and say, "I know that song."

Most people then, and probably to this day, think the song is a traditional. How do you feel about that?

M.S.: At first, when that happened, we felt we had achieved something, that we had written something good enough to be thought of as traditional.

J.L.: At the time we were writing it, Mike and I had a little bit of an argument, and Mike turned out to be right. I didn't want it to have a melody. I wanted it to have a traditional, straight-blues contour, one that any blues singer would sing in his own style with just the changes and the words. Mike said, "I don't want to do that, I want to write a melody. I want this to have a real identity." I said, "The other way it's much more flexible." He said, "Well, man, you're writing the words and I'm writing the music, and I'm going to write the music the way I hear it." [Laughter.]

At this point, and until the "Hound Dog" session with Big Mama Thornton in 1952, your records were being produced by other people?

M.S.: Yeah. In the case of "Kansas City" we went out to Maxwell Davis' house. He was an A&R man, producer, arranger, songwriter, horn player. And he was the house musical director for Aladdin Records. He also made records for Modern, Specialty, Mercury, and other labels.

J.L.: If he were alive today, he'd be making a million dollars a second. He was wonderful. There were four or five guys around the country at that time who had his ability.

M.S.: Like Jesse Stone who worked for Atlantic or Bumps Blackwell who worked for Specialty. But anyway, up until that time, after we performed a song for an artist, we frequently went to the studio. At first it was like, "You guys can stay here, but be quiet." Later we began to express some ideas to whomever was running the session. Sometimes they'd use some of the ideas. After all, when you're working with the blues—which is pretty repetitive—you need as many ideas as you can get to make it a little different. We would be invited to the studio after a while. Ralph would call us to bring songs to the studio. We would run them down with artists like Little Esther or Bobby Nunn or Little Willie Littlefield with Johnny Otis' band, and discuss how they ought to go. They would be worked out in the session. Sometimes we'd bring three songs with us and write a fourth during the session. When we did "Kansas City," it was the first time we had the opportunity to really spend time before the session laying out the ideas with an arranger who actually wrote them down, as opposed to the way we had worked with Johnny Otis, where the charts were head arrangements done on the spot.

During the time when your material was being produced by others, were you happy with the way it was coming out?

J.L.: A lot of the stuff was misinterpreted. For instance, they'd have some kind of swing beat going, instead of a Texas shuffle. So we started to involve ourselves more and more in the making of arrangements and the running of sessions until we got to a point where we could run our own sessions. After a while they were calling us to produce records.

M.S.: "Hound Dog" was the first record we produced, although unofficially. Johnny Otis had played drums at the rehearsal. He had the snares turned off and was playing some old Southern, Latin-sounding kind of beat. On the actual recording date, he had his road drummer playing because Johnny was supposed to be running the session, for Don Robey of Peacock Records. It wasn't happening. So Jerry said, "Johnny, get on the drums the way you were." Johnny said, "Who's gonna run the session?" and we said, "We will." Jerry went into the booth and directed from there. I stayed on the floor and worked with the musicians. There were only two takes, and both of them were good, but the second was better than the first.

You were known, along with Jerry Wexler and Ahmet Ertegun at Atlantic, for doing as many takes as necessary to get the song right, and for rehearsing your artists before entering the studio with them. That was pretty unusual in R&B at that time, wasn't it?

M.S.: I think so.

J.L.: We took a lot more time than the Biharis and the Mesners did. They'd do two, three, four, five takes and goodbye. We'd lay in there for two hours on a side if we had to. But we almost always got four sides in the allotted three hours—two A sides and two B sides. In fact, "Searchin'," which we did in the last six minutes of a session as a B side, was the fourth song of the session and we just *had* to get it. I mean, if we had come out of a session with only three sides, we'd have felt like failures.

Were you guys just very fast workers?

J.L.: We were very thorough. We would rehearse for three weeks before a session, eight hours a day. Every lick was planned. The only thing we would leave to chance on the session was the feel, and the tempo. Sometimes Mike would take a note or two out of a bass pattern because it was too cluttered, or add a note or two. We knew what kind of a beat the drummer was going to lay down because we knew the drummer. We knew more or less how the piano player was going to play because Mike was playing piano. So we knew pretty much what to expect. The only thing we were looking for was that magic, that thing that comes together when everything is cooking.

M.S.: I used to write out some kind of road map for all the musicians. When it came to The Coasters, it took lots of preparation. Harmony was not their forte, and I used to rehearse them for weeks until they could remember who had which note.

Were the musicians available for this kind of extended rehearsal?

M.S.: No, no. We never rehearsed the musicians, only the vocal group. The musicians came to the studio where we had these little charts written out for them so that they wouldn't have to start learning from scratch what the bass pattern was, whether we had a four- or eight-bar intro, or where the break chords came.

You had been working for a number of record companies. Then you and Lester decided to start Spark Records. That was in 1952?

M.S.: I think it was 1954. It lasted about a year and a half. We didn't know what to do in terms of promotion. Well, we knew in a sense. Lester Sill knew that we couldn't get past the Rockies.

J.L.: We were under-financed. We

expect, with nothing cooking.

Photograph: Courtesy of Leiber & Stoller

Photograph: Frank Driggs Collection

With The Coasters, Leiber and Stoller (at piano) had several hits including "Charlie Brown" and "Yakety Yak." Behind them are Lester Sill, The Coasters' manager; Jerry Wexler, Atlantic VP; Coasters members Carl Gardner, Dub Jones, Billy Guy, and Cornelius Gunter; and Ahmet Ertegun, Atlantic's president.

Big Mama Thornton's "Hound Dog" was the first record Leiber and Stoller produced, even though it was not officially theirs.

couldn't afford to send Lester on a trip. We were selling 100,000 singles in Los Angeles and nothing in the rest of the country.

And Lester was quite a promotion guy, quite a character, wasn't he?

J.L.: Fantastic. He'd do a sand dance—take some sand out of his pocket, throw it on the floor and dance to a record . . .

M.S.: . . . in the record store, to show the store owner what a great, danceable record it was. Anyway, Atlantic liked our records very much. They convinced us, which wasn't very hard to do, that they were better in selling product—or records, I should say. I hate that word, "product." They took our last release, The Robins' "Smokey Joe's Cafe," and put it on one of their labels, Atco. They sold a quarter of a million after we'd sold 100,000 in L.A.

What was the deal that Ahmet and Jerry made you at Atlantic?

J.L.: Two cents a record. And we arm-wrestled over getting our names on the records as producers, because at the time Jerry Wexler said, "What do you mean? You're getting the money. What do you need? We don't put *our* names on the records." I said, "Yeah, but you own the label."

M.S.: He said, "Well, you have your names on as writers, and we tell everybody that you made the record!"

J.L.: He said, "We told [Waxie] Maxie, and Henry Stone knows, man. Who else do you want to know about it?" [Laughter.]

M.S.: Actually, although we kept this argument up for a number of years, it only began to make sense to them when we started producing songs that we hadn't written.

J.L.: We got good at producing, and we started doing other people's songs. We would give assignments to Doc Pomus and Mort Shuman, Bacharach and David, Mann and Weil, Goffen and King. Sometimes we wouldn't write for the sessions; we just wouldn't feel it. If we were doing a Drifters date, we'd write a song, but we weren't going to write four songs. We would try to get the best song from each team.

M.S.: Then we would concentrate on ideas for orchestral coloration.

J.L.: It varied the work. We didn't feel like writing all the time. So we'd devote some weeks to writing, and sometimes just devote time to producing, or we'd produce in a style other than that in which we were writing.

Before, records were generally made by staff producers. So you were really the first independent producers.

M.S.: Jerry Wexler told me that we were, so I assume we were.

J.L.: There were people doing independent record dates with their own money, like Buck Ram. But we were the first independent producers ever, as I understand it, formally contracted by a label to make records.

M.S. (laughing): We were record-company owners who were persuaded to give up their company and become producers on a royalty basis.

It was a new job title.

M.S.: And a misnomer which we didn't invent ourselves—"producer."

J.L.: The title actually should have been "director." The producer has always been the money-raiser and the manufacturer.

M.S.: Like the producer of a film or a show. We were the supervisors, the directors.

At Atlantic, how would it be decided whether you guys or Wexler or Ertegun would be the producers?

M.S.: In the very beginning we brought in our own artists.

J.L.: We brought The Coasters in and produced them. Later they would say,

Photograph: Frank Driggs Collection

The Drifters, c. 1958, with Ben E. King on the left.

"Producer" is a misnomer; it should be "director." Leiber and Stoller were the supervisors, the overseers, not the manufacturers.

"You want to do Ruth Brown this week? She's coming in and we need some new ideas." Or LaVern Baker. Or, "Hey, we need a hit for The Drifters. We've gone cold on The Drifters."

M.S.: In '59, after being a hit group for years, The Drifters themselves got cold and finally broke up. Atlantic still owned the name, and felt it was a hot name—so the managers hired some new group to be The Drifters, and Ahmet and Jerry asked us to take over the production.

These lush productions you did with The Drifters were really ground-breaking ones.

J.L.: That's one of the reasons we did them. We wanted to have some fun with the arrangements. We didn't feel we could do these arrangements with The Coasters because, for us, The Coasters were a vaudeville act.

I want to get back to The Drifters, but since you've brought them up, let's talk about The Coasters first. You were obviously very simpatico with them. Why did you and The Coasters work together so well for so long? They almost seemed like alter egos.

J.L.: They were an extension of us.

M.S.: They thought our songs were funny and they were able to perform them funny.

J.L.: In retrospect, I feel that Stoller and I were essentially comedians and social satirists in our writing. It was only many years later that we wrote some romantic songs and some love songs, some complicated songs. We were doing either some kind of really truckin' blues number that you could dance to, or the songs were jokes.

You wrote probably the funniest rock 'n' roll songs ever written—"Charlie Brown" and "Poison Ivy."

J.L.: See, what they are are tall tales. They come out of folk culture, like "John Henry." They're Paul Bunyan stories. This is all braggadocio. It always comes out of cultures . . .

M.S.: . . . that are suppressed. Out of those cultures you get heroes who are strong men, guys who, against all odds, end up winning—by either outpunching or out-smarting somebody. But the hero in our songs didn't always have to be triumphant. Some of our heroes were guys who got knocked around or framed . . .

J.L.: . . . or were like the mark in "Little Egypt" who gets taken at the strip joint. They're like three-minute radio plays. I was very much influenced by listening to radio shows like *The Shadow* and *Bulldog Drummond* as a kid.

The Coasters were the ideal group for the funny songs.

J.L.: They were a bunch of comedians. We put them together for that reason. We selected those guys. When The Robins broke up, we took Billy Guy and Carl Gardner. We saw comic qualities in Carl that Carl didn't see in himself and still doesn't. Carl considered himself a romantic ballad singer, and he is very well equipped to do that. But we also heard in his voice a kind of pompous, authoritarian sound that used to knock us out. We used him in that way, almost as if he was the barker at a carnival.

M.S.: "Step right up, folks."

J.L.: Billy Guy was always like the fool.

M.S.: Billy was actually discovered later. Carl and Bobby Nunn came out of The Robins.

J.L.: The Coasters were a vaudeville comedy act that gave me the opportunity to employ every gag and routine I'd ever seen or heard in the movies or on television, from the Marx Brothers to Amos 'n' Andy.

Did the humor help get the songs across to a broader audience?

J.L.: I think what really got the stuff across more than anything was the rhythm section. If it didn't have that swing, then it didn't mean a thing [laughter], and then the joke wasn't funny and the song didn't matter. We had our characters. Like Ralph Cramden, Gleason on *The Honeymooners*. The stories changed. One was about cowboys. I mean, what could be funnier than a bunch of black cats doing a send-up of a bunch of white cowboys? What could be sillier?

M.S.: I think the most fun we ever had working with any artist, including Elvis Presley, was with The Coasters. We'd be falling on the floor—all of us—and staggering around the room holding our bellies because we were laughing so hard.

M.S.: Billy Guy would say things like, "Man, we just cannot do this song. They're going to lynch us in Mississippi, man!" Then someone would say, "Oh, come on, they're going to dig us." Billy'd say, "No, man, they're *not* going to think it's funny. They're going to know we're putting them on!" [Laughter.] Billy was always worried that they were going to see through it [laughter]. We had a great time.

So what happened with The Coasters?

M.S.: The world changed . . . .

J.L.: Everybody got serious.

M.S.: Everybody got very serious and lost their sense of humor. The black power movement strained a lot of black/white relationships. It polarized things. The music changed. The Coasters seemed to be a relic of a more innocent time. A

The concluding part of this interview will appear in the next issue.

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Build a Passive Image Enhancer

RICHARD J. KAUFMAN

In stereo, both ears hear both speakers, and stereo imaging suffers. Restoring image solidity and moving the image out into the room just takes an extra pair of speakers and one potentiometer.

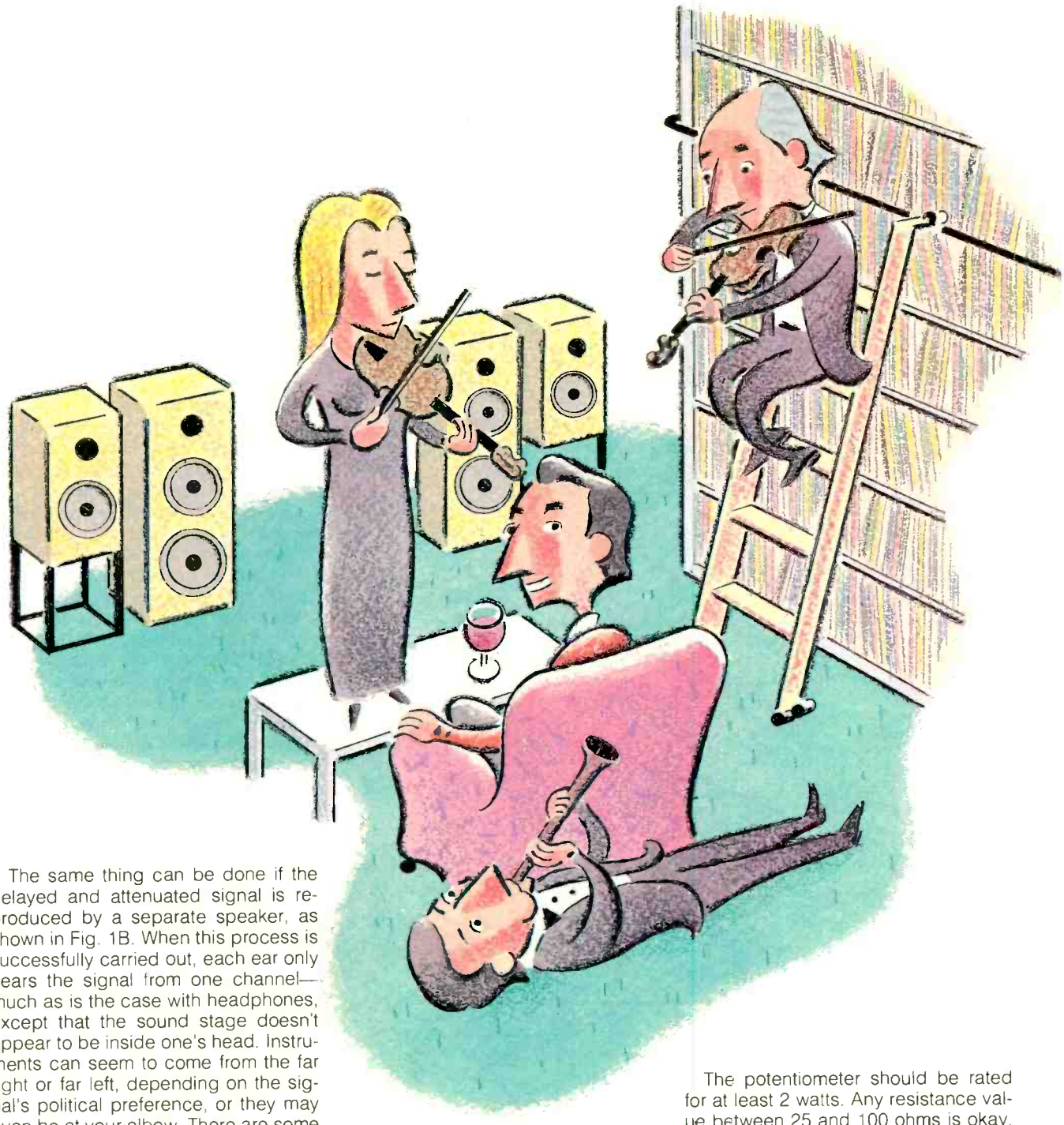
One of the more interesting stereo add-on devices is the image enhancer. The first of these devices, such as Bob Carver's Sonic Holography and Sound Concepts' Image Restoration System, were electronic. Passive devices relying on extra speakers are also possible, and such speaker systems have been introduced, most notably by Polk Audio.

It is relatively simple to add passive image enhancement to your stereo system; the only additional components required are a potentiometer and an extra pair of speakers. This effect is well worth experimenting with; at its best, it can give an uncanny solidity to reproduced music by moving the apparent sound source out from between the speakers and into the room.

The premise on which image enhancement is based is that because both speakers are heard by each ear, degradation of stereo separation and imaging is inevitable. Listen to your system. Even with your eyes closed, it is always possible to tell where the speakers are. Similarly, your system cannot produce a sound whose apparent source is further left than the left speaker, nor further right than the right.

The reason for this is illustrated in Fig. 1A. The signal from the left speaker is also heard by the right ear, delayed and attenuated by a factor of alpha due to the longer path length involved. Electronic image enhancers create a version of the left-channel signal, with the same delay and attenuation as that created by the longer path length, then invert it and mix it into the right channel. When this signal from the right speaker reaches the right ear, it cancels out the undesired signal from the left speaker. The same process is applied to the other channel. (You may be wondering what happens to the inverted cancellation signal when it arrives at the opposite ear. Since it is doubly attenuated, it is no longer significant in determining localization.)

Illustrations: Philip Anderson



The same thing can be done if the delayed and attenuated signal is reproduced by a separate speaker, as shown in Fig. 1B. When this process is successfully carried out, each ear only hears the signal from one channel—much as is the case with headphones, except that the sound stage doesn't appear to be inside one's head. Instruments can seem to come from the far right or far left, depending on the signal's political preference, or they may even be at your elbow. There are some disadvantages: The ideal listening position is more circumscribed than normal, and the effect is not suited to every recording.

Ideally, you will want four identical speakers to set up your own image enhancer, but this is not strictly necessary. Imaging may suffer unless the speakers are very well matched in terms of frequency response, but the general ambience will come across even if the imaging is less precise. It is suggested that you experiment with inexpensive speakers before duplicating your main speakers.

The electrical hookup is shown in Fig. 2. Some of you may recognize this as being similar to the Dynaco quad system from the early '70s. Like that system, we are using only the difference (L – R) signal. This part of the signal carries all of the directional information, so it is sufficient to use it alone. There is an added advantage in that bass is primarily nondirectional and mono, so it will not be reproduced this way, relieving your amp of an unnecessary load.

The potentiometer should be rated for at least 2 watts. Any resistance value between 25 and 100 ohms is okay. Unfortunately, such pots are not easy to find these days, and some scrounging may be necessary. ETCO sometimes carries such pots, but they are not always available. (Alpert-Mansell Associates, Dept. A, 1650 Broadway, Suite 608, New York, N.Y. 10019, has agreed to supply a suitable pot for $7.50, plus sales tax in New York. Allow six to eight weeks for delivery.)

A cautionary note: The extra load imposed by the additional speakers may overload some amplifiers. Generally, there will be no problem if the amp is rated at 60 watts or more, and many

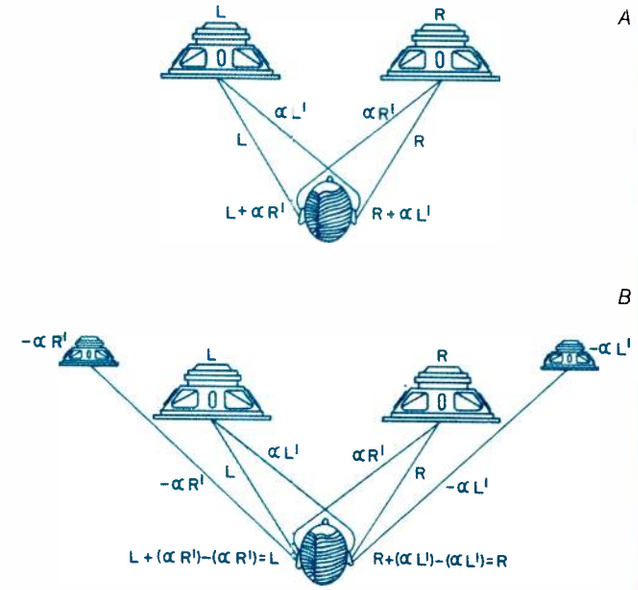


Fig. 1—With normal stereo (A), each ear picks up a delayed, attenuated version of the signal meant for the other ear. This degrades separation and imaging. By feeding to each ear signals that cancel the interaural crosstalk (B), imaging and separation are restored.

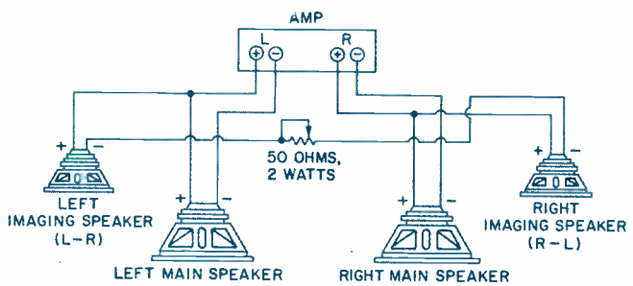


Fig. 2—Wiring diagram of a passive image-recovery system using two extra speakers to produce an inverted, crossfed difference signal. Attenuation is controlled by the rheostat-wired potentiometer shown, and time delay is controlled by the position of the imaging speakers.

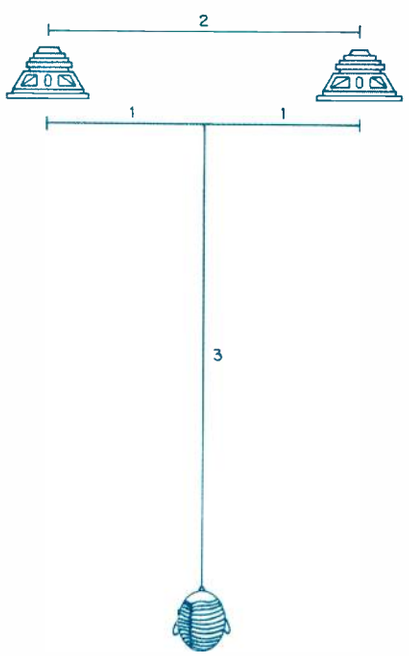


Fig. 3—For optimum image recovery, the listener should be positioned on the center line between the speakers, 1½ times as far from the speakers as they are from each other.

amps rated at lower power also deliver enough current to avoid difficulty. If the manufacturer does not recommend driving extra speakers in parallel, you may have problems. In such a case, if the image speakers are more efficient than the main speakers, the proper setting of the potentiometer will assure a high enough load not to bother the amp. In any case, a 2-A speaker fuse at the amp's output, which is usually provided by the manufacturer, should protect the amp. If you have any doubts whether this circuit is suitable, write to the amp's manufacturer.

To position the imaging speakers, you will want to keep their path length to the listener about 6 inches longer than that of the main speakers. Most bookshelf speakers, with drivers no larger than 8 inches, can be placed next to each other to achieve this. Larger systems will require you to move the imaging speakers forward slightly. Also, the ideal listening position will be different than for normal stereo: The effect works best when the speakers are slightly closer together than is usually the case. The optimum distance to the listener should be chosen according to the distance between speakers, following approximately the ratio shown in Fig. 3. You will want to adjust the pot so the signal from the imaging speakers is 3 to 6 dB down compared to that from the main speakers, or about half as loud. If you follow these rough guidelines, only a little experimentation will be necessary to get the best results.

This may remind readers of a similar system I wrote about in the May 1983 *Audio*. The main technical difference is the use of L − R and R − L imaging signals here, while the previous system used −R and −L. In practical terms, the system shown here is a bit simpler to build and much more likely to give good results without elaborate tweaking and the use of test instruments. The older system was theoretically capable of slightly better results, but only if the speaker impedances were relatively constant and if the capacitor values were precisely right for the impedance of the particular speakers used. As capacitors in that size are rarely precise, and speaker impedances vary, the older system required a great deal of tweaking.

1

KLIPSCHORN LOUDSPEAKER

Manufacturer's Specifications
System Type: Three-way horn-loaded, for corner placement.
Drivers: 15-inch woofer, 2-inch midrange, and 1-inch tweeter.
Frequency Range: 35 Hz to 17 kHz, ±5 dB.
Sensitivity: 104 dB SPL at 1 meter for 1 watt input.
Crossover Frequencies: 400 Hz and 6 kHz.
Impedance: 8 ohms nominal, 4 ohms minimum.
Recommended Amplifier Power: 20 watts minimum.
Dimensions: 52 in. H x 31 in. W x 29 in. D (132 cm x 79 cm x 74 cm).
Weight: 165 lbs. (74.9 kg).
Price: $1,499 each.
Company Address: Klipsch, P.O. Box 688, Hope, Ark. 71801.
For literature, circle No. 90

Photograph: Robert Lewis

A legitimate Golden Oldie, now well into its fourth decade, the Klipschorn, along with its designer, Paul Klipsch, are true legends in the field of high-fidelity sound. Nothing I could write would do complete justice to its description, so let me quote the words of a dear friend, long past, Howard Tremaine, who many years ago described the Klipschorn in his *Audio Cyclopedia* (Howard W. Sams & Co., 1959) as follows: "The enclosure is a low-frequency horn so folded that it may be placed in a room corner to utilize reflections from the floor and walls to improve the impedance match at the mouth of the horn and thus increase the response at low frequencies." Continuing Tremaine's description: "One advantage of using a horn at the low frequencies, compared to the use of a direct radiator mounted in a flat baffle, is that the horn efficiency is 10 to 50 times greater; and because of the acoustic loading, a given acoustic power may be generated with considerably less excursion of the loudspeaker diaphragm, thus reducing harmonic and intermodulation distortion."

The low-frequency horn is substantially exponential in its expansion rate and thus would have an acoustic path length of about 8 feet if unfolded. This horn is intended to cover the lower four octaves of the audible range, from about 32 Hz to 400 Hz, where the folded horn is crossed over to a midrange "squawker" that carries the range up to 6 kHz, where the response passes to a tweeter. Midrange and tweeter are also horn loudspeakers, and both are mounted behind a grille assembly placed on top of the folded bass horn.

The system is heavy. Oh, my, it is heavy. And it is big. But there is a reason for its size, and the reason is acoustic efficiency. Ten watts of music into this speaker will part your hair if you stand too close. One is soon reminded of the old horsepower adage: There's no substitute for cubic inches.

Because the Klipschorn uses the corner and floor of the

room as a part of the bass reproduction process, the speakers must be placed in the corners for best reproduction. If the listening room does not have available corners or is very small, then, in my opinion, purchase of a Klipschorn system should not be contemplated. It simply needs room to sing.

Because of its bulk, the Klipschorn comes in two pieces, the bass horn and the midrange/tweeter unit. The instructions are clear, and no difficulty should be experienced in assembly or hookup. There are no controls or switches, and electrical connection is made to two well-marked terminals on the rear of the enclosure.

Because of the extreme efficiency of these speakers, you will not need a large power amplifier; 100 watts is more than adequate, and most listening will probably be done at levels below 5 watts. But the amplifier must be of high quality and have low noise. If it should have any hiss or hum, you will hear it with these speakers.

Measurements

The measured magnitude of impedance which the Klipschorn presents to an amplifier is shown in Fig. 1. The lowest value within the audio range is 4.5 ohms and occurs at 55 Hz, while the highest value is almost 10 times that amount, 42.3 ohms, at 2,155 Hz. The peak lies above the limits of the plot of Fig. 1, which is scaled to show the details of impedance throughout most of the audio range.

From the standpoint of amplifier drive requirements, a worst-case frequency appears to be around 5,200 Hz, where the phase angle lags by 70°, although the magnitude of impedance is 11 ohms. This can be seen in the complex impedance plot of Fig. 2. The many pig-tails in this plot are due to local impedance resonances. With the exception of the major bass resonance at 37 Hz, the majority of pig-tails are probably caused by acoustic reflections which occur in the bass, midrange, and tweeter horns. Figure 3 shows the complex impedance rescaled to show the midrange impedance peak at 2,155 Hz. This peak is not a smooth loop, but itself has several minor deviations in its peak range.

Fortunately, from the standpoint of amplifier drive requirements, none of these deviations can cause any problems whatsoever, as long as the power amplifier can drive 4 ohms at modest power. Because of this, and the fact that up to 25 average watts there is absolutely no change of admittance with drive level, I chose to omit the admittance plot for the Klipschorn. In this case, we do not need it.

Doing a complete set of acoustic performance measurements on the Klipschorn is a tour de force for any reviewer. This is a corner horn loudspeaker system; hence it requires a corner. How does one make free-field response measurements when there are corners? Paul Klipsch solved the problem by building an anechoic chamber with insertable corners. The Klipschorn is also intended to be listened to at ranges greater than 3 meters. The substantial size of this speaker and its geometry require that measurements be performed at such distance, and I have chosen 3½ meters, since this is the distance at which I listened to these units. Even assuming I could lift it, I could not haul the Klipschorn out of doors for lower frequency measurements since it needs corners to reproduce low notes. I puzzled over this problem for quite some time (more time than my incredibly patient editor should ever be forced to wait for a review) and then decided to resort to computer software and physics.

Figure 4 shows the measured free-field amplitude of sound pressure as a function of frequency for a constant drive voltage corresponding to 1 average watt into 4 ohms. The plot is corrected for an equivalent distance of 1 meter on axis relative to the front of the enclosure, although the actual measuring distance is 3½ meters.

Figure 5, the free-field phase response, is plotted in two sections. The midrange phase plot is corrected for a time delay of 11,980 µS, and the tweeter phase plot is corrected for a time delay of 10,308 µS. The 1.672-mS time difference is caused by the physical offset between the tweeter and midrange.

The free-field sound is reasonably uniform from a lower cutoff of around 38 Hz to an upper cutoff of around 18 kHz. The irregularities both above and below the acoustic crossover at 6 kHz are caused by internal acoustic reflections from the drivers, horns, and grille assembly. The system is incredibly sensitive, producing well over 98 dB per watt at 1 meter. It is easy to see why the suggested amplifier rating is only 20 watts per channel. This system really will give the rated 104 dB SPL at a distance of 4 feet into a room. One watt into a Klipschorn will produce the sound level that 30 watts produces with many smaller loudspeakers. If one were to use the full 100 watts of drive for which the Klipsch is rated, the sound level would soar to migraine limits. Dropping a stylus on a record might break a lease, as well as some crockery.

The low-frequency response has some interesting surprises. A measured low-frequency roll-off below 38 Hz does not seem impressive; there are many smaller enclosures which measure as well. But something happens when this low frequency comes as a large-area wavefront whose boundaries are the walls of the room, rather than as a wavefront expanding spherically from a position in front of a wall. For one thing, the first impression one has is that the low end is deficient, because the low-frequency rumbling and grumbling of most systems, which many people associate with low-end reproduction, just isn't there. However, as one begins to really listen to the music and sound, one

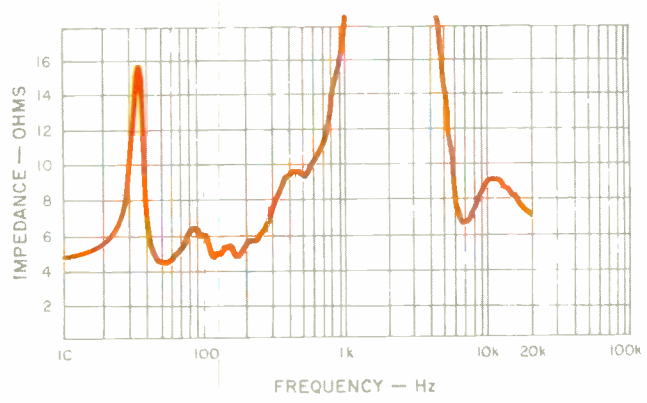


Fig. 1—Magnitude of impedance.

The Klipschorn is heavy! And big! But there is a reason—acoustic efficiency. Just 10 watts will part your hair at close range.

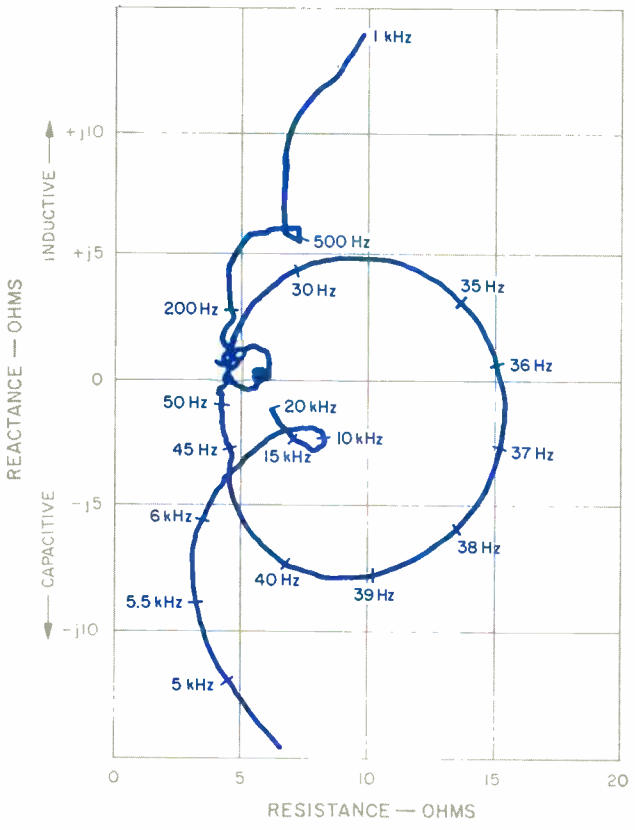


Fig. 2—Complex impedance; see also Fig. 3 for the range from 1 to 5 kHz.

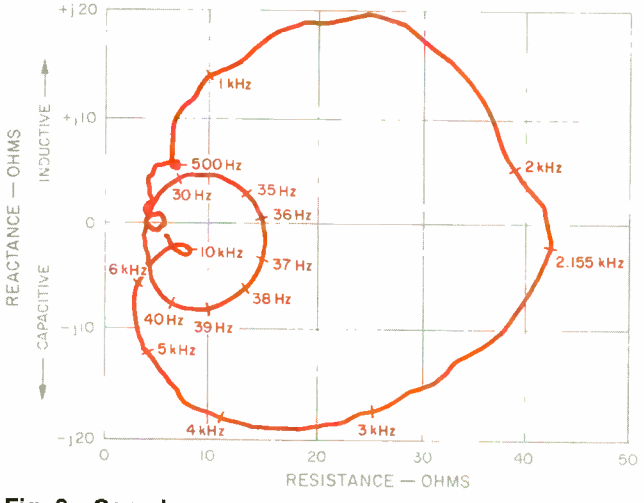


Fig. 3—Complex impedance. Note the rescaling from Fig. 2.

realizes that the deep bass is actually there and that it sounds natural, not overemphasized. Real low-end ambience in a room doesn't rumble; it's simply there as a pervasive ambience. So with the Klipschorn. To be sure, the horn unloads very rapidly as one progresses below 35 Hz and the woofer can be made to rattle with excessive drive at 10 Hz with no great amount of low-frequency musical content in the room, but above 35 Hz it is darn good.

The free-field frequency response measurement of Figs. 4 and 5 required some computer processing. Figure 6 is the 20 Hz to 20 kHz energy-time curve (ETC) of the Klipschorn, measured in the listening room at a distance of 3½ meters. The floor, ceiling, walls, and furniture reflections are present in this measurement. Figure 7 is a processed ETC in which everything has been removed except the direct sound from the Klipschorn. The frequency response measurements of Figs. 4 and 5 correspond to the ETC of Fig. 7. The expanded ETC of the free-field response of Fig. 7 is shown as Fig. 8. This departs from our conventional review format, which puts this expanded ETC at the end of the review.

It is instructive to compare the ETCs of Figs. 6 and 7 since they explain some of the audible midrange problems with this system. Consider Fig. 7. The first response, at 10.3 mS, is the sound from the tweeter, which is mounted up front on the grille. The second response, at 12 mS, is the sound from the midrange horn, whose compression driver lies back near the rear of the enclosure. Believe it or not, the small broad peak at 17.7 mS is the sound from the bass driver, which carries the frequencies below 300 Hz. Now consider Fig. 6. This is the complete sound, room and all. The multiple peaks at 12.5 and 13 mS are due to the tweeter sound which reflects off the side walls and the ceiling. At the listening location, we first hear the tweeter, then the midrange, then a staccato hit from the tweeter reflecting off the floor and ceiling, then a weak tweeter reflection from the side wall, and then the midrange reflecting off the floor and ceiling, with the rest of the room furnishings coming in several milliseconds later. Fortunately, the left and right channels are symmetric in this sound, since it is caused by the geometry of walls, ceiling and floor. In my earlier listening test, I felt that there was a problem with upper-midrange instrumental clarity, and I believe it is due to this effect. I infer from these actual room ETCs that the Klipschorn will sound best in a very large room with a high ceiling and a heavily carpeted floor.

There is another obvious item related to geometry, but due this time to the geometry of mounting the tweeter and midrange horns on the front of the enclosure. The ETC of Fig. 8 illustrates this situation. In Fig. 8, I have corrected the time scale to correspond to a microphone position which is 1 meter in front of the grille. The tweeter sound arrives at 3.7 mS but has an internal reverberation whose period is about 167 μS with a decay rate of about 9 dB per period. This causes the irregularities in free-field sound around 6 kHz, which is evident in Fig. 4. Since this frequency coincides with the acoustic crossover range, the reverberation may possibly be associated with the crossover process. The midrange sound first appears at 5.38 mS and shows a mild reverberation characteristic which pulls the energy out for a half-millisecond or so before it drops. Subsequent enclo-

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Measured "free-field" using computer software, the K-horn is reasonably uniform from around 38 Hz to upper cutoff at 18 kHz.

sure reflections occur after about 6 mS. The first sound from the woofer is not on this measurement since it arrives about 8.4 mS after the sound from the tweeter.

What does it mean? A loss of clarity for those sounds which contain significant energy around 6 kHz, such as higher register female vocals and piano, but clean transient sound for both mid-register and extreme upper-register instruments such as some horns and triangle.

The 3-meter room response (which, for this speaker only, was actually measured at 3½ meters) is shown in Fig. 9. I measured only the on-axis response, not only since this is the recommended listening position, but also because a 30° off-axis response does not make much sense for a corner horn. This is the frequency spectrum of the first 13 mS of sound at the listening position and includes all the signals shown in the ETC of Fig. 6. The effect of early reflections is clearly evident in the plot of Fig. 9. Of particular interest is the fall-off of energy below 350 Hz. The reason is simple: The woofer sound doesn't begin to arrive until more than 8 mS after the sound from the tweeter, and is rejected by the time gate of the TDS measuring instrument. If I were to tune to the sound from the woofer, then the midrange and tweeter would be substantially reduced. In general, the 3-meter response is quite similar in character to the free-field response (which was taken at precisely the same physical location). The timbral balance of high, mid, and low portions of the spectrum is quite good. Only the time of arrival of those sounds will detract from sonic accuracy.

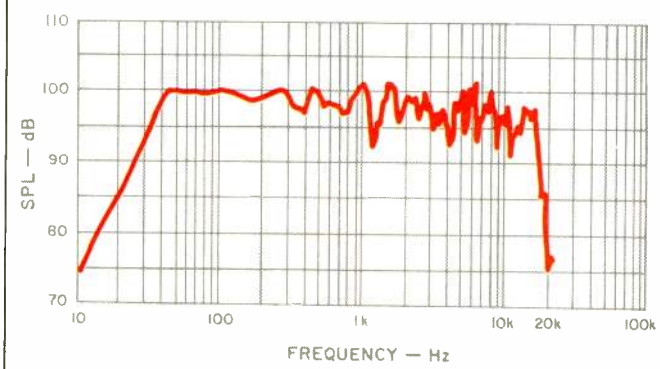

Fig. 4—Free-field sound pressure level for a constant voltage drive corresponding to 1 average watt into 4 ohms.

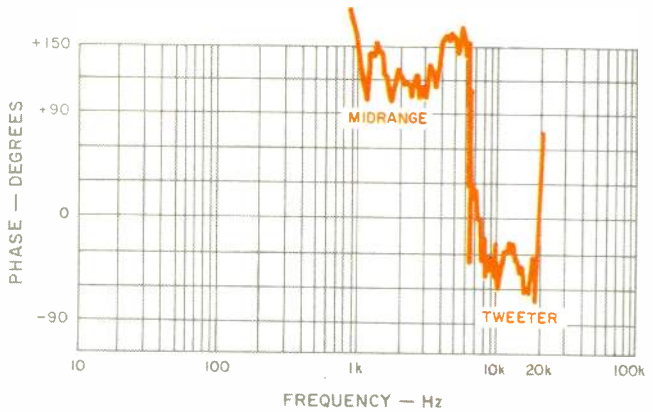

Fig. 5—Free-field phase response at 3½ meters. The midrange response is corrected for 11,980-μS time delay, while the tweeter response is corrected for 10,308-μS time delay.

For reasons that may be obvious, I was not able to make a far-field turntable measurement of the horizontal and vertical polar energy response. Even if I had the services of King Kong to move the speaker, I would still need to rotate the whole room, walls and all. However, I was able to verify, by selected close-up microphone measurements, that the horizontal and vertical polar energy response was essentially smooth within ± 15° of the normal listening position. This agreed with my earlier listening impressions; I was able to walk around the room, over a significant range, without change in the level or tonal balance of the sound.

Measured harmonic distortion for the frequencies of 41.2 Hz, 110 Hz, and 262 Hz is shown in Fig. 10. These frequencies correspond to the musical tones of E_1, A_2, and middle C, respectively. I chose middle C rather than A_4 (440 Hz) because the actual acoustic crossover from woofer to midrange is slightly above 250 Hz, and I wanted to measure the distortion for the same driver at all frequencies. Low bass (E_1) harmonic distortion progresses smoothly from a few tenths of a percent at 100 mW drive upward to near 10% at 60 average watts, with second harmonic slightly above third harmonic throughout the whole range. Mid-bass harmonic distortion at 110 Hz does not look at all like the low-bass distortion. Mid-bass harmonic level stays essentially uniform and of low level throughout the entire drive range, as the woofer really likes the acoustic load in this important frequency range and pumps out acoustic power with little distortion. Up near the crossover at middle C, the harmonic distortion again rises uniformly with drive level, although its total level is very low even at a thundering 100+ dB SPL at normal listening distance. If you like it loud and you like it clean, this is the speaker.

Intermodulation of middle C by E_1 (41.2 Hz), when both are mixed in equal proportions, is shown in Fig. 11. The magnitude of IM is impressively low when we look at the sound pressure levels which are involved. Music played at a 10-watt average level into the Klipschorn is reproduced at sound pressure levels which many other fine loudspeaker systems simply cannot reproduce, yet the IM remains below 4%. The nature of this IM is principally amplitude modulation of middle C by the lower tone up to about 50 average watts. At 100 average watts (ear-protection levels), the IM mea-

So then the dealer said, "Get the Akai, okay?"

So I said, "Okay." And then I said, "But like why the Akai, okay?"

And he said, "The Interactive Monitor System."

And I said, "Omygod, no *way*."

He said, "Yes indeed, on-screen VCR programming on every one of their models."

So I said, "Okay, okay. Akai."

AKAI

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Because the listening room is part of the low-bass reproducing system, the K-horn requires at least four feet of side walls in the listening room.

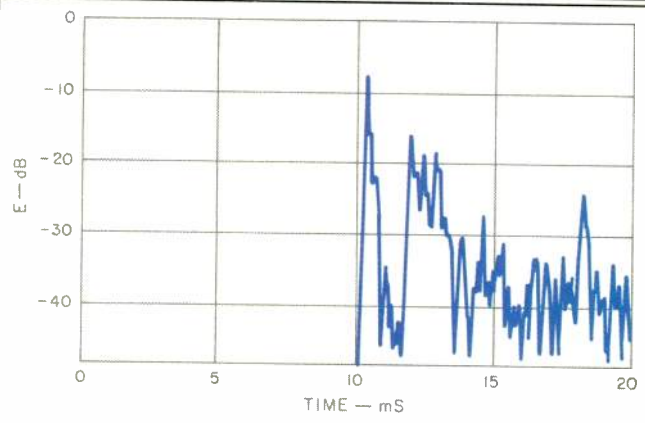

Fig. 6—ETC of the Klipschorn including early reflections from the room.

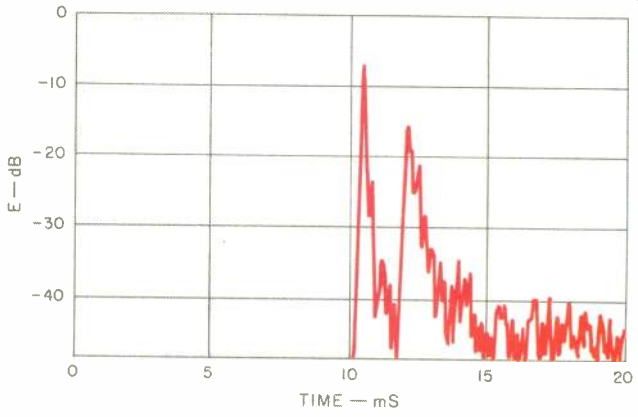

Fig. 7—ETC of Fig. 6 minus the room reflections.

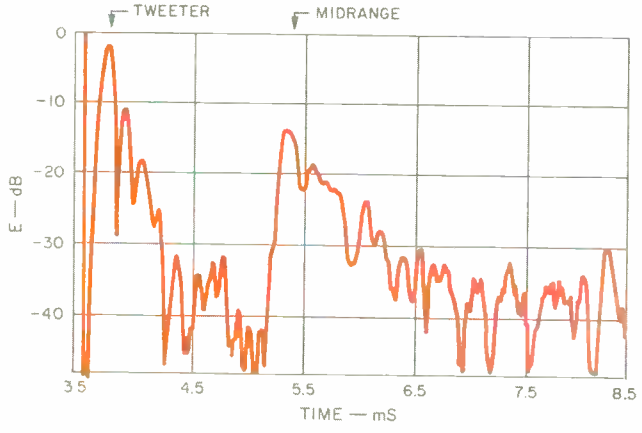

Fig. 8—ETC of Fig. 7 with an expanded time scale and corrected for a 1-meter measurement position.

sures 12.88% and has picked up a phase modulation of 6° peak-to-peak on middle C, in addition to about 8% peak-to-peak amplitude modulation.

The result of the crescendo test is also impressively good. In this test, the ratio of sound pressure level to drive power is measured for selected musical tones. Perfection occurs when the SPL precisely tracks the drive power. In the case of the Klipsch, the tone of E_1 (41.2 Hz) slowly drops in relative SPL with drive power such that a 63-watt test level is 0.5 dB below the level which represents perfection, relative to a starting power level of 100 mW. The tone of A_2 (110 Hz) drops in a similar manner by 1.2 dB from a starting reference of 100 mW to a 63-watt maximum test level, while middle C slowly drops by 0.7 dB over the same range. The net effect will be an extremely mild softening of instrumental timbre as the sound pressure rises to high levels. This measurement also indicates that no discernible lateral shift of stereo image should occur with changes in drive level.

The same exemplary performance is maintained when a second musical tone is added to an existing tone. This means that stereo imaging should remain steady, with no instrumental wander caused by changes in musical dynamics throughout the useful intensity range of the Klipsch reproducer. In short, the Klipsch stays together regardless of what happens in the music.

Use and Listening Tests

A stereo Klipschorn reproducing system requires a room with two good corners. Period! If your listening room does not have left-channel and right-channel walls which come out in an uninterrupted fashion for at least 1½ meters from their respective corners, then forget it.

I am fortunate in that I have two such corners in my listening room. The geometry of the room also reasonably matches Klipsch's recommendations of a ratio of 1.00 to 0.618 for distance between speakers to distance from front wall to rear wall. The reason for all this fussiness becomes evident when you begin to listen to the system: The listening room is part of the low-bass reproducing system.

As mentioned above, the first impression one has is that the Klipschorn is deficient in low bass. This impression is visually reinforced by the massive presence of the system itself: "Anything that big should go right on downstairs in bass." But as one settles down for listening, it becomes apparent that the low end really is there. Not obtrusive, not rumbly, but there.

Many years ago, when listening to a similar pair of Klipschorns, I decided to find out how accurate the low end was. So I placed two high-quality condenser microphones outside my house, in a location where I could listen to the sound they picked up while viewing the same microphone location through a picture window that stretched between the two Klipschorns. It was only a matter of walking outside

The dealer said, "Surround Sound" is the difference between okay and Akai.

And *every* Akai receiver has "Surround Sound."

So I surrendered. Wouldn't you?

Wouldn't you buy a receiver that wrapped you in a saxophone sound so big it made you shiver and so real it woke up your cat?

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Surrender.

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Overall, the Klipschorn demands a great deal of respect as an accurate reproducer, surviving modern recording and electronic technology well.

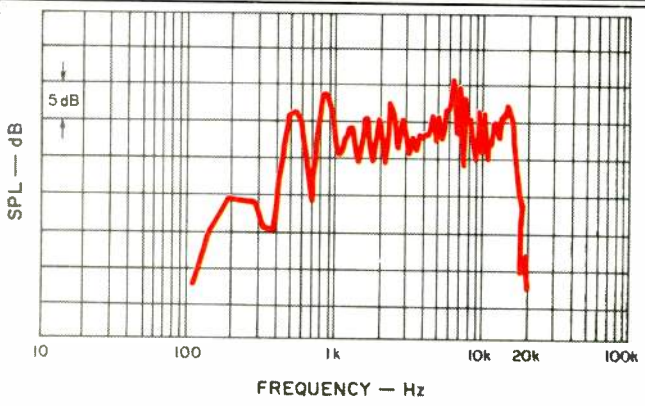


Fig. 9—Three-meter room response; see text.

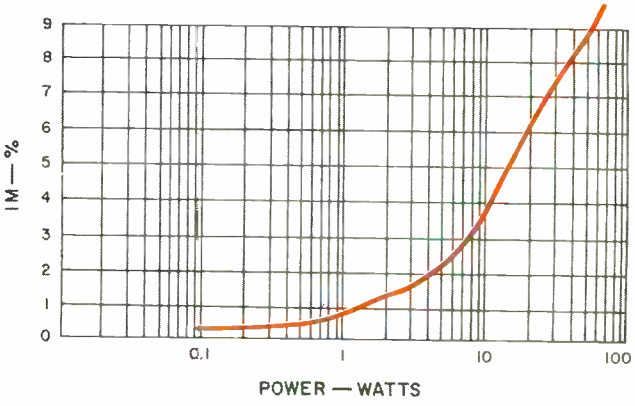


Fig. 11—IM of middle C (262 Hz) caused by mixing with E_1 (41.2 Hz) at equal levels.

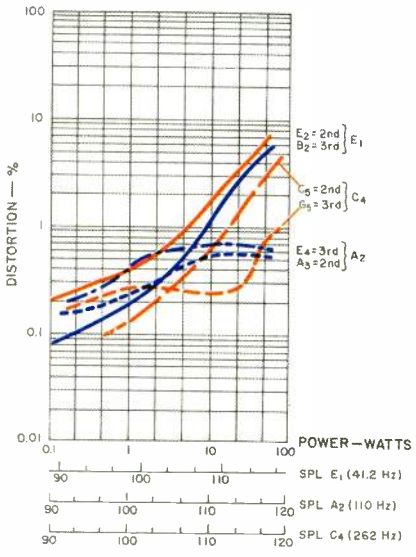


Fig. 10—Harmonic distortion for the test tones of E_1 or 41.2 Hz, A_2 or 110 Hz, and C_4 (middle C) or 262 Hz.

and listening, then walking inside and listening to compare the reproduced sound with reality. I could also switch between the K-horns and a pair of excellent speakers whose bass could shake the house on pipe organ; they made the K-horns sound thin by comparison. Then a funny thing happened. The sound of a slammed car door sounded like a slammed car door on the K-horns, but sounded like muffled "whumps" on the "wider range" system. The same with helicopter fly-overs (quite frequent where I used to live) and with the sound of distant traffic. I never forgot that experiment nor its ear-opening ramifications with regard to sonic accuracy versus measurement. Quite true, I have listened to many excellent subwoofers that could shake the walls at 10 Hz, while the K-horn produced little sound pressure even an octave above that frequency. But in my personal opinion, accurate percussive bass is a specialty which a properly set-up corner horn seems to have to itself.

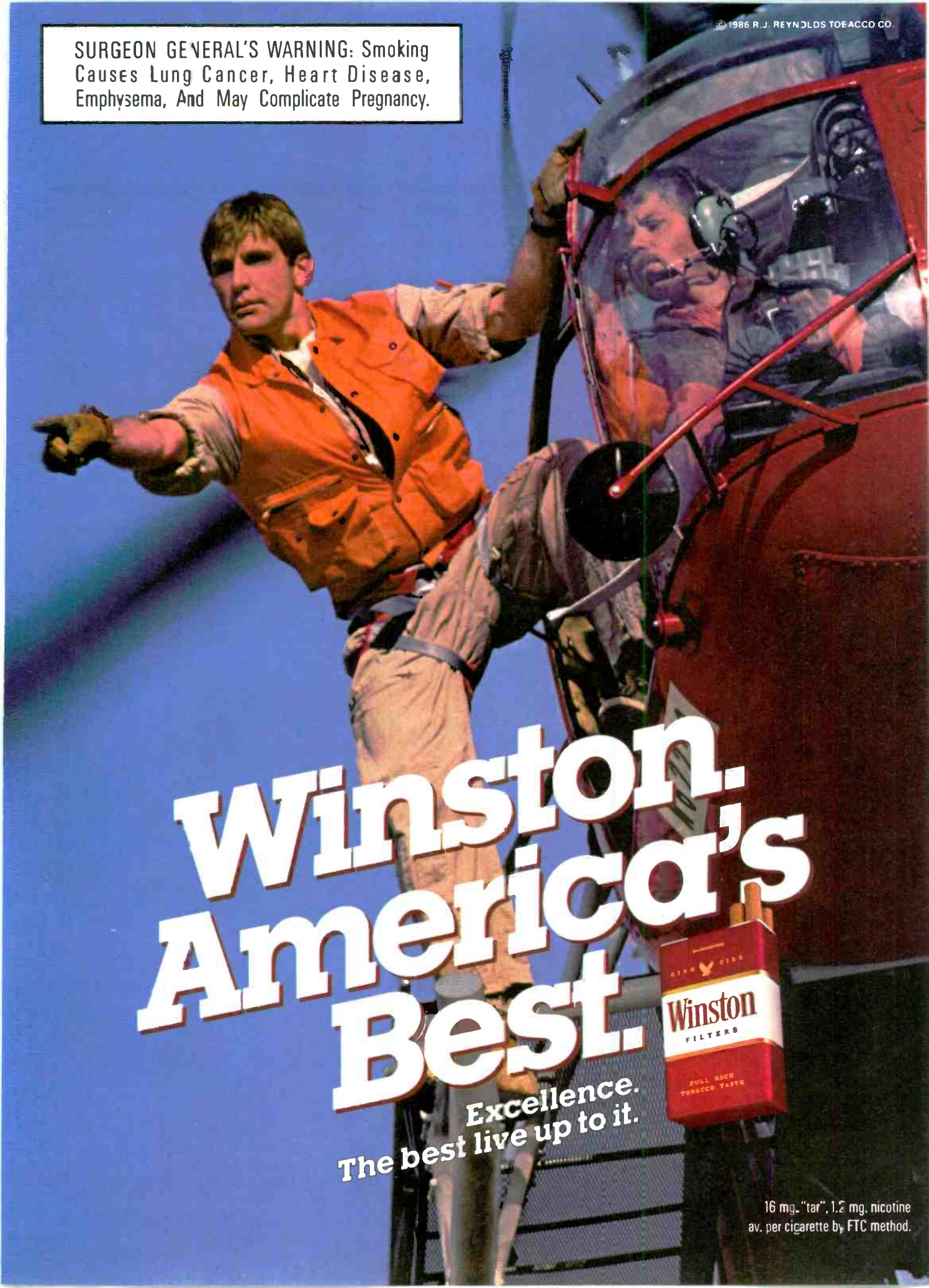
Orchestral balance is also quite accurate; horns and strings stay put and are accurately placed on the stereo stage. Brass is brilliant and accurate on this system, and these instruments are so well placed that I felt I could point directly at each instrument. On the down side, to my ears, vocals, particularly female ones, seemed strident, and I could not get an accurate sonic illusion of piano, which always seemed larger than life, even at lower sound levels.

The usable listening area extends over much of the listening room, and one can move about freely without losing stereo balance as long as the speakers are at least 3 meters from your listening location. It takes a pretty good-sized room to get a good sound from the Klipsch system; a small room will probably produce sonic disappointment. This is not a speaker system you haul to a dormitory.

The Klipsch system has two additional sonic characteristics which warrant discussion. First, it is one of the few sound-reproducing systems which sound natural when one walks into an adjacent room. This is an interesting subjective illusion, one which I cannot explain. However, we have all had the experience of hearing a live musical instrument being played in an adjacent room; it still sounds natural and we can readily tell that it is not artificially reproduced. The piano recordings with which I had had trouble while in the listening room actually sounded "live in the next room" when I was in a room adjacent to the listening area. While others may disagree, that is the illusion I experience.

The second characteristic is the maintenance of timbral balance even when the sound is reproduced at substantially lower sound levels than would be normal for a given piece of material. Again, this is my personal opinion, and others may disagree.

Overall, the Klipschorn is a Golden Oldie that survives modern recording and electronic technology very well. A bit jagged in the midrange, it still demands a great deal of respect as an accurate reproducer. *Richard C. Heyser*



16 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

2

HAFLER DH-330 FM TUNER

Manufacturer's Specifications
Usable Sensitivity: 11.3 dBf.
50-dB Quieting Sensitivity: Mono, 17.2 dBf; stereo, 37.2 dBf.
THD: Mono, 0.1% at 1 kHz; stereo, 0.18% at 1 kHz.
S/N Ratio: Mono, 72 dB; stereo, 68 dB.
Capture Ratio: 1.5 dB.
Alternate-Channel Selectivity: 60 dB.
Dimensions: 17 in. W × 3 in. H × 8½ in. D (43.2 cm × 7.6 cm × 21.6 cm).
Weight: 9 lbs. (4.1 kg).
Price: $460; $385 in kit form.
Company Address: 5910 Crescent Blvd., Pennsauken, N.J. 08109.
For literature, circle No. 91

David Hafler, one of the true pioneers in the world of high fidelity, continues to provide well-designed audio components which offer outstanding value when purchased in wired form, and which offer substantial additional savings if you are willing to put in the time and effort to assemble them from a kit. The latest FM tuner to come from Hafler's company is the DH-330, an FM-only unit featuring a quartz-controlled, digitally synthesized tuning system, five station presets, and automatic and preset-scan tuning. Hafler has also come up with interference-reduction circuitry which he calls an "AutoFilter." This circuit, automatically activated when noise or multipath interference is excessive, dynamically limits high-frequency separation and response in proportion to the amount of interference present in the signal. In the

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An LED supplements the standard frequency readout, helpful when you need to off-tune slightly to avoid interference.

presence of a strong, interference-free signal, however, this special circuit is completely out of the audio path.

The front end of the DH-330 employs a triple-tuned circuit between the r.f. stage and the mixer, in addition to a tuned antenna circuit. The r.f. stage and mixer semiconductors are dual-gate MOS-FETs, and another dual-gate MOS-FET is used as a buffer between the mixer and the local oscillator stage to prevent "pulling" of the oscillator by strong signal modulation. A delayed AGC circuit allows the tuner to handle high-level antenna inputs. The i.f. stages employ four ceramic filters and have a flat group-delay characteristic and good phase linearity.

Control Layout

Like so many other Hafler products over the years, the DH-330's front panel is clean and uncluttered. The "Power" switch and a headphone jack are located at the extreme right, and a master "Volume" control is to their left. The volume control affects both phone and rear-panel line output levels, but is intended primarily for use with phones. To the left of the volume control are four small buttons. One of these turns interstation muting on and off. A second button, when pushed, raises muting sensitivity to 31 dBf, so that when you use the automatic tuning mode the system will not stop at weaker stations. The "AutoFilter" feature, described earlier, is turned on and off by the third button, and the fourth is used to switch to mono reception if a given station's stereo signal is too weak to yield adequate signal-to-noise levels.

Five preset buttons; a preset "Store" button; "Auto," "Scan," and "Manual" (up and down) tuning buttons, and a "Halt" button (used to stop the scanning when you hear a station you want to lock in) are found near the center of the panel. The left end contains a multi-purpose display area with indicators for signal strength (five LEDs are used for this purpose), stereo reception, and frequency. A 50-kHz indicator LED supplements the frequency readout, indicating a half-step higher than the numerical reading shown in megahertz to the nearest tenth. In the U.S., where stations are spaced at odd tenths of a megahertz, this half-step indicator would normally not be very useful. However, in the rare cases where a particular station is hard to tune to without interference, it is sometimes helpful to tune slightly off the assigned frequency, and this extra indication helps to do that properly. In addition, many cable companies that carry FM transmissions often position them (deliberately or unknowingly) at frequencies which are a bit off the standard channel allocation points assigned by the FCC for broadcast purposes.

Kit Construction

Even if you've never assembled an electronic kit before, have no fears about building this tuner. The really difficult part of the wiring—assembly and soldering of the four major circuit boards—has already been done by Hafler. Furthermore, the mounted r.f., i.f., and multiplex decoder sections have been carefully aligned. Your part of the assembly work consists of 62 easy-to-follow steps having to do primarily with p.c. board mounting, power-supply wiring, and interwiring of the p.c. boards. Excellent pictorial diagrams are

Following only 62 steps turns this kit into a finished tuner, thanks to pre-wired, pre-aligned circuit boards.

provided, and if you can resist the temptation to skip certain instructions which seem overly obvious and follow the steps exactly as listed, I can practically guarantee that the tuner will work the first time you turn it on.

Of course, there is always a possibility that you may have done something wrong while assembling the tuner, or that a part (other than those mounted in the pretested p.c. boards) may be bad. For such situations, Hafler maintains a Technical Services Department that can help you by phone, or you can send the tuner back to Hafler along with $35. If the fault is with a part, they will replace it and return your money, less shipping charges. If the fault is yours, they will try to find it, send your unit back to you in working order, and keep your $35 for their trouble. If the problem was minor and took little time to spot and repair, they may even refund part of your money. I can't imagine a fairer deal than that.

I didn't assemble the tuner that I tested in my lab. That task was completed—rather neatly, I must say—by Richard L. Lerner of Phoenix, Arizona.

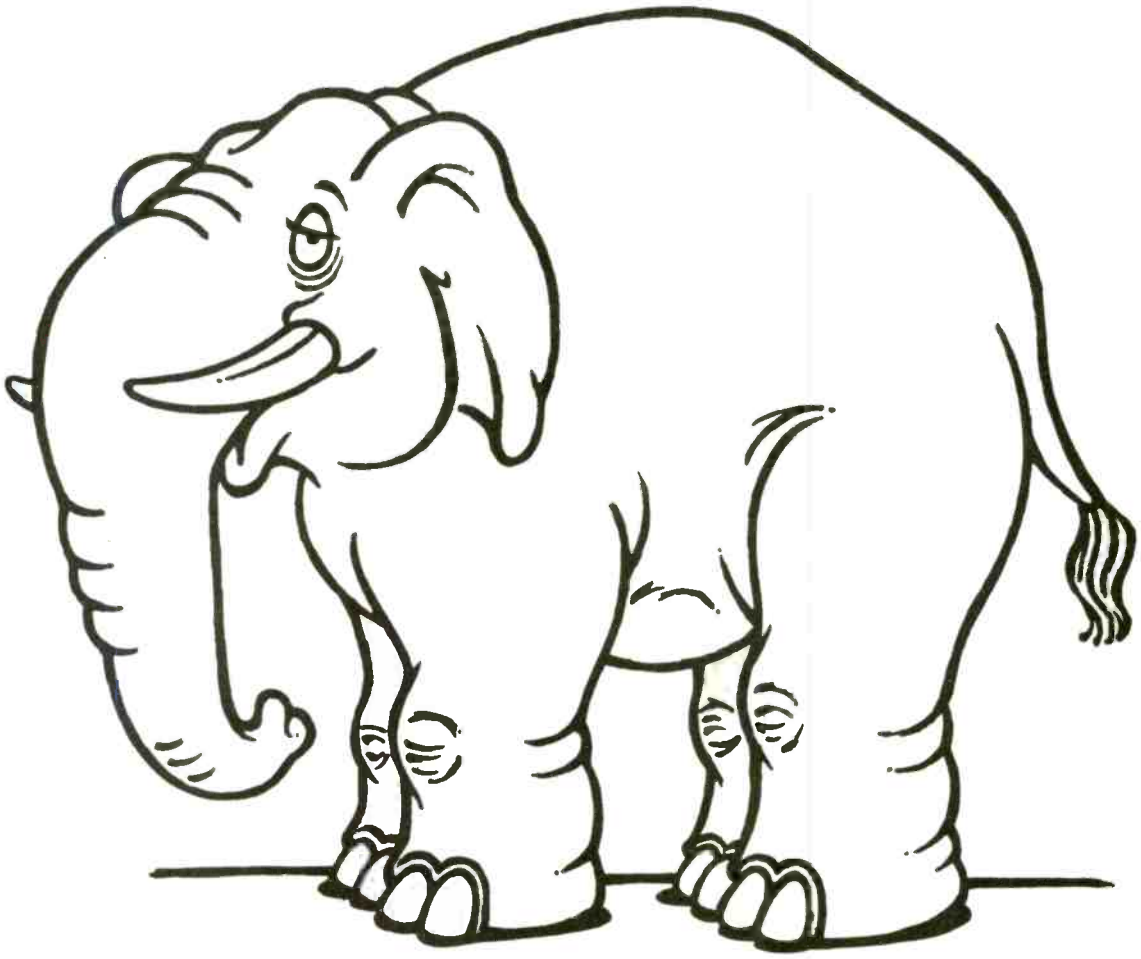
Measurements

Figure 1 shows the quieting and distortion characteristics of the finished FM tuner as a function of signal input levels. Usable sensitivity in mono measured 10.8 dBf, and in stereo it was 22.0 dBf. For strong (65-dBf or greater) input signals, the signal-to-noise ratio was a very high 81 dB; in stereo, best S/N measured 75 dB. Both of these S/N values are considerably better than claimed in Hafler's published specifications. When you consider the fact that this tuner was assembled from a kit, with pre-aligned p.c. boards, these excellent results are even more remarkable. I was equally impressed with the low distortion readings obtained. In mono, mid-frequency THD measured only 0.06%, and stereo THD measured 0.13%.

Figure 2 shows plots of harmonic distortion versus modulating frequency. At 100 Hz, THD measured 0.19% in mono and 0.2% in stereo. At 6 kHz, mono THD was 0.22% while stereo THD was actually a bit lower, only 0.16%.

Figure 3 is my usual spectrum analyzer 'scope photo showing frequency response and stereo separation. Re-

He's good. But can he remember 785 of your favorite songs?



This Magnavox compact disc player can. In fact, the top-rated CDB650 is the *only* CD you can program to play 785 selections. As you build your library, just program in your favorite selections from each disc in any order you want. The CDB650 will never forget them. Because it's the only CD with Favorite Track Selection. With FTS, the memory remains forever, even during power outages, even if it's unplugged. And it comes with full-function remote control.

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The CDB650. Unforgettable.

Flawless sound. The ultimate memory.

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probably give outstanding service for a long time.

•Finally, the Denon DCD-1500 tops my list. It's the player I recommend most highly. It has oversampling, dual D/A converters, remote controller, formidable specifications, full features, and Denon sound. The Denon engineers who created it should be honored in public.

player in

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performed well on the bench a
remote control or via its front-pan
as good as any CD player I have te
its price is a good deal lower than
favorite CD players. It is a winner in n

Test: CD-Spieler Denon DCD-1500

Feuer und Flamme

...Welt wollte Denon ...ine Palastrevolution.

...Play, Pause and...

...ärwicklungen die ...Mechanik, den ...gangsver-

DENON

disc

DENON DCD-1500
typically £399

The current range of Denon players covers the ground from true budget to audiophile models. The DCD-1500 fits bang in the middle of the range as far as price is concerned and could best be described as being a full-feature domestic machine that is built with audiophile attention to detail!

Rather like the second generation of Sony players, the Denon uses separate converters for the two stereo channels rather than time-sharing the o... therefore escapes ... phase problems of ... approach. The r... twice oversampli... has two specially ... phase filters bu... back board insi... correction is vi... the chosen ... Burr-Brown.

The circu... that each se... has its own ... and powe... own digi...

Rich, atmospheric sounding player

...ccess

The Real Deal

This Denon DCD-1500 is well designed throughout. Everywhere you look you'll see signs of careful engineering and evidence of the willingness to spend the extra time and money to do the job right. The Denon engineers who created the DCD-1500 have done a superb job.

In features, design, and sonics, the DCD-1500 is an outstanding player at any price, and a phenomenon at its list price. In my opinion, it's the best deal in today's CD player market. ⊡

Ken Pohlmann is a contributing editor to Digital Audio.

Construction	■■■■□
Ease of use	■■■■■
Sound quality	■■■■■
Value for money	■■■■■

...about ...want. ...keypad ...ton also ...over the ...variable ...e Sony 502 ...lication and ...headphone ...

...under remote control.

The facia has to pack in a lot of buttons but remains fairly easy to understand. The main Search and Skip controls are in a strip in the centre bottom of the player. The keypad is duplicated to the right side of the comprehensive display while the Repeat, memory call and clear functions are up with the Play, Pause and Stop controls on the top right. The display gives continuous readout of Track/Index numbers, time and a 0-20 track grid.

...k access was not particu... ...my test being ...

...correction once or twice... highest information layer gave ... test. The equivalent level surface mark and fingerprint tests were cleared without problems.

Hayden Labs, importer of Denon, has said that current production of the DCD-1500 is being changed to incorporate better RF screening — no problems were encountered with our sample during the review.

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...ger Mess... Schaltungen und ... gen Bauteilen an.

Beispielsweise speist der klotzige Netztrafo mit vier einzel...

Denon America, Inc., 27 Law Drive, Fairfield, NJ 07006
Denon Canada, Inc., 17 Denison Street, Markham, Ont. L3R 1B5 Canada
Reviews reprinted with permission. (*Digital Audio* 3/86 and 6/86; *Audio* 5/86).

The audio critics of the world hardly ever agree on anything. But when it comes to superlative CD players, Ken Pohlmann, Len Feldman, Masamitsu Fukuda, Ulrich Smyrek, David Frakel, Yoshiyuki Ishida, Artur Jung, and Hideo Kaneko recommend one model with amazing consistency: the Denon DCD-1500.

How did Denon achieve this exalted status? Not by offering useless buttons, switches and fluorescent displays. But by developing better digital circuitry, building to higher standards, and using better parts. Our proprietary Super Linear Converter is the only one that actually corrects D/A transfer distortion. Each circuit gets its own separate power supply. And our filters are computer-analyzed for linear phase. So you hear sound that rewards the most critical listening.

In a player as reasonably priced as the DCD-1500, these refinements are enough to make even a hard-boiled critic stand up and cheer. And now there's more cause for celebration: three new Denon CD Players. They're built on the same principles as the DCD-1500, and they're even more affordable.

So if you want to hear the best that the Compact Disc format has to offer, get yourself to a Denon dealer. And don't forget to tell him who sent you: Ken, Len, Masamitsu, Ulrich...

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DCD-1500: Dual Super Linear Converters; Oversampling Digital Filters; CALP Analog Filters; Programming; Remote Control.

DCD-1300: Super Linear Converter; Oversampling Digital Filters, Real-Time Phase Correction; Programming; Remote Control.

DCD-700: Super Linear Converter; Real-Time Phase Correction; Programming; Remote Control; Headphone Jack with Level Control.

DCD-500: Super Linear Converter; Real-Time Phase Correction; Programming; Emphasis Display; Headphone Jack.

Measured S/N values were considerably better than specs, and I was equally impressed by the low distortion readings.

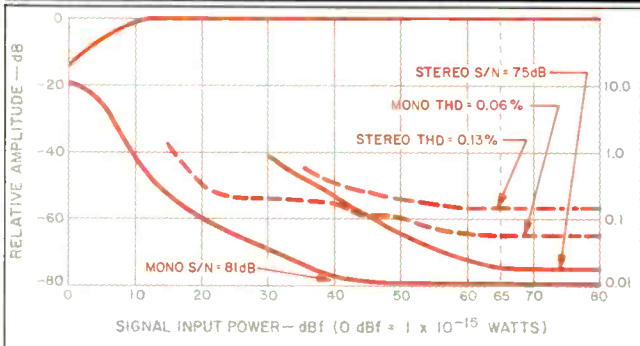


Fig. 1—Mono and stereo quieting and distortion characteristics.

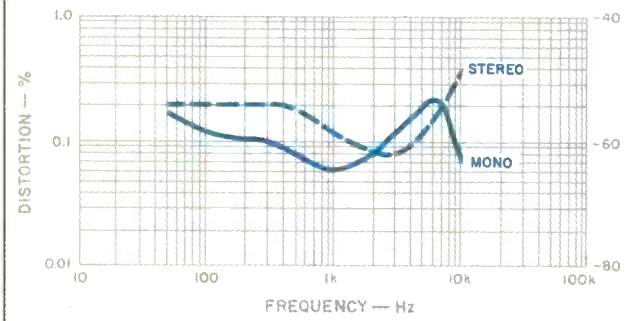


Fig. 2—THD vs. modulating frequency.

sponse was flat to within 0.5 dB from 30 Hz to 15 kHz. Separation at mid-frequencies measured just over 50 dB. At 100 Hz, stereo separation was 47 dB; at 10 kHz, it decreased to 37 dB. Figure 4 shows the crosstalk and distortion components that appear at the output of the unmodulated stereo channel when a 5-kHz audio signal is used to 100% modulate the opposite channel. The tall spike at the left represents desired output from the left, modulated channel and the shorter spike within the taller one represents the 5-kHz crosstalk appearing at the right-channel output. Further to the right you can see additional, well-attenuated spikes which represent residual 19-kHz pilot crosstalk, 38-kHz subcarrier crosstalk, and some very low-level distortion products. The crosstalk components observed here are, for the most part, lower than those observed with many more costly, factory-wired tuners I have tested in recent months.

Capture ratio for the DH-330 measured 1.3 dB and alternate-channel selectivity measured 65 dB. Image rejection was a high 85 dB, i.f. rejection measured 90 dB, AM suppression was in excess of 55 dB, and spurious response rejection was better than 90 dB.

Use and Listening Tests

At its price, the DH-330 offers everything that I would expect by way of good FM reception, and more. A simple wire dipole antenna is included, as is a 300-ohm/75-ohm transformer for those who want to use a coaxial signal input cable. However, Hafler wisely suggests using an outdoor antenna to realize this well-designed tuner's full capabilities, and I followed that advice. With a good directional outdoor antenna I was able to receive some 53 satisfactory signals at my location, with all but three of them quiet enough to be

FEMTOWATTS TAKE OVER

Way back in 1975, the Institute of Electrical and Electronic Engineers (IEEE) and the Institute of High Fidelity (IHF) adopted a Standard for testing and measuring the performance of FM tuners and receivers. With the merging of the IHF into the Electronic Industries Association (EIA), that broader based organization adopted the same Standard.

One of the points of confusion that the Standard sought to address and correct was the question of how to state signal strengths. For many years manufacturers talked about the sensitivity of their FM tuners by quoting the number of *microvolts* required at the FM antenna terminals to achieve a given degree of noise quieting or lowering of distortion. Unfortunately, noise quieting in an FM tuner varies with signal *power* applied at the antenna terminals, and power, though directly related to voltage, is also a function of the antenna input impedance across which the voltage is applied.

For example, suppose you apply 1 V across a resistive impedance of 10 ohms. Ohm's law tells us that the power developed across that impedance will be E^2/R, where E is the voltage applied and R is the resistive impedance. The input power in this case would be $1^2/10$, or 0.1 watt. Now suppose the same 1 V were applied across a resistive impedance of 20 ohms. The power developed would now be only $1^2/20$, or 0.05 watt—half as much as before. Yet the *voltage* applied is exactly the same as in the first example.

Relating that problem to FM tuners and receivers, you may have noticed that some tuners (mostly home units) have antenna input impedances of 300 ohms, while others (notably car-stereo tuners) have antenna input impedances of 75 ohms. Still other tuners may have both types of antenna inputs. Suppose that a tuner manufacturer whose product offers only a 300-ohm impedance claims a usable sensitivity of 2.0 μV. Another tuner maker, though fully as honest as the first one, happens to make a tuner with a 75-ohm antenna input, and that maker also claims a sensitivity of 2.0 μV. If you go through the calculations of power required by each tuner to reach usable sensitivity, you'll quickly see that the 75-ohm tuner actually needs *twice as much power* as the 300-ohm tuner. To put it another way,

At its price, the DH-330 offers all I'd expect by way of good FM reception, and more. I picked up 53 satisfactory signals using an outdoor antenna.

enjoyed in stereo. When I allowed the "AutoFilter" circuit to do its thing, two of those three became listenable as well, and the loss of separation was hardly noticeable.

I like the way Hafler has arranged the automatic-tuning feature of the DH-330. The scanning speed is just right, and the 4- to 5-S pause at each station is just long enough to let you decide if that's the station you want to listen to. I have a similar feature in my car-stereo system, but I am always somewhat bothered by the fact that automatic tuning can only be done in one direction—up the dial. If you missed locking in a station at 106.5, for example, you have to wait until the tuner gets up to 107.9 and then begins again from 88.1, or else go back to manual tuning. Hafler has solved that minor irritation by letting you auto-tune in both directions. To scan down the dial, you press the "down" manual-tuning button and then "Auto"; pressing the "Auto" button alone will result in a scan up the dial.

Another nice feature I discovered while using the tuner was its ability to recall a previously listened-to station when power is turned off and then on again, providing you push the "Halt" button before turning off the set. In addition to searching for stations with the "Auto" button, you can scan through your five memorized preset stations as well, using the "Scan" button. The memory used for retaining the five desired station frequencies is nonvolatile. This means that even if the a.c. power plug is pulled or there is a power failure or interruption, the DH-330 retains its memory. Hafler states that it will retain its memory "for years." I couldn't verify that claim, but I'm willing to bet that you will enjoy outstanding FM sound quality and performance "for years" if you choose to build, or buy already wired, a DH-330.

Leonard Feldman

Fig. 3—Frequency response (upper trace) and separation vs. frequency.

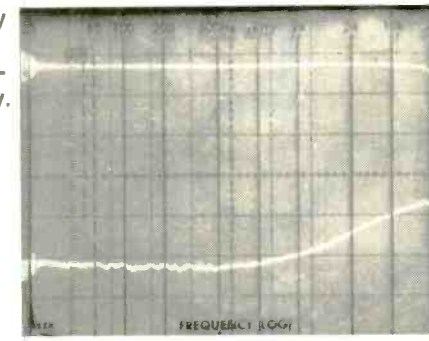
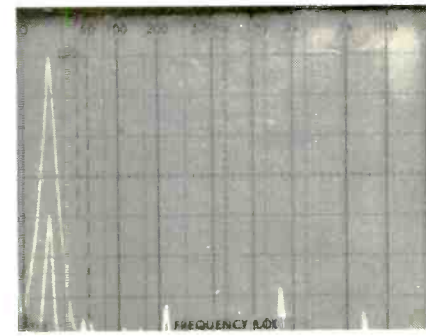


Fig. 4—Crosstalk and distortion components for a 5-kHz modulating signal.



the tuner with the 75-ohm input is not nearly as sensitive as the other. Yet, so long as manufacturers continued to quote sensitivity in microvolts, a consumer might well take them both to have equal sensitivities.

Obviously, a solution to the problem would be to express signal inputs in power rather than in voltage values. However, the watt would be too large a unit to use for such a specification, so the IEEE and the IHF decided to use the femtowatt instead. One femtowatt is equal to 1×10^{-15} watt, or a decimal point followed by 15 zeros and a 1! To avoid the burden of having to count zeros, it was decided to use a decibel or dB reference as a starting point; that is how the term dBf (dB with respect to 1 femtowatt) was born.

Once sensitivity is expressed in terms of power, it doesn't matter what the input impedance is; 10 dBf is the same amount of power whether you are dealing with a 75-ohm, a 300-ohm, or any other input impedance. Unfortunately, old habits die hard. Manufacturers were slow to adopt the new terminology. Gradually, some began to list dBf ratings at first in parentheses along with the "primary" microvolt ratings. As the years passed, the microvolts went inside the parentheses while the dBf figures came outside where they belong. Today most manufacturers of FM tuners have stopped quoting the confusing and misleading microvolt values altogether.

So long as the "dual rating" system persisted, *Audio* showed both microvolt and dBf values on graphs depicting quieting and harmonic distortion as a function of input signal strength. Beginning with this test report, however, we are finally going to drop the microvolt scale at the top of those graphs (see Fig. 1 of this report) and confine ourselves to the unambiguous dBf scale along the bottom. For those few manufacturers who insist upon using microvolts and for those readers who still find it tough to think in terms of dBf, I offer four formulas to help you convert from one form of measurement to the other.

To convert from microvolts, across a 300-ohm load impedance, into dBf:

$$dBf = 20 \times \log_{10}(\mu V/0.55).$$

To convert from microvolts, across a 75-ohm load impedance, into dBf:

$$dBf = 20 \times \log_{10}(\mu V/0.275).$$

To convert from dBf back to microvolts across a 300-ohm load impedance:

$$\mu V = 0.55 \times \log_{10}^{-1}(dBf/20).$$

To convert from dBf back to microvolts across a 75-ohm load impedance:

$$\mu V = 0.275 \times \log_{10}^{-1}(dBf/20).$$

Leonard Feldman

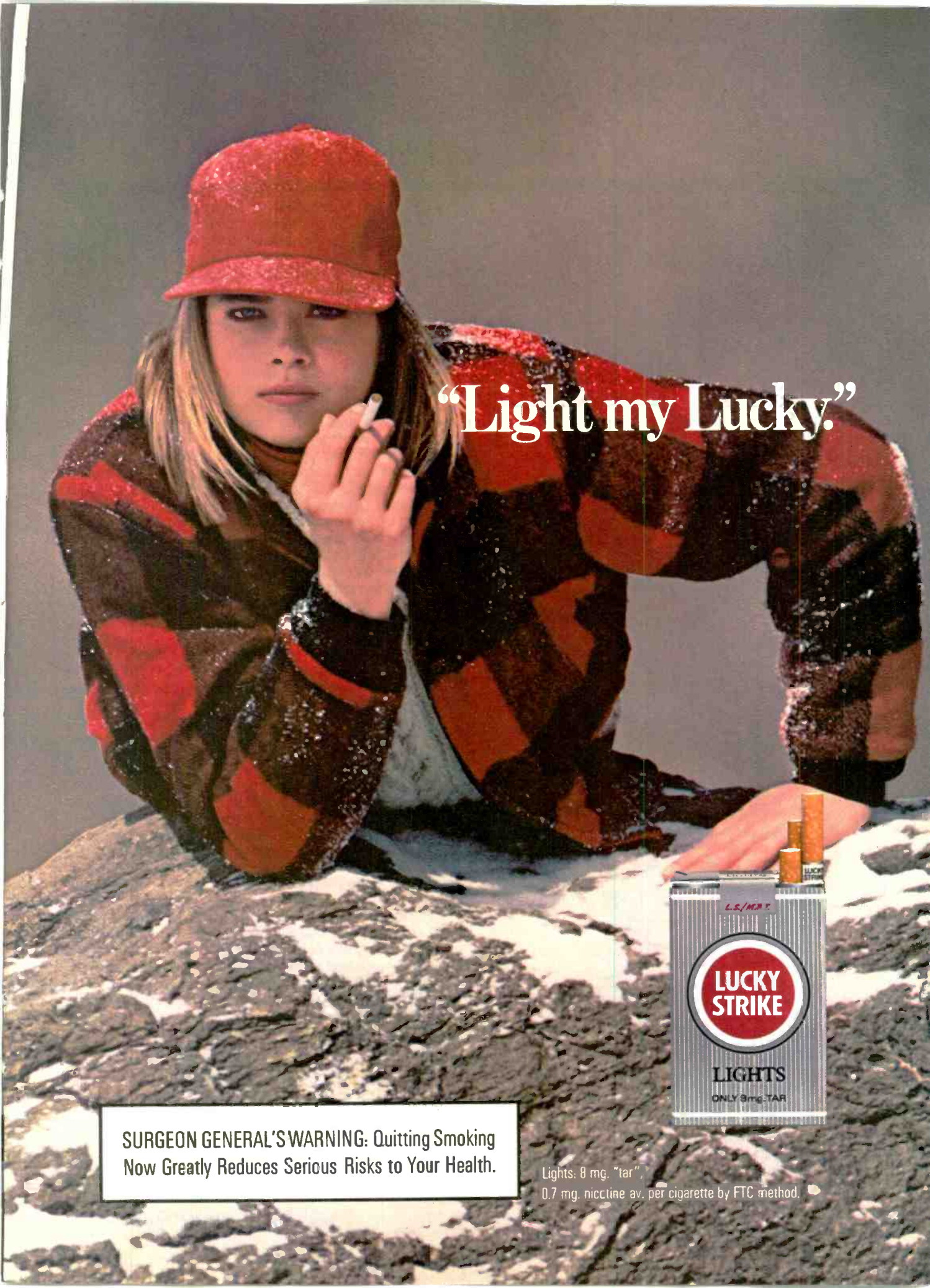
3

DBX DX3 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 10 Hz to 20 kHz, +0.5, −1.0 dB.
THD: Less than 0.002% at 1 kHz with signal processors switched out, 0.07% with processors switched in.
Dynamic Range: 96 dB without signal processing, 60 to 106 dB with processing.
Channel Separation: 90 dB.
Output Level: 2.0 V rms.
Dimensions: 17⅛ in. W × 3 11/16 in. H × 11 7/16 in. D (43.5 cm × 9.37 cm × 29.1 cm).
Weight: 10 lbs. (4.55 kg).
Price: $599.
Company Address: 71 Chapel St., Newton, Mass. 02195.
For literature, circle No. 92

If you're beginning to think that all CD players are pretty much alike, consider the DX3 from dbx, the company that developed linear companding, professional compressors and expanders, and a variety of other consumer and professional audio equipment. When dbx decided to enter the CD-player sweepstakes, it was only natural that they should add a little of their own brand of signal-processing magic to their first CD unit, and so they did. The designers decided that they should let the user "correct" some of the flaws they found in some CD software. Similar thinking is shown by Bob Carver, whose CD player offers a couple of nonadjustable "fixes" which must be used together or not at all. However, dbx offers four sonic embellishments, each of which can be varied in degree or intensity.

One of these embellishments, Digital Audio Impact Recovery ("DAIR"), is a form of fast-acting upward expansion which adds impact to musical transients. Why would anyone want even more dynamic range than is already available in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LIGHTS
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Lights: 8 mg. "tar", 0.7 mg. nicotine av. per cigarette by FTC method.

The DX3 can be made to compress signals, add dynamic impact, and widen or tighten the image. When not desired, those circuits can be switched out.

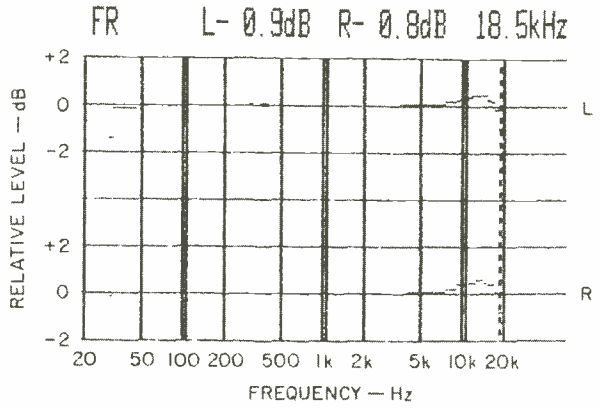

Fig. 1—Frequency response, left (top) and right channels.

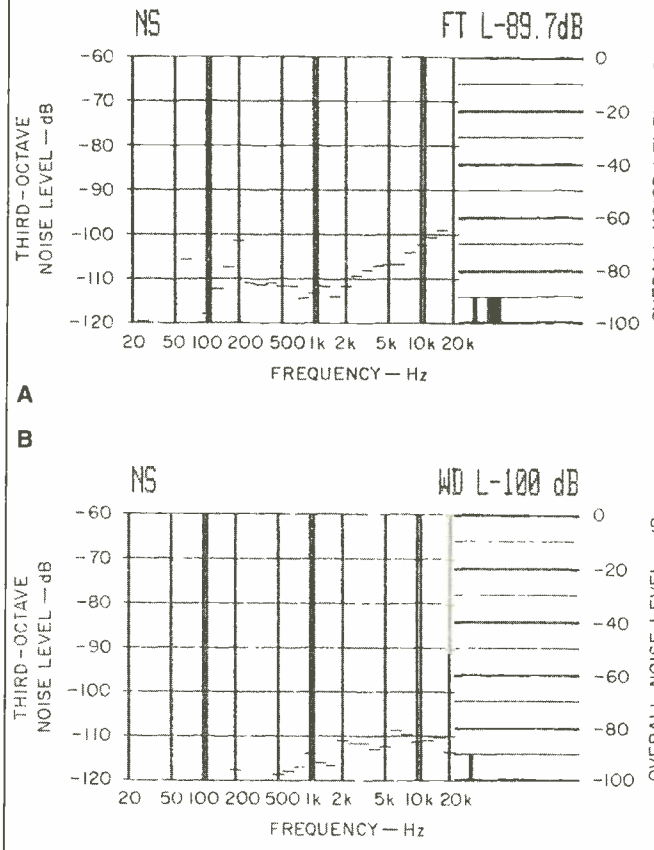

Fig. 2—Signal-to-noise analysis, unweighted (A) and A-weighted (B).

CDs? Well, dbx maintains that some CDs, such as those made from old analog masters, do not in fact offer as much dynamic range as they should, and DAIR is supposed to correct for those particular CDs' failings. The "Dynamics" knob which controls DAIR also controls a second embellishment, a variable amount of compression, when turned in the opposite direction. The purpose, here, is to reduce the dynamic range of CDs when listening to them as background music or when recording them onto cassettes to be used in your car. Anyone who has tried to play a digitally mastered, wide dynamic range CD in a car player will appreciate the ability to apply a bit of compression to such recordings, albeit via a cassette copy of the original CD.

A second control on the front panel of the DX3, labelled "Ambience," can be rotated clockwise to increase apparent separation or stereo spread. Turned in the opposite direction, the control has the reverse effect, decreasing separation until reproduced program material sounds almost monophonic. These two sonic tricks are nothing new. The apparent increase in separation is accomplished by adding a bit of out-of-phase left-channel signal to the right-channel output and a bit of out-of-phase right-channel signal to the left-channel output. (In the case of the DX3, the cross-blending of out-of-phase signals is done for middle and high frequencies only.) Conversely, simple in-phase cross-blending of middle and high frequencies reduces separation. As is true of the Carver CD player, the dbx DX3 has a switch which removes all of this special circuitry from the signal path. After all, there are some CDs that require neither compression, nor expansion, nor stereo enhancement, nor image "tightening."

As for the more usual CD-player features, the DX3 can be programmed to play up to nine selected tracks in any order. You can repeat an entire disc or the programmed tracks over and over again. Pairs of "Skip" and "Scan" buttons let you move quickly from track to track; if the latter are used while in play mode, you can audibly scan the program at an attenuated level to reach any desired point within a track quickly. Although indexed points within a track cannot be programmed or dialed in directly, any such points encoded on a CD can be displayed numerically during scanning, so you can stop the player when you reach the desired index point.

The display area shows either track number, elapsed time, or (in the stopped mode) total disc time, depending upon the setting of a pushbutton. Three rows of LEDs let you know how much and what type of signal processing is going on when either DAIR or compression is in use.

Aside from the controls already described, the DX3's front panel has the usual operating pushbuttons, such as "Open/Close" for the front-loading disc drawer, "Pause/Stop," "Play," "Repeat," "Program," "Display Mode" (for changing the display), and, at the extreme left of the panel, "Power." No remote control is provided. The usual output jacks are found at the rear of the player; there is no provision for controlling output level.

Measurements

Frequency response of the DX3, shown in Fig. 1, was essentially flat from 20 Hz to 20 kHz, with a slight rise at

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Used with moderation, the compressor delivered a reasonable dynamic range, not too wide for recording nor so narrow as to destroy musical integrity.

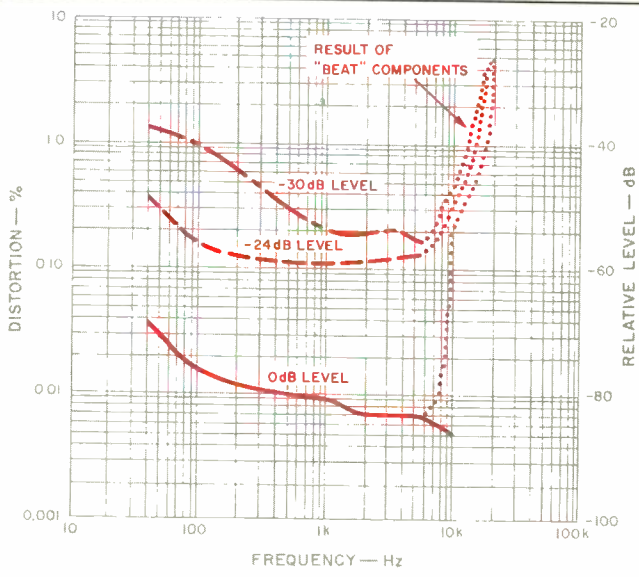

Fig. 3—THD vs. frequency at three signal levels.

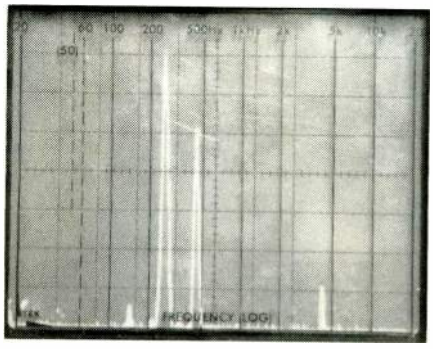

Fig. 4—Spectrum analysis of reproduced 20-kHz test signal, from 0 Hz to 50 kHz, showing out-of-band and in-band beats (see text).

about 15 kHz. At 20 kHz, response was down about 1.0 dB in each channel. Unweighted signal-to-noise ratio measured 89.7 dB, and the A-weighted measurement was a high 100.0 dB exactly. (See Figs. 2A and 2B.) The three curves of Fig. 3 depict harmonic distortion at maximum (0-dB) recorded level and at −24 and −30 dB levels. As is true of many CD players, harmonic distortion readings above 10 kHz are deceptive (and in fact rather meaningless), since many CD units tend to create "beats" between test discs' desired high-frequency signals and the sampling frequency (in this case 44.1 kHz). In Fig. 3 the sum of actual THD *plus* the spurious, out-of-band beats is depicted by the dotted-line plots at high frequencies. The effect of such beats is clearly illustrated in the spectrum analysis 'scope photo of Fig. 4. The analyzer was linearly swept from 0 Hz to 50 kHz. The tallest spike is the desired 20-kHz signal; the shorter one just to its right is an unwanted beat that is outside the audio frequency range. What surprised me about this test was the appearance of a much shorter spike or spurious component at around 16 kHz, well within the audible spectrum. This component may well have been a form of IM distortion caused by nonlinearities in the player's post-D/A analog output stages. When I reduced the output level by only 10 dB, it disappeared entirely, although the out-of-band beat remained at the same relative amplitude compared with the desired 20-kHz output. By introducing a band-pass filter (with a cutoff of 20 kHz), as suggested by the new EIAJ measurement standards, I was able to isolate the "real" harmonic distortion from these nonharmonically related components. Under those conditions, THD at 10 kHz measured only 0.005%, and at 1 kHz (even without the EIAJ filter) it measured an acceptably low 0.01% for 0-dB recorded outputs.

Amplitude linearity was not nearly as good as that which I have measured for most other CD players. While deviation from perfect linearity was only 1.1 dB at −60 dB levels, signals that should have theoretically been reproduced at −80 dB from my test disc were reproduced at a level of −68.4 dB. Of course, with the compression circuits active I would have expected this, but these results were obtained when the signal-processing circuits were completely bypassed. When maximum compression was applied, signals between maximum recorded level and −24 dB recorded level were squeezed into a dynamic range of no more than 2.5 dB, while signals recorded at −60 dB were raised to −30 dB at the output of the DX3. Of course, that's the most extreme case. Using somewhat less compression, the dynamic range was restored to a reasonable level—not too great to record onto cassettes without saturating tapes, but not so little as to destroy musical integrity.

SMPTE-IM measured 0.005% at maximum recorded level, increasing to 0.055% at −20 dB recorded level; CCIF-IM (twin-tone, using 19- and 20-kHz tones at the equivalent of highest recorded level) measured a low 0.011% at maximum recorded level and 0.035% at −10 dB recorded level.

Stereo separation, plotted as a function of frequency in Fig. 5, ranged from approximately 54 dB at the high-frequency extremes to no more than 65.0 dB at mid- and low frequencies, nowhere near the 90 dB claimed by dbx. Once again, these measurements were made with the signal-processing circuits turned off. I suspect that even with these circuits disabled, signals must pass through certain ICs which perhaps have an effect upon stereo separation. But, as I've often mentioned, I can't fault a CD player that provides more than 50 dB of separation throughout the audio band. Whatever the case may be with these ICs, many current CD players *do* do better than that, and I'm not sure why this one didn't. Of course, when the channel-blending circuit is introduced, separation drops down to next to nothing, but that's what is supposed to happen—reduction of the stereo spread. The unusual upper curve in Fig. 5 shows how mid-band separation is reduced to practi-

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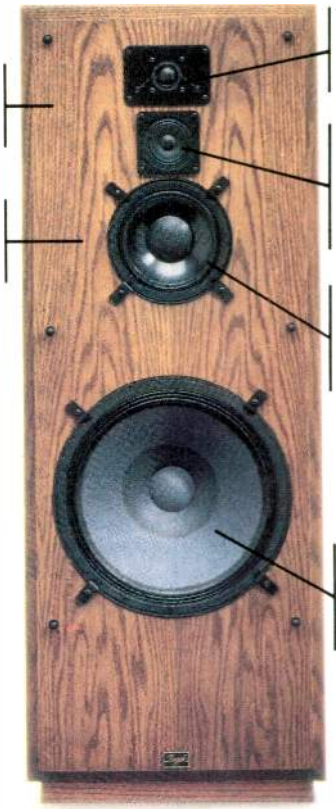

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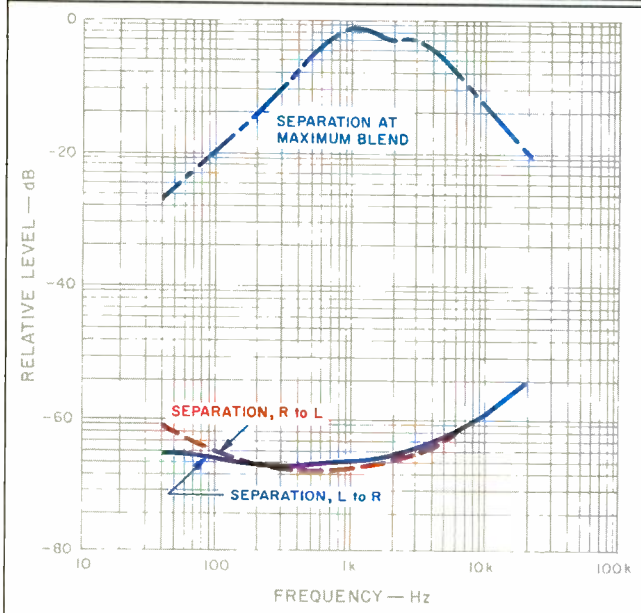


Fig. 5—Separation vs. frequency, without blend (bottom curves) and with maximum blend (top curve).

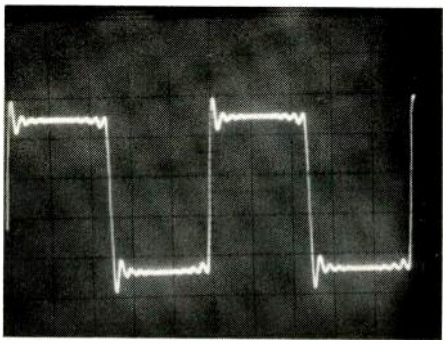


Fig. 6—Square-wave reproduction, 1 kHz.

cally nil (monophonic) when the "Ambience" control on the DX3 is turned fully counterclockwise.

Wow and flutter was too low to be measured by my test instruments. There was no measurable level difference between left- and right-channel outputs, both of which delivered exactly 1.9 V rms for maximum recorded level on a CD. Pitch error amounted to no more than 0.1%. Short access time (from one playing track to the next, using the track-advance keys) was no more than 1 S, and long access time (from an inner track to an outer track, using the programming mode) was close to 5 S.

Reproduction of a 1-kHz square wave is shown in the 'scope photo of Fig. 6. The reproduced wave shape is typical of that produced by CD players which employ steep digital filters and two-times oversampling. The unit pulse shown in Fig. 7 further confirms the use of digital filtering techniques. The owner's manual supplied with the DX3 advises that a third-order analog filter is used after D/A conversion to gently attenuate frequencies above 20 kHz. Such minimal filtering is enough to get rid of any 88.2-kHz components and sidebands of that frequency which result from the recovered program material. That, of course, is one of the benefits of oversampling; you don't have to use as steep a filter as you would if sampling were done at 44.1 kHz. Of interest, too, is the fact that dbx uses a three-spot or triple-beam laser pickup. It has yet to be definitively proven whether that arrangement is superior to the one-beam approach or vice versa.

Figure 8 shows the time difference between reproduced left- and right-channel 20-kHz signals; the 'scope's horizontal sweep calibration was set to 10 μS per division. This time difference amounted to just under 12 μS, indicating that a single D/A converter is being used in the DX3 rather than independent D/As for each channel.

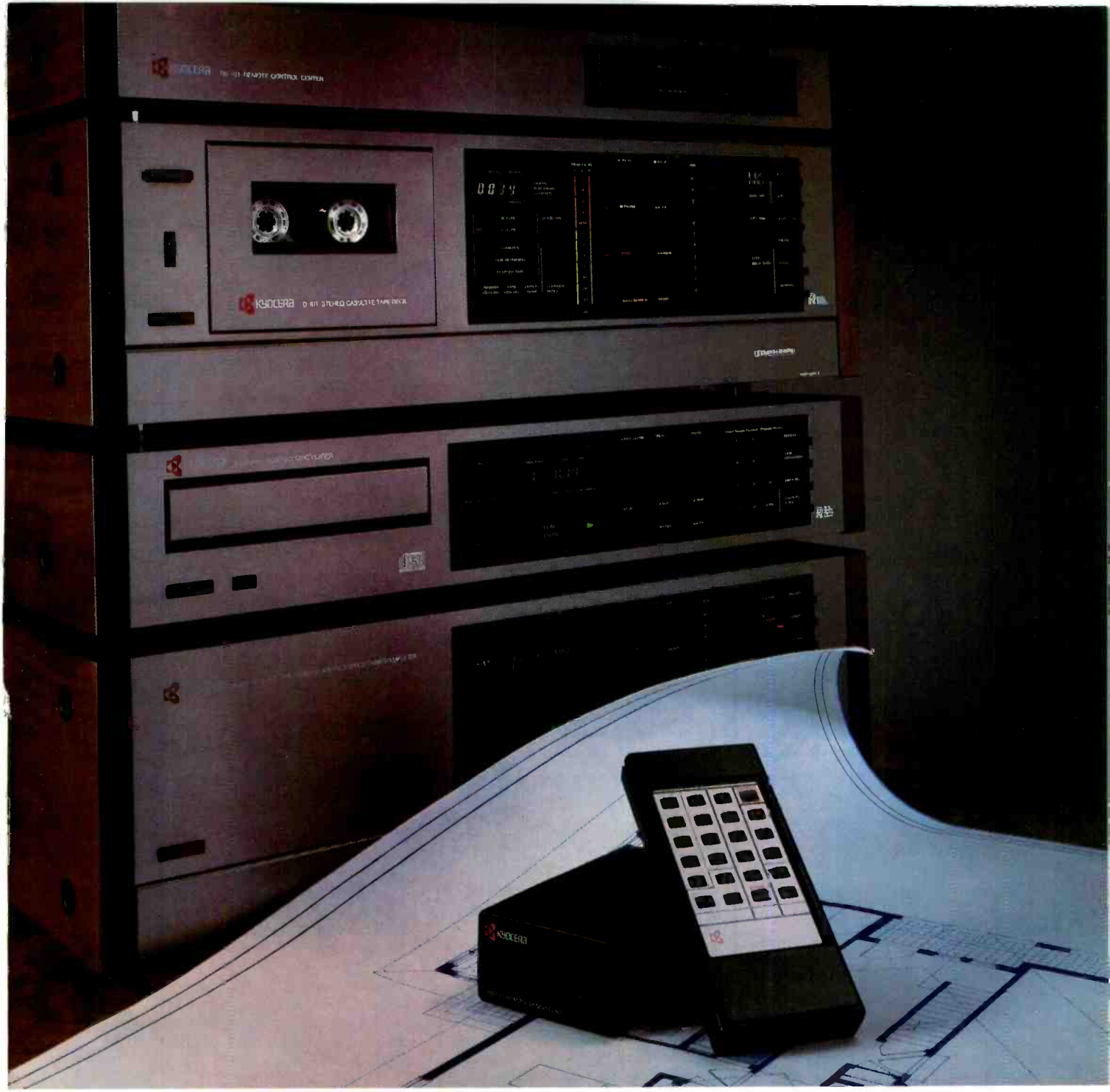
The DX3 was able to play through the simulated scratch on my test disc, the 800-micron diameter simulated dust particles, and the simulated fingerprint smudge. Its resistance to vibration and shocks applied to its top surface was excellent as well.

Use and Listening Tests

Naturally, I was particularly interested in checking out the DX3's special signal-processing circuits. After I had satisfied myself that the player sounded good without any of those extra enhancements, I pushed the button marked "In," located near the two rotary controls that determine the amounts of signal processing. When I did that, the word "In" lit up just above the "In" button. I rather think someone might have come up with less redundant nomenclature, but no matter.

The "Dynamics" control, which offers either compression or impact recovery, earns a score of 50% from me. I don't own a single disc that can benefit from the DAIR half of the knob's rotation. In fact, if you want to know what "pumping and breathing" sounds like, turn that knob fully clockwise and listen to the player fairly gasping for air. On the other hand, I can see the merits of the compression half of the control. I've tried to record several of my favorite CDs onto cassettes; invariably, I end up with either a noisy background (because I held down record levels so as not to saturate the tape during peaks) or distorted musical crescendos. I wish dbx would come out with an accessory box so that those of us who have installed CD players in cars (or are planning to) could add such a compressor there.

(*Editor's Note*: I have exactly the reverse opinion of the DX3's DAIR circuitry and its effectiveness. Yes, I can easily hear it working, particularly when it's turned up to full effectiveness, but I don't turn it on unless I'm listening to an analog-based recording, usually of the pop/rock variety. On Rod Stewart's *Atlantic Crossing*, for example, the DAIR adds snap to the drummer's rimshots and punch to his kick drum. Similarly, there is more edge and penetration to the



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Consider the DX3's special circuits as an addition to the decently executed, good-sounding CD player that's found underneath.

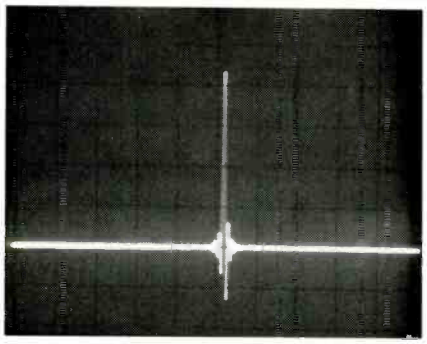


Fig. 7—Single-pulse test.

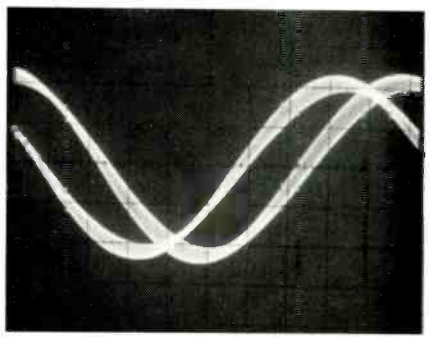


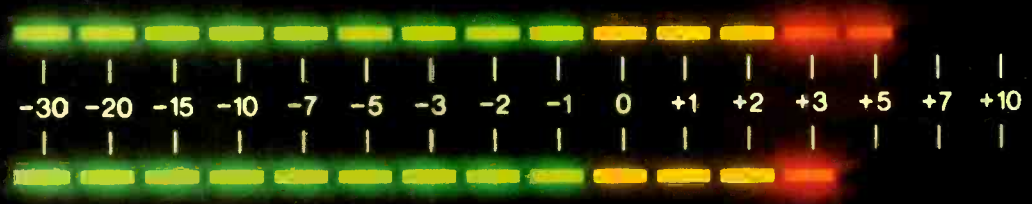
Fig. 8—Time difference between left- and right-channel 20-kHz signals.

guitar. Rarely do I add it to digitally recorded material, and I usually don't add very much of it.—*E.P.*)

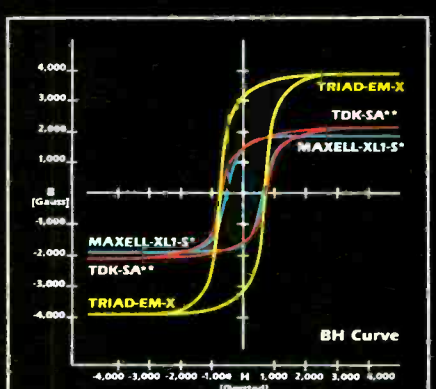
As for the "Ambience" control, I feel much more kindly disposed towards *both* of its effects. I have CDs that do suffer from a lack of stereo spread or depth, and I also have some that exhibit exaggerated stereo effects. Both of these problems are the result of improper microphone placement, mix-down, or final mastering, and being able to selectively compensate for those instances of poor judgment on the part of recording engineers or producers is desirable. The trick of adding out-of-phase information from opposite-channel signals is an old one (I designed it into one of my first stereo preamplifiers back in the early 1960s), but it is very effective if used in moderation. Cross-blending, too, is an old trick for reducing exaggerated stereo spread (and, in FM, for reducing the extra noise generated during weak-signal stereo reception). The nice thing about the DX3 is that you can regulate the amount of blend or stereo spread with precision, thanks to the continuously variable "Ambience" control.

While I spent a good deal of time listening to the DX3's special circuits, I don't want to overemphasize them to you. Consider them an addition to the decently executed player underneath. In this light, the DX3 can be thought of as a good-sounding, moderately priced member of the third generation of CD players. *Leonard Feldman*

TAPE IT TO THE LIMIT.



The dawn of a new tape decade.
The digital age has pushed recorded sound to the limit. Now Triad Digital Transcription Tape takes you there, too. It's the first totally new tape for your deck in a decade.



Comparison of the magnetic flux of Triad EM-X vs. two leading tapes under identical recording conditions. EM-X records approximately twice the signal, for increased dynamic range and lower distortion at higher signal levels.

Leading tapes share limited, pre-digital formulas. They just don't measure up to today's advanced recording techniques and audio equipment.

Triad's exclusive, patented metal tape formulations deliver maximum performance with a composition of exceptionally dense, uniform ferrous hydroxide particles. Their increased surface area holds more signal with less distortion than previously possible.

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Unlike pre-digital tapes designed for sources with dynamics averaging only 45-50dB, Triad's advanced metal technology delivers over 80dB of exciting, true-to-life dynamic range. With Triad, tape decks can actually perform beyond the limits of their own manufacturers' expectations.

Triad MG-X's high retentivity and coercivity are optimum for metal position transcription of digital material. For true metal quality in the high (CrO_2) position, the EM-X's reduced coercivity and controlled retentivity deliver more high frequency headroom and dynamic signal with higher overload levels than any other Type II tape. And for the widest dynamic range with the flattest frequency response in the normal position, it's the cobalt-doped Triad F-X.

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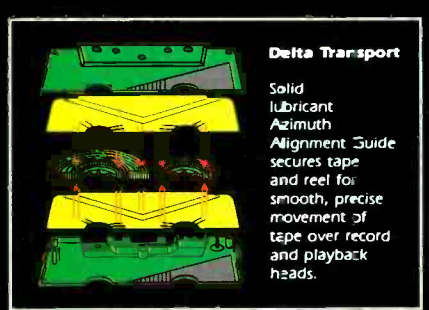

high frequency response and spatially accurate, three-dimensional sound. The unique Delta Transport housing also features a full-length, solid lubricant slip shield for less friction, reduced wow-and-flutter and prolonged tape life.

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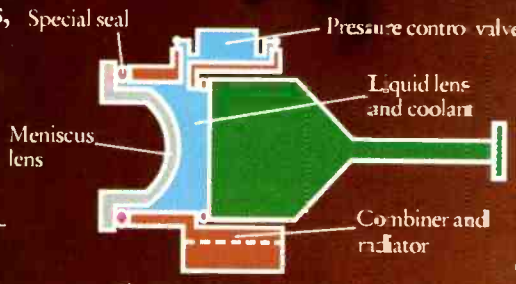
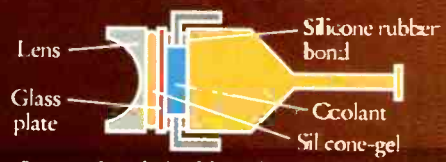


The "Liquid Lens" Technique



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4

TECHNICS SH-8066 EQUALIZER

Manufacturer's Specifications

Equalizer/Analyzer

Frequency Response: 10 Hz to 50 kHz.
THD: 0.003% at 1 V output.
S/N: 107 dBA, re: 1 V.
Input Impedance: 22 kilohms.
Input Sensitivity: 150 mV.
Maximum Input/Output Voltage: 8 V.
Band-Level Control Range: ±12 dB, in 2-dB steps.
Center Frequencies: 25, 40, 63, 100, 160, 250 and 500 Hz; 1, 2, 4, 8 and 16 kHz.
Display Range of Spectrum Analyzer: 30 dB.

Microphone

Type: Back-electret condenser.
Pattern: Nondirectional.
Sensitivity: −72 dBV, re: 1 μbar.
Maximum Input Level: 110 dB SPL.
Frequency Response: 20 Hz to 20 kHz.

General Specifications

Dimensions: $16^{15}/_{16}$ in. W × $4^{11}/_{16}$ in. H × $10^{11}/_{16}$ in. D (430 mm × 119 mm × 272 mm).
Weight: 8.4 lbs. (3.8 kg).
Price: $525.
Company Address: One Panasonic Way, Secaucus, N.J. 07094.

For literature, circle No. 93

The Technics SH-8066 is one of a growing number of stereo equalizers which include not only a spectral display but a means for performing room equalization automatically. There is a built-in pink-noise source, of course, and with the supplied microphone placed at a preferred listening position, a couple of button pushes gets the job done. There are some constraints, which we'll get to later.

More unusual is the direct-touch method that the SH-8066 uses for making manual EQ selections. The 12 filters are adjusted not by moving sliders, but by touching the desired boost or cut setting as presented on the 156-point array. There are a total of eight EQ-memory positions: Four are open for user-set curves, one is reserved for the Auto EQ mode, and three are fixed with preset curves for rock, jazz and vocal. The overall combination of options sounded good, but I was a little wary of the preset curves; more on that later.

Like other recent-vintage equalizers from Technics, this unit uses constant-Q filters. There *are* some advantages to this, but also some precautions (given later in this review).

Supplied with the SH-8066 is a measurement microphone, the RP-3800E. It is an electret type, powered by a single AA-type battery which is adequate for up to 2,000 hours of operation. With use of the case-mounted on/off switch, the battery life should be close to the shelf life of the cell. The cord length of 13.2 feet would be plenty for some users, but marginal for others—so extend it as needed. Also included are a handy mike clip and desk stand which facilitate placing the microphone for tests.

Control Layout

The large, square "Power" button is at the left end of the front panel; the "Stand By" label for its off position indicates that minor power consumption is necessary to maintain the user equalizations stored in memory. However, a high-quality capacitor in the memory circuit will retain the stored information for up to a week if the unit is unplugged.

Below the power switch is the microphone jack, and to the right is the spectrum analyzer/equalizer level display. The spectrum analyzer display has an indicated range of "0" to "30" dB for each of the 12 filter bands and also for the entire band, which is twice as wide as the others and labelled "Full Range." Without an incoming signal, the bottom segment of each of the 13 positions is illuminated by bluish white bars, each made up of three parallel horizontal lines. Each of the 12 steps to the maximum value is 2.5 dB; this is acceptable resolution for general music monitoring. There is no level-set control for the display, which I would have liked, but the unit automatically increases the displayed level by 10 dB when the overall level is below "5" and decreases the display the same amount when the overall level is greater than "25." The spectrum levels are displayed in bar-graph form, much to be preferred, in my view.

When the "EQ Level" is displayed, there is no full-range level to be shown, and each of the EQ band level settings is indicated by triple-line bars. The display can show either left- or right-channel EQ, or both at the same time. Normally, all of the bars have the same high brightness, but in left/right mode the EQ indicators for the right channel are just half as bright as those for the left, so it is immediately apparent what each of the settings is. The range of EQ level is from "−12" to "+12," with 2-dB increments.

To the right of the display, and dominating the center of the front panel, is the "Direct EQ Level Control" with its matrix of 156 touch points for setting EQ from "−12" to "+12" for any of the 12 bands. A fairly gentle push with a finger achieves an EQ change, confirmed by the display to the left. It is possible to "draw" a curve by simply running a finger across the matrix. I wasn't certain of the real value of this, but it does allow the effect of EQ changes to be assessed very quickly.

Below the display are large, angled channel-select pushbuttons which control both the action of the matrix switches and the EQ display; in other words, the channels can be adjusted together or separately, with simultaneous display of the EQ choices being made. Above the channel-select buttons are yellow indicators that show whether one has chosen the "L," "R," or "L.R" mode.

There are four other large, angled pushbutton switches to the right of the channel-select buttons: "EQ Rec" (in/out), "Tape 1/T1 to T2," "Tape 2/T2 to T1," and "Source." "EQ Rec" can be used at any time to insert any selected EQ in the signal paths to the two recorder outputs; a red LED then reminds the user that the EQ is becoming part of the recording. The other three switches constitute the input selector, and also can control dubbing connections.

Just to the right of the EQ-control matrix are three small buttons, flush-mounted to help ensure against accidental turn-on. "Lock" at the top will lock in an EQ adjustment so that an inadvertent touch on the matrix will not change the setting. It has a red indicator to show when it is in use, as does "Auto EQ" just below. For automatic EQ to work, the microphone must be plugged in and turned on, pink noise turned on (via the button just below "Auto EQ"), "EQ" turned

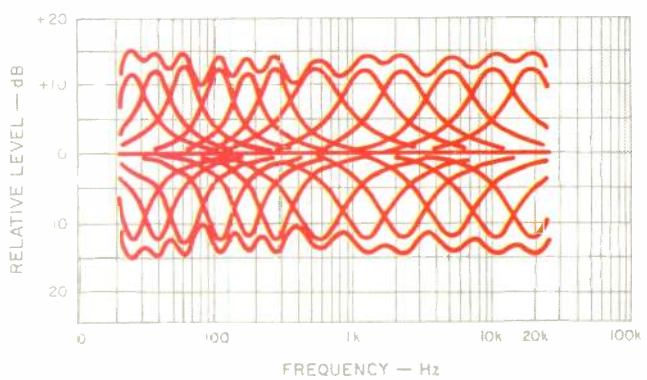

Fig. 1—Swept-frequency responses of each filter section at maximum boost and maximum cut, and of all sections combined, at maximum boost, maximum cut, and zero.

One can "draw" an EQ curve simply by running a finger across the SH-8066's matrix. This allows adjustments to be very quickly assessed.

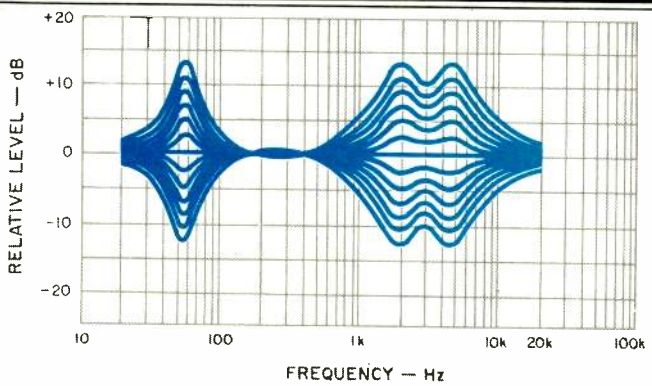

Fig. 2—Swept-frequency responses with 63-Hz, 2-kHz, and 4-kHz filters set successively for 2-dB steps from −12 to +12 dB.

off, and the amplifier volume set high enough for a spectrum analyzer display reading of at least "15." The left channel is corrected first, then the right channel; each band is sampled and corrected a maximum of 16 times, all within 50 S. To ensure that the system won't accidentally overdrive speakers, the Auto EQ function does not adjust the 25-Hz filters, even though many systems have very little acoustic output in this region. The user can always adjust this (or any other) band manually, afterwards. The curve set by the Auto EQ is always entered automatically into preset memory number 5, whose button is labelled "Auto/Room Acoustic."

There are eight memory buttons at the upper right of the front panel, each with a red indicator. The top row of four ("1" to "4") are used for storing any desired user-set EQ. In the second row, the button labelled "5" is used with Auto EQ, as stated above; "6" activates the internally stored EQ for "Rock"; "7" is for the stored "Jazz" EQ, and "8" is for the stored "Vocal" EQ. Below the memory presets are two large buttons for "Memory" and "EQ Plus." After an EQ has been set, a push of the "Memory" button starts its indicator flashing until one of the first four numbered buttons is pressed to store that curve for recall later.

Pressing "EQ Plus" adds whatever equalization curve is on the display to as many memorized curves as desired; you can, for example, add the "Rock" curve to whatever curve you have set, manually or automatically, to match your room and system. Initially, I had misgivings about this approach of direct addition of levels, but I put off final conclusions until the listening tests.

To the right of "EQ Plus" is the "EQ" on/off button with its red indicator, and below are the interlocked "Display Mode" switches: "EQ Level" and "Spectrum Analyzer."

On the back panel are the stereo pairs for line in and line out and for record/playback for two recorders. There is also an a.c. convenience outlet to replace whatever one the SH-8066 uses.

Removal of the top and side cover of the SH-8066 revealed a large, almost chassis-size p.c. board containing the great majority of the circuitry. There were some discrete components, but ICs were most evident. Board and parts quality was satisfactory, but the large board was springy and the front panel needed the cover for good rigidity. Soldering was generally excellent, with most inter-board connections made with multi-conductor cabling. The plastic transformer enclosure was just warm to the touch after some hours of operation. Parts and functions were labelled.

Equalizer Measurements

Frequency response was down only 0.1 dB at 20 Hz and only 0.04 dB at 20 kHz, both with and without EQ punched in. At the low end, the −3 dB points were 3.1 Hz both with and without EQ; at the high-frequency end, those points were 152 kHz with EQ and 248 kHz without. Swept-frequency response plots were made (Fig. 1) for each of the filters at maximum cut and boost, and for all of the filters, combined, at the maximums. The plots show quite clearly the closer spacing of the bottom six filters in comparison to the top six. This is an advantage to the user, in general, for greater resolution in the bass region can help tame standing-wave effects.

Most of the filters had center frequencies within 5% of the specification, which is good, but two were 8% high, which is just satisfactory. The maximum boosts ranged from +12.0 to +13.6 dB and the maximum cuts ran from −11.8 to −13.4 dB, which is an acceptable spread at these maximum points. The boost for a 1-octave bandwidth (Q = 1.4) was +8 dB, lower than most units, and the boost for Q = 1 (1.4 octaves) was only +4 dB, much lower than most units.

The swept-frequency responses of the 63-Hz and 2- and 4-kHz filters (Fig. 2) illustrate the sharpness of the filters even with relatively little boost or cut. In comparison with many other equalizers, the constant-Q SH-8066 is more correct graphically, and there is not much interaction among its filter responses. However, boosts, in particular, should be used with caution to minimize the possibility of ringing. The accuracy of the 2-dB steps was checked at 1 kHz, and most of the steps were very close to 2.0 dB. However, the first steps in either direction from center zero were on the high side, measuring ±2.46 dB.

With various test frequencies and EQ settings, the maximum input/output voltages were usually 8.0 to 8.9 V. For some settings, however, 7.1 V proved to be a more realistic limit to prevent even a hint of clipping. The input impedance was 19.4 kilohms and the output impedance was 1.1 kilohms, both very satisfactory. Harmonic distortion was 0.004% or less from 20 Hz to 20 kHz. No slew-rate limiting was observed with 2 V input at 100 kHz. The A-weighted noise voltage was below 10 μV, giving a signal-to-noise ratio of greater than 100 dBA (re: 1 V) through the SH-8066 when no equalization was applied. After trying a number of different equalization settings, I determined that in normal use, with EQ, 97 dBA (re: 1 V) would be more typical.

Spectrum Analyzer Measurements

The filters of the real-time spectrum analyzer were well aligned to those of the equalizer for most bands, but not for the 100-Hz band, where the RTA's filter was centered on 87 Hz. The analyzer filters were found to have quite peaked

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Overall sound was better with automatic EQ than without it—certainly smoother, in general, but lacking in detail.

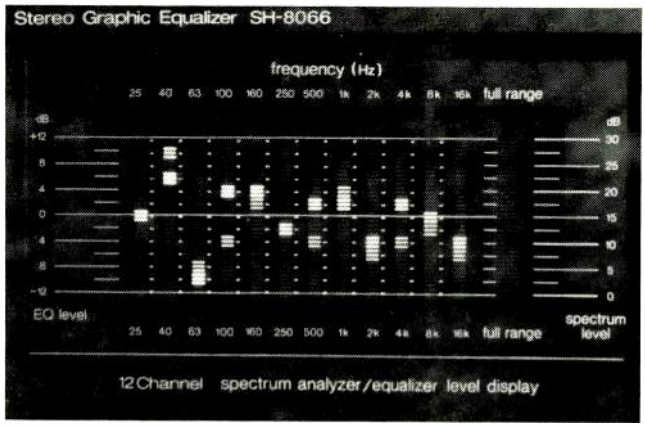

Fig. 3—RTA display showing equalization settings obtained for left and right channels after automatic equalization.

responses with adjacent-filter crossovers from 5 to 10 dB down. The analyzer's level steps were about the expected 2.5 dB.

The analyzer display's response was flat, within its limits of resolution, when fed pink noise from an Ivie IE-20A. The response time of the 1-kHz filter was about 250 mS, and it took about 1.5 S for a 20-dB decay.

The built-in pink-noise source had an output level of 200 mV rms. Measured with an Ivie IE-30A ⅓-octave analyzer, the frequency content of the pink noise was within ±1 dB or better at most points, but was 1 to 2 dB low from 25 to 63 Hz and about 1 dB high from 200 to 400 Hz.

It was possible to use the analyzer to display the frequency content of music fed into the SH-8066 from a music system. However, measurement of the required input range showed that 20 mV would be about minimum for a good display, and 200 mV would be the maximum allowable to prevent what appeared to be a form of compression above "25" on the SH-8066's display. I felt frustrated that I couldn't just turn a knob to shift the display range.

Using the microphone supplied, the RTA's indicated level was somewhat erratic when sound levels below about 70 dB SPL were involved; above 90 dB, the RTA indications showed some compression. However, the display was reliable with sound signals ranging between these two levels.

A comparison was made between the SH-8066 with its microphone and the Ivie IE-30A, with both subjected to the same noise field. Over most of the band, the Technics microphone matched the Ivie's within ±2 dB, but it did show some low-end droop. It was also observed to be slightly directional, albeit—to its credit—less so than most microphones supplied with EQ/RTA combinations.

Use and Listening Tests

The owner's manual for the SH-8066 is quite well written, with good figures to emphasize the points being made and many suggested applications. I don't agree with all the suggestions, but I'm glad Technics encourages listeners to use their equalizers again and again, thereby learning more about music and the listening environment.

All controls and functions were completely reliable throughout the testing. I really liked the pushbutton switches, which had good tactile and audible snap action. The status lights were also helpful. I did feel that the indicator light for the "Lock" button was on the faint side, though in low light it was easier to see. Most of the panel labels could be read in such light, but I did lose track of where I was on the EQ matrix at times. A look at the display, of course, pinpointed what I had or had not done. In making some manual EQ changes, I did feel that I wanted smaller steps.

To test the Auto EQ function, I plugged in the microphone, turned on the pink noise, and increased the system volume to get an analyzer display. I put the mike at a good listening spot and pushed "Auto EQ." The display gave indications of the flattening process, but levels in several bands were erratic. Rechecks showed that 80 dB SPL was about the minimum sound level for a good analyzer display and speedy correction. Figure 3 shows the automatically determined EQ for both channels on a system without any other equalization. The overall sound was better with this EQ than without, certainly smoother in general, but lacking in detail. I next tried the SH-8066 on a system that was quite smooth already; some changes were for the better, but the sound still needed something, and the RTA display showed what it was. With both sound systems, the SH-8066 had cut response in the 2-kHz band, right about where I felt something was missing. Once I restored response in this band to zero, the whole sound improved greatly. This serves to reinforce an important point: Setting equalizers, manually or automatically, according to the dictates of an RTA may yield significant aural improvements, but the user must still listen and make manual adjustments to get the best result.

In making some manual corrections, I definitely felt the need for steps smaller than 2 dB to satisfy my ears. I tried the rock, jazz, and vocal fixed-memory EQs, singly and in combination with the Auto EQ. I always felt I wanted to change something to satisfy my tastes. I had hoped that "EQ Plus" would average response curves, instead of summing them, to get the best overall EQ for a given listening space. Alas, it does not.

The bar-graph display of the analyzer provided good, general monitoring of the music spectrum. Its sensitivity was well matched to most of the signal levels in my system, but the display became strongly compressed at high signal levels when the SH-8066 was connected to recorders with outputs of more than 0.5 V. (On decks with adjustable output levels, of course, this is no problem.) The display has a lot of vertical parallax, so I had to continually bend down to be certain what the actual boost and cut values were.

With the constraints of the 2-dB resolution of the filter steps and the somewhat sharp constant-Q filters, this Technics unit is not actually as flexible as some less sophisticated devices. The individual user should make his own personal assessment of the limitations discussed. Outside of those, the SH-8066 performed quickly and reliably, offering an excellent display of what it was doing at all times.

Howard A. Roberson

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5

DISCRETE TECHNOLOGY LSI Mk. II COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 20 Hz to 20 kHz, ±0.3 dB.
Dynamic Range: 110 dB.
S/N Ratio: 103 dB unweighted, 110.3 dB A-weighted.
THD: 0.004% at 1 kHz.
IM Distortion: 0.0044% at 0 dB.
Channel Separation: 103 dB at 1 kHz.
Line Output Level: 2.0 V rms.
Number of Programmable Selections: 20.
Power Consumption: 30 watts.
Dimensions: 16 9/16 in. W x 3 9/16 in. H x 11 13/16 in. D (42 cm x 9 cm x 30 cm).
Weight: 16.5 lbs. (7.5 kg).
Price: $1,195.
Company Address: 2911 Oceanside Rd., Oceanside, N.Y. 11572.
For literature, circle No. 94

The popularization of Compact Discs has generated a whole new secondary industry. No, I'm not talking about the companies that produce CD cleaners, scratch removers, disc stabilizers, mounting feet and the like, though surely the makers of these "peripherals" have benefited from the digital revolution too. I'm referring to the increasing number of companies which modify Philips or Philips-made Magnavox players by replacing the audio stages, output filters, and perhaps Philips' permanently wired output cables. In the process, the price of these audiophile versions increases, from a few hundred dollars to over $1,000. This $1,195 unit from Discrete Technology (Distech), for example, is based on the Magnavox FD2040, whose suggested retail price is $300.

The Magnavox FD2040 was and is a fine-sounding CD player, employing as it does four-times oversampling and digital filtering to begin with. It can be programmed for random access of up to 20 CD tracks. No remote control is supplied with this Magnavox model nor with its Distech counterpart. As far as I can tell, what Distech has done is to add some heavy internal output cables and substitute their own line output amplifier and analog output filter. They have also added a variable output control for one of the two pairs of output jacks; this enables the user to connect the unit directly to a power amplifier, thereby eliminating one component in the signal path. Distech tells us that they have also modified the power supply to lower its impedance, and have split up the circuitry into a quasi dual-mono configuration, for increased separation. Distech has included a two-page addendum to the owner's manual, one page of which lists technical specifications of the revised unit.

Control Layout

A power "On/Off" button and an "Open/Close" button flank the slide-out disc drawer at the left of the LSI Mk. II's front panel. The multi-purpose display to the right of the drawer indicates the number of tracks and total playing time of a disc shortly after it's been inserted. During play, indications of track number and elapsed playing time of that track are shown. During programming, the display shows track numbers to be stored and those already stored. "Error," "Repeat," and "Pause" LEDs are also located in this area.

A large, multi-function control pad to the right of the display area is used for starting play, returning to the beginning of a track, fast searching in either direction or interrupting play ("Pause"). Different functions are activated by touching the appropriate edge of this rocker pad. A "Stop" button is located beneath the rocker pad; to this button's left, below the display area, are a "Repeat" button, a headphone jack, a button labelled "Previous" (for returning to a previous track during play or during programming), a "Program" button (for storing tracks and producing a display of the program stored), and a button marked "Next" (for moving on to the next track during play or programming).

On the rear panel, Distech has installed two pairs of output jacks and an output level control in place of Philips' permanently mounted audio cables. Separate output cables, heavier than the originals, are supplied by Distech. These cables are marked with arrows which should point away from the player, Distech says, as if to guide the signal

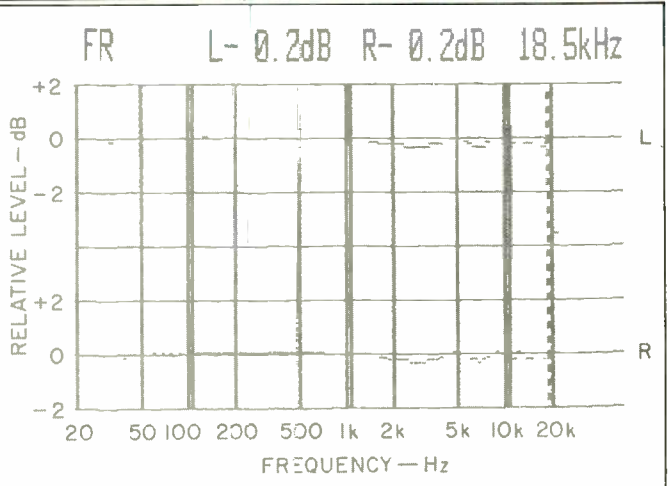
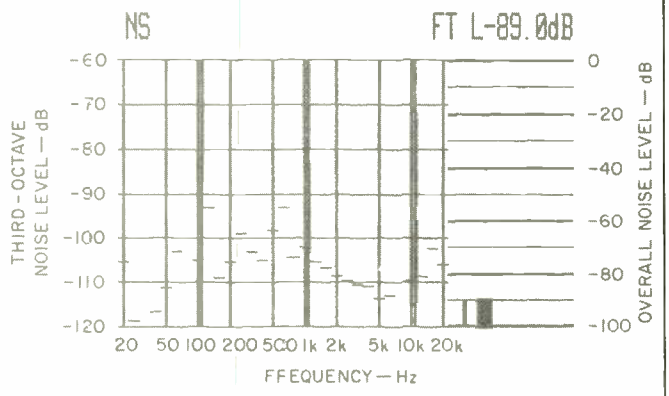


Fig. 1—Frequency response, left (top) and right channels.



A

B

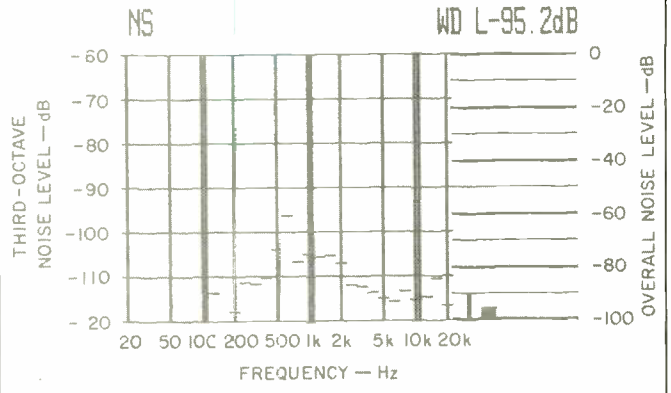


Fig. 2—S/N analysis, both unweighted (A) and A-weighted (B).

Dynamic range, using the new EIAJ test, measured 113 dB, 3 dB above spec, while separation ranged from 79 to 84 dB.

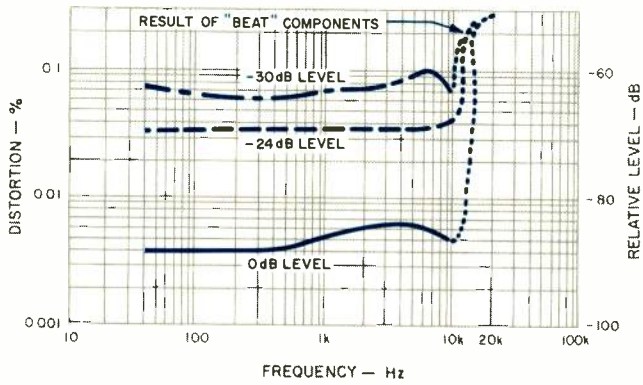


Fig. 3—THD vs. frequency at three signal levels.

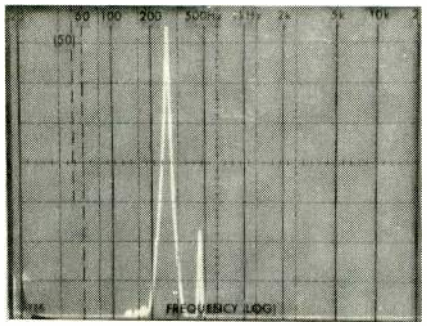


Fig. 4—Spectrum analysis of 20-kHz test signal. Note the ultrasonic component at 24 kHz, to the right of the desired signal.

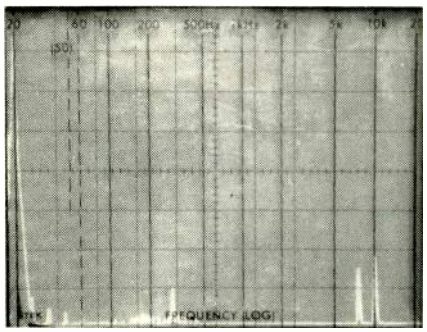


Fig. 5—Spectrum analysis of 1-kHz signal (large spike at extreme left). While the main spurious components are at 40 to 45 kHz (far right), at least one is in the audible band at about 17 or 18 kHz. (See text.) Sweep is linear from 0 Hz to 50 kHz.

in the proper direction. The cables are also color-coded with wraps of tape to match similar bits of tape affixed near the output jacks. In my sample, however, the colors were reversed, causing the channels to be reversed, left for right, when Distech's color code was followed. I corrected this when testing, and made sure the arrows on the supplied cables pointed in the recommended direction.

Measurements

Frequency response of the LSI Mk. II was flat within −0.2 dB from 20 Hz to 20 kHz. Response curves, shown in Fig. 1, display a bit of a wobble near the high end, though the wobbles are less than a couple of tenths of a dB in amplitude. These are probably attributable to the "improved" analog output filters which Distech says are incorporated in the unit. I don't seem to recall a similar undulation in the response curve of the original Magnavox unit.

Signal-to-noise readings did not measure up to the published claims nor, for that matter, to the S/N values achieved by the unaltered Magnavox (or Philips) unit. As shown in Figs. 2A and 2B, unweighted S/N for my sample measured 89.0 dB and A-weighted S/N was 95.2 dB. Neither figure is anything to crow about compared to the readings I have been getting lately for third- and fourth-generation CD players. Linearity was accurate to within 0.1 dB down to a −60 dB signal level, but was off by more than 3.0 dB at a −80 dB level. Output level for a maximum (0-dB) recorded signal was 2.09 V, and there was no difference in output level between channels.

Harmonic distortion measured around 0.005% at mid-frequencies for a 0-dB recorded signal level. Figure 3 shows THD as a function of frequency for this and lower levels. The dotted lines above 10 kHz or so represent "beats" or spurious output components not harmonically related to the recorded test tones. Figure 4 shows what happens in the presence of a 20-kHz tone reproduced by this player. An ultrasonic component at around 24 kHz shows up, and it is only about 50 dB below the desired 20-kHz output. Naturally the distortion analyzer sees this as a distortion component even though it would be inaudible to a human listener.

Of a somewhat more serious nature are the spurious components generated when a 1-kHz signal is reproduced from a test disc at the 0-dB level, as shown in the spectrum analysis photo of Fig. 5. The tall spike at the extreme left (almost off-screen) is the desired 1-kHz signal. Additional signals, at least one of which is in the audible region at around 17 or 18 kHz, appear farther to the right, with other spurious components seen at around 40 to 45 kHz. I have not previously encountered such spurious components with other CD players when reproducing a low-frequency tone such as this. I can only conclude that perhaps the newly installed line-output preamplifier stage is causing the difficulty and that we are dealing here with an overload problem rather than with a "digitally" generated artifact. This conclusion is substantiated by the fact that the spurious products disappeared entirely at lower recorded levels.

Separation between channels was excellent, ranging from about 84 dB to around 79 dB at high frequencies. If nothing else, the separate output-stage cables (both the internally wired ones and those supplied for external connection to an

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The Distech sounds very good, better than a couple of $300 portables I had on hand, and equal to some other high-end units I was also testing.

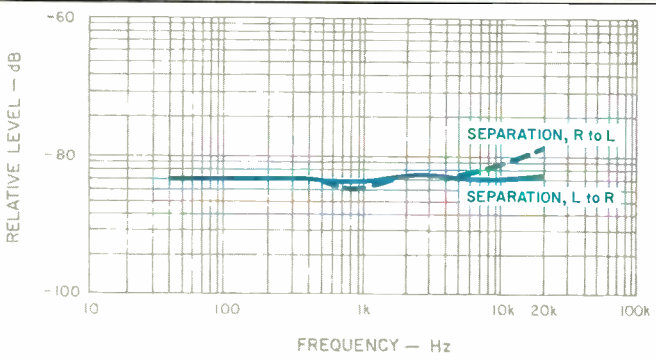

Fig. 6—Separation vs. frequency.

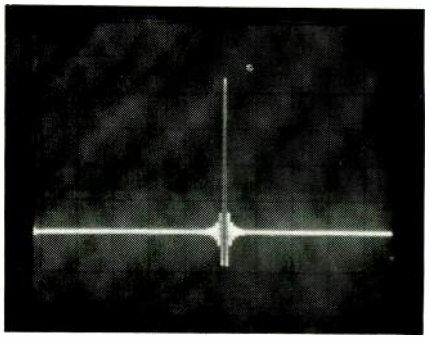

Fig. 8—Unit-pulse test.

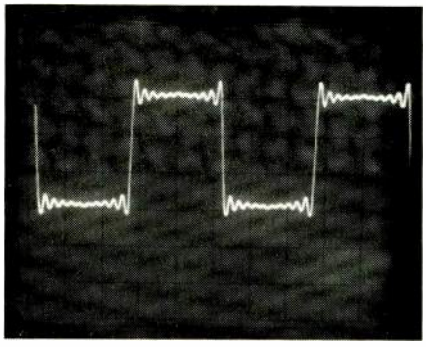

Fig. 7—Reproduction of a 1-kHz square wave.

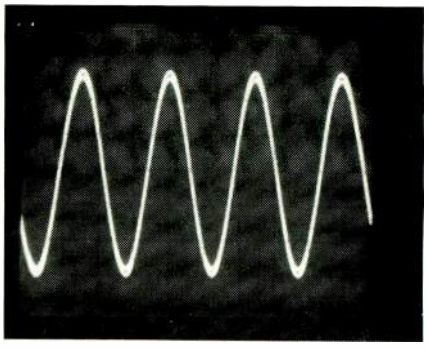

Fig. 9—Interchannel phase response using 20-kHz test tone shows that separate D/A converters are used in each channel. The match was so exact that one channel was vertically displaced to prevent total overlap.

amplifier) prevent any capacitive coupling of signals between channels. Separation as a function of frequency is shown in Fig. 6.

Dynamic range of the Distech LSI Mk. II, measured in accordance with the new EIAJ method, was 113 dB, 3 dB higher than claimed. SMPTE-IM distortion was 0.003% at 0-dB recorded level and 0.022% at a −20 dB level. Using 19- and 20-kHz test tones of equal amplitude, CCIF (twin-tone) IM measured a very low 0.0018% at a 0-dB recorded level, increasing to 0.008% at a −10 dB recorded level.

Figure 7, a 'scope photo of a reproduced 1-kHz square wave at a 0-dB recorded level, confirms the fact that digital filtering is used in this player, as does Fig. 8, a 'scope photo of a reproduced unit-pulse signal. Figure 9 confirms the fact that this player employs dual D/A converters; the 20-kHz signals at the left- and right-channel outputs are exactly in phase. (I vertically offset the two signal traces in the photo so you could see that two signals were present.)

The first and second generation of Magnavox players, which I tested more than two years ago, were among the few players of that era that could successfully play through the simulated defects on my special Philips test disc. Since Distech bases their LSI Mk. II on the second-generation Magnavox FD2040, it was not surprising to find that this player also made its way through the simulated scratch, dust particles, and fingerprint smudge of the test disc without so much as a momentary glitch. As for speed of access, the unit could go from one track to an adjacent track in about 2 S, and from an innermost track to an outer track in about 6 S. That's a bit slower than some of the newest players using linear motors, but hardly cause for upset.

Use and Listening Tests

The Distech LSI Mk. II sounded fine to me, but then, so did the player upon which it is based. I wish that I had had the unmodified version of the FD2040 against which to compare the Distech unit in a double-blind test. Since I did not, the best I could do was try to honestly judge the sound quality of this player against that of other top-of-the-line units which were in my lab. I also compared the sound quality with that achieved by lower priced units I had on hand, including a couple of portables selling for around $300. There was no question in my mind that the LSI Mk. II sounded better than the portables. However, I cannot honestly say that it sounded any better than the high-end samples. Incidentally, as the higher priced units all had variable output-level controls, I followed Distech's advice and connected these players directly to a power amplifier when making my comparisons, as I had done with the Distech. After several hours of listening, I concluded that the LSI Mk. II sounds very good indeed, but no better than several other of my favorite CD players, some of which sell for considerably less and include remote controls.

Leonard Feldman

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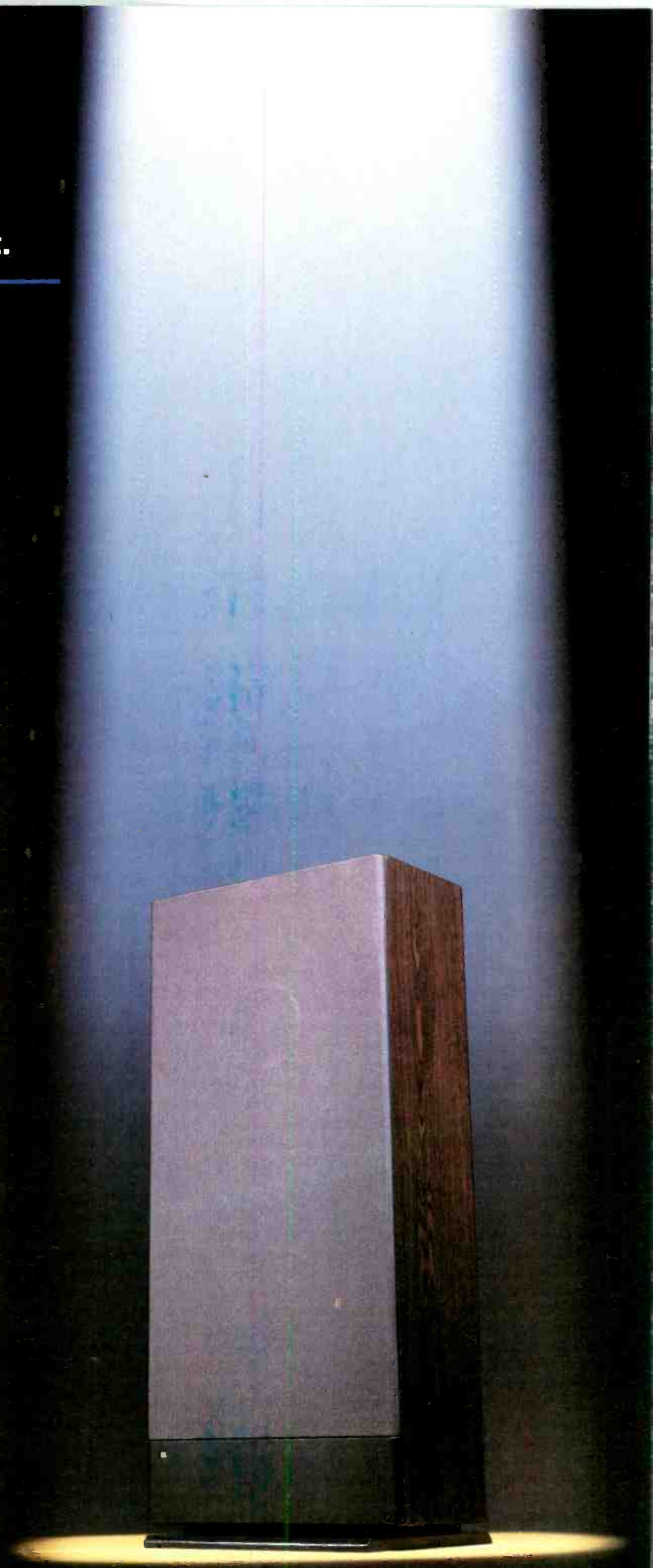

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6

AZDEN WMS-10 WIRELESS MICROPHONE

Manufacturer's Specifications

Transmitter

Transmission Frequencies: 49.830 and 49.890 MHz.
Modulation System: FM.
Microphone: Electret condenser, 5 mm diameter.
Maximum Input Level: 94 dB SPL at 3.3 kHz.
Field Strength: 10,000 μV/meter (10 mV/meter) or less, at 3 meters.
Battery: One AA (MN-1500), 1.5 V (not included).
Power Consumption: 27 mA.
Battery Life: Approximately 20 hours.
Dimensions: Microphone, 5/16 in. diameter × 11/16 in. long (8 mm × 17 mm); transmitter, 3¼ in. H x 2½ in. W × ⅞ in. D (83 mm × 63 mm × 22 mm); cord, 1/10 in. diameter × 39⅜ in. long (2.5 mm × 1 meter).
Weight: 3.9 oz., including battery.

Receiver

Circuit Type: Double superheterodyne.
Reception Sensitivity: 2 μV/meter.
Outputs: Monitor, 0.6 V at 10 ohms; microphone, 3 mV at 300 ohms.
Battery: One 6F22 (MN-1604), 9 V (not included).
Power Consumption: 20 mA.
Battery Life: Approximately 20 hours.
Dimensions: 5 11/16 in. H × 3 in. W × 15/16 in. D (145 mm × 77 mm × 24 mm).
Weight: 6.7 oz., including battery.

General Specifications

Accessories Supplied: Windscreen, earphone, transmitter carrying case.
Price: $150.
Company Address: 147 New Hyde Park Rd., Franklin Square, N.Y. 11010.
For literature, circle No. 95

The Azden WMS-10 wireless microphone system includes the WM-10 transmitter and the WR-10 receiver. Both are battery operated, as their intended use is with a video camera. Other applications may include sound reinforcement, the recording of speakers who move about, and amplification of vocalists in amateur musical shows. Interviews can be amplified or recorded by using two systems set to each of the two selectable radio frequencies. This review concentrates on these purely audio applications. I have excluded amplification of rock-music vocals as a suggested application because of the 94-dB limit on SPL. However, since audio distortion is tolerated in this art form, an enterprising rock vocalist might still want to try the WMS-10. In addition, the Azden should not be considered a substitute for a costly professional wireless system in critical applications such as professional stage shows, where a 49-MHz system is not proper because of possible interference and noise.

The WMS-10's low power drain means that its batteries will last a very long time. The receiver is designed to mount directly onto a video camera (where lights would otherwise be mounted), so the audio-only user will have to improvise.

The camera mount can be detached, and the lightweight unit can easily be affixed to other equipment with tape or with the Velcro panel supplied by the manufacturer. The transmitter easily fits into a pocket or clips to a belt. The lavalier microphone is permanently wired to the transmitter, so there are no connectors to get out of order. The transmitter has a built-in, telescoping antenna. This improves reliability: I find that users of professional body-pack transmitters with wire antennas often curl up the antenna wire, making transmission weak. The mike clips to clothing and has a windscreen for outdoor use. (For those who prefer detachable mikes, Azden now offers the $175 WMS-20, identical to the WMS-10 except that it comes with detachable hand-held and clip-on microphones.)

Measurements

A plot of impedance versus frequency of the receiver's microphone output is shown in Fig. 1. Up to 5 kHz, it is close to the specified nominal value of 300 ohms. The impedance does not change when the transmitter or receiver is turned off, which suggests that the output is terminated with a resistor. The roll-off at high frequencies suggests that the output is also terminated in a shunt capacitor, perhaps serving as an r.f. filter. These impedance characteristics are suited to many recorders and mixers having low-impedance inputs. For connection to three-pin inputs, which may not work with an unbalanced source, I suggest that you purchase a 200:200-ohm microphone isolation transformer from a reliable manufacturer such as Jensen. Mount it in a steel box with a three-pin male output jack and two ⅛-inch input jacks. The extra jack could serve as an output to a recorder.

I used an isolation box for my listening tests, but for the lab tests I connected the mike to a preamp with an unbalanced input. Figure 2 shows the frequency response of the system, which, owing to the small microphone, varies little with axial (0°) or side (90°) orientation. The microphone is, of course, omnidirectional. Since in normal use the mike faces upwards to the mouth, the axial response is the appropriate measure. Noting the roll-off above 2 kHz, I removed the windscreen, which is glued to the cap. (Unscrewing this cap exposes a tiny electret cartridge.) I then retested the response and found little change. Inexpensive electret elements of this size have flat response to 8 kHz or higher, so I assume that the smooth-sloped roll-off here results from a flat cartridge plus an RC roll-off in the system. FM modulation and detection has many complications, so this response may be a trade-off Azden made in order to design a simple, low-cost system.

Next, I measured the radio-frequency accuracies of transmitter and receiver. Transmitter frequencies were measured using a 225-MHz Hewlett-Packard counter. Receiver frequencies were measured by monitoring the frequency of an H-P 608 signal generator with the counter, while tuning for minimum receiver noise. (The generator is AM only and was used with no modulation.) For the transmitter, I measured an error of 0.00064% at each of the two transmitting frequencies; for the receiver, I measured errors of 0.00920% at 49.830 MHz and 0.00020% at 49.890 MHz. I usually allow an error of ±0.01% for equipment that has been in use for a while, to allow for crystal aging. A crystal when new may have a tolerance of 0.005%. The receiver's error at 49.830 MHz is significantly larger than the other errors and attracts attention, but the other errors are very small. This system was used a few times before testing, and the 0.01% rule-of-thumb tolerance, I think, is appropriate.

Harmonic distortion was measured to establish the overload SPL of the system. I used a 2-inch precision sound source which has low distortion at the frequencies tested. The results are shown in Table I. At 500 Hz, the frequency region where the SPL of voices is highest, the maximum input is 91 dB. This represents fairly loud speech at 6 inches, which is the average distance of a lavalier microphone to a speaker's mouth. It is adequate performance for

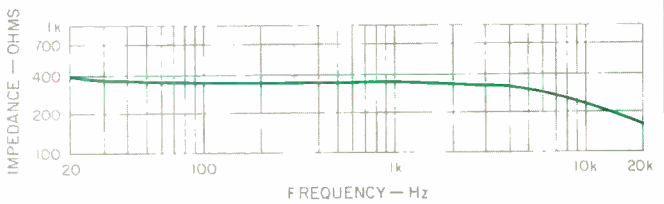

Fig. 1—Receiver output impedance vs. frequency. Impedance at 1 kHz is 340 ohms, whether receiver or transmitter is on or off (see text). Impedance scale is logarithmic.

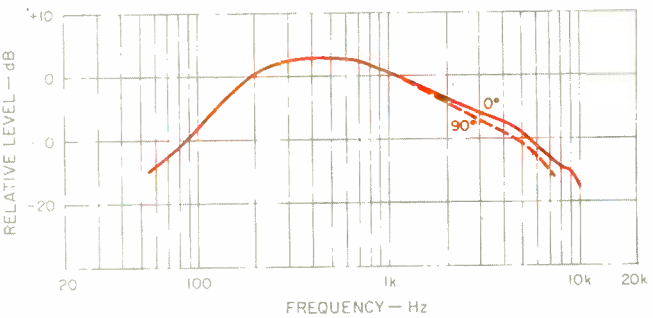

Fig. 2—Frequency response of system (microphone, transmitter, and receiver) at 0° and 90° from microphone axis. Levels shown are dB re: −56 dBV/Pa.

Table I—Overload thresholds (see text).

Freq. (Hz)	SPL (dB)	Receiver Output (dBV)	THD (%)
500	87	−61	1.0
500	91	−57	3.0
1k	85	−63	1.6

The system's noise is satisfactorily low at transmission distances of up to 24 feet, where dynamic range is 50 dB.

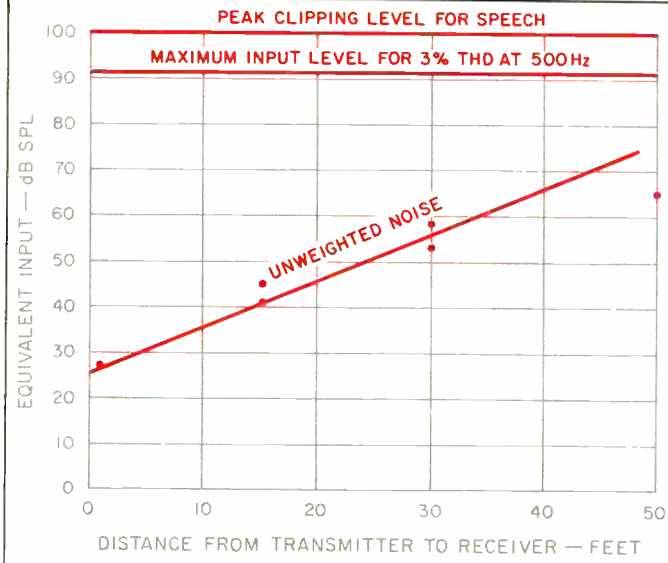

Fig. 3—S/N and dynamic range for a typical range of transmission distances. Dual data points at 15 and 30 feet indicate signal variations due to room reflections; as a result, the linear noise curve shown here is an approximation (see text).

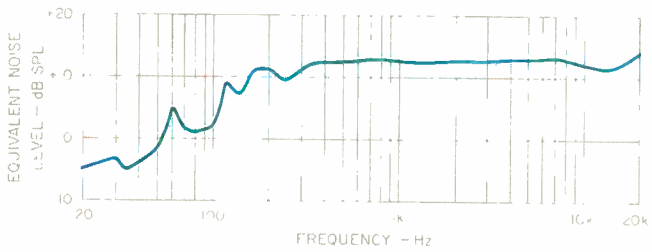

Fig. 4—Noise spectrum (⅓-octave band) of system. The noise curve reaches a peak at 23 kHz (not shown). Peaks at 60, 120, and 180 Hz are probably due to hum pickup in the test system.

a consumer-grade system which does not have a gain control on the transmitter or an a.g.c. circuit to level out the peaks from loud talkers. On an oscilloscope, I observed that speech peaks clipped at −4 mV, corresponding to a peak SPL of 100 dB. Thus, I think the system meets its specified 94-dB maximum.

Next, I tried measuring the unweighted receiver noise level with the transmitter at distances from 6 inches to 50 feet, which is possible in my laboratory without any intervening obstacles. This is not a very precise measurement, of course, because of up and downs in the signal due to room reflections, much the same as with sound. At the 49-MHz frequency used by this microphone system, signal nulls within a room tend to be spaced several feet apart. Professional wireless mikes, operating at much higher radio frequencies, suffer from more closely spaced nulls; most professional systems therefore use diversity reception to get around the problem.

Figure 3 shows the results of my noise measurements, with input overload data added to show the available dynamic range. The dual data points show the range of uncertainty caused by signal reflections; the straight line I have fitted to the data points, which rises about 1 dB per foot of increased distance, is therefore just an approximation. Furthermore, Azden says it has improved the transmitter circuit since this sample was made.

The noise level is very low at a few inches; to make that measurement, the transmitter had to be placed in the sound-retardant box I use for microphone noise measurements. The A-weighted noise level with the system closely coupled in this fashion is equivalent to 24.5 dB SPL, similar to that of many professional condenser mikes. The noise of the system, while increasing with distance, is satisfactorily low at distances up to 24 feet, by which point the dynamic range is 50 dB. This, I think, is adequate for a system where the receiver is portable and may be set up close to the transmitter. (The transmitter power is limited so as to meet FCC regulations.)

Figure 4 shows the curve of ⅓-octave-band noise levels versus frequency. It is quite uniform, indicating a nearly "pink" noise characteristic. The peaks at 60 Hz and its harmonics are, I think, due to hum pickup in my test leads.

Wind and "pop" noise seem adequately low for most outdoor uses. Magnetically induced hum is virtually nonexistent. Rubbing noise can be a problem with lavaliers, but the Azden had slightly less of this than my RCA BK-12A (see below), and so is satisfactory.

Use and Listening Tests

In all listening tests, the receiver was connected through my isolation box to a sound-reinforcement system in the basement auditorium of my church. I found the WMS-10 to be a very good substitute for a wired lavalier mike in amplifying a lecture series by a college professor who walked about and operated two slide projectors as he spoke. (The wired lavalier was impossible, as the professor tripped over the cable and the mike landed on the floor.) In this room, I was able to put the receiver about 40 feet away, at the sound rack in the rear of the room. By listening to the receiver through the earphone, I was able to reorient its antenna as the professor moved around, thus maintaining the noise level below that which would have been noticeable to the audience. Of course, in sound reinforcement an S/N of 30 to 40 dB is okay.

I noticed a lack of treble response right away, compared to the wired mike, because the latter was an RCA BK-12A

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The WMS-10 proved that in some applications a wireless mike with less than ideal frequency response is better than an ideal wired mike.

dynamic which I designed to have a rising response to compensate for the treble loss encountered in lavalier use. The BK-12A has a rise of more than 5 dB at 3 to 4 kHz. However, I found that by turning up the treble control on the old RCA tube amplifier in the system, I was able to attain reasonably natural-sounding speech, and the noise was not noticeably increased.

Later on, I used the WMS-10 at monthly meetings of a seniors' group in the same hall. I started to notice some hiss with maximum treble equalization, so I moved the receiver to the stage, along with the isolation box, and connected its output to a nearby house-mike jack. With the working distance reduced to 15 to 20 feet, there was no audible hiss when the talkers moved about. I thought these meetings were very critical tests because many of the senior listeners no doubt had some hearing loss, and some wore hearing aids (which are difficult to use effectively in auditoriums). I did not have a single complaint. On the contrary, I was asked to set the mike up each month until the summer break provided relief from this unintentionally assumed new duty.

All of this taught me that, in these lecture applications, a wireless mike with less than ideal frequency response is better than a wired mike with ideal response. (I also learned much about archaeology, sailing, travel, and dishes found on old trains.) Many of the modern electret "mini mikes" are designed with flat rather than peaked response, probably because they are also used for nonlavalier applications. Many users do not add the needed equalization, so we are getting used to a slightly muffled sound with lavaliers. In contrast, the ball-end, hand-held vocal mikes which are popular today typically have a rising response which would be ideal for lavalier use!

I think that the smooth roll-off of the WMS-10 will be easy to equalize with controls found on modern mixers and amplifiers. Those using it with recorders without equalizers will no doubt notice a muffled sound. I hasten to note that the frequency response of the Azden mike is very similar to the optical soundtrack response of a good-quality 16-mm film projector, according to my tests. The Azden, as well as the 16-mm systems, would have increased hiss if the response were made flat.

Last, but far from least, I found that no interference of any kind was heard on the Azden during these many hours of use. This performance was impressive. If any interference had been heard, I don't think I would have been asked for all of those encores. Of course, I do not know what would be encountered in other locations.

The WMS-10 is an extremely handy system, and I highly recommend it for any voice pickup situation where a wired mike is inconvenient, and where economics do not permit an investment of $1,500 to $3,000 for a professional-grade wireless microphone system. *Jon R. Sank*

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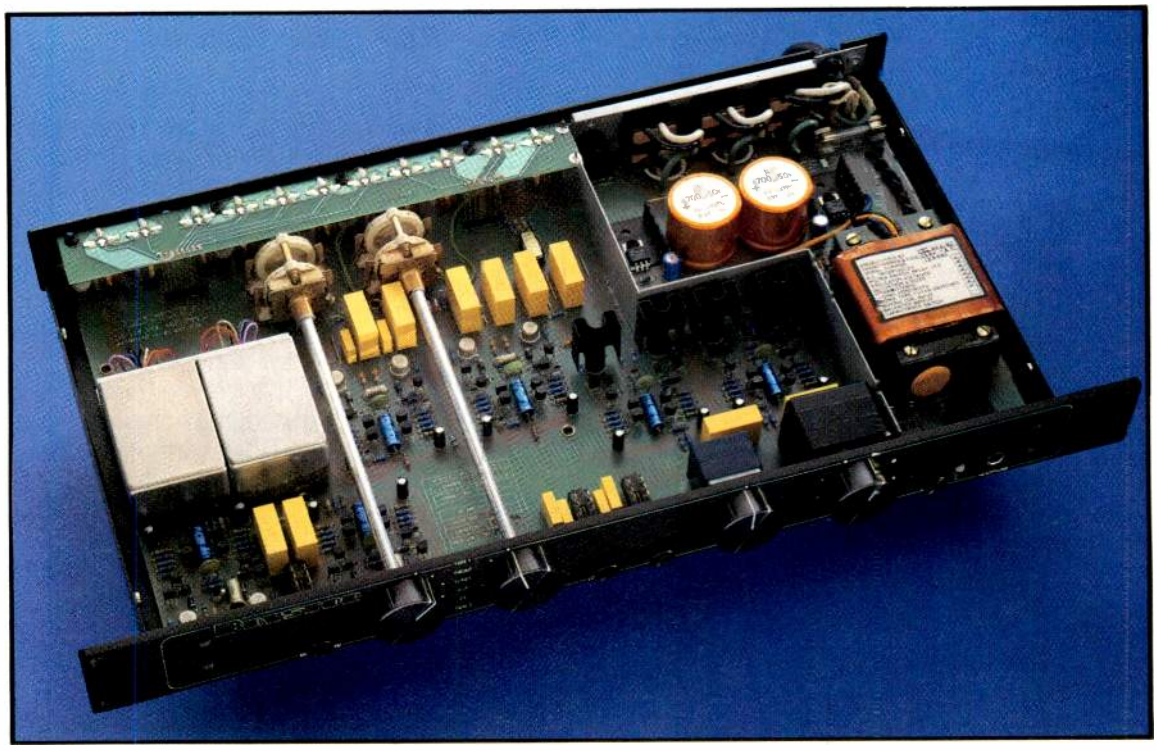

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CHALLENGING DESIGN.

HOW BOB CARVER CREATED A NEW MAGNETIC FIELD AMPLIFIER WITH THE SOUND CHARACTERISTICS OF A $3000 MODEL, SATISFIED SOME OF THE WORLD'S MOST HIGHLY TRAINED AUDIO EARS... AND HOW YOU CAN OWN HIS DESIGN FOR UNDER $500.

Bob Carver's newest Magnetic Field Amplifier is sending shock waves through the staid audiophile world. Because it won a challenge that no other amplifier designer could even consider.

The M-1.0t was judged, in extensive listening tests by one of America's most respected audiophile publications, to be the sonic equivalent of a pair of legendary, esoteric mono amplifiers which retail for over fives times as much.

A DESIGN FOR THE CHALLENGE OF MODERN MUSIC REPRODUCTION.

Before you learn the fascinating details of Bob Carver's unprecedented feat, let's consider the final product of that challenge. An amplifier design which stands on its own merits in any case, with astonishingly high voltage/high current output and exclusive operation features. An amplifier for the demands of compact digital discs, VHS Hi-fi and other wide dynamic range playback media.

THE M-1.0t:

- **◊ Has a continuous FTC sine-wave output conservatively rated at 200 watts RMS per channel into 8 ohms from 20Hz to 20kHz with no more than 0.15% THD.**
- *◊ Produces 350-500 watts per channel of RMS power and 800-1100 watts peak power for transients. (8 ohms and 4 ohms respectively).*
- *◊ Delivers 1000 watts continuous sine wave output at 8 ohms in bridging mode without switching or modification.*
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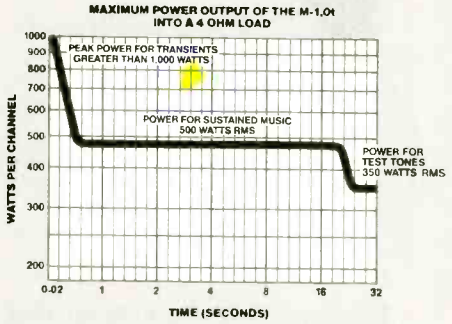
POWER FOR THE CHALLENGES OF MUSICAL WAVEFORMS.

The rating differences between the M-1.0t's FTC and Carver's continuous



The Carver M-1.0t delivers massive power at all important output levels.

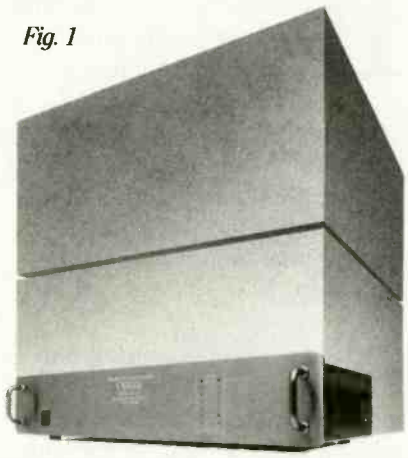
RMS power reserves represent Bob's insistence that electronic designs should address real world problems. He reasoned that the M-1.0t must excel at reproducing those types of power waveforms that are most essential to music's stunning impact and realism.

First there are the instantaneous peak transients – the sudden individual attacks of each musical note which demand a tremendous amount of amplifier power. While these waveforms last less than 1/100 of a second, they form the keen edge of musical reality.

Next come combinant musical crests of demand from multiple instruments and their harmonics. These longer-term power demands usually come and go in less than a second, yet can tax all but the most powerful amplifier.

Thus, even at 8 ohms and at extremely high output current levels, the Carver M-1.0t not only delivers over 800 watts of peak power for momentary musical transients, but can provide over 350 watts RMS of long-term power for demands lasting up to 20 seconds. More power, more current and more voltage than any other comparably-priced amplifier.

Fig. 1



Two distinctively different approaches to sonic excellence.

THE MAGNETIC FIELD AMPLIFIER VS. CONVENTION.

Audiophiles, critics and ultimately other manufacturers have accepted

the wisdom of Bob Carver's innovative approach to delivering power in musical terms. Yet only Carver has so elegantly translated theory into practice.

Figure 1 shows the new Carver M-1.0t Magnetic Field amplifier. It weighs 20 pounds and runs cool to the touch. Behind it is the outline of the *pair* of legendary mono amplifiers you'll read more about below. Even individually, they can hardly be lifted and demand stringent ventilation requirements. And yet, according to some of the most discriminating audiophiles in the world, Bob's new design is their sonic equal.

The ultimate secret lies in the patented Magnetic Field Coil (figure 2) employed in the Carver M-1.0t. Instead of increasing cost, size and heat output with huge storage circuits, Magnetic Field Amplification delivers its awesome output from this small but powerful component. The result

Fig. 2

A single Magnetic Field Coil supplants traditional heavy power supplies.

is a design capable of simultaneous high current and high voltage. A compact cool-running design that fills your room with sound, not bulk.

CARVER'S GREAT AMPLIFIER CHALLENGE.

On the merits of its enviable specifications and features alone, the M-1.0t could easily have become another industry benchmark of power, accuracy and economy.

But Bob is never satisfied. He felt that his fifth Magnetic Field Amplifier design should be even more remarkable.

So last year, he made a bold offer to the editors of *Stereophile Magazine*, one of America's most respected audiophile publications. He claimed that he could make special modifications to his new amplifier design which would enable it to sound EXACTLY like any high-priced, esoteric, perfectionist amplifier (or amplifiers) the editors could choose.

Moreover, his design work would not happen in his Lynnwood, Washington laboratory, but in a motel room near *Stereophile's* offices in New Mexico. And would match the M-1.0t's final sound to any contender in *48* hours!

As the magazine put it, *"If it were possible, wouldn't it already have been done? Bob's claim was something we just couldn't pass up unchallenged."*

Out of respect, ethics (and even a little bit of awe), neither *Stereophile Magazine* nor Carver will divulge the name of the legendary "world class" mono vacuum tube amplifiers that were selected as the M-1.0t's contender.

Suffice to say that what transpired in the next 48 hours is high fidelity history. It makes great reading in *Stereophile*, Vol. 8, No. 6, or in the reprint we'll send you on request.

MUSIC IS THE FINAL PROOF.

The *Stereophile* evaluation team was admittedly skeptical (*"We wanted Bob to fail. We wanted to hear a difference"*). They drove both amplifiers with some of the finest components in the world. Through reference speakers that are nothing short of awesome.

But it was their ears and carefully selected music ranging from chamber to symphonic to high-impact pop that led them to write, *"...each time we'd put the other amplifier in and listen to the same musical passage again, and hear exactly the same thing. On the second day of listening to his final design, we threw in the towel and conceded Bob the bout. According to the rules... Bob had won."*

The inquiring audiophile can't help but wonder if M-1.0t production models will sound as good. Ask the man who designed it. "I promise they will sound exactly the same. And just as good. In fact, I stake my reputation and that of our company on it."

SHARE THE CHALLENGE AND THE VICTORY.

The real winner is you. Because you can own world class, superlative electronics at reasonable prices by visiting your nearest Carver dealer. Compare the new M-1.0t against any and all competition. Including the very expensive amplifiers that have been deemed the M-1.0t's sonic equivalent. But even if you can't make that comparison, you won't be surprised when the M-1.0t lives up to every other claim made in this ad.

What you will be surprised at is just how affordable this much power, musicality and accuracy can be.

SPECIFICATIONS: Power, 200 watts/channel into 8 ohms 20Hz to 20KHz, both channels driven with no more than 0.15% THD. *Long term, sustained RMS power,* 500 watts into 4 ohms, 350 watts into 8 ohms. *Bridged Mono RMS power,* 1000 watts into 8 ohms. *Noise,* -110dB IHF A-Weighted. *Frequency Response,* +0-3dB 10Hz-100KHz. *Slew Factor,* greater than 200. *Weight,* 20 lbs. *Finish,* light brushed anthracite, anodized.

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MICHAEL TEARSON
JON & SALLY TIVEN

COMPETITIVE EDGES

Photograph: ©1984, Ebet Roberts

Eat 'Em and Smile: David Lee Roth
Warner Bros. 25470-1, $8.98.

Sound: B+ Performance: A

5150: Van Halen
Warner Bros. 25394-1, $8.98.

Sound: C Performance: B+

As soon as the dialog with Steve Vai's talking guitar begins on *Eat 'Em and Smile*, you know David Lee Roth is still in business as the prince of hyperbolic salaciousness. Now he's stepped out with a dynamic new band that roughs up the edges of the classic pop-metal quartet sound that he rode to fame.

Roth (abetted by ex-Van Halen producer Ted Templeman) continues to cultivate the cynical, self-conscious vocal style we've come to expect, with camp cabaret ("That's Life"), raucous covers ("Tobacco Road"), and trademark yelps and squeals ("Going Crazy"). If you enjoy Roth, it's probably more for his entertaining histrionics than for his vocal range or metaphysical lyrics.

But the real smiles will come from the band. Zooming around and neatly enveloping Roth's voice are whinnying sonic effects—stunning technique, not electronics—from cowriter and brilliant ex-Zappa guitarist Steve Vai. "Shyboy" and "Ladies' Night in Buffalo?" are Vai highlights, but his diverse textures and sense of humor crawl all over this disc.

Pumping hard underneath are the steady skinsman Greg Bissonette and youthful bass legend Billy Sheehan, whose brief, demon-speed solo and duet with Vai on "Elephant Gun" would be reason enough to hear this record.

After listening to the sizzling musicianship on *Eat 'Em and Smile*, one can't help but wonder if the album title relates as much to Roth's former band-mates as to the suggestive packaging graphics. Even if it were nothing else, *Eat 'Em* would be a shining testimony to the virtue of competition.

Michael Wright

Now, what about the new version of Van Halen? To say that Sammy Hagar is a major improvement over David Lee Roth is like comparing apples and oranges—Sammy is a singer/musician, while David is a personality. Sammy's contribution to Van Halen is musical in nature, while David Lee Roth—the frontman, the mouth—contributed image without substance. The real question is, can Van Halen become a musical experience?

If you were to listen only to side one of *5150*, you'd swear that they didn't even try. The formula of trashy jams with inane (and sexually obsessed) lyrics thrown on top is still the watchword of their faith, and you'd be right if you guessed that Sammy Hagar is doing a Roth impersonation. "Why Can't This Be Love" has its moments, but the rest of this side (with the possible exception of "Summer Nights") makes no attempt to be anything better than pre-1986 Van Halen at its most typical. It sounds like they came into the studio without songs, laid down some instrumental tracks, and came back later to graft some vocals onto the non-songs. Completely unimpressive, stock stuff.

But on "Best of Both Worlds" they suddenly flip on their "music" switch. Hagar's got a voice, and it's not always the same, and it almost has a (gasp) soulful quality to it. Despite what Yngwie and Ratt have laid down lately, Eddie Van Halen does on guitar what he does better than any of his imitators, and his keyboard playing has also gained a notch or two in subtlety. Too bad the cut that closes the record, "Inside," threatens to destroy whatever credibility the group has built up on the previous four songs.

As for the sound of the record, let us say that the recording of the guitar and keyboard parts are impeccable. But on drums, the production—recording, tuning, outboard effects, and dynamic range—is even worse than on previous albums. The toms, snare, and bass drum all are reduced to thuds with very little tonal difference among them. The cymbals and hi-hat are loud, full of treble, and they obliterate the rest of the kit. Surely there isn't another band in all of hard rock with a worse drum sound! The bass is occasionally heard, never loudly, and Hagar's vocals are well recorded but hardly "produced." Mick Jones (Foreigner's guitarist/songwriter/producer) handled the produc-

Photograph: ©1986, Ebet Roberts

tion in conjuction with engineer Donn Landee and the band.

But aside from this one complaint, Van Halen is showing signs of becoming more than just another soundtrack playing behind two million teenagers in the throes of becoming intoxicated.

Jon & Sally Tiven

The Bridge: Billy Joel
CBS OC 40402.

Sound: B Performance: B

Recently, Billy Joel was reported as saying that he is interested in trying his hand at writing tunes for Broadway. He doesn't have far to reach, and it sounds like it will be Broadway's gain rather than rock's loss. His songs are seamlessly crafted, appropriately arranged, and perfectly in tune with the latest trappings of pop culture. His mastery of the form, however, is forcing him into another class, since a lot of what keeps rock alive is its rough edges. From the homogenized ska of the opening cut to the funkless vehicle for Steve Winwood's valiant Hammond organ solos, *The Bridge* coasts along like the Disneyland pirate ride that you know darn well is firmly attached to an invisible track. Don't get me wrong; the songs are all good, and the three duets are great. There's just no real suspense anywhere.

Cyndi Lauper, who co-penned the lyrics for "Code of Silence," gets to add her voice to the catchy tune about bottled-up emotion. Most amazing is Joel's duet with Ray Charles, whom Joel has idolized and emulated for years (his young daughter is named after the legend). "Baby Grand" is made-to-order for Charles; as he and Joel trade off verses, it becomes apparent that the song is as much a tribute to the singer as to its subject, Joel's favorite piano. *Susan Borey*

Knocked Out Loaded: Bob Dylan
Columbia OC 40439.

Sound: C– Performance: C+

What a curious album this is, even for Bob Dylan! These eight selections come from at least four different recording situations, involving different locations and wildly differing sidemen. Aside from Bob himself, the only constant is the black female gospel chorus which appears on all tracks. Although engineers and locations are listed, they are not matched to specific selections. In addition, there is no producer credit at all.

Three songs are covers. "You Wanna Ramble" is a Junior Parker oldie that, from the sound of the guitar line, might have been the model for "Obviously 5 Believers" back on 1966's *Blonde on Blonde*. Al Kooper, who appeared on *Blonde*, returns to add keys here. "They Killed Him" is a powerful Kris Kristofferson song, a tribute to such martyrs and men of peace as Gandhi, Martin Luther King and Jesus Christ. "Precious Memories" is a traditional hymn given a bit of reggae treatment.

Of the originals, the most interesting are the three collaborations that fill up side two. "Got My Mind Made Up" is a full-throttle rocker written with Tom Petty and performed with Petty and The Heartbreakers. "Under Your Spell" was composed with Carole Bayer Sager (talk about odd couples). It is a lovely love

Rod Stewart's new album is poorly recorded, and his writing has slipped another notch. "Love Touch" is the only thing that saves it.

song, the one here most likely to be covered by another artist down the line. With Sam Shepard, who has known Dylan since their Greenwich Village days, Bob has delivered "Brownsville Girl," a rambling, 11-minute narrative about Gregory Peck movies, among other things. It is as picaresque as "Tangled Up in Blue" but not nearly as focused.

Knocked Out Loaded is about equally far from Dylan's worst as it is from his best. Not at all a unified album, it has a patchwork feel of odds and ends falling togther. It is far more fun to listen to than I expected it to be, but I think it's time to slap *John Wesley Harding* or *Blonde on Blonde* on for a spin. *Michael Tearson*

Rod Stewart
Warner Bros. 25466-1, $8.98.

Sound: D Performance: C–

The single from this album, produced and cowritten by Mike Chapman, is the only thing that saves it from earning a pair of Fs—"Love Touch" is a nice little song, well sung and well produced. The rest of the album was produced by Bob Ezrin, who hasn't the faintest idea of how to record Rod Stewart's voice; it sounds like he was miked from the backside. Rod's somewhat at fault too, as his songwriting has slipped yet another notch, and the covers (which he sort of rewrote) are lame as well. Too often, singers are an odd lot—the ones most into "soul" are the first to lose it. *Jon & Sally Tiven*

Little Miss Dangerous: Ted Nugent
Atlantic 81632-1, $8.95.

Sound: C+ Performance: C

Do your profoundest emotions have their aural equivalents in the screeches, whines and grinds of machine shops and the fusillades of Gatling guns? Does your usual interior monologue consist of nothing but juvenile meditations on the dangers of women? If so, this is the album for you. In a field characterized by TNT dynamics and Mack truck sensibilities, Ted Nugent's relatively restrained arrangements and solos and his relatively large dynamic range are positive virtues.

Two of the songs here were written and recorded for *Miami Vice*: "Angry Young Man" is notable for changing midstream from a catchy riff set in a spacious groove, to grinding power chords, to a whining solo, to a funky bass break, and then back to power chords and an anthemic caveman chorus. "Little Miss Dangerous" has a clean, deep mix wherein lots of brooding, natureless whammy bar and synthesizer provide the setting for Nugent's singing of archetypically laughable lyrics. Another notable song, "Crazy Ladies," brings to mind a hyper-manic Led Zep and includes the sounds of a barking dog and a motorcycle. Fans of fine art, beware!
Susan Borey

True Blue: Madonna
Sire 25442-1, $9.98.

Sound: B+ Performance: C+

Unlike many critics, I actually liked *Like a Virgin* far more than I expected or wanted to. With its bracing wit, that album soundly put the lie to the image of Madonna as an empty-headed disco diva.

There is much less of that wit in *True Blue*. It can be found in "Papa Don't Preach," the first single, with its story of a pregnant teen-age girl and the father who coldly refuses to help her. "Open Your Heart" doesn't pack the same punch, but it is an ingratiating number with memorable hooks that make it another likely smash. Beyond these, the songs are a pretty ordinary lot. "True Love" and "Jimmy Jimmy" are partly throwbacks to such '60s girl groups as The Chiffons and The Shangri-Las, respectively, while "La Isla Bonita" infuses a touch of Latin heat.

Production—by Madonna, with collaborators Stephen Bray and Patrick Leonard—is fine. The album's sound is very lively and invigorating; it grabs your ear, and it works terrifically on the dance floor.

Face it. The lady's on a roll, and *True Blue* is a sure bet to continue it. Madonna may not be your personal cup of tea, but it is impossible to deny her potent appeal. Her records come out as ready-made hits, playing right to the fantasies of millions. *Michael Tearson*

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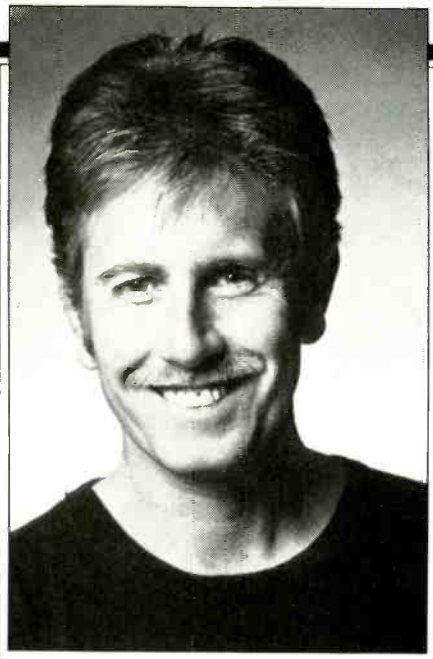
Though Graham Nash's lyrics for *Innocent Eyes* are trivial, they're definitely improved over the pseudo-profundity of his earlier work.

Innocent Eyes: Graham Nash
Atlantic 81633-1, $8.98.

Sound: C Performance: C

Though his issue-oriented, folky, organic homespuns have been swapped for digital art and synthetic sound, Graham Nash's product remains, underneath, what it always was—slightly better-than-average, lyrically fluffy, musically cloying pop. The gentlemen who have hit with this kind of stuff, folks like Men at Work and Phil Collins, are the people whom Nash, in his new '80s wraps, most resembles. Like theirs, his lyrics are trivial, though for Nash this is a definite improvement over the pretentious pseudo-profundity of his earlier work. Also like theirs, his instrumentation is thoroughly modern at the expense of warmth and human feeling—only more so. On song after song—whether disco, rock, or reggae—a relentless, swingless, drum-machine dance beat orders us to dance for no reason. Neither in arrangement nor in recording was much allowance made for silence—that ingredient without which music becomes oppressive.

Susan Borey



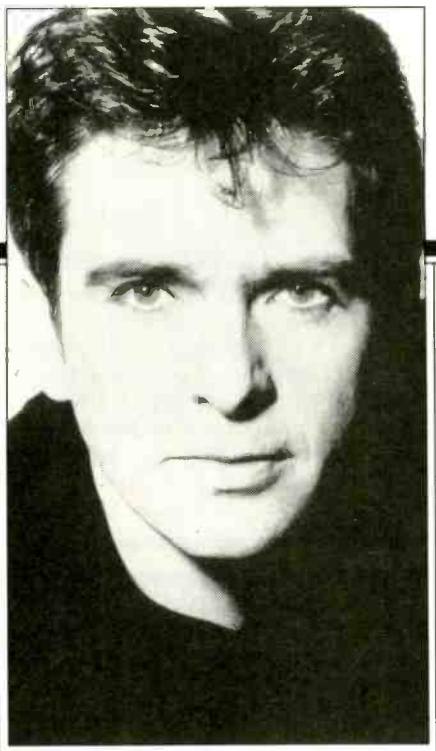
Press to Play: Paul McCartney
Capitol 12475, $9.98.

Sound: B+ Performance: C

First, the good news: The bass guitar work on this album (by Paul, natch) is really something special. And producer Hugh Padgham's sounds are quite lovely. It's nice that Paul is back on Capitol; his records for Columbia were not nearly as good. That's it, folks; it's all downhill from here.

You've no doubt heard the first single by now, and the gooey lyrics make you long for the days of those McCartney classics such as "Spies Like Us." This is not one of his better records—in fact, it's really difficult to see how he could consider it *finished*. The lyrics are at best nonsensical, often downright bad, and hardly the kind of thing you would expect from a man of Paul's experience.

It's a sad affair when the latest Mike & The Mechanics single ("Taken In") resembles classic McCartney to a



Peter Gabriel's music has been stripped of fat and pared to the essentials; barely a note is given away lightly.

greater degree than anything on *Press to Play*. Paul can do better, and no doubt he will. One can only hope this album is soon forgotten.

Jon & Sally Tiven

So: Peter Gabriel
Geffen GHS 24088, $8.98.

Sound: B Performance: A–

It has been too long between albums for Peter Gabriel, a man who, from his earliest days as Genesis' front man, has been a remarkable performer unafraid of taking risks and growing more complex. The peak of Gabriel's complexity came with *Security*, his previous studio effort issued more than three years ago, an album teeming with polyrhythms.

For *So*, Gabriel has streamlined his recording style to get to a supple, powerful core. The effect is reminiscent of what the equally mercurial David Bowie risked and achieved on his fabulously successful *Let's Dance*. Some of the credit for the sound of *So* must go to coproducer Daniel Lanois, fresh from his work with U2 on *The Unforgettable Fire*. Gabriel's music has been stripped of fat and pared to essentials; barely a note is given away lightly in this excellent production job.

The songs on side one keep coming back to a common theme, the ramifications of love and commitment. Among them are "Sledgehammer," a satire of the macho posturing of much R&B, with a lot of Motown in its sound; and "Don't Give Up," featuring Kate Bush's voice with Peter's in a song about a man whose friends and loved ones pull him back from the brink. Noteworthy on side two are "Big Time," a fun, bouncy song about the insatiable drive for success, and the finale, "We Do What We Are Told," which is rather scary and brooding. On the cassette and CD there is an extra cut, a new version of a song Gabriel and Laurie Anderson wrote and recorded for Laurie's *Mister Heartbreak*. The new version, too, is a duet.

So is a very satisfying album. The cerebral touches which Gabriel's devotees have come to expect are still there, but subtly. What could not be anticipated is the disarming directness and immediacy of the project.

Michael Tearson

Strange Land is even better than Box of Frogs' last album. This is the best work any of its members have done lately.

Strange Land: Box of Frogs
Epic BFE 39923.

Sound: B+ Performance: B+

Last time around, these guys were a Yardbirds reunion, but this time they're a home for unemployed British rock musicians. That's the great thing about the British rock scene—physical proximity allows you to get whomever you want for a record, there being no East or West Coast, just a couple of miles of London real estate. What we have here is a still-Yardbirdsian rhythm section: Paul Samwell-Smith on bass, Jim McCarty on drums, and Chris Dreja on rhythm guitar. The rest is provided by guitarist Rory Gallagher, vocalist Roger Chapman, guitarist Steve Hackett, and holdovers from the last album, vocalist John Fiddler and guitarist Dzal Martin. Graham Parker and Ian Dury contribute vocals on one track each, and James Patrick Page adds guitar, also (unfortunately) on only one cut.

Strange Land is actually better than the last B.O.F. effort, and that one was pretty durn good! The Frogs have managed to come up with an album that's competitive with the current pop market without having to neglect their blues/rock roots. There's a place for fuzz tones and psychedelic guitar doodling along with synth sweetening and some solid compositions, and producer Samwell-Smith should be noted for pinpointing it all with such style. Side one's synth bass opening and sampled snare hits indicate up front the modern nature of this production, which includes an even mixture of pop ("You Mix Me Up" isn't far from a Cars-type tune) and blues/rock numbers. The Frogs even have something that sounds like "Every Breath You Take" (which has been aped so often it's now a genre instead of a composition) and pull it off with considerable delicacy, especially considering the demonic tremolo of Graham Chapman's vocals. With its synth choral voices, chorused guitar arpeggios, and crisp snare mixed way in front, "Strange Land" is a spacious and atmospheric number that shows Mr. S-S to be no slouch at arrangement. Also listen to the all-new version of "Heart Full of Soul," with all the familiar hooks and lots of new console moves to create more dynamics for the ol' warhorse.

If this were a real group that toured and did all the stuff that most groups do, you'd say that they have a bright future. However, Box of Frogs is not about to take up the rock 'n' roll grind, and this recording excursion should be enjoyed as a one-off. A few more of these a year wouldn't do anybody any harm, though—it's the best work any of these folks have done lately, including Messrs. Page and Parker. It's as if the old geezers met in a pub and decided to have a blow for old time's sake, and in the process came out with the goods. *Jon & Sally Tiven*

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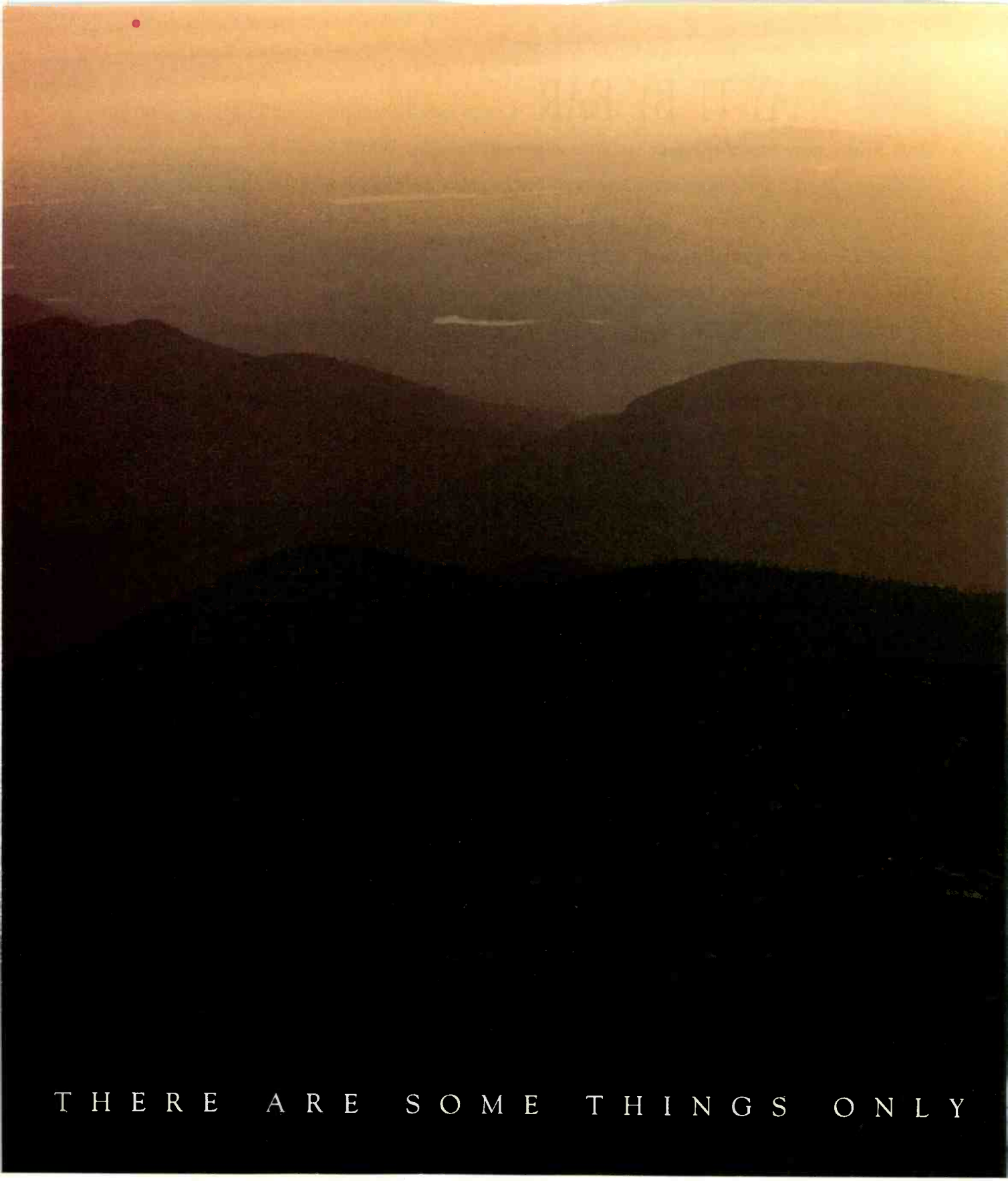

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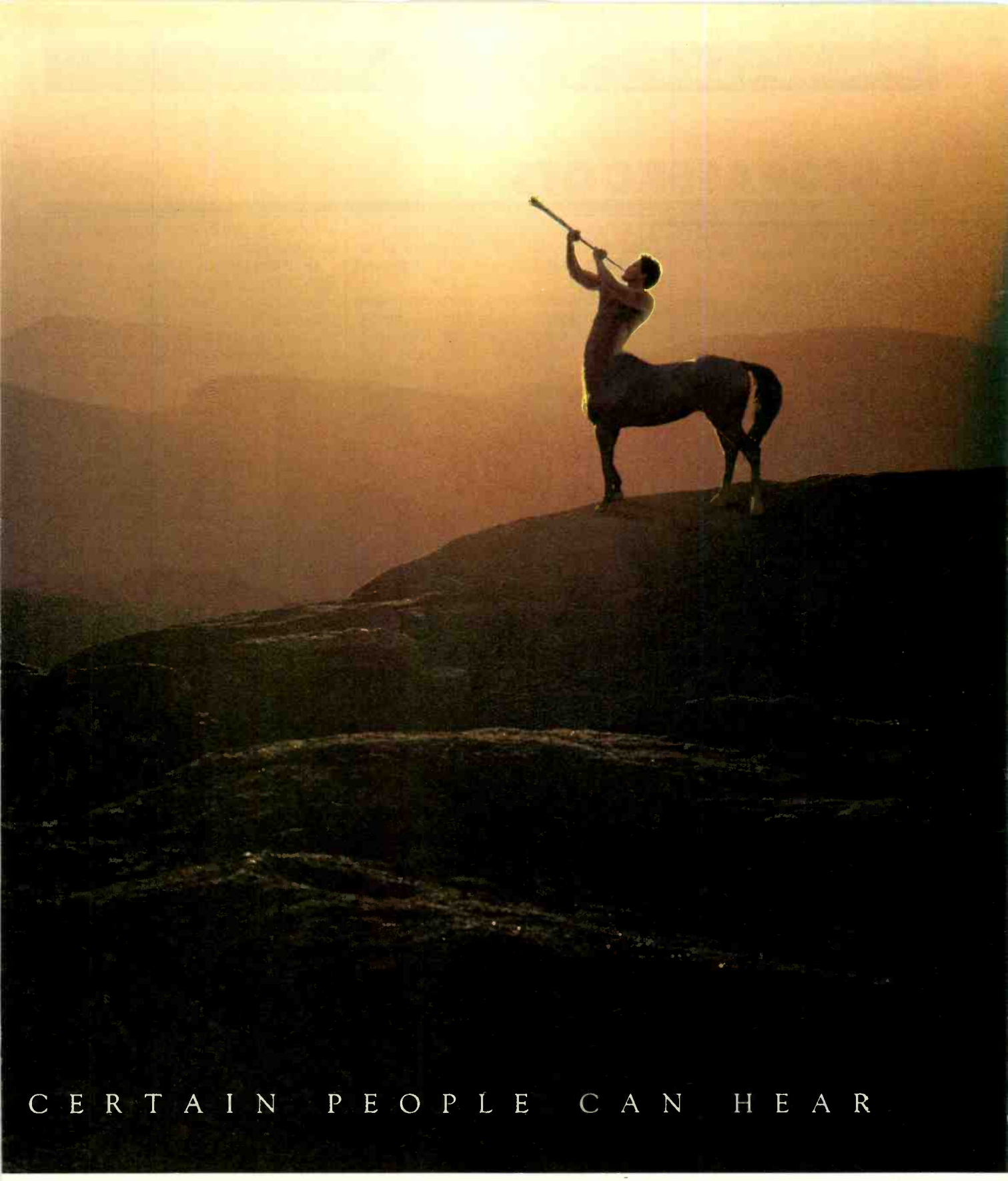

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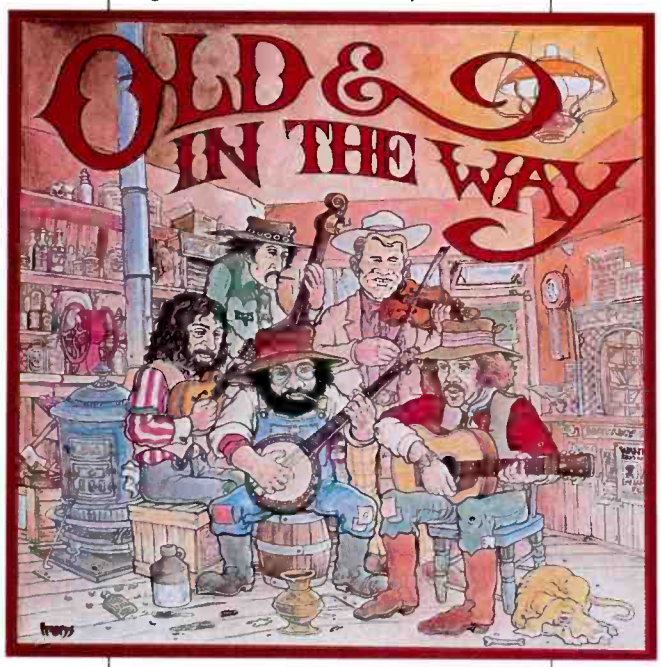
BLUEGRASSROOTS

Old & in the Way: Jerry Garcia, David Grisman, Peter Rowan, Vassar Clements, John Kahn
Rykodisc RCD 10009.

Sound: A Performance: B+

Psychedelia rediscovering its roots is the process that can be heard on this CD re-release of an all-star bluegrass jam. Originally recorded live in 1973 with mind-expanding clarity by famed chemist/Grateful Dead sound engineer Owsley Stanley, it's remarkable how good this concert sounds today. (It was released on Dead Headsman Jerry Garcia's Round Records label in 1975.) While dynamic range is slightly limited, compared to contemporary capabilities, the musical voices are astonishingly crisp and nicely mixed, with very little tape or audience interference. Band members are rock steady in aural location on a stage about five feet deep; the crowd noise extends the stage depth, astonishingly, between tunes.



Even more remarkable is how timeless the performance is. Garcia's creditable banjo ("The Hobo Song") and Grisman's facile mandolin ("Wild Horses") set the pace for Rowan's appropriately folksy, good-time vocals ("Panama Red," "Land of the Navajo"). Stealing the show, however, is the *extraordinary* fiddle of Vassar Clements, whose soaring improvisations personify beauty and grace in traditional American music ("Midnight Moonlight," "Kissimmee Kid").

Old & in the Way takes you back to a time when pop musicians were trying to recover the nonacidic sweetness of pure music that transcends time altogether. In the process, a good time is had by all! *Michael Wright*

Birds of Fire: The Mahavishnu Orchestra
CBS CK 31996.

Using the best technology of the time, The Mahavishnu Orchestra produced a clean, hiss-free sound with an unusually wide dynamic range. This is a Compact Disc re-release of an album that has definitely improved with age.

Strong contrasts of every imaginable kind highlight this brilliant album. Extremely distorted sounds slide past crystal-clear ones. Truly loud passages collide with nearly inaudible ones. The first sound you hear is a gong (in the distance), then the gong again (this time sent through a phaser), followed by an extremely distorted guitar (at low level) that overloads the circuit and breaks up as if the energy it contained were about to tear loose and rampage uncontrolled. Next, an electric harpsichord joins in. Finally, The Mahavishnu Orchestra's "real" instruments enter—loud, up front, and with clean, undistorted sound. The violin has an almost frightening edge in its tone. John McLaughlin takes off on a wild solo shortly thereafter.

Certainly that's a whole lot of activity for just the opening minute of an album, but *Birds of Fire* never loses that intensity. Even the quiet pieces simmer with barely restrained energy, and their instrumental colors add to the effect, as The Mahavishnu Orchestra sends signals through fuzz-tone devices or selects synthesized waveforms that have complex harmonic structures. For contrast, they also use simple, purely acoustic sounds to highlight the complex ones.

On the quiet side, "Thousand Island Park" offers a moment of repose in the middle of the album. Here the sonic character is natural and acoustical, as opposed to the electronic sounds in the previous track, "Sapphire Bullets of Pure Love." The production style in "Park" uses pristine, pure, undistorted sound, with a satisfyingly relaxed feeling of Blumlein-style miking. Acoustic bass and piano replace the electric bass and synthesizers.

"One World" has some truly quiet passages to contrast with the loud ones, providing the CD with an opportunity to display its dynamic range capabilities. Opening with a nearly inaudible roll on a snare drum, it quickly blossoms into another high-energy track, with Rick Laird's extended bass solo dancing vigorously over the propulsive accompaniment. Billy Cobham's virtuoso drum solo, where he plays multi-metrically, is a showcase of the complex rhythmic devices that are a major feature of the entire album.

At the beginning of " Open Country Joy," Jerry Goodman starts with a nostalgic violin solo. The quasi-country sounds carry just a whiff of new-mown hay—then whammo! Sudden joy breaks forth. Later, the violin returns, and Goodman's style almost becomes country fiddling. Here the sliding tones are quite different from the Indian melodic ornaments prevalent elsewhere on the album.

John McLaughlin's guitar work is outstanding. He soars and slides with joyous abandon, and digs in with incredible energy. The imaginative interplay among McLaughlin and the others as they trade solos makes for some exciting jazz. *Steve Birchall*

Offenbach, Strauss, Suppe: Famous Overtures. The Academy of St. Martin-in-the-Fields, Neville Marriner.
Philips 411 450-2.

This is the sort of recording that is ideal for the CD medium. It has a big,

bright, boisterous sound, very clean, with sparkling transient attack and dynamic expression of great impact. Apply this kind of sound to such tuneful overtures as "Die Fledermaus," "Morning, Noon and Night in Vienna," "Fra Diavolo," "The Bartered Bride," "La Belle Helene" and the "Mikado," and it is an irresistible combination.

To gild this musical lily, give these pieces infectious, exuberant performances by Neville Marriner and his superb Academy of St. Martin-in-the-Fields. Marriner performs this sort of music so well, and he is such an extremely gifted conductor in a very broad range of music, that he quite deserves his knighthood. Bravo!

Bert Whyte

Aurèle Nicolet

J. S. Bach: Sonatas and Movements for Flute Based on Various Sonatas for Violin. Aurèle Nicolet, flute; Michio Kobayashi, harpsichord; Mari Fujiwara, cello.
Denon 37C7599.

Put this one on your CD player and you will instantly be struck by the most ravishing flute sound that you have ever heard, and some of the finest Bach playing as well, if a trace on the Romantic side. I was astonished.

I often complain about the apparent lack of attention to hall acoustics that one hears in many recordings, both on the part of the performers (or conductor) and the recording engineer: Harmonies crudely blurred together, too fast for the acoustics, reverb that is cut into too soon in the die-away, poor balance between direct and reverberant sound, and so on. A multitude of sins, musical and engineering. But the opposite is possible—the perfect match between hall and sound source, again the combined product of performer and engineer. That is what we have here.

These are technically "arrangements" for flute based on compositions for violin, but in Bach's technique the two instruments were easily interchangeable for the same music and often the oboe as well. The same applies to other composers of the time—Handel, Telemann, even Vivaldi now and then. The program is nicely chosen—considering that it is a single type of sound and all of it Bach—so you will not be bored. Plenty of variety, several very familiar items, and (surprisingly) even some occasional humor to help your listening. A lovely recording.

Edward Tatnall Canby

Neville Marriner

20th Century Blues: Colin Dudman, Dill Katz, Nic France, Peter Harley
MMC 002/CD. (Available from Sounds Good Music Co., 3355 West El Segundo Blvd., Hawthorne, Cal. 90250.)

Although calling itself 20th Century Blues, this British jazz group doesn't play traditional blues. What they express musically is the interplay of despair and hope that characterizes life in the nuclear age. Like most of us, they present a calm, well-adjusted façade, but lurking somewhere in the background is that subtle, basal feeling of fear and anxiety.

The Pink Opaque is a good introduction to the entrancing yet eccentric Cocteau Twins (who have no members named Cocteau and are usually a trio).

Each player has the freedom to play in his own manner; the result is a contrapuntal web of individual styles shaped by the group's overall framework, with lean textures predominating. The group pays careful attention to instrumental colors and their electronic transformations through filters, phasers, delay, and reverb.

In "Marathon" the overall structure is like a rondo, with a tension-creating main idea alternating with contrasting sections that go quite far afield. Anxious, unsettled feelings really rise to the surface here, frequently expressed by quiet, delicate sounds such as wind chimes and guitar harmonics. The group takes the beat, tonality, and melody right to the brink of breaking down, but never lets them go over the edge. The effect is dramatic.

A questioning, unsettled sax solo begins "Study to Be Quiet." The sax is isolated, off in a lonely corner of a big room sparsely filled with supporting harmonies. Suddenly the entire group enters at the front and center of the stage. Near the end, a solo violin pops up in front, spotlighted by an aura of big, empty reverb. Finally the solo sax returns, still off in a distant corner. These are really beautiful production effects, perfectly blended with the music and its expressive intentions.

The "Four Pieces" are an imaginative set of miniatures. For example, the "Trio for Moog Synthesizer, Violin and Bass" features a boogie-woogie walking-bass figure in a bone-dry acoustic environment that gives the music an uncomfortable intensity, even though it is relatively quiet. In the "Solo Violins Improvisations" that follows, you'll hear some nicely executed phasing effects. (Unfortunately, the mastering engineer was careless with the PQ subcodes here, so you cannot access every index point that the printed material says you'll be able to.)

Produced by 20th Century Blues and Nick Horne, this disc is a showcase of audio techniques and musical ideas working together. Don't expect blockbuster effects that will overwhelm you, but look for subtlety, clarity, variety, and a unified purpose. It's a beautiful CD in every respect, and repeated playing only increases the pleasure of listening to it. *Steve Birchall*

The Cocteau Twins

The Pink Opaque: The Cocteau Twins **4AD/Relativity EMCD 8040.**

With a lacy web of sound that harkens back to another era, The Cocteau Twins have been called the Laura Ashleys of the new wave. The group—there is no one named Cocteau and it's usually a trio—has, since 1982, been melding Elizabethan psychedelia and the "doom school" of British new wave purveyed by such groups as Joy Division and Siouxsie and The Banshees.

The Pink Opaque, their first U.S. release, comprises British album cuts, EPs and singles. Heard in CD form, it reveals the convoluted lairs of The Cocteau Twins' music, which relies on heavily processed guitar droning through reverberations and delays, with a relentless rhythm machine shuddering with trance-dance grooves. Crying out through the dense fabric is Elizabeth Fraser, an earnest Alice, lost in a Wonderland.

Fraser delivers lyrics with heartfelt anguish, but they are incomprehensible. For the last three years I've tried deciphering her songs, thinking the maze of echoes was burying the words. It turns out she's singing a mishmash of French, Gaelic, German and gibberish, with the odd English phrase tantalizingly tossed away. She delivers it with such conviction, however, I figured she had to be saying something.

Early works like "Wax and Wane" show the Twins' debt to Siouxsie and The Banshees with their serrated guitars and teasing vocal wail. But Fraser has since become more refined and innocent. "Aikea-Guinea" would be a searing love refrain if you could understand the words.

The Cocteau Twins do not record to audiophile standards. Their sound is closed-in and compressed, with massive instruments and churning delays filling every corner. The CD lends a bit of clarity, with anchoring ostinato bass lines adding an edge of menace to Fraser's ethereal calls. It helps make *The Pink Opaque* the best introduction to this entrancing yet eccentric British group. *John Diliberto*

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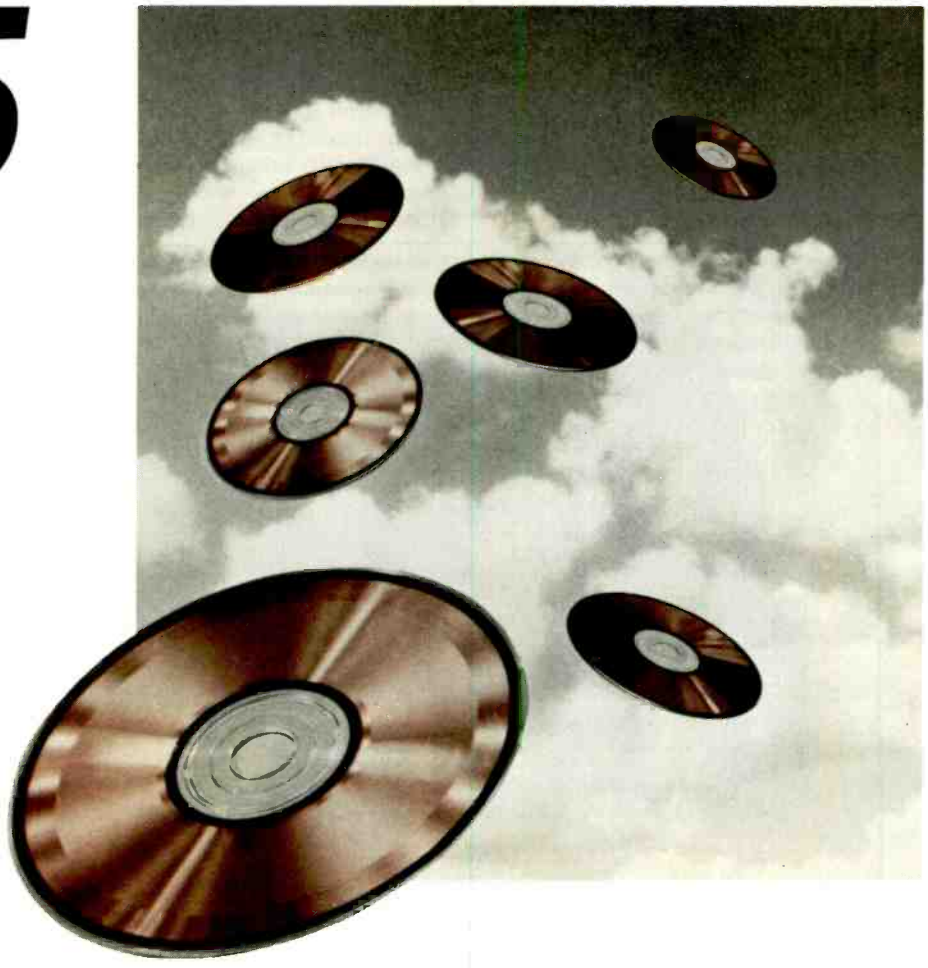

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Lars Erstrand and Four Brothers are not major jazz talents, but they show that Swedes can swing, and the recording is exceptional.

Lars Erstrand and Four Brothers Opus 3 8402 CD. (Available from Scandinavian Sounds, P.O. Box 12241, La Jolla, Cal. 92037.)

Apparently Opus 3 set out to prove that Swedes can swing, and that the jazz idiom is not the exclusive province of Americans.

They recorded vibraphonist Lars Erstrand along with some good sidemen on tenor sax, piano, bass, and drums. The program opens with "Four Brothers" (made famous by the Woody Herman band), continues with a sultry version of "There with You," and then wends its way through such ballads as "Body and Soul," "Sunday," and several lesser known pieces. The arrangements are fairly straightforward, and the group plays them in a nice, easy, freewheeling style.

The sound is of demonstration quality, though this CD was made from an analog master recorded in 1984. Because it is of such recent vintage and probably was recorded at 30 ips, there is virtually no background noise. The recording was made quite close up, in a very dry acoustic space. This affords an intimate sound with great presence and projection. Stereo imaging is quite good, but there is very little depth.

With a vibraphonist heading the band, there is considerable emphasis on this instrument. The sharp, explosive transients of the vibraphone have to be heard to be believed. The tremendous peak energy of some of these high-frequency transients could easily damage some tweeters if playback level is set too high. The other instruments are equally well recorded.

Admittedly, there are no major jazz talents here. Nonetheless, this group demonstrates a good feeling for jazz, plays well, and has the advantage of exceptionally good recorded sound.

Bert Whyte

Simon and Garfunkel's Greatest Hits Columbia CK 31350.

Remember these guys, Simon and Garfunkel, né Tom and Jerry? Well, remember them or not, if you've got ears and a heart and a brain that all work properly, you're gonna love this wonderful little Compact Disc.

Paul Simon's brilliant material holds up through the years, as sprightly, engaging, and beautiful as they were over a decade ago, with lyrics as intelligent, meaningful, and moving as ever. Art Garfunkel's pure, choirboy voice, raised in gorgeous harmony with Simon's darker, wryer one, reaches across the years and plucks the same responsive chords as before.

The first strains of "Mrs. Robinson" simultaneously opened the floodgates of memory and set the old toes to tapping. The soaring purity of "Bridge over Troubled Water," the sheer melodic gorgeousness of "Scarborough Fair/Canticle," the eloquent dramas woven by "The Boxer" and "America,"

Stewart and Gaskin won me over instantly with their grace, intelligence, and quiet humor. But is America ready for *Up from the Dark*?

the giddy, joyous energy of "Cecilia" all contribute to an exceptional greatest-hits album, with nary a loser in this 14-selection bunch.

Art Halee was responsible for a sweet production job, remarkable considering the recording limitations of the time. This CD shows up some of his creative successes as well as some studio flubs and quirky choices. On the plus side, the digital recording cleans up a lot of old noise and reveals some lovely recording coups. The live cuts are beautifully recorded, featuring just the two singers with simple acoustic guitar accompaniment. The natural reverberation creates a fine sense of space. The studio cuts have very little depth, but left-right channel placement and movement are used superbly, as the CD clarifies details present but barely noticeable on the original analog album.

The weaknesses that are highlighted by digital remastering include, unfortunately, a good deal of uneradicable tape hiss—distracting, but not unbearable. Garfunkel's vocal crescendo accented by cymbals in "Bridge" is noticeably distorted. In the Quirky Production Department, for some reason "Mrs. Robinson" and "The Boxer" have fade-out endings that are shifted entirely into the right channel. The left channel simply goes dead.

The pros of this disc far outweigh the cons. I'm sorry the boys have split up, but on this CD they are together forever, old friends, bookends. Amen.

Paulette Weiss

Up from the Dark: Dave Stewart & Barbara Gaskin
Rykodisc RCD 10011.

Sound: B+ Performance: A–

No, it's not the Dave Stewart from Eurythmics. This Dave Stewart is the British keyboardist who's played in such adventurous groups as Egg, National Health, and Hatfield and The North. If none of those names rings a bell, then you have a good idea why Stewart abandoned his progressive instrumental music for the more financially rewarding area of synth-pop.

Normally this would bring cries of "Sellout!" from me, but this CD-only release, compiling most of the British singles which Stewart has recorded with Barbara Gaskin, instantly won me over with its grace, intelligence and quiet humor. Gaskin's voice also had something to do with it; she sounds a little like a more mature Kate Bush.

Stewart has a knack for picking great old songs and giving them a modern twist. "It's My Party," the old Lesley Gore tune, is turned into a surrealistic nightmare with tick-tock rhythm, screeching synthesizers, and a swirling dream sequence. Gaskin updates Gore's lament with imperious assurance. In updating old Motown tunes, Stewart and Gaskin avoid the blue-eyed soul clichés and instead im-

Solti's ultradynamic Haydn performances gain from the ambience of Kingsway Hall and from Decca's intimate knowledge of its acoustics.

part a distinctly British air. The Temptations' "I'm Losing You" and Holland/Dozier/Holland's "I'm in a Different World" are given majestic treatments.

Not content updating the past, Stewart also covers modern writers. Thomas Dolby's "Leipzig," an exquisite song, is given a more upbeat and futuristic reading than Dolby's own nostalgic version. I suspect that this song was meant to be sung by a female. If not, Barbara Gaskin makes it so.

Up from the Dark also contains Stewart originals. "When the Guards Are Asleep" is a crunching rocker with fuzzed-out synthesizer lines. "The World Spins So Slow" is an atmospheric love song, with a serene choir made up of Gaskin's multi-tracked voice drifting over a moody electronic bed.

Stewart has a keen sense of electronic keyboard orchestration, and his recording makes each voice clearly defined. Most tracks are analog-mastered, with a few digitals tossed in, but there's no discernible difference in quality; throughout, there is an expansive dynamic range and distant noise floor.

Stewart and Gaskin deserve to be a hit, but as long as they insist on being clever, original and slightly eccentric, a place on the U.S. pop charts will probably be denied them. Is America ready for a twisted version of "Siamese Cat Song"? *John Diliberto*

Haydn: Symphonies Nos. 94 and 100. The London Philharmonic Orchestra, Sir Georg Solti.
London 411 897-2.

The Haydn Symphony No. 94 ("The Surprise") and Symphony No. 100 ("Military") are given taut, spirited performances by Sir Georg Solti, who elicits some particularly good playing from the London Philharmonic Orchestra. The precision and élan of the string section is especially noteworthy.

London/Decca also recorded the Haydn "Military" symphony with Christopher Hogwood and the Academy of Ancient Music, reviewed in the May 1985 issue of *Audio*. In that review, I pointed out that various conductors, and the engineers of their recording companies, have taken widely different approaches to the famous "Allegretto" second movement with its bass drums, tympani, military snares and trumpet calls. The ancient Scherchen recording on Westminster Records became a famous hi-fi demo record because of the very bombastic treatment of the percussion. The Hogwood recording opted for a straightforward, rather literal approach.

Interestingly, the Hogwood version and this one by Solti were both made in Kingsway Hall in London, long a favorite venue of Decca, whose engineers knew the hall intimately and how to achieve the best sound with various kinds of music. When I recently was a guest of Decca in London, Tony Griffiths, their digital wiz and general manager, told me he was saddened by the

From the first hearing on, *Requiem* gains powerful impact from its beautiful sonorities and exquisitely shaped melodies.

fact that they could no longer use Kingsway Hall for recording because external rumbles and roars and other assorted traffic noises were impossible to control.

In any case, recording engineer Stan Goodall, abetted by Solti, decided to take an ultra-dynamic approach to the percussion in the "Allegretto." The result is brilliant and exciting, with the very large bass drum, tympani, and snare drums explosive in their sheer weight and sonority. The overall sound is very clean, with all the vaunted advantages that are lent by the Kingsway Hall ambience.

Those who revel in big dynamic sounds will probably prefer this Solti CD, while those with more conservative tastes will be inclined to favor the Hogwood version. *Bert Whyte*

Andrew Lloyd Webber: Requiem. The English Chamber Orchestra and Winchester Cathedral Choir, Lorin Maazel. Placido Domingo, tenor; Sarah Brightman, soprano; Paul Miles-Kingston, treble; James Lancelot, organ. **Angel CDC 7 47146-2.**

Rich in inventively beautiful sonorities and exquisitely shaped melodies, Andrew Lloyd Webber's *Requiem* makes a powerful emotional impact even on first hearing. Its effect grows stronger the more you listen.

Lloyd Webber cites two influences that led him to write the *Requiem*. The first was the death of his father, a church organist and composer, in 1982. While gathering ideas for a work to honor him, Lloyd Webber saw a *New York Times* story about a gruesome war incident in Cambodia. The interplay between his personal loss and the larger suffering of humanity makes his *Requiem* intensely moving.

The melodic ideas in the various movements are related, and derived from a handful of motives. He keeps a melody intact within a movement, and develops it with a rich palette of harmonic, instrumental, and vocal colors—always with a strong sense of a tonal center. His melodic development occurs through the unfolding of these motives to construct the themes for each movement.

There are three basic building blocks. First is the opening "Requiem" theme on the notes do sol sol do. (The falling fourth usually becomes a falling third, but the fourth is significant because it gives the "Recordare" and the "Hosanna" melodies their special angular character.) Second is a decorated diminished seventh chord ("Rex Tremendae" and "Lachrimosa"). The third basic element is a step up followed by a leap down ("Recordare" and "Pie Jesu"). A falling minor third eerily crawling up and down by half steps in the "Ingemisco" is another expression of the step/leap idea.

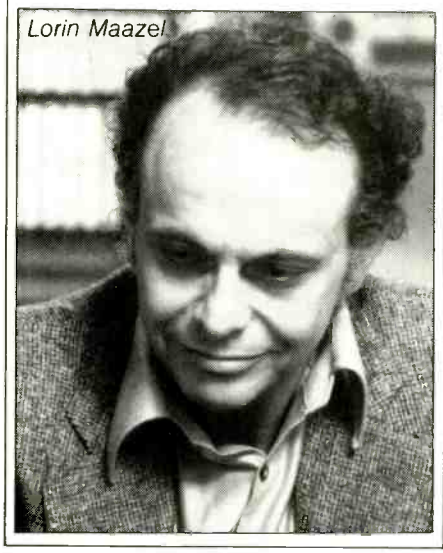
At the very end, Lloyd Webber returns to the opening "Requiem" motive, quietly sung again by the solo boy

Yuji Takahashi takes us on a surprisingly tranquil and exotic journey through Cage's interior world of odd, visceral rhythms.

treble. Suddenly the organ and tympani interrupt, obscuring his voice with loud, dissonant sounds. Just as suddenly they stop. As the reverberations die away, the boy's voice re-emerges, and you realize that he had been singing *perpetua* through all of that sound. The effect is magical, and capsulizes the emotions of the entire work: The persistence of the human spirit.

Surprisingly, the recording site was not a cathedral or concert hall, but Abbey Road Studio One. Producer David Murray combined the studio's natural acoustics with synthetic ambience to make it *sound* like a minimal-mike cathedral recording, but with some creative departures. Listen to the beginning of the "Hosanna." The aura of reverb around the tenor's voice sounds normal and spacious. But after a quiet horn interlude, the tenor returns. This time, the room sounds larger as he sings *hosanna in excelsis*. You relax, believing the stage is being set for the joyous movement about to follow. Suddenly, on the word *benedictus*, the reverb disappears. The tenor seems to be standing in front of you, saying, "Bless *you!*" Later, the tenor reappears in that less reverberant space, giving the effect of a closeup shot in a film. Then the acoustic space expands again, along with the music. I like this way of using the recording medium, because it provides new ways to communicate artistically.

The album package is well done, with a good balance of informative text and photos. However, after seeing the "Pie Jesu" video, I thought the entire *Requiem* would be an excellent candidate for a CD with subcoded graphics. Those images of suffering and destruction, contrasted with photos from the performance, would make an "illustrated" CD a powerful experience.



Lorin Maazel

Placido Domingo tends to overshadow the other soloists, if only because he is such an exceptional performer. He makes the "Hosanna," with its dance-like syncopations, sparkle. Sarah Brightman seems a bit challenged by her difficult part, but she carries it off quite well. Paul Miles-Kingston sings with a purity of tone, a certainty of intonation, and a depth of feeling that few musicians as young as he are able to provide. Conductor Lorin Maazel draws an exciting and quite moving performance out of the combined forces.

I predict that music schools and church groups all over the country will be eager to perform this *Requiem*. Many movements are suitable for inclusion in a voice recital. Those wonderfully dramatic solo parts will appeal to young singers, and the orchestral parts require a stylistic flexibility that challenges and rewards the players. Andrew Lloyd Webber's *Requiem* should find a treasured place in the repertoire quickly. *Steve Birchall*

John Cage: Sonatas and Interludes for Prepared Piano. Yuji Takahashi
Denon 33C37-7673.

"Sonatas and Interludes for Prepared Piano" is one of John Cage's most eloquent audio documents. Cage revolutionized the concept of music in the 20th century, and one of his first experimental guinea pigs was the piano, the icon of chromatic virtues. Simply put, Cage reinvented the piano, transmuting it into a percussion ensemble.

Dating to the late 1940s, the "Sonatas and Interludes" are among Cage's most enduring and most performed works. His score includes precise directions for the placement of bolts, screws, pieces of rubber, and erasers into the strings of the piano. So rather than a finely tuned, orchestral instrument, what faces the musician is an un-pitched array of muted sounds: Slaps, rattles, honky-tonk effects, gamelan orchestras, and steel percussion.

One might think that the music produced from such a mutated instrument would be a random clash of disharmonic thuds, a symphony for trash collectors. But this recording is surprisingly tranquil and exotic, reflecting Cage's interest in Eastern philosophies at the time he wrote the pieces as well as Yuji Takahashi's sensitive performance. These are journeys into an interior world where sound dances in odd yet visceral rhythms.

The preparations create effects that lend an Asian feel to many of the pieces, although the score gives no designation for pitches. This is a work of rhythm and space. Takahashi is left to create counterpoints in sound rather than notes, and he does it wonderfully. By challenging our preconceptions of what a piano sounds like, Cage opens a new world of emotions.

This recording was made digitally in 1975, but it has only recently become available on Compact Disc. Cage realized that for the human species, true silence doesn't exist, but this recording places his "Sonatas and Interludes" against the deepest black spaces to date. More than ever, the "Sonatas" seem to emanate from something beyond human hands and mind.

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THE WISDOM OF SOLOMONS

Illustration: Yvonne Buchanan

Haydn: Symphonies Nos. 94 & 98. The Scottish Chamber Orchestra, Raymond Leppard.
Erato 75151, digital, $10.98.

Haydn: Symphonies, Vol. 10, Stürm und Drang (Nos. 50, 54, 55, 56, 57, 64). L'Estro Armonico, Derek Solomons.
CBS M3 42111, digital, three-record set.

In the early days of electrical recording on 78s, there were a handful of Haydn symphonies to put down, those which had "remained in the concert repertoire," known by their rather silly titles and numbered in a 19th-century sequence—the "Surprise" symphony was No. 6, for instance. The rest of Haydn's symphonic musical iceberg remained totally hidden—except, oddly, for the "Farewell" symphony, which was listed as No. 45, inexplicably for many who got to love that imperishable work in which the musicians walk out in the last movement, leaving only one violin. (It was a "strike" for better treatment of the musicians.) I owned this work on royal-blue Columbia shellac 78s and must have played it a thousand times.

After World War II, and especially with the LP, that iceberg became a very visible whale, as the original and more correct numbers were attached to later recordings—the "Surprise" became No. 94 and the "London" No. 104. Wow! *That many symphonies?* And all as good as No. 45? Not quite, but I will not forget my encounter with Nos. 6, 7 and 8, titled "Morning," "Noon" and "Night," absolutely charming music! The rest of those works were inevitably going to be recorded, though it took a generation—and we are still doggedly at it.

These two projects represent the two current approaches to Haydn's music, succeeding the often eccentric large-orchestra versions of the times of Sir Thomas Beecham and other old-line conductors. Raymond Leppard's late symphonies out of Scotland are of the old school, played entirely on modern instruments and with conventional modern sound but, by now, with a properly smaller orchestra and more sensible tempi, well suited to the music. They go down easily, these playings. On the other hand, there is a lack of real tension, even a tiredness, which grows on the ear as the outwardly accurate performance continues. Leppard could merely be beating time. The once-novel high points of the music are merely played, without emphasis. Dull. Too bad, considering the overall beauty of sound and the excellent recorded balance. Two different recording sites were used, and Symphony No. 98, recorded in a church in Paris, is blurred by a very long reverberation in spite of careful microphone treatment.

The Derek Solomons performances are dramatically different. These, part of what seems to be a project to record all the symphonies, are played entirely on "authentic" instruments. Beyond that, they are played in a new (for today) and more authentic manner, minus vibrato in the strings. This big, three-LP set is crackerjack good. The performances are not only exhaustively, literally authentic (according to latest information and practice), with authoritative notes by H. C. Robbins Landon, but in the "new wave" of this sort of music, they are tight, dynamic, dedicated, beautifully shaped and phrased. No more dull "musicological" recordings, thank the Lord! These playings make the Leppard symphonies sound even duller by comparison. No question—the "authentic" people have now brought their valveless horns and trumpets, finger-hole oboes and bassoons, and steely, vibrato-less violins to the top level of professional playing. They said it couldn't be done. Just try for yourself—but be prepared to be startled and perhaps a bit dismayed. It *is* a very different sound. It is, very closely, what people actually heard in 1774.

I note very fine digital recording and an interesting bit of intelligent engineering in the Solomons set. Two of the symphonies were built up for special occasions with extra instruments, flutes, tympani, trumpets. Remarkably, these LP sides are actually louder than the others, correctly reflecting a very real sonic difference.

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Bel Canto. The London Early Music Group, James Tyler.
Nonesuch 79109, digital, $10.98.

Like Baroque, bel canto was a term applied well after the fact, to a classic 17th-century way of singing, mostly in early operas with Italian texts. No one alive has heard this sound; the voices, alas, are long since returned to dust. On the other hand, instruments of the time do exist and can be replicated. Assorted instructions and descriptions as to their playing also exist, and so their sound can be regenerated with considerable accuracy.

Anybody can call his or her singing "bel canto" and get away with it; all it means, after all, is "beautiful singing" or "singing well." But along with the revival of older instruments, there are more and more attempts to somehow match their sound with what must have been, or might have been, the vocal sound that is lost to us. That is what we have here—two high tenors and a high soprano. Their voices are very bright, often metallic (matching the old instruments in color), and minus most of the modern vibrato. You may call them piercing; the adjustment to this novel sound isn't very easy. But progress is being made! This is getting to be like what people actually heard in the original stage performances. They loved it—so may we.

There is one respect, though, in which audio makes things tough. The old performers projected their tones loudly, to fill big spaces. That is still the rule today, but the spaces are bigger. The sound has to be louder for performance without sound reinforcement. So these three singers are too powerful for the recording mikes. The machinery copes; there's no blasting overload. But can the ear cope? You'll find their sudden loud climaxes, following very soft passages, a sonic annoyance. Listen from a nearby room! It works.

J. N. Hummel: Mass in B Flat, Op. 77; Tantum Ergo (after Glück). The Westminster Oratorio Choir, The New Brunswick Chamber Orchestra; John Eric Floreen, conductor.
Spectrum SR 199, digital, $8.98.

In the early 19th century, Johann Nepomuk Hummel rated as one of the most exalted pianists ever, and was viewed next to Beethoven himself as a Great Composer. He was Beethoven's friend, in fact—though it can be guessed that old B. knew he really had nothing to fear in such a professional friendship. That is how it has turned out. Until the end of the century, Hummel was widely performed along with such as Mendelssohn. Then he disappeared. He wasn't Romantic enough; he was quaintly old-fashioned.

Well, he still sounds that way, if pleasingly so. The date here is 1811 and the music is somewhere between Haydn and Beethoven but milder than either, and minus any great surprises. It's all very melodious and elegant; it sounds big, but big like a Newfoundland puppy, 150 pounds of gentleness. No solos, just chorus and orchestra—Hummel evidently didn't trust the local soloists where he worked.

The performance matches the music. It is a youthful sound out of a large choir of music students, many of them teenagers sounding still like kids—but they are already professional and do not make mistakes nor squeal on the high notes. The American college choir sound at its best! Westminster Choir College must be big—there are six choral groups and these are only the sophomores and transfers.

You will note that the record is produced and edited by Craig Dory and Al Swanson, respectively, two audio engineers who worked with me on my own digital recordings. This is an example of what can be done in Delta-type editing, as I've described in "Audio ETC." My only comment on the excellent Dory miking in New Jersey is that, somehow, he has made the chorus sound bigger and fuller than the orchestra, which is a bit down in the musical balance (the opposite of the usual tendency to have too much orchestra and a weak sound from the chorus, which in concert practice usually stands behind the instruments). I would have enjoyed a bit more of Hummel's Beethoven-like orchestral sound.

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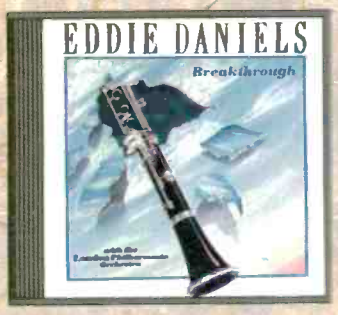

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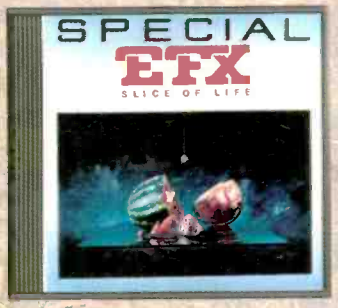

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The recording, for these wind-group pieces, is perfection—almost totally dead, dry and un-Romantic, just like the music.

but perhaps things are best as they are; the chorus is in fact more important, and in this case it was the originating body for the undertaking.

Bergsma: Changes for Seven; Goodman: Quartet; Zaninelli: Burla and Variations; Etler: Quintet No. 2. The Soni Ventorum Wind Quartet. **Crystal S258,** $9.98.

Here is that persistent and successful small label, Crystal, turning out more audio of a sort that we just have to notice—it's our biz, after all. And yet, right in the Crystal tradition, the content of the recording, on sale to all, is clearly targeted at an in-group: Academic, professional musician/composers, in university, college, or conservatory. Everything about the music says that, in no uncertain terms.

Of course I am on thin ice here and am likely to run out of steam when it comes to condemning this music. Some of our greatest—like so much by Bach—has been composed under just such narrow circumstances, for a special purpose, a local group, a practical end. We must always keep that in mind. The history of *all* our music simply shows that practitioners often get out of hand and write for the ages, without perhaps so intending.

Anyhow, every one of these wind-group works sounds just the way it is supposed to sound in academic circles these days—here ranging from 1957 to around 1983. Not knowing, you would likely spot the effect as middle to late 1920s. It is all nervous, dry, jazzy, syncopated, full of deliberately violent dissonance (often hiding some rather conventional consonance), very carefully avoiding anything that might sound—horrors!—like old-fashioned Romantic elegance. Some day, we'll get tired of this neo-classic style. Outside of the universities and conservatories, we already have.

The recording, for this music, is perfection. It is almost totally dead, dry, close, un-Romantic, just like the music. Good job! You are very near these musicians in their small practice room (that's the way it sounds) and you get every nuance, .including all the breaths. It is a beautiful job of recording, perfectly balanced, each instrument sounding, whether soft or loud,

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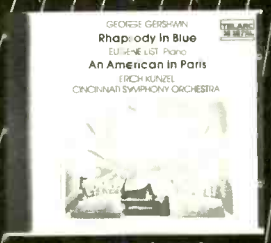

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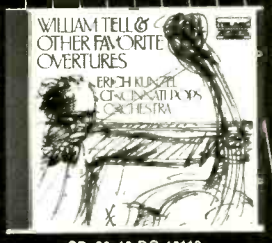

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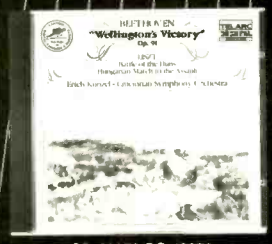

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This greatest-hits record is a mishmash, truly. But conductor Richard Kapp is enthusiastic, and that is enough to redeem all.

exactly as it would at a distance of a few yards or less in a dead room.

As a matter of fact, as always, I began to like most of this music once I got into the mood and feel of it. Only the opening Bergsma rubbed me the wrong way. The others are both expert and fluent in their art, each one of them. The players are excellent, solidly rehearsed and doing a difficult job with professional ease.

Greatest Hits of the 1900's. The Philharmonia Virtuosi, Richard Kapp. **CBS MX 42125.**

Somehow, the "greatest" anything indicates to most record buyers a passel of harmless background music. Unless, of course, Richard Kapp is involved. This somewhat quirky conductor enjoys tossing odd sidelights on all sorts of music, hopefully to surprise and delight. This disc is sheer Kapp; the selections vary from very serious to simply *grreat*. Hardly one of them would seem to be what he tries to make of them. For instance, among all of Leonard Bernstein's stage works, "Candide" was not a "greatest hit" when it came out! It was his greatest flop, at the time. Oh well. This is a mishmash, truly (there's even one piece from 1887), and I'd think almost anybody would be confused.

The folksy works by Copland and Virgil Thomson are surely the most easily listenable of those here, along with, maybe, the familiar excerpt from the Prokofiev "Classical" symphony. The "Candide" bits, all fussy with classical Broadway touches, show up the worst. Ibert's little "Parade," a super parody of John Philip Sousa, is called "quintessentially 20th-century French," which had me stunned. Similarly, the most beautiful of the movements in Ravel's pair of piano concerti, a masterpiece of serious, sad dissonance, is associated with Gershwin in the album notes (and is played—beautifully—by Bob James), whereas in truth it is the least so of those very much Gershwin-influenced pieces. Yes, Barber's famed "Adagio" was a hit, but it's awfully, awfully serious, to great length. You see what I mean. Mixed up, though anybody can see that Kapp means well and is enthusiastic. That is enough to redeem all.

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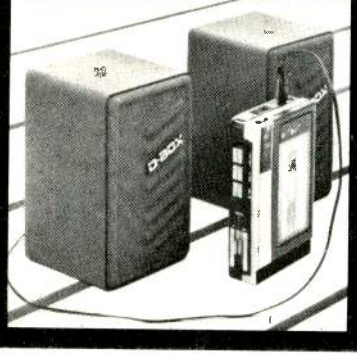

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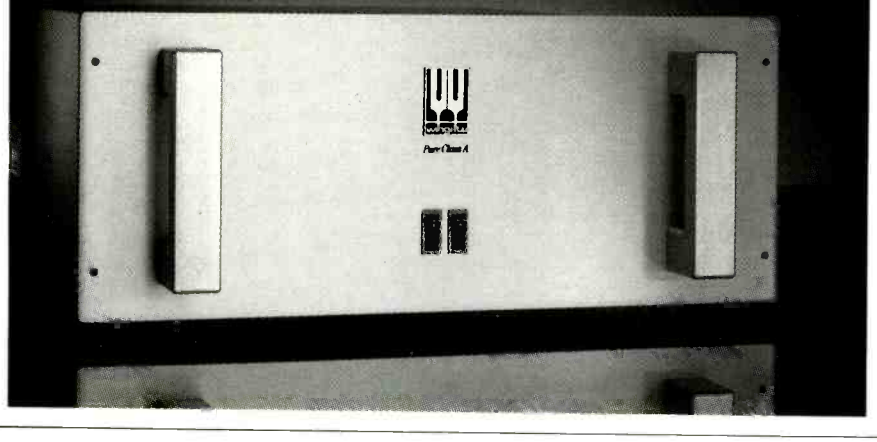

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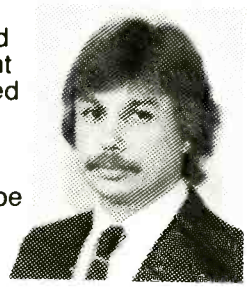

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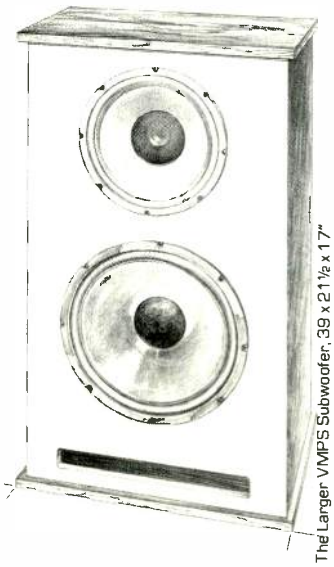

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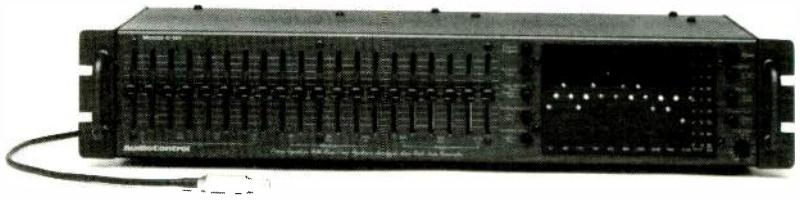

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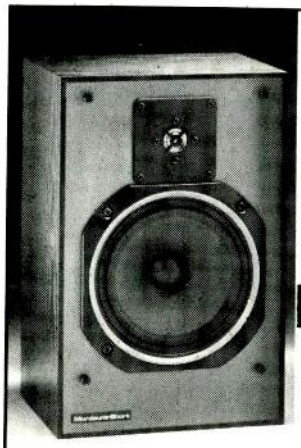

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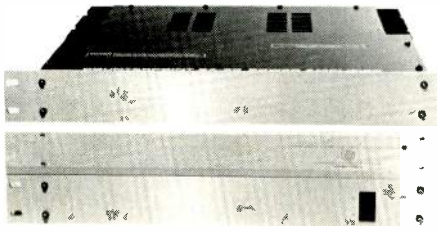

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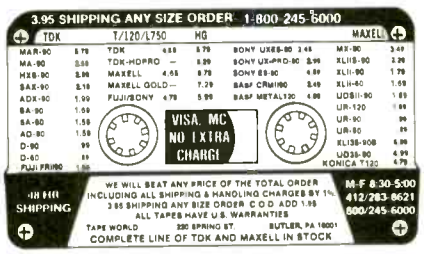

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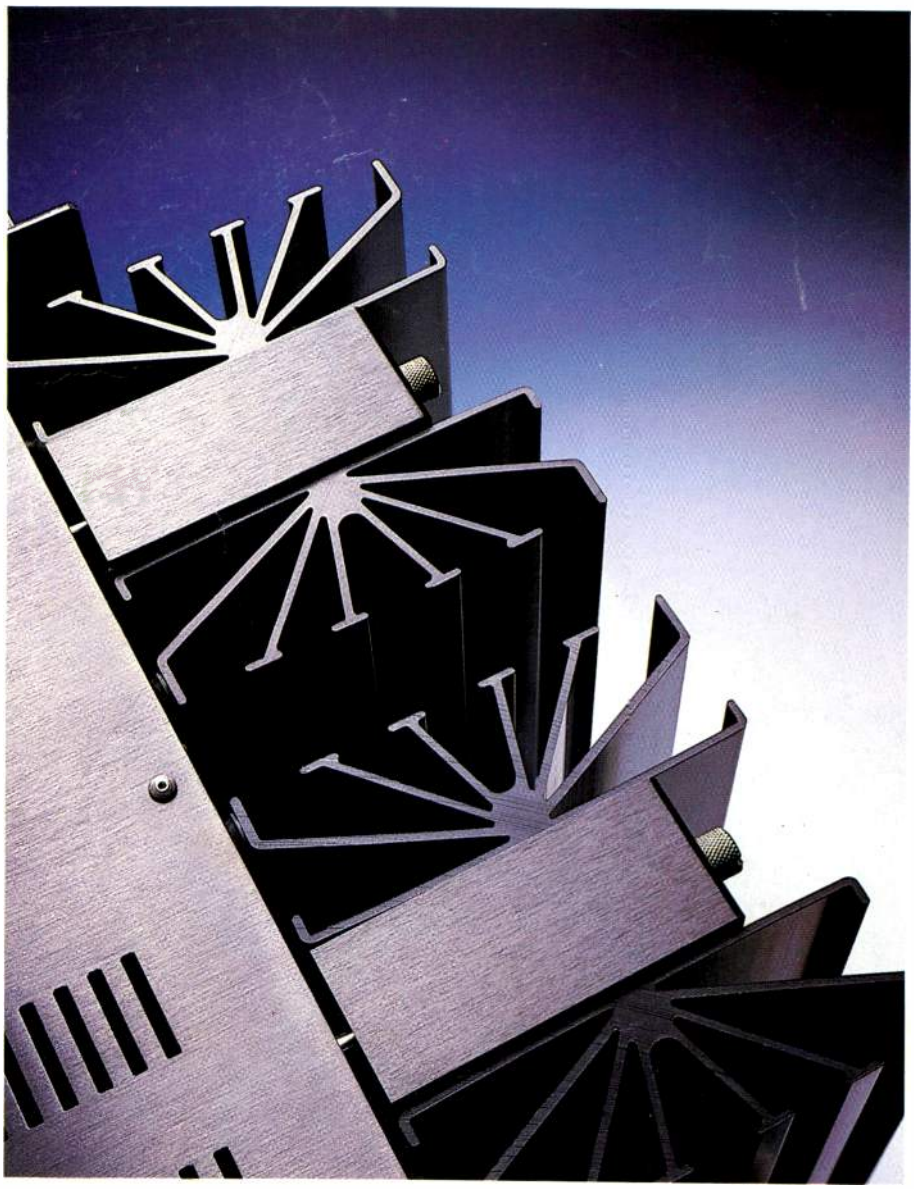

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