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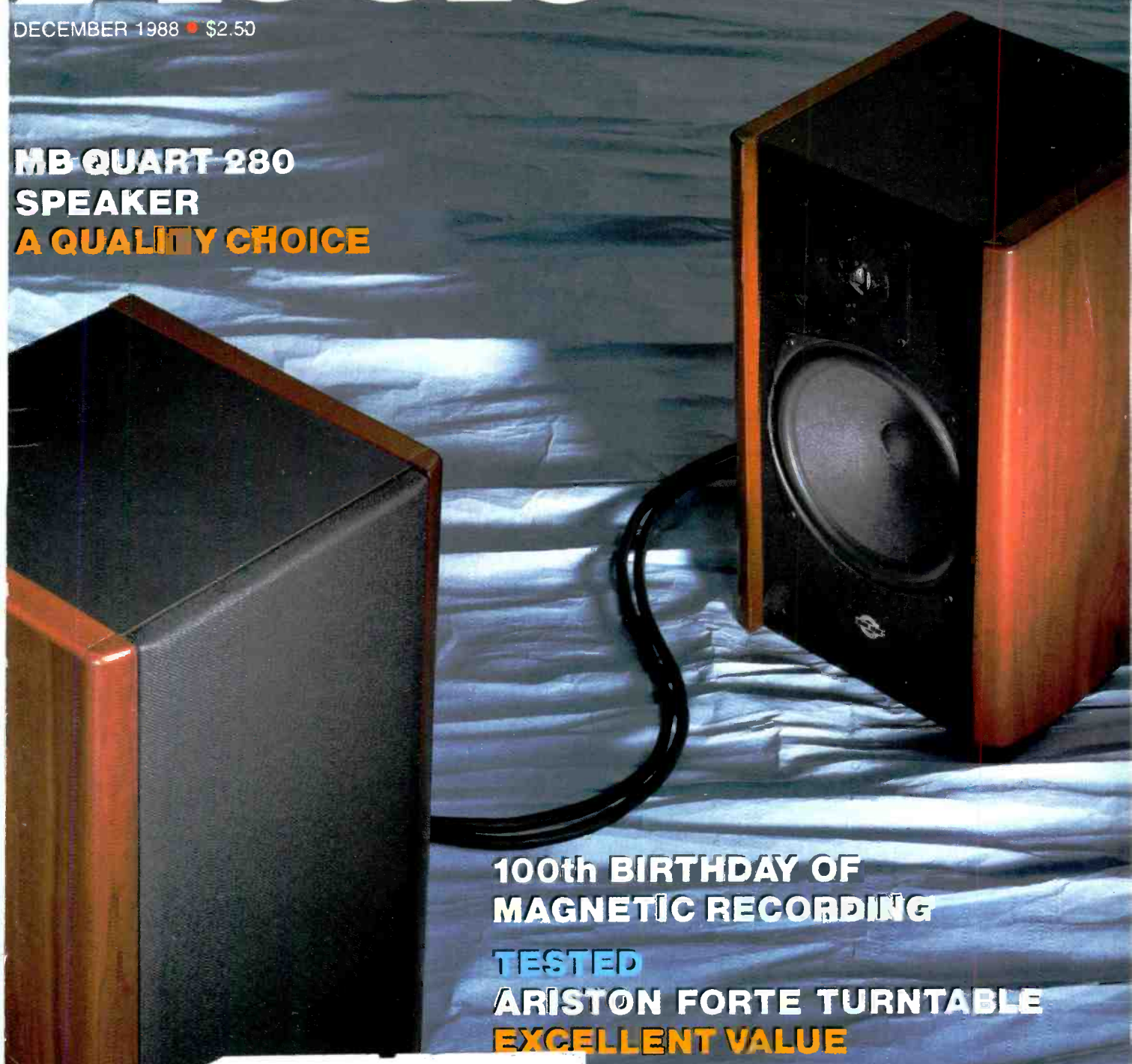

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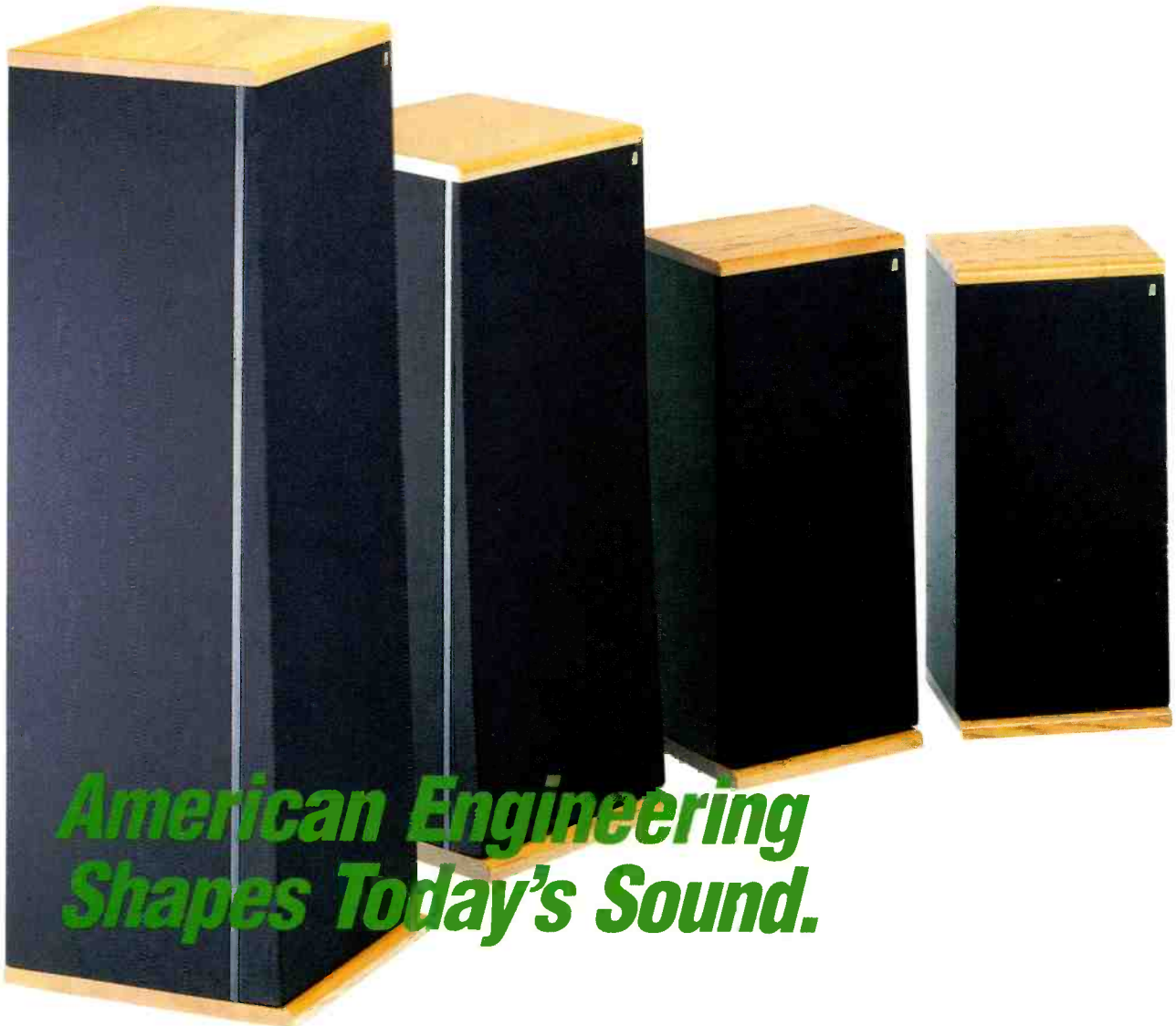

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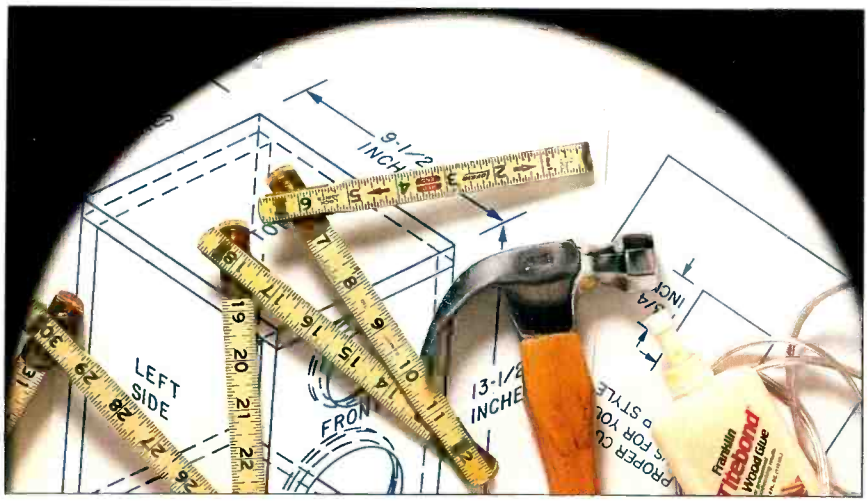

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The Cover Equipment: MB Quart 280 speaker.
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MPA

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THE SHAPE OF THINGS TO COME

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

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Unfortunately, most audio equipment today misses the most important element of music.

The performance.

The first equipment that doesn't just play music.

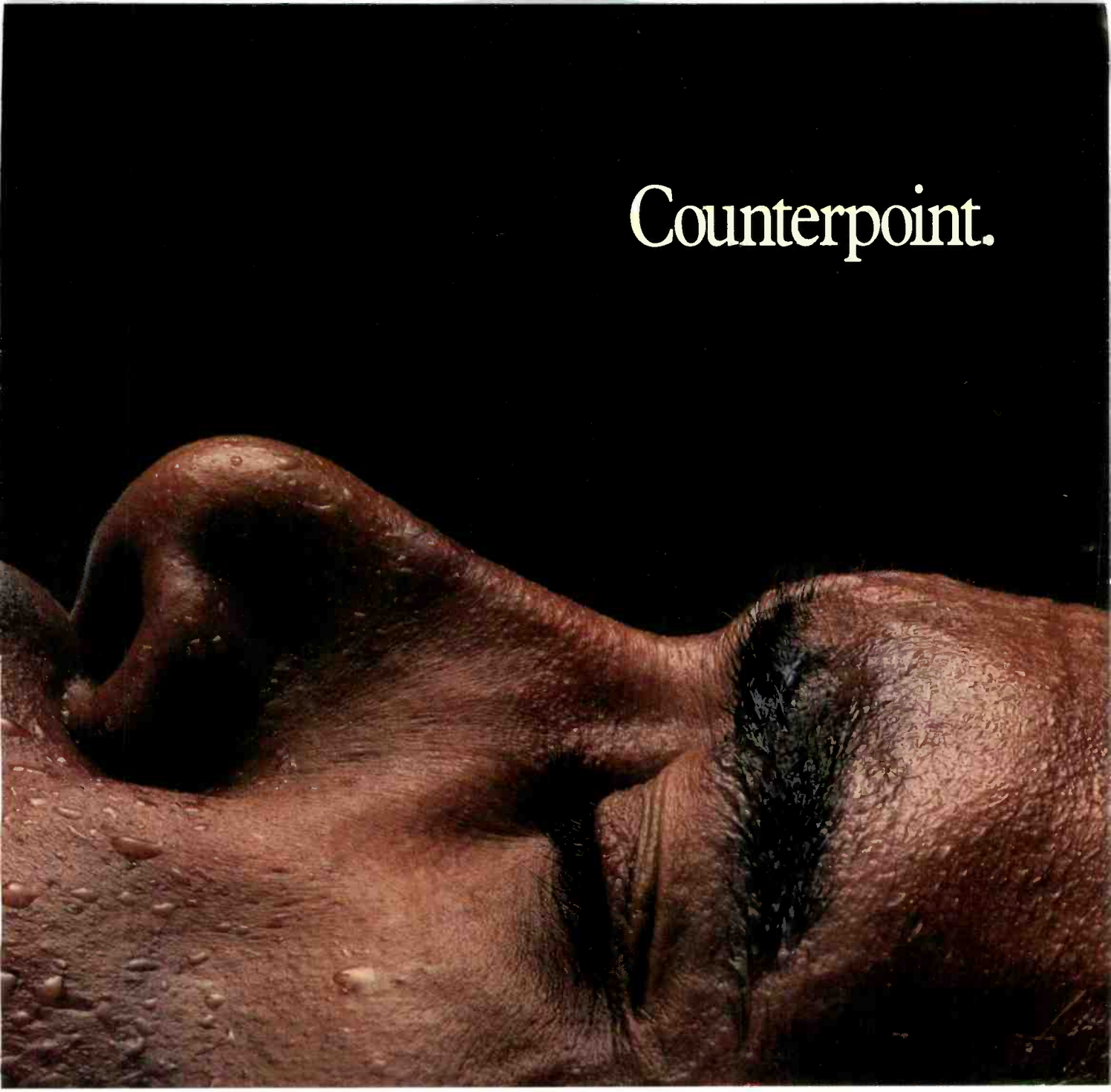
It recreates it.

To the most discriminating listeners, music isn't a passive hobby. It's an all-out passion.

At Counterpoint, we've never forgotten that.

In our quest for the purest, most natural qualities of sound, Counterpoint has embarked on a decidedly different tack, dictated not by blind obsession with

Counterpoint.



specifications, but rather by absolute devotion to flawless musical recreation.

Steadfastly embracing that philosophy, Counterpoint has focused exclusively on the element that makes a piece of music especially endearing:

The artistry of the live performance.

For once, you won't just *hear* the music. You'll experience it as if you were there. The steamy breaths of a tenor saxophonist. The searing intensity of a vocal. The sense-tingling pluck of a harp string.

We invite you to conduct your own aural examination of Counterpoint equipment.

In doing so, we believe you'll discover how much of the music you've been missing.

And why Counterpoint is widely regarded as the consummate choice for critical listening.

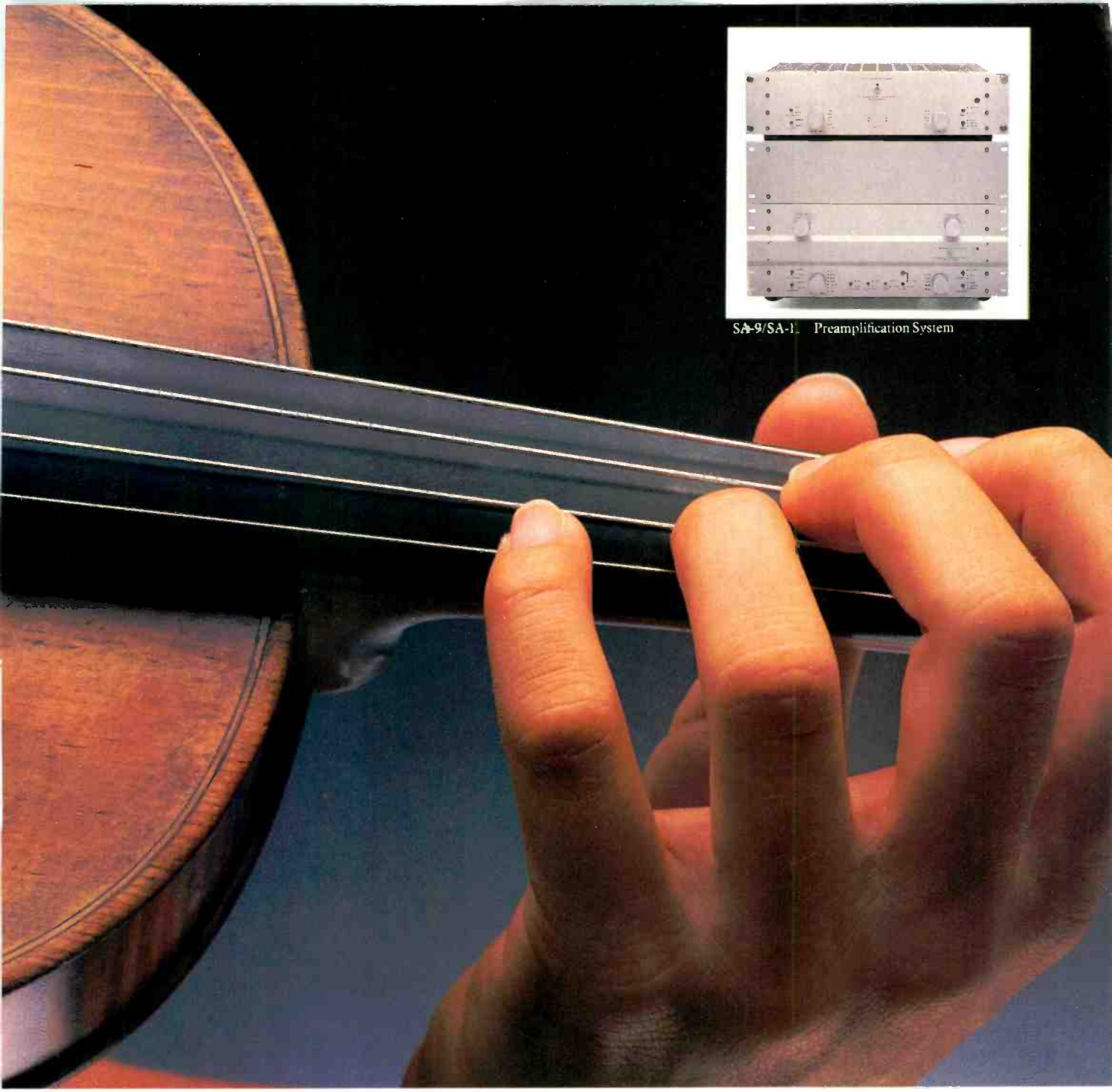
Music so real, so natural, you can practically see it before your eyes.

Perhaps nowhere is Counterpoint's purity of purpose more compellingly demonstrated than in the SA-9/SA-11 system.

The unequivocable choice of the critical elite.

Rarely, if ever, has the raw emotion and feeling of individual performers and instruments been captured with such richness, brilliance and clarity.

The SA-9 Phono Equalizer represents the ultimate in musical accuracy, providing



SA-9/SA-11 Preamplification System

exceptional width and depth to the audio soundstage.

Offering "reference quality" performance in every conceivable aspect of its hybrid tube design, this dedicated phono cartridge preamplification and equalization system features independent moving-coil and moving-magnet circuits for unrivaled phono stage quality.

If the SA-9 can be considered the quintessential pre-amp, the SA-11 Control Amplifier is its perfectly matched counterpart.

The SA-11 extends the isolinear concept to its fullest potential. Its exacting circuit design and high voltage operation ensure extremely low distortion sound. But the imaging and dynamic headroom delivered by the SA-11 make it the clear favorite with purists who refuse to settle for second best.

The SA-9 and SA-11. Without compromise, and without peer.

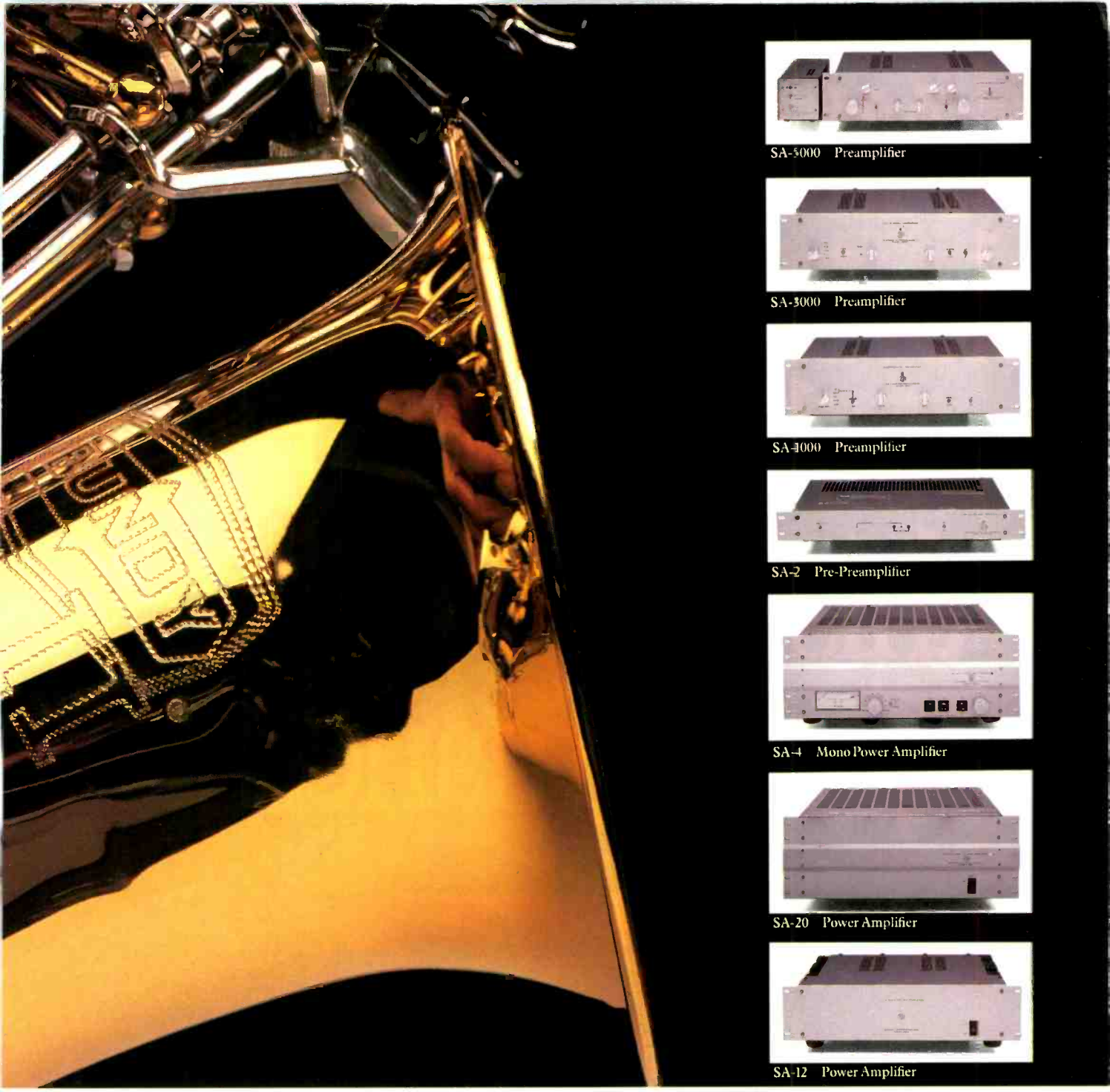
For afficionados who instead of looking for features, listen for sound.

In discerning circles, the term "musicality" is frequently mentioned in the same breath with Counterpoint preamplifiers.

The SA-5000 preamplifier, with an impressive vacuum-tube power supply, provides highly refined, very dynamic sound. It's especially notable for its revelation of inner detail and outstanding soundstaging abilities.

The SA-3000 preamplifier exemplifies sonic realism. The product of sophisticated hybrid tube technology, this high-performance preamp delivers a clean, quick signal, a rich bottom end and a nicely focused soundstage.

Along the same hybrid lines, the SA-1000 features many



SA-5000 Preamplifier

SA-3000 Preamplifier

SA-1000 Preamplifier

SA-2 Pre-Preamplifier

SA-4 Mono Power Amplifier

SA-20 Power Amplifier

SA-12 Power Amplifier

of the design characteristics and advanced engineering of its higher-performance siblings, yet is affordably priced.

For those to whom musical accuracy must approach that of the live performance, Counterpoint presents the SA-2 pre-preamplifier with its fully vacuum-tube regulated power supply. The result is excellent frequency extension, stage presentation and unblurred open detail, for hours of smooth, unfatigued listening.

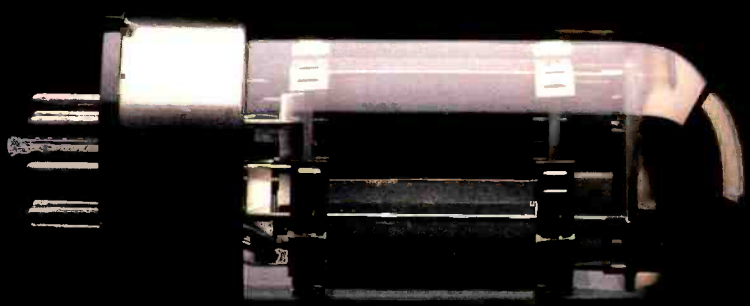
Over the years, Counterpoint Amplifiers have continually set new standards of listening excellence.

The SA-4 has taken sonic purity to unprecedented heights. Its all-tube design produces truly astounding three-dimensionality, along with extraordinary focus and soundstaging. If you're looking for amazingly natural, transparent sound, it just doesn't get any better.

Vivid reproduction is also the forte of the SA-20, the power amplifier we consider our "gutsiest." It provides great bass, midbass and incredible verity in reproducing the characteristics of the original recording hall, as well as positioning instruments.

For big performance and a smaller price tag, the SA-12 delivers sonic virtuosity other power amps can't touch at twice the price. It's exceptionally dynamic with a liquid midrange, detailed trebles and an excellent bottom end.

All the solid state devices in the world still can't match this tube for pure performance.



Through the years, in a field where there are no true absolutes, one simple fact has not changed.

The vacuum tube remains the standard for music amplification.

Classic in form and function, man's oldest amplifying device is still the best for delivering unsurpassed performance.

Which is precisely why Counterpoint continues to employ only selected premium tubes for its audio components.

From the beginning, Counterpoint has resolutely refused to engage in a superficial game of "specsmanship."

Rather, every Counterpoint pre-amplifier and power amplifier is meticulously designed and precisely crafted for one express purpose:

To deliver unbelievably real, remarkably pure sound.

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For the Record

Dear Editor:

As we come to the end of the '80s, it seems that CDs are "in" and records are "out." With people having more records than anything else on the market, I feel that the record industry should stay alive! Records still sound better than prerecorded tapes, and most people like to look at the bigger LP covers. To keep LPs strong, I feel it is essential to improve them. Using half-speed mastering, super vinyl (which gives a more quiet playing surface), and static-free rice paper as inner sleeves are just some suggestions to improve LPs.

I will admit that CDs are nice, since they are quiet and small, and soon I too will be obtaining a CD player. The fact remains that not all catalog will be available on Compact Disc. Further, I found that records sound better than analog CDs on a high-quality stereo system.

Glenn Bucci
Garden City, N.Y.

Forgotten History

Dear Editor:

I would like to commend Daniel Sweeney and Steve Mantz on their finely written article on solid-state amplifiers in the June issue ("An Informal History of Solid-State Amps"). It was very well presented, with a wealth of information for many interested audiophiles. I would, however, like to clarify some points and correct some minor factual errors and errors of omission.

First, some time frames need to be corrected. Indeed, the first *publicly* known adaptation of a full-complementary amplifier was produced as a construction project for *Popular Electronics* in 1972—I believe by Dan Meyer of Southwest Technical Products. It was my original suggestion to Dan (while I was at Dynaco) for this concept which led him to do the project: The Tiger .01 amplifier.

Another point to make is that while the authors are absolutely correct in that C. F. Wheatley and a Mr. Kleinman at RCA were the very first to use the series output topology, they did this for entirely different reasons than I did. They were dealing with the new (at that time, circa 1962-63) drift-field germanium power transistors which, due to the lattice structure of germanium, had tremendous leakage problems (I_{CEO}) associated with collector-to-emitter voltage (V_{CEO}) and exacerbated with elevated temperatures. They needed the series connection to make the devices even reasonably safe. Safe-operating-area problems (SOAR) were a thing of the future and were not even known until silicon power transistors were in universal use, circa 1965-66.

I believe that I was the first to use the series topology in output stages. However, I used it first in the Dynaco 400 in 1972. I then used the first output *triple* series in the SAE Mark 3C. Ampzilla was my *third*-generation use of the output series topology.

Regressing a bit, I was the first to make a commercially available dual-differential, full-complementary amplifier, but it was with the SAE Mark 31B in 1973. This continued through the Marks IIIC, IVD, 2200, 2300, 2400, 2500, 2600, etc., up to this day. Ampzilla was a much later refinement of these original concepts.

The authors state that "No true Class-A amp has ever been produced for the mass market." This is incorrect. In 1980, I received the only *conceptual* patent ever issued for a solid-state, pure Class-A power amp from the U.S. Patent Office. Subsequently, I produced (at Sumo) the Model Nine, a 70-watt/channel, pure Class-A amplifier which then retailed for $599. This has to be considered on the low end of the price scale and as close to mass market as you can get with this kind of product.

Finally, I am disappointed that two of our industry's great pioneering engineers were not mentioned. Bart Locanthi must be given credit for his famous T-circuit produced at JBL in 1965. He was the very first person I know of to use the full-complementary output stage. Also, in 1966, Sidney S. Smith of Marantz designed the Model 15, which certainly must be considered a milestone in solid-state design. (I feel privileged to have been the final design engineer on that product.) His drive circuit remains a virtual de facto standard in the world of solid-state amps, as does his use of the compound RAEF pair. Aside from all his previous tube designs, Sid must be considered one of the giants in our industry.

I would like to thank Sweeney and Mantz for mentioning me in their article with more than deserved praise. My work is merely based on the efforts and experiences of all those clever engineers whose brilliance fortunately preceded me.

James Bongiorno
Santa Barbara, Cal.

Burning "Bridges"

Dear Editor:

When I sent in the forms for this year's Annual Equipment Directory, I indicated that our two stereo amplifiers, the Krell KSA-80 and the KSA-200, can be converted to mono operation. For publication, this was changed to read "bridges to 160 watts" for the KSA-80 and "bridges to 400 watts" for the KSA-200.

This change is inaccurate, as it misrepresents the design concept of the amplifiers and will undoubtedly cause confusion in the marketplace. First, it is well known that bridged operation yields four times the unbridged power. As printed, it appears that our units cannot do this. Second, it is also well known that bridging does not deliver good sonic quality. This is certainly in opposition to Krell's reputation and intentions. Further, in the KSA-80 owner's manual, we make the point very clear that the mono unit is not a bridged version of the stereo unit.

In technical terms, the KSA-80 and KSA-200 amplifiers contain two independent supplies. When programmed for mono operation, for the KMA-160 or the KMA-400, the supplies are joined and higher voltage taps are used. The unit then has double the number of output transistors, further increasing the safe operating area. The audio input is also changed, from single-ended to balanced.

Dan D'Agostino
Designer and Engineer
Krell Industries
Milford, Conn.

Consumer Clout

Dear Editor:

I would like to comment on the letter to "Tape Guide" from Steve Medel that appeared in the June issue ("Complaint Department"). Both the writer and Herman Burstein, in his reply, criticized high-feature/low-quality prod-

The buying public has the power to direct the audio industry. When consumers vote with their dollars, manufacturers listen.

ucts, implying that marketing concerns are leading to a deterioration of overall product quality. I believe this view puts the cart before the horse.

From my experience as an audio retailer, in marketing management at both American and Japanese companies, and now as manager of a market research program in consumer electronics, I will agree that sales are of utmost importance. But manufacturers rarely lead the consumer into making foolish choices. Instead, the marketing departments try their best to discover what their customers (retailers and consumers) are looking for, and then attempt to have their factories produce it competitively. Certainly many tradeoffs in product design are possible, leading to the richness of choices we all enjoy. But if a product doesn't sell, you can bet the company will discontinue it. All efforts will turn to the combination of features and price that, hopefully, will better meet the customers' demands. The history of our industry is littered with "fantastic" products that few, if any, consumers wanted to buy.

It is my basic observation that the quality level of components today is high and edging upward. Even if this were not the case, an educated consumer, having read *Audio* and other magazines, could presumably find the combination of features, precision, etc. that best meets his or her needs. We, the buying public, have the power to direct the industry. When consumers vote with dollars, manufacturers listen!

Clark Johnson
Port Washington, N.Y.

A Star Is Reborn

Dear Editor:

As a very critical listener/performer of early music, I spent a year deciding on my "last" turntable, a SOTA Star. Because this company is committed to ongoing updates, they eventually caused me a problem. First, it would cost money. Second, I would lose my second favorite musical instrument (after my viola da gamba) for who knew how long.

To my surprise, two days after SOTA received my table, I got a phone call from Robert Becker. He told me that SOTA couldn't really upgrade my very early Star to their satisfaction. To my amazement, he then told me that SOTA had decided to replace my table with a current Series III, at no additional cost. None! Nada! And from the head of the company!

Five days later, my new Star was performing in my system. Let me tell you, no CD player could come close to SOTA's latest vacuum model—and perhaps no other turntable—for less than megabucks. But I am not writing to rave about the sound. I simply think this kind of support, motivated solely by SOTA's standards (and without pressure from me), deserves public notice. My other upgrade experiences have been far less rewarding. With this kind of customer support, the LP will live forever. I hope good news travels fast.

Peter Brewster Brown
El Cerrito, Cal.

Editor's Note: Yeah, but Becker is the only one with a key to the phone lock.—*E.P.*

Whytewashed

Dear Editor:

It is very discouraging to read in your October issue that one must spend $6,500 just to extract a decent signal from a CD player ("Behind the Scenes") and that even the optical connections provided in high-end equipment are rotten.

I have several Compact Disc players, a very fine digital preamp, and numerous CDs, and can make my system sound as good with CDs as with a $1,500 cartridge/arm/turntable combo. Let's face it: Some Compact Discs sound lousy, even if played through a Wadia, just as some LPs sound lousy even when played using the latest Koetsu phono cartridge.

What does Bert Whyte propose using as a CD transport suitable for connection to the Wadia? Surely not a Magnavox 460. Perhaps a CD-ROM drive at about $1,500?

In short, I think Bert Whyte's column is going to turn off, rather than turn on, those readers who have been sitting on the fence with regard to the Compact Disc. I mean, wouldn't you question the feasibility of a playback technique requiring 72,000,000 calculations per second?

Bernard A. Engholm
Carlsbad, Cal.

DAT

COMPACT disc DIGITAL AUDIO

Headphones For The Digital Era.

Records aren't the only things made obsolete by CD's. Many headphones that sounded fine with analog audio just aren't up to reproducing the remarkable clarity and full dynamic range of digital sound. In the tradition of the professionally used AKG K240 series, AKG continues to meet this technological challenge with the new K280— the first *parabolic* headphones designed specifically for digital recordings. Within each earcup are two perfectly matched transducers computer-positioned to focus interference-free sound at the center of the user's ear. This "acoustic lens" offers exceptionally transparent sound and dimensional imaging, while the use of doubled transducers improves channel balance and increases dynamic range to match the most demanding performance. Comfortable and accurate, AKG K280 headphones are designed to be driven by the low impedance outputs of modern CD players and audio gear. Also available is the K270, a non-open air [sealed] version of the K280.

AKG headphones. The standard of performing artists and recording engineers around the world. When you're listening in the digital era, you'll want to hear it all.

AKG acoustics

Focusing on new technology.
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(203) 348-2121

AUDIOCLINIC

JOSEPH GIOVANELLI

Nighttime AM Reception

Q. Why is it that some AM stations are not very strong after sunset, and others, not even present during the day, are strong after sunset?—Richard Harding, Peabody, Mass.

A. The effect of sunlight in the portion of the radio-frequency spectrum used to transmit AM broadcast signals is such that, during daylight hours, these signals are absorbed by the ionosphere. After sunset, the nature of the atmosphere changes, and these signals are not absorbed to the same extent. If the signals are not absorbed, they will travel farther and be heard at night.

This can result in problems after sunset. Just tune around the dial, and you'll discover that many frequencies which had no stations on them during the day are so overpopulated that there is nothing but a jumble of sound. Even when you are near a desired AM station, reception may be blurred by distant stations occupying the same frequency.

The scenario just described would be worse if steps were not taken to alleviate the situation. Let's assume that stations A and B share the same frequency. Station A interferes with station B at night. Station B may be interfering with station A, as well. To avoid the problem, they "protect" one another. This is done by changing the pattern in which their waves are radiated. In daylight hours, these stations may radiate their signals equally in all directions. At sundown, each station adjusts its radiation pattern so that it becomes directional.

If you happen to live south of station A, and if that station causes interference to listeners of station B (located south of you), you will notice that the signal strength of station A drops suddenly at sunset. Because station B protects against interfering with points to its north, you may never even know it is sharing the frequency with station A.

Noisy Alternator

Q. I have a problem with my car stereo. Despite what I believe is the right installation and grounding of the equipment, and even the isolation of the equipment from the rest of the electrical system, I hear a whining, variable pitch on acceleration. This happens despite the installation of a noise suppressor, and I can hear the noise with the gain turned down. It is most apparent when other parts of my 1980 Honda Accord LXi's electrical system are in use (particularly headlights, brake lights, or the air conditioner).—Richard Borts, St. Louis, Mo.

A. You say that you installed a noise suppressor, but some suppressors are used to cover noise from ignition systems while others are designed for use with alternators. Because of the description you gave, I believe that the noise you hear is produced by the alternator. If you do not have a suppressor on the alternator, have one installed as a first step.

If you have wired your stereo equipment to the battery, did you wire both the ground and "hot" wires directly to the battery? You should do so. It is never a good idea to rely on the body of the car to carry ground to the battery. It may also be that you relied on the body to carry speaker grounds. Wire the speakers directly to the equipment.

(*Editor's Note:* My installer, Tony Igel of Stratford Service in New York, suggested some additional possibilities. He says Hondas often have wiring harnesses running just above the dashboard's radio slot. One or more wires are probably radiating interference into your stereo system. These should be checked, one by one, for interference; many installers have "sniffer" devices that detect nearby signals. The guilty wires should be cut, lengthened, and rerouted. If your system has a separate amplifier, try low-level noise filters, which are designed to be wired or plugged into the signal cables between the system's head unit and the amplifier.—*I.B.*)

Possible Overload

Q. When I am listening to FM stereo with headphones, I can hear what sounds like another station in the background during quiet passages. I can only hear this with headphones. Is it the result of some shortcoming in my stereo system's tuner?—Joseph S. Barbera, Buffalo, N.Y.

A. Do you hear the background "station" only when listening to FM? If it turns out that you hear it when listening to other sources, chances are the problem is caused by radio frequencies getting into the equipment via an interconnect cord or other means.

We'll assume, however, that you hear this background station only when listening to FM stereo, as you said. There can be a couple of potential sources of the sound.

The first possibility is that your tuner is being overloaded by a strong signal. If you can hear a signal when tuning the dial—and this signal is heard at several points on the dial, in addition to the proper one—you probably have FM overload. To cure this, you'll need to place an attenuator between the antenna lead-in and the antenna input terminals.

The other possibility is not at all related to overload. The sound you hear may not be that of a background station, but the audio of an SCA subcarrier. These subcarriers are broadcast along with the programs you expect to find on your FM stations, and are designed for special applications, such as background music for stores and restaurants. If the subcarrier is modulated more heavily than is appropriate, listeners to the main FM program will hear a faint trace of the SCA subcarrier signal.

It also is possible that your tuner is misaligned somewhat, especially in its i.f. stages. If this is so, nonlinearities will be introduced and will result in the SCA signal being heard as described.

Relative Power of Phones and Speakers

Q. When I listen to my system via loudspeakers, the power level meter shows a reading of "1." To listen via headphones at what I believe to be the same loudness, I have to turn up the volume such that the meter shows almost "3." Can you explain this? It is my understanding that headphones require much less power than loudspeakers.—Michael Gompper, Manchester, Conn.

A. You are quite right! Headphones require much less power than loudspeakers do. If the phones were con-

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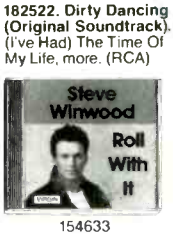

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180187. Bruce Hornsby & The Range—Scenes From The Southside. The Valley Road, more. (RCA)

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123721. Jimmy Page—Outrider. Wasting My Time, The Only One, Wanna Make Love, Hummingbird. (Geffen)

173233

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134347

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In large measure, it is by the fundamental frequencies and their relative strengths that we can determine the nature of a sound.

nected directly to the speaker terminals, very little volume would be needed. In fact, it would be almost impossible to adjust the volume. When the volume was properly set, you would find that the power level meter would probably show nothing, so slight is the power being used.

What accounts for your observations? There is a power-reducing circuit in the amp. The phones are connected to it, rather than to the speaker terminals. This permits better control of the volume and prevents the phones from being damaged by excessive power.

Your level indicator doesn't really read power (which involves both voltage and current) but voltage alone. Depending on where it is in the amplifier circuit, the reading will be about the same for any given volume control setting and input signal level. This is true whether the amplifier is feeding reasonably high power to the speakers or low power to the headphones.

Harmonics and Octaves

Q. I am confused as to what a harmonic is. What are first, second, third, etc. harmonics? What are they used for? Also, what is an octave and how does it fit in with the subject of harmonics?—Sid Drexler, Wantagh, N.Y.

A. Mankind can, and does, deal with harmonics. They are inherent in most devices which produce sound waves.

Consider a frequency—any frequency. For illustration, we will consider a frequency of 200 Hz. When this frequency is transmitted in air, the device producing that frequency will vibrate 200 times each second. This is also true of our eardrums, which receive the sound. Because of the nature of a vibrating system, there will be other vibrations set up in the device which is producing our 200 Hz. The most common occurrence is for the device to vibrate both as a whole and as though it were really two separate halves. Thus, in addition to the main, 200-Hz tone, this same device will also produce a 400-Hz tone.

The original 200-Hz tone is often referred to as the fundamental, or the first harmonic. The second frequency (400 Hz) is twice that of the fundamental and is known as the second harmonic. Other vibrations can be generated which will always be exact multiples of the original, or fundamental, frequency. Thus, the third harmonic is 600 Hz (three times the fundamental).

Harmonics and octaves are related. If the fundamental frequency is doubled, we say that the resulting frequency (the 400-Hz second harmonic) is one octave higher than the fundamental (the 200-Hz frequency we started with). What is the relation to the fundamental if we wish to produce the next higher octave? Well, it is 800 Hz because, in order to obtain it, we again must double the frequency. Hence, the

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just about perfect, we decided to
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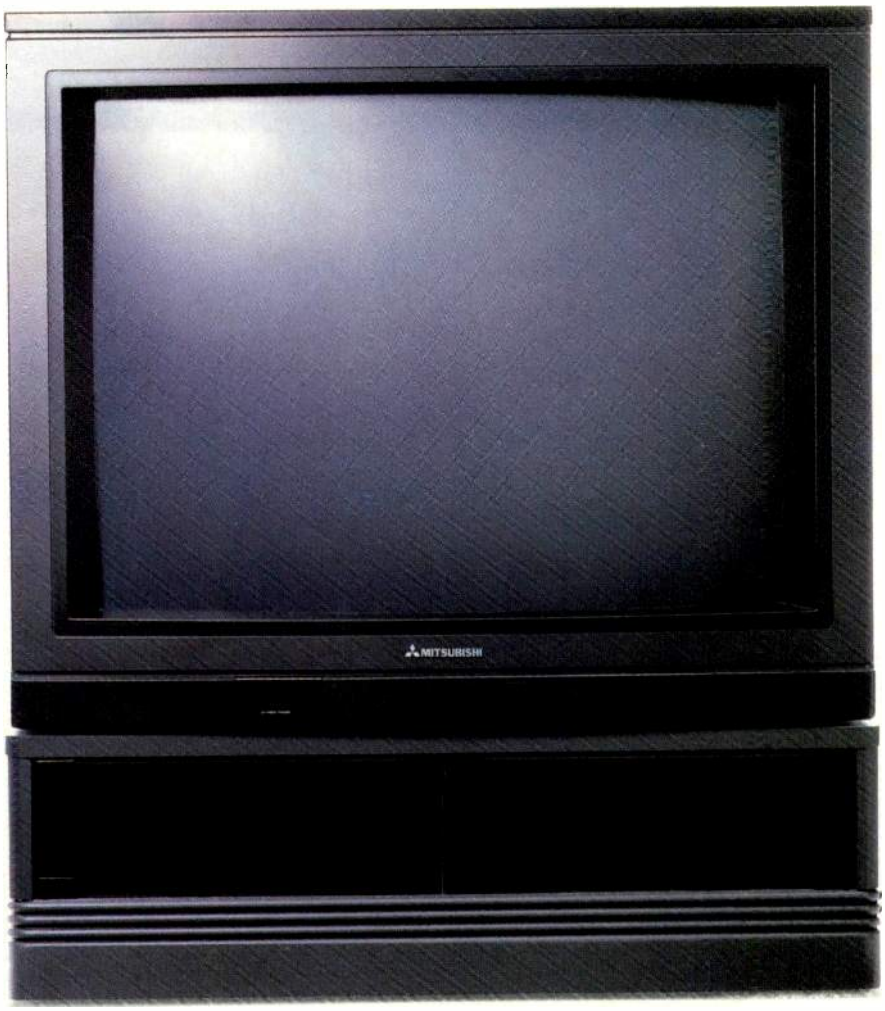

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Using a motor generator for converting European power to American standards would be bulky and expensive but might have its benefits.

second *octave* above the fundamental is 800 Hz, which is the fourth harmonic of 200 Hz, and not the third as you might have supposed.

Different vibrating systems produce different degrees of harmonic energy in relation to the fundamental. In large measure, it is by these frequencies and their relative strength that we determine the nature of a sound. The difference in sound between a clarinet and a flute is determined in this way. The flute's output contains very little harmonic energy. The clarinet, on the other hand, is an instrument that is rich in harmonics.

When it comes to the reproduction of sound, our goal is to reproduce a tone as accurately as possible. We do *not* want added harmonics to be generated in a high-fidelity system. If there are harmonics already present in the original program source, so be it. We do not wish to add more of them via the sound system.

When we refer to measuring harmonic distortion, we are measuring the amount of harmonics which are introduced by the device being tested. The lower the percentage of such added harmonics, the better the device will be in this regard.

A Different Approach To European Power

Q. I believe that I have another answer to the matter of operating nominal 110-V, 60-Hz sound equipment when you are in an area which has 220-V, 50-Hz power. Why not simply produce your own 110-V, 60-Hz power? Just buy a portable a.c. generator, available at most hardware stores. Rather than using the noisy gasoline engine to turn the shaft, remove it and replace it with a suitable 220-V a.c. motor capable of running at 50 Hz.

I am assuming that this can be situated in a basement far enough from the listener that the noise would be inaudible. The 110-V current could be brought to the audio equipment via an extension cord, if necessary. Do you think this solution is reasonable?—Rick Heil, Glendale, Wisc.

A. Well, yes, it is possible to do what you suggest. You must be sure that the motor turns at the speed which will permit the generator to produce 60-Hz current. This could entail using belts and pulleys properly chosen to produce the needed generator speed.

The contraption will be bulky and expensive. I can't prove it, but I think it will cost more than the step-down transformer usually employed. Of course, your scheme will provide 60 Hz; that is important for some devices which include synchronous or induction motors whose speed is directly dependent on power-line frequency.

Not only will you need a line from the basement to feed power into your audio equipment, but you will also need a way of turning the generator off when it is not needed. A

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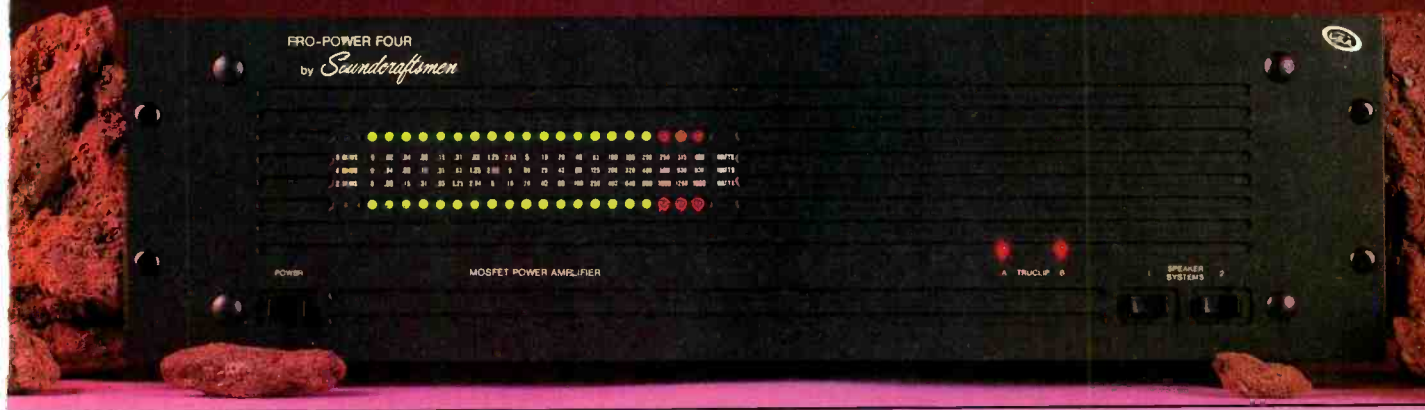

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TAPE GUIDE

HERMAN BURSTEIN

Test-Tone Generator

Q. I have a Numark TC4100 tape deck with a built-in tone calibrator/mixer which generates 400-Hz and 8-kHz test tones and has adjustable bias. The instruction manual is not very good, however, and I have a couple of questions. Can the test tones be used to adjust bias for a particular brand and type of tape, and, if so, what is the procedure? Can the test tones be used to check the azimuth alignment of the tape heads?—Mike Morena, Camarillo, Cal.

A. The usual procedure for adjusting bias in a tape deck by means of a two-tone calibration system is to record both tones and adjust bias so that the levels of the two tones are equal in playback. If you find the resultant very high treble response unsatisfactory, you can touch up the bias by reducing it slightly. Contrariwise, if treble proves excessive, you can increase bias somewhat (which has the advantage of also reducing distortion).

The test tones cannot be used for adjusting playback azimuth. For that you need a test tape (quite expensive) containing a high-frequency tone, typically about 12 or 15 kHz. The procedure is to play the test tape and adjust playback-head azimuth for maximum output. If the deck has a separate record head, an audio generator is required to produce the same tone, and record-head azimuth is adjusted to produce maximum output in playback.

Picking a Reliable Deck

Q. Have there been any studies concerning the reliability of various brands and models of tape decks? Or can you point out any guidelines for buying a reliable deck? My family and I have had a lot of problems with every type of cassette deck we've had—home, car, or portable.—Joseph A. Arlt II, Philadelphia, Pa.

A. I do not know of any studies that have sought to rate tape decks, or other audio components, in terms of reliability. This would be a very time-consuming study, and by the time it was completed, there would be a whole new assortment of cassette decks on the market.

A reasonable guide to reliability is the deck's price and the reputation of the manufacturer. Two decks may outwardly look very much alike and may offer pretty much the same features, yet they may differ substantially in price. A key reason for this difference is usually the quality of parts and construction, which substantially determines reliability.

Another factor in reliability is complexity. The more features a deck boasts, the more things there are that can go wrong; so the simpler the better, all else being equal.

Equipment reviewers sometimes look inside a deck to evaluate the quality of components and assembly. Their remarks in this respect can be an index to reliability. Finally, a model that has been on the market for a substantial period and has sold successfully may have an edge in reliability because the manufacturer will have had time to refine the product and eliminate the bugs. Similarly, a firm which has made cassette decks for many years will usually have an edge.

"Hot" Tape

Q. I have just changed to a different brand of tape; its output is 3 dB greater at the high end. My deck automatically optimizes itself for any tape, and tests have shown that its frequency response is ±1 dB from 20 Hz to 18 kHz. Will my deck compensate for the 3-dB gain at the high end and still give flat response, or will there be a 3-dB rise at the high end? If the deck compensates for the high-end gain and gives flat response, what would be the purpose of having a tape with such a characteristic?—Michael P. Conner, St. Louis, Mo.

A. If your deck does a proper job of automatically adjusting bias, EQ, and record sensitivity for the tape in use, response should remain flat with the new tape.

The purpose of a tape with an extra few dB of response at the high end is to reduce the chances of distortion owing to insufficient bias. Reduced bias may be needed to maintain treble response of a poor tape, but if a tape has good high-end response, more bias may be used with less chance of distortion.

If your deck automatically adjusts record EQ, the tape with superior treble response requires less treble boost in recording, which reduces the chance of tape saturation. (Tape saturation causes distortion and loss of response at the very high end.)

All in all, if everything else remains equal, the extra gain at the high end can prove useful.

Tape Type Choice

Q. After reading Howard A. Roberson's article in the November 1987 issue, in which he reviewed 35 cassette tapes, I am more confused than ever about the pros and cons of low- and high-bias tapes. In the article, it seems that Type I (low-bias) tapes are rated better than Type II (high-bias) tapes. If that's the case, why do tape companies push high-bias tapes, and why do they cost more?—Greg Stefano, Seattle, Wash.

A. Originally, Type II tapes were introduced because they provided better performance than Type I, particularly with respect to high-frequency response. However, continued technological advances have enabled Type I tapes to stay not much behind (and in some cases to equal or surpass) Type II, as was brought out in Mr. Roberson's article and in other articles. In general, the chief advantage of Type II lies in its somewhat higher S/N ratio, which is due to the fact that this tape type's playback EQ entails greater bass boost (or, depending on how you look at it, greater treble cut). Still, some companies that employ Type II for prerecorded cassettes eschew this advantage in order to achieve more headroom, and designate their cassettes for Type I playback EQ. They do so because less treble cut in playback entails less treble boost in recording and, therefore, less risk of tape saturation at high frequencies.

The generally higher price of Type II tape owes principally to the higher cost of making its magnetic coating, which is either chromium dioxide or cobalt-doped ferric oxide.

Type IV tapes (which require by far the highest bias of all) are particularly advantageous in providing headroom. That is, they permit more extended tre-

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

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The recommended bias setting may produce a slight drop in treble response, but further reducing bias would probably cause increased distortion.

ble response at high recording levels. Still, by providing a safety margin of a few dB when setting record level, you can achieve very good treble response with Types I and II cassettes and a gooc tape deck. As for price, Type IV tape is the most difficult and costly to make.

New Tape for an Old Deck

Q. I have an open-reel deck and am shifting to a new tape. However, with the present bias and record EQ, the new tape has excessive highs from about 4 kHz upward, reaching 6 dB at 16 kHz. This indicates underbiasing and/or excessive treble boost in the record circuitry of the deck. How can I optimize bias for the new tape? The instruction manual says that I should adjust bias so a 1-kHz tone drops 0.2 dB past maximum response. Should I do this with the old tape and then adjust the record EQ on the basis of the new tape?—R. Wendell Butz, Columbus, Ohio

A. Bias should be adjusted based on the tape you plan to use: Your new tape. Therefore, following the procedure recommended in your manual, you would record a 1-kHz tone on the new tape, gradually increase bias until you get maximum output of this tone in playback, and further increase bias until output drops about 0.2 dB.

If this results in nearly flat response, you can stop there. You might consider adjusting bias *slightly* to get even flatter response; if you don't change the bias, you'll have to adjust the record EQ. As you already recognize, increasing bias causes high-end response to drop, and vice versa. If the manual's bias adjustment procedure produces a slight drop in treble response, I would be inclined to accept this; otherwise, if you reduce bias, you will probably be increasing distortion.

Bias for Metal Tape

Q. In a recent review of cassette tapes, it was noted that a particular metal tape will not perform at its best unless one's deck is adjusted to match the tape's high bias requirement. My deck has a system for adjusting bias in order to match various tapes, but, just as the owner's manual predicts, it does not work with metal tapes. How do I adjust bias so I can use metal tape to its best advantage? Should the adjustment vary from side to side, tape to tape, or batch to batch?—Ruhl Heffner, Hunt Valley, Md.

A. From what you say, it may well be that your deck cannot produce sufficient bias for metal tape. However, if you simply mean that your deck's automatic bias-adjustment system does not work well with metal tapes, you can (if your deck permits) try adjusting bias by ear. Record FM interstation noise at a low level, play it back, and compare it with the original. Experiment to find the bias setting which provides the playback response most similar to the FM noise.

Metal tape's bias requirements (and sensitivity) tend to vary a fair amount from one brand to another. However, they do tend to be fairly stable from one cassette to another of the same brand and grade, and from one direction of tape travel to the other. Still, you might find that optimum bias varies from one batch to another of the same tape, making it advisable to buy your metal tapes in volume rather than a few at a time.

Dulled Sound

Q. I presently own a cassette deck which is connected to a dbx noise-reduction unit. I wish to purchase a higher-quality deck, but when I played one of my tapes on this new deck through another dbx unit, I found that the playback readings were about 5 dB below those obtained in playback on my current deck. The music quality on the proposed new deck was good, except that it seemed as if the speakers were underneath a blanket. If I have a service technician recalibrate the meters on the new deck to match the meter readings on my present deck, would the music then sound as good on the proposed deck? Would this change in calibration affect the new deck's frequency response?—Andy Ross, Beloit, Wisc.

A. Recalibrating the meters of the new deck in playback would not affect the quality of the sound in any way.

The veiled sound that you describe seems to stem from an azimuth mismatch between your present deck and the contemplated new one. One or the other, maybe even both, seems to be out of correct azimuth alignment.

Another possibility is some discrepancy between the dbx unit employed in recording and the one employed in playback. This can be checked by recording a tape on your present deck without dbx, and playing it on the new one without dbx. If the sound is still veiled, this indicates an azimuth mismatch.

Adjusting Azimuth

Q. I own a Nakamichi ZX-9 that provides for easy azimuth alignment in the record mode. Unfortunately, as far as I know, the azimuth alignment control can only be operated when recording. I would like to find out how to adjust the deck's playback head.—Alex Ortiz, El Monte, Cal.

A. Playback-head azimuth is adjusted at the Nakamichi factory to conform to a standard test tape—that is, to provide maximum output at a high frequency on this tape (typically 15 kHz or so). Record-head azimuth is made variable in order to achieve maximum response when simultaneously recording and playing a high-frequency test tone (such as 15 kHz) or, if this tone is unavailable, to achieve best high-frequency response when reproducing FM interstation noise.

Adjusting the azimuth of the playback head is not advised, unless you have reason to believe that it is out of correct alignment. Even then, this adjustment is best left to a competent audio technician. He will make the adjustment on the basis of a standard test tape which is quite expensive. If you are determined to adjust playback-head azimuth yourself, you will have to refer to the service manual; it typically costs about $10.

MPX Filter

Q. My cassette deck has something called an MPX filter. I am not sure what it does. Can you please explain it to me?—Mitchell Dodo, Hilo, Hawaii

A. The multiplex (MPX) filter is present in order to exclude any of the 19-kHz pilot tone that may remain in the signal which the tuner presents to the cassette deck in recording. Some tuners have adequate filtering; others do not. This 19-kHz tone can interfere with correct operation of Dolby circuitry, so it is probably best to leave the MPX filter on when recording from FM.

Martin-Logan Loudspeaker

The newest addition to Martin-Logan's line of electrostatic loudspeakers is the Sequel, which combines a 10-inch, high-excursion woofer with a 12 in. W × 48 in. H electrostatic transducer with 30° horizontal dispersion. This model uses oxygen-free copper coils and polypropylene bypass capacitors. Crossover frequency is 125 Hz at 6 dB per octave for the first octave and 12 dB per octave thereafter. Frequency response is rated at 28 Hz to 24 kHz, ±2 dB. The Sequel is 14 in. W × 71½ in. H × 13 in. D. Price: $2,250 per pair.
For literature, circle No. 100

TEAC CD Player and D/A Converter

The Esoteric CD player consists of a separate CD drive unit (Model P-1) and D/A converter (D-1). The D-1's D/A converter is an 18-bit type, with four-times oversampling. A "Zero Distortion" circuit adds dither to the signal in playback, to change conversion errors into inaudible white noise. The D-1's double-PLL clock circuit adjusts to any sampling frequency between 30 and 50 kHz, including all three standard DAT, CD, and satellite sampling frequencies. Dual mono D/A converters are used to eliminate the 11-μS delay inherent in single-D/A converters. Both balanced XLR and unbalanced output jacks are provided. The companion P-1 drive unit has an exclusive disc-clamping system to eliminate disc warps, and a motor that is separate from the laser pickup for a more rigid drive system. Both optical and coaxial digital outputs are provided, and a remote control is included. Price: $5,995 for both units.
For literature, circle No. 102

Koss Headphones

Using a hybrid design, the Pro/450 incorporates a piezoelectric tweeter and a dynamic moving-coil bass driver for increased bass performance and extended dynamic range. The Pro/450's neodymium magnet is designed for a stronger and lighter motor structure, and a copper-clad aluminum voice-coil reduces moving mass and increases diaphragm velocity. Price: $174.95.
For literature, circle No. 101

Citizen Amplifier

Ultra-simple and compact, the PAF 303 has inputs for two high-level stereo sources, switchable bass boost, and no other controls except for volume and power. It delivers 25 watts per channel into 8 ohms, at 1% distortion, from 20 Hz to 20 kHz. Input sensitivity is 150 mV, and S/N is 90 dBA. Price: $165.
For literature, circle No. 103

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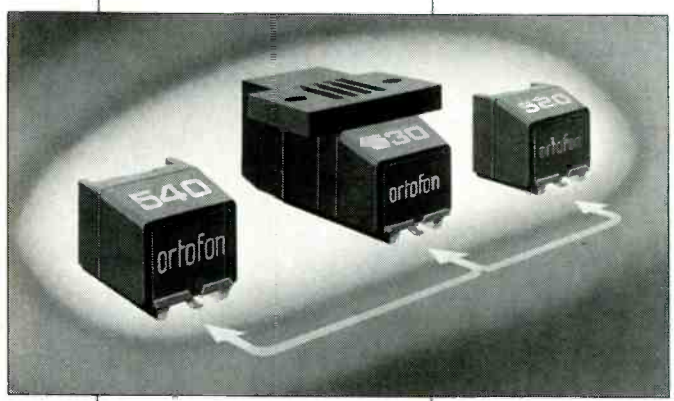
Designed for home and commercial installations in walls and other flat panels, the AB-7 is a two-way system using one 6½-inch trilaminate polymer bass-midrange driver and a 1-inch SL2000 silver-coil dome tweeter. Frequency response is 30 Hz to 26 kHz. Price: Approximately $400 per pair.

For literature, circle No. 104

Ortofon Cartridges

The cartridges in Ortofon's 500 Series are identical except for their styli. The top-of-the-line 540 features the new Fritz Gyger II stylus, which is designed for low drag and maximum groove contact. The 540's frequency response is rated to 27 kHz. The 530 uses a nude-mounted Fine Line stylus with response to 25 kHz. The 520 uses an elliptical stylus with response to 23 kHz. The 500 Series cartridges are moving-magnet designs, and their coils and magnetic systems were engineered to reduce eddy-current losses through a split-pole pin. The cartridge body is made from Noryl fiber plastic and melted glass. A three-position stylus guard allows for easy removal of the stylus as well as protection against damage during installation and shipping. Prices: 540, $300; 530, $225; 520, $150.

For literature, circle No. 106



Eclipse Car Stereo

The tuner section of the ECE-101 is rated at 10.2 dBf sensitivity for 50-dB quieting. Features include two-way seek tuning and 18 station presets with preset scan. The tape section uses a dual azimuth adjustment system, even though it does not reverse, and has a narrow, 1-micron head gap. Using a frequency-generator servo motor, the unit's rated wow and flutter is only 0.06%. Both Dolby B and C noise reduction are on tap. The four-channel amplifier section is rated at 20 watts per channel, and the unit has an input for a CD player. Price: $629.95.

For literature, circle No. 105

Kenwood Personal CD Player

Designed for portable use, with a home system or with a car system, the DPC-77 uses a 16-bit, four-times oversampling filter. With rechargeable batteries, the DPC-77 provides 5½ hours of continuous playing time. A 16-track random program memory and audible search are featured. The DPC-77 comes with an a.c. adaptor, battery charger, and carrying strap. Price: $299.

For literature, circle No. 107

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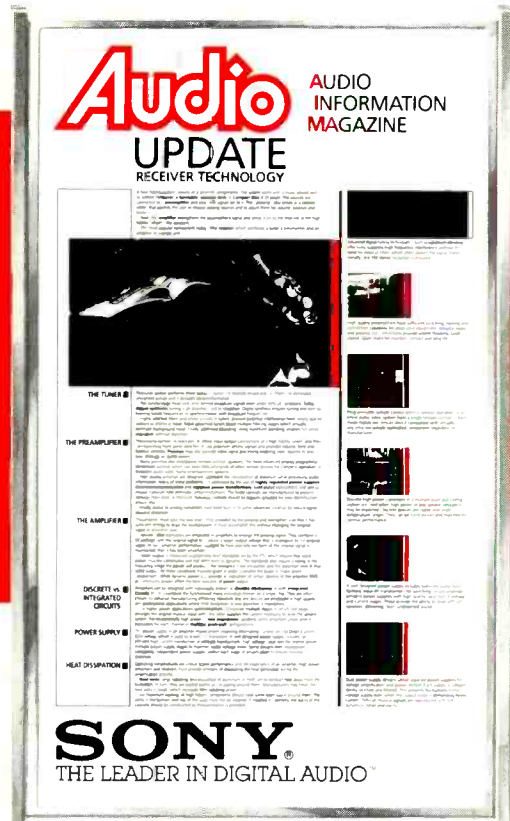

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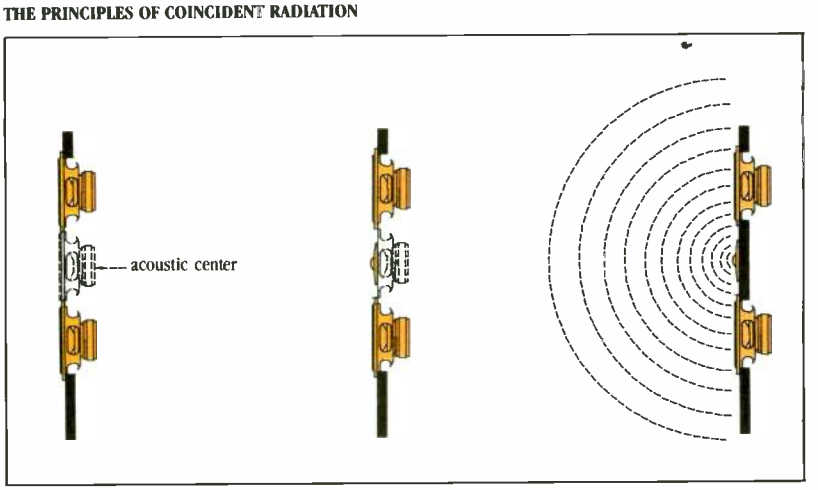

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EDWARD TATNALL CANBY

BARNSTORMING

Illustration: Les Kanturek

Late last summer, when it was still warm enough so that an uninsulated old barn was a comfortable place to be in, I gave another audio show, my umpteenth one-man event in some 60 years. No—not an equipment display. Rather, an ad-lib lecture with abundant taped sonics. I hate to call these things lectures—they rate in my mind as instructive entertainments, a minor branch of show biz. Hence a show, an audio show.

Well, this time I had to get help to move a pair of extremely heavy loudspeakers back and forth from my living room. (A right decision, it turned out, choosing these over a much smaller and more convenient pair.) I hefted my old professional TEAC, a Tascam equivalent, and also mountains of cables, stacks of prepared tapes (reel to reel and full of white leader cues), and my most pessimistic standby equipment, a box of extra cables, sticky tape, connectors, pliers, screwdriver, and of course soldering iron. I am too well acquainted with Mr. Murphy to skip these essentials. Also, forewarned by long experience, I demanded at least two hours by myself in that barn (converted to a guest house in 1921) for detailed setup. I used all but five minutes, and was I lucky! Only one inoperative a.c. wall outlet and one sputtering speaker.

Now this was a very tiny show by big-time pop music standards, but already, I think, our audio big shots will see that we live in the same world. As the Boy Scouts have it: *Be prepared.* Be prepared for all sorts of improbables you would never have thought of, if you did not know how probable they were. Be prepared even in the material you present, the show itself. Leave nothing to happenstance.

Paradoxically, the very basis of my thorough preparation has always been the opposite of what you may think. Never a fixed procedure, safely recorded and timed out to the last second. Instead, every successful "lecture" I have ever given has been without script, done entirely ad-lib. My sort of ad-lib involves hours, days, of prior study and experiment, long rehearsals of possible procedures, the rejection of vast amounts of material, and the amassing of at least twice as much usable stuff as I will have time to handle. This, both in the ideas and in the actual audio on tape. Alternatives! Quick ones, ready-cued, that can be slipped in dexterously anywhere, just as though they were part of the plan. Indeed, any plan I have is always a batch of alternatives—of clumps of material, spoken comment and played illustrations, even a flexible sequence of events, depending on audience reaction as well as the effectiveness of the sound in a soundspace totally different from that at my home. All this is very specific, with leader tape at each possible example—so I can get there quickly—and a well-tried group of spoken phrases that I go over in my mind, and sometimes out loud, just to see how they will work. Oddly, this is what makes for a feeling of spontaneity, as though I really were making it all up on the spot.

After you get through the equipment hazards and sonic surprises in the setting up of a show and everything is working, you still have that unpredictable unknown: All those bodies and minds that are your audience. This time I had maybe 75 or so in attendance, ranging in age from kids of seven or eight to doddering ancients with impaired hearing. How was I to know which of my alternatives would please? And how long would they listen to each? You understand that the recorded spoken word, which is all I've had in this show (over a span of 40 years) is notoriously difficult to listen to as projected to a lot of people at once. No TV picture, no live presence, just the sound. At best the attention span for this kind of audio is short before restlessness sets in.

Oddly, music reproduction is less critical. Problems, yes, but recorded music is more easily adaptable to a variety of situations, your audience's attention span is longer, and your recorded examples can be longer too. Yet even music commentary with recorded sound is a tough proposition to put to a live audience. You must exert every ingenuity you can devise to make it work.

So on my small scale, and on many intermediate scales, you must be prepared to be flexible. The more rigid your plan, whether in the spoken comment or the recorded sonics, the more likely is disaster. No, you don't just improvise. You juggle your material—and with ease, since you have it well prepared. You shape your show as you go along, with an eagle eye on that audience. You nip boredom in the bud just as soon as you sense it, shifting

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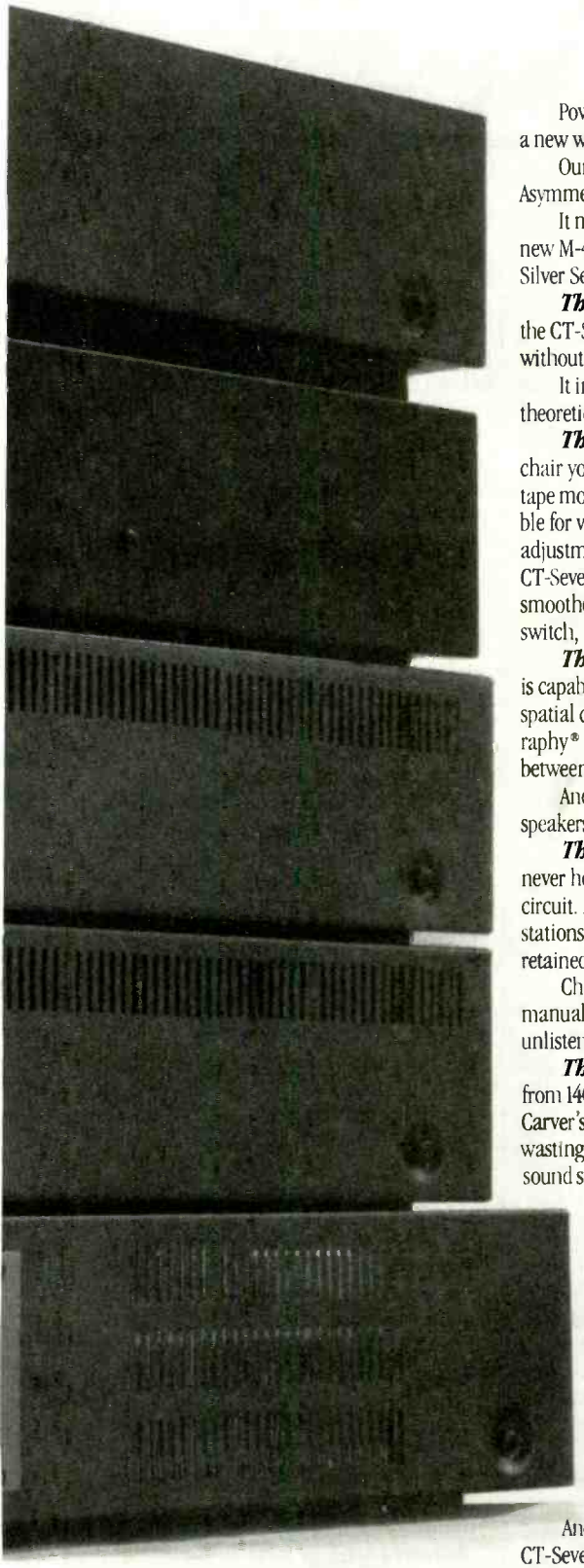

Power and finesse. They've always been important factors in a serious listening system. Now there's a new way to achieve both without overpowering your budget.

Our new CT-Seven preamplifier/tuner combines a Sonic Holography® preamplifier and Asymmetrical Charge-Coupled FM Detection tuner into one convenient component.

It makes beautiful music with our whole line of Magnetic Field Power amplifiers. Including the new M-4.0t with the same transfer function and power output as Bob Carver's $17,500-pr. ultra-esoteric Silver Seven monoblock amplifiers.

The CT-Seven as an audiophile preamplifier: Like Carver's fine separate preamplifiers, the CT-Seven is designed as a "straight wire with gain," capable of perfectly passing input signals without adding or subtracting any musical nuances.

It includes a meticulously engineered, ultra-low noise phono stage that flawlessly duplicates the theoretical RIAA equalization curve.

The CT-Seven as a complete sound control center: From the comfort of your listening chair you can choose from six sound sources including dual tape monitors, CD input and video/auxiliary inputs (suitable for video sound or DAT). Unlike most remote volume adjustments which use distortion-inducing electronics, the CT-Seven employs a motorized volume control for smooth control and smoother sound quality. Also included are useful 3-band tone controls, mono switch, loudness equalization and a studio-quality headphone amplifier.

The CT-Seven as your passport to musical reality: The CT's Sonic Holography® Generator is capable of redefining your perception of music by recreating the sound stage and 3-dimensional spatial characteristics of a live performance. According to some of America's top reviewers, Sonic Holography® "...seems to open a curtain and reveal a deployment of musical forces extending behind, between and beyond the speakers. The effect strains credibility."

And you can create it from any stereo record, tape CD or even FM broadcast. With your existing speakers. At the touch of a remote button.

The CT-Seven as a high performance quartz synthesized FM tuner: You've simply never heard FM until you've heard it through the Carver Asymmetrical Charge-Coupled FM Detector circuit. Multipath distortion, interference and distant station noise are dramatically reduced. Weak stations emerge into dramatic clarity. Yet stereo separation, space, depth, and ambience were not only retained, but seemingly enhanced by the lack of background noise.

Choose 8 FM and 8 AM presets by remote control. Scan the broadcast band automatically or manually. With the CT-Seven's ACCD circuit on, you'll discover "new" stations which were previously unlistenable!

The CT-Seven's power partners: Only Carver gives you four high power amplifier choices from 140 watts to 375 watts per channel. Each is perfectly matched to the CT-Seven. And each uses Carver's cool-running Magnetic Field Technology which dispenses with bulky power supplies and power-wasting external heat sinks... yet which is so rugged it's used in the world's largest touring professional sound systems.

Choose from the new "modestly-powered" M-0.5t **(140 watts per channel RMS 20-20kHz both channels driven into 8 ohms with less than 0.1% THD),** the M-1.0t **(200 watts/ch. per channel RMS 20-20kHz both channels driven into 8 ohms with less than 0.15% THD),** M-500t **(250 watts per channel RMS 20-20kHz both channels driven into 8 ohms with less than 0.15% THD),** or the new M-4.0t **(375 watts per channel RMS 20-20kHz both channels driven into 8 ohms with less than 0.5% THD).**

Hear brains and brawn together at your Carver dealer. Switch the CT-Seven and the most expensive tuner in the room to hear Asymmetrical Charge-Coupled FM Detection work its magic. Put on your favorite CD, press the CT-Seven's Sonic Holography® remote button and feel the sound room "disappear." Turn up the volume to live performance levels and discover the impact of true dynamic headroom.

And then get ready for another pleasant experience when you discover what a super value the CT-Seven and Carver power amplifiers are.

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When preparing lectures, I am too well acquainted with Mr. Murphy to skip pessimistic essentials like standby equipment.

neatly to something else as though you had meant to all along. You can really fool 'em this way. Keep one step ahead, and you have them right in your hand. That's my kind of audio show.

The average high-end consumer, I am aware, is much more familiar with differences in the sound of equipment than with differences in playback location. You come to know your listening room so well, or the sound in your car, that when you acquire new audio you can judge the differences accurately and quickly, quite aside from room acoustics. Most audio people I know have developed remarkably sensitive ears for those tiny but fascinating variations in quality—to the point where even in a noisy audio show (of the equipment type) or in a dealer's demo room, they can judge, or profess to judge, all sorts of subtle performance factors, quite easily ignoring the hideous sonic interference all around. I am in awe of such people—I have never been able to hear sonic quality in such an environment! It all depends on what you train yourself to listen for. My ears go for music as reproduced—wherever it may be. I hear the total effect. A different perspective, neither better nor worse.

As a "lecturer," then, a sonic show producer, the listening space variables are vital to me, and are they huge! The variety of effects displayed *by the same equipment* in different places—notably the large assortment of public rooms, halls, churches, and libraries where sound may be reproduced—is absolutely macro, endlessly astonishing. Until you have heard, you will scarcely believe. I would put the comparison between *equipment* differences and *listening hall* differences as perhaps 100 to 1. The most glorious high-end speakers you can buy can sound like mud in the most unexpected places. It's bewildering. But once you gauge the enormous size and scope of these differences in playback effect, you can do things to help.

Sometimes, for instance, you find yourself in what seems to be a quite bright hall, and yet when you set up your equipment, you discover that, inexplicably, your speakers are dismally muffled. No highs. Worse, the bass is grotesquely too loud and boomy. This, you understand, with entirely "normal" settings, as of your home living room. Disconcerting, to say the least. Your first reaction is that something dreadful is wrong; your equipment is ruined. How could it possibly sound so awful? Unless there's a pair of burnt-out tweeter units and some hideous electrical malfunction to produce all that muffled and boomy bass. What to do? Your audience is going to think you have very poor equipment, for all that cash you spent. Or that the recordings you play are inexcusably deficient. In plain fact, the equipment is in perfect order and working normally. It is the strange room space that spoils your sound.

Fortunately, experience has taught me a lot of things to do in this sort of situation. I am only momentarily surprised when that dismal bass-heavy sound emits from perfectly good loudspeakers. It happened this time once again, in the old barn. For maybe 10 seconds I had the usual shocked reaction—something must be horribly wrong. Then I realized what it was.

The barn is all wood in its main room, where the cows once lived, with a peaked and shingled roof, ancient irregular sidings (some of the boards 2 feet across), and a wide-spaced and sturdy barn frame of huge oak and chestnut supports that were hand hewn a century or so ago. Though all wood, the room is actually quite bright in sound, with only thin curtains and very little furniture padding. So I had set up my speakers, one on each side of a huge central fireplace and chimney, and hooked up the rest of the gear quickly—only stopping for the one dead speaker, a loose connection in a professional connector, and the wall receptacle that was inoperative. I admit I do not really understand what produces that boomy, bass-heavy sound with the total lack of highs. But it was *there*, and I had heard it before.

Even so, might I have real trouble this time? It's always a possibility. I could never give my show with *this* sound! And I had not brought spare speakers. A bit of brief panic!

So first, pessimist that I am, I walked up to the speakers from out in the room and listened, close up, to the tweets that should have been producing sweet highs, half expecting them to be dead. From 8 inches away, they were

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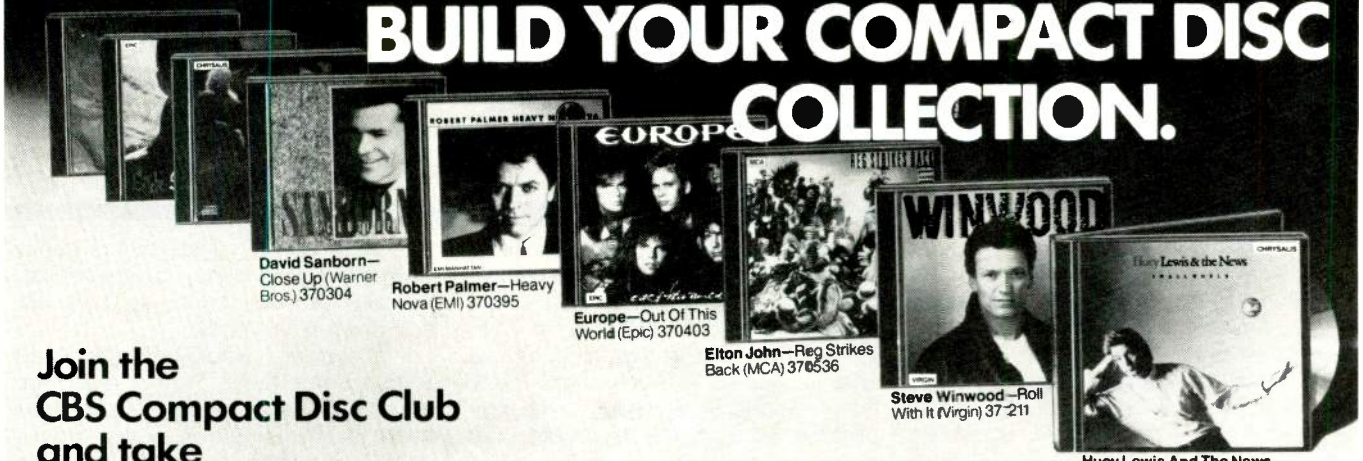

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The most glorious high-end speakers money can buy may sound like mud in the most unexpected of places. The room is usually at fault.

alive and well and working normally, both midrange and supertweeter units. But at 4 feet, they were already inaudible. And the bass was still booming, even close up. Very strange! But it had to be the room, not the equipment.

Now what would *you* do next? With one of those fashionable equalizers that have sliders, I suppose most home audio owners would try a modest move as a first adjustment: Pushing up the high-end sliders for more highs. Nothing radical—let's not go to extremes. This is fine audio equipment. Everything in moderation. Then, for the inexplicable bass boom, you would edge the corresponding bass sliders gently downward so that the whole equalizer indicated a sloping line, up in the treble, down in the bass.

At that point, I would have produced a loud horse laugh. You're much too delicate. You don't understand. You have to do something really drastic here. This room is overwhelming those speakers with its sheer acoustic weight.

I didn't happen to have slider adjustments, but my sturdy old standby system—the Crown 150 control unit and amp—did have a reliable and well-designed standard boost-and-attenuate double knob, for both channels or either one. Moreover, on the big loudspeakers (brand name and model withheld—no longer produced), there was a screwdriver adjustment for both midrange and tweeter units. So I knew what I needed to do, and I did it.

First, I turned the control-unit bass on both channels *all the way down* and the treble controls *all the way up* to maximum highs. Then I took screwdriver in hand and jacked up the already somewhat harsh loudspeaker highs (as of my living room) far beyond the "normal" point and to "flat," the maximum volume. At home, I knew, this would emit an unendurable screech. But here, it was strong medicine. I needed nothing less than violent compensation.

I had it! The sound became almost human, with a normal-seeming balance. The room was defeated. One thing still wrong: Too much beaming. Straight out in front, especially near the speakers, those highs hurt. So with two enormous heaves, I tipped the big speakers back against the wall and removed their fronts (more highs) so that the beam went largely overhead for a good dispersal, not into anybody's face. That killed the head-on confrontations.

You know, after that show I received all sorts of compliments on how splendidly natural the sound was, how real the personalities of the recorded voices—just as if the talkers were there. Some of those voices, I should add, were those of the dead. With living relatives in the audience. They still loved it. In spite of all that crazy audio tweaking? Just goes to show. I guess I rate as a good Boy Scout.

HI-FI NEWS & RECORD REVIEW

REVIEW REPRINT **SHEER ARAGONS**

HI-FI NEWS & RECORD REVIEW

Mondial's contract-built Aragon amplifiers have shattered the high-end price barrier. Ken Kessler wonders: are they the bargains of the decade?

THE ARAGON 4004 amplifier is the result of what Mondial's management call the Aragon Audio Project Team. By delegating aspects of the products' design to outside specialists, the company has produced two amplifiers and a preamp which meet a set of very tight standards.

First, Mondial pegged the goods to sell at above mid-fi levels but way below the lunacy point. Then, the stuff had to have the kind of finish and appearance which wouldn't drive away non-tweaks (see the Primare review in March for further thoughts on this approach). It had to be reliable. It had to sound amazing. And it had to be made in the USA.

Despite such seemingly opposed goals—good sound *and* good looks? Street cred *and* reliability? — Mondial accomplished all of the above by using hired guns. The key player is Krell's Dan D'Agostino, who designed the circuits, specified the parts and established the quality-control programme. When word leaked out about his involvement, the Aragons were dubbed instantly as 'poor man's Krells'. This causes problems for neither, for Mondial admits that the Aragon amplifiers are not surrogate Krells, selling as they do for a much lower tariff. As for Dan D, he is quite happy making his cost-no-object beauties; this consultancy simply proved that he can cook up a storm even with price constraints.

Having decided that all Aragon units must fit into a space no deeper than 14in and no wider than 19in to ensure that domestic acceptability would not be an issue, Mondial enlisted Robbii Wessen to provide the aesthetics. Wessen, cover artist for *The Absolute Sound*, is one of those rare individuals who can marry visual style with hi-fi purpose, a far better choice than, say, a pure industrial designer or a mere hi-fi nut. Wessen added class to what is basically a box by keeping it absolutely simple, yet incorporating touches like the chamfering around the on/off switch, subtle badging and the 'signature' V-groove in the top of the case. Jokes aside ('a built-in notch filter,' a holder for your Watts Preener), this is not merely a styling conceit, it's a ventilation port. Although this is a Class AB design — one of the primary differences between an Aragon and a Krell — the 4004 runs warm. The groove means that customers who insist on placing something on top of it won't be cutting off all avenues of ventilation.

Yes, the vent, coupled with 'flow-through' openings below, does work. I ran the 4004 for eight hours a day into a 3 ohm load in a big room, the unit suffering only 1.5in of clearance between its top and the shelf above, and it never misbehaved, shut down, or blew up.

To complete the project, Mondial subcontracted the construction to a company specialising in military and medical equipment. Rather than buying and setting up a plant, training staff and suffering a learning curve, Mondial was able to initiate production through an up-and-running concern. This automatically guaranteed price control through the economies of scale, and quality control because of an existing regimen. This in itself is not a new idea; what's unusual is that Mondial stayed in the USA rather than seek help from the Far East.

D'Agostino has designed what is effectively a Krell without the Class A operation or the overkill power supplies. The power supply in the 200W/channel 4004 consists of two massive toroidals, one per channel, specified to fit when stacked into the 6.5in high case and to work from a US 15 amp AC line without tripping every circuit breaker in the house. There's no drama when switching on, no lights dimming. (The 100W/ch 2004 uses a single dual-wound toroidal and fewer active devices, but is otherwise identical.) While Mondial doesn't suggest running the 4004 into the Apogee Scintilla's sub-1 ohm load, the amp is judged as able to play with nastier systems; neither the WATTs nor the Divas caused problems.

There are no capacitors in the Aragon's signal path; but the Aragon does incorporate a digital protection circuit to prevent DC from the output and other unpleasantnesses. Whether an Aragon is as bomb-proof as a Krell I don't know, but I'd rather trust my home and speakers to this than to a couple of UK-made powerhouses I could name.

Nosey types who take the lids off amplifiers to see what makes them tick are going to find what look suspiciously like ICs in the driver stage, but they aren't — or so I gather. They're transistors installed in IC cases and are supposed to be more compact, easier to trim and much easier to match than conventional semi-conductors. Manufactured by Sprague, they're described as Quad Transistor Arrays, and Mondial points out that the tolerances are far tighter than bulk-purchase, garden variety transistors which have to be tailored for a circuit with heavy negative feedback or feed-forward tweaking.

As long as you've got the lid off, you may as well note the superb construction and componentry, including military-grade, glass-epoxy boards, 1% film resistors, gold-plated Teflon-insulated input connectors (sounds like a phrase from a rap record), fastidious cable routing and even the modular construction.

Externally, the piece is gorgeous, belying its price tag. The fascia, finished in a handsome charcoal colour, is machined from a 3/8in thick metal slab. The front sports only the on/off switch and a green indicator lamp. The back is fitted with Monster Cable's superb five-way binding posts (which accept industry-standard spaced bananas) and gold-plated Tiffany phono sockets. Another nice touch is that the legends on the back are printed both right-side-up and upside-down for people like me who lean over amplifiers when we're connecting the leads. Mains reaches the unit through an IEC three-pin connection. The fuse holder resides just above the mains input.

Using the Aragon exclusively for a couple of months, I've had it share signals with Primare, Sumo, Vacuum State and Rose preamplifiers, the Alphason Sonata-Ortofon combo and the AR Legend/Grado, Nakamichi CR-3E and CR-4E cassette decks, Yamaha and Sony CD players, and a load of speakers. Most of my heavy sessions involved the Apogee Divas, but adaptability was measured through periods with the WATTs, the new Monitor Audio R300s, AR's exotic cousins, the Rowens, Celestion SL600s and Myriad JBLs. Wires consisted of Lieder leads throughout, as well as some Sony ES cable, stretches of Monitor PC and some of that cheapo cable I refuse to identify. As for warm up I found the unit to reach optimum performance after a few hours, but cold listening isn't as bad as I've found in other designs.

Look, gang, this amp is a revelation. Mondial's Aragon 4004 is simply the biggest bargain in high-end audio, even if — when it's finally imported — the price suffers through tariffs. Though I wanted to get melodramatic and save the price for the very closing, I have to tell you that this retails for a truly approachable $1495 in the USA. I want you to know this so that whoever grabs the agency doesn't kill it by trying to get £2000 for it over here. Even with the usual formula of $1 = £1 (which at today's exchange rate of around $1.80 = £1 *definitely* covers shipping, handling, duty, VAT, distributor's margin and retailer's margin), it's still a bargain relative to what else is on offer at £1500 in the UK.

With the possible exception of the Scintilla, this amplifier seems capable of driving any speakers to which it's attached. Hammering the hell out of it into the Divas and in a 7.1×7.4m room, I heard little that even remotely sounded like clipping, squashing or compression of dynamics, or lack of 'steam.' While this is not a match for the Krells I've used — even those rated at 100W rather than 200W — you're unlikely to need more oomph, and I value my ears too much for that. On a most basic level, that of sheer drive capability, the 4004 should deal with all but the most spacious of installations, filled with the hungriest of speakers and operated by masochists.

Sonically, whew, this is a real sweetheart. Run side by side with the lovely Nestorovic valve amps, I was knocked out by the 4004's tube-like grace and freedom from minor nasties. It's a characteristic D'Agostino trait, and one of the reasons why tube fanatics find little difficulty in moving to Krell designs. The warmth in itself is not the whole story — there are plenty of solid-state designs these days which can mimic the lushness and bloom of valve gear; rather, it's the civility which is evident regardless of the complexity, speed or dynamic demands of the material. At no point did the Aragon sound confused or reach its limitations, either in terms of dynamics or its ability to deal with subtle details amidst a near-chaotic performance.

The most impressive aspect of its performance, again keeping price in mind, is its lower registers. Both the Divas and the Rowens plumb the depths, and I've some recordings like the recent Willy DeVille 12in mix of 'Assassin Of Love' which will stretch any system in a downward direction. Extension? About the only thing lower is a TV evangelist. There's absolute control, superb transients without too much aggression, and a richness that's going to have you reaching for a copy of the Kodo drummers' CD. I know, some prefer things even tighter, but for that I prescribe alum root. Or a shrink.

The 4004's midrange skill is something to behold, with transparency that I've heard bettered only by designs costing two or three times the price, *e.g.* the Krells. Crystal-clear portrayal, virtually grain-free textures (and silences) — you will not believe how real a voice can sound, especially at this price point. The Juice Newton track on the Technics/EMI/*HFN/RR* CD compilation is a favourite test (for transients as well as vocals) because it hovers on a fine edge between acceptability and teeth-jarring sibilance. The Aragon resolved all that the cut can offer, and its freedom from additives kept Newton's 'T's and 'S's from spraying imaginary saliva against the grilles.

The smoothness extends all the way to the top, and I don't recall any time during my sessions where the upper frequencies manifested signs of traditional solid-state nastiness. Despite this seemingly forgiving nature, it was ruthlessly revealing of failings in recording technique and pressing quality, a trait some reviewers believe to be a fatal demerit. As I'm not of the school that says certain products can make bad recordings sound good (which sounds like a *Tomorrow's World* justification for graphic equalisers) I judge this as part of the cost of living with high-end gear.

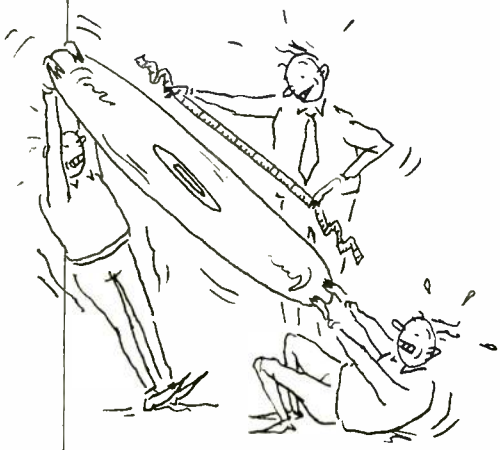
If this sounds like I'm presenting a case for the demise of all amplifiers costing above, say £1500 or £2000, let me point out that there are areas in which the 4004 is bettered. Having optimised my judgements around recordings of my own making, I know what some products are capable of doing when it comes to resolving the sense of space, of the actual venue in which live recordings are produced. I'd be the last to say that spatial considerations are as important as the tonal/sonic aspects of sound reproduction, but they are an integral by-product of accuracy. While the Aragon could reassemble a convincing soundstage in all three planes, its scale was level-dependent and less precise than most of its once-removed cousins, the Audio Research amplifiers I've used, and a host of other much dearer units. At its price point, though, I can name *nothing* which even comes close. Within that soundstage are rock-solid, three-dimensional images, which more than makes up for any vagueness at the stage extremities.

I know the maths for US imports, and I know what this *should* sell for over here. Unfortunately, I also know that the Aragon performs so well that — had I not splattered its US price over these pages — you'd be excused for thinking that it's a steal at £2500. Assuming that the distributor selected by Mondial is a *mensch*, you've just read about the best-value, smartest-looking, best-constructed, finest-sounding amplifier to the south of a Krell. And that, my friends, is a gift from hi-fi heaven.

To order your Aragon, write or call Mondial Designs LTD, 2 Elm Street, Ardsley, New York 10502, USA. Tel. (914) 693-8008.

IVAN BERGER

ARS LONGA, AND LONGA STILL



Adding Minutes, Losing Track

The world record for the most music on a stereo CD has just been broken—so many times, this year, that I've lost track.

The first breakthrough was Telarc 80135, back in 1987, which contained 74 minutes and 23 seconds of choral music by Fauré and Duruflé. "The factories that make our Compact Discs tell us this is the absolute maximum amount of playing time possible with current technology," said Telarc President Robert Woods at the time. "They say you can't squeeze in another second."

Well, turned out you could. A few months later, along came a BIS album (CD 145/6) containing two discs of flute works by Franz and Karl Doppler, each disc playing for 74 minutes and 50 seconds. This probably remains the longest double-CD album, but longer single discs have been announced with monotonous regularity. First, BIS broke its own record with a 75:01 compilation of Sibelius piano transcriptions. Next, Telarc announced a Mozart symphony disc that clocked in at just over 77 minutes. Then Bridge Records delivered *Valis*, an opera by Todd Machover, at 77:30—only to have *Billboard* report that "Angel still holds the record for classical CD length on a commercial label: Slightly more than 79 minutes on the second disc of . . . Haydn's *Seasons*, recorded by the Berlin Philharmonic under Herbert von Karajan."

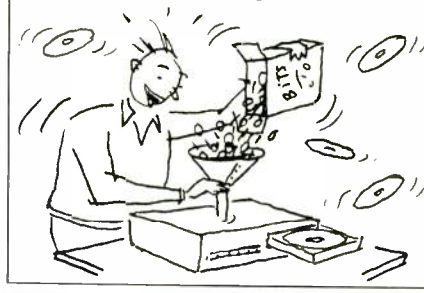
And the winner? None of the above. Rykodisc's *Mission of Burma* (RCD 40072) runs just over 80 minutes. (The pop music field delights in going to excess.)

To achieve these lengths, the record companies are skating on the thin edge of technology. When the CD Standard was first announced, Philips and Sony said a disc could hold about 60 minutes of music. I've heard predictions that some players will have trouble tracking all these super-long discs, though I have not heard any specific instances of such mistracking. It's still possible that someone will bring out a longer CD than Rykodisc's, but it won't be *much* longer. And if they do so by the time this issue goes to press, I'll just add the news as a postscript. I'm tired of rewriting this item.

The War to End All Bit Wars

First, we had 16-bit CD players (and 14-bit models that used oversampling to reach 16-bit S/N ratios). Then we had quasi 18-bit players, which used bit shifting and 16-bit D/A converters to get 18-bit S/N. Hard on those players' heels came models with true 18-bit converters. Now Denon has introduced two 20-bit models, the DCD-3520 and DCD-1520—not with a fanfare, but with something like apologies for the state of the art.

According to Denon's Senior Vice President, Robert Heiblim, "For Denon, it's uncomfortable to have a big number, because we don't like to hang our hat on specifications. We don't want to start a bit war. We know that an endless procession of higher bit and higher oversampling CD players is no guarantee of better sound. The important thing is to deliver the best 16-bit system possible. The 20-bit system is our solution for today. But if we ever get perfect 16-bit converters, there will be no need for anything more, and this numbers race will end."



Illustrations: David Goldin

Will CDs Get the Blues?

The amount of information that can fit on a CD depends on the size of the pits encoding that information, and the size of the pits depends on the wavelength of the laser reading them. The smaller the wavelength, the smaller the pits can be.

The CD Standard is based on a wavelength of 780 nanometers, in the near infrared portion of the light spectrum. One reason for this choice was the availability of fairly inexpensive, solid-state lasers which produced 780-nm light.

A recent development opens up the possibility of solid-state laser systems which would operate at half that wavelength, where large, argon-gas lasers are used currently. To generate coherent light at half the wavelength produced by the diode alone, scientists at Matsushita have teamed conventional laser diodes with an optical waveguide of hydrogen-doped lithium niobate. This would shift a 780-nm infrared laser's output to 390 nm, in the blue region.

At about $10,000, Matsushita's prototype blue laser is impractically expensive. It's also inefficient, and its output is limited to 1 mW. Eventual refinements of the device could conceivably find their way into flat color TV screens and optical disc systems.

This does not mean an instant revolution in CD technology, even when solid-state blue lasers become practical. Discs made to be read by 390-nm beams would have pits too small to be read by existing CD players, and players with only 390-nm lasers would have difficulties playing conventional CDs. A new 390-nm Standard would, however, allow 3-inch CDs to carry more music than standard-sized CDs do now, and would usually eliminate the need for multi-disc CD sets. Players compatible with both the old and new discs could be made. The catch would be convincing people to buy them.

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Born out of a tradition of fine craftsmanship in Scotland, Ariston Acoustics is proudly introducing the Ariston System, a sophisticated yet elegantly simple expression of technology at the service of music. The Ariston System was designed to produce superb sound quality and offer maximum convenience by means of a full function remote control that comes standard with our amplifier.

Founded in 1969, Ariston Acoustics has enjoyed a steadily increasing reputation over the years for their innovative, quality products. Ariston components have been critically acclaimed for their sheer musicality by reviewers on both sides of the Atlantic. Ariston's commitment for the future is to develop new components which both complement and expand upon the existing system while maintaining the concept of true music reproduction at eminently affordable prices.

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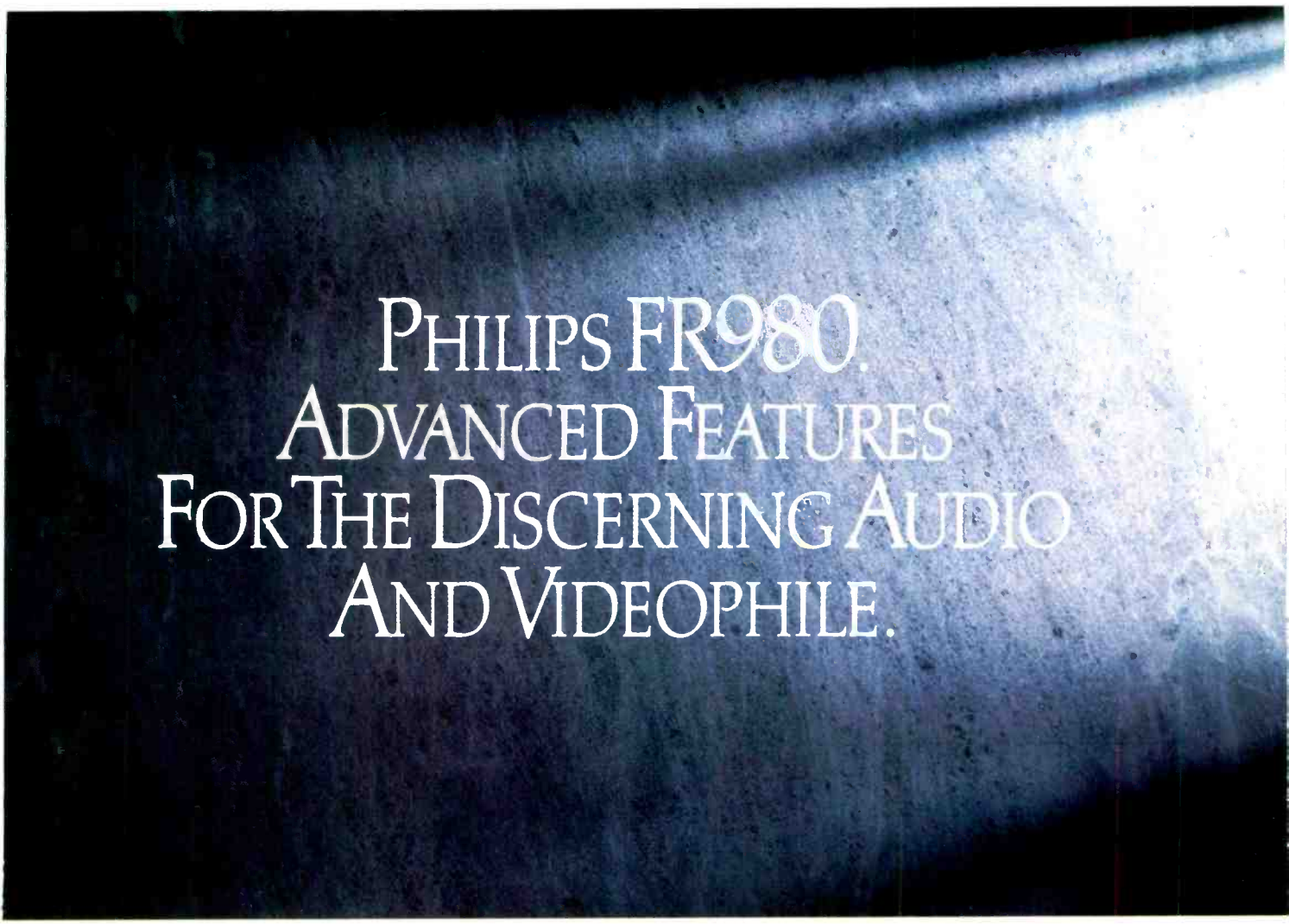

The engineers at Philips of the Netherlands steadfastly refuse to accept the commonly accepted. The result: The Philips FR980.

Arguably the most sophisticated A/V receiver available today.

Not only does the FR980 provide the world's most advanced technology, it also offers an extraordinary array of options to mix and match audio and video signals. The possibilities are virtually limitless.

Philips has designed and crafted an advanced receiver that keeps you abreast of emerging technologies like CD-V. Further, the FR980 incorporates three audiophile-quality listening modes to pamper you with impeccable sonic authenticity.

Beyond the experience of true Dolby® Surround Sound, the FR980 features two custom equalization modes: Movie mode to make special audio effects come alive. And Music mode with a more gentle equalization to bring out the best in the newest music videos already encoded with Dolby Surround Sound.

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PHILIPS

BERT WHYTE

ONE GOOD TUBE DESERVES...

Even the most casual observer of the audio scene will have noted that, while many people can be classified as audiophiles, sub-groups within this fraternity have widely divergent views concerning reproduction of recorded music. Thus we have the "objectivists," who assess the quality of audio components by how well they measure in rigorous, standardized tests, and the "subjectivists," who judge sound quality on a more emotional and intuitive level, making no attempt to technically account for the often elusive, ephemeral sonic qualities of audio components. Needless to say, the more hidebound adherents of both camps have endlessly argued the merits of their viewpoints. My feeling is that the well-rounded audiophile embraces the best qualities of both philosophies.

I raise this point because this month I'm going to report on a new, high-end tube preamplifier—the conrad-johnson Premier Seven. Nothing quite fans the flames of audio debate, even in the subjective camp, like the relative merits of solid-state versus tube equipment!

Certain analogies can be made between the solid-state/tube controversy and the digital/analog imbroglio. For example, when transistorized preamps and power amps first appeared in the early '60s, they were widely condemned by audiophiles, mainly because of a "thin, shrill" high-frequency sound and a "cold, sterile, clinical" sound that was "lacking in musicality." Does this sound familiar? While solid-state audio components are near-universal these days and have attained a very high degree of refinement, there are still those who prefer vacuum tube equipment. It is hardly a coincidence that tube gear is the "darling" of the underground audio press, the very same group which so adamantly opposes and condemns digital audio technology.

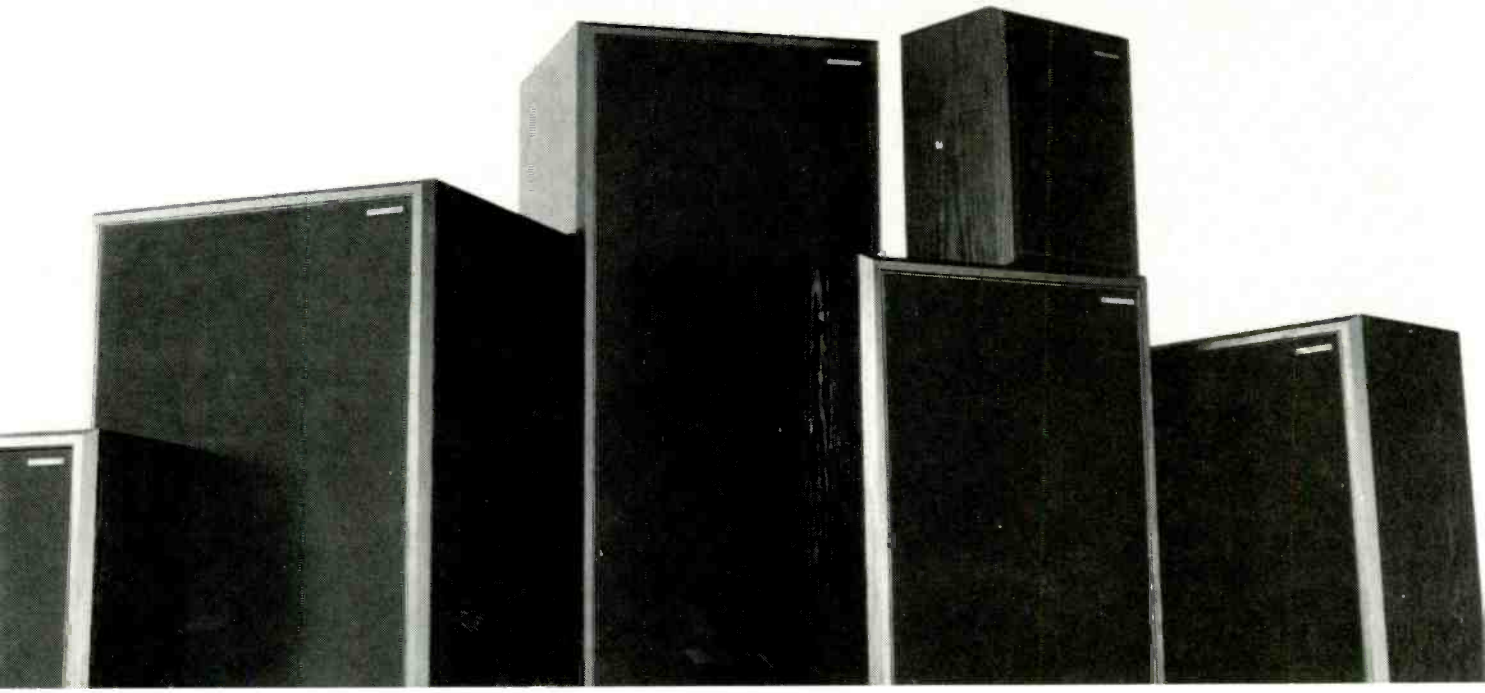
Please don't misunderstand—I don't mean to infer that those who prefer tube equipment and analog sound are part of some mysterious, dark cabal against progress in audio. Rather, it is the qualities the underground press ascribe to tube electronics and analog sound that make them philosophical and technological bedfellows. I myself have no bias in favor of tube equipment or, for that matter, analog sound, and I should also point out that tube equipment still has a loyal following in England and, of all places, Japan, where vintage McIntosh and Marantz tube amps command prices with five figures and no decimal point!

If you reckon the introduction of the CD in 1983 as the de facto beginning of the digital era, such a dawning hasn't inhibited the development and marketing of new tube electronics. Back in 1984, I reported on the conrad-johnson Premier Three tube preamplifier. Since then other "pure" tube preamps have been introduced, and we have seen the development of hybrid solid-state/tube preamplifiers, culminating in the very popular Audio Research SP-11. Currently, *Audio*'s Annual Equipment Directory lists about 20 high-end tube preamps, and now conrad-johnson has introduced the Premier Seven, which may well be the ultimate embodiment of the no-holds-barred, no-compromise, "pure" tube preamp.

The Premier Seven operates in a Class-A circuit topology utilizing one 6CW4 low-noise nuvistor input tube (which can accommodate fairly low-output MC phono cartridges) per channel and five 6GK5 single-triode tubes per channel. Each channel's gain blocks consist of a triode amplifier and a cathode follower. The phono stage of each channel has two gain blocks, and in between them is the passive RIAA EQ, which is accurate to ±0.25 dB, 20 Hz to 20 kHz. The line stage consists of a single gain block. Phono gain is 40 dB, line stage gain is 29 dB, and, unusually for a tube preamp, no negative loop feedback is used. At 1 V output, THD and IMD are rated at less than 0.25%. Each channel's gain blocks are powered by discrete supplies, with a preregulator and two stages of regulation for very low noise. Proprietary polystyrene capacitors are used in all audio circuitry; even the power supplies use only polystyrene and polypropylene capacitors, and that includes the input condenser.

The first time you see the Premier Seven, you see striking evidence that Bill Conrad and Lew Johnson were determined to make a definitive design statement. The massive unit has a simple, uncluttered front panel that is singularly free of "bells and whistles" and is beautiful to behold in its gold anodized finish.

The Premier Seven is actually a dual-mono tube preamp. Each unit is in a separate chassis and has its own discrete solid-state power supply in another separate chassis. The preamplifiers are mounted left channel on top of



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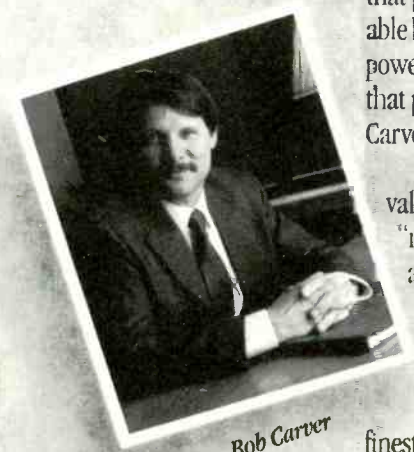
The Silver Seven, finest power amplifier in the world. $8,750 each. Two required for stereo. Tube connoisseurs note: The 15th KT88/6550A is a voltage regulator.

Before you meet the new M-4.0t, Bob Carver wants you to meet its inspiration, the money-is-no-object Silver Seven.



Bob Carver

"One of my important design precepts is that power amplifiers should be easily affordable but last year, when I began designing a powerful new amplifier, I temporarily set aside that precept of affordability. The result is the Carver Silver Seven Mono Power Amplifier."

Destined to redefine ultra-high-end values forever, the Silver Seven is truly a "money-is-no-object" design. In fact, just a single pair of its fourteen KT88/6550A Beam Power output tubes cost more than some budget amplifiers.

The Silver Seven employs classic, fully balanced circuit topology and the finest components in existence.

A-450 Ultra Linear output transformers with oxygen-free primary leads and pure silver secondaries.

- *Wonder Cap capacitors throughout.*
- *Interconnects are Van den Hul Silver.*
- *Internal wiring is pure silver.*
- *Wonder Solder throughout.*
- *Gold input connectors and high current gold output connectors.*

The Silver Seven's polished granite anti-vibration base floats on four Simm's vibration dampers. The separate power supply's power transformer end-bells are machined from a solid block of high-density aluminum.

Capable of an astonishing 390 joules energy storage, the Silver Seven delivers ***a conservatively rated 375 watts into 8 ohms from 20Hz to 20kHz with no more than 0.5% distortion.*** On the 1-ohm tap, peak current is in excess of 35 amps!

Sonically, a pair (for stereo) of the flawless Silver Sevens almost defies description.

Powerful

Distributed in Canada by: evolution technology

"Because I wanted to share its magnificent sound with you we built the new Carver M-4.0t."

The M-4.0t, identical transfer function and ***375 watts rms/ch. at 8 ohms 20-20kHz with no more than 0.5% thd.*** *Total maximum output current is 60 amperes.*

Superlatives are insufficient.

What does this have to do with the new M-4.0t?

Everything. Because the M-4.0t precisely duplicates the transfer function of the Silver Seven.

Ever wondered why two amplifiers of identical wattage can sound different? Or why two designs with different output ratings can sound much the same? In many cases, it's because each power amplifier exhibits a unique relationship between its input and output signals. Like human fingerprints, this *transfer function* is subtly distinct, defining much of the sonic character of the design. Bob has not only perfected the art of measuring an amplifier's transfer function, but is able to duplicate it in a completely dissimilar amplifier design! That's how he invested his solid state M-1.0t with the transfer function of a set of $5000 esoteric tube amps several years ago.

This time he's gone one better. Or two.

He's used this powerful scientific method to duplicate the transfer function of the Silver Seven in the new M-4.0t (now you know what the "t" signifies). Mind you, we are not saying the M-4.0t is *identical* to a pair of Silver Sevens. An M-4.0t weighs 23 pounds versus the Silver Seven at 300 pounds a pair. The Silver Seven stores 390 joules of energy while the M-4.0t stores none. As a Magnetic Field Power Amplifier the M-4.0t instantly draws the power it needs directly from the AC line.

Though in choosing the M-4.0t you may miss the warm glow of the Silver Seven's silver tipped vacuum tubes reflecting in polished black lacquer, be assured both amplifiers are the most musical, effortless, and open sounding you have ever heard. Bass is full and tight, midrange is detailed, treble is pure and transparent.

Each can float a full symphony orchestra across the hemisphere of your living room with striking realism.

Bob Carver developed this incredible design for one reason: to bring you the best the world has to offer and the best amplifier value ever, and he has succeeded handsomely.

Listen to the new, incredibly affordable M-4.0t at your nearest Carver dealer. Or write us for more information. We'll even send you data on the Silver Seven. After all, if you ever want to move up from the M-4.0t, there's only one possible alternative.

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The 56-pound Premier Seven is a physically imposing preamp, and I'm happy to say that its performance is equally impressive.

right and are connected by a massive, ⅜-inch solid metal face- and endplate. Although the power supplies are on separate chassis, they share a common enclosure. The units are completely separate electrically, to the extent of a separate a.c. line cord for each power supply and separate 5-foot umbilical cords which connect power sources to the units. In the preamps, all active circuitry is on the subchassis and shock-mounted to minimize microphonics. With filament and plate transformers for each preamp, the entire Premier Seven weighs 56 pounds and is surely one of the heaviest preamplifiers extant.

Throughout, the conrad-johnson uses "cost no object" parts and components. Precision metal-foil resistors are laser trimmed for accuracy. All internal wiring is 300-micron, linear-crystal solid silver. There are no potentiometers in the Premier Seven; level controls are stepped attenuators which switch discrete pairs of precision resistors. The controls provide attenuation in 23 steps from 0 to −54 dB. Individual LEDs on the front panel of each channel illuminate for the 23 steps.

Each preamp has solid metal controls for source selection (phono, tuner, CD, and tape 1 and 2) and a record selector for the same sources. To the right of this control is the level attenuator. On the extreme right is a small on/off mute pushbutton. Each power supply has a separate switch, and the Premier Seven incorporates delay relays to suppress turn-on/off transients.

The rear panel has gold-plated RCA inputs for all sources, including the tape loops. Two pairs of main output jacks facilitate bi-wiring and biamping. Each channel has a phono impedance control, ranging from 70 ohms to 47 kilohms, to accommodate both moving-coil and moving-magnet phono cartridges.

The Premier Seven claims a passband from 2 Hz to more than 100 kHz. It has a maximum output of 20 V rms and is an exceptionally quiet tube preamp, with phono noise 80 dB below 10 mV input and the line level noise 88 dB below 2.5 V input. Output impedance is less than 200 ohms. The Premier Seven is also rack mountable. No question about it, this is a physically imposing preamp, and I'm happy to say its performance was on the same elevated plane.

I set up this unit two ways. First, I decided to assemble a quintessential, tube-freak/analog-lover's system consisting of the superb Versa Dynamics 2.0 turntable with the new Ortofon MC3000 moving-coil cartridge alternating with a Cello cartridge feeding into the Premier Seven. The output of the Seven was fed into the conrad-johnson Premier Five 200-watt monoblock tube amps and then to B & W 801 Matrix and new Duntech Sovereign Mark Two loudspeakers. Since the Premier Seven inverts polarity, I wired the speakers accordingly. I tried the Ortofon straight in, without its special stepup transformer. While the Seven has a lot of gain, the extremely low output of the Ortofon cartridge created some problems. I could get enough output for a fairly loud playback, but the Seven's tubes would go microphonic on some bass transients. Using the Ortofon transformer into a 47-kilohm load gave plenty of level.

As most vinyl addicts are aware, current classical LPs are almost invariably cut from digital masters, but in my tests with this system, I used many older vinyl records mastered from analog tapes. These included some from EMI and London Decca, and a few of my own recordings for Everest. I sought out the great Neville Marriner performances of Mozart and Haydn with the orchestra of the St. Martins-in-the Field Academy. Finally, for the ultimate in analog sound, I played some of Sheffield's direct-to-disc recordings of Lincoln Mayorga as well as my Crystal Clear direct-to-disc recordings of Arthur Fiedler and the Boston Pops and of the organist Virgil Fox.

Apart from the inevitable record surface noise, which fortunately wasn't excessive, reproduction was revelatory! The combination of the three-dimensional imaging of the 801 Matrix, plus the Premier Five and the Premier Seven, provided a wonderfully natural, very musical listening experience. The Premier Seven simply extracts every iota of hall ambience from decently miked recordings. The stage presentation is startling. The same can be said of depth perspective, which extended deep into the recording stage and was uncanny in capturing the off-stage brass in Mahler's Third Symphony. All this was heightened by the airy transparency of the sound and the enveloping space around instruments. In the percussion on the Sheffield discs, cleanness and transient attack were outstanding, quite crisp with no overhang. Bass response was excellent although without the solidity, weight, and control of a top solid-state amplifier. This was very beguiling, musically seductive sound. If some choose to call this reproduction "euphonic coloration," so be it. It is very easy on the ears, essentially non-fatiguing, and at least in my listening room, not amorphous. The results with the Duntech Sovereign were fairly similar, although the Seven didn't fully exploit this speaker's bass capabilities.

There are many people who like certain combinations of tube and solid-state equipment. Some like to use a solid-state preamp to drive a tube amp. Others prefer to drive a solid-state amp with a tube preamp because of the better-controlled, cleaner bass. (Even most avid tube devotees usually admit this is a good idea.)

My second setup consisted of Sony CDP-707ESD and Denon DCD-3300 CD players and a Sony DTC-1000ES R-DAT recorder all feeding into the Premier Seven, along with the same phono input. I then fed the Seven into Cello Performance solid-state, monoblock amps and then to the Duntech Sovereigns. Here again was an impressively natural, highly musical listening experience, with a definite improvement in bass response. If you force me to choose, I'd have to pick the Premier Seven/Cello combination. It had just the extra definition, better articulation, and tighter bass that add a touch more realism—although I have to admit the freedom from noise in the digital source material probably influenced some of my perceptions.

Obviously, either setup would have gladdened the heart of any audiophile of any persuasion. There is no question that a unit like the Premier Seven needs to be teamed with the very best equipment in order to fully savor its unique qualities. For those who are "into" tubes and can afford its $7,850 price, the Premier Seven is currently the ultimate expression of vacuum tube technology.

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

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

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

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

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

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

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

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

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

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

"What we've accomplished is no trick. It's knowing what to do, then doing it.

"If you'd like to know more about the T830 and other Boston Acoustics speakers, please write or call. We promise to reply promptly."

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

Andy Petite, chief designer, Boston Acoustics

The 3-way T830 Tower System.
It needs only 10 x 9¼″ of floor space, only 32″ in height.
Suggested retail: $500 a pair.

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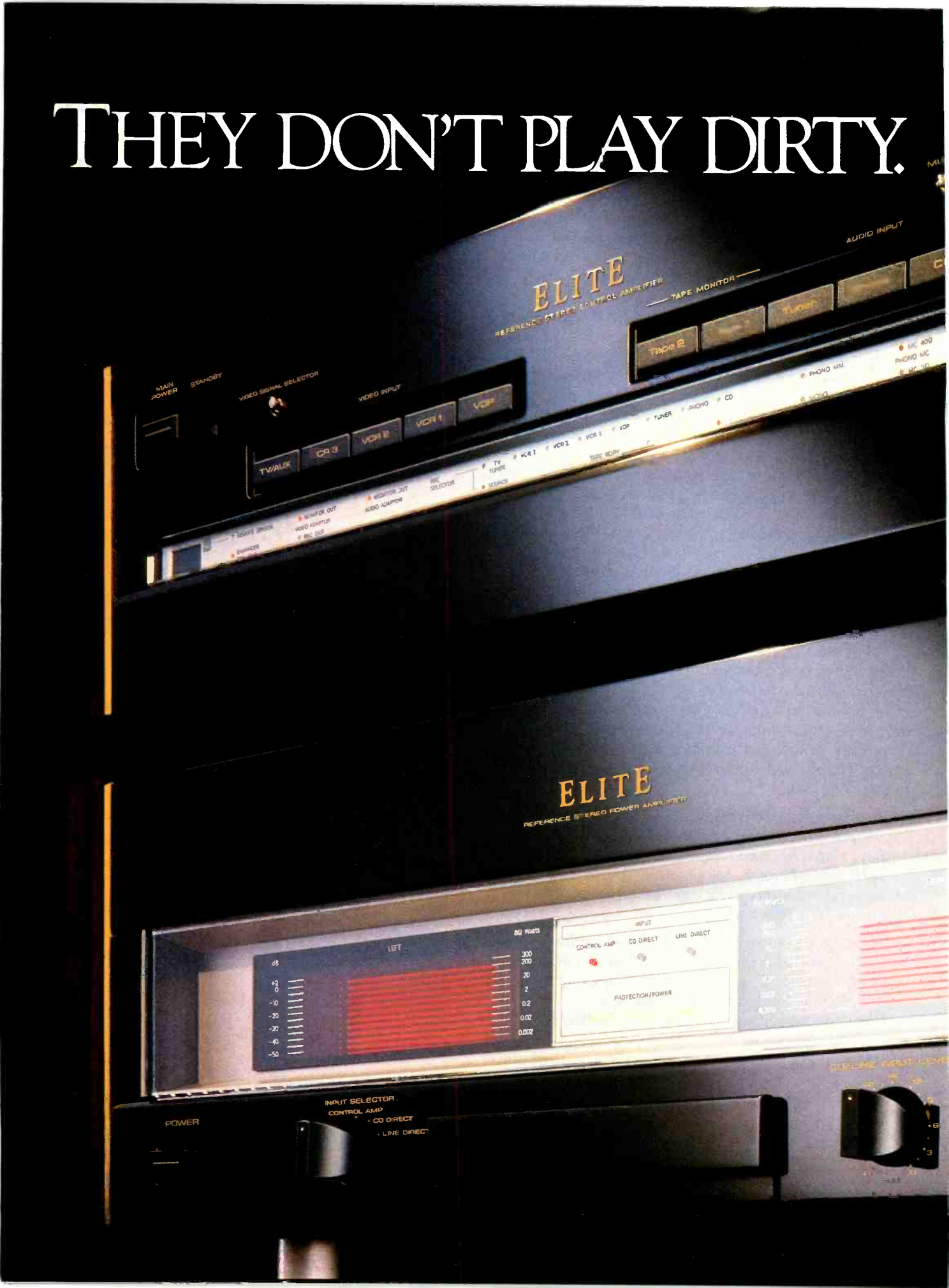

THE ELITE M-91 AND C-91 REFERENCE COMPONENTS.

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Impurities.

The Elite C-91 pre-amp and M-91 power amp are no-compromise components designed to give you more of the pure signal and less annoying noise. By keeping critical signal paths as short as possible. By providing honeycomb construction throughout to reduce excess vibration. By using separate twin cast-iron transformers to eliminate stray magnetic flux and dissipate heat quickly.

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*Measured by EIA method.
**Based on FTC rules regarding measurement of amplifier power ratings.
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Newington
Sound Playground
Norwich
Leiser Sound
Orange
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Audio/Video
John Iverson Co.

OHIO
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Maple Heights
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Pierre
Team Electronics
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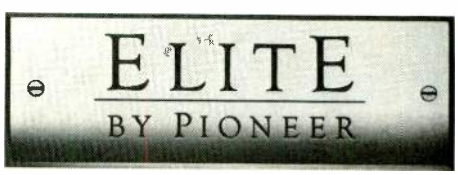
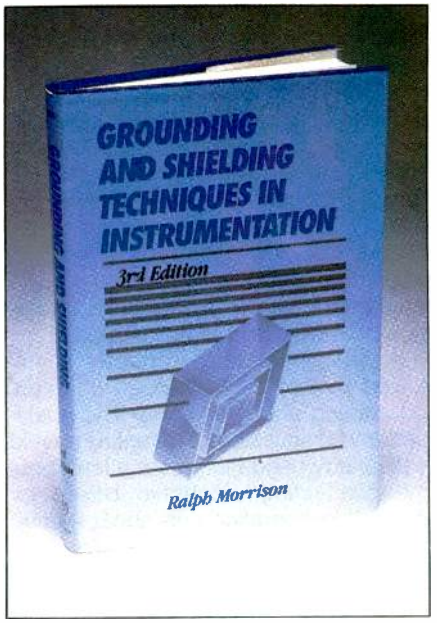
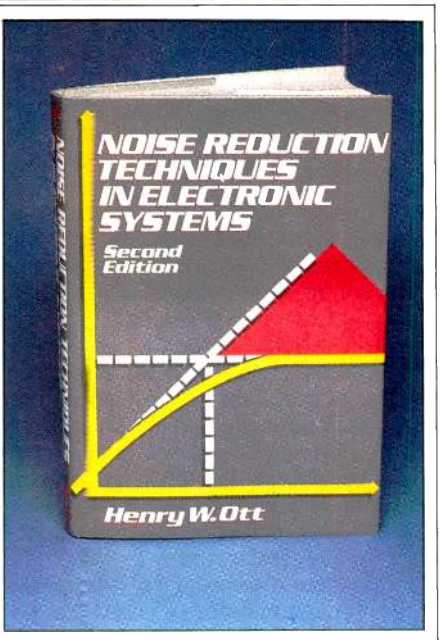


PERFECTING SILENCE

Grounding and Shielding Techniques in Instrumentation, Third Edition by Ralph Morrison. Wiley-Interscience, 172 pp., hardback, $29.95.

Noise Reduction Techniques in Electronic Systems, Second Edition by Henry W. Ott. Wiley-Interscience, 426 pp., hardback, $39.95.





For many years, I used an earlier edition of *Grounding and Shielding Techniques in Instrumentation* to solve problems, and I have advised many students to refer to this book for help when their electronic systems show residual noise, hum, and interference. Recently, I was most pleased to be introduced to *Noise Reduction Techniques in Electronic Systems* since few books are available on the important subject of shielding, grounding, and noise and interference reduction.

The problems addressed by these books are rarely discussed in formal classes at universities or technical schools. Reducing residual noise in a system which is supposed to have a very large S/N ratio has often been left to the engineer or technician on the design team who seems to understand this "black art." There is always some noise remaining in any electronic system, and it is too often left for the final tweaking stage of the design. The problems are usually "solved" by moving ground connections internally, changing a connector or a cable, adding a wire or shield, moving a part or subcircuit, or some similarly mysterious and chancy technique.

It should not be necessary to proceed in such haphazard ways. There is, and always has been, a science behind these black arts. I must say that both of the books under review here are very good introductions to the methodology of removing noise and getting the signal from the source to its destination without contamination.

The topic of lowering the residual noise of electronic systems is important in the design of all types of equipment and is of especially great importance to the audio engineer. The ear is very sensitive to residual noise because of its great dynamic range, possibly 120 dB or so. This range is almost as great as that of well-designed electronic equipment. The issue of residual noise and interference is more important than ever these days because of the quality of the Compact Disc. Its extended dynamic range, in particular, has made the audio listener ever more sensitive to the quality of the silence between musical passages. This level of silence is attained sonically only by the most careful design of the electronic circuits, their precise mounting and shielding within the chassis or box, the quality of the box design and the connectors, the use of correct wiring techniques, the exact placement of transformers, and a seemingly endless list of other construction details.

Many designers are apparently ignorant of, or not careful about, some hardware design details. Defects in these areas can make or break a product. I recommend both of these books for those involved in the design of electronic equipment of any type. Even the most successful designers will learn something from them.

While I am more familiar with the Morrison book, I am more impressed with the one by Ott. Interestingly, with so few books available on noise reduction, both texts come from Wiley-Interscience. And although they compete for a position in the marketplace, they also complement one another.

Grounding and Shielding Techniques is a good book for those with a more casual interest in the design of electronics and a main concern with interconnecting systems using good grounding and shielding methods. It is a relatively short book of only 172 pages, but it is crammed with information. Its only problem is that it lacks references for further study. To me, this is an important defect since I usually dig deeper when I have a problem and only a partial solution; references make a good starting point. The book is without doubt based on extensive experience on the part of the author. He has a clear and friendly writing style and explains the figures and his interpretations of systems clearly and accurately. Morrision covers both electrostatic and electromagnetic shielding problems, and he has a nice section on the use of differential inputs for instrumentation purposes.

After three short chapters on electrostatic principles, the author gets down to the shielding of instruments and does so with considerable specificity. These chapters include details about shielding power lines, transformers, and the like. A rather long chapter on the differential amplifier used as an instrumentation amplifier follows. It contains a detailed discussion of amplifier configurations mainly of interest for instrumentation use rather than audio applications. Topics include everything from thermocouple to electrocardiogram uses. A short chapter on shielding bridge-type systems follows.

These Wiley-Interscience books, so very good on their own, complement each other quite well as reference works.

Magnetic processes are covered, with special emphasis on transformer shielding. The problem of radio frequency interference is discussed rather briefly, with some information on transmission lines, and the book concludes with five pages of rather interesting information about making connection to the earth with buried rods and wires. Although it is not particularly relevant for audio applications, I found this discussion enlightening.

The Ott book is much longer, some 364 pages of text and 50 additional pages of problems and solutions. The problem-and-solution section makes *Noise Reduction Techniques* attractive as a textbook or for the more serious readers who wish to test their knowledge. There is also a good bibliography at the end of each chapter, although I found some lack of references from the last half-dozen years. Nevertheless, this is a much more scholarly work and covers a greater variety of topics than does Morrison's.

The material in Ott's book ranges from shielding and cabling to active-device noise and digital-circuit shielding. Everything is discussed from a solid theoretical base, and many practical examples are given. Almost all of the topics covered are of great interest to anyone concerned about designing electronic equipment capable of reproducing wide dynamic range. This applies especially to modern audio equipment, which is often a combination of analog and digital circuitry.

A brief introductory chapter is followed by two very thorough chapters on cabling and grounding. The analyses and discussions presented should satisfy any needs for information about interconnecting electronic boxes for noise-free operation and about routing the signal between components without degradation. The material is as complete and clear as any I have seen. The chapter on balanced circuits is a bit short, but this is where *Grounding and Shielding Techniques* can augment what is presented here. A short chapter on passive components contains some interesting information on capacitors and inductors. (The Morrison book has better detail on the topic of transformers.) There is an excellent chapter on shielding, which will be of interest to all box and chassis designers. I find the chapter on contact protection somewhat out of place, except for the fact that contacts are a serious noise source in some systems.

Chapters 8 and 9 are on intrinsic and active noise sources. These sections will be of interest principally to circuit designers and are important because they set the ultimate lower noise limit for most equipment. There is an excellent chapter on digital circuit noise and layout, and one on digital radiation. These topics are of great interest for those involved in the design of equipment that is partially digital and partially analog.

I found the final chapter, on electrostatic discharge, very interesting. It ex-

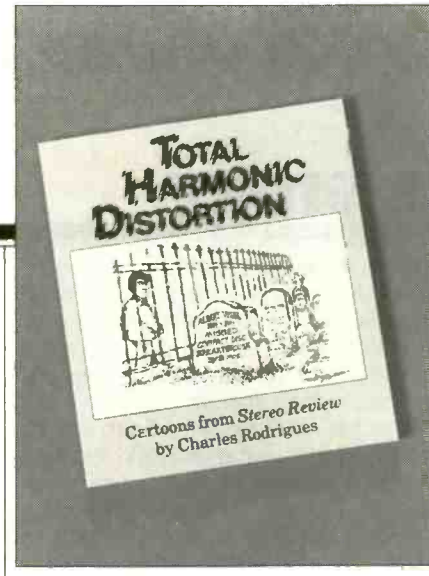
plains why walking around and then touching equipment causes sparks and thus pops and clicks—or worse—in electronic equipment.

Noise Reduction Techniques is thorough, accurate, and full of practical discussions. It is one book which should be required reading for every person who wants to be knowledgeable about cabling, noise, and interference. I recommend it highly.

Both volumes are so good in their own ways that neither really upstages the other. Ott's book is essential to those who would understand the overall design and interconnection of modern analog/digital electronics. Morrison's is full of practical information about interconnecting equipment, and it offers a clear and very practical discussion of instrumentation techniques.

R. A. Greiner

R. A. Greiner is Professor in the Department of Electrical and Computer Engineering at the University of Wisconsin in Madison, Wisc.



Rodrigues' 118 rollicking cartoons demonstrate that although audio is serious, the people involved in it are something else again.

Total Harmonic Distortion by Charles Rodrigues. Perfectbound Press, 128 pp., paperback, $7.95. (Available only by mail from Perfectbound Press, 1120 Ave. of the Americas, Suite 4118C, New York, N.Y. 10036. Add $1.50 postage and handling per U.S. order; for foreign orders, add $1.75 for the first book and 50¢ for each additional copy; New York State residents, add 65¢ sales tax per book.)

Audio and video are Serious Matters; there's nothing funny about them. But the *people* involved in those fields, both professionally and as customers, are something else again. Charles Rodrigues has been poking fun at them (but not at you and me, of course) in his cartoons in *Stereo Review* since 1958. Now, 118 of those cartoons have been collected by David Stein, *Stereo Review*'s managing editor, in a paperback all too appropriately entitled *Total Harmonic Distortion*. Total pandemonium is more like it: Leafing through, you'll get a fresh look at audiophile sympathy cards, viscious-damped turntables, the influence of supertankers on FM reception, how a child prodigy's career ends, what to do if you don't trust your test record, the nonacoustic advantages of pyramidal speakers, and most important of all, how to buy expensive speakers when your spouse is watching.

Why sit there, deluged with useful information, when Charles Rodrigues is so willing to purvey the other kind?

Ivan Berger

IVAN BERGER

END OF THE SAAB STORY

Not many people put fancy audio systems into eight-year-old cars, but that's what I did to my Saab 99 Wagonback a few years ago. Actually, I'd started stuffing the Saab with stereo gear as soon as I got it, back in 1975, but only on a do-it-myself basis. When I started working at *Audio*, I felt it time I had a professional take a crack at it, so I took the car to New England Radio and Moon Roof, in New Haven, Conn.

The system they installed (which was covered in this column in August and September 1983 and in March 1984) sounded good, but it seemed awfully elaborate and expensive. I felt similar results could be achieved by less extravagant means. In the years of tinkering that followed, I learned that they could—but not in that Saab.

As a car, my 99 Wagonback was a delight, combining sporty handling, capacious accommodations, and good gas mileage. As the vehicle for a stereo installation, however, its three major vices offset its two useful virtues.

The first virtue was the Wagonback's rear deck, a simple, removable slab of carpet-covered, ¾-inch layered Masonite that could be reworked and rebuilt for any speaker configuration. The second virtue was that the car was full of places to hide the electrical equipment, including a large compartment under the trunk floor and a smaller one beneath the fold-down back seat.

On the negative side, Saab had made no provision for any kind of audio system. There was no radio slot in the dashboard, so we had to build a console. Worse, there were not only no factory-cut speaker holes, but no good places for front speakers at all. Installing speakers in the dashtop might have given good results (Saab put them there in the Model 900, which succeeded the 99), but this would have involved taking the dashboard apart. Since the dash was already full of squeaks and tremors from several earlier audio-related disassemblies, we wanted to avoid doing that.

The doors' interior skins were made of plastic foam that could not support speaker screws, and the steel framework behind the skins offered support in all the wrong places. The door skins were also swoopily sculptured (which is why Saab made them out of foam), with no flat planes near the upper front corners except the knuckle-clearance spaces for the window cranks. Door-mounted speakers would therefore have to fire into the front passengers' armpits or their socks.

Last but not least of the Saab's vices was its electrical capacity. I'd installed more powerful headlights when I first bought the car; adding all that electronic gear posed problems which its battery and smallish alternator couldn't handle. This was exacerbated by the fact that my car often sat idle for three weeks or more—long enough for the tiny, cumulative drain of the radio's memory, the amplifiers' turn-on circuits, and the car's clock to slowly make the battery go flat. As a result, my future wife and I spent so much of our courtship behind tow trucks that she now finds them romantic. Long-time "Roadsigns" readers may recollect my chronicling such problems as dead batteries, an amp blown by a reverse-charge jump start, and the total failure of my audio electronics due to the death of the car's voltage regulator.

Nevertheless, with the aid of a sympathetic installer, Tony Igel of Stratford Service here in New York, I set out to explore the possibilities. Instead of rushing to produce the perfect finished Phase II system, we labored slowly to see what would and would not work in the old Saab. With this attitude, we never reached a stopping place, so we just kept tinkering, without pausing to write up interim reports.

Of course, I could have traded in the Saab for something easier to work on, but by this time, I had a fierce affection for a fine old car and a gritted-teeth determination that, by gum, I'd make it sound good. And with a car so old, it helped to be working with an installer whose shop was also a full-service garage.

The first thing we tried was the AudioMobile K40 system, which consisted of four two-way speaker systems in oval pod enclosures, two 6 × 9-inch subwoofers, and a 4 × 40-watt amp with a built-in crossover. Thanks to the pods' tapering shape and single-screwhole mounting, we could mount the front speakers high up on the front corners of the doors. (The rear pods, as I recall, went onto the rear deck.) The high-mounted front pods proved we could get good imaging without a center channel, but the structural foam of the Saab's door panels wouldn't hold the pods' weight. We had to abort the test because the speakers wound up dangling by their wires.

The second thing we tackled was the antenna. The only antenna built specifically for the Saab 99 was a manual, telescoping antenna which had

Illustrations: Philip Anderson

TO ALL THOSE WHO ALREADY OWN A CD PLAYER,

OUR CONDOLENCES.

ACCULINEAR 18-BIT TEC

ENTER THE NEW

Everything has limitations. Including conventional CD players.

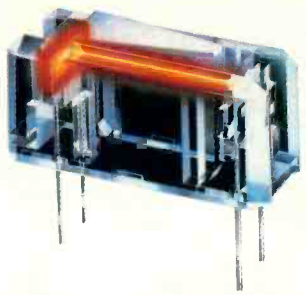
That's because 16-bit digital processing simply isn't accurate enough to retrieve all the data that's on a disc. So some of the music is lost.

Onkyo's linear 18-bit technology, on the other hand, assures you that all the musical information gets processed. So you don't lose anything. Even the subtle clues that tell you about the space the music was recorded in. And how well the engineer chose the microphones.

Dual Acculinear D/A Converters with calibrated accuracy to the 4th Significant Bit.

But getting all the data off the disc is only the first step. Getting it to your ears is at least as important.

That's why Onkyo developed the Acculinear D/A Converter. And individually calibrates each one to minimize crossover distortion. This unprecedented accuracy means you'll be able to listen to music, even at low levels, and still hear the delicate harmonic structures that distinguish a Gibson guitar from a Martin.



Exclusive Opto-Coupling Modules use light to transmit digital data and reduce harshness.

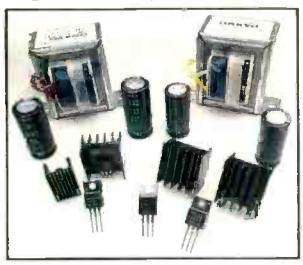
Onkyo's extensive use of optical transmission techniques instead of conventional wiring further increases musical enjoyment. Proprietary Opto-

HNOLOGY FROM ONKYO.

DIGITAL DOMAIN

Coupling Modules at critical circuit junctions eliminate Digital Signal Interference (DSI) and its consequent metallic harshness. So you can enjoy the sound of the Philadelphia Symphony without wondering if the entire string section was playing aluminum violins.

The power supply combines low impedance/low loss transformers, regulators, and capacitors for high stability and isolation.



Dual transformers in the DX-7500 thoroughly isolate digital and analog stages.

In addition, the critical D/A converters benefit from Opto-Drive, a new Onkyo technology that uses LED/phototransistor arrays for the ultimate in current stability and operating accuracy. Which means that any sonic variations you hear will be in the music, not in the disc player.

And the best part? We didn't reserve these technical innovations for one outrageously expensive flagship model. All the musical benefits are affordable.

Yes, this is the New Digital Domain.

Audibly significant technology.
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In a city where signs that say "No Radio—Already Stolen" are common, Bensi boxes and mild paranoia are quite justifiable.

been installed on the right rear fender. From a human-engineering standpoint, this was terrible. If I pushed the antenna down when I parked, I'd usually forget to raise it again when I started out, and not remember until I was on the road and turned the radio on. At that point, I'd have to pull over, walk around the back of the car to the far side, pull the antenna up, and go back to the driver's seat. (If it rained, I just played tapes.) But if I parked on a New York street without pushing the antenna down, there'd be nothing left to pull up when I returned.

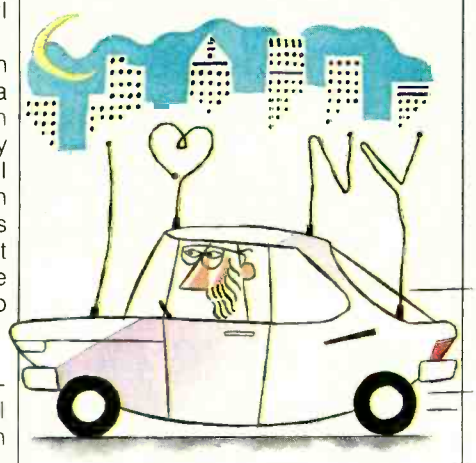
After the manual antenna had been broken for the ninth time, I put in a combination AM/FM/CB antenna on the left rear fender. It didn't work very well on the broadcast bands, so I eventually had a power antenna put in on the right rear fender, a few inches from the manual antenna's stub. I kept the stub because I had nothing else with which to plug its hole, and I also kept the combination model as a "disguise" antenna for my CB.

Later, when I began to get dual-antenna diversity-tuning radios to test, I added a short, amplified Hirschmann "rubber ducky" in the front of the car. Tony cleverly positioned this antenna so that the windshield pillar would almost hide it from my sight while I was driving. Incidentally, the little Hirschmann proved it could pick up just as many stations as the longer, unamplified model; this surprised me, as I'd expected lower noise from the latter when used with a good head unit.

Right Speakers, Wrong Place

In the original system, the front speakers had been built into custom-made enclosures hung beneath each end of the dash. In those locations, frequency response was good, but stereo imaging was terrible; each front listener was so much closer to one speaker than the other that he or she heard unbalanced mono with occasional squawks from the speakers on the other side. That system's installer had therefore built a console which incorporated center-channel speakers. This pretty well solved the imaging problem, but the extra amps and crossovers it entailed made the system overly complex and added to the drain on my overburdened electrical system. Because these speakers had to be at the top of the console, they also forced me to place my head unit too low for easy use.

In the rear, the Phase I system had wound up with Genesis speakers and 10-inch Alpine 6110 woofers in the parcel shelf. Unfortunately, the big woofers protruded so far into the trunk that I could no longer get large boxes in—and being able to pack large boxes was one of the reasons I'd bought a



hatchback in the first place! The woofers' black-painted magnet assemblies were a hard-to-see obstruction in the dark trunk; if I hadn't replaced the speakers, I'd have painted their frames white.

For Phase II, I tried new speakers. The then-new KEF GT100 two-way plates, and KEF's GT200 plates with external subwoofers, sounded slightly better to me than any other speakers I heard, so I insisted on them. For the Saab, however, these proved a poor choice. As I soon learned, a good speaker in a bad place no longer sounds like a good speaker.

Normally, the GT200 midrange/tweeter plates and the subwoofer grilles go on a car's rear parcel shelf, and the subwoofers go in the trunk with their sound vented to the grilles via hoses. The GT100s would go in the front doors. That's what I tried first.

The GT200 plates fit my rear shelf just fine. However, in order to use existing openings in that shelf, rather than weaken it by cutting new ones (it was already close enough to Swiss cheese), I had to mount the subwoofer away from the sidewalls of the trunk. This narrowed the trunk too much. Mounting the woofers to the underside of the shelf restored the trunk to full width but reduced its height even more than the old 10-inch woofers had. By now, I had so many other problems that rebuilding the rear deck to optimize woofer placement didn't seem worth the candle.

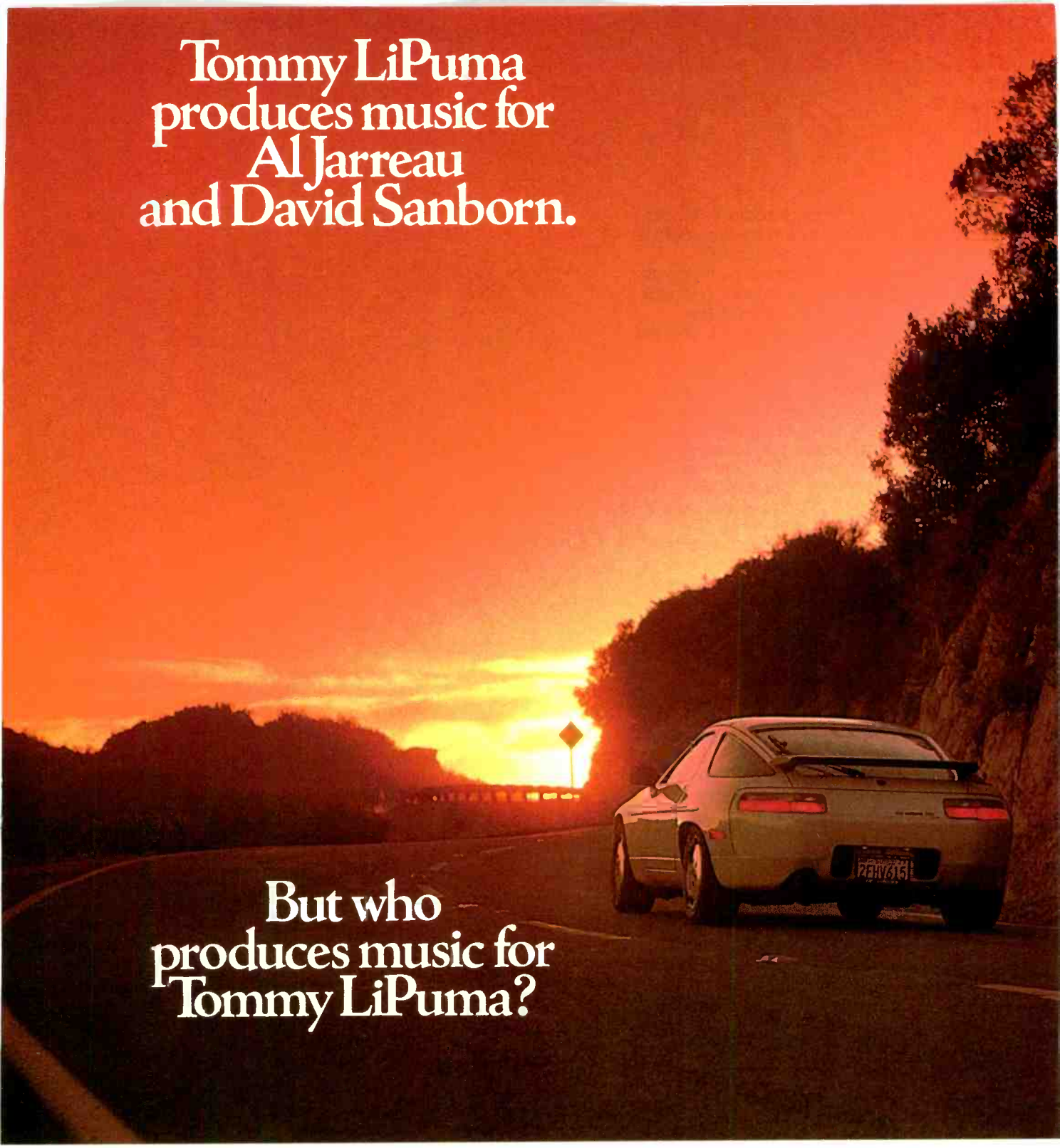
The rear speakers' response, measured from several driver's-seat ear positions, was pretty flat from about 25 to 100 Hz, with a slight rise between 100 Hz and 4 kHz, followed by a roll-off that had almost eliminated the treble above 16 kHz. The roll-off didn't bother me much, as I use my rear speakers mainly for fill. But the flat bass response allowed road noise to drown out the bass whenever I got going. I solved that with an active crossover and a separate amp for the subwoofers, so I could boost the bass for the road. The crossover we used was part of Audio Control's EQX crossover/equalizer; we used its equalizer section to tweak the response still further.

While plates plus subwoofers worked fine in the rear, putting plate speakers in the front of the Saab was a really bad idea. Plates require large, flat mounting surfaces. The doors, usually desirable locations, had no such surfaces available where the sound would have a clear shot at the listeners. Separates wouldn't have helped much, given those doors, but they might have worked a little better in the locations we finally picked.

Those locations were the kick panels in the side of the car below the dash. There's no useful cavity behind the panels, so Tony had to build small enclosures to mount on the panel's surfaces. Because I needed someplace to park my size-12 feet and I wanted to get into and out of the car without pratfalls, the enclosures had to be very shallow—hardly more than picture frames. The frames were made a little shallower at the tweeter end, to tilt them toward the driver and passengers, but there was no room to angle the enclosures directly at us. Even so, this setup gave better imaging than I'd expected.

The treble was actually quite good—surprising, since the steering column

Tommy LiPuma produces music for Al Jarreau and David Sanborn.



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As a car, the Saab 99 was a delight, but as a vehicle for stereo installations, it had several problems.

and the driver's and front passenger's knees came between the speakers and my ears. At the odd angle from which I heard the speakers (well off-axis and well above the tweeter), there was a strong suckout at 2.5 kHz, the midrange/tweeter crossover point, but it was not as audible as it looked on my analyzer plots. (The rear speakers, which were heard from a different angle, had only a slight dip at the crossover point.)

The bass, as one might easily expect, was terrible. The cramped enclosure volume caused a noticeable peak at about 100 Hz (perhaps augmented by the resonance of the space below the dash into which the speakers fired), with a rapid dropoff below that. Also, when I faded down the rear speakers to move the image up front, the subwoofers faded with them.

Then I had an idea. The GT100 plates are designed to go down to 50 Hz, but my enclosures did not let them do this. The GT200 plates are designed to fade out below 150 Hz, where the subwoofer crosses in. I therefore swapped plates. Now, the GT100s could take advantage of the trunk as an enclosure. The GT200 plates, with less bass to start with, would have less to lose from the picture-frame enclosures.

This definitely helped. The resonance problems in the front diminished, though they did not disappear. Since the subwoofers were still linked to the GT200s, which were now in front, I got good bass when I faded out the rear channels. Yet I still got good bass from the rear channels, now that the GT100s could benefit from the Saab's cavernous trunk.

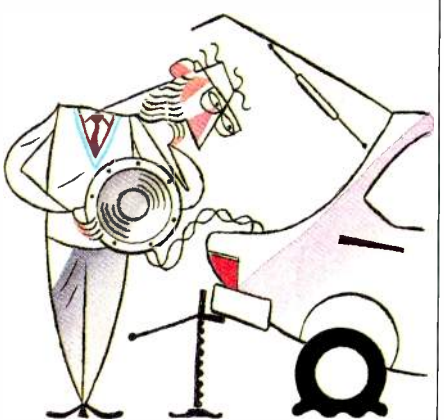
Eventually, however, I replaced the GT100s in the back with Infinity CS-1 separates. They sounded a bit fuller and, perhaps partly because I had more flexibility in mounting their tweeters, seemed to have more treble.

The Console

The rest of the system worked out better than the speakers did. Tony Igel rebuilt the console, eliminating the center-channel speakers and replacing all the built-in electronics with three Bensi boxes; he also angled the console slightly toward the driver's seat, which made the setup easier to use.

The Bensi boxes, and Tony's careful concealment of the amps, CB, and such, eased my mind a lot. In a city where "No Radio—Already Stolen" signs are almost as common as pizzerias and Chinese restaurants, mild paranoia is justifiable.

The main reason for the Bensis, however, was to let me shuffle and change equipment for my "Behind the Wheel" road tests. It's far easier to wire a head unit into a Bensi box than to wire it into



a car; that is important when you test up to a half-dozen head units each year. While testing, my reference head unit went into the second Bensi slot, for quick comparison; all three Bensis were wired to a selector switch installed in the dash.

If the unit under test did not fit into a Bensi, it went into the shelf beneath the dash, which had been retained from the Phase I installation. Antenna connections were then run directly to the unit from behind the console, and the power and audio connections dangled down and wrapped around the console front to hook into a specially prepared Bensi box. As a bachelor's test setup, this worked fine; when I wed, there was suddenly a front-seat passenger (sometimes me) to kick the dangling wires out or trip on them and sprawl into the gutter when getting out.

Between tests, my reference head unit went in the top slot, for convenience. On long trips, I'd stick a CD player in the slot below it. The third slot, and the space below that, could then be used to hold tapes or CDs.

In the old console, an AudioMobile SP300 three-band equalizer preamp sat just below the head unit. Since there was no room for it in the new console, Tony moved the SP300 up into the dashboard (where the head unit would have gone, had there been room for it). However, as the addition of CD improved the system's sound, I found myself using the equalizer less and less.

Finishing Touches

For wiring, we used a mix of Phoenix Gold and Monster cables. These double-shielded interconnects definitely proved their worth in keeping down noise pickup. Aside from that, not having heard the system with any other cables, I can't say how much, if at all, they may have helped the sound quality. Cable comparisons are hard to make in car systems, because once cables are installed, they stay there. (Things are easier at home, where you don't have to unbolt the couch and raise the floor to change your stereo system's cabling.)

My resident head unit, Soundstream's TC 308, was chosen because it had exactly the right balance of virtues to serve as a long-term reference. It had good performance, good looks, and good ergonomics. It also had all the features I really desired (such as station scan and Dolby C NR) so that I would not quickly tire of using it. At the same time, its performance was not so dramatically outstanding that other units I tested wouldn't have a shot at matching or surpassing it. In fact, in the last few years' car stereo tests, quite a few other units *did* outdo the Soundstream in one respect or another, although I don't believe any unit that wasn't way above the Soundstream's price range outdid it in everything.

For most of the Saab's last few years with me, the amp I used in front was Soundstream's Class A 40, a good-sounding unit of relatively modest power (16 watts per channel). In the back, we started with a Soundstream D 200 (100 watts per channel), which eventually got cooked when a good samaritan accidentally gave me a reverse-polarity jump start.

About this time, we replaced the Saab's original 55-watt alternator with

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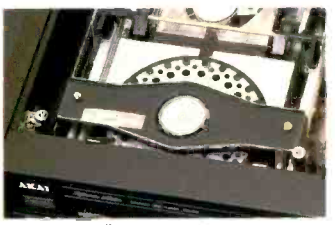

Akai's disc clamper: because more stable rotation means fewer playback errors.

The CD-93-B's die-cast 3-beam laser pick-up with "A" servo system further ensures that the disc is read with unsurpassed accuracy. By effectively minimizing playback errors, Akai engineers have reduced the distortion generated by error concealment.

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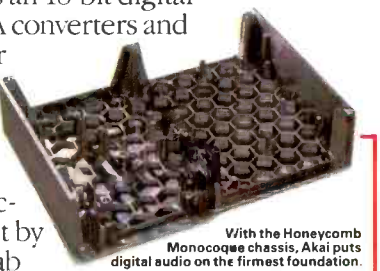

With the Honeycomb Monocoque chassis, Akai puts digital audio on the firmest foundation.

Akai's extra attention to engineering, design and construction quality is proven out by *Stereo Review's* recent lab tests.* The CD-93-B had one of the flattest frequency responses and the best low-level linearity they ever measured.

Let the other manufacturers search for the one thing that will make their players sound better. At Akai, that one thing is everything.

*Stereo Review, August, 1988

CD-93-B
Reference Master
CD Player

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In my new Scorpio, I'll likely use 50 to 80 watts per channel. I don't mind overkill, as long as it's moderate.

an aftermarket 85-watt model, in hopes that my battery would not go dead as often. Then we felt safe in biamping, adding a Carver M-240 (120 watts per channel) to the Soundstream amp in the rear. Eventually, we replaced the rear D 200 with another Carver, on the assumption that its Magnetic Field technology would be efficient enough to make it less current-hungry at equivalent power levels. Actually, as I learned during our eight-amplifier roundup test (May 1987), both amps are about equally efficient—as are several other models in this particular power class.

Overkill?

How much power was the right amount? With the rear speakers (driven by the big Soundstream amp, for fill), 16 good, clean watts per channel in front was certainly adequate. Even in this noisy old car and with its windows open in the summer, using speakers whose sensitivity is on the low side of average, there was power enough to let me hear the music clearly and without distortion.

Could I have gotten by with even less? As it happened, I was forced to find out. When my high-powered alternator's voltage regulator blew, taking out the alternator, battery, and all my electronics, I realized that we should replace the Saab as soon as possible. (My wife had come to that conclusion earlier; she's not *that* dewy-eyed about tow trucks.) So instead of replacing the big amplifiers for the few remaining months we'd have the car, I cut back to just the front speakers and tried driving them with a Soundstream D-10 and later with Linear Power's Runt. The D-10, which was designed to power tweeters in biamp and triamp setups, delivers only 5 watts per channel, about as much as the amplifiers built into most head units; this was clearly not enough to do the job. ("Oh," said my wife, cutting off my long technical spiel on why we heard so much distortion, "you mean it's *clipping*.") The Linear Power Runt, which was designed for roughly the same uses as the Soundstream D-10, delivers 16 watts per channel; this was adequate—but without help from the rear channels, just barely so. I'd estimate that the least power I could actually have been happy with in the old Saab was 20 to 25 watts per channel, although 50 watts per channel would have been even better.

In a quieter car, however, one can live with less. The Merkur Scorpio my wife and I just bought has a factory-installed amp which delivers 12 watts from each of its four channels and does fine—at least with the factory speakers, which are probably pretty efficient. The sound system that Tony and I eventually will install in the Scorpio likely will have between 50 and 80 watts per channel.

I'm not against overkill, if it's done with moderation.

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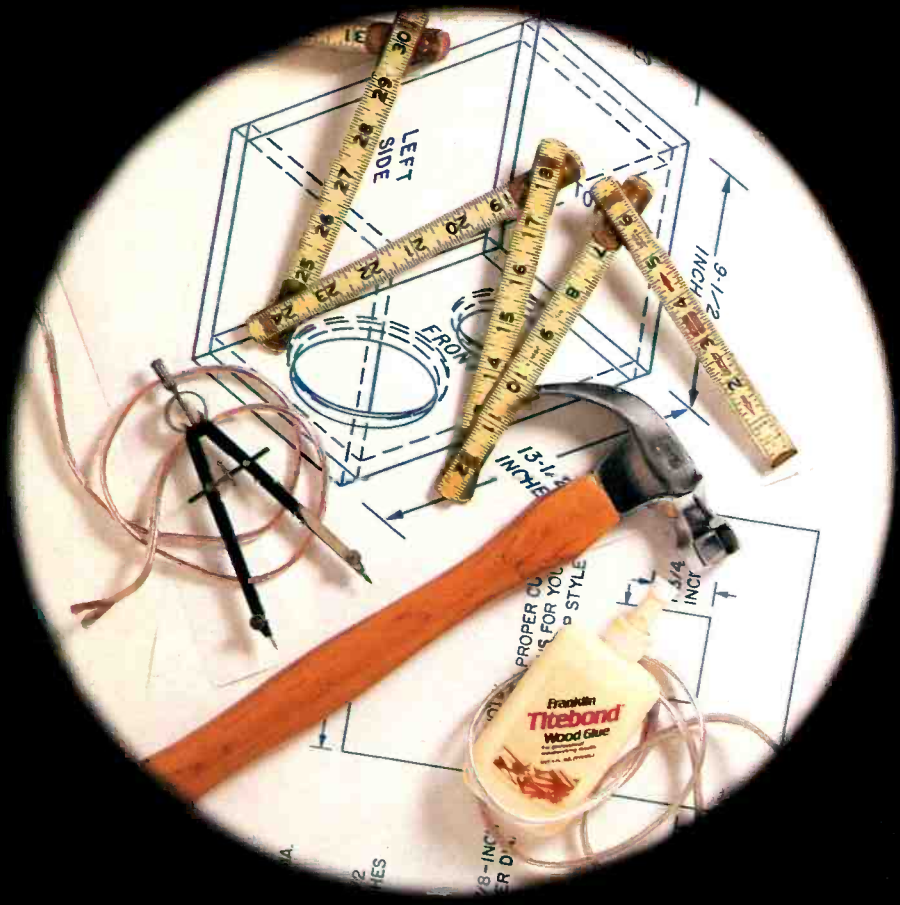
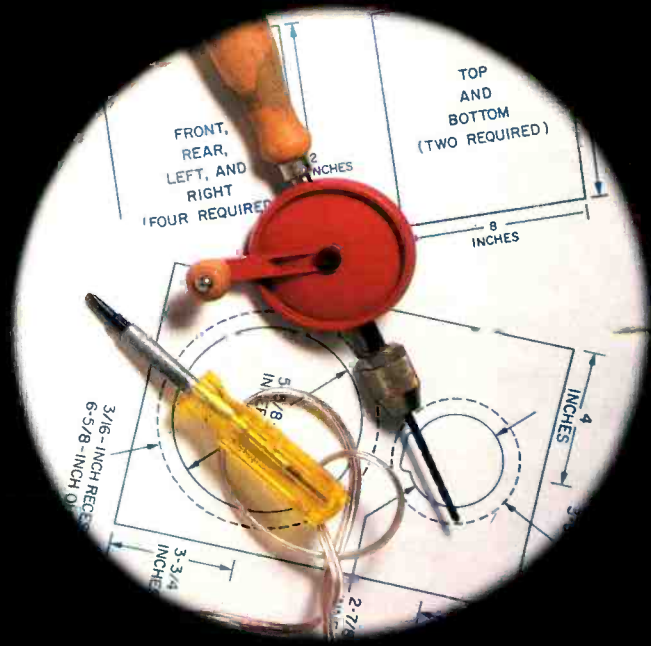




Photograph: David Hamsley

SPEAKERS BY DESIGN

PART II

Ken Kantor

In Part I of this article, with the help of a personal computer, we walked through the design of a two-way, 6½-inch loudspeaker system. We selected appropriate drivers, determined cabinet volume, and developed and refined a crossover network. Now we are ready to discuss the construction of our loudspeaker system. This won't be a step-by-step instruction manual, as you would find in a kit. Rather, it is assumed that the reader has the skill to work from sketches, so we will therefore concentrate on the general issues involved in loudspeaker construction (cabinet shape, driver placement, etc.) along with some specific construction guidelines.

Just as our previous selection of drivers and crossover topology avoided esoteric approaches in favor of quality elements and proven design techniques, so too our cabinet design will follow the same logic. Taking this course will result in a loudspeaker with very good performance. The inspired reader is encouraged to experiment with alternative materials, shapes, and construction techniques for the cabinet enclosure.

Ken Kantor is president of Product Design and Evaluation Services, in San Francisco, and is co-founder of speaker manufacturer Now Hear This.

Box Dimensions

As shown in Table VII, the first step of our construction will be to translate our calculated enclosure volume into working cabinet dimensions. Since we are leaving the realm of engineering to enter that of carpentry, we probably should make a transition from meters to inches. Doing this, our target enclosure volume of 10 liters translates into 610 cubic inches, which is equivalent to a cube of about 8½ inches per side. In loudspeaker terms, a cubic enclosure is not really a very good idea, for two reasons. First, the more similar the three internal cabinet dimensions are, the more standing waves will tend to build up and reinforce one another. This leads to irregular frequency response in the upper bass and midrange, with resulting coloration, particularly of vocals. The second problem is finding room for the tweeter on the same surface as the woofer.

Figure 8 shows an assembly that will allow the entire cabinet to be constructed from stock boards that are ¾ inch thick and 8 inches wide. The stock material can be cut into six lengths to form the six sides of our enclosure. This

technique will maximize the use of precut edges, thus making it easier to achieve tight, clean joints. The 8-inch boards result in an internal cross-sectional area of 52 square inches. Some quick calculating indicates that a height of 11¾ inches will provide a volume within 1% of our target of 610 cubic inches. Increasing this to 12 inches gives us 624 cubic inches, which is just about right to account for the space taken up by the rear section of the woofer. The dimensions of the six boards required for each speaker are given in Fig. 9.

Medium-density fiberboard (MDF) makes an excellent material for the construction of smaller loudspeakers. "Medium density" refers to the ratio of fibers to adhesive in the composite; the actual stuff is much denser and more vibration-resistant than wood. A thickness of ¾ of an inch is recommended, as this will provide adequate structural rigidity without the use of any bracing. Particleboard will also provide enough strength, but it is harder to obtain a clean surface appearance, especially at the edges of the boards. If care is taken to assure good corner joints, a speaker this size should be very solid.

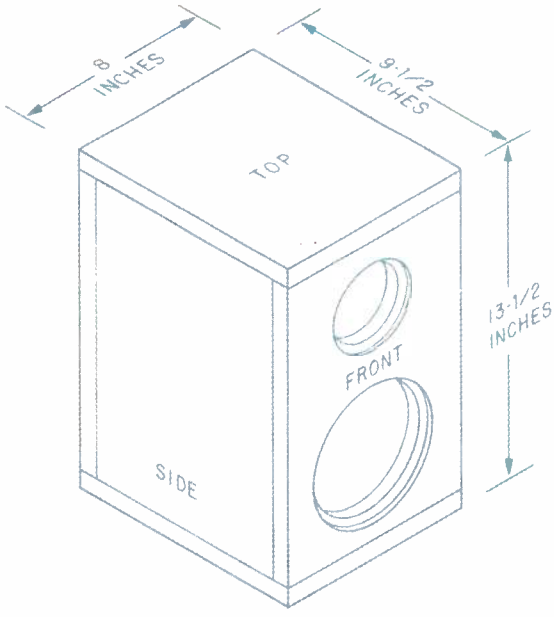


Fig. 8— *How the finished enclosure fits together.*

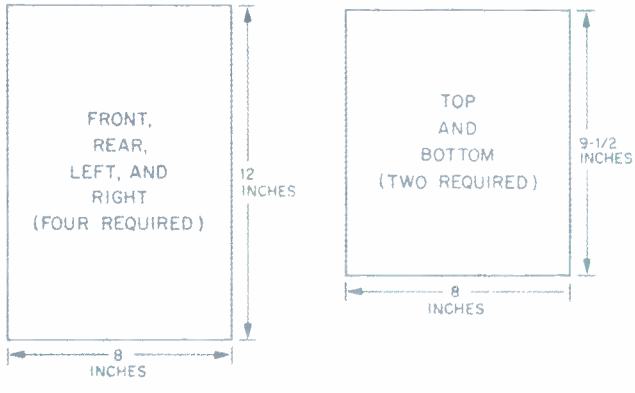


Fig. 9— *Dimensions of the enclosure's individual parts. Note that four 8 × 12-inch and two 8 × 9½-inch pieces are required for each loudspeaker.*

Parts and Parcels

A quick and convenient way to obtain material for our speaker box is to buy prefabricated shelves from a hardware store. These are readily available in the ¾ × 8-inch size, in several lengths, and can be purchased with a variety of relatively attractive finishes. Two speaker cabinets require a total of 134 linear inches of material, but allow extra for cutting losses and be sure to consider how the required cuts fit into the particular lengths you buy. For example, if 36-inch prefab shelves are purchased, four should suffice for each pair of speakers built.

Table VIII lists the major parts required to build a single speaker. In many cases, substitutions or modifications are acceptable; these changes are noted in the text where appropriate. For this reason, it is a good idea to read carefully through the sections describing various assembly tasks. Plan out how you intend to approach the construction, and alter the parts list as you wish. Almost any hardware store should have the materials required for the box assembly. Finding crossover parts, however, will be more difficult. Typical electronics supply stores do not carry the type of capacitors or inductors necessary to build speaker crossovers. A list of companies that specialize in the sale of speaker parts can be found in Table IX. All of these

firms should be able to provide the crossover parts discussed here, and most will be happy to send a catalog of their offerings. Often, local audio shops, particulary those doing service work, sell inductors, capacitors, resistors, and even terminal cups. These may not be on display, so it pays to ask. Radio Shack sells a variety of speaker terminals and capacitors. Be sure that the terminal cup you get is specifically designed for speaker use, for terminals used on amplifiers are rarely airtight. Old Colony Sound Lab has arranged to provide *Audio* readers with the Tonegen 16K65 woofer and 94C70 tweeter. This company is, in fact, the only source of these driver units in the U.S. (see Table IX for terms of sale).

Cutting and Drilling

First off, cut and drill with care, especially when using power tools. Cut the lengths of board according to the dimensions given in Fig. 9. Try to get clean edges on the pieces. Not only will your speakers look better, it will be easier to get a good airtight seal from the finished enclosure. A table saw is recommended because of the straight edges and accurate right angles it provides. If you do not have access to one, a local lumberyard can cut your stock or even sell you cut pieces. Just impress upon them the need for accuracy. If you are good with a circular saw, or really good with a handsaw, best of luck. If you don't mind lots of caulking, you can even use a jigsaw or a sabre saw.

Before the boards are assembled, holes must be cut in two of the 8 × 12-inch sheets for the drivers and terminals. These holes are shown in Fig. 10. The terminal cutout dimensions given are typical for molded plastic cups which contain spring clips or binding posts. Of course, you should adjust the size and shape of these holes for the particular terminals you choose. It is best to leave the driver positions as indicated. The relative spacing between woofer and tweeter has a great influence on crossover design, since it affects how the sound waves add up in the transition-frequency region. In general, closer spacing is better, as long as enough material remains for solid support. The driver and terminal openings can be cut successfully with a hand-held jigsaw; many of these saws accept an inexpensive attachment for making clean circles. If yours does not, just draw a line in pencil and follow it by eye. Be sure to use the inner diameters shown in Fig. 10 when cutting holes for the two drivers. The outer

Table VII—Steps in the construction process.

1) Determine enclosure's internal dimensions
2) Purchase construction parts and materials
3) Cut six panels
4) Machine driver and terminal cutouts
5) Assemble enclosure
6) Assemble crossover and terminals into enclosure
7) Add polyester fiber material
8) Assemble drivers into enclosure
9) Test for air leaks and driver polarity
10) Hook up to stereo
11) Impress friends
12) Browbeat enemies

Table VIII—Major parts required (per speaker).

Drivers
Woofer—Tonegen 16K65.
Tweeter—Tonegen 94C70.

Crossover
Terminal cup—Two-connector.
Capacitor—2.2 μF, 100 V, 10% nonpolar electrolytic.
Inductor—0.6 mH, air core, 18 gauge (two needed).
Resistor—10 ohms, 15 watts, 5%.
Perfboard—3 × 5 inches.
Wire—18 gauge; approximately 40 inches red, 40 inches black.

Enclosure Construction
Fiberboard—¾ × 8 × 67 inches.
Mounting screws—¾-inch pan head #6 (11 needed).
Foam weatherstrip tape—⅛ inch thick × ¼ inch wide; 48 inches needed.
Glue, screws, caulking—As required.
Polyester fiber—2 ounces.

Fig. 10—*Cutout details for front and rear boards. If facilities for making the recesses shown are not available, false fronts incorporating the recesses can be glued on; see text.*

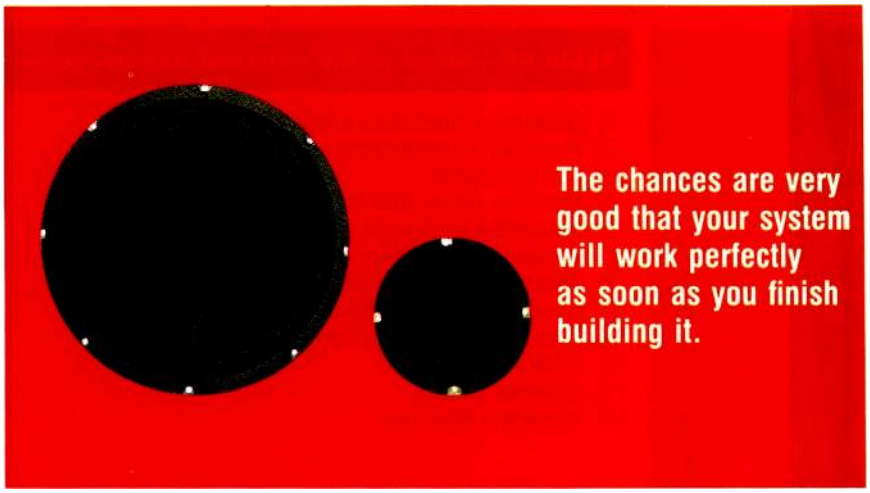


Table IX—Parts sources.

Just Speakers, 3170 23rd St., San Francisco, Cal. 94110; (415) 641-9228.

Madisound Speaker Components, 8608 University Green, Box 4283, Madison, Wisc. 53711; (608) 831-3433.

Old Colony Sound Lab, P.O. Box 243, Peterborough, N.H. 03458; (603) 924-6371. Drivers only: $127 for pair of woofers and pair of tweeters; price includes shipping in U.S. Defective units will be replaced at no charge if they are returned with freight prepaid. Units damaged accidentally or because of abuse will not be replaced or repaired.

Option Audio, 32 Terrapin Lane, Mercerville, N.J. 08619; (609) 890-0520. Unfinished medium-density fiberboard (MDF) front panels, $40 per pair, including shipping. Entire completed enclosure also available; prices vary with materials and finishes specified.

Fig. 11—*Diagram of speaker and crossover wiring. See the Parts List (Table VIII) for details on components.*

circles, shown by a dotted line, are for recessing the drivers into the front panel. These cutouts don't need to be super accurate or neat, just reasonably close. The little notch for the tweeter terminals should be filed away after the circle is cut.

The next step is probably the hardest one in this entire construction project. The job is to provide a routed band around the driver holes so that the drivers may be recessed back. Flush-mounting the drivers, particularly the tweeter, provides a noticeably smoother response. Diffraction effects can cause up to 3 dB of boost at the lower part of the tweeter's range if the tweeter protrudes from the front panel. Recessing the woofer is less important, but it will have some effect due to the reflection and diffraction of tweeter output. There isn't an easy way to machine these recesses with hand tools; it might be possible, but it probably would not be fun. The task would be simple for a wood shop worker with a router, however, and can be accomplished on a home drill press if care is taken.

Because routing is difficult, an alternative approach may be attractive. Using dense (not corrugated) 3/16-inch-thick cardboard or poster board, cut a template and glue it onto the speaker front. The template should be 13½ × 8 inches and should have cutout hole diameters of 3¾ and 6⅝ inches. Attachment of this piece should be delayed until after the box is assembled. If the cardboard is cut accurately and then painted, it should be undetectable—in fact, it will help hide the joint line formed by the top and bottom pieces, resulting in a nicer front view. If glued firmly, dense cardboard, poster board, or any other solid, smooth-surfaced material will serve our acoustic needs just fine.

Because of the wide variety of construction approaches possible, many of the final box assembly decisions are left to the reader. The important thing is to get a strong, airtight seal at every joint. (We will test the integrity of the seal after the drivers are installed.) The simplest technique would be to glue together the four sides with wood glue, securing them immediately with small nails. After the glue dries, the top and bottom can be glued and nailed on in the same way. Later, through the woofer hole, all the internal joints can be caulked with silicone sealer or hot-melt glue. Glue- and caulk-only methods are certainly possible. The result will be a nice outer appearance, but this approach does require clamping of some sort.

Soldering

The final crossover values are shown in Fig. 11. Even those not familiar with reading circuit diagrams should be able to handle this one. Connection polarity is not important on the resistor, capacitor, or inductors; it *is* important on the terminals and drivers, however, so observe the plus and minus signs here. The positive driver terminals are marked in red. All connections should be soldered using electronics-grade rosin-core solder. Do *not* use the plumbing or acid-core variety.

Most electronics supply stores should have the 2.2-µF capacitor value. Incidentally, the crossover response has been specifically designed for the characteristics of a bipolar electrolytic capacitor. You cannot simply replace this part with mylar or polypropylene types. Their lower internal resistance will result in several dB of excessive high-frequency energy. If you are inclined to make this substitution, add a 3.3-ohm, 10-watt resistor in series with the 10-ohm resistor, to restore proper tonal balance.

The circuit can be built free-form and then glued, piece by piece, to the inside bottom of the speaker box. Hot-melt glue works great for this, which is

why so many manufacturers use it. The network may also be assembled onto a piece of perfboard, which in turn is glued or screwed down. There are three things to remember when laying out the crossover parts. Keep the two coils at least 2 inches apart; otherwise, they can affect one another electrically. Further, the resistor gets moderately hot under high-power conditions; don't let it touch other components. And finally, place the crossover circuit far enough back in the box so that it won't interfere with the woofer mounting.

It is a good idea to cut and attach leads for the drivers and terminals before the crossover goes into the box. Strip and solder coat the loose ends of the wires. Use red wire for positive leads, black for negative ones, and be sure to label each wire as to its destination. This will make things much easier when it's time to insert the drivers. A length of 12 inches is recommended for the woofer leads, 16 inches for the tweeter leads, and 10 inches for the terminal leads.

Final Assembly

Once all the glue is completely dry, we can start final assembly. To get a truly airtight seal, it is necessary to have a soft gasket between the fiberboard and the drivers and terminal cup. Adhesive-foam weatherstrip tape can be used for this. Buy the softest ⅛ × ¼-inch material you can find. Lay the drivers face down on a table and wipe off their mounting flanges with a paper towel or clean cloth to remove dirt and oil. Now apply the foam tape completely around the driver flange, just to the point of overlap. On the woofer, the tape should lie toward the inner edge of the flange; on the tweeter, put the tape toward the outer edge. You should also apply tape to the mounting flange of the crossover cup. If any screw holes get covered, just pierce the tape with a pin. There is no need to clear the hole.

Now it's time to close things up. Place the terminal cup in the back hole, and mark the screw locations. Remove the cup and drill or punch small pilot holes to facilitate screw insertion. Find the leads for the terminals and pull them through the hole. With the cabinet resting on its front side, the terminal leads can be soldered to the terminals (observing polarity), and the cup can be screwed down to the cabinet. If there are no clear polarity markings on the terminals, use the red connector for positive.

Turning the cabinet over, pull the woofer and tweeter leads through their respective front-panel cutouts. It's a good idea to tape the leads to the cabinet with masking tape to avoid losing them when inserting the polyester fiber. Polyester can be obtained at a store that sells sewing materials or fabric; discount departments stores generally carry it too, for making or repairing pillows and blankets. If you have a choice, select the material which has the softest feel.

There are no formulas for calculating the exact amount of fiber to use in a speaker. With the mixed dimensional units that indicate a good, scientific rule-of-thumb, most designers try between 1 and 1.5 ounces per 5 liters of enclosure volume. We'll use 2 ounces. The fiber can be weighed in a light plastic bag on a postage scale. Start with too much, and remove a little at a time. Throw away the torn bits, since small, unattached pieces could conceivably foul up a woofer. The fiber should be spread evenly throughout the box and should flow around and behind the wires.

Mark the driver screw holes as you did for the terminal cup. It will be easier to remove the drivers if you apply small tags of tape before dropping them into their openings. Resting the drivers on the cabinet, carefully solder on their leads (again observing polarity). Don't overheat the driver terminals as this may damage them. Lastly, screw the drivers securely into the box, tucking the leads back into the fiber. If you opted for a cardboard facia, glue it onto the enclosure now.

Basic Tests

There are two very basic tests to perform before connecting our completed speakers to an amplifier: Air seal and woofer polarity. Air seal is pretty easy. Gently push the woofer cone back into the cabinet until increased resistance is felt. Take care to push at several points at once, and don't press on the dust cap. Hold the cone down for about 5 seconds and then release it, watching closely. The cone should return slowly and evenly to its normal position, taking a good 1 or 2 seconds to do so. A more rapid return indicates one or more air leaks, in which case all joints and seals are suspect. Often, if a hissing sound is heard when pushing on the woofer, this is a clue to a leak. The flickering of a match flame can also help you locate a leak; to create the necessary wind, either push on the woofer or play music at a moderate level with your bass control all the way up. If you suspect a problem, be sure to check out the areas around the drivers and the terminal cup, as well as all the joined edges. Caulk will usually fix a leaky edge. A bad driver seal can often be cured by simply removing and reseating the unit. Stubborn cases might require a second layer of foam tape.

The second test confirms proper woofer polarity. Use two lengths of wire to connect a 9-V transistor-radio battery directly to the speaker terminals for a few seconds. The positive battery terminal (the smaller one) must be connected to the positive speaker input (red). Proper polarity is indicated by an outward motion of the woofer. When the battery is disconnected, the woofer should slowly return to rest, which serves as a last check for air leaks.

Chances are very good that your system will work perfectly as soon as it is finished. All the component parts are extremely reliable, and there aren't many glitches that won't surface during our two simple tests. Almost all of your listening should be for pure enjoyment, not for analysis. However, it is a good idea to listen for a few potential problems that can arise, just as a precaution. I won't say too much about listening tests; *Audio* readers probably do them a lot. Besides, speaker builders are like new parents: They think their creation is far and away the best—at least for the very first part of its new life. I've never been anything but overjoyed when listening to one of my own designs . . . until the morning after.

This design has been balanced for mid-shelf placement. Corner or floor placement will increase deep bass output. Likewise, a more open placement—say, on stands moved out from the rear wall—will result in a lighter overall balance. Overly bad imaging and/or a suck-out in the midrange indicate that one or both tweeters are out of phase. No highs mean a tweeter problem, no lows a woofer problem.

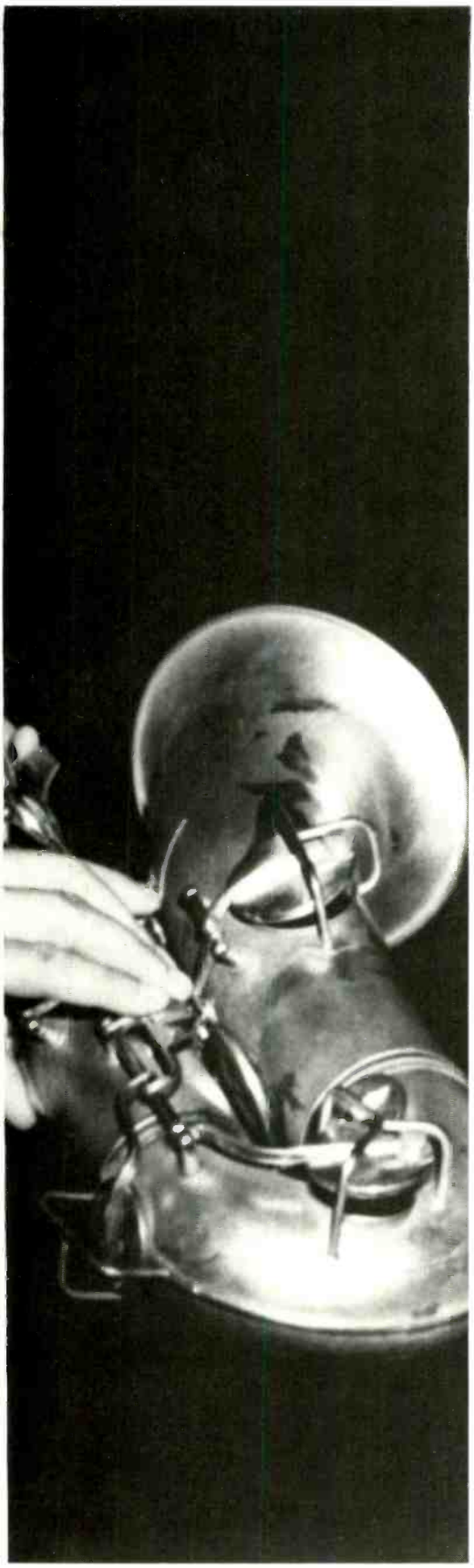
Naming the Baby

At first, I wasn't going to name this loudspeaker, which has served to illustrate, among other things, the role of personal computers in speaker design. However, in the course of reading up on other published designs, I realized that naming the new baby is practically obligatory. Since I dislike futuristic, technical names for audio products, I hoped to find something warm and human.

After considerable reflection, I decided to dedicate my new design to the acclaimed editor of *Audio* magazine who, in truth, gave me my first big break in the writing business several years ago. I refer, of course, to Eugene Pitts III. Upon reflection, however, I realized that this name was too long for a 6½-inch loudspeaker. So for the sake of simplicity, I'll call it "The Pitts." A

Lester Young in 1938 (below) and Jack Teagarden in 1940 (opposite).

Photographs: Frank Driggs Collection



REPRISE

The Keynote and Commodore Collections

Frank Driggs

Mosaic, the Stamford, Connecticut based jazz-reissue label, has once again set a standard by rereleasing material that is simply impossible to beat. Its first volume of *The Complete Commodore Jazz Recordings* (Mosaic MR23-123) contains 23 LPs packaged in a handsome double-boxed set with a black slipcase. Its 64-page, generously illustrated booklet includes a completely documented discography, extensive and thorough liner notes, and an interview with Commodore's founder, Milt Gabler, that recounts the label's history. Dan Morgenstern, Director of the Institute of Jazz Studies in Newark, N.J., wrote the notes and did a commendable job on such a massive undertaking. This reissue has my nomination for record set of the year.

Commodore was the first independent jazz record company in this country. It all started when Gabler, soon after his high school graduation, began selling phonograph records in his father's radio parts store on Manhattan's 42nd Street. Gabler's sideline was so successful that he was able to convince his father to turn the business into a record store. Through the Commodore Music Shop (so-named because it was across from the old Commodore Hotel), Gabler began reissuing rare and long-out-of-print jazz records. This venture led to the formation, in 1938, of the Commodore Music Shop label, and in fact, some of these early titles appear on *The Complete Commodore*.

The late 1930s were the height of the Swing Era, and interest in small combo

New York City, 1944: Coleman Hawkins (at piano) with producer Harry Lim behind him.

The 44 albums in these two collections constitute the greatest body of reissued jazz we are likely to have for the foreseeable future.

jazz had begun in earnest. This was the music that, by and large, the "Big Three" (RCA Victor, Columbia, and Decca) tended to ignore. Through Gabler's efforts, and those of the many independents that followed him, small combo jazz was brought to a large audience. This proved to be a boon for the musicians as well as for jazz lovers, and it even spurred the three major labels to begin fulfilling at least part of their obligation to this uniquely American music.

The only other collection currently on the market that can rival the sundry riches of *The Complete Commodore* is *The Complete Keynote Collection* (PolyGram 830-121-1). Although this 21-LP package was released in 1987, its importance, along with Mosaic's *Commodore* and their other boxed sets, constitutes the greatest body of reissued jazz we are likely to have for the foreseeable future.

The beige-boxed *Keynote* contains a large booklet, also written by Morgenstern, in both English and Japanese. Although the booklet is not as extensive as the *Commodore*'s, it does include a history of the company and quite a few vintage photos.

The Complete Keynote Collection, assembled in Japan by Kiyoshi Koyama, features hundreds of alternate takes and unissued tracks from dates produced mainly by Harry Lim for Eric Bernay's folk-oriented Keynote. When the label went out of business in 1947, absorbed by a larger company, its material fared rather poorly, reissue-wise, until this set. Jazz lovers owe Koyama and PolyGram's Richard Seidel a deep debt of gratitude for taking the large risk of bringing such an immense collection to this country intact.

On both collections, many of the same artists appear at the peaks of their careers. Remember, these recordings were made during a period when musicians were working in the most thriving and competitive atmosphere in the history of jazz. This was 52nd Street's heyday, the period of the big band, and it offered many musicians not only frequent jobs but valuable experience. In those years, the after-hours jam sessions in every major city enabled musicians to learn and grow in the hothouse of mutual exchange.

Because these recordings were made during what I refer to as the "Golden Era" of jazz (1938-47), they represent much of what we have come to treasure from those years. The *Commodore* covers roughly 1939-43, and the *Keynote* features work from 1943-

The Bobby Hackett Orchestra, in 1939, featuring guitarist Eddie Condon, clarinetist Pee Wee Russell, and cornetist/leader Bobby Hackett (foreground).

47. Although these collections contain too many riches to detail thoroughly here, their wonderfully complete liner notes do the job nicely. But perhaps a few words on the highlights of these sets will partly satisfy the jazz lover's curiosity.

On both collections, there are individual sessions produced by Leonard Feather. The Bunk Johnson and Jelly Roll Morton dates (done by Gene Williams and Alan Lomax, respectively), as well as others, were acquired by Gabler for Commodore after the labels that had originally released them folded. Steve Smith of HRS label fame, John Hammond, and Eric Bernay also produced dates of varying quality during Keynote's history.

Each set has multiple takes, alternate and unissued masters galore, and surprises. There are only a few failures, sessions that somehow, in the midst of all this wealth of talent, simply don't come off. But these are very much in the minority. Further, even the less interesting cuts occasionally offer fine solo moments, so there is little waste.

The *Commodore* has the marvelous Lester Young and The Kansas City Six on clarinet and tenor sax from 1938, and Billie Holiday doing "Strange Fruit" with soulful accompaniment by trumpeter Frankie Newton. (This was a song her own label, Columbia Records, would not allow her to record because of its controversial lyrics about lynching in the Deep South.) There also are songs by Jack Teagarden, Stuff Smith, Jess Stacy, Joe Sullivan, Lee Wiley, Muggsy Spanier, Joe Bushkin, and Chu Berry. You'll hear Willie "The Lion" Smith doing his finest piano solo work, Mel Powell with accompaniment by "Shoeless Joe Jackson" (Benny Goodman, using his pseudonym) in 1942, Edmond Hall, and cuts by Teddy Wilson that were originally released as part of his "School for Pianists" series. (These songs were slightly simplified versions of Wilson's material and arrangements, intended to teach the general public how to play piano in his style.) Art Tatum also is captured on a 1943 Coleman Hawkins date with Cootie Williams, among others. There's no fat to be found.

Milt Gabler mainly concentrated on a select group of artists (namely Eddie Condon, Pee Wee Russell, Bud Freeman, Bobby Hackett, and Wild Bill Davison). The very high-caliber, small

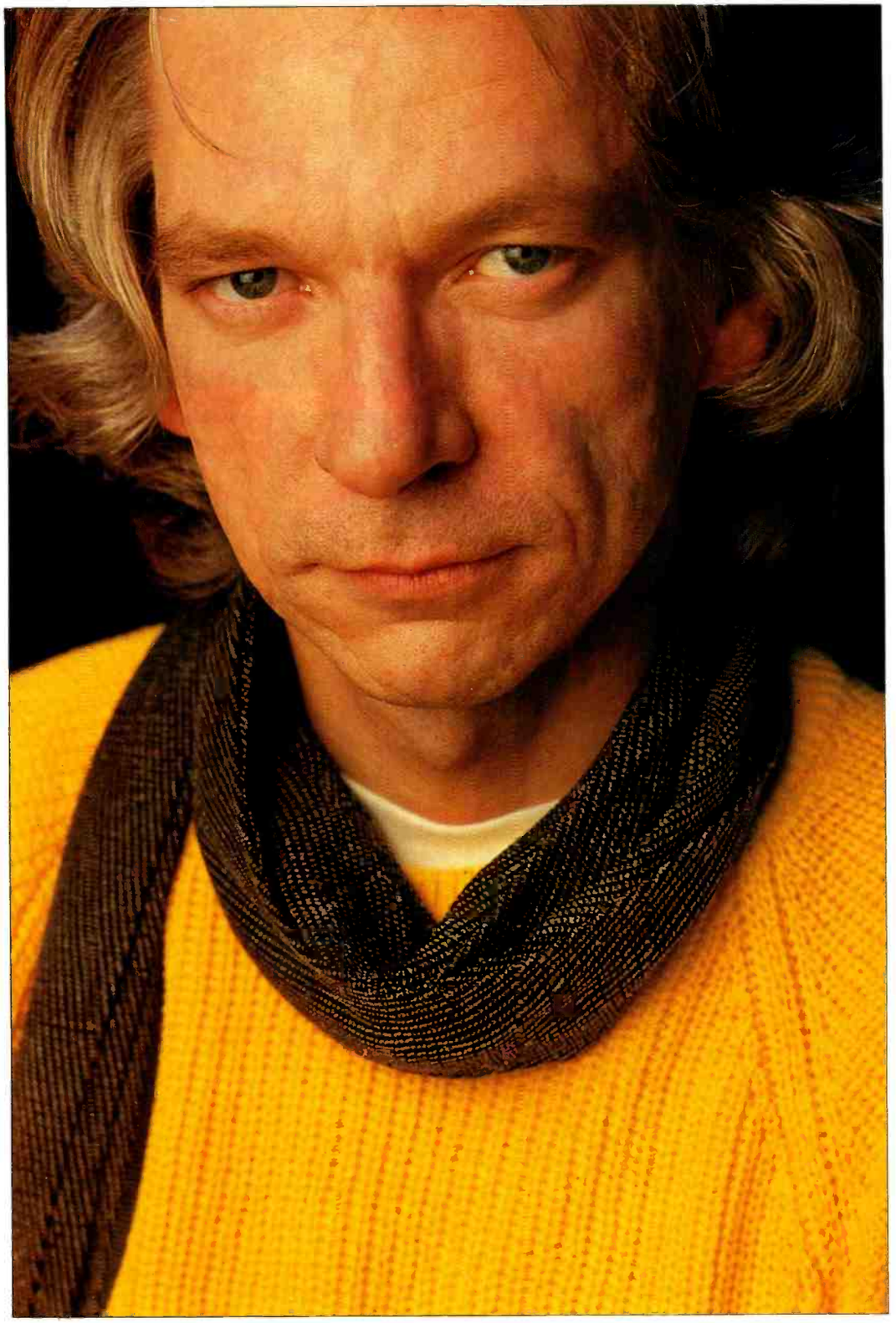
jazz-band sound of Condon and these other musicians accounts for nearly half the Commodore label's output through the years. This somewhat conservative approach certainly doesn't handicap this rerelease.

Keynote, meanwhile, reflects Harry Lim's more adventurous perspective on recording jazz. Lim, a Japanese-born, Dutch-educated jazz lover, recorded in a manner completely different than Gabler. There is more musical variety in Lim's work, as he used different and unusual combinations of instruments and artists. On *The Keynote Collection*, some of his best cuts include Roy Eldridge's trumpet ensemble with Emmett Berry and Joe Thomas; a Coleman Hawkins sax ensemble with Harry Carney, Don Byas, and Tab Smith; Benny Morton's trombone choir with Vic Dickenson, Bill Harris, and Claude Jones, and a host of legendary jazzmen such as Jonah Jones, Pete Brown, Kenny Kersey, Herman Chittison, Budd Johnson, Red Norvo, Johnny Hodges, Charlie Shavers, Barney Bigard, the great alto star Willie Smith, Red Rodney, Allen Eager, Serge Chaloff, and finally Lennie Tristano.

The prices of these sets are high, as should be expected from boxes of 21 and 23 LPs. Both top out at more than $200 (plus shipping and handling, in Mosaic's case). But they offer weeks and months of listening pleasure from mature artists in the prime of their playing power.

It would be a devilishly difficult choice to make, deciding which box to acquire. I say save up and get both! Each represents the best that jazz had to offer in the years prior to the advent of Charlie Parker, Dizzy Gillespie, and be-bop, a style which is reflected on some of the last Keynote dates. Many things changed in the late '40s, and bop became the prevalent style—one that would be followed through many convolutions, almost to the present day. In due course, this meant that many of the artists captured to perfection in these sets would rarely find the same sympathetic recording situations again. These two collections are truly the best ever released. A

The Complete Commodore Jazz Recordings, Vol. I is available only from Mosaic Records, 197 Strawberry Hill Ave., Stamford, Conn. 06902; (203) 327-7111.
The Complete Keynote Collection is available in better record stores.



PHOTOGRAPH: KEVIN KNIGHT

RICK ROWE
HAIR
RESTORATION

Susan Elliott

Flash back to April 1968. *Hair*, the seminal rock musical, had just opened at Broadway's Biltmore Theater. Although the cast was young and inexperienced, the show went on to become one of the most influential of its era. And now, 20 years later, RCA has chosen to commemorate *Hair*'s anniversary by issuing a Compact Disc of the album, digitally remastered from the original master tapes.

The original cast album of *Hair*, made just three days before the show's Broadway opening, was produced in an environment that eyewitnesses recall as "general havoc." The relatively novice engineering staff endeavored to record rock 'n' roll rendered by what some close to the session referred to as a cast of "pot-smoking hippies." The restoration's executive producer, Peter Elliott, describes the scene this way: "You had this cast of wild kids, most of whom had never been in a recording studio before." Some of those unknown, inexperienced "kids," however, went on to become famous in their own right—Melba Moore, Diane Keaton, Paul Jabara, Ronnie Dyson, Lynn Kellogg, and the late Lamont Washington, to name only a few.

Original producer Andy Wiswell, though highly respected for his work on Broadway cast albums such as *Hello Dolly* and *My Fair Lady*, was unfamiliar with recording rock. "It wasn't his kind of show," says Elliott. At the time, most Broadway records were made in 3-track, while the rock world was well into 8- and 12-track recording. Producer Wiswell was undoubtedly uncomfortable with the medium, to say nothing of the message.

These problems were compounded by the fact that *Hair* was the last album made in RCA's East 24th Street facility; most of the best equipment already had been moved uptown to the studio's current location on West 44th Street. As the cast chewed up the microphones—rock 'n' roll style—the equipment chewed up and/or folded much of the tape.

THE TAPES OF THE ORIGINAL *HAIR* SESSION WERE IN TERRIBLE SHAPE. YOU COULD HOLD THEM UP TO THE LIGHT AND SEE RIGHT THROUGH.

Photofest

Lamont Washington in the original cast production of *Hair* at the Biltmore.

Now fast-forward to the present. As the 20th anniversary of the first rock musical approached, RCA engineer Rick Rowe, known for his painstaking resuscitations of Elvis Presley, Sam Cooke, and *The Sound of Music*, was called in to perform a complete digital restoration. Distortion, flaking oxide, missing pieces, and wavering pitch from uneven voltage were among the problems he encountered when he began work two years ago. Rowe estimates that he spent several hundred hours in the control room of Studio A, literally piecing *Hair* back together. He consulted regularly with composer Galt MacDermot, book/lyric writers Gerome Ragni and James Rado, original engineer Mike Moran, and cast member Paul Jabara, whose performance of "Electric Blues" (one of four heretofore unreleased tracks) makes its debut on the new CD.

A particular boon for the remastering effort was the fact that Rick Rowe, in addition to being an exceptionally gifted recording engineer, is a former *Hair* groupie. "I saw the show maybe a dozen times," he says. "I knew the pit band and I knew a lot of the cast members. It was the puppyhood of my career. I was working at Electric Lady Studios, and I'd go up to the Biltmore whenever I could, just to hang out. I entered through the stage door, like all the rest of the hippies. So it was a real thrill to get to do this CD." *S.E.*

Gerome Ragni (behind the music stand) in RCA's old 24th Street studio, during recording of the original cast album.

Michael Ochs Archives/RCA Victor

How did you start work on this project?
By listening to as many commercial discs of *Hair* as I could find, just to see if they were all cut from the same production master. Sometimes they're not. Sometimes you might say, "Wow, who cut this one? How can I get my hands on that production master?" As it turned out, they were all the same. So I determined that I didn't want to use any of the 2-track production masters that were available.

Why?
For one thing, I didn't like the mix. For another, making a direct transfer would have been horrendous. There was no noise reduction, no elevated level. When you take a premixed tape and just make it louder, all you do is bring up all the hidden bugaboos. Like tape hiss and room hiss.

That's what happened on the first *Sound of Music* CD. It was AAD, like a lot of early CDs. [RCA rereleased the disc ADD, as restored by Rowe.] I don't believe in that, because I don't think our sophistication remembers as much as our memory does. We don't remember The Chords' "Sh-Boom (Life Could Be a Dream)" as sounding awful and puny and weak, we remember it as sounding strong and hot. People's ears forget how limited the medium was in the '50s and '60s.

So you went to the original 2-track masters?
I couldn't get hold of all of them. I probably could've pursued it further, but I didn't like the mix anyway. It was very reflective of the style at that time: A lot of it was binaural, meaning that you had left, right, or center and not much in between. The idea of putting the bass on the left and the drums on the right weakens the record, because bass tends to drift toward the middle, especially on an LP, and that causes the stereo image to collapse.

Also, we weren't using [Ampex] 456 Grandmaster tape in 1968. The tape type they were mixing to couldn't take peak levels without distorting, and I wanted to get as much dynamic range as there was—and then some. So I decided to go back to the original 8-track. I knew I could clean things up better if I treated the tracks individually.

SINCE THE MACHINE USED IN '68 LACKED THE NEW SOPHISTICATED GUIDE SYSTEM, THE TAPE FOLDED AS IT WENT ONTO THE TAKE-UP REEL.

At that point, what kind of shape were the 8-tracks in?

Awful. Hideous. Terrible. For a number of reasons. I figured out, in playing Inspector Clouseau, that it got away from them at one point. They were probably using one of the old Ampex or 3M decks, which have one start and one stop button and a gear shift that you grab onto to fast-forward or rewind. If you hit the wrong button, God forbid, the tape goes flying into little tiny bits and gets stretched and crazed. That's what happened on "Initials," about 4 or 5 seconds of which had been taped back together and simply wouldn't play. And of course, the tape was losing oxide. You could hold it up to the light and see right through it in certain places.

That must have made it pretty dicey to work with.

How true. This is 20-year-old, 1-inch tape. It was losing oxide every time I drew it across the heads because it has an acetate, as opposed to Mylar, backing. We're talking slippery. Some machines won't even track it without it slowing down a little bit. But that wasn't the worst of it. Since the machine didn't have as sophisticated a guide system as we have today, it allowed the tape to fold as it went onto the take-up reel. They were using thin tape because they wanted to get the whole hour, plus test tones, on two reels. Thinner tape is susceptible to folding. Since track 1 is at the top edge and track 8 at the bottom, on many of the songs those two tracks didn't touch the playback head, and if they did, there'd be no high end because the tape was destroyed—literally creased.

When do you think the folding took place initially?

It had to have been when the multitracks were being used, so my guess is that it sat that way for 20 years.

What happened when you unfolded it?

It would fold right back up again.

But you still had the safeties.

Right. I figured, okay, so it's a second generation, but if I only remix 5 or 10 seconds here and there, I can cover up the hiss—no one will know I'm going from first generation to second to first. But apparently the safety masters were never played back—no one ever listened to hear if they were any good before they packed them up, put them away, and tore the studio apart to move uptown. The decks that were left downtown may or may not have been checked. The voltage regulators already may have been moved. The voltage from [New York City utility] Con Edison was fluctuating that day, and so was the speed of the machine making the safety master, which of course altered the pitch. The safeties would have been useful paperweights, but that's about all.

How about the outtakes?

They were in better shape. But there weren't a lot of outtakes—sometimes there were only two. In going through the recording pages, I discovered that the whole show was done in one day. Everything. You have to figure the engineering staff worked from 7 a.m., with the pre-setup, till about 1 or 2 the next morning, with maybe an hour off for dinner. They went right from tracks to overdubs—while the band took a break—then back to tracks.

Why so fast? Didn't RCA know it had a hit on its hands?

They knew that what they were recording was something a lot of people were talking about and that it was really controversial and that it had a nude scene and that there were hippies who didn't abide by the Moral Majority or care too much about the war in Vietnam. Think

Stanley Green Collection

Melba Moore (top, center) and Diane Keaton (bottom, center) in "Black Boys/White Boys."

Michael Ochs Archives/RCA Victor

Galt MacDermot (left) with the original cast at the 1968 recording session.

TO SAVE RESET TIME AT THE 1968 SESSION, TRACKING WAS SET FOR THE SONG WITH THE MOST ELEMENTS, RULING OUT A REAL STEREO MIX.

Hair stars and authors James Rado (left) and Gerome Ragni taping the show's title song.

Michael Ochs Archives/RCA Victor

of it. You've got a bunch of hippies and a bunch of straight people recording them. Chances are there's not going to be too much love—the artistic kind of love that says, "Oh, let's do one more take. You've got it in you."

I understand there were some pretty, shall we say, interesting things going on at the sessions.

They tell me it was a zoo. There was no control in the control room—there were 15 or 20 people in there. Galt [MacDermot, the composer] was the go-between. He was very straight. He acted as the liaison between the establishment and the hippies, and he tried to keep the peace.

[Producer Andy] Wiswell's idea was to record everything live and to keep things moving. I asked Mike Moran [the original engineer] why, when there were only drums, bass, piano, and a vocal on a song, he used only four tracks? Why not split up the drums, maybe stereo the piano—stuff like that, so you have a little more control? Apparently, Andy didn't want to stop for resets. It would have taken too much time. So they set up the tracking for whatever song had the maximum number of elements, which limited everything to a mono track and made real stereo mixing impossible.

Which song dictated the track layout?

"Aquarius" was pretty full. There was one track for drums, including all percussion; another track for piano, horns, and solo horns; electric piano on one, and both guitars on one. On a typical stereo mix, you want to have one track apiece; one for principal vocals; two for company, one left and one right, and one that is either a second lead or a third company track.

Wasn't a track assigned to overdubs?

No. Whenever they overdubbed, they erased the third company track. Rado and Ragney [who wrote the book and the lyrics and also played two of the lead roles in the Broadway show] did some overdubs the next day.

So there you are with a bunch of folded tape, useless safeties, and a couple of outtakes. Then what?

I wanted to get a better handle on just what happened, so I interviewed all the guys who worked on it—Mike, Joe Lopes, and anybody else who was still around. And I talked to the cast: Paul Jabara, who got me in touch with Natalie Mosco and with Sally Eaton, who's now a computer analyst for Prudential Bache. (She sang "Air.") I asked questions like, "How long did you work on it? What was done first? Second? Why? What time of day? What was the general atmosphere?" When I'm doing a restoration, any bit of information—even what they were wearing—*anything* can be helpful. Listening to the outtakes also helped. I could hear where they would start on something and give it up because it wasn't working. That happened a lot, particularly with the dialog—which, by the way, we rerecorded with the original cast in some instances.

So in some ways this is a re-creation as well as a restoration.

This is not historical restoration. It's not supposed to be. This is my idea of what the show should have sounded like, had I been the producer 20 years ago. The one rule was that there were no rules. Whatever I had to do, I did—even if I had to bring someone back from the dead. I'm not really interested in the historical value of this piece of acetate. I can't be concerned with that and with rendering a new product.

Is the new version complete?

No. There are eight or nine songs that were never recorded. But I did find four songs and some reprises, like the

The 1970 Broadway cast in the infamous "Hair" number.

©1987, Martha Swope

I KEPT THE FOLDED MASTER TAPE AGAINST THE HEAD WITH A MATCHBOOK, COTTON BALLS, AND A RUBBER BAND HOLDING IT ALL TOGETHER.

one for "Ain't Got No." Galt tells me it was dropped at the last minute because the lyric was too objectionable, but it's on there now. I also got a copy of the script and put the show back in order. It was out of order because they needed the sides to be compatible, time-wise.

What was your procedure for the actual restoration?

First, I went through all the 8-track tapes, making note of the track layouts and evaluating each track on each song. Second, I went over my evaluations and made a recommendation to myself of what to do. I kept all this on a separate computer system. I have a wonderful program called "Thinking Cap." Then I wrote a flow chart for each tune. Where did I want things matrixed [panned] in the stereo? How did they relate to my memory of what I saw onstage? Did I feel like doubling the horns, making them a little fluffier and fatter? Could I use both tracks of the company, or is one so distorted that I'd be better off using only one and doubling it? I did virtually the same thing for the guitars as for the chorus.

How did you deal with the piano and horns being on the same track?

If they were both playing at the same time and there was an important horn lick, I'd EQ as much of the piano out as I could and get the horns blattier by EQ-ing them and working with the compression ratio. By now, I was also expanding the dynamics of each of the eight tracks through EQ, compression, overall limiting, or combinations thereof. I used noise gates to take away the tape hiss, and other devices like the Aphex II and various Lexicon chambers. But things were changing constantly. It was not a question of setting it up and mixing to one song. It was mixing from one musical landmark to another. From bar 5 to 9 is different than from 1 to 5. And there were extensive pieces missing. In some cases, I even went to the 2-track production master. There is a clarinet solo at the end of "Frank Mills" that had no assigned track; it came through as leakage on the piano track. But it was a little more present in the 2-track version of the song.

Stanley Green Collection

Lamont Washington and Lynn Kellogg (center) in a scene from *Hair*.

How many faders did you use on the 32-track machine?

I sometimes used as many as 28. I had eight original signals, and all the rest were special effects—chamber delays, doubled tracks, an echo chamber for the drum kit, and so forth. One of the lead vocals had two or three faders supporting him—one is just the sibilance of his sound, the other is the body.

What were some of the ways you dealt with distortion?

One of the things I discovered was that in rewind, the tape deposited a thin film of the flaking oxide at the leading edge of the head, so for the next few minutes, while going forward, there was a little less distortion. Maybe 30, 40 seconds. So I got some of the tape I wasn't using and scraped off all of the oxide and coated the head occasionally. It cut down some of the distortion—not all, but some. I also used various kinds of analog signal processing, which is a slow, painstaking process, done in bits and pieces.

How about the folded tape?

I got the tape to stay up against the head with an empty matchbook cover, a couple of cotton balls behind it, and a rubber band holding the whole thing to the head assembly. That can ruin the head block—the playback heads on the 8-track machine were garbage when I finished the project. But I had billed more than the price of a new

A scene from "The American Tribal Love-Rock Musical," with the 1970 cast.

©1986, Martha Swope

THIS IS NOT HISTORICAL RESTORATION. IT'S MY IDEA OF WHAT THIS SHOW SHOULD HAVE SOUNDED LIKE IF I'D BEEN THE PRODUCER.

Photofest

On stage with *Hair*'s original cast at the old Biltmore Theater.

©1987, Martha Swope

The 1970 Broadway cast performing "White Boys."

"Curly, fuzzy, snaggy, shaggy, ratty, matty, shining, gleaming"; the 1970 *Hair* cast.

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machine, so I don't think the studio minded too much.

The matchbook apparatus would last maybe a minute and a half, and then the whole thing would break down. But hey, I got a minute and a half down onto the digital and I liked the mix. If I didn't, I'd go back to square one. Reset it, coat the head, put the rubber bands together, get everything ready, hope the mix would balance, and go. As soon as it collapsed or didn't sound right anymore, I'd stop and go back.

A day later, I'd start putting pieces together. I put "Where Do I Go?" together two or three times. First, I'd get it to where it sounded pretty good. Then I'd wait a day and play it again. The sound was good, the placement okay, but the lead vocal wasn't quite there. So back to the beginning. I couldn't bring out the lead vocal anymore, so I'd go back and remix the song in six or seven pieces, maybe more.

Once a song was on the 2-track stereo, I'd use that as the source, and re-EQ the whole thing to keep the distortion down further or to brighten everything up a little bit. At any given time, I had as many as eight or nine digital cassettes with pieces. There were two or three submasters with longer pieces and one final master where I would take stuff and insert it into the final working master.

Where and when did you do most of the work?

In Studio A, from 6 p.m. till 2 or 3 in the morning—that's when I could get most of the equipment. I'd bring in stacks of stuff, including three or four different speaker systems. The whole project took hundreds of hours, including time spent with headphones at home.

I have a* Hair *cassette that I bought about five years ago. Other than the usual differences between CD and cassette, what am I going to hear as a result of the restoration?

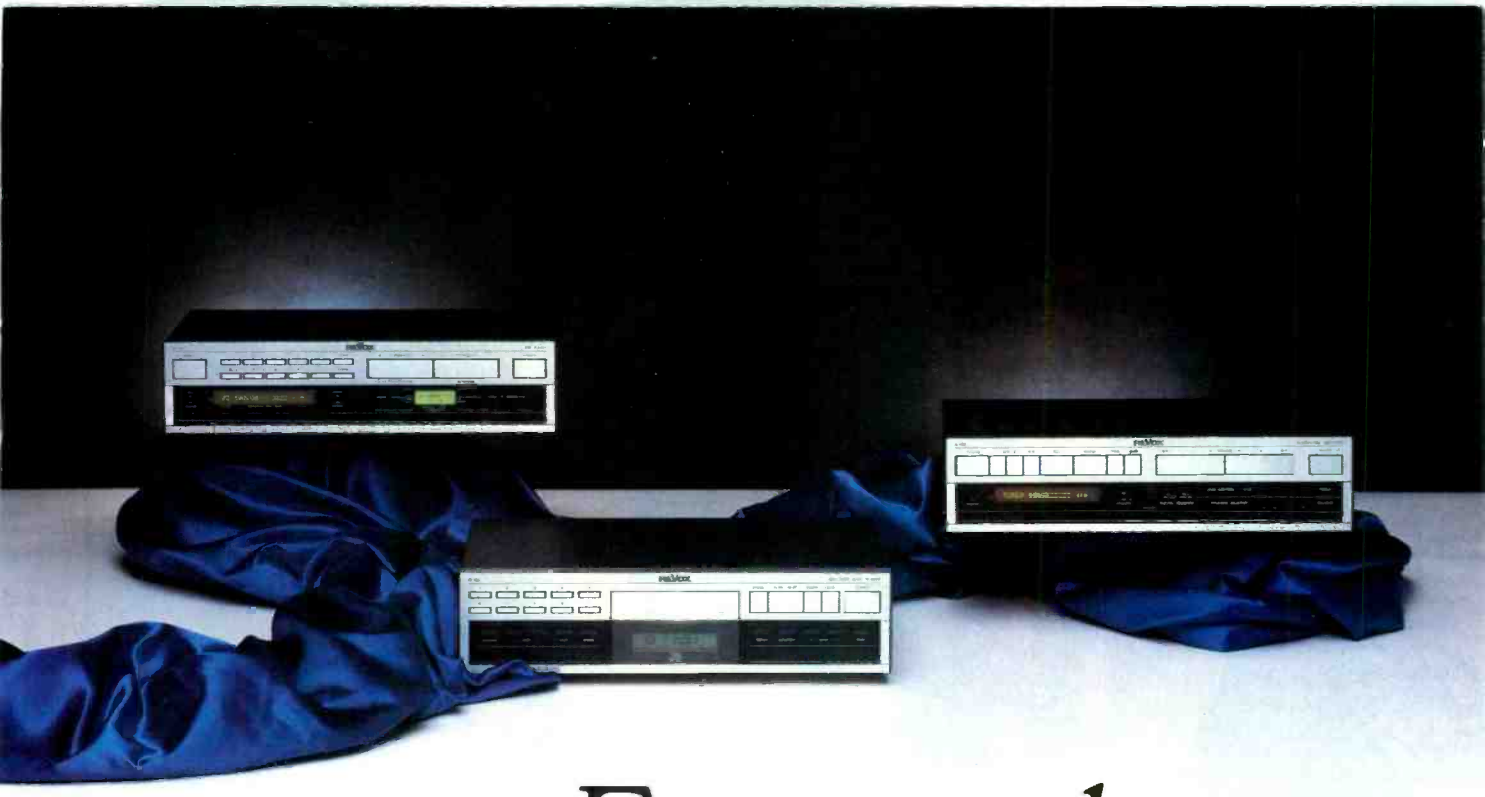
You're going to notice right away that the sound of the CD is wider; you're sitting in row E on the center aisle. The original doesn't have that Broadway house feel. It sounds like a studio. With the Lexicon 224X, I can program just about any room I want.

The sound is also going to be a lot brighter. One reason is, of course, that cassettes don't carry the high end well. The other is that, on the production master, they took down a lot of the high end to mask tape hiss. You wouldn't have heard the hiss on the record because it was cut so lightly onto the vinyl [in order to squeeze 58 minutes onto one album] that it had mostly high end. Also, all the low elements were split out—bass to one side, drums to the other.

Part of one of the algorithms I use on restorations is very much like what Sonic Solutions' NoNoise [distortion- and noise-reduction technique] does, but without the big computer. Once you eliminate the tape hiss, you can selectively put back parts of the high end and get the crispness back in. If I can hear people's lips smacking, that's great. Once again, that's why I believe in ADD as opposed to AAD.

What's your next digital restoration?

I'm working on a live recording of an Elvis concert in Madison Square Garden. I'm starting from 16-track this time, so there's lots more control. But I've learned from *Hair* that re-creating a moment perfectly, even if it wasn't captured perfectly, is not impossible. All it takes is a little bit of theatrics and imagination, and a lot of patience.



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Oberlin Smith, of Bridgeton, N.J., is now credited as the inventor of magnetic recording, c. September 1888.

Photograph: Robert Lewis

Wire recorders, the earliest actualized form of magnetic recording, were shown in Smith's drawings. This American Telegraphone, which belongs to recording historian Bob Angus, was foreshadowed by Smith's ideas.

Photograph: Jon R. Sash

Aerial photo of Smith's Ferracute Machine Co. plant. Offices were in the little building with the conical roof, adjacent to the factory.

Oberlin Smith

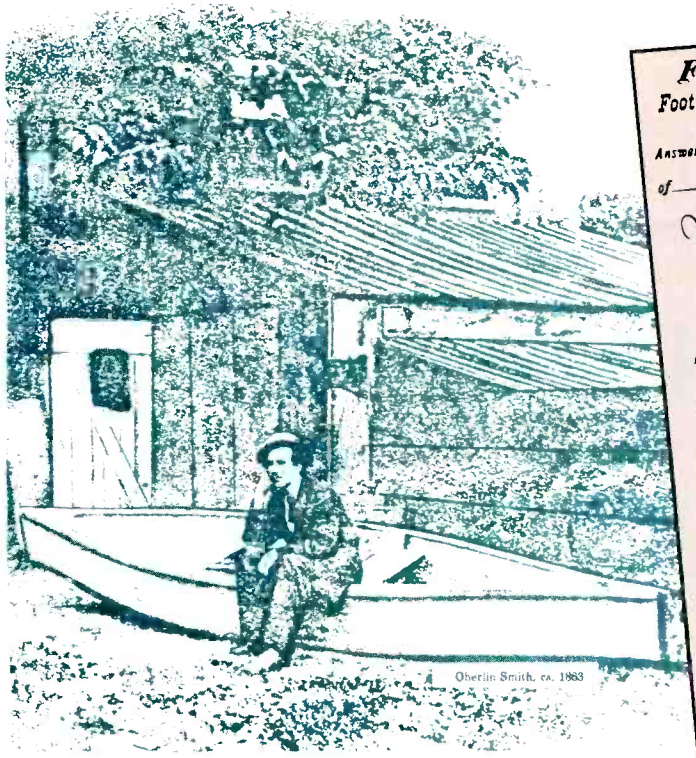
Centenary of Magnetic Recording

JON R. SANK

Audio history was revised by a paper in the March 1988 *Journal of the Audio Engineering Society*. Until then, Valdemar Poulsen of Denmark was thought to have invented magnetic recording in 1898, with his Telegraphone machine. In the *Journal* article, "1888-1988: A Hundred Years of Magnetic Sound Recording," author Friedrich Karl Engel, of the German firm BASF, revealed an 1888 paper by Oberlin Smith of Bridgeton, N.J., proving that Smith had spawned the idea before Poulsen. It is remarkable that Smith's article remained unknown all these years, despite the fact that it is readily available on microfilm—even at the Philadelphia Free Library near my home. Fortunately, Engel found Oberlin Smith's writings in time for magnetic recording's centennial year.

When I told this story to one of the junior audiophiles in my family, he found it hard to believe that the art was so ancient. This is understandable because magnetic recording was not introduced in the U.S. until after World War II. My AES colleague and audio-museum curator, Jack Mullin, discovered the Magnetophon tape recorder in Germany after the war and brought it to the U.S. He recorded Bing Crosby's radio shows on that machine, using the German tapes. Via a complex chain of events, Ampex and 3M became involved in magnetic recording and developed the recorders and tapes that led to the products of today.

The first magnetic recorder I can recall was a Webcor wire recorder; it reproduced speech reasonably well, but music sounded bad. My present antique collection includes an RCA wire recorder which, instead of having open spools like those on the Webcor, has a cartridge resembling an overgrown 8-track. In about 1950, I purchased a TapeMaster tape recorder which had only one motor. This recorder never ran at the correct speed, but early on the morning of June 2, 1953, I managed to record the coronation of Queen Elizabeth II via shortwave. I still have the recording, now dubbed to modern tape. (One reel of the master had been on paper-backed tape.) Later, in my acoustic lab at RCA, I had a monstrous RCA RT-11 full-track, ¼-inch tape recorder which I hardly used because the capstan motor sounded like a railroad car. Finally, some 20 years ago, I obtained the solid-state successor to the RT-11, the RT-21. It is a 2-track, ¼-inch machine with three big motors and has performed reliably



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Answering yours of ——— Bridgeton, N. Jersey, Nov. 26, 1878.

Mr. T. A. Edison,

Dear Sir:—

In some amateur electrical experiments I am making I need a "button" of mercury-impregnated-carbon, similar to those you use in your carbon telephone. Can you kindly furnish me one? If so, please state what will be the price, that I may remit.

How come along the specifications for the new pattern of phonographs about which we corresponded with you a few months ago?

Yours very truly,
Oberlin Smith.

Fig. 1—Oberlin Smith's letter to Thomas Edison. Photo of Smith and this letter are reprinted from The Antique Phonograph Monthly, *February 1975.*

Oberlin Smith (above) and Valdemar Poulsen can each be said to have discovered magnetic recording. Smith has priority, but Poulsen made the first working models.

to the present. It is very useful for editing and dubbing to cassettes.

Poulsen's wire recorder was demonstrated at the Paris Exposition of 1900. The lack of amplification prevented it from being a commercial success. Since it was a purely electrical system, amplification was needed. The very popular mechanical cylinder and disc recorders of the early part of the century could drive a reproducing horn directly, and so they did not need amplification. Nevertheless, Poulsen is reported to have received the Exposition's Grand Prize. His machine seems to have been the first working magnetic recorder. Later versions included magnetic disc and cylinder units. There is no evidence that Smith ever completed a working recorder, and his models perished in a factory fire in 1903.

Oberlin Smith visited Thomas Edison and heard a demonstration of his cylinder phonograph, apparently in 1878. Afterwards, Smith developed ideas on alternate forms of the mechanical phonograph and invented the magnetic recording and playback systems. He documented these ideas by filing papers with the Clerk of Cumberland County, N.J. on September 24, 1878. Then, on October 4 of that year, he filed a "caveat" paper with the U.S. Patent Office. His experiments at the time were witnessed, but no description of the hardware is available. Shortly after filing the caveat, he wrote a letter to Edison (Fig. 1), requesting some electrical parts. This letter, discovered in the Edison Museum, indicates Smith's developmental activities in the fall of 1878. He was, however, also busy managing a growing tool company, and didn't find time to do any more experiments in the following years. Ten years later, in 1888, he decided to make public his invention by means of a short article, "Some Possible Forms of Phonograph." The article was published in *The Electrical World*, and in it, Smith encouraged others to continue his work.

I compared the documents of 1878 with the 1888 article and concluded

The recording medium favored by Smith was a string impregnated with magnetic particles, similar in principle to modern plastic tape coated with magnetic powder.

that the systems described are identical. In 10 years, Smith had not made any discoveries which would cause any changes in his invention. His 1911 letter to the *Journal of the Franklin Institute* (which we'll discuss later) indicated that he did no more work on magnetic recording after 1878, and the models destroyed in the fire were those from his early work. (Both sets of papers also show some proposed variations in Edison's cylinder phonograph.) Two of Smith's sketches from the September 8, 1888 issue of *The Electrical World* are reproduced here (Figs. 2 and 3). This newspaper-style periodical, though printed in New York and regionally oriented, was widely read by those interested in electricity. Shortly before the turn of the century, there were many individual inventors working in all areas of electricity. Examining the 1888 issue of *The Electrical World* showed that one person had built an electric generating plant in his home, while others were inventing telephone gadgets. More search may reveal some long-forgotten device that needs re-inventing.

Figure 2 shows Smith's recorder. A magnetic wire or string travels from one spool to the other. The direct current flowing through the telephone transmitter (carbon microphone) is modulated by the audio signal, and both act to magnetize the moving medium by means of the induction coil. The d.c. bias in a carbon microphone is relatively stronger than the signal current. This could have functioned similarly to the a.c. bias of modern analog recording, which moves the magnetic operating point to the linear region of the medium.

Figure 3 shows the magnetic recorder in playback mode. A voltage is induced in the pickup coil as the lines of flux from the magnetized media cut the turns of the coil. This audio signal would be heard in the telephone receiver if an amplifier were inserted at point X. Smith recognized that the voltage would be too low to drive the earphone directly, and therefore he perceived that an "intensifier" was needed. His only thought was a battery; the vacuum tube amplifier was not invented until the next century.

In the September 29, 1888 issue of *The Electrical World*, a one-paragraph note quotes a letter from Smith describing improvements to recording and playback systems. With reference to our Fig. 2, he wrote that the recording transducer should be a coil wrapped around an electromagnet, with the core against the magnetic medium. This is clearly a forerunner of the magnetic head. The playback pickup helix in Fig. 3 would be shortened to one turn to "localize the magnetism," which fits in with Smith's correct notion of tiny magnets along the string. This modification leads to the modern idea of a very small gap in the playback head core. The playing or reading device in any system which scans a moving medium must be small compared to the details in that particular medium, be it magnetic tape, phonograph record, digital Compact Disc, or optical film soundtrack.

Smith also had some accurate and prophetic thoughts about the recording medium. He thought that it was

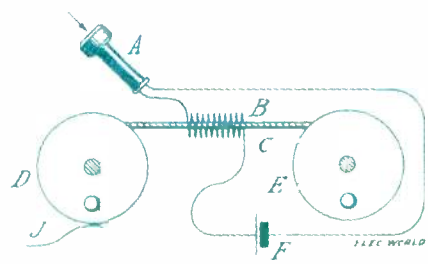


Fig. 2—Smith's magnetic recorder in record mode. Reproduced from the September 8, 1888 issue of The Electrical World.

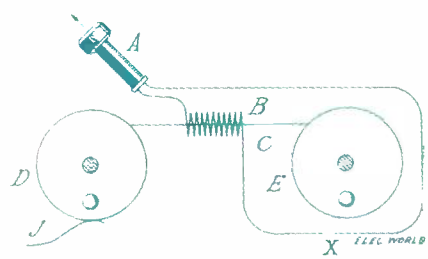


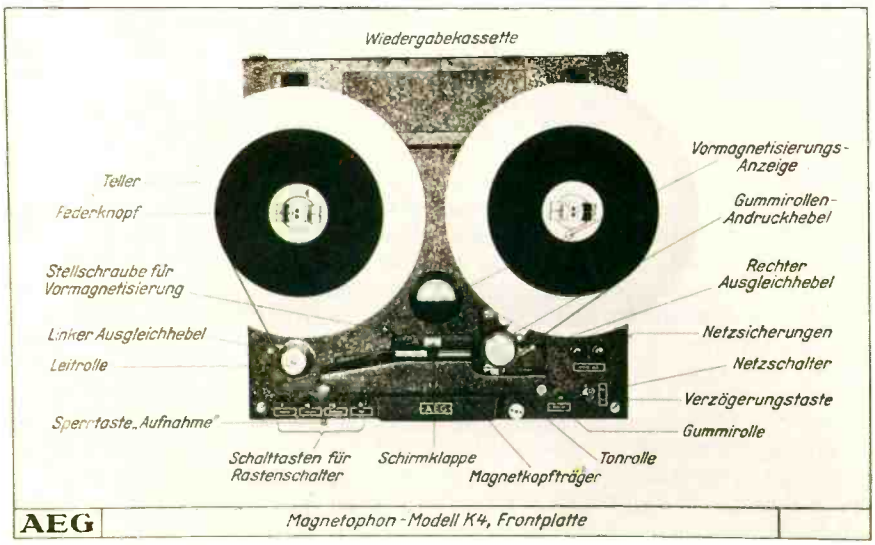
Fig. 3—Smith's magnetic recorder in playback mode. Reproduced from the September 8, 1888 issue of The Electrical World.

incorrect to use a magnetic wire, because the little recorded magnets would demagnetize each other, resulting in low output. Therefore, his favored medium was a string or, more specifically, a cotton sewing thread filled with magnetic particles. This was, in principle, the same as our modern plastic tape, which is coated with magnetic powder and held together with some "glue," the binder. Now we know that a magnetic wire will give ample output compared to tape, but the high-frequency response of magnetic wire is poorer if both are running at the same speed. Oliver Read has stated that recording wire must be run at 24 ips to equal the quality of tape at 7½ ips. (See "Suggested Reading" at the end of this article.)

The solid wire proved to be good enough for the telephone quality standards of the day. Poulsen was successful, and Smith was surprised. In Smith's 1911 letter to the *Journal of the Franklin Institute*, he stated that Poulsen's machines were designed exactly the same as in his own earlier descriptions, but he gave Poulsen credit for discovering that the little recorded magnets in a solid medium do not demagnetize each other. Smith mentioned solid wire as a medium in his 1878 papers filed with the Cumberland County Clerk and in the 1888 article, but he "accidentally" omitted mention of wire in his filing with the U.S. Patent Office. If only Smith could have known that some 40 years in the future, magnetic wire would give way to particle-coated tape.

Who was Oberlin Smith? This interested me, because I have spent much time in Bridgeton, N.J. in recent years, helping the hospital with its paging systems and with noise control of mechanical equipment. I have enjoyed the town's abundance of Victorian architecture and its many historic places. I contacted William Chestnut of the Bridgeton Antiquarian League, who put me in touch with Arthur Cox, a high school art teacher who is an expert on Oberlin Smith, one of Bridgeton's most famous citizens. Cox had just completed a book titled *Ferracute: The History of an American Enterprise*, which chronicles Smith's company as well as his spare-time inventions. These included not only magnetic recording

Smith recognized that an "intensifier" was needed to drive his recorder's earphone, but the vacuum tube amp wasn't invented until the next century.



The first recorders to use a ribbon-like tape medium were produced as a joint venture by AEG and BASF in Germany in the early 1930s. Recorders such as the Magnecord PT-6 (right) appeared in the U.S. in the late 1940s.

but also his Autofono, the first jukebox. I am indebted to Cox for his book as well as for copies of many old documents which he has collected.

Smith was born in Ohio in 1840 and died in Bridgeton in 1926. He was a prolific inventor and held 70 patents. In 1890, he was president of the American Society of Mechanical Engineers. Smith never seemed to be short of cash and, at age 23, opened a machine shop in Bridgeton which later became the Ferracute Machine Company. Ferracute (which means "sharp iron") made presses for cutting and forming metals, and it grew rapidly because of the need for tools to make tin cans quickly for the food industry. In the early part of the 20th century, the Ford Motor Company became Ferracute's largest customer, and during both World Wars, the plant produced presses for making small-arms ammunition. After World War II, business slowed, and in 1968, the company was sold to the Fulton Iron Works of St. Louis. The Bridgeton plant was closed and remains empty to this day.

One of my hobbies is taking aerial photographs while piloting, and Ferracute's location on a lake made a nice picture (see first page of article). The plant, as shown, was built in 1905, after the 1903 fire destroyed the original, along with Smith's recorders. The Smith mansion, Lochwold, was located on the lake a few hundred yards from the plant. It was destroyed by fire in 1934, and I could see no traces. The plant offices were in the little building with the conical roof, adjacent to the factory building. Smith's office was in the room below the cone.

His most valuable contributions were in the mechanical realm, and his 1896 book, *Pressworking of Metals*, remains a classic in its field. Oberlin Smith loved to play phonograph records, and, incidentally, he was a very good dancer.

Author's Acknowledgments

Arthur Cox, in addition to furnishing documents, supplied the formal portrait of Smith at the beginning of this article, for which I am grateful. I would also like to acknowledge the assistance of Allen Koenigsberg, publisher of *The Antique Phonograph Monthly*, who provided a copy of Smith's letter to Edison, which originally came from the archives of the Edison National Historic Site in West Orange, N.J.

Suggested Reading

Benson, K. B., ed., *Audio Engineering Handbook*, McGraw-Hill, New York, 1988. Benson's *Handbook* has a good history of magnetic recording by Busby of Ampex; you may also wish to read my chapter on microphones.

Cox and Malim, *Ferracute: The History of an American Enterprise*, Bridgeton, N.J., 1985. (Available for $32 postpaid from Arthur Cox, P.O. Box 411, Bridgeton, N.J. 08302.)

Read, Oliver, *The Recording and Reproduction of Sound*, Howard W. Sams, Indianapolis, 1952. Read's old book contains an excellent description of wire recorders and how they magnetize the wire, as well as a comparison to tape recording.

The Antique Phonograph Monthly, 502 East 17th St., Brooklyn, N.Y. 11226. Allen Koenigsberg's digest-sized publication is for those avidly interested in the older means of recording, not necessarily collectors. Articles on unusual subjects and the classified advertising section are both interesting.

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Crest Factors Of CDs

It's almost become axiomatic that the music peaks in a recording are much greater in amplitude than the average power level of a program source. This notion has enabled audio salespeople to sell amplifiers whose power output approaches the kilowatt level. It is also the reason that some speaker manufacturers have been able to boast about their systems' ability to handle short-term peaks that are 10 (20, 50, 100?) times greater than their rated maximum power handling capacity.

The difference between average and peak power levels (called crest factor) gave rise to the lab test for dynamic headroom which is part of the EIA Standard for Amplifier Measurements. In this test, a 1-kHz, full-amplitude, sinusoidal signal lasting for 20 mS is followed by 480 mS worth of the same signal, attenuated by 20 dB. A 'scope photo of this special tone-burst signal is shown in Fig. 1. By repeating the sequence over and over again, you can ascertain how much more short-term power can be delivered by an amplifier or receiver than the same unit would be able to deliver on a continuous basis. The amplitude of the 20 brief alternations at high level, when clipping begins, is compared with the amplitude of a 1-kHz signal that represents the amplifier's rated continuous power output; the ratio of the two amplitudes is expressed in dB. Thus, with a dynamic headroom rating of 3 dB, the given amplifier can deliver short-term power levels exactly twice as great as its continuous rated power.

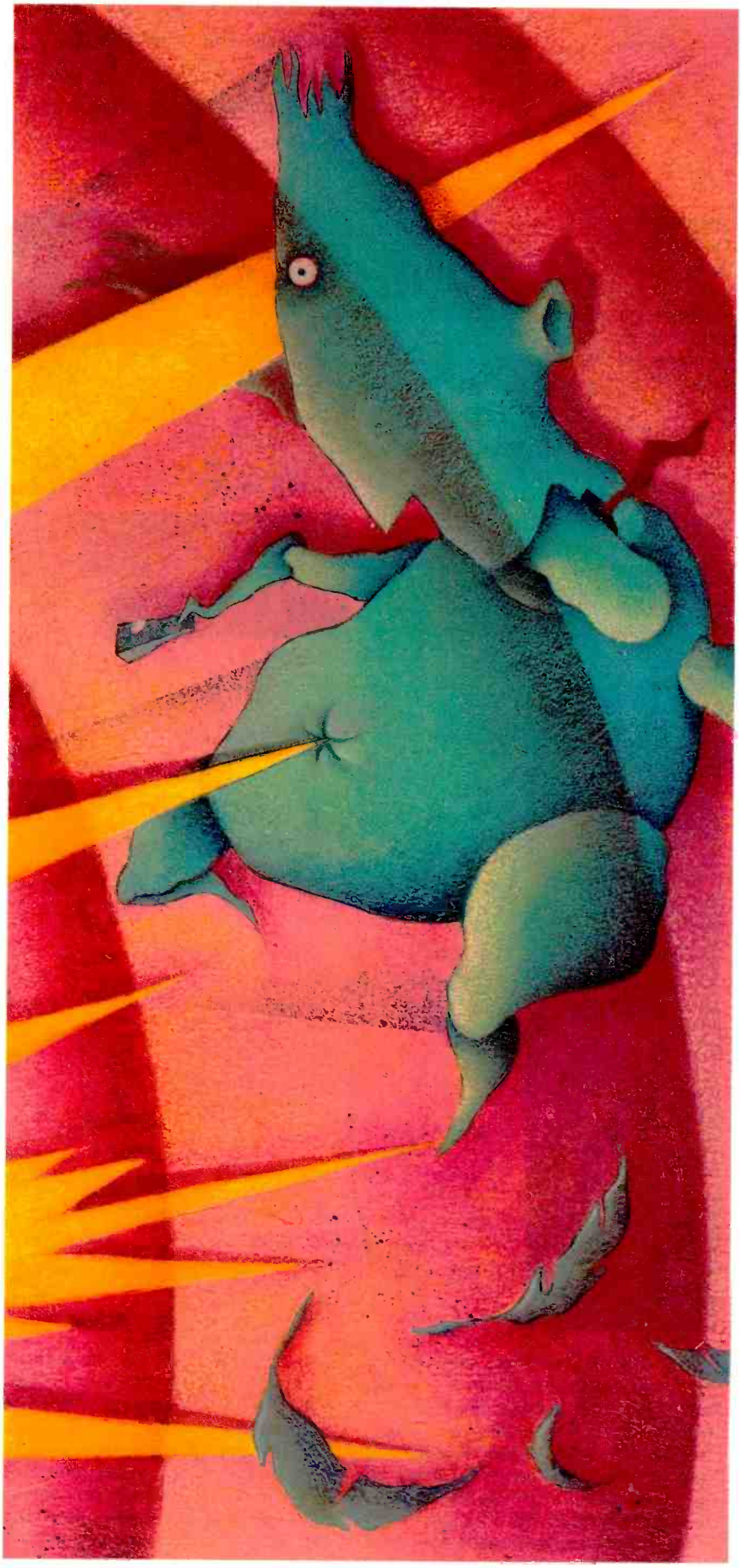
The 20 mS worth of "burst" in Fig. 1 is supposed to approximate short-term music peaks, while the low-level continuous signal is supposed to represent average music signal levels. But is this contrived signal realistic? Do music peaks occur only 4% of the time (20/500 = 0.04, or 4%)? And are the differences between average and peak levels typically 20 dB?

Of course, much depends upon the type of music you listen to. Studies of rock music stations reveal that the total dynamic range some of them transmit is no greater than 6 dB! On the other hand, listen to a symphony recorded by a full orchestra, and you are likely to encounter peaks more than 20 dB greater than the average level of the music and certainly *much* greater in level than the work's softest musical passages.

During a recent Consumer Electronics Show, I chanced upon an experiment being conducted by Denon in their exhibit space. I was attracted to the exhibit because I recognized that the test was being performed using the Audio Precision System One, the same equipment I recently put into use in my lab. This instrument is able to measure

LEONARD FELDMAN

Illustrations: Wallace E. Keller



peak and average voltages simultaneously, using its two available metering systems. In setting up a graph for this type of measurement, the X axis can be made to represent time. In Denon's experiment, the same program material was sent to both metering systems (for simultaneous "peak" and "average" readings), and the test gear was programmed to take 1,000 samples over a time period of 10 minutes. This works out to about 1.67 samples per second for 600 seconds of music. One curve of the graph slowly spelled out the peak levels measured; the other curve, clearly much lower in amplitude, painted a picture of average levels.

I couldn't wait to repeat the experiment in my lab. I simply connected the output of one channel of my reference CD player directly to the test gear, determined the parameters of the graph to be plotted, and chose a music selection as a test case. Frankly, I wasn't too particular about the music, so long as it was orchestral. "Dance of the Seven Veils" from Richard Strauss' opera *Salome*, recorded by Delos on their *Symphonic Sound Stage* CD sampler (D/CD 3502), has a playing time of just over 10 minutes, so it seemed as good a choice as any.

The results are shown in Fig. 2. The curve in Fig. 2A represents peak amplitude samples during playback, while the Fig. 2B curve represents average amplitudes. Obviously, there are substantial differences in amplitude at any point along the time base, but it is not as easy to quantify the specific decibel differences at any given instance. Happily, the test gear does more than simply plot graphs; it also stores every data point as a numeric value. These values can be retrieved at the touch of a couple of computer keys, so I printed out all 1,000 readings for both peak and average amplitudes.

One of the more significant readings occurred at 1.38 minutes into the selection. The peak amplitude read by the metering system was +5.58 dB, and the average amplitude at the same instant was −11.70 dB—a difference between peak and average levels of 17.28 dB! A fraction of a second later, at 1.5 minutes into the selection, the peak was only +0.84 dB. The average

Manufacturers apparently were right when they said that the demands of digital might mean we'd need more powerful amps and more efficient speakers.

amplitude reading was −3.91 dB, a difference of only 4.75 dB. Another substantial difference between peak and average levels occurred at 5.5 minutes into the selection, when the peak reading was +7.28 dB while the average reading was −10.0 dB. Once again, the difference between the two levels was 17.28 dB.

Scanning the hundreds of readings in the printout, I concluded that the difference between average and peak levels *for this particular musical selection* usually hovered between about 8 and 10 dB. Another musical selection *might* have yielded vastly different results; however, so long as we are talking about full orchestral works, I very much doubt it. So now we come to the bottom line of this entire experiment. The claim that music peaks on CDs are far greater than average levels is fully substantiated. If we accept the 10-dB difference as being reasonably typical, then generally we need 10 times as much power to reproduce music peaks as we do to reproduce average levels. Of course, we haven't even taken into account the degree to which average and peak levels in a given musical selection can vary. When the speaker and amplifier makers told us that the demands of digital would mean we might have to use more powerful amplifiers and/or more efficient loudspeakers, it appears they were right after all.

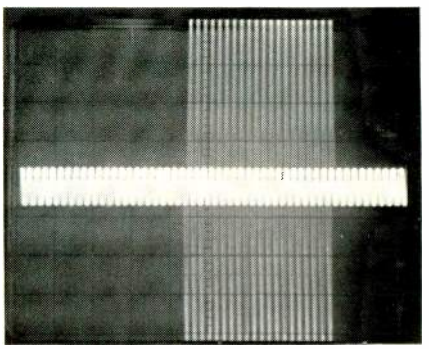


Fig. 1—Tone-burst test used in checking dynamic headroom. Signal consists of 20 cycles of 1 kHz at full amplitude followed by 480 cycles of 1 kHz at −20 dB.

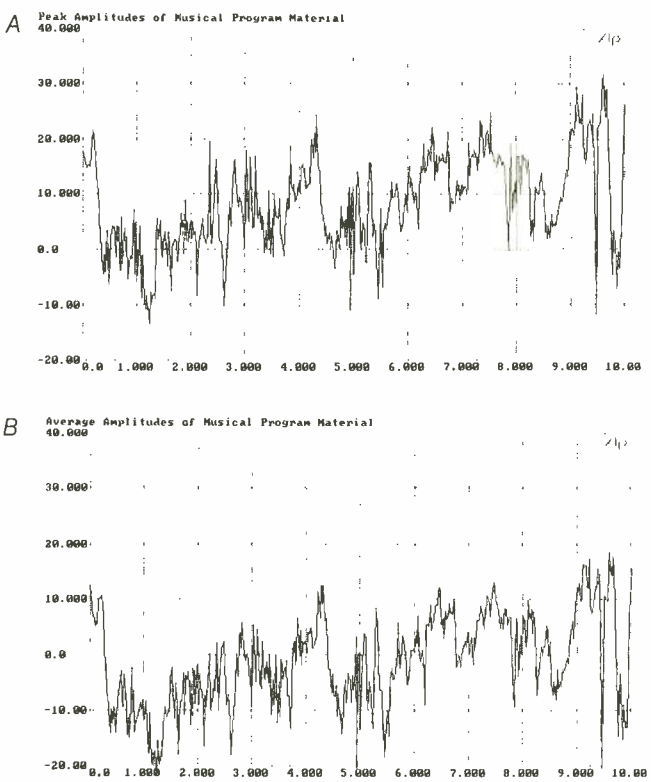


Fig. 2—Peak amplitudes (A) and average amplitudes (B) from "Dance of the Seven Veils" on Symphonic Sound Stage *CD. Test period was 10 minutes.*

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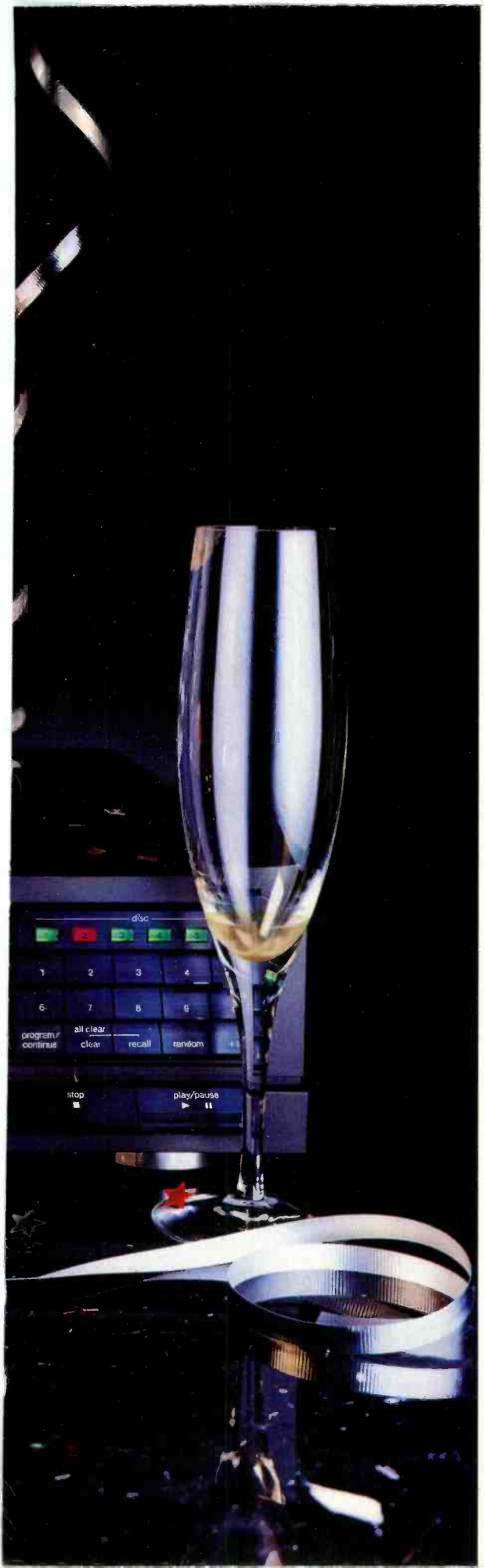

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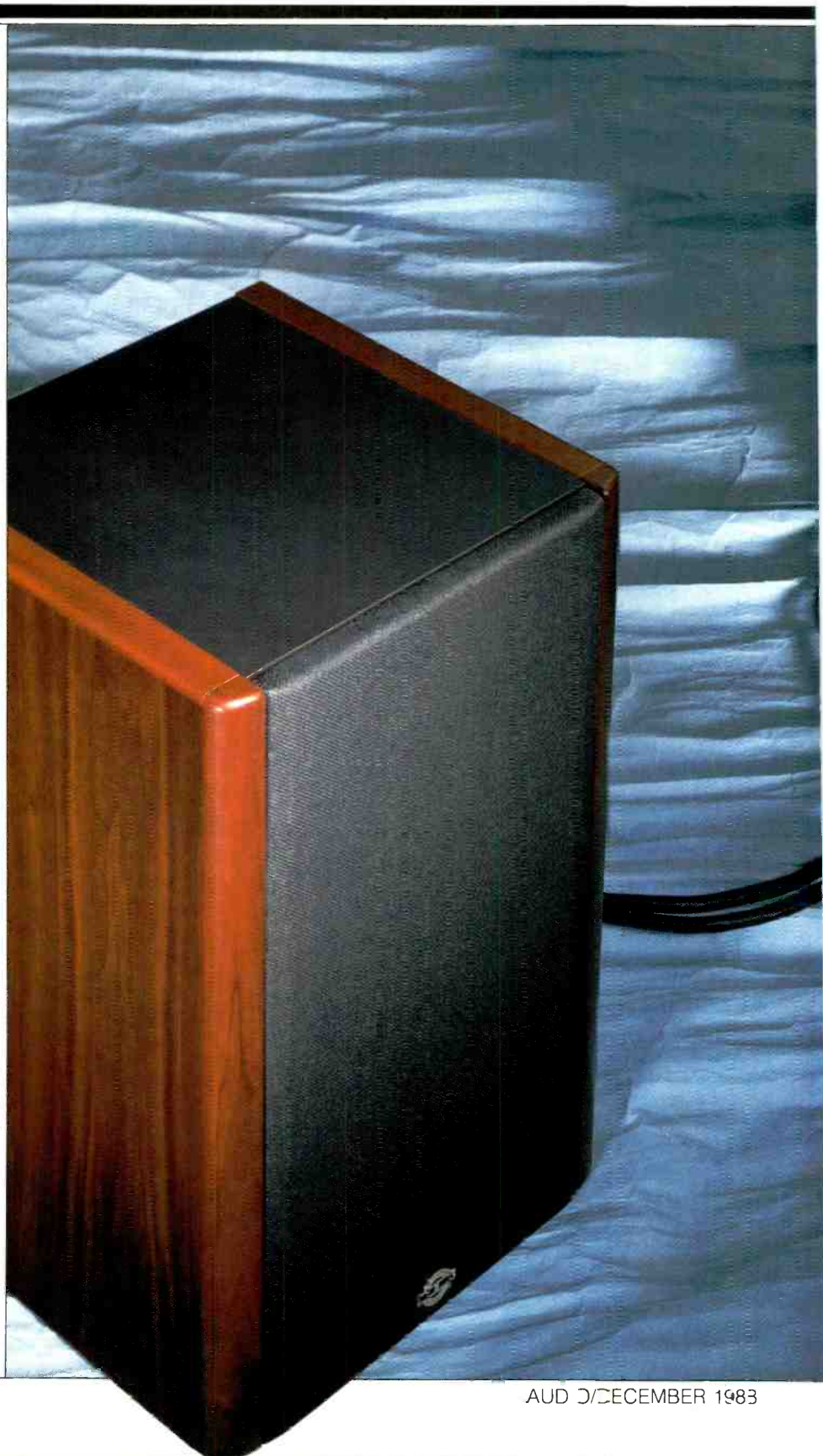
1

MB QUART 280 SPEAKER



Manufacturer's Specifications
System Type: Two-way, sealed-box woofer.
Drivers: 8-in. (20.5-cm) woofer and 1-in. (2.5-cm) dome tweeter.
Crossover: 1.5 kHz.
Frequency Range: 40 Hz to 32 kHz.
Sensitivity: 88 dB SPL at 1 watt/1 meter.
Nominal Impedance: 4 ohms.
DIN Power Handling: 80 watts.
Music Power Handling: 100 watts.
Dimensions: 10½ in. W × 17⅜ in. H × 11¼ in. D (26.8 cm × 44.1 cm × 28.6 cm).
Weight: 21.2 lbs. (9.6 kg).
Price: $579 per pair.
Company Address: MB Quart Electronics, 25 Walpole Park South, Walpole, Mass. 02081.
For literature, circle No. 90

The MB Quart 280 has to be a special two-way bookshelf speaker just to survive the competition. Loudspeakers utilizing an 8-inch woofer and a 1-inch dome tweeter, and slight variations, are the most common types available to the audio enthusiast. Prices range from under $200 to $4,600 per pair. At $579 per pair, the MB Quart 280 is right in the thick of this saturated market. However, the 280 is imported from Germany and has a multitude of features that sets it apart.

The West German parent company, MB Quart, is experienced. They began in 1963 as a supplier of drivers to other speaker manufacturers. For the past six years, they have successfully marketed systems under their own name throughout Europe. Now they are expanding to North America with the introduction of a line of five speaker systems which are said to have had their sound adjusted to suit American tastes.

Personally, I have always felt that "correct is correct" and that "taste" was best handled by tone controls. How can the European and the American 280s both be correct? Alex Goetzenberger, a company spokesman, explained that Europeans tend to listen in an analytic manner and for shorter periods of time. He said that differences in preference are becoming less pronounced, but Americans tend to have the music playing all the time while they are involved in other activities. Thus, a slightly more prominent midrange and treble spectrum is offered in the European speakers and more bass capability in the U.S.

Quality materials and cabinet construction help differentiate the 280 from many other speaker systems. The particleboard panels, an unusual ⅞ inch thick, are manufactured specifically for MB Quart speaker cabinets. They are composed of five layers of differing density and particle size, to achieve strength and damping. The boards are assembled with tongue-and-groove joints and thick wood edge trim. Extra-thick veneer on the sides ensures that minor scratches can be repaired without sanding, and the front panel has a velvet-like, black "flocked" treatment that is electrostatically applied and is claimed to control unwanted diffraction. The rear, top, and bottom panels are brown plastic laminate with an attractive contrasting texture. Knit fabric, in a color matching the speaker's finish, is stretched over a simple particleboard frame to form the removable front panel. Heavy-duty five-way binding posts are partially recessed in the rear panel; their spacing does not allow the use of double-banana plugs.

The titanium dome tweeter, operating above 1.5 kHz, is the most intriguing technical component. Titanium requires expensive processing to form it into a thin dome shape, but its combination of strength and lightness makes it worth the trouble: The first breakup modes can be pushed to well above 20 kHz. (It is interesting to note that the seemingly opposite approach, used in "soft dome" tweeters, can also result in good sound. Highly damped fabric dome tweeters have "benign" breakup modes beginning very low in their frequency range.)

The MB Quart 280's crossover frequency of 1.5 kHz is an octave lower than that typically found in two-way systems. This crossover brings in the tweeter's wide directivity just as the woofer pattern is narrowing down. The problem is to

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Andrew Marshall
Audio Ideas Guide, Canada

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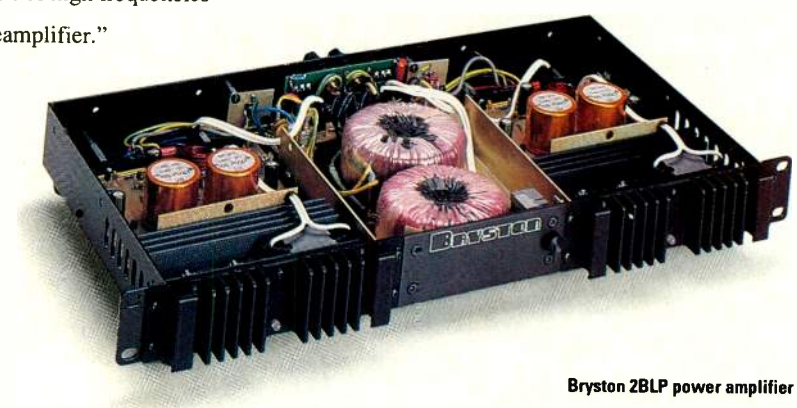

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The 280's directivity is broad in both planes and avoids the narrowing that many two-way loudspeakers exhibit.

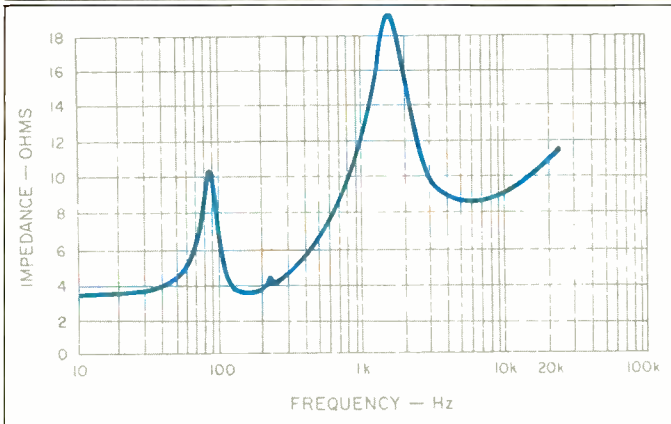

Fig. 1—Magnitude of impedance.

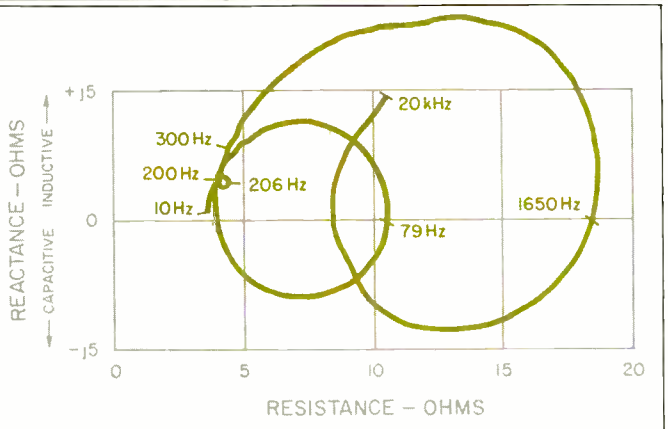

Fig. 2—Complex impedance. Note the slight glitch at about 200 Hz; see text.

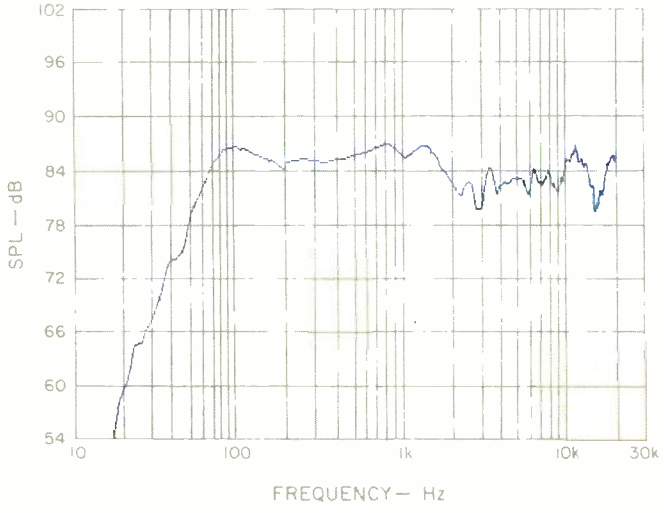

Fig. 3—One-meter on-axis anechoic frequency response, with an input of 1.0 watt into 4 ohms (2.0 V).

design a tweeter to go that low with good efficiency, low distortion, and reliability.

The 280's tweeter starts with a large magnetic system for efficiency and linearity. An additional ferrite doughnut is glued to the rear of the tweeter, in opposing magnetic polarity, to force flux to stay in the circuit, further increasing efficiency. Voice-coil heat is conducted across the gap to the magnetic circuit by Ferrofluid, which also helps damp the primary mass/suspension resonance. Passages coupling the air volume under the dome with the volume under the surround help to achieve the low resonance frequency needed to respond down to 1.5 kHz. Essentially, the dome gets a larger enclosure.

High-quality components are used in the unit's crossover, and heavy wire runs to the speakers. Crossover slopes are nominally 12 dB per octave.

The woofer has about 13% more surface area than a conventional 8-inch device. This is accomplished within an 8-inch frame width by using a narrow flange with four protruding mounting ears. Other than that, the 280's stamped-frame, paper-cone woofer is not unusual, except for its longer-than-average linear travel.

Unusually good imaging is claimed for this loudspeaker, and it is attributed to wide directivity and diffraction control. Wide directivity is achieved by using the low 1.5-kHz crossover frequency and a "dispersion ring" in front of the tweeter dome. Diffraction, the re-radiation of sound as it passes over a sharp discontinuity, is claimed to be reduced by flush tweeter-mounting screws and the flocked panel treatment. The fact that the substantial wood frame and woofer protrusions would likely produce strong diffraction is claimed to be handled by the asymmetrical tweeter mounting. Diffraction is controlled—not necessarily eliminated.

Measurements

Input impedance is shown as a plot of magnitude versus frequency in Fig. 1 and as reactance versus resistance in Fig. 2. Both plots show fairly typical performance for a 4-ohm-rated speaker except for the curious little glitch at just over 200 Hz. To investigate this, I applied a 206-Hz sine wave at about 10 watts. I discovered that one edge of the woofer frame was vibrating heavily. Pressing on it with the blade of a screwdriver stopped the vibration and increased the sound output. I removed the woofer and discovered that the foam gasket between the driver and the box had slipped out of place. With the gasket back in its proper position, the glitch disappeared, but some vibration remained in the speaker frame.

Figure 3 is the on-axis frequency response measured at 1 meter without the influence of room reflections. Sensitivity is about 85 dB below 1.5 kHz with 2 V input. MB Quart's claim of 88-dB sensitivity appears to be made using 2.83 V input,

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

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The 280's time response is about as close to ideal as you are likely to get from a loudspeaker.

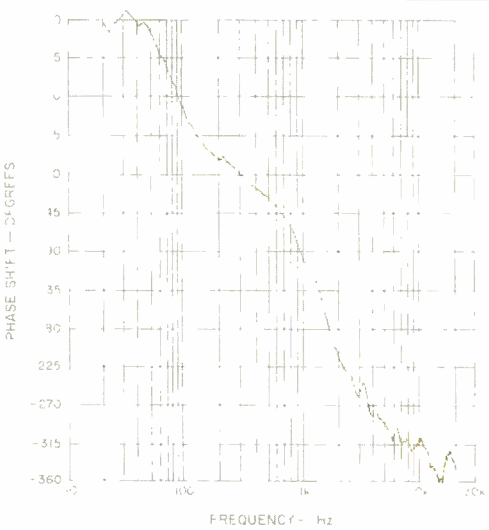

Fig. 4—One-meter on-axis anechoic phase response.

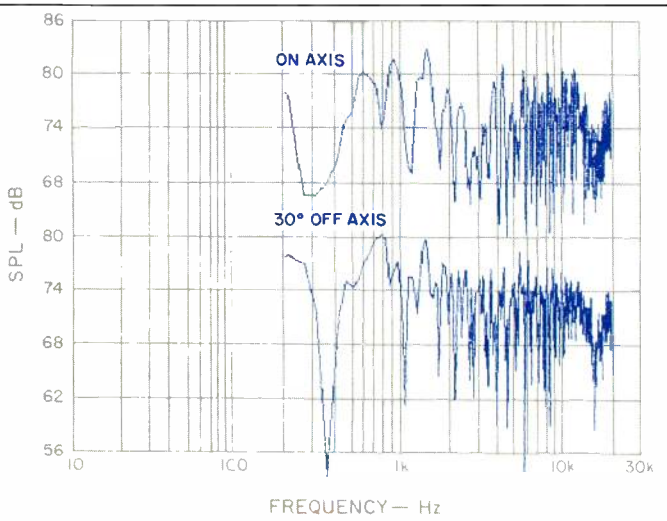

Fig. 5—Three-meter room response measured on-axis and 30° off-axis; for clarity, off-axis curve has been lowered.

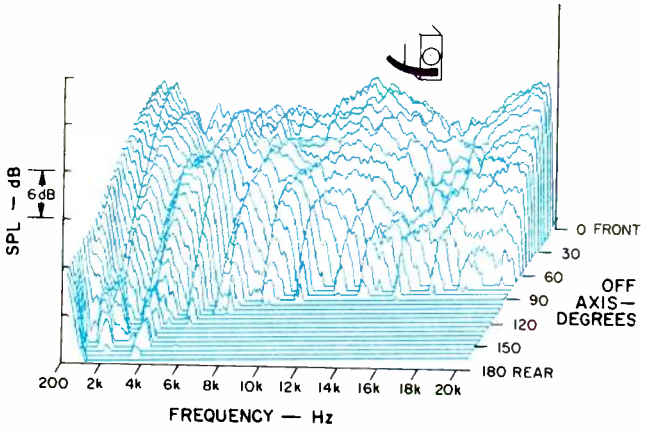

Fig. 6—Horizontal off-axis responses taken from the front, around the side, to the rear of the speaker.

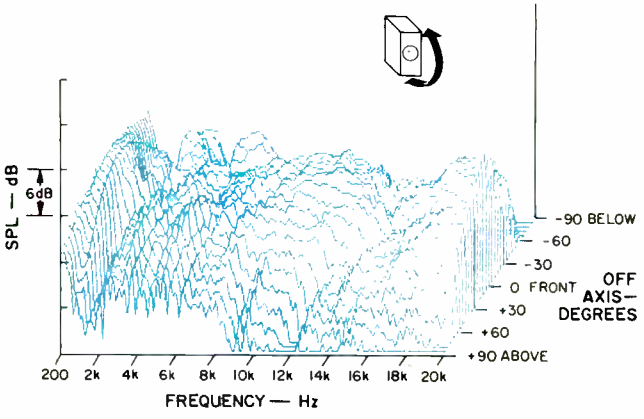

Fig. 7—Vertical off-axis responses taken from below, up the front, to the top of the speaker.

which is equivalent to 1 watt into an 8-ohm speaker. The 280, however, is a 4-ohm unit, but using the same drive levels, the measurements agree. Look at the power your amplifier will provide into a 4-ohm load and consider the 85-dB figure. This sensitivity is a bit on the low side, but reasonable. An amplifier capable of 100 watts per channel should produce peaks around 108 dB SPL in a typical room.

Low-frequency response shows the roll-off of 12 dB per octave expected from a sealed-box system below its resonance frequency, which is 79 Hz for the MB Quart 280. Apparently, this system is intentionally a little underdamped, which gives a slight boost at 100 Hz and extends the −3 dB frequency to about 60 Hz. For the same cabinet size, designing for higher sensitivity would have the indirect effect of increasing damping and raising the cutoff frequency. The upper range is reasonably smooth but is suppressed about 3 dB above 1.5 kHz. (Could this be the tweak to Americanize the 280? I think the subject is a little more complicated, and I will go into it further when we look at the directivity plots.) The titanium tweeter shows no sign of giving up by the end of the plot at 20 kHz.

Phase response (Fig. 4) is just what one would expect of a classically designed two-way loudspeaker with a second-order crossover. Phase lead is expected at very low frequencies, where the response is rising. Phase passes through −180° in the midrange, due to the crossover, and lags a further 180° due to the eventual tweeter roll-off. Each speaker in this pair matches the other quite closely.

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Though placement and aiming were noncritical, bass and spaciousness where best with the 280s out from the walls and off the floor.

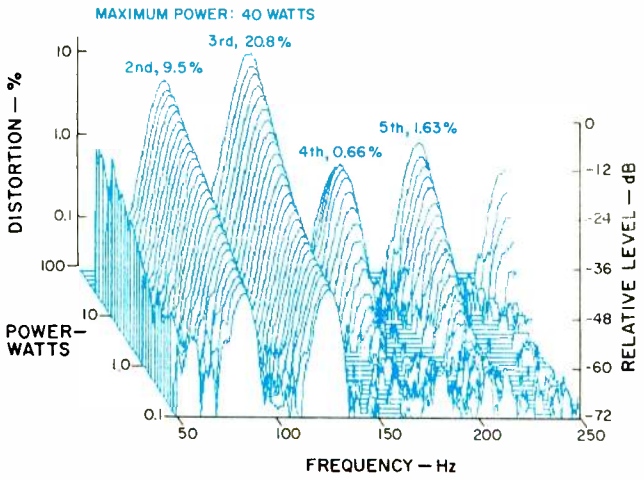

Fig. 8—Harmonic distortion products for the tone E_1 (41.2 Hz).

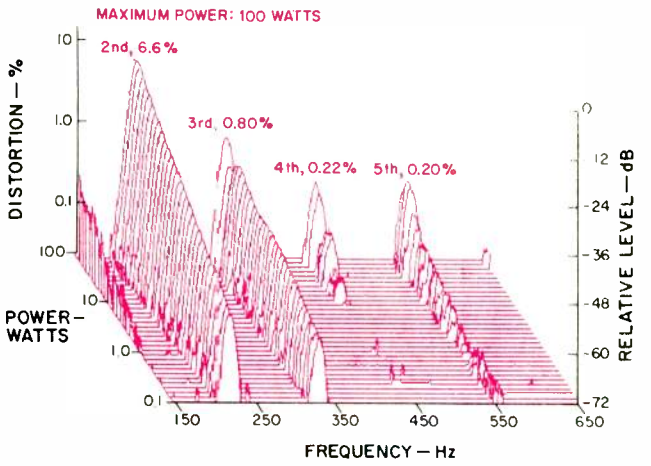

Fig. 9—Harmonic distortion products for the tone A_2 (110 Hz).

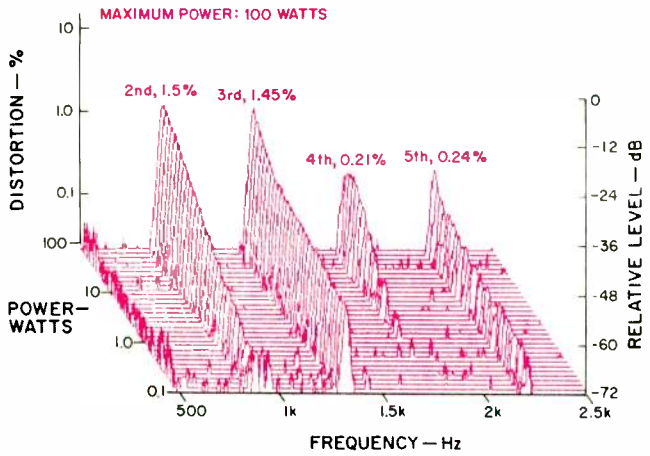

Fig. 10—Harmonic distortion products for the tone A_4 (440 Hz).

The on-axis and 30° off-axis 3-meter room response (Fig. 5) includes the important early reflections that might be found in any listening room if the speakers are positioned as I used them. The locations which worked best for me in the listening test were 19 inches off the floor, 48 inches away from the side wall, and 36 inches in from the wall behind the speakers. The plots in Fig. 5 show reduced output at 300 Hz, which is traceable to sound bouncing off the floor on its way to the microphone. The longer path delays the signal such that 300 Hz suffers a partial cancellation. Above 300 Hz, the average response is uniform and extended, even at 30° off-axis.

Horizontal directivity versus frequency is shown in Fig. 6, a "3-D" plot. It is wide at low frequencies, as expected from a physically small loudspeaker. Directivity gradually narrows at high frequencies but never becomes overly directional. Something unusual to note is that there is no evidence of the narrowing directivity from 1 to 3 kHz found in most two-way speaker systems. I would consider this a technical plus for the MB Quart 280, but I have heard many fine systems that do exhibit midrange narrowing. Perhaps the 280's on-axis response in this range must be suppressed—as we observed it to be in Fig. 3—in order to reduce total input to the room. I do not want to criticize this unit for being "too good"; rather, I am wondering how other speakers that do not measure as well on this can *sound* so good.

Vertical off-axis plots—taken from below, up the front, to above the speaker—are shown in Fig. 7. The same wide directivity is evident, and there is the expected interference between the two drivers in the crossover range for angles well off-axis.

Linearity of the MB Quart 280 was measured in three different ways. First, the plots of Figs. 8, 9, and 10 show the harmonics generated for the musical tones E_1 or 41.2 Hz, A_2 or 110 Hz, and A_4 or 440 Hz in steps from 0.1 to 100 watts. Since the lowest fundamental is below the system's operating range and thus down in level, the harmonics, which are in the speaker's range, appear to be very high. In the earlier listening test, the 280 handled this input in a dignified, if quiet, manner. The plots at higher test frequencies are more reasonable, with 440 Hz showing quite low distortion.

The second linearity test is to observe the effect of a low tone (E_1 or 41.2 Hz) on a high tone (A_4 or 440 Hz). This is the intermodulation test plotted in Fig. 11. Distortion remains below 3% until about 20 watts input. Above this power level, the lower test frequency begins to move the voice-coil out of the magnetic gap twice during each cycle. This produces a cyclic modulation of the 440-Hz tone being measured. A

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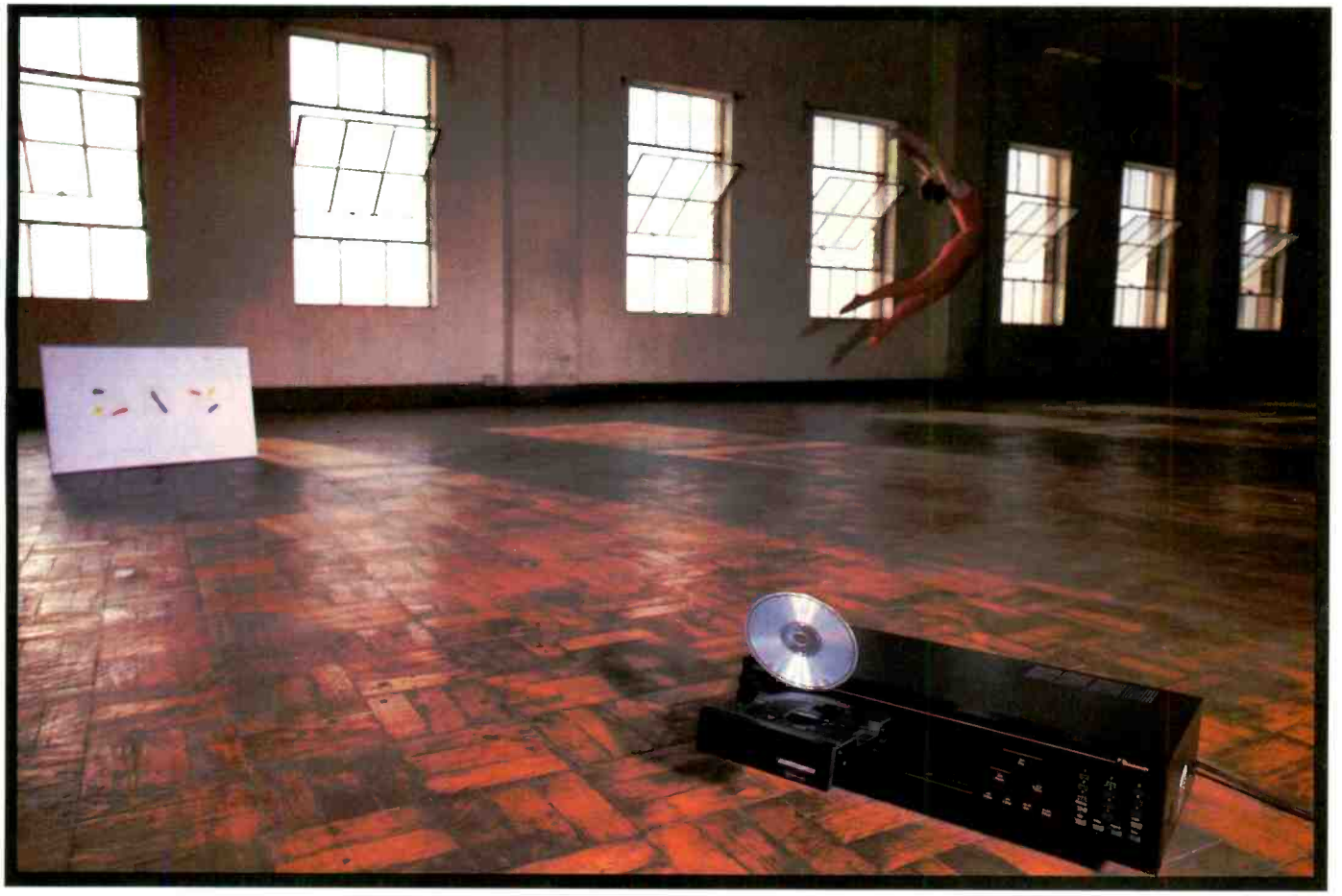

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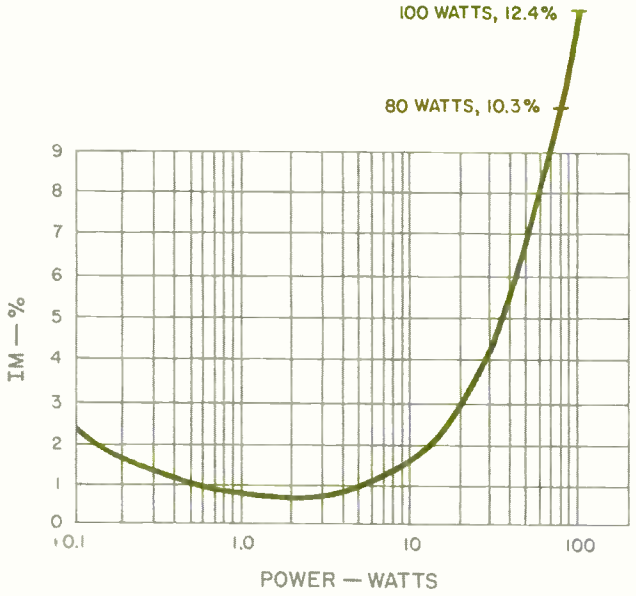

Fig. 11—IM distortion on 440 Hz (A_4) produced by 41.2 Hz (E_1) when mixed in 1-to-1 proportion. Readings below 3 watts are due to noise.

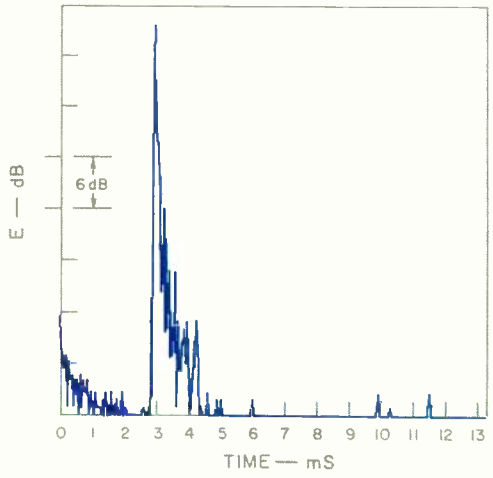

Fig. 13—One-meter on-axis energy vs. time response.

distortion level of 10%, an objectionable amount, is reached at 80 watts.

The third linearity test checks midrange and treble as well as lower frequencies. Increasing power is applied until the acoustic output fails to track the input by 1 dB. Figure 12 plots the power input for this mistracking. It can be seen that it doesn't pay to use ultra-high powered amplifiers with this small loudspeaker.

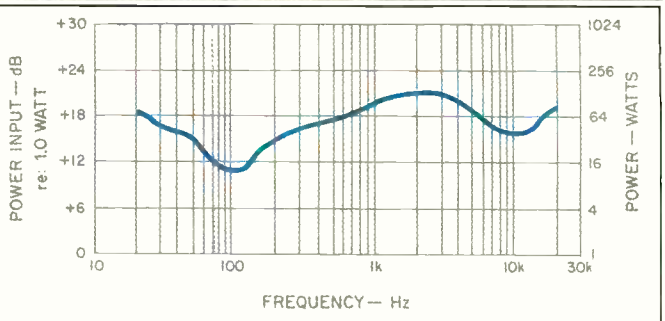

Fig. 12—Power linearity.

Figure 13 shows the energy versus time response of the 280. Ideally, the test pulse's energy should be reproduced at one instant in time. The tested unit's response is about as close to this as you are likely to get from a speaker. Obviously, diffraction, which would show up as a widening of the pulse, is not a problem.

Use and Listening Tests

As usual, listening tests were performed before the technical measurements were made. More listening after the testing convinced me that the loose gasket found in one of the speakers had not had a noticeable effect on the sound. I found placement and aiming of the MB Quart 280s to be relatively noncritical. Spaciousness and smoothness of bass response were best, however, with the speakers well out from the walls and 19 inches off the floor. They could be placed next to other small speakers without ill effects, which led me to make lots of comparison tests in different rooms.

In these comparisons, the performance of the 280s was consistently good in all respects, while that of other speakers varied. Few could match the balanced, uncolored character of the 280s. Of those that did, fewer still had as extended a frequency range. The MB Quarts rendered the sound of recordings with a close-up perspective more accurately than their competitors did, and made solo instruments and voices sound like they were forward and present in the room. Some other models, comparable in size and price, sacrificed this presence for an improved sense of depth and spaciousness.

Speakers are the weakest link in the sound-reproduction chain. Frequently, they are also the most visible and the most costly. In the price range of under $600 per pair, you can't get everything from any speaker. You should concentrate on those qualities that mean the most to you. For low coloration, good range and dynamics, and a forward presence, the MB Quart 280 is a top contender. Visual appeal and convenient size complete the package. This loudspeaker is likely to be the best choice for many audiophiles.

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2

MARANTZ PM-94 INTEGRATED AMPLIFIER

Manufacturer's Specifications

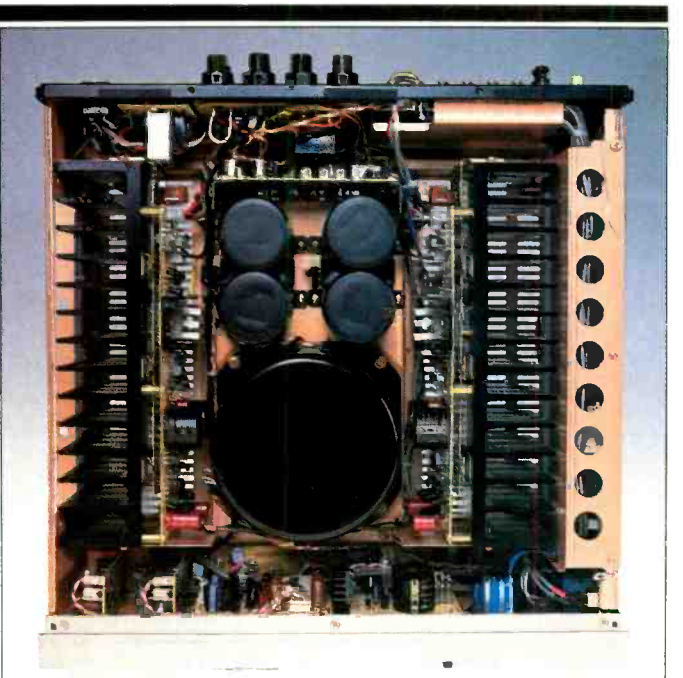
Power Output: 140 watts per channel, 8 ohms, 20 Hz to 20 kHz; 200 watts per channel, 4 ohms, 20 Hz to 20 kHz.
Rated THD: 0.02% into 8 ohms, 0.03% into 4 ohms.
Rated SMPTE IM: 0.006% into 8 ohms, 0.005% into 4 ohms.
IHF Dynamic Power: 180 watts into 8 ohms, 300 watts into 4 ohms.
Damping Factor: 200.
Slew Rate: Main input, 70 V/μS.
Frequency Response: Main input, 10 Hz to 200 kHz, ±1 dB; MM phono input, RIAA ±0.2 dB; high-level inputs, 10 Hz to 70 kHz.
Input Sensitivity: MM phono, 2.5 mV; high MC, 350 μV; low MC, 125 μV; high level, 150 mV.
Phono Overload: MM, 200 mV; high MC, 28 mV; low MC, 10 mV.
A-Weighted S/N: Main, 97 dB (re: 1 watt); MM phono, 83 dB; MC phono, 83 dB; high level, 98 dB.
Voltage Output Levels: Tape out (re: 7.75 mV, 1 kHz in at MM phono), 465 mV; preamplifier out (re: 150 mV, 1 kHz in at AUX), 1.5 V.
Power Requirements: 120 V a.c., 60 Hz, 490 watts.
Dimensions: 18¼ in. W × 5¾ in. H × 16⅛ in. D (46.5 cm × 14.6 cm × 41 cm).
Weight: 51 lbs. (23 kg).
Price: $2,900.
Company Address: 20525 Nordhoff St., Chatsworth, Cal. 91311.
For literature, circle No. 91

One quick look at the Marantz PM-94 integrated amplifier, and I am reminded of the kinds of components that first propelled Saul Marantz and his company to the pinnacle of the high-end audio realm in the 1950s and 1960s. The sheer elegance of the gold front panel (it's available in black, if you insist), the solid look and feel, and, yes, the high price of this integrated amp all bring back memories of such Marantz classics as the Model 10 B tuner. Of course, Saul Marantz hasn't been involved with the company in many years, but with products such as this superb-sounding amplifier, it's clear that present management is attempting to recapture the company's original image.

The PM-94 incorporates four separate power supplies. Each channel has a separate supply for the low-level voltage-amplifying circuitry and another for the MOS-FET output stage. Separate windings on a toroidal power transformer ensure adequate current capacity when driving low-impedance loads and also help to reduce hum and interchannel crosstalk.

The PM-94 features circuitry which Marantz calls "Quarter A" operation. This term denotes that the amplifier operates in pure Class A until power output reaches approximately a quarter of its rated value. The output stage changes to Class-AB operation only at high signal levels. This would explain the heavy weight of the PM-94 (51 pounds) as well as the extensive open grille work on its top surface. Class-A operation means high idling current, even in the absence of signal, which, in turn, means an amplifier that will run warm and therefore require adequate ventilation. Since average power levels in music are at least 10 dB (and often more) below short-term peaks, the PM-94 operates in Class A nearly all of the time.

Examination of the inside of this amplifier revealed the use of extremely high-grade components. The chassis is copper plated, and, according to Marantz, oxygen-free copper wiring is used for all critical signal-handling connections. All connectors are gold plated for positive, corrosion-free contact. Another reminder of earlier Marantz preamps and amps is the use of separate bass and treble controls for each channel. And, as if to satisfy all factions, Marantz designed this amp so that CD and phono inputs can be routed directly to amplifying circuits, bypassing the tape-dubbing and tone-control circuitry. This feature should please those who eschew tone controls altogether. For other program sources, the tone-control circuitry can also be selectively defeated.



The phono section offers three separate input levels (MM and low- and high-level MC), and a high-quality transformer is employed for the moving-coil cartridge inputs. A separate pair of preamp output jacks permits you to connect a second amp for a biamplified system. The sample that I tested had a rose-gold colored front panel and hand-rubbed rosewood side panels. Should you prefer the satin-black front-panel finish, that version comes with oak side panels.

Control Layout

The symmetrical layout of the PM-94's front panel includes four gold-colored rotary knobs at the left, for independent left- and right-channel bass and treble control, and four matching knobs at the right. These four knobs handle master volume, selection of the phono input (MM and two MC gain settings), selection of major signal inputs (CD, phono, tuner, AUX 1, or AUX 2), and tape-copying modes.

Below the four rotary knobs at the left end of the panel are a "Power" on/off button, a stereo headphone jack, and two speaker-selector pushbuttons. Below the four rotary controls at the right are subsonic filter on/off and stereo/mono pushbuttons, a small rotary balance control, and a "CD/Phono Direct" button which, when pressed, minimizes the signal path from input to main amplifier stages.

The center section of the panel is elegantly bare, except for a vertical bank of tiny indicator lights that show which program source has been selected, whether the "CD/Phono Direct" button has been pressed, and whether the amp is in one of its several tape-monitor modes. Six additional non-protruding square pushbuttons, along the bottom of the panel's center section, include four tape-monitor switches

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The look, feel, and high price of the PM-94 remind me of the components that first built Marantz's high-end reputation.

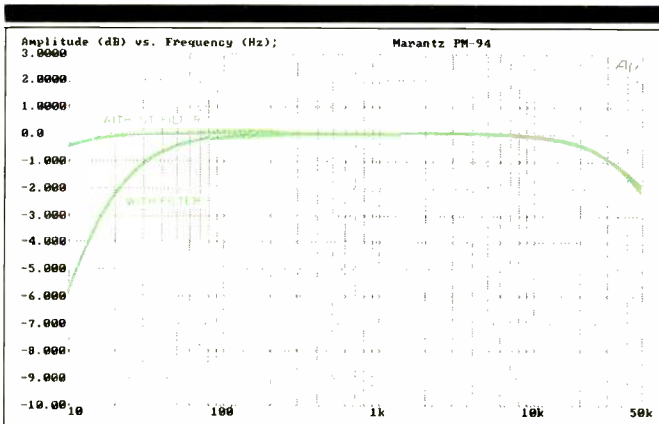

Fig. 1—Frequency response, without and with subsonic filter activated.

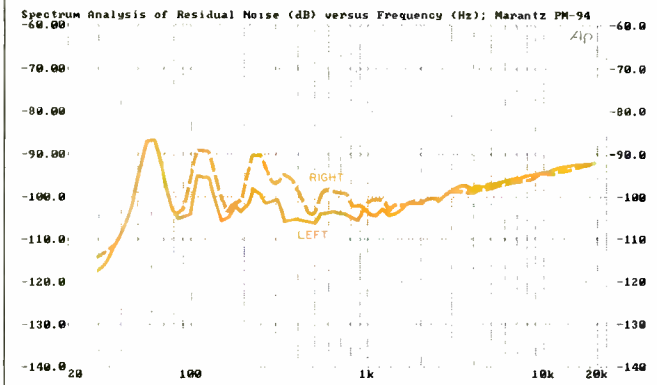

Fig. 2—Spectrum analysis of residual noise, re: 1 watt output.

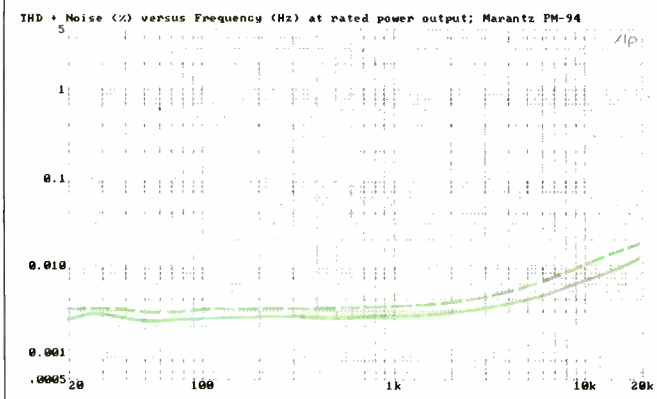

Fig. 3—THD + N vs. frequency for 8-ohm load (solid curve) and 4-ohm load (dashed curve), at rated outputs (140 watts per channel for 8 ohms, 200 watts per channel for 4 ohms).

(for one of two tape decks or DAT recorders, the audio loop of a Hi-Fi VCR, and to select "Source"). The remaining two switches are "Tone Defeat" and "Muting."

The rear panel has four pairs of color-coded speaker terminals of the type that securely lock the stripped ends of speaker cables in place. There are three a.c. receptacles for the power cords of associated components (two switched, one unswitched), the usual array of gold-plated phono and high-level inputs, the preamp out and main amp in jacks, three sets of tape-monitor in and out jacks, and a chassis ground terminal for use with turntables. A fuse-holder completes the rear panel.

As mentioned earlier, large open grille areas atop the cabinet allow for dissipation of the increased heat associated with Class-A operation, and the owner's manual warns not to obstruct these openings or those beneath the cabinet. You can expect the grilles to get quite warm when the amp is operating, regardless of volume-control setting or whether a signal is even being applied to one of the inputs.

Measurements

Figure 1 is a plot of the response of the PM-94, with signals applied to the CD (high-level) inputs, over the range from 10 Hz to 50 kHz. The upper curve, which was made without the subsonic filter activated, shows response down 0.5 dB at 10 Hz and 20 kHz and down 2 dB at 50 kHz. The second curve, exhibiting low-frequency roll-off, was made with the subsonic filter activated. The −3 dB point for this filter occurred at 16 Hz, and the slope of this filter is a gentle 6 dB/octave.

Marantz uses a bit of "specsmanship" in specifying the PM-94's signal-to-noise ratios. For example, they quote the A-weighted S/N via the "main" input with reference to 1 watt (as called for in the EIA Amplifier Measurement Standard) and come up with an impressive result of 97 dB. I confirmed this figure on the sample I tested. However, for the S/N spec of the high-level inputs, Marantz references rated output; they don't say so, but it's fairly obvious from the claim of 98 dB. It should also be obvious to anyone acquainted with amplifiers that the S/N ratio via the high-level inputs (with all the extra stages and loops the signal will go through) cannot possibly be better than the S/N of the main amplifier section, which comes *several stages after* the high-level inputs! I preferred to stick with the EIA Standard method, applying 0.5 V to the high-level inputs and adjusting the master volume control for **1** watt output. Under such circumstances, S/N measured 86.5 dB for the left channel and 85 dB for the right. These are certainly very good results by anyone's standards.

The S/N ratio for the MM phono input was 84 dB referred to 1 watt output and with a 5-mV input applied—also a superb result. For the MC phono input, the reference is still 1 watt output but the input is reduced to 500 μV (0.5 mV). Under these circumstances, S/N was 69 dB for high MC and 61 dB for low MC. Figure 2 is a spectrum-analysis sweep of residual noise produced by this amplifier with the selector switch set to one of the high-level inputs. The reference level is 1 watt, and it is clear that major noise contributions, as low as they are, derive from the power-supply frequency and its harmonics (60, 120, 240 Hz, etc.).

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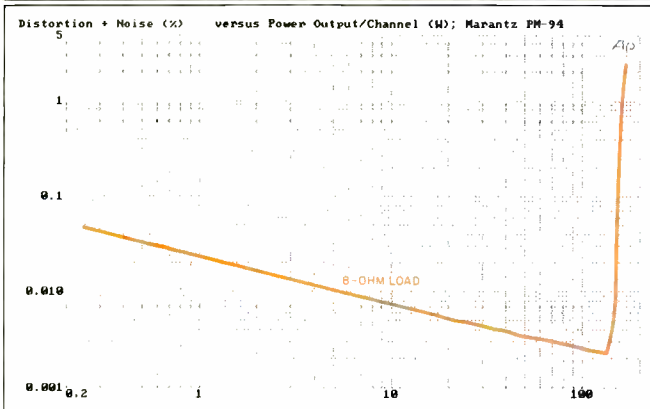


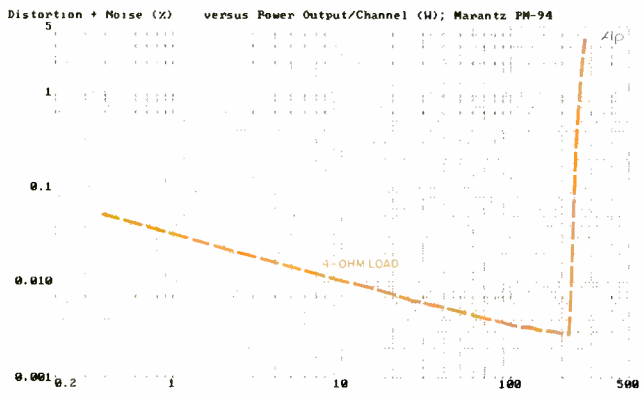
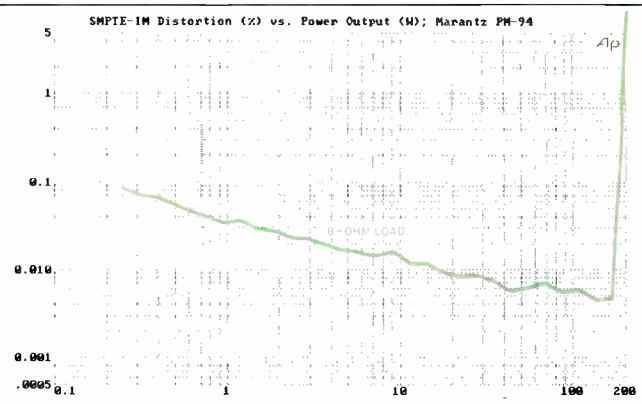


Fig. 4—THD + N vs. power output at 1 kHz, for 8-ohm load (A) and 4-ohm load (B).



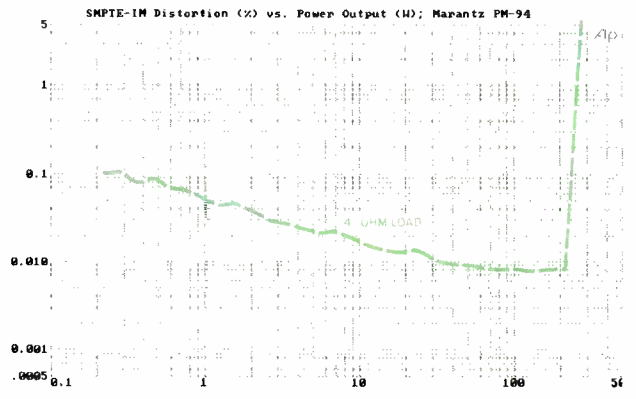


Fig. 5—SMPTE-IM distortion vs. power output, for 8-ohm load (A) and 4-ohm load (B).

The input designations assigned by Marantz are "MC (High)" for MC cartridges with relatively high output and "MC (Low)" for those that deliver lower output voltages. Since the higher level input has the lower gain, and vice versa, perhaps Marantz should have used labels such as "MC (High Level)" to prevent confusion with high-gain inputs. It took about 30 μV to produce 1 watt of output via the high MC input and about 11 μV to produce 1 watt via the low MC input. MM phono sensitivity was 0.22 mV for 1 watt output. Phono overload was much better than claimed by Marantz, measuring 230 mV for the MM input, 173 mV for the high MC input, and 83 mV for the low MC input. High-level input sensitivity was 13 mV for 1 watt output.

At rated output (140 watts per channel into 8 ohms), mid-frequency THD + N was only 0.0026%. Even at 20 kHz, distortion measured only 0.012%. Figure 3 shows how THD + N varied with frequency, for a constant 140 watts output per channel into 8 ohms, both channels driven, and for the 4-ohm load condition, with output maintained at a constant 200 watts per channel. At 1 kHz, THD + N for 4-ohm loads was 0.0032%; at 20 kHz, it rose slightly to 0.016%.

Figure 4A shows how THD + N varies for a 1-kHz test signal as power output is increased from about 0.2 watt to beyond rated power, using an 8-ohm load. Rated THD of 0.02% was reached when the amplifier delivered 149 watts per channel, with both channels driven. For Fig. 4B, I altered the load to 4 ohms, and the amplifier delivered 240 watts per channel before reaching its rated THD of 0.03%. (The high THD + N readings at low power levels are principally due to noise rather than distortion.)

Plots of SMPTE-IM distortion and CCIF-IM (twin-tone) distortion are shown for 8- and 4-ohm loads in Figs. 5A and 5B and Figs. 6A and 6B, respectively. In all cases, power output exceeded published ratings by fairly wide margins

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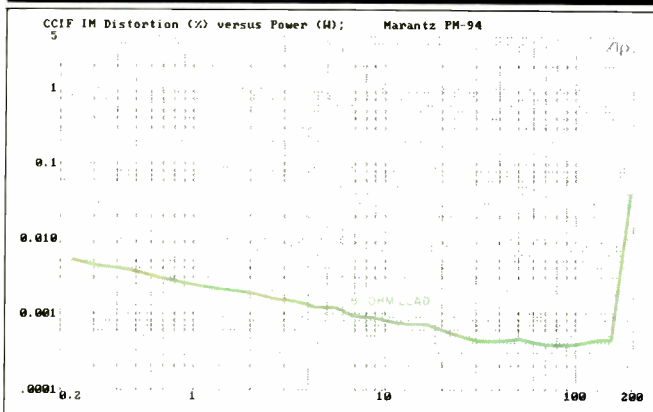
Marantz's PM-94 handled the sound effects on Telarc's new CD sampler with as much aplomb as it did the varied musical selections.



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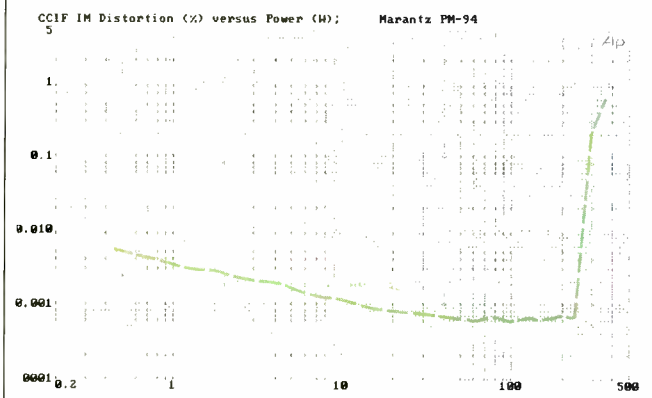

B

Fig. 6—CCIF-IM distortion vs. power output, for 8-ohm load (A) and 4-ohm load (B).

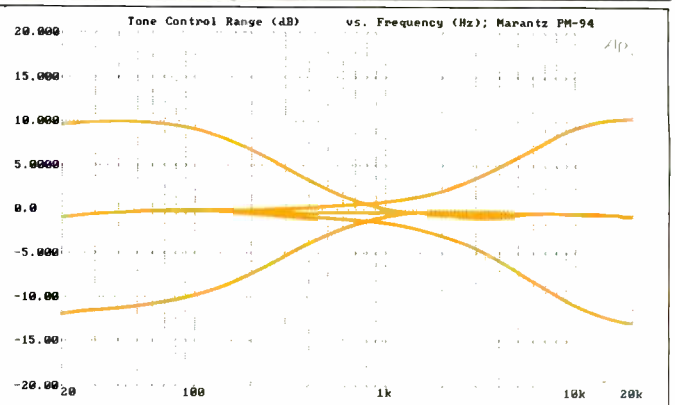

Fig. 7—Bass and treble tone-control range.

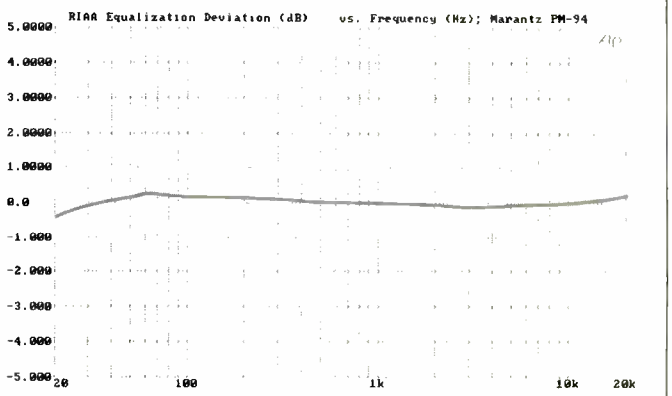

Fig. 8—Deviation from RIAA equalization.

before a steep rise in distortion, caused by clipping, was noted.

Marantz elected to publish a now-obsolete—and, according to FTC rules, proscribed—power rating called IHF dynamic power. Marantz claims 300 watts per channel at 4 ohms and 180 watts per channel at 8 ohms. What they should have published—and what is a proper specification, even by FTC standards—is IHF (or EIA) dynamic headroom, in dB. The idea here is that the FTC doesn't want potential buyers to be confused by multiple power ratings. ("Is this a 200-watt/channel amp or a 300-watt/channel amp?") I measured dynamic headroom of the PM-94 using a special tone-burst signal consisting of 20 alternations of a high-amplitude 1-kHz signal, followed by 480 alternations of the same signal reduced in amplitude by 20 dB. I came up with a figure of 1.1 dB for the 8-ohm load and 1.7 dB for the 4-ohm load. If I were to translate these dB values to equivalent power levels, I would obtain almost exactly the 180- and 300-watt figures published by Marantz.

Using the multiple sweep modes of my Audio Precision System One test equipment, I superimposed a series of five frequency response sweeps in Fig. 7, to show the maximum cut and boost range of the PM-94's bass and treble controls. In the boost positions, note that both the bass and treble circuits have a shelving characteristic to prevent the circuits from continuing to deliver ever higher levels with decreasing (or increasing) frequencies.

Figure 8 is a plot of the *deviation* from precise RIAA equalization exhibited by the phono preamplifier/equalizer circuitry of the amplifier. This response curve was obtained by inserting the inverse RIAA curve in the signal path from the Audio Precision's generator section and then performing a frequency sweep from 20 Hz to 20 kHz. I then measured the amplitude at the output of the PM-94, with tone controls

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The clarity of the PM-94's sound, especially on quiet passages, seemed to confirm some of the advantages of Class-A operation.

bypassed. Deviation from perfect RIAA equalization was less than 0.2 dB at 20 kHz and only −0.1 dB at 30 Hz (the lower limit of the "official" RIAA curve).

Use and Listening Tests

I've had the Marantz PM-94 mounted in my system for the better part of a week now, and during all that time, while playing everything from some of my older LPs to my latest CD and DAT acquisitions, the amplifier has been able to drive my reference Infinity RS 9 Kappa speakers with no difficulty. I can report that the "CD/Phono Direct" switch is no mere gimmick. Although I detected little or no difference between the direct mode and the regular mode (with tone controls defeated) when playing LPs and cassettes via the CD input, there seemed to be a definite firming up of the image when I listened to some of my more recently acquired CDs. Vocals were more solidly positioned between my speakers, and it seemed somewhat easier to pinpoint and concentrate on individual musical instruments of orchestral selections.

If you want to put an amplifier such as this through its paces, I recommend playing straight through Telarc's new CD sampler, *Sampler Five Plus* (CD-80005). It's got everything on it from Vivaldi to Liza Minnelli. In addition to 65 or so minutes of music of every genre and of widely differing dynamic ranges, the "Plus" in the title refers to a few minutes of sound effects such as pistol and rifle shots, cannons, and aerial explosions—all taken from sound-effects tracks of earlier Telarc LPs and CDs. The Marantz PM-94 handled the sound effects with as much aplomb as it did the musical selections, though I was careful to start my effects listening at low level settings—as cautioned by Telarc in the notes accompanying the sampler.

The clarity of sound reproduced by the PM-94, particularly during quieter passages, seemed to confirm at least some of the advantages of Class-A operation. I must confess, too, that when sudden loud passages were reproduced, I was not conscious of any sort of artifacts caused by the amplifier's switching between Class A and Class AB. Whether this is because such switching transients would be masked by the levels involved or because Marantz has figured out a way to have the switching occur in a totally seamless manner is academic, so long as the system doesn't intrude on musical integrity and enjoyment.

I am told that vintage Marantz products built in the early years of the company's history, if in working condition, can bring a high price here and a very high one abroad. If that's the case, then the rather high price of this Marantz "limited-production" amplifier may well be thought of as an investment for the future. Meanwhile, as you wait for its value to appreciate, you can enjoy the PM-94 as a central component in your present-day audio system. *Leonard Feldman*

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3

AKAI AT-93 TUNER

Manufacturer's Specifications

FM Section

Usable Sensitivity: Mono, 11.2 dBf.
50-dB Quieting Sensitivity: Mono, 17.2 dBf; stereo, 38.2 dBf.
S/N: Mono, 90 dB; stereo, 80 dB.
THD (at 1 kHz): Mono, 0.02% in wide mode and 0.08% in narrow mode; stereo, 0.07% in wide mode and 0.3% in narrow mode.
Alternate-Channel Selectivity: Wide, 60 dB; narrow, 90 dB.
Capture Ratio: Wide, 1.3 dB.
Frequency Response: 30 Hz to 15 kHz, ±0.5 dB.
AM Suppression: 65 dB.
I.f. Rejection: 100 dB.
Image Rejection: 90 dB.
Spurious-Response Rejection: 100 dB.
Subcarrier Rejection: 70 dB.
Output Level: 770 mV at 100% modulation.
Separation (at 1 kHz): Wide, 62 dB; narrow, 55 dB; blend 1, 20 dB; blend 2, 10 dB.

AM Section

Sensitivity (Loop Antenna): 300 μV/m.
Selectivity: 50 dB.
Image Rejection: 40 dB.
I.f. Rejection: 60 dB.
S/N: 45 dB.
THD: 0.6%.
Output Level: 250 mV, at 30% modulation.
High-Cut Filter: −6 dB at 10 kHz.

General Specifications

Power Requirements: 120 V, 60 Hz.
Dimensions: 18⅛ in. W × 3 7/16 in. H × 13½ in. D (46.1 cm × 8.7 cm × 34.4 cm).
Weight: 13.9 lbs. (6.3 kg).
Price: $599.
Company Address: Akai Div. of Mitsubishi, 225 Old New Brunswick Rd., Suite 101, Piscataway, N.J. 08854.

For literature, circle No. 92

As I began to examine the features of the attractively styled AT-93 AM/FM tuner from Akai, my first reaction was one of moderate resentment. I resent equipment that tries to think for me instead of letting me do things myself. The Akai AT-93 is one of those tuners that decides which of its two antenna inputs provides the best signal, whether it should be in wide or narrow i.f. mode, whether to employ one of its two levels of stereo blend circuitry to reduce noise for weak-signal stereo, and whether to activate its high-cut filter to further reduce noise or other interference. Upon closer examination, and a brief reading of the owner's manual, my resentment quickly turned to admiration. Akai had the good sense to allow a user to defeat those decisions by simply touching any one of several manual-override buttons. Here, at last, was a tuner that offered the best of both worlds: Optimum automatic operating modes for those who simply want to sit back and listen to the best FM reception available, even during rapid DX-ing, and manual selection of all modes for inveterate experimenters and button-pushers.

The Akai tuner has a pair of antenna inputs, each of which can be connected to a separate antenna. For example, you could have two outdoor antennas facing in different directions. The AT-93 employs a comparator circuit that samples the incoming signals and routes the stronger signal to the tuner circuitry when the station is first tuned in.

As mentioned, the microprocessor-equipped AT-93 judges signal quality to determine the best setting for i.f. bandwidth, stereo blend (two levels plus mono), and high-frequency cut. These settings (or your own overriding ones) can be stored in any one of the tuner's 20 memory presets. There's an unusual feature associated with these presets: The Akai has a sequential station-call function for automatic selection of up to three different stations. The desired stations are memorized and then recalled when the tuner is turned on via a timer. This function is extremely useful for absentee recording. If you set the external timer to switch on and off as many as three times, the unit will be tuned to preset 20 the first time, preset 19 the second, and preset 18 the third. In addition to the sequential station-call tuning just described, there are several other ways to tune the AT-93: You can manually select presets, auto-scan through the presets, auto-scan to the next station up or down, or tune up or down in 0.1-MHz increments.

As for the AT-93's circuitry, it employs a dual-gate MOSFET in the r.f. stage and a phase-locked-loop, quartz-synthesized tuning system. Separate power-supply circuits are used for the digital and audio sections.

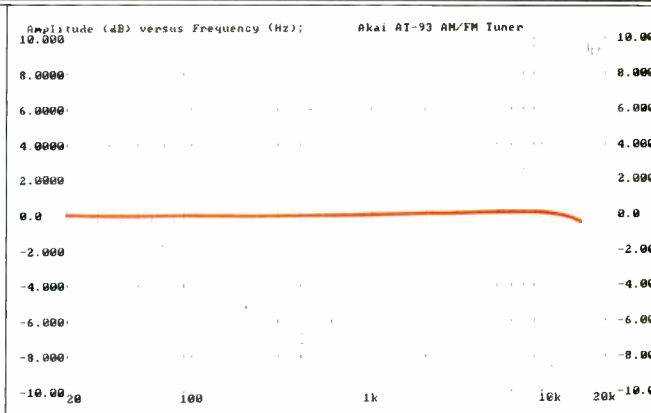


Fig. 1—FM frequency response. Response of the two channels is substantially the same.

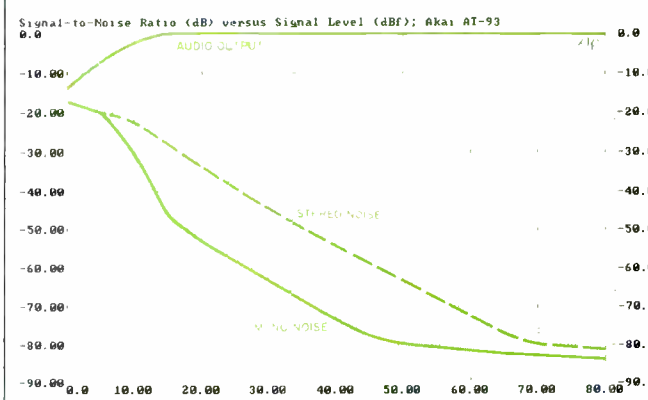


Fig. 2—Mono and stereo quieting characteristics for wide i.f. mode. Results for the narrow mode were virtually identical.

Control Layout

At the left end of the slim, black front panel is the power on/off button. Operating-mode buttons for antenna selection, i.f. bandwidth, blend selection, and high-cut filtering come next. An "FM Auto" button selects automatic or manual FM-reception mode, while touching any of the other four operating buttons restores manual control of the previously automated function. The display area at the upper right of the panel shows tuning information as well as the various modes currently in effect. Pressing a "Preset Scan" button at the far right initiates scanning; pressing the same button a second time locks in the chosen station. Additional buttons along the lower left edge of the panel select muting, band, and the scanning mode. Next come the up and down manual tuning switches and 10 preset buttons. No "shift" key is needed to make these handle the 20 preset station frequencies; pushing any button twice switches it from the first decade (1 to 10) to the second (11 to 20). Above the preset buttons, appropriate green or red LEDs illuminate to show which decade has been chosen. A "Memory" button at the lower right corner completes the front-panel layout.

The rear panel is equipped with two 75-ohm coaxial antenna connectors, spring-loaded terminals for hooking up

After four years at Hewlett-Packard, we w

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

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

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

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

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

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

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

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

In this veritable mountain of information, acoustic truths resided.

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

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

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

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

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

Unisōn is a trademark of Analog and Digital Systems, Inc.

the keyboard of a ere ready for a Steinway.

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

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

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

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

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

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

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

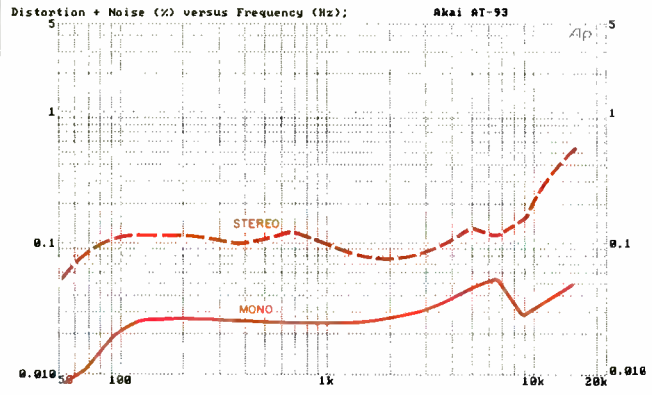
Our tweeters' domes are made of yet another proprietary copolymer, giving them the unique ability to provide smooth, detailed, high frequency response at even the highest levels.

To our ears, our new speakers—the M Series and compact CM Series—offer convincing proof that Unisōn technology does indeed define a new era in speaker performance.

The M12 is the instrument on the right.

a/d/s/

The AT-93's automatically optimized operation allows you to just sit back and listen or to do all the button-pushing you want.



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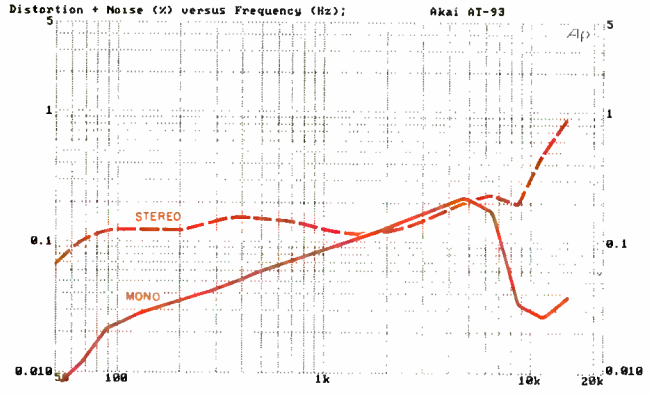
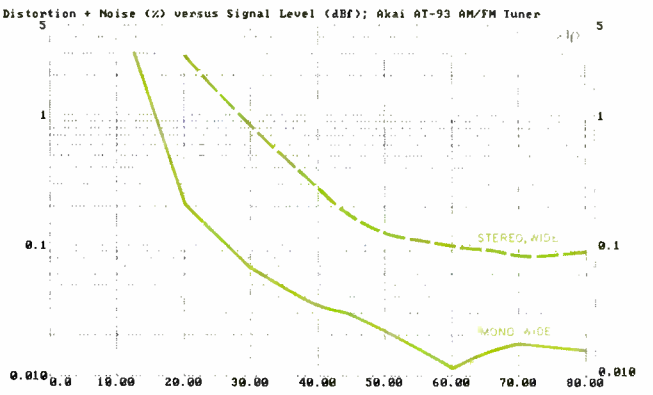


Fig. 3—THD + N vs. frequency for wide (A) and narrow (B) i.f. modes.



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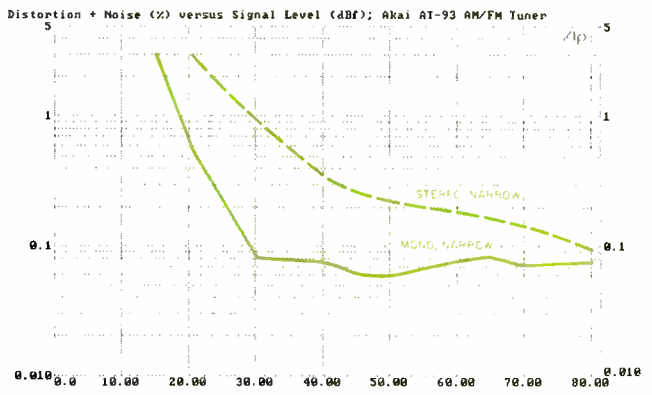


Fig. 4—THD + N vs. signal strength for wide (A) and narrow (B) i.f. modes.

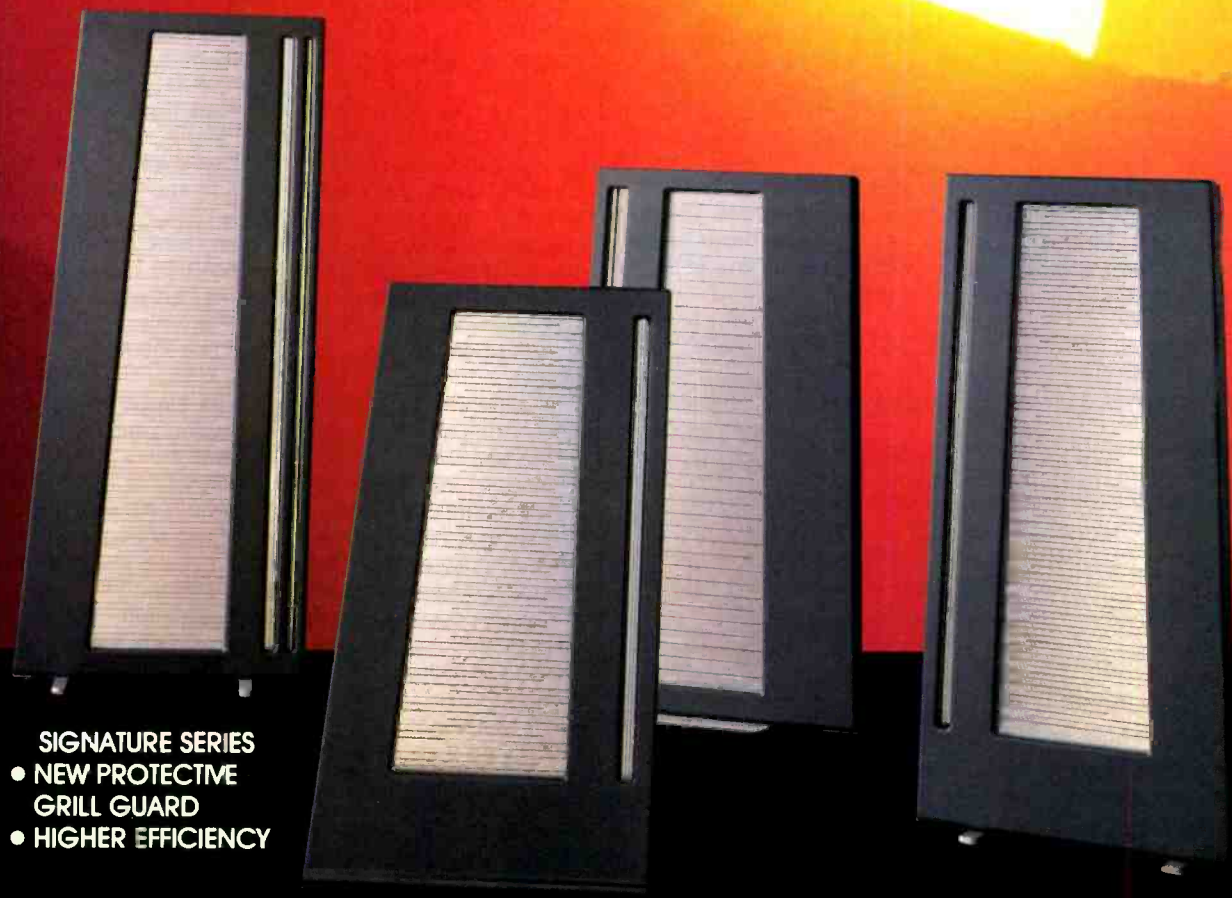
the separately supplied AM loop antenna, and a pair of audio output jacks. The 75-ohm coaxial receptacles are not quite the standard F-type used in the U.S. for video and other r.f. applications, but fortunately Akai provides the necessary adaptor so you can connect a standard coaxial transmission line.

Measurements

Figure 1 shows the overall FM frequency response of both channels; the two channels were so closely matched that no difference is visible between them. Response was close to ruler-flat from 20 Hz to 13 kHz and was down a mere 0.2 dB at 15 kHz. Usable sensitivity in mono measured just over 12 dBf. The stereo indicator light goes off at about 20 dBf, but stereo reception continues down to about 6 dBf, as shown in Fig. 2, though with diminished separation. Of greater significance was the tuner's excellent quieting characteristics: 50-dB quieting in mono was reached with a signal level of only 16.5 dBf, while for stereo, the signal level required for 50 dB of S/N was 35 dBf. Both figures are better than those claimed by Akai. A full plot of mono and stereo noise characteristics, as a function of signal strength, is shown in Fig. 2. Because results were substantially the same whether I used the narrow or wide i.f. mode, only one set of curves is shown. With strong signals, mono S/N reached 83 dB. At 65 dBf, stereo S/N was 77 dB, but with an even stronger signal of 80 dBf, stereo S/N surpassed the 80-dB mark.

Figures 3A and 3B show how THD + N varied with frequency for the wide and narrow i.f. modes. The IHF/EIA Standard for tuner measurement requires that THD be quoted for three frequencies: 100 Hz, 1 kHz, and 6 kHz. Whenever I make these tests, I use a recommended band-pass filter with −3 dB cutoff points at 200 Hz and 15 kHz. This filter explains the apparent "dip" in THD at the extreme low end of the audio spectrum and the seeming reversal of the curve direction between about 7 and 10 kHz. In any event, at 1 kHz, actual mono THD + N in wide i.f. mode was about the lowest I have ever recorded for any FM tuner:

When your horizons expand, so should your speaker system.



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In its narrow i.f. mode, the AT-93 has lower distortion than several highly regarded tuners do in wide mode.

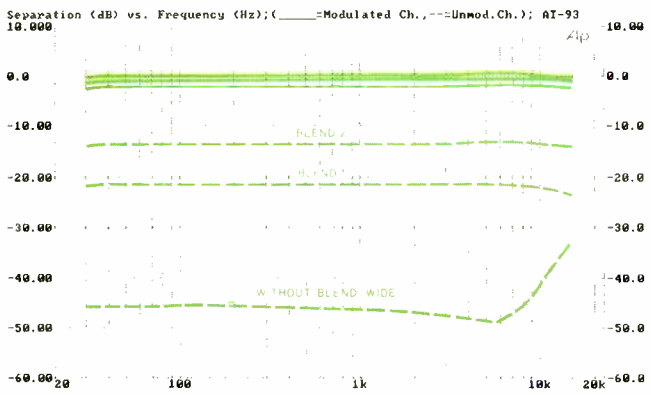

Fig. 5A—Frequency response (top curves) and separation (bottom curves), with and without blend, for wide i.f. mode at 65-dBf signal level. Response curves are (top to bottom) without blend, with blend 1, and with blend 2.

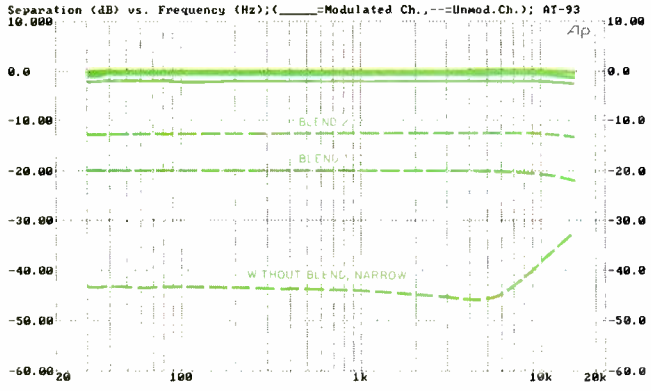

Fig. 5B—Same as Fig. 5A but using narrow i.f. mode.

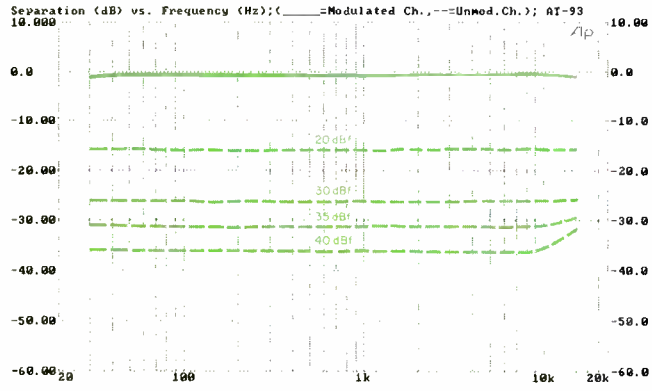

Fig. 5C—Frequency response (top curves) and separation (bottom curves), without blend, for four low signal levels in wide i.f. mode.

0.025%! In stereo, at 1 kHz, distortion plus noise measured 0.095% in wide mode. The results were almost as impressive at 100 Hz, and at 6 kHz, mono THD + N was only 0.052%; in stereo, it increased to 0.12%. Of course, when I switched to the narrow i.f. mode (Fig. 3B), distortion figures increased, but even then, mono THD + N measured only 0.088% at 1 kHz; in stereo, the reading was 0.13%. I know of several highly regarded tuners which don't do this well even in their widest i.f. bandwidth setting.

Figures 4A and 4B show how THD + N varied as a function of signal strength in mono and stereo. Note that in the wide i.f. mode (Fig. 4A), it took only 26 dBf of signal input to bring distortion down below the 0.1% mark. Even when switching to the narrow mode (Fig. 4B), mono THD + N remained below 0.1% for all signal levels above 28 dBf. In choosing selectivity levels for the i.f. modes, it is clear that Akai did not go overboard in their choice of parameters for the narrow bandwidth. All too many tuner designers, given this multi-bandwidth option, choose to make the narrow setting so narrow that, although its use reduces alternate- and even adjacent-channel interference, distortion often rises to unacceptable levels, negating the advantage of this setting.

In experimenting with the stereo circuitry, I discovered that in addition to the two available blend settings selectable by the user, weak stereo signals will also result in reduced separation, very much as car FM tuners operate in a semi-stereo mode under weak-signal conditions. The purpose, of course, is to retain some stereo effect while partially reducing the unacceptable background noise levels that otherwise would exist. Consequently, I decided to plot three sets of curves to show the AT-93's separation characteristics. The first set, Fig. 5A, was plotted with the tuner in wide i.f. mode. The bottom curve is the normal separation achieved when no blend setting is used. Separation over most of the audio range was around 47 dB, decreasing to 41 dB at 10 kHz. When blend 1 was selected, separation decreased to about 22 dB; in blend 2 mode, separation decreased still further, to about 13 dB over the entire audio range.

There was a slight difference in output level from the modulated channel as I switched from normal to the two blend positions, which explains the three closely spaced response curves at the top of Fig. 5A. The top solid curve is the referenced output for the normal stereo setting, while the two lower solid curves were obtained for blend 1 and blend 2, respectively.

Figure 5B is the same as Fig. 5A, except the plots were made with the tuner set to the narrow i.f. position. Note that in this mode, separation for normal stereo reception (bottom curve) was very nearly as good as that obtained in the wide setting: About 44 dB at 1 kHz, as opposed to 47 dB in Fig. 5A. Again, this attests to the intelligent choice of bandwidths made by Akai's engineers in designing their i.f. modes. As might be expected, the blend 1 and 2 settings provided almost identical results to those obtained in the wide mode.

Finally, with neither blend setting activated, I reduced signal strength in steps—to 40, 35, 30, and 20 dBf (just above the point where the stereo light goes out)—to obtain the separation curves of Fig. 5C. This time, no level shift of the modulated output (top curves) was observed, but with

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"In short, there is more a sense of listening to music. . . than there was of listening to hi-fi." — Hi-Fi Review on the Linn Index

These quotes about Linn loudspeakers come from highly respected reviewers. We could literally fill this entire page with similar quotes (but then, so could any other manufacturer). Fortunately for us, it takes a lot more than a rave review to make a good speaker. It takes solid engineering.

Take the Linn Nexus, which was selected as "one of the most innovative consumer electronics products of 1988" by the Design and Engineering Exhibition in Chicago.

In the Nexus we didn't bend the laws of physics to fit some pet theory. We simply applied fifteen years of engineering experience in mechanics, acoustics, material science, electronics, and computer programming to produce a speaker that really works.

The front baffle is molded from expanded structural foam which is acoustically superior to wood. It is then bonded to the critically braced MDF cabinet using ultra-strong adhesives developed for aircraft and Formula One racing cars.

The cone of the bass driver is manufactured from an exceptionally light and rigid carbon-loaded polypropylene material.

The crossover is a fourth-order (24dB per octave) Linkwitz-Reilly phase coherent system based on research we did during the development of our standard-setting "Aktiv" electronic crossover. It is even housed in a separate, sealed enclosure to avoid microphonic distortions.

The very same engineering expertise has been applied to the full range of Linn Loudspeakers starting with the under-$600-a-pair Linn Index and progressing through to the "Aktiv" Isobarik Monitor System.

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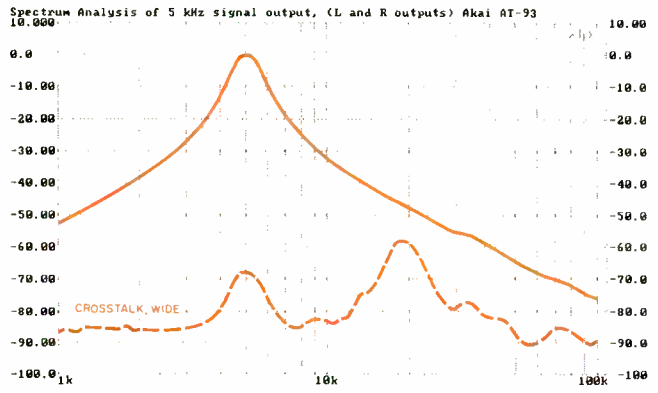
Enter No. 36 on Reader Service Card

Some designers go overboard in deciding on narrow-band parameters, but engineers made just the right choices on the Akai AT-93.



A

B

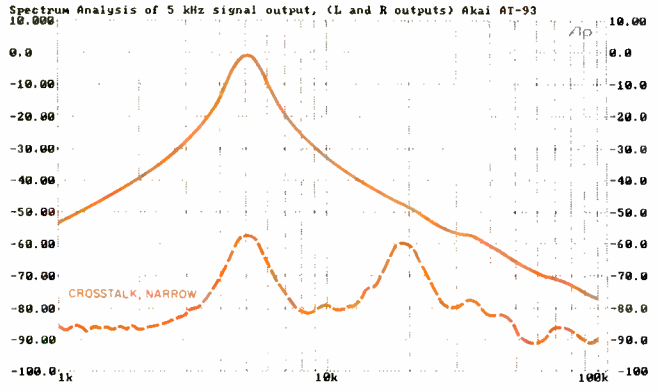


Fig. 6—Separation for a 5-kHz modulating signal (top curve) and crosstalk components plus subcarrier and sideband components (bottom curve) for wide (A) and narrow (B) modes.

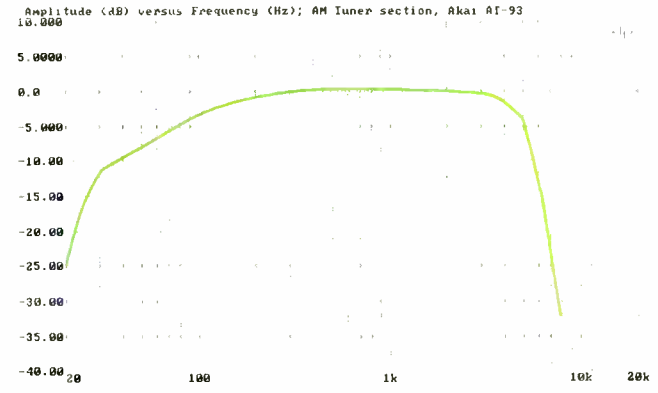


Fig. 7—AM frequency response for signal with NRSC pre-emphasis.

decreasing signal strength, separation decreased almost linearly, as the tuner gradually shifted from full stereo toward monophonic operation. Even at 20 dBf, however, there was still enough separation—around 16 dB at all frequencies—to render a reasonably good stereo effect.

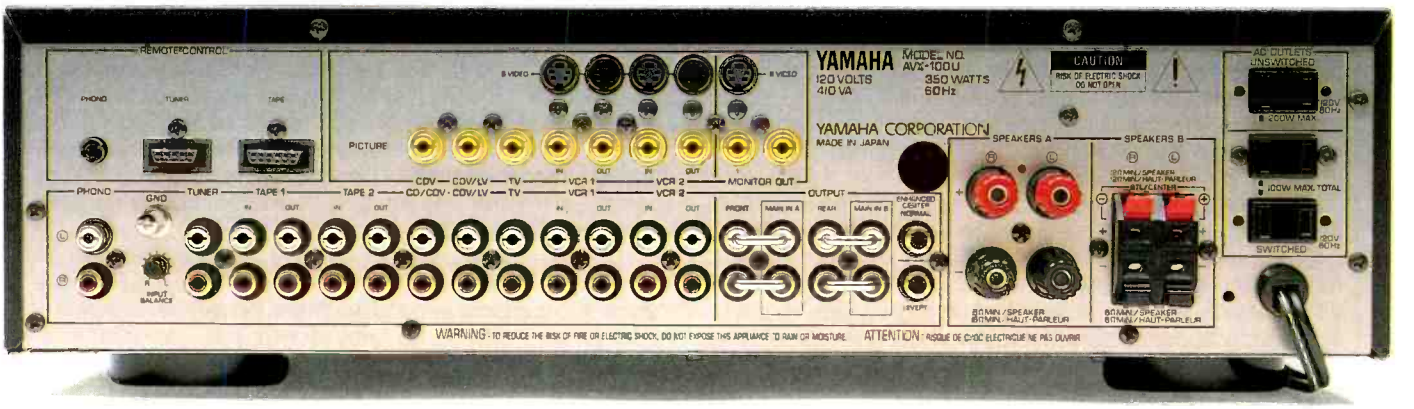
Figures 6A and 6B are my standard tests showing the output when a 5-kHz signal modulates my FM test generator in stereo. Figure 6A was plotted with the tuner set to the wide i.f. mode, and Fig. 6B was plotted with the tuner set to the narrow mode. Each solid curve (with a peak at 5 kHz) represents the desired output from the left channel, while the dashed curves show separation as well as other distortion and crosstalk products. In both figures, note that the 19-kHz subcarrier product is only about 60 dB below maximum modulation level. In separate spot tests, a 61-dB attenuation of the 19-kHz subcarrier output was observed. I have, of course, measured tuners which exhibit greater suppression of this signal, but the lower amount of attenuation, in this case, is directly related to the excellent response shown earlier in Fig. 1. By not using too sharp a 19-kHz rejection filter and by making sure that the filter did not start attenuating frequencies below 15 kHz, Akai's engineers managed to retain virtually flat response over the entire FM audio frequency range. As for the 60-dB pilot-carrier attenuation, it is really quite enough. Any residual 19-kHz subcarrier product present at the outputs is not likely to affect Dolby tracking when you use the AT-93 to record FM programs. It is also unlikely that you will hear any 19-kHz artifacts when listening to the tuner, even if your ears are as keen as a teenager's. About the only difference I detected between the results of Figs. 6A and 6B was the slightly reduced separation at 5 kHz in the narrow mode (Fig. 6B).

If you are a careful observer of my graphs, you may be wondering why the apparent separation at 5 kHz in Fig. 6A (68 dB) and Fig. 6B (58 dB) is so much greater than it appears to be in Fig. 5A (48 dB) and Fig. 5B (45 dB). The reason is simple: When I measure separation across the band, the amplitude emanating from the unmodulated channel includes not only the discrete frequency modulating the opposite channel, but the other related signal components (harmonic distortion) and unrelated signal components (subcarrier products, noise, etc.) which are present at that output. In Figs. 6A and 6B, however, the test equipment is behaving much like a spectrum analyzer. Thus, when sweeping through the 5-kHz point, it reads only the 5-kHz component.

Capture ratio, measured only for the wide setting, was 1.2 dB, and i.f. and spurious-response rejection both were in excess of 100 dB. Alternate-channel selectivity was 58 dB in the wide mode and exactly 90 dB in the narrow mode. AM suppression was 63 dB on my sample, and image rejection was 95 dB. SCA rejection measured 59 dB; muting threshold was set to 39 dBf, a bit higher than I would have liked.

For this and all future tuner reports, I am going to assume that AM stations in most areas have adopted the newly proposed NRSC Pre-Emphasis Standard. (Hundreds of radio stations have reported that they are already using this fixed pre-emphasis.) Accordingly, when I measure AM frequency response from now on, I will be incorporating 75-μS pre-emphasis in the audio sweep signal that is used to modulate my AM test generator. Thus, a tuner designed by

How to patch things up around the house.



Now's a good time to start thinking about home improvements.

We're referring, of course, to that hodge-podge of switch boxes, enhancers, tuner, amps, VCRs, cassette decks, monitors and speakers you affectionately call your home entertainment center.

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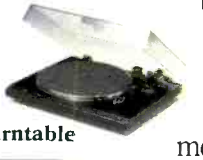
Turntable


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It wounds my ego to admit this, but for all but two of the 53 stations received, I could not outsmart or second-guess this tuner!

engineers who care about AM response will yield a reasonably flat response curve with this test setup. Such was the case with the Akai AT-93's AM section—at least at the high-frequency end of the spectrum. As shown in Fig. 7, response extended out to just above 5 kHz for the −6 dB cutoff point. I'm not quite sure why response rolled off so rapidly at the low end (down 6 dB at around 70 Hz), but that's the curve that it plotted.

As for other AM characteristics, selectivity measured 48 dB (very good for AM), i.f. rejection was 62 dB, and image rejection was 41 dB. Distortion, using a 1-kHz signal at 30% modulation, was 0.5%, while S/N for a 1-mV input signal was 47 dB. Aside from the absence of ultra-low bass response, listening tests conducted for the AM section revealed that it sounded better than most of the AM tuner sections in many name-brand "high-fidelity" tuners and receivers.

Use and Listening Tests

I started auditioning the Akai AT-93 with the unit set to its automatic tuning mode—the one in which the tuner's own microcomputer decides which antenna, i.f. setting, blend mode, and high-frequency cut to use for each received signal. The two antennas employed were my outdoor multi-element antenna and an amplified indoor antenna. For each of the 53 usable signals I was able to pick up, I deliberately reset all of the parameters that the tuner had decided to use, one by one, to see if I could improve on the AT-93's choices. Of the 53 signals received, the tuner switched to mono on five of them because of weak signal strength. I decided that I could tolerate two of those five signals in stereo after all. *In every other respect and for every other signal received, I could not outsmart or second-guess this tuner!* It always chose the optimum operating parameters. Although this may have wounded my ego a bit, it sure speaks well for the way the built-in microcomputer decides to program this amazing unit.

Setting up my 20 presets was easy—a lot easier than on some tuners and receivers I've tested. I also tried out the absentee recording capability. While the AT-93 was in my listening room, I had to be away for two days. On both days, two different stations were broadcasting programs I wanted to record. I only had a one-event timer, so I got someone in the lab to manually turn on the tuner for the second event. Sure enough, the second preset frequency appeared, just as promised. As an FM tuner fan from way back, I was truly astonished by the performance this Akai component delivered—especially since its price is about half that of several tuners I recently tested and listened to that didn't perform as well. If you are looking for the right FM tuner for your system and care about good FM reception, I can recommend the Akai AT-93 without any qualifications or reservations.

Leonard Feldman

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Stereophile 8-88

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"The sound of the Ohm Sound Cylinders was smooth, balanced and thoroughly enjoyable, well beyond what anyone would expect from such a small, light speaker. Its dispersion was subjectively complete, and we were never aware of the speakers as distinct sound sources, no matter how much we moved around the room...these speakers certainly offer impressive value for their price and size."[3]

New York Times 3-88

"...the various frequencies emerge in their natural phase relationship--more than in conventional designs. To what extent this accounts for the speakers fine sound may be debatable, yet there is no question that the Ohm Sound Cylinders represent an excellent bargain, with a clarity and richness of sound rarely found in a speaker of this size and price."[4]

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For Those Who Care to Listen

4

ARISTON FORTE TURNTABLE AND ENIGMA TONEARM

Manufacturer's Specifications

Turntable

Drive System: Belt.
Speeds: 33⅓ and 45 rpm.
Start-Up Time: 3.5 S to audible stabilization.
Wow & Flutter: 0.06% DIN weighted peak.
Rumble: −75 dB.
Platter Weight: 4 lbs. (1.75 kg).
Overall Weight: 10½ lbs. (4.8 kg), less arm.
Price: Without arm, $500; with Enigma arm, $625.

Tonearm

Type: Static-balance, straight-pipe, pivoted.
Horizontal Mechanism: One-point gimbal support system.
Effective Length: 9 in. (228 mm).
Overhang: ¾ in. (18 mm).
Offset Angle: 23°45′.
Tracking Error: +2° to −1°30′.
Sensitivity: Vertical or horizontal, 50 mg (first action) except for lead friction.
Range of Stylus-Force Adjustment: 0 to 3 grams, direct-reading with 0.5-gram calibrations.
Cartridge Weight Range: 4 to 10.5 grams.
Anti-Skating Adjustment: 0.5 to 3 grams.

Company Address: 12 Rte. 17 North, Suite 309, Paramus, N.J. 07652.
For literature, circle No. 93

Ariston Acoustics is not a familiar name to most Americans, although the company has been building high-quality turntables for many years. It is located in Scotland at the Prestwick International Airport, which isn't very far from Glasgow. I love to find the origins of words, so I looked in the dictionary and found that *aristos* is the Greek word for "best" and *tonos* is Greek for "a stretching or tone." I like it! The first time I heard of Ariston was back in 1973, when I read about their RD11 turntable, which achieved a new performance standard. It was a single-speed, 33⅓-rpm belt-drive turntable which used a main platter spindle with an integrally machined conical bearing. This was unusual at the time; even today, most turntables, including the Ariston Forte, use a separate ball bearing between the bottom of the platter shaft and the thrust plate at the bottom of the main bearing well. Many turntables of this type allow the ball bearing to shift position, especially when the turntable platter is removed for inspection or to oil the bearing shaft. Because all bearings tend to develop flat spots over time, allowing the bearing to change position with respect to the thrust plate can cause the bearing to move in a new but eccentric pattern. This may result in an increase in mechanical noise and rumble that can affect the sound. The Forte's ball bearing is locked in place to prevent motion. Since the bearing of the RD11 turntable was made an integral part of the rotating main shaft, it also eliminated the usual surface-to-surface contact between the main shaft and a ball bearing, which also reduced mechanical noise and rumble. When making the bearing part of the main platter shaft, the two principal problems that must be overcome are obtaining sufficient precision and hardening of the part.

The Forte that I tested came with the Ariston Enigma tonearm, and I used an Ortofon X3-MC cartridge, the same model that I used for the Dual CS 5000 test report (November 1988 issue) but a different unit.

First Impressions

The Forte's appearance is unusual, to say the least. It certainly doesn't look conventional, even though it uses many conventional, proven techniques in its engineering approach. The turntable platter is round, as expected, but so are the main chassis and the floating subchassis. Each of these three main parts is an aluminum casting. There is no separate base, or "plinth" as it is called in the British Isles. Instead, three round supports are bolted to the main support chassis. These supports have rubber grommet feet, which are not adjustable, screwed to them. Three matching supports are bolted to the subchassis, which is isolated from the bottom main chassis by springs inside these supports. Each spring is adjustable by turning a knob on top of each support. The knobs are held by cap screws that tend to loosen when the knobs are turned, which can be a nuisance.

The round, metal tonearm mount is a separate casting and is bolted to the right rear of the subchassis. It has a round plate to which the Ariston Enigma tonearm is mounted; blank boards and boards precut for SME or Premier's MMT arms are also available. When I tapped the Enigma tonearm tube, I heard a complex tonal quality which I find hard to describe. It was the same at both the cartridge and pillar ends of the tonearm tube, but it had a more damped quality in the center. While holding the main tonearm pillar firmly in one hand, I tried to pull, push, and twist the tonearm tube to check for any play or looseness in the bearings and the headshell. I found none, which is good. The cartridge mounts to what appears to be a headshell, but it is firmly attached to the armtube and is not removable. Even though the entire turntable is made of metal, it is extremely light and weighs only 10½ pounds.

Features

The Ariston Forte has a three-position rocker switch, mounted on a flattened section on the front of the main chassis, which is used to select 33⅓ rpm, power off, and 45 rpm. The 3-pound, cast aluminum-alloy platter is painted to match the subchassis and main chassis. My sample was white, but a black and silver model is available. Strips of Ariston's patented Q-damping material, which resembles foam rubber, are fastened to the inside of the rim to damp out any ringing. The subchassis also has strips of Q-damping material around its inside periphery. The record mat, which weighs ½ pound, also damps out platter resonances.

The platter is driven by a belt from the motor pulley to a ring, 6½ inches in diameter, which is cast into the bottom of the platter. Three large access holes in the platter allow the belt to be slipped over the motor pulley; the pulley is rather large and appears to be made of brass. These access holes are about ⅜ inch from the ring, which makes grasping the belt a bit difficult after the platter has been put in place. I found that the trick is to pull the belt through an access hole, place the belt around a pencil, and lay the pencil against the platter. This holds the belt so that it can be placed around the motor pulley at a later time. Positioning the belt must be delayed because the machining of the bearing well and the platter shaft is so precise that it takes up to 15 minutes for the shaft to slide down to its final resting position in the well, and for the oil at the bottom to move up the bearing well. The belt must be removed from the motor pulley before the platter can be removed.

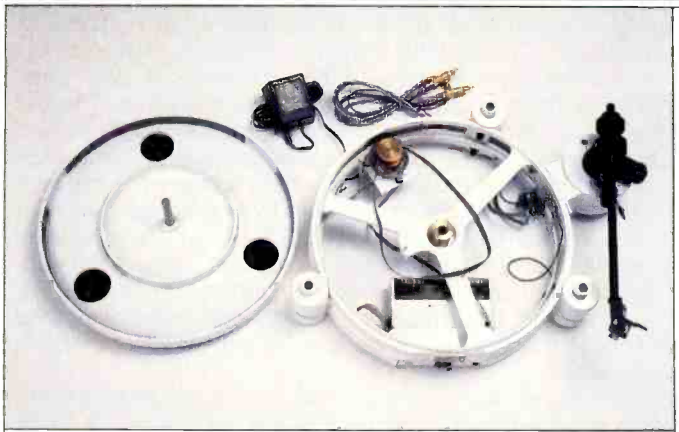
MEASURED DATA

Ariston Forte Turntable

Parameter	Measured	Comment
Speed (at 33⅓ rpm)	−1.40%	No adjustment
Speed Stability	±0.15%	Excellent
Wow, Unwtd. Peak	0.22%	Very good
Wow, DIN Wtd. Peak	0.11%	Very good
Flutter, Unwtd. Peak	0.08%	Excellent
Flutter, DIN Wtd. Peak	0.03%	Excellent
W & F, Unwtd. Peak	0.24%	Very good
W & F, DIN Wtd. Peak	0.11%	Very good
Long-Term Drift	±0.10%	Excellent
Rumble, Unwtd.	−75.9 dB	Excellent
Rumble, Wtd.	−88.7 dB	Excellent
Suspension Resonance*	1.4 Hz	Well damped

*Suspension resonance was difficult to measure because it was very highly damped.

The Forte's appearance is unusual, to say the least, but despite unconventional looks, this turntable uses proven design techniques.



The center post, for the record hole, and the main platter shaft are one continuous piece. The top is rounded, while the bottom has a slight taper with a small flat surface which rests on the ball bearing at the bottom of the bearing well. The drive motor is rather small and is mounted on a spring-like ring, which in turn is supported by three coil springs. These are adjusted at the factory for minimum transmission of mechanical energy to the main chassis, on which the motor assembly is mounted. The main bearing well, which also appears to be made of brass, is mounted at the center of three spokes extending out to the edge of the subchassis. The power for the motor is supplied by a small, 9-V transformer with two prongs that allow it to be plugged into a normal a.c. power socket. If room for the turntable is a consideration, the Forte can be slipped into a space about 16 inches wide by about 14 inches deep. There is no cover to vie for space above the turntable, but the clearance needed to change records conveniently is about 8 inches. This could be reduced, in a pinch, since the distance between a shelf or platform and the top of the tonearm is about 5¼ inches. The turntable comes with a removable strobe disc for 33⅓ and 45 rpm which fits down into the recess in the platter mat. However, since the Forte's speed control is not accessible when the platter is mounted (it's an unmarked factory adjustment, inside the base), it's better to leave it off so that the record can be in closer contact with the record mat, thus increasing sound clarity by further removing extraneous energy from the record.

The Enigma tonearm is a statically balanced type, with the tracking force provided by a movable counterweight on the rear of the tonearm tube. The weight is first rotated to the position which balances the arm. Then the adjustable scale, calibrated from 0 to 3, is set to 0, and finally the counterweight and scale are rotated together to set the tracking force. The rear of the armtube is lubricated with a thin film of viscous material that helps to damp any tendency for the counterweight to rattle.

With the Ortofon X3-MC cartridge, which weighs only 4.2 grams, the counterweight is close to the main pillar. This position is desirable because it reduces the dynamic mass of the tonearm, but it does make reading the tracking force scale difficult. A separate sidethrust force adjustment is provided by a knob that is also calibrated from 0 to 3 to match the tracking force chosen. The vertical bearings appear to be jewelled pivots, while the horizontal bearings appear to be the ball-and-race type. The damped cueing lever allows the arm to float down to the record in about 2 S. The fingerlift on the headshell allows faster cueing for those with steady hands.

The base of the tonearm is fastened by three screws, and the height of the tonearm pillar is adjustable after loosening two hex screws. The armtube is one continuous piece, from the nonremovable headshell to the rear. The tonearm is a bit shorter than others I have tested, and it appears that the tracking error has wider limits across the record surface.

The phono leads are captive, being soldered directly to a terminal block near the tonearm. The cartridge connectors are gold plated, and the phono cables have gold phono

MEASURED DATA

Ariston Enigma Tonearm

Pivot-to-Stylus Distance: 9.125 in. (23.2 cm).
Pivot-to-Rear-of-Arm Distance: 2.250 in. (5.7 cm).
Overall Height Adjustment: 1.00 in. (2.54 cm).
Tracking Force Adjustment: Knob on main pillar adjusts spiral spring.
Tracking Force Calibration: 1 to 3 grams, within 0.1 gram.
Cartridge Weight Range: 4 to 10 grams.
Counterweights: One, 97 grams.
Counterweight Mounting: Direct to tonearm tube, with viscous coating.
Sidethrust Correction: Calibrated knob on base of main pillar.
Pivot Damping: None.
Lifting Device: Fingerlift on headshell and damped cueing lever.
Headshell Offset: 23.0°.
Overhang Adjustment: Slots in headshell.
Bearing Alignment: Excellent.
Bearing Friction: Very low.
Bearing Type: Horizontal, ball race; vertical, jewel point.
Lead Torque: Very low.
Arm-Lead Capacitance: Left, 283 pF; right, 329 pF.
Arm-Lead Resistance: 0.5 ohm, both channels.
External Lead Length: 33 inches.
Structural Resonances: 1000, 3800, 4200, and 6200 Hz.
Base Mounting: Center hole for arm post and three screws for base.

Ortofon X3-MC Cartridge

Coil Inductance: Left, 515 µH; right, 530 µH.
Coil Resistance: Left, 78.3 ohms; right, 78.1 ohms.
Output Voltage: Left, 0.46 mV/cm/S; right, 0.39 mV/cm/S.
Cartridge Mass: 4.15 grams.
Microphony: Very low.
Hum Rejection: Excellent.
Rise-Time: 10 µS.
High-Frequency Resonance: 19.6 kHz.
Low-Frequency Resonance: 15.8 Hz (in Ariston Enigma tonearm).
Low-Frequency Q: 6.3 (in Ariston Enigma tonearm).
Recommended Load Resistance: 47 kilohms; greater than 1 kilohm has no effect.
Recommended Load Capacitance: Less than 1,000 pF has no effect.
Recommended Tracking Force: 2.1 grams.
Polarity: Plus, for RIAA Standard.

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The Ariston's machining is so precise that its platter shaft can take as long as 15 minutes to slide down into the turntable bearing well.

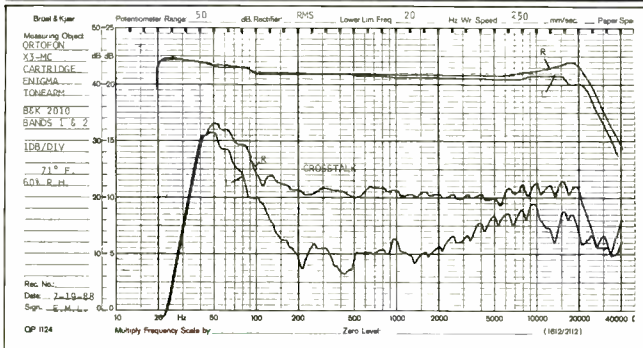


Fig. 1—Frequency response and interchannel crosstalk of the Ariston Enigma tonearm and Ortofon X3-MC cartridge, using B & K 2010 test record.

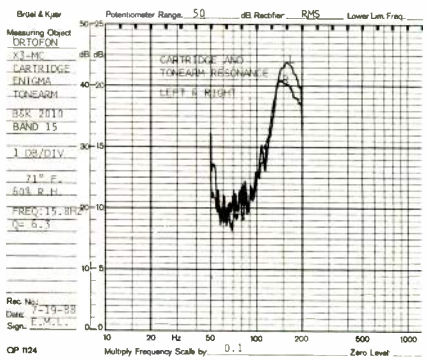


Fig. 2—Low-frequency arm/cartridge resonance is at 15.8 Hz with a Q of 6.3.

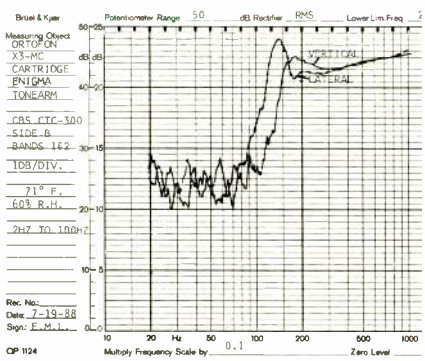
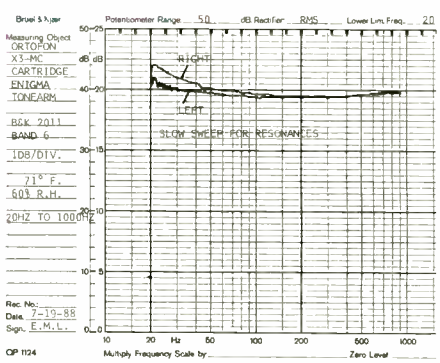


Fig. 3—Low-frequency response of X3-MC cartridge and Enigma tonearm for vertical and lateral modulation, using slow sweep from 2 to 100 Hz. The damping is better in the vertical mode; see text.

Fig. 4—Slow sweep from 20 Hz to 1 kHz to test for structural resonances. No serious structural resonances are visible.



plugs. A separate ground wire, which is attached to all metal turntable parts, is also provided.

Measurements and Listening Tests

The technical measurements were completed on the Ariston Forte turntable, Enigma tonearm, and Ortofon X3-MC cartridge combination before any listening was attempted. This is my usual procedure because, unlike with amplifiers, loudspeakers, and other components, many adjustments have to be made when setting up a turntable, tonearm, and cartridge combination. If the adjustments are not done correctly, they can adversely affect the outcome of listening evaluations. During the technical measurements, the results of faulty setup adjustments can be seen and corrected. This ensures that the combination will be judged for its sound reproducing quality only after it has been adjusted for optimum performance.

The Ariston/Enigma/Ortofon combination was compared to a high-quality reference system by using a series of selections from different recordings. Each selection featured a type of instrument or voice as well as a type of music. The listening panel was comprised of both trained and casual listeners. Each panel member was given a form listing the different types of instruments to which they should pay particular attention, and they were also encouraged to make comments about anything having to do with the sound as they perceived it, even things such as rumble, hiss, background noise, etc. The reference and the tested combination were designated as systems A and B. For each musical selection, panel members rated the systems by placing an "X" in one of six boxes, marked from 0 to −5. A rating of 0 would mean that the listener heard absolutely no deficiency in the sound reproduction; a −3 would be good, and a −5 would mean poor reproduction. (Over the years, there have been almost no zeros awarded and very few −5s; most ratings have been between −1 and −4.) After the listening panel had made its evaluation, I tried to correlate their ratings and comments with the technical measurements. Although trained listeners provide the most astute observations, casual listeners usually provide very enlightening comments, since they seem to hear the music rather than the sound. It should be remembered that the com-

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Although listeners noted a lack of spaciousness, and my measurements showed why, the tested system did not score badly for imaging.

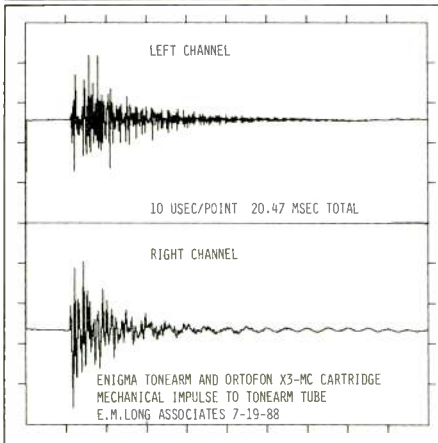

Fig. 5—Output vs. time of arm/cartridge when mechanical impulse was applied to armtube; see text.

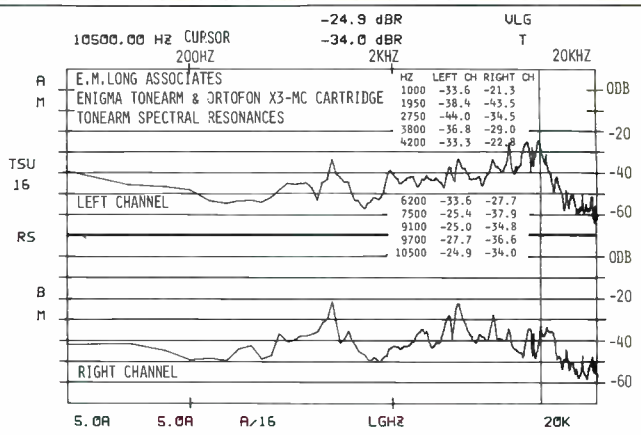

Fig. 6—Spectral output (averaged) of arm/cartridge due to 16 mechanical impulses applied to armtube.

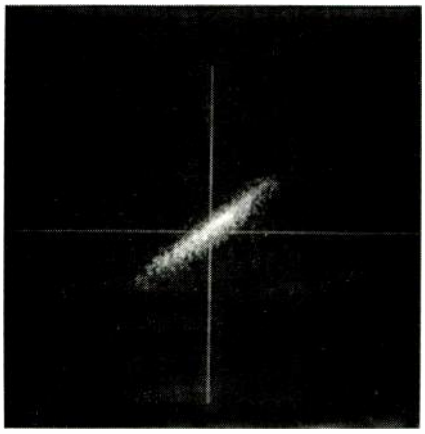

Fig. 7—Interchannel phase difference of arm/cartridge using pink noise from B & K 2011, band 7.

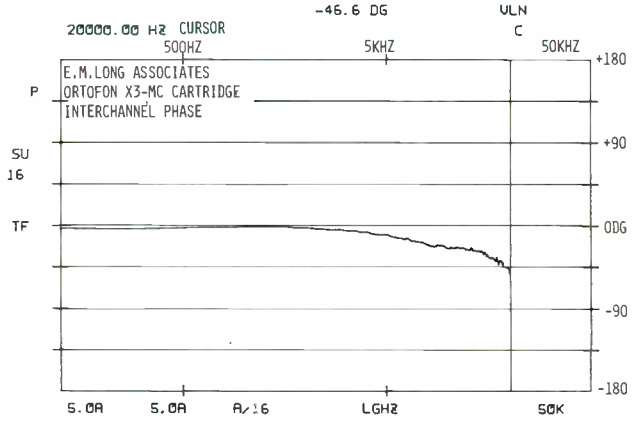

Fig. 8—Arm/cartridge interchannel phase difference vs. frequency. The difference at 20 kHz is −46.6° (6.5 μS).

ments are written, since the panel is cautioned against making any statements or gestures during the listening sessions. While some of the comments might seem severe, they are made in an attempt to describe very subtle differences between two systems.

Figure 1 shows the amplitude versus frequency response and the interchannel crosstalk of the Ortofon X3-MC moving-coil cartridge when mounted in the Ariston Enigma tonearm. There were comments from the listening panel about a "certain flatness" or "lack of spaciousness" which could be related to the fact that the leakage of left-channel sound into the right channel is rather high. Interestingly enough, this did not cause the panel to rate the Ariston/Enigma/Ortofon combination poorly for image localization.

Figure 2 shows the result of a slow sweep of tones from 5 to 20 Hz for left and right channels. The low-frequency resonance caused by the interaction of the compliance of the X3-MC stylus and the mass of the Enigma tonearm occurs at 15.8 Hz with a Q of 6.3; the left channel has about 2 dB more output than the right. Low-frequency sounds, such as those produced by the bass guitar, organ, etc., can be affected by this resonance. Usually it causes the bass to sound "fuller," as some of the panel members noted. The reference system has a lower resonance and a much lower Q, so the rise in its output at resonance is much less. The reference system elicited comments such as "tighter" and "more realistic" when reproducing bass instruments.

Figure 3 shows the response of the tested combination to vertical and lateral modulation between 2 and 100 Hz. Because the resonance occurs at a lower frequency for lateral modulation than for vertical modulation, either the mass of the tonearm or the compliance of the cartridge—or both—is greater in the lateral plane of motion. Since the Q is also greater in the lateral plane of motion, it is safe to assume that the mass of the tonearm is the predominant factor. As far as sound quality is concerned, this means that for this pair the exact centering of the record is probably more important than a slight amount of up-and-down warp.

Figure 4 shows the output of the left and right channels for a very slow sweep from 20 Hz to 1 kHz, which is intended to excite any resonances in the tonearm/cartridge combination. These resonances can cause delayed energy reflec-

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The Ariston Forte turntable deserves to be rated very good for wow and excellent for flutter characteristics.

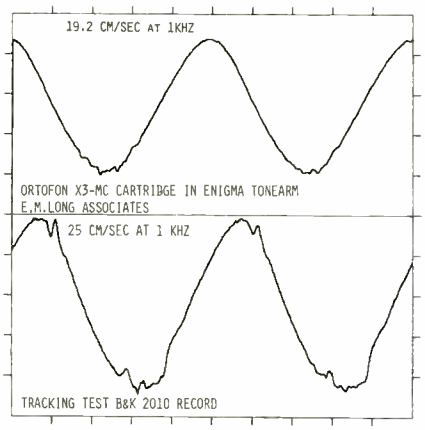

Fig. 9—Tracking of arm/cartridge with 1-kHz test tones at 19.2 cm/S and 25 cm/S.

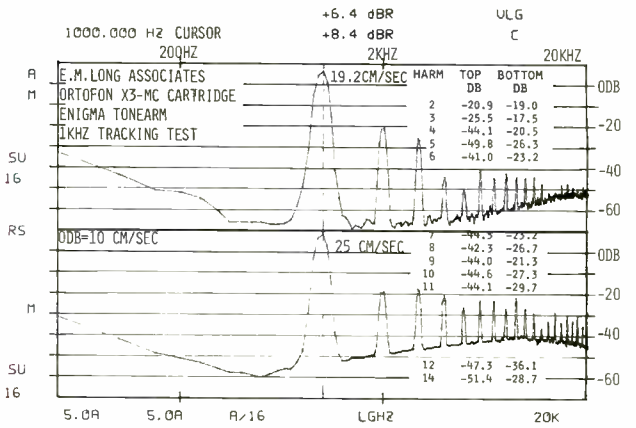

Fig. 10—Spectral analysis of the cartridge output when reproducing the signals of Fig. 9. Distortion at third harmonic is −25.5 dB for the 19.2-cm/S track and −17.5 dB for the 25-cm/S track. See text.

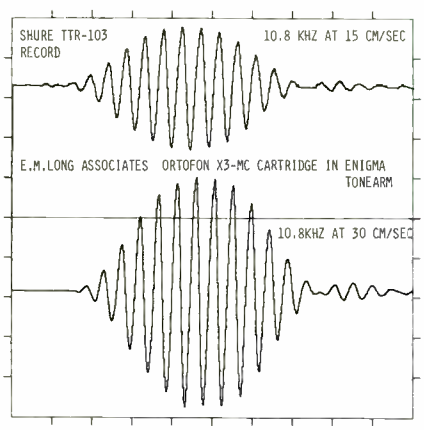

Fig. 11—Output from 15- and 30-cm/S, 10.8-kHz pulse test, using Shure TTR-103 test record.

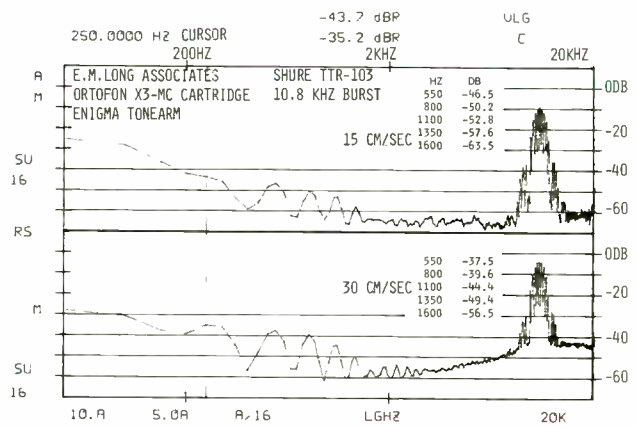

Fig. 12—Spectrum analysis of distortion products from signals shown in Fig. 11. At the 30-cm/S level (8 dB above the reference level of 10 cm/S), distortion at 250 Hz is only 0.69%, which is very good, but note the change in the relative levels of different frequencies for the two recorded levels.

tions as well as simple vibrations that can color the sound reproduction and/or detract from the clarity. The tested combination does show minor resonances at 45, 80, and 130 Hz which might be due to the counterweight mounting and the main bearings. Comments were made about the Forte/Enigma/X3-MC combination which might correlate with these resonances; it was said to have "slightly less clarity" and to be "less transparent," especially during high-level orchestral passages.

I mentioned earlier that I found it difficult to describe the tonal quality of the Enigma tonearm's sound when I performed the simple tap test. Figure 5 shows what the sound looks like, and when I saw these results I realized why I had had difficulty. The pattern is very complex and also lasts long enough to give a sense of tonality. In Fig. 6, a spectral analysis, there are a large number of harmonically unrelated resonances which make it difficult to assign a definite pitch to the sound. The presence of an energy peak at 1 kHz might account for comments about voice being "shrill" and violin being "brighter" and "grating."

Figure 7 shows the interchannel phase relationship between the left and right channels. A straight line at 45° would indicate perfectly identical response in both channels. There is a difference between the channels, though not very great, and Fig. 8 shows that it is mainly at the higher frequencies. No comments were made by panel members which could be directly related to the information in these two figures.

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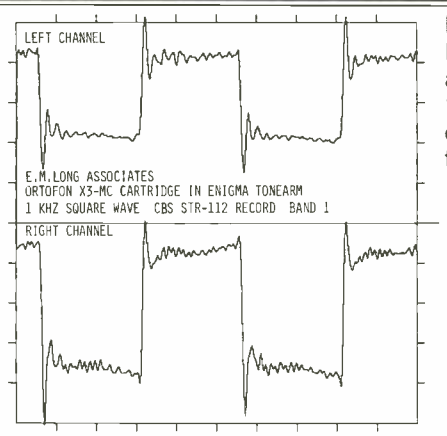

Fig. 13—Response of arm/cartridge to 1-kHz square wave on CBS STR-112 test record.

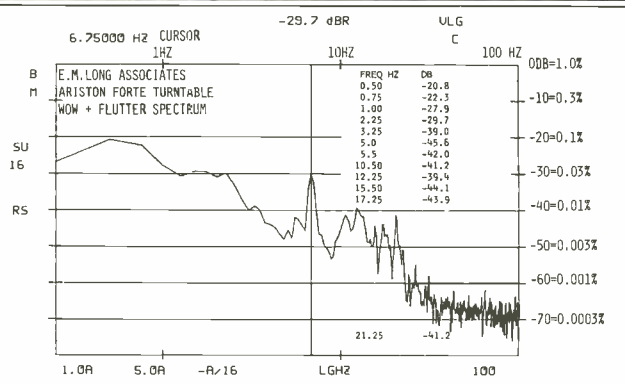

Fig. 14—Wow and flutter spectrum of Forte turntable, from 0 to 100 Hz. See text.

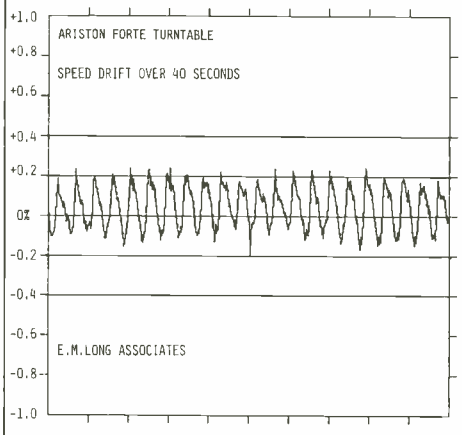

Fig. 15—Speed drift over a 40-S period. The variations are at 1.8 S per cycle (0.56 Hz), related to the 33⅓-rpm speed.

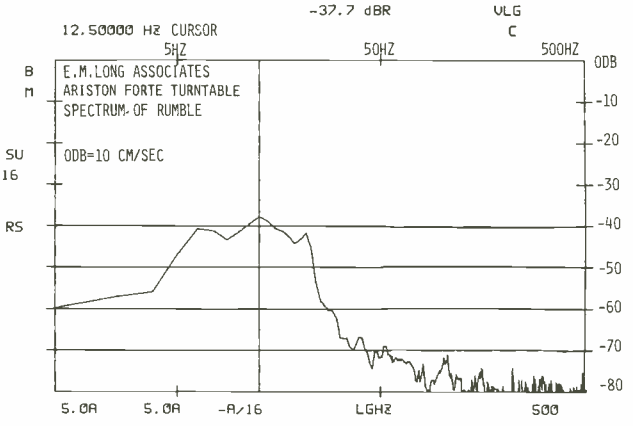

Fig. 16—Rumble spectrum. Most of the output shown is due to the toneam/cartridge resonance.

Figure 9 shows the output of the Ortofon cartridge for the two highest levels of the 1-kHz tone on the B & K 2010 test record. The waveform at the bottom of the figure shows that the X3-MC not only has difficulty tracking the 25-cm/S level, but has problems with the 19.2-cm/S level (top curve) as well. The spectrum of the distortion produced by these two levels is shown in Fig. 10. An interesting thing about the spectrum is that the sixth and eighth harmonics are predominant at the 19.2-cm/S level, while the sixth, seventh, and ninth harmonics predominate at the 25-cm/S level. I was able to correlate this with listeners' comments about the sound of low-level versus high-level strings and brass. At lower levels, the sound was described as "mellow" and "sonorous"; at higher levels, comments were made that it was "brighter" and even "zizzier"!

Some panel members' remarks regarding the sound quality of cymbals can be related to the results shown in Figs. 11 and 12. The ability of the X3-MC/Enigma combination to track the 15-cm/S level of the 10.8-kHz shaped tone burst on the Shure TTR-103 test record is very good, as shown in the top curve of Fig. 11. The 30-cm/S level (bottom curve) reveals that the combination causes some flattening of the waveform, especially at the bottom. This can cause the sound of cymbals to take on a "slightly duller" quality. The increase in the levels shown for different frequencies (Fig. 12), especially at 800 Hz, can certainly contribute to this perception.

The response of the arm/cartridge combination to the 1-kHz square wave of the CBS STR-112 test record is shown in Fig. 13. The output of the right channel is slightly higher, which confirms the data of Fig. 1. One panel member described the sound of acoustic guitar, being played in a real acoustic space, to be "bigger than it should be." This was mainly due to the "boomier" quality caused by the increased lower frequency shown in the first four figures, but it could also be due to the difference in channel levels. This would shift the apparent location of a complex sound's spectral components.

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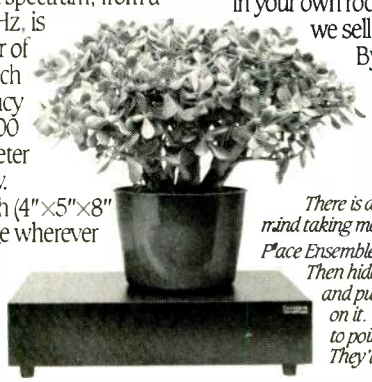

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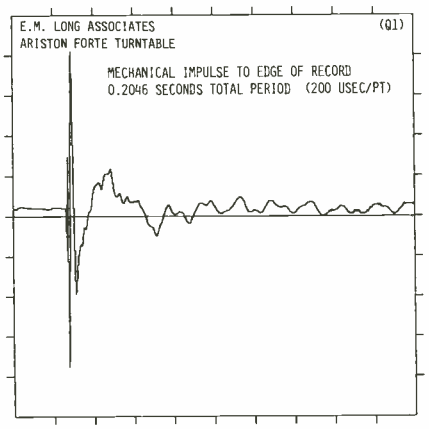

Fig. 17—Output vs. time for mechanical shock applied to edge of record, with stylus resting in groove, to test for damping by turntable mat. The mat does better at damping the platter's ringing than at removing energy from the record.

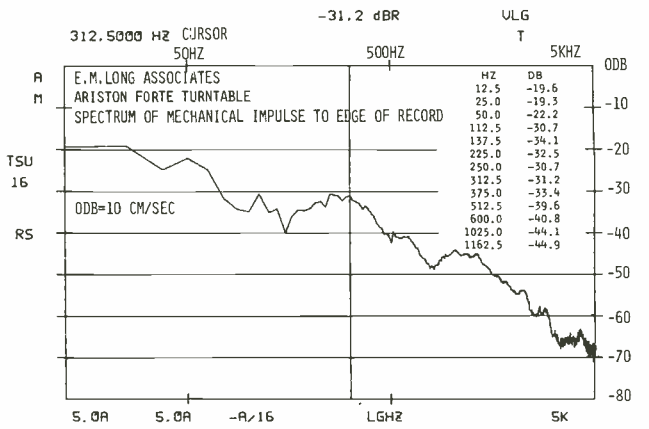

Fig. 18—Spectrum to 5 kHz (averaged) of output from 16 impulses applied to edge of record.

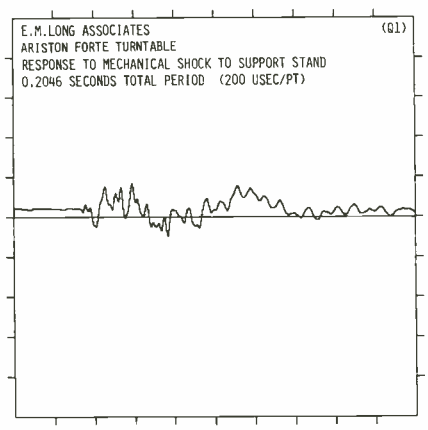

Fig. 19—Output vs. time for mechanical shock applied to stand on which the turntable was resting. Isolation is excellent.

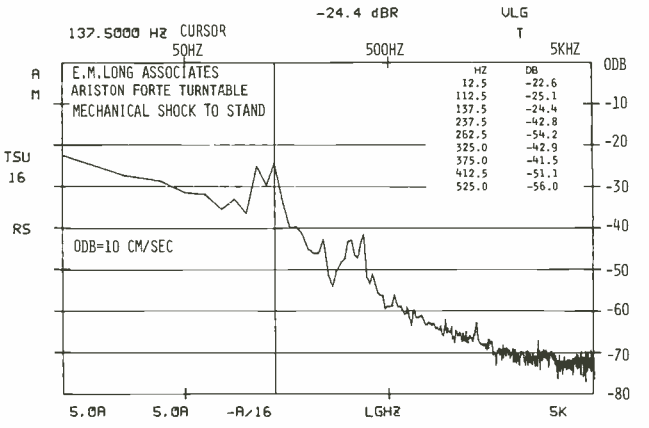

Fig. 20—Spectrum to 5 kHz (averaged) of output from 16 impulses applied to stand on which the turntable was resting.

The spectrum of the Forte turntable's wow and flutter is shown in Fig. 14. I am not sure what is causing the spectral component at 6.75 Hz, but it is a little less than one-half the tonearm/cartridge resonance, which occurs at 15.8 Hz. The tonearm resonance is responsible for the energy in the range from 10.50 to 17.25 Hz. This data shows that the Ariston Forte turntable deserves to be rated very good for wow and excellent for flutter characteristics. No adverse comments were made by panel members that could be correlated directly with these characteristics.

The Forte's pitch variation over a 40-S period is shown in Fig. 15. The cyclical variations correspond to the rotational speed of the turntable at 33⅓ rpm and occur at a rate of 0.56 Hz, or 1.8 S apart. There is evidence of some higher frequency components which caused the spikes in the waveform, and these may be related to the 6.75-Hz spectral output mentioned above. I did not try to analyze the turntable drive system to determine the exact cause. The sound of the piano, although described by one panel member as being "slightly wooden" for one selection, did not cause anyone to make comments which could be directly related to unsteadiness in tone.

The spectrum of the rumble, Fig. 16, shows a large spread of energy below the tonearm resonance, which is 15.8 Hz, down to about 6 Hz. The listening panel's comments regarding rumble and low-frequency background noise varied from record to record, indicating that the rumble from the Ariston Forte was well below that of the various records used for the listening evaluation.

The damping qualities of the Forte's record mat, with respect to removal of energy from the record, are plotted in Fig. 17. The output versus time is due to a single mechanical impulse applied to the edge of a stationary record, with the stylus resting in a groove. The mat is only moderately effective in this regard; it is really more successful in damping the platter's tendency to ring than it is in removing

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energy from the record. The spectrum of the energy due to a series of 16 impulses, applied to the edge of the record and averaged, is shown in Fig. 18. An energy hump in the range around 312.5 Hz could contribute to the "wooden" piano quality mentioned earlier.

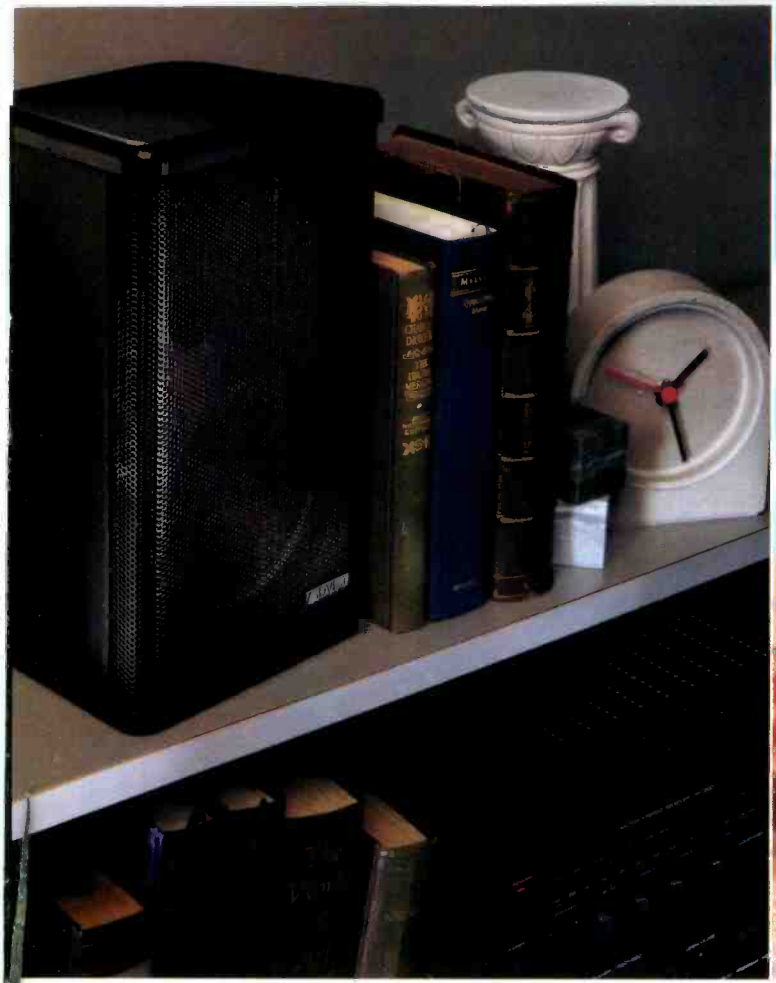
The isolation afforded by the Forte's three-point spring suspension, for mechanical-induced energy due to outside shocks, is shown in Fig. 19. A mechanical shock was applied to the stand on which the turntable was resting, while the stylus was in a stationary record groove. The results shown are excellent. If in the past you've had problems with this type of induced energy—such as shocks from walking or even dancing in the same room as the turntable—the Forte will certainly cure them. Figure 20 shows the spectrum due to 16 mechanical shocks applied to the stand and averaged. There are peaks of energy at 112.5 and 137.5 Hz, but above about 400 Hz, the energy drops off rapidly.

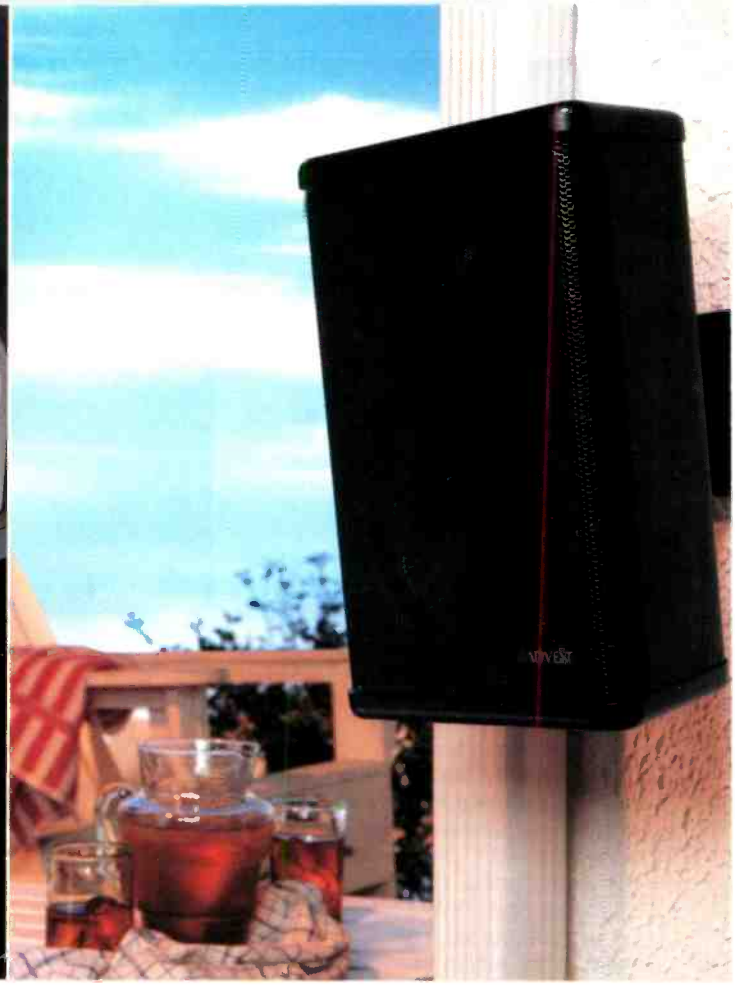
Tests were also made to determine the susceptibility of the tested combination to acoustical feedback. The results, although not shown, indicated that isolation is excellent.

Conclusions

The Ariston Forte turntable has a distinctively different appearance and provides very good performance. I am not sure why Ariston decided to use a separate, though locked, main ball bearing rather than the single-piece, shaft-and-bearing design which they pioneered. However, I can't fault the company for this engineering decision because the turntable's rumble and wow and flutter are extremely low. This turntable is easy to use, extremely light and yet rugged, compact enough to fit in a small space, and has good isolation from mechanically and acoustically induced energy. The Enigma tonearm is also very good and certainly easy to use, with everything working as it should, and it has no strange idiosyncrasies. I do wonder about the effect of its reduced length on tracking error across the record surface, but the Enigma performed very well during the listening evaluations.

If you compare the Measured Data Table for the Ortofon X3-MC which accompanies this report with the Table for the same model cartridge used with the Dual CS 5000 turntable and OPS tonearm (November 1988), you will see that the two samples performed a bit differently. I believe the differences in the Dual OPS and Ariston Enigma tonearms caused more subtle variations in the sound quality than did the cartridges. Despite the slight differences in the Measured Data, I regard the Ortofon X3-MC cartridge as an excellent value and capable of very good sound reproduction. The combination of the Ariston Forte turntable, the Enigma tonearm, and the Ortofon X3-MC cartridge provided excellent sound. Even more important, I enjoyed listening to the music that it reproduced. *Edward M. Long*





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There's something to be said for active, or powered, loudspeakers. When you stop to think of it, if a manufacturer has control over the frequency response of both the driving amplifier and the transducers being driven, through careful equalization he can do much to produce a relatively flat overall system response. That's exactly the approach AR's engineers took when they designed this pair of active speakers, the TSW 115P. Actually, to be more accurate, I would have to call them one active and one passive speaker, since the two channels of power amplification used to drive the speakers are installed in only one of the two cabinets.

The enclosures themselves, attractively styled with solid-hardwood walnut or oak tops and bottoms, black vinyl veneer cabinets, and black grille cloths, measure only 10½ inches high × 7 1/16 inches wide × 6⅞ inches deep. Internal volume is only 0.12 cubic feet (3.34 liters). Despite this minuscule internal volume, the system is capable of delivering response down to 50 Hz (if one measures to the half-power, or −3 dB point). Drivers in each enclosure include a 4-inch, filled polypropylene-cone, acoustic-suspension woofer and a ¾-inch, titanium-dome, liquid-cooled, shielded tweeter.

A 9½-foot twin-conductor cable, permanently attached to the "active" speaker enclosure, terminates in a polarized, two-pin plug that connects to the alternate speaker. While 9½ feet is generally a more than adequate distance between stereo speakers, I rather wish that AR had left it to the user to interconnect the speakers with a cable of his own choice and length. As matters stand, if you want to have the speakers closer together, you have to coil up the excess cable; if you need the speakers further apart, the only solution is to cut and splice the supplied, fixed cable. Fortunately, the cable insulation is marked for polarity, so if you are careful, you are not likely to invert the polarity of one speaker relative to the other.

An 11-foot, dual, shielded cable, terminated at one end with a mini stereo plug and at the other with standard RCA-type phono plugs, poses no problems. It can easily be extended, if necessary, using readily available audio cables and female-to-female jack adaptors. This cable, of course, is intended for connection to your program source, be it the outputs of a preamp, CD player, portable stereo system, stereo TV, or perhaps best of all, the rear channels of a surround-sound system.

The active unit is equipped with a rocker power switch, and it is this speaker, of course, which must be plugged into a 120-V, 60-Hz source via its power cord. The dual-channel amp housed in this enclosure consumes a maximum of 60 watts. Tiny dual, concentric, input-level controls allow you to adjust the system's overall gain, even if your program source lacks its own volume control. It took approximately 300 mV of input to drive the system to its maximum output. Therefore, if you hook up a CD player as your program source, you will need to turn down the TSW 115P's level controls considerably, since most players deliver 2 V or more at maximum level.

Although the audio cables are color coded and the mini stereo plug determines which speaker will be driven from which colored plug at the other end of the cable, it is easy enough to reverse the locations of the speakers themselves. Either unit can become the left- or right-channel speaker by simply ignoring the color coding on the terminating ends of the audio cable and reversing the normal connections. This is an added convenience, since positioning of the program-source equipment relative to the "active" speaker thus becomes less critical.

I listen to speaker systems before I measure their performance, so I placed the two units near the wall, mounting them on a long table with the tweeters at ear level. This is the preferred listening position recommended by AR. The two things that impressed

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Julian Hirsch, *Stereo Review*, 6/88

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A 2

On the whole, the sense of power and space that defines a good organ recording came through quite well on these small loudspeakers.

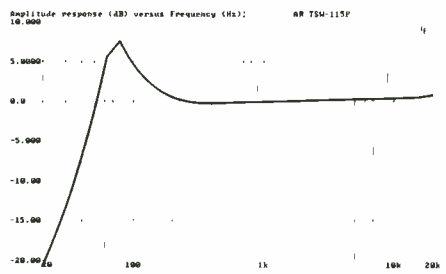

Fig. 1—Frequency response of the built-in amplifier. Note the bass boost, tailored to offset bass roll-off on the speakers.

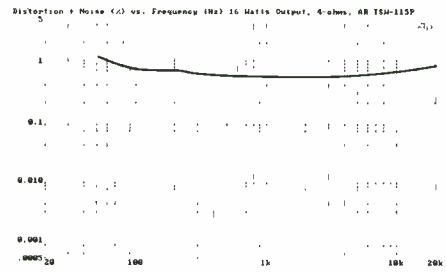

Fig. 2—Amplifier THD + N vs. frequency, at rated output of 16 watts per channel into 4 ohms.

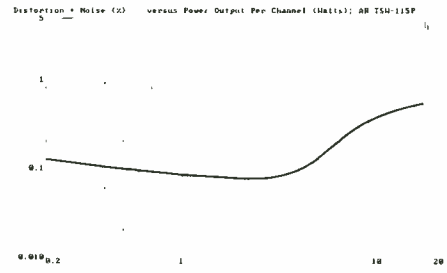

Fig. 3—Amplifier THD + N vs. power output per channel, at 1 kHz into 4 ohms.

me most, when starting to listen to the system, were the amount of clean bass such small enclosures were able to deliver and the high sound pressure levels the system was able to achieve before overload occurred.

I decided to do my listening tests by hooking up a portable CD player, as many users of this system are likely to do. Among the most recently acquired CDs in my collection are a couple of new Delos releases. One of these is *French Fireworks: The Symphonic Organ* (D/CD 3049). I figured that if any program material could tax the capabilities of a small system such as this, the "king of instruments" certainly would. To be sure, there was some doubling when the lower pedal notes were struck, but on the whole, the sense of power and space that defines a good organ recording came through quite well. Using a sound level meter, I measured peaks of 105 dB SPL, as claimed by AR, with little or no distortion or other forms of overload.

I did find that orientation of the speakers had a lot to do with how well good stereo imaging was maintained. A slight toe-in of the units, so that they actually faced me, provided a somewhat more stable stereo image than when both speaker enclosures faced directly forward. (The owner's manual had suggested this positioning, and AR was correct.) Another Delos disc, *A Brahms/Schumann Soiree* (D/CD 3025), features chamber works. It offered an opportunity to listen to a more intimate kind of sound, as reproduced by the TSW 115P. Here, the AR system really came into its own, with excellent clarity of clarinet sounds and good transient quality of the accompanying piano. The piano offers an excellent opportunity to judge spectral balance, and I was especially impressed with the sound reproduced by this small speaker system.

Being an incurable lab-test fanatic, I had to see what AR had done to their amplifier in order to have it drive these speakers with what seemed like excellent overall flat system response. Fortunately, the configuration of the cable, coming from the active speaker, allowed me to substitute a resistive load for the second speaker. This way, I was able to measure the built-in amplifier's response as well as take a look at power output levels and harmonic distortion characteristics.

For the response test, I turned down the level of the remaining speaker so that I wouldn't have to listen to the sweep tone. The results of my measurements, done at a nominal 1-watt level, are shown in Fig. 1. It is clear that AR has deliberately shaped the response curve, below around 150 Hz, to compensate for the natural roll-off of the 4-inch driver. Bass boost in the amplifier begins at about that frequency and reaches a maximum of around 7 or 8 dB at 80 Hz.

While no load impedance is specified, it became clear that the amplifier was designed to deliver its maximum power into 4-ohm loads. So, setting my resistive load to this value, I measured distortion as a function of frequency, for a constant output of 16 watts per channel. Since I wanted to drive both channels for this test—one driving my resistive 4-ohm load, the other driving the actual loudspeaker—I used ear protectors. The results are shown in Fig. 2. At 1 kHz, THD + N was 0.55%, rising to 0.8% at 20 kHz and to just over 1% at 50 Hz, the acknowledged lower frequency limit of the system. Finally, using a 1-kHz test signal, I measured THD + N versus power output. Distortion was around 0.1% for output levels below 4 watts per channel, rising gradually to the previously measured 0.55% level at the rated output of 16 watts per channel (Fig. 3).

The AR TSW 115P, at $400 per pair, is certainly no substitute for larger speaker systems, nor would I consider it suitable as the primary speaker/amplifier combination in my stereo system. Nevertheless, where secondary speakers are required for surround-sound applications, or where space is at a premium—as in a bedroom, den, or vacation home—the AR TSW 115P offers not only an acceptable but an excellent alternative to the totally unacceptable "boom box."

Leonard Feldman

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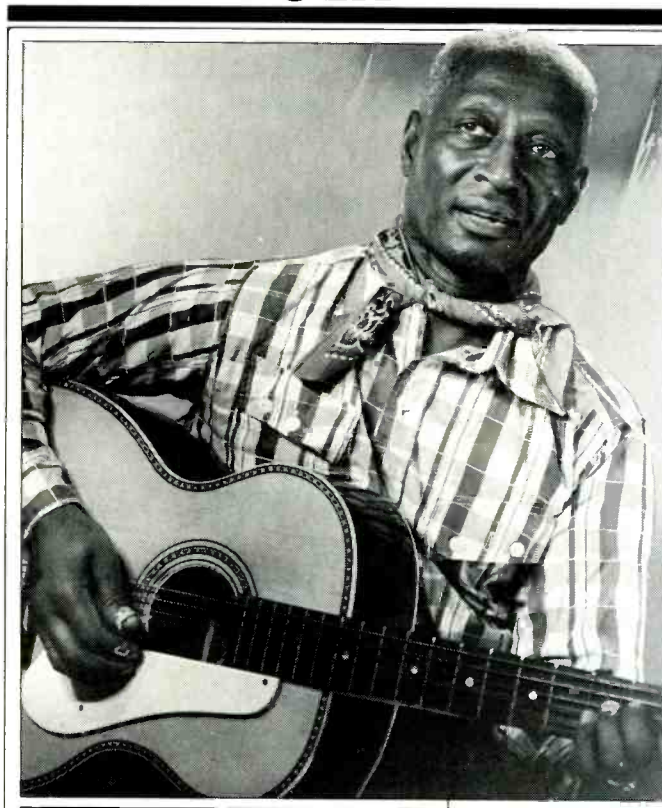


Photographs: Frank Driggs Collection

Folkways—A Vision Shared: Various Artists
Columbia CK 44034, CD.

Sound: B Performance: B

Folkways—A Vision Shared is billed as "A Tribute to Woody Guthrie and Leadbelly." It is a benefit album to help The Smithsonian Institution market its catalog of Folkways Records, whose rights it recently acquired from the estate of Folkways founder Moses Asch.

The 14 selections are rendered by a wildly varied group of performers serving up songs by both great artists. Some of the best are U2's version of "Jesus Christ," which Guthrie wrote to the tune of "Jesse James"; Taj Mahal's "Bourgeois Blues," in which he mimics Leadbelly's memorable style on guitar and piano as well as vocals; Emmylou Harris' tender read of Woody's "Hobo's Lullabye," where she is joined by Mark O'Connor's eloquent fiddle; Bob Dylan's terrific cover of Woody's "Pretty Boy Floyd," and Bruce Springsteen's electric version of Guthrie's "Vigilante Man." Bruce also gives us a dour acoustic version of "I Ain't Got No Home," while Sweet Honey in the Rock's five female a cappella voices mix beautifully for two Leadbelly songs, "Sylvie" and "Gray Goose." Little Richard's ride on the "Rock Island Line," backed by Fishbone, is a pure goof. Depending on your view, you can either take this cut as a delight or an atrocity. I like it. Arlo Guthrie does a straight-ahead version of the cowboy ballad "East Texas Red," a song his father loved but never recorded. John Mellencamp and his band on "Do Re Mi" is somewhat sloppy and not fully gelled, and the Willie Nelson rendition of "Philadelphia Lawyer," while pleasant, feels almost like a throwaway.

That leaves only two clinkers to complete the set. Brian Wilson doing "Goodnight Irene" seems like an inspired idea on paper, especially considering The Beach Boys once recorded a wonderful version of "Cotton Fields." But in practice, it does not work; Wilson sounds profoundly uncomfortable. The finale, "This Land is Your Land," is a perfect choice, yet it is far from the best version Pete Seeger has recorded. Inexplicably, he omits the song's most pointed verse, the one about the sign that reads private property while "On the other side it didn't say nothing."

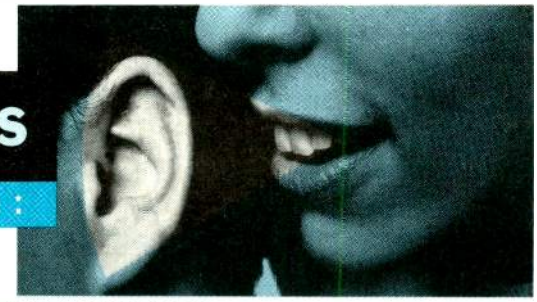
It should be no surprise that there is a whole lot of heart in most of the performances. As an entity, *Folkways* will probably mean the most to listeners who are not very familiar with the songs of Guthrie and Leadbelly (each of whom is given a selected discography in the liner notes). For those already aware of the originals, the album will be little more than pleasant entertainment.

My greatest reservation about the set is that I don't feel the canons of Guthrie and Leadbelly mix all that well here. Granted, each is represented by both whimsical and politically pointed songs, but the total package feels forced. The pairing of the two seems more convenient than anything else, since Guthrie and Leadbelly are sort of the twin titans of both folk music and the Folkways catalog. A separate volume for each might have been more aesthetically satisfying, but it surely would have been a less viable idea commercially.

Still, the grand intentions and the album's musical variety carry the day and make *Folkways—A Vision Shared* a Compact Disc well worth getting close to. *Michael Tearson*

COMPACT DISCLOSURES

December CDs of Note:



On record, no one's been in and out of love more often in the past 25 years than BARBRA STREISAND. On the other hand, no one's been more consistently successful in sales: Streisand has had 36 certified gold albums, more than any other star. Her latest, "Till I Loved You" (featuring the hit duet with DON JOHNSON), is Streisand's first studio album in three years. Including Barbra's inimitable rendition of "All I Ask Of You" from *The Phantom Of The Opera*, "Till I Loved You" is sure to keep love songs (and out-of-love songs) in style for at least another 25 years.

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A STAR IN STEREO

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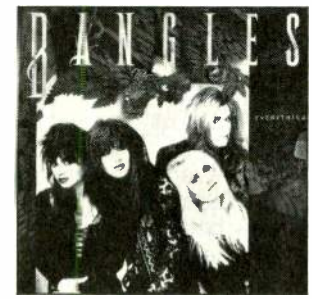
Don't be alarmed: Despite the title, "Everything's Different Now," 'TIL TUESDAY's third album builds on all the things you loved in the group's first two smash hit albums. And of course that includes lead singer/bassist Aimee Mann's ethereal voice and 'Til Tuesday's hauntingly unique sound and unusually powerful lyrics. And in addition to all that, "Everything's Different Now" also includes a song called "The Other End (Of The Telescope)," not to mention 'Til Tuesday's new hit single, "(Believed You Were) Lucky."

And speaking of the holidays, the BANGLES are on their way to becoming as enduring a tradition as silver bells and mistletoe. Now ready to dominate the charts for the third December in a row, the band's latest collection of irresistible four-part harmonies and pop-rock wisdom makes the perfect gift for someone who thinks they have "Everything." Because chances are, they won't have "Everything," which is, of course, the Bangles' new album. Their most mature – and varied – recording yet, "Everything" will appeal to everybody.



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What makes Stealin Horses unusual is that, much like Bruce Hornsby & The Range, the group is song-oriented rather than riff-driven.

Stealin Horses
Arista ARCD-8520, CD.

Sound: B+ Performance: A–

If, as I have always believed, there is always a place on the charts for well-written, well-executed music, then Stealin Horses has a bright future before them. The band is based around the duo of Kiya Heartwood—who sings lead, plays acoustic rhythm guitar, and writes most of the songs—and drummer Kopana Terry, who sings harmonies and occasionally co-writes with Kiya. What makes this group unusual is that they are song-oriented rather than riff-driven, much in the way of Bruce Hornsby & The Range. Indeed, their greatest strengths are the consistently strong songwriting, Kiya's singing, and Greg Ladanyi's excellent production.

There is a lot of substantial songwriting on *Stealin Horses*. The lyrics tend to tell stories that most often take place in rural areas, far away from the big cities. "Where All the Rivers Run" is about a romance with a ranch hand; "Walk Away" focuses on a woman having trouble working her farm and making ends meet, and "Ballad of the Pralltown Cafe" tells how people felt when the town fathers closed down a hip hangout "for being too loud and black." The little details Kiya puts into the songs give them added verisimilitude. The refrain of "Tangled," for instance, paints a vivid portrait of a woman who meets her lover while he is hitchhiking; she sings of "a strange fascination with his cotton shirts/his whiskey on the arrows." "Turnaround" may be the very best cut, with its haunting melody shouting determination while the words tell of desperately trying to patch up a wounded relationship. Even as poppish-sounding a song as "Gotta Get a Letter to You," which revolves around a one-night stand at the end of a bus ride through Delaware, has something to say.

Stylistically, Kiya's singing recalls the Wilson sisters of Heart, but it is not nearly as hard edged or brittle. Kiya likes to cuddle her lyrics romantically, with a winsome twist of phrasing or a soft passage that is more spoken than sung.

Ladanyi's production is superb. He has done an excellent job of getting everything the songs offer onto tape. He employed some of L.A.'s best players to back the Nashville-based duo. Waddy Wachtel's co-production credits are well earned on "Turnaround," "Walk Away," and "Where All the Rivers Run," which he helped arrange and to which he added extraordinarily vivid and inventive guitar work. Elsewhere, Danny Kortchmar, Steve Lukather, Steve Dukes, and group member Mandy Mayer add guitars; Bob Glaub, Mike Porcaro, and Leland Sklar split bass chores; Russ Kunkel and J.R. Robinson augment Kopana Terry on drums; Jai Winding covers keyboard parts, and Neil Young adds his distinctive harmonica sound to "Harriet Tubman." Kiya and Kopana do all the harmonies in a tight style that recalls Everly Brothers harmony. Driving home that their origins are folky, the group has opted to leave the finale, "Pralltown Cafe," as an acoustic number backed by a single guitar.

Kiya Heartwood shows that she can effectively sing warm and smooth—or tough. She is a real find as a songwriter, too. Her special sympatico with partner Kopana Terry is keen, and it is obvious that a real good time was had in making this record the impressive debut that it is. *Michael Tearson*

Heavy Nova: Robert Palmer
EMI-Manhattan E1-48057, CD.

This is one hell of an album. On *Heavy Nova*, his tenth solo LP and his debut EMI disc, Robert Palmer rocks viciously, croons liltingly, and practices an eclecticism well beyond the reach of most current-day rockers. Inveterate Palmer fans—and they are legion—know that his cool, be-suited veneer belies a passionate, explosive energy. On this album, which he describes as "heavy metal meets bossa nova," the singer lets fly with some of the toughest, tightest sounds to be found on record.

The opener, "Simply Irresistible," blows out all the stops, from the synthesizer notes rocketing between left and right channels to the razor-sharp guitar work and ominous, thunderous drum. This one is big, but it doesn't suffer from overkill. There's subtlety in the brilliant edgings of acoustic piano and in the holes of silence that let you know Palmer and his crew are totally in control. And what a crew! Around his nucleus band—Eddie Martinez, Dony Wynn, Frank Blair, and William Bryant—revolves a small galaxy of musical stars, among them Garth Hudson and Rick Danko (The Band), Dom Um Romao, Clare Fischer, and T-Bone Wolk. Matching the star power of this gathering is some glittering production work by Palmer himself.

More For My Money

I'd always thought you needed big speakers to get good sound. So every couple of years, some department store would have a sale and I would buy the biggest speakers I could find for the money. Then I moved across the country to take a new job. I left my old speakers behind. I was sure they wouldn't fit in my new apartment and I was ready for new ones anyway.

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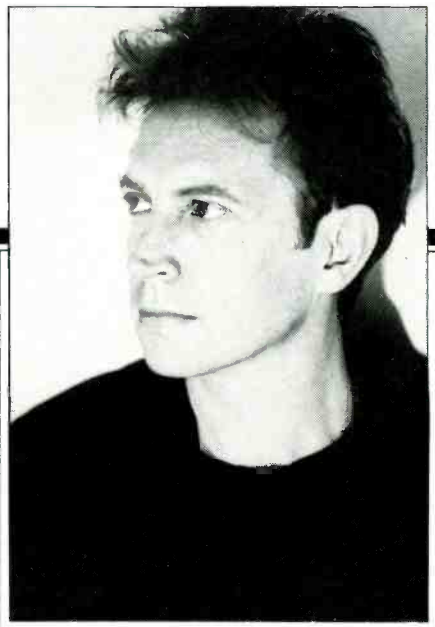
mysterious barricades lies somewhere between rock and a soft place, which should come as no surprise to fans of Andy Summers.



There is a surprising diversity of material included here. In sharp contrast with the all-out rockers is "It Could Happen to You," the old Jimmy Van Heusen/Johnny Burk standard which Palmer croons in a slow, smoky manner that would make Peggy Lee proud. "Change His Ways" is an oddball blend of South African beat, Arcadian guitars, hillbilly accordion, and some honest-to-god authentic yodelling from Palmer. "Between Us" is the singer's homage to the lilting, poetic Brazilian tradition as practiced by one of its masters, Joao Gilberto.

Heavy Nova is a thoroughly remarkable offering. It is exciting, intelligent, sexy, blistering, disturbing, amusing, charming, and altogether brilliant. 'Nuff said. *Paulette Weiss*

Sur La Mer: Moody Blues
Polydor 835 756-1, LP.

Sound: B– Performance: C+

The Moody Blues return in sleeker-than-ever modern dress to face the end of the '80s with *Sur La Mer*. Smartly produced by ace veteran progressive Tony Visconti at his Good Earth Studios in London, the Moodies are instantly recognizable yet up to date. One curiosity is immediately apparent. Flutist Ray Thomas is listed as a group member, although he does not appear at all on the record. Nor does he contribute to the songwriting, all of which is the work of either Justin Hayward, John Lodge, or both.

The album opener, "I Know You're Out There Somewhere," is typical Moody Blues—wistful and wishful—but at 6½ minutes, it goes on too long. The edit for the single, down to 4½ minutes, feels better. Heavily laden with synthesizers and sequencers, "River of Endless Love" has a big oomphy sound that I'm sure fares better on CD than LP. It has a nice sax part by Mel Collins. "No More Lies" is a pretty "let's make up" song that is slower in tempo. Hayward's "Vintage Wine" celebrates the group's glory days of the '60s, when they were already cosmic rockers but not veteran cosmic rockers. It is a wallow, to be sure, but a nice one.

"Miracle" sounds positively dancefloor friendly, a peculiar thing to say about a Moody Blues song, but the song feels peculiar, too. I found it annoying.

Thematically and sonically, the Moodies play it safe on *Sur La Mer*. Their sole (small) risk is in attempting to sound '80s through programmed drums and various synth sounds. It is a solid effort that I suspect will please their fans. The danger is that their familiar sound borders on formula, and that line is often obliterated here.
Michael Tearson

mysterious barricades: Andy Summers
Private Music 2039-2-P, CD.

Sound: A Performance: C

Between rock and a soft place is where you'll find Andy Summers' *mysterious barricades*, and you can forget the "rock," if you have his last Police-like album in mind. Gone are the cleverly crafted pop songs, in favor of New Age atmospherics, on this series of duets with keyboardist David Hentschel.

As New Age, *mysterious barricades* is allied more with the orchestral, Philip Glass-like musings of Robert Fripp and Bill Nelson. Washes of sound and repeating arpeggios float over minimalist chord changes in songs entitled "red balloon," "luna," "emperor's last straw," and "in praise of shadows." Rhythmically speaking, the most interesting tune is the sombre "train song," which is alleviated somewhat with the use of percussion.

The sonics of this CD are fine, although aside from a heavy reliance on digital-delay effects, the sound is placed very close to the speakers, with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I'm Your Man may not be the best Leonard Cohen album ever, but it is a haunting work that's not easily forgotten.

very little use of the spatial potential which could have added dimension to this kind of musical approach. Texturalism has always been Summers' instrumental forte, so this excursion into airiness should come as no surprise to any long-time listeners. And it is no doubt difficult for an artist like Summers to break away from the Police legacy. If you like ethereal background music, you'll find *mysterious barricades* pleasant enough. However, these musical barricades have been broken down too often before to make this album particularly original or noteworthy. *Michael Wright*

I'm Your Man: Leonard Cohen
Columbia CK 44191, CD.

Sound: B Performance: B

People automatically associate Leonard Cohen with depressing songs, "songs to slit your wrist to," as more than one wag has called them. It's a bad rap. Like Byron or Shelley, Leonard Cohen is a romantic of the first order. His songs and poetry delve into intense beauty, often as found in the dark and seedy aspects of life. As a line from his early song "Suzanne" went, he "shows you where to look among the garbage and the flowers." Just because his voice is gruff and the colors of his music dark, does not mean that he is miserably sad or dour.

I'm Your Man is his most aggressively produced album and has the most cosmopolitan sound. This is made clear from the first flush of the crackling energy that propels the opener, "First We Take Manhattan." Any lingering doubts about Cohen's romanticism are swept away by "Ain't No Cure for Love," in which the singer cannot imagine being free of love's grasp. (Incidentally, these two songs first appeared on Jennifer Warnes' extraordinary collection of Cohen songs, *Famous Blue Raincoat*. Jennifer, who has worked with Leonard for over a decade, on records and in concert, lends her wonderful and startling support vocals to five of the eight songs here.)

Exotic instrumental textures have always been a part of Leonard Cohen's art, and *I'm Your Man* is no exception, with John Bilezikjian's oud on "Everybody Knows," Raffi Hakopian's gypsy violin on "Take This Waltz" (a song based on a Federico García Lorca poem), and the nervous percussion and jazz piano solo by Jeff Fisher on "Jazz Police."

A dry, bizarre humor suffuses Cohen's work, most notably in "First We Take Manhattan," "Jazz Police," and best of all, the finale, "Tower of Song." Then there's the black-and-white cover photo of a nattily attired, thoughtful Leonard Cohen, standing in a nearly deserted train station with a half-eaten banana in his hand.

I'm Your Man surely is not the best Leonard Cohen album ever, but it is a haunting work that is not easily put aside or forgotten. *Michael Tearson*

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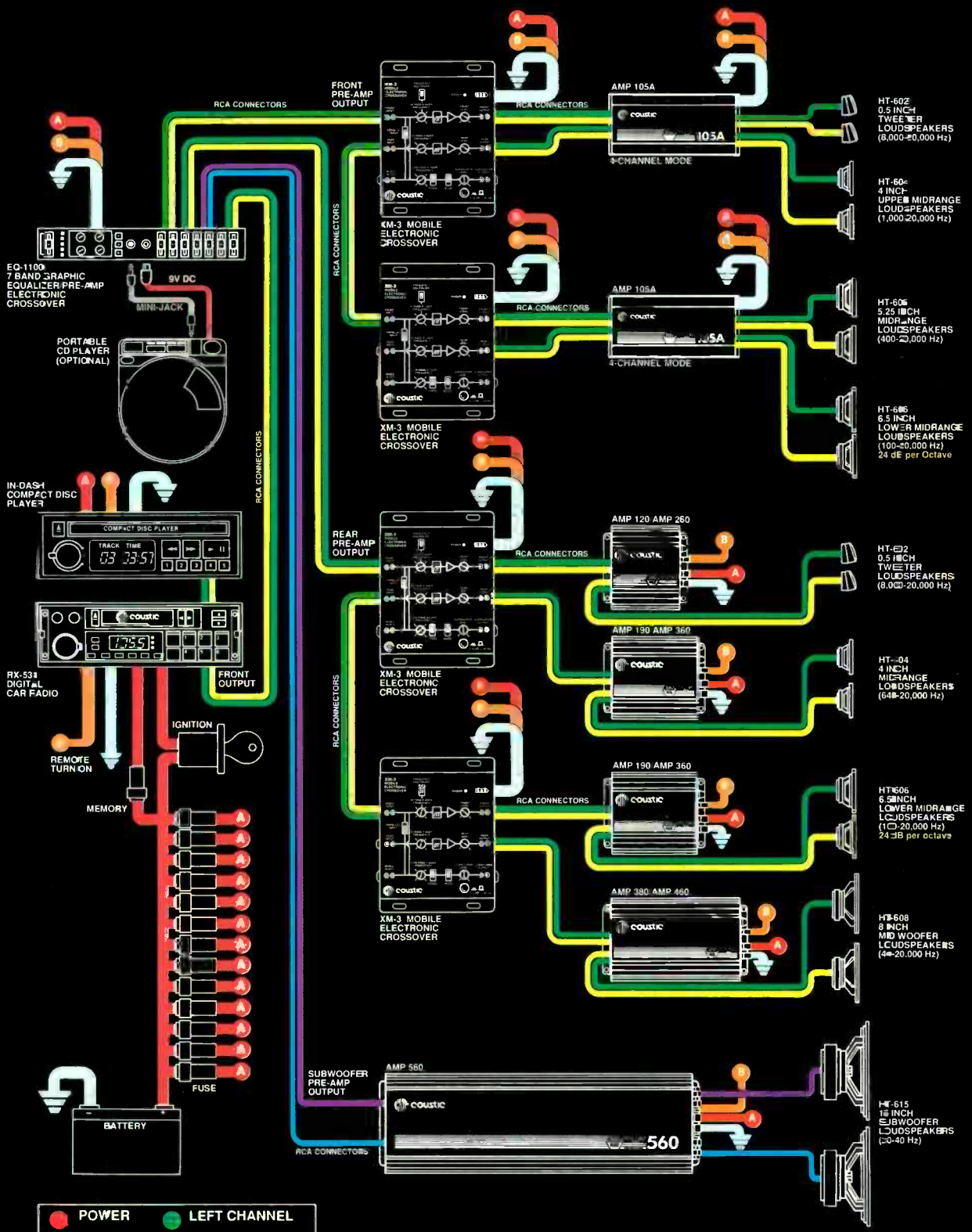

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RENAISSANCE REVELATION

Illustration: Rick Tulka

Gesualdo: Madrigals for Five Voices. Les Arts Florissants; William Christie.
Harmonia Mundi HMC-90.1268, CD.

The Renaissance artist has always, to many an onlooker these three and four centuries later, occupied a spot in the spectrum of temperament that ranges from the blandly pious to the wildly hedonistic. Carlo Gesualdo, Principe di Venosa (circa 1561-1613), quivered rather at the spicy end of the scale. Where some artists had steamy interludes in normal working lives, this unpredictable, ambiguous prince sizzled and flamed all through a ructious 40-odd years. His first wife's unfaithfulness with a highly placed duke—the lady had discernment, at least!—led him to take out a murder contract on her. It was fulfilled in 1590, in the best of Neapolitan manners. Turnabout was fair enough for Gesualdo, evidently, because his second nuptial attempt did not keep the man from sowing his own oats in noble and ignoble places. So much so, in fact, that his wife's family, nobles all and noble-minded, wanted to free her of him. When she confessed to a lingering fondness for her wayward spouse, though, they relented. She even wrote copiously of her sorrow at his death . . . it seems things got a bit dull without his tempestuous presence.

And *so much* of this is mirrored in the music! In an age that specialized in tailoring melody and harmony to every hue, shade, sentiment, and passion of splendid texts, Gesualdo, an uncommonly versatile connoisseur of classical and contemporary arts and literature, excelled. At a time that saw drama from poetry and the feverishly active court intrigues from Venice to far-off Naples, this composer simply seethed with a passion that imbues his music. A fair amount of which survives intact, thank heavens—with fire, contrast, oxymoronic juxtaposition of opposing images for maximum rhetorical effect, and an expressivity that defeats analysis. Gesualdo's flesh-and-blood life imposed severe strains on the social and familial fabric that cloaked his aristocratic (and therefore quite visible) career. Small wonder, then, that the music he left, so viscerally alive and straining at the bounds of systematic composition, should prove a cloth too challenging for many of today's fine performers.

No such disappointment, though, comes from a first encounter with the five-part *madrigali* on this 55-minute Harmonia Mundi CD. William Christie's group comprises seven vocalists and three accompanying instrumentalists (on lute, Renaissance harp, and lyrone, a smallish bass viol with sympathetic strings *alla* viola d'amore). Their rendering of Gesualdo's work is of stunning ensemble, with impressive warmth and sympathy for this challenging musical fare. They often unleash vibrato as an expressive device, which might have some straight-tone enthusiasts writhing but is, in this headlong, love-besotted, death-enchanted assemblage of 17 madrigals, sheer magic. It is really pointless to single out any one of the performances for attention. As a traversal of Gesualdo's astonishing art—yes, astonishing even to our jaded ears—this album by Les Arts Florissants is a stunner.

The sound capture is by the inimitable Jean-Francois Pontefract, who unfortunately left HM France earlier this year. He is the man whose extraordinarily consistent and transparent recordings have made Harmonia Mundi's catalog such a treasure house for the music-loving audiophile. The sound is open, full, vivid, and superimposed on a somewhat unreverberant, uncolored acoustic that is a good deal less resonant than in most HM albums. However, there is no sense of the claustrophobic closeness that too-small spaces impart to any acoustic music. Superb annotation accompanies the full texts of the madrigals in French, English, German, and Italian.

A final note: If you are already tired of the white, pure sound of the Tallis Scholars, you will discover that, indeed, there *are* vocal groups breathing irresistible life into Renaissance music. This Arts Florissants CD will be a revelation. *Christopher Greenleaf*

Mozart: Symphonies Nos. 25, 28, and 29. Prague Chamber Orchestra, Sir Charles Mackerras.
Telarc CD-80165, CD.

Mozart: Symphonies Nos. 40 and 41 ("Jupiter"). Prague Chamber Orchestra, Sir Charles Mackerras.
Telarc CD-80139, CD.

Telarc has chosen an ideal group of performers from Mozart's favorite city, Prague (where he won his only real "rave reviews"), to make these record-

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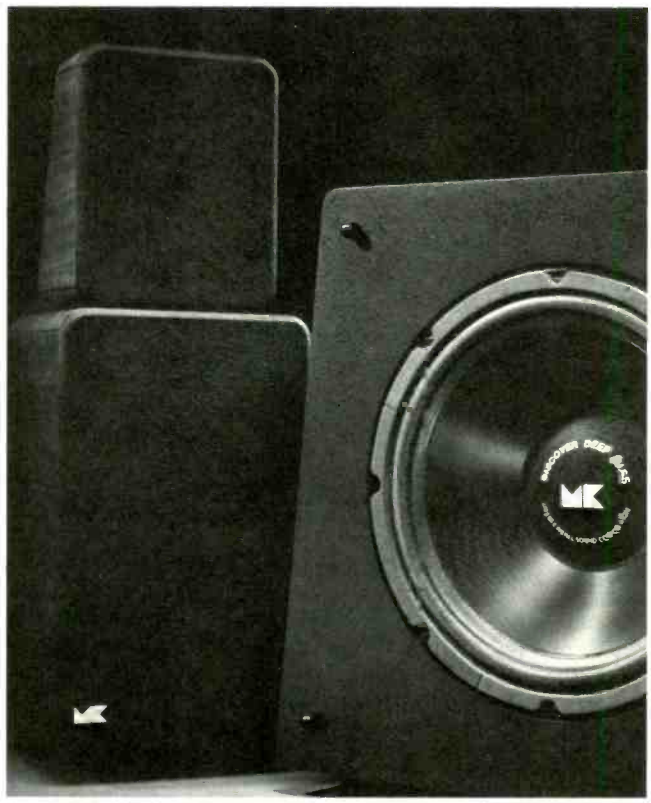

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Sir Charles Mackerras is persuasive and works hard in his Mozart restylings, but much is lost in the monotonous, rigid tempi.

ings. Prague is a city in which, despite recent politics, the central tradition of European music continues at a very high level. But the Telarc choice of conductor is, for my ears, unfortunate.

It is not the very fast tempi, the reasoning for which is given succinctly in the booklet of notes. The music probably *was* done fast, and a whole lot faster than the ponderous big-symphony versions of the earliest electrical recordings (and the then-current "live" performances). This may shock some ears still, though we have already speeded most of the classic repertory toward a less heavily Romantic bias. What bothers me throughout these five works is a remarkable rigidity of tempo, straight through like a machine, with never the slightest "give" for moments of special import and expressiveness—even for beginnings and endings of major sections. I hate to say so, but this starts to sound like pop music or, rather, the "beautiful music" of a thousand background stations. (Perhaps it *was* that way—performance at some sort of "Casino" was a possible motive in the composition!)

Sir Charles would seem to be very persuasive and hard working in these restylings. But those who know how such works are made—how there are indeed extraordinary moments of tension, of transition, of return to an opening theme—will hear these lost in the monotonous and rigid tempi. Whatever the style, there has to be *some* give, some sort of recognition for these moments.

On the other hand, it is simply impossible to force these Prague players into any sort of hard performance. They play warmly and beautifully as well as with remarkable accuracy. No single phrase is just *played*; all are shaped, melodious, and fluent. That redeems the recordings, decidedly.

Still, at times, I am reminded of those electronic language speeder-uppers that hasten the spoken word without changing its contours.

Edward Tatnall Canby

Nielsen: Symphony No. 5. Swedish Radio Symphony Orchestra, Esa-Pekka Salonen.
CBS MK-44547, CD.

Esa-Pekka Salonen continues his traversal of the Carl Nielsen symphonies with this brilliant, propulsive, and insightful performance of the Fifth Symphony, surely the most satisfying recording since the legendary Leonard Bernstein LP in the late '60s.

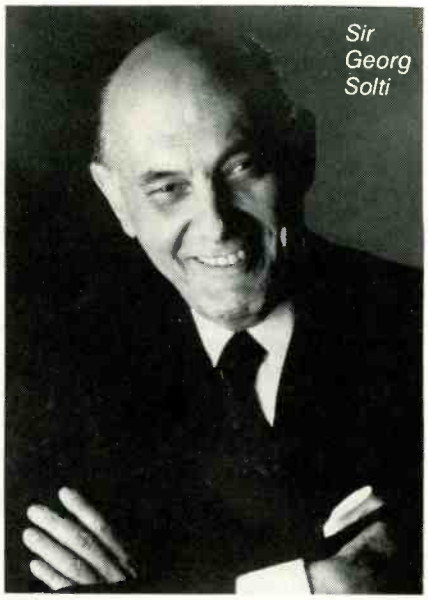
Those not familiar with Nielsen's Fifth Symphony may find the jagged complexities of much of his scoring a little intimidating, but this orchestral tour de force is endlessly fascinating. In fact, the liner notes tell of a 1924 Stockholm performance conducted by Nielsen at which concert-goers staged a near riot (reminiscent of the infamous riot in Paris at the 1913 première of Stravinsky's "Rite of Spring"). In Stockholm, the audience fled the hall, "appalled by the ostinato clarinet, insistent snare drum, and cacophonous effects of the first movement."

Esa-Pekka Salonen

Salonen gets inspired playing from the Swedish Radio Symphony Orchestra, and he provides a finely detailed, yet cohesive view of the very convoluted orchestration. A worthwhile filler on this CD are some excerpts from Nielsen's opera, "Masquerade."

The sound is superb, with great presence and dynamics, and a most natural perspective, affording great front-to-back depth in the spacious acoustics of Stockholm's Berwald Hall.

Bert Whyte



Sir Georg Solti

Bartók: Sonata for Two Pianos & Percussion. Murray Perahia and Sir Georg Solti, pianos; David Corkhill and Evelyn Glennie, percussion.
CBS MK-42625, CD.

At first glance, it might seem odd to pair young piano virtuoso Murray Perahia with 75-year-old Sir Georg Solti, the celebrated conductor of the Chicago Symphony Orchestra, in Bartók's demanding "Sonata for Two Pianos & Percussion." The complex scoring of this work, with its intricate rhythmic permutations, requires the two pianists to be absolutely precise in synchronizing their instruments, while at the same time integrating their playing with the percussion.

Sir Georg, with his Hungarian origin, has always provided splendid performances of countryman Béla Bartók's

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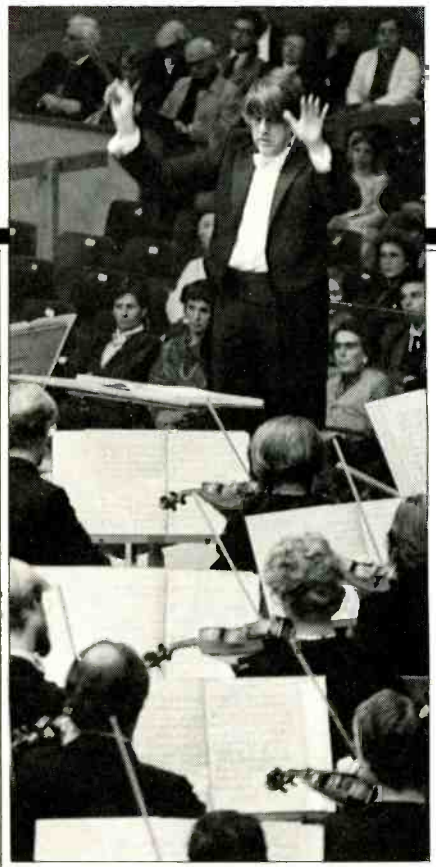
On the most ingratiating of Ravel's works, conductor Armin Jordan has elicited sympathetic accompaniments from the orchestra.



music. Although he rarely steps outside his conductorial role, this recording showcases him as a performer, in a venture that is obviously a labor of love. Listening to this superlative recording allays any fears that Sir Georg might not have been able to keep pace with the formidable talents of Perahia. In fact, Sir Georg and Perahia perfectly complement each other, both displaying the sure, clean touch, good articulation, and precise timing so essential in this work. Their performance is exciting and propulsive, with very broad dynamic expression. The gifted percussionists, David Corkhill and Evelyn Glennie, provide a wholly integrated accompaniment, and their precision is exemplary.

This CD was recorded in the Maltings in Snape, England, a venue often used by London/Decca for taping the music of Benjamin Britten. The hall is of fairly modest size and is used for smaller-scaled works. Tony Faulkner, a top-flight British recording engineer who is a staunch advocate of simple, purist microphone techniques, has given us a stunning sound. The pianos and percussion are perfectly placed in the hall, providing a magical blend of high instrumental definition wrapped in a lovely, warm ambience. The transient attack of both pianos and percussion is utterly clean and instantaneous, with the punctuations of the xylophone positively explosive!

In the filler work, Brahms' "Variation on a Theme by Haydn for Two Pianos," the performance of Perahia and Solti is equally compelling. The sound of the pianos is richly resonant, very full, and wonderfully projected—one of the most realistic I have heard on a recording. This disc is highly recommended.

Bert Whyte

Ravel: Two Concertos. Suisse Romande Orchestre, Armin Jordan; François-René Duchable, piano; Rachael Yakar, soprano.
Erato ECD-75323, CD.

If you have a penchant for the music of Ravel, you will delight in this generous 66-minute CD of some of his most ingratiating works. The great "Concerto in D Major for Piano (left hand) and Orchestra" is coupled with the effervescent "Concerto in G Major for Piano and Orchestra," the dazzling "Tzigane," and the lovely vocal/orchestral poems of "Shéhérazade."

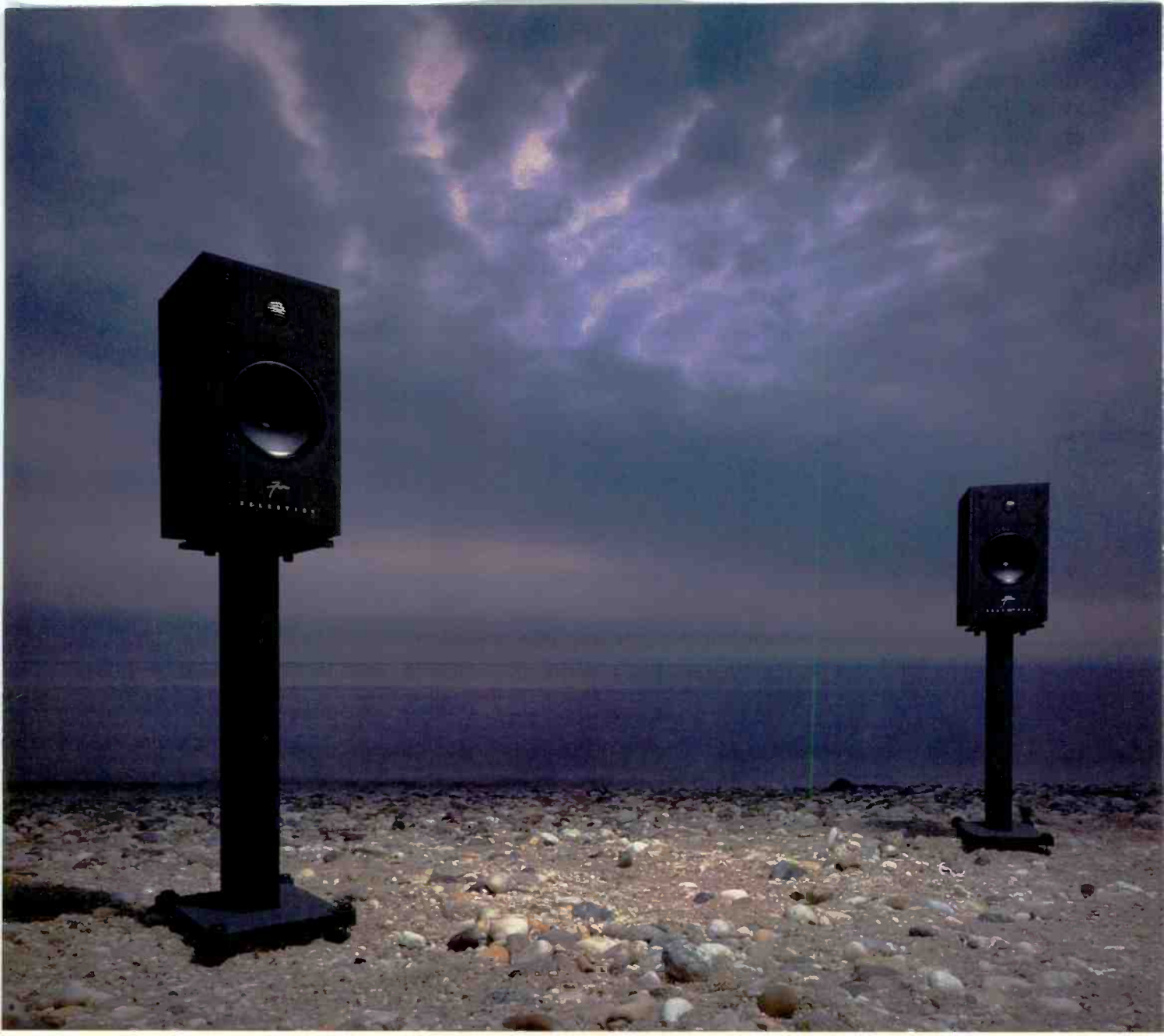
Pianist Francois-Rene Duchable provides a powerful and evocative account of the piano concertos, while violinist Pierre Amoyal displays his virtuosity in the florid complexities of "Tzigane." Soprano Rachael Yakar has an exceptionally clean, pure tone, and her lovely, poignant performance of "Shehérazade" is quite memorable. Conductor Armin Jordan has elicited well-played and sympathetic accompaniments from the Suisse Romande Orchestre. This disc was recorded in the felicitous acoustics of Victoria Hall in Geneva, the venue frequently used by London/Decca for many of their wonderful Ernest Ansermet/Suisse Romande recordings. Here, the balances between piano, violin, and voice are in fine musical perspective, and the sound is clean and well defined, with expressive dynamics.

Bert Whyte

Charles Ives: Piano Sonata No. 2. Herbert Henck, piano.
Wergo WER 60080-50, CD. (Available from Harmonia Mundi, 3364 South Robertson Blvd., Los Angeles, Cal. 90034.)

Sound: B– Performance: B+

A glance at the Schwann catalog shows Herbert Henck to be something of a specialist in the piano music of



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Ives' Piano Sonata No. 2 is full of schizophrenic juxtapositions of moods and idioms, but pianist Henck stays easily apace.

Charles Ives. A refreshing observation, when viewed from historical perspective, since Henck and Wergo both hail from Germany. Would that more of our native composers were recognized internationally.

In his very detailed liner note, the pianist explains that "Piano Sonata No. 2, Concord, Mass., 1840-1860" is subtitled for the place and time that the Transcendentalist movement reached its height. The figures for whom the four sonata movements are named—Emerson, Hawthorne, the Alcotts, and Thoreau—were, according to Henck, leaders of the Transcendentalist school of thought. Henck argues that the Sonata was derived from the ideals of Transcendentalism that Ives espoused.

Certainly it was inspired by the New England town of Concord and by the four American writer/philosopher/poets who lived and worked in its environs: The thorny "Emerson," the fantastic "Hawthorne," the home-and-hearth "Alcotts," the mystical "Thoreau." Each movement is distinctive yet connected through recurring motifs, the most prevalent of which is the opening four notes of Beethoven's Fifth Symphony.

Ives' schizophrenic juxtapositions of moods and idioms run rampant throughout, and Henck stays apace with little trouble. Originally thought of as an orchestral piece, the first movement's compressed textures are dense, its engulfing sweep often wild. But there are also moments of quiet resolution and, in Henck's capable hands, even tenderness.

"Hawthorne" is a scherzo that can grow as wild as its predecessor, but with a lighter touch. The vernacular is most easily discernible here, as hymns, marches, and ragtime syncopations wander through as if on their way home from a previous engagement. Henck's skillfully placed upper-register tone clusters suggest a higher, perhaps even a spiritual, plane of commentary.

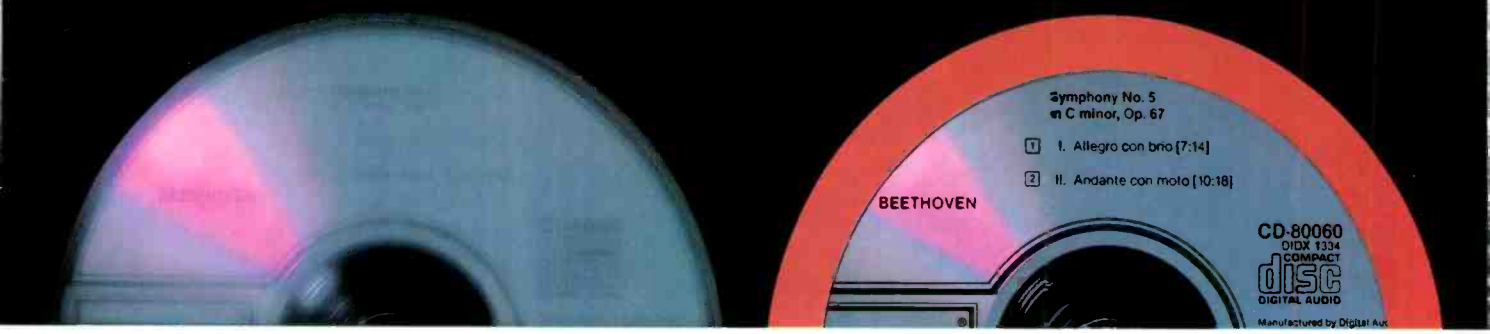
"The Alcotts" provides a welcome respite from all this activity. Henck does much to bring out the movement's religious and therapeutic beauty but falls short of bringing it home to a warm, New England hearth, the virtual symbol of its namesake. The piano, which sounds slightly the worse for wear in "Hawthorne," is, in this movement, noticeably in need of tuning.

The mysticism of "Thoreau" links it most directly with the spirit of Transcendentalism, though its contemplative, inner calm is occasionally threatened by fleet fits of nervous energy.

The recorded sound is fine, if occasionally shallow: Henck's capable interpretations do not sound as expansive in the lower registers, nor as crisp in the upper, as they might. Still, this documentation of a contemporary masterwork is well worth owning.

Susan Elliott

Are you hearing only 4/5ths of Beethoven's Fifth?



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Photograph: Adrian Boot

Destiny's Song + The Image of Pursuance: Courtney Pine
Antilles/New Directions 90697-2, CD.

Sound: B+ Performance: A–

Radical shifts in music used to be the stuff of controversy in jazz, things like the be-bop revolution reacting to swing, free jazz reacting to the strictures of be-bop, fusion reacting to the influx of rock. This was what controversy used to be about—movements that unseated the established order of jazz, with musicians like Charlie Parker, Cecil Taylor, Ornette Coleman, and Miles Davis forcing listeners to redefine their criteria.

But in the tepid '80s, controversy has taken the form of Wynton Marsalis' rerun of the bop traditions and the Blue Note standards, and now Courtney Pine's recharging of energy music. Pine, who was only 23 when he recorded this album, is a British saxophonist who has been likened to John Coltrane and Wayne Shorter. These comparisons have been a double-edged sword, however, praising his abilities and sources on one hand and labelling him a clone on the other.

Certainly the Coltrane reference is apt. From the opening solo tenor notes of "Beyond the Thought of My Last Reckoning," you're taken back to *A Love Supreme* and *Live at the Village Vanguard*, two of Coltrane's epochal recordings. Pine sings out with the same muscular authority and focused passion. His solos have a determined thrust. No matter how many twists and turns they take, Pine is always moving full-throttle toward his destination with single-minded purpose. *Destiny's Song* is only Pine's second solo recording, but already he's laying the foundation for the future.

"Guardian of the Flame" is a spinning, tumbling foray, with Pine and drummer Mark Mondesir heading pell-mell into uncharted sonic tunnels. On "Prismic Omnipotence" he slices sideways and back, like an avenging angel tumbling scales in a tenor squall. Mondesir is clearly Pine's alter ego, playing the Elvin Jones to his John Coltrane, stoking a burning furnace of rhythm. But Pine isn't all storm and fury. He courageously takes on Thelonious Monk's "'Round Midnight" completely solo. And his soprano sound, unlike Coltrane's eastern whine, is sweet and lyrical on "The Vision."

The album was produced by yet another Marsalis, Delfeayo Marsalis, and the sound is direct and uncluttered, although perhaps a bit too heavy on the reverb. Pine's placement, hard left in the stereo mix, is a suspect technique. If the intent was to make this more an ensemble record than a star vehicle, it failed. Pine is just too overpowering, and pianist Julian Joseph, in particular, never really keeps up. His solo on "Prismic Omnipotence" is simply obliterated by the echo of Pine's previous dervish whirl.

Yes, Courtney Pine does harken back to Coltrane, but with the sanitized saxes of Kenny G, Kirk Whalum, and Najee, invoking the spirit of Coltrane doesn't sound like such a bad idea—especially when that invocation includes the passion and individuality that Pine brings to his music. Pine is a musician engaged in an adventurous search, and so far it's pretty exciting.

John Diliberto

Across the Tracks: B. B. King
Ace CHD 230, LP. (Available from Roundup Records, P.O. Box 154, North Cambridge, Mass. 02140.)

Sound: A– Performance: A

A number of European record companies have been mining the vaults of American blues and R&B labels, bringing to the public a treasure trove of long-forgotten classics. Hence, England's Ace gives us *Across the Tracks*, a compilation of alternative and previously unreleased songs that B. B. King recorded during the 1950s.

Frank Driggs Collection

Frank Driggs Collection

The first thing that you'll encounter is the perennial B. B. conundrum: Is he "King" because he knows how to wring distilled blues from those short, soulful note clusters on his guitar? Or is it because of those vocals which squeeze and extend phrase ends into the sweetest blues feeling?

B. B.'s economical guitar style is simply everywhere here, like brief bursts from an Uzi. For classic licks, check out "Bad Luck," the nifty double stopping on "Everyday (I Have the Blues)," the trills and turns on "Jump with You Baby," and the instrumental jam "Talkin' the Blues."

B. B.'s vocals have this remarkable quality of writhing from a smooth, almost nasal tenor into a mellow croon, down in the diaphragm. Listen to it at work on "Let's Do the Boogie," "Troubles, Troubles, Troubles," and "Confessin' the Blues."

If you've ever heard any of these cuts before, it was probably on bootlegs or noisy collections dubbed from discs. This digital remaster, made from the original mono masters, sounds as clean as if it had been recorded yesterday. At times, the presence of the mix sounds a bit primitive, but then, it was that way originally.

Across the Tracks provides an insightful glimpse of a young B. B. King making his reputation 10 years before both his voice and guitar would thicken and mature into true blues royalty. This is one compilation you won't want to miss. *Michael Wright*

The Complete Verve Recordings of the Buddy DeFranco Quartet/Quintet with Sonny Clark
Mosaic MR5-117, LP.

Sound: A– Performance: A

This is another of Mosaic's superbly remastered and packaged jazz boxes, and one which I think discerning listeners may very well want to add to their collections. Buddy DeFranco's 1954 and '55 Verve dates are a tribute, not only to the musicians who made them (masters all) but also to Norman Granz, whose output in those years was of a consistently high order.

Besides DeFranco's clarinet—an instrument on which, in his chosen contemporary style of playing, he is practically without peer—there is the infrequently heard or mentioned Sonny Clark on both piano and organ, and the master guitarist Tal Farlow. All three are ignited by the fine bassist Gene Wright and the excellent drumming of Bobby White.

On the up-tempo numbers, DeFranco shines as one would expect. The surprise is how well he plays ballads, not overburdening the listener by filling in every bar and phrase with showers of notes, as all too many boppers were prone to do. He has an unusually warm and full sound for a musician who could and did play so often. As Ira Gitler's very good liner notes point out, there are many fine examples of his ballad work throughout the set. These cuts wash away all claims by detractors who insisted that DeFranco was a cold, mechanical player.

As good a guitarist as Tal Farlow is and was, at that stage in his career he was still inclined to play too much, and it shows on the ballads. Sonny Clark is fluid and fluent throughout; the man knew music very well indeed. I especially like his organ work—it reminds me of the warm and evocative old radio soap-opera sound, and it swings in Clark's hands. A very good buy all around. *Frank Driggs*

In the Great Abbey of Clement VI: Stuart Dempster
New Albion NA-013, CD. (Available from New Albion Records, 584 Castro St., #463, San Francisco, Cal. 94114.)

Anyone who has an interest in hall ambience and the art of recording the sound of a room will find this disc a fascinating experience. First of all, just to allay fears about still another avant-garde brass recording from the "bloop-splat" school, be assured that this disc represents a totally different style. Yes, this is New Music that is actually pleasant to hear! Recorded in the Great Abbey of Pope Clement VI in Avignon, France, Stuart Dempster's trombone improvisations are in the tradition of Paul Horn's flute solos in the Taj Mahal and other places. Dempster uses the long reverb time and the natural resonance frequencies of the hall to create truly gorgeous harmonies from a solo performance. All three works on this disc are slow-paced and meditative in style. Nonetheless, they include some daringly imaginative—and unexpected—sonic effects.

Though the three pieces are similar in sound, each has a distinct character. "Standing Waves—1976" is a fairly straightforward solo trombone improvisation inside the stone-walled Abbey. It starts out sounding the way you would expect, with overlapping notes generating exquisitely beautiful chords. Dempster begins slowly (the first note lasts 14 seconds) and builds his effects with unusual skill. His har-

Photograph: Philip Amdal

Stuart Dempster's sound has the elusive qualities long absent from modern music: It makes sense and is pleasing to the ear.

monies hang in midair like clouds, and if you listen carefully, you can hear the subtle changes in timbre as reflected waves cross, and recross, each other. But, as the piece becomes more complex, he begins to use avant-garde playing techniques to create more complicated effects. About halfway through, the piece begins to sound like the songs of the humpback whales; in Dempster's words, "It almost sounds like crickets." But, whatever they seem to be, the sounds are astonishingly beautiful.

In the second improvisation, "Didjeridervish," Dempster plays the Australian aborigine instrument, the *didjeridu*, inside the Abbey. Since he conceived this piece for a dance performance related to the whirling dervishes of Turkey, he often rotates as he plays the *didjeridu*, creating resonances in the Abbey that change with his position. The sonic palette is quite different from the other two pieces—but no less fascinating. (Listen to this track through headphones as well, to get the full effect of the moving sound source.)

For the final improvisation, "Standing Waves—78/87," Dempster returns to the trombone and adds modern digital audio technology. He plays in what he calls an "enhanced concert hall," using previously taped quadraphonic material as accompaniment. His live sound is processed through a digital reverb unit to match the 40-second digital reverb time on the tape. Then, the entire performance is recorded in stereo. The resulting music has an incredible warmth and richness, enhanced by the complex, multi-layered interactions of the various sounds.

Stuart Dempster's music has those elusive characteristics which have been missing in modern music for so long: It makes sense, and it's pleasing to the ear. For anyone interested in the beauty of musical sounds and the problems of capturing the ambience of a concert hall, this disc will provide some fascinating listening experiences.

Steve Birchall

The Peace Album: Paul Horn
Kuckuck 11083-2, CD. (Available from Celestial Harmonies, 4549 East Fort Lowell, Tucson, Ariz. 85712.)

Sound: C+ Performance: A

A GRP Christmas Collection: Various Artists
GRP GRD-9574, CD.

Sound: A Performance: C–

Not since Handel's "Messiah" has Christmas been a vehicle for art. For the most part, Christmas albums have been the province of middle-of-the-road pop, a tradition left over from the '50s. It's always been appropriated by the soporific choruses of *Ray Conniff's Christmas Album* or Robert Goulet getting emotional on *Robert Goulet's Wonderful World of Christmas*, both of which have been reissued on Columbia CDs for connoisseurs of schlock.

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Paul Horn has elevated standard holiday fare to an art, imbuing it with serenity and, yes, even with peace.

But in the '80s, we are seeing a small Christmas renaissance that is linked to New Age music. Windham Hill released *A Winter Solstice*, and with New Age synchronicity, the Narada label brought out David Lanz and Michael Jones' *Solstice*, with overextended, George Winston-like workouts on familiar themes. Two new albums, *The Peace Album* and *A GRP Christmas Collection*, highlight the best and worst of this type of holiday music.

Paul Horn is a noted flutist and experimenter whose music ranges from avant-garde jazz to be-bop and from Indian ragas to solo meditations. With *The Peace Album*, he has created one of the most delightfully serene Christmas recordings ever made. Here we have a Compact Disc which truly speaks to the timelessness that the holiday season evokes.

Drawing on such sources as Gregorian chants and classical music from the 16th to 18th centuries, he starts out ahead of most Christmas albums which borrow from MOR pop. But great sources alone don't make music as transcendent as *The Peace Album*. It's a solo recording but contains many voices, as Horn multi-tracks his soprano, alto, and bass flutes. He also multiplies their lines by using a Conn Multi-Divider, an instrument that splits a tone into numerous parallel notes.

Horn uses these techniques to create soaring flute choirs, symmetrical counterpoints, and haunting refrains. He takes "Good King Wenceslas," a 16th century melody, out of the supermarkets and turns it into a piece of caressing undulations and enfolding curves. "Angels We Have Heard on High" glides and spins in canon form before Horn alights from the display to play the melody on soprano flute. He single-handedly liberates Bach's "Air," Handel's "Joy to the World," "The Lord's Prayer," and "Silent Night" from their oversentimentalized modern incarnations, orchestrating them into the quiet songs of peace they were meant to be. *The Peace Album* uncovers the inner spaces of Christmas.

Horn has done a stunning job of arranging and orchestrating his flutes, although the recording falls short. There's a gentle background hum, possibly from the Conn Multi-Divider, and tape hiss seems excessive for a recording made on 16 tracks with dbx noise reduction and mastered to digital 2-track. But that still leaves *The Peace Album* as a new holiday record worth buying in 1988.

Of course, others are available. One of them, *A GRP Christmas Collection*, avoids the technical flaws of *Peace* but has none of its soul. GRP has taken their roster of artists and given us the kind of music that fills shopping malls after Thanksgiving. This CD wouldn't be out of place there at all.

For most of the artists, doing Christmas music means jazzing up the pop Christmas standards. So David Benoit

Peace Pipes is filled with sonic imagination, musical inventiveness, and a sound that is strikingly fresh.

vamps on the modal modulations of "Carol of the Bells," Chick Corea's Elektric Band lays a string of rote solos across a heavy-handed fusion stomp of "God Rest Ye Merry Gentlemen," and Gary Burton be-bops on "O Tannenbaum" like some sort of hep-cat beatnik parody.

There are some mild pleasures. Vocalist Diane Schuur is surprisingly restrained on "The Christmas Song." Lee Ritenour does a tasteful arrangement of "White Christmas," with his acoustic guitar triggering MIDI ghost choruses. And Special EFX applies an Arabic feel to "Silent Night" with George Jinda's trance-like percussion underpinning Chieli Minucci's snaky, sustained guitar line.

But overall, *A GRP Christmas Collection* taps into the most banal, oversentimentalized vision of Christmas. It belongs next to the plastic Santa Claus with the blinking nose, while Paul Horn's *The Peace Album* is a record we'll be listening to years from now.

John Diliberto

Peace Pipes: Arco Iris
Passport Jazz PJCD88037, CD.

Beneath its surface veneer of delightful and unusual sounds, *Peace Pipes* is filled with musical inventiveness and sonic imagination. The group, called Arco Iris, derives its music and style from a wide variety of sources, principally South American. The result is a flexible, expressive jazz with Incan inflections. *Peace Pipes* features a variety of South American flute-like instruments—a refreshing change from the expected array of exotic percussion. They use all the *guiros*, drums, and rattles, but as background to the flutes. Synthesizers, too, are less prominent than is common these days. All of this makes the sound of *Peace Pipes* strikingly fresh.

The album also makes effective use of the recording medium. Producer Ara Tokatlian showcases the subtle colors of the unusual instruments with great skill. For the flutes, which she also plays, she often "zooms in" to make new effects. Sometimes she brings out the "breathiness" of a flute, magnifying it in a magical way. At other times, she uses the straight tone of an exotic flute, focusing on its special timbre. She also seems to have a keen ear for ambient effects, carefully creating artificial realities for different pieces. Sometimes, the main group seems to play in a normal acoustic space, while the solo flute plays in a much different ambience that brings out its special qualities. All of these effects make good musical sense and avoid falling into mere studio gimmickry. Overall, the sound quality has a wonderful transparency without a trace of distortion, even on cymbals or bells. *Peace Pipes* is a thoroughly delightful album, and I look forward to hearing more from Arco Iris.

Steve Birchall

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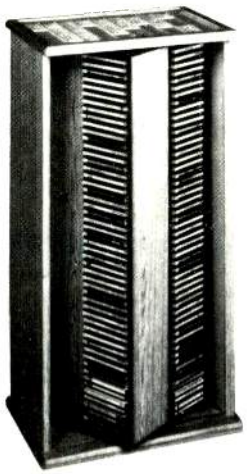

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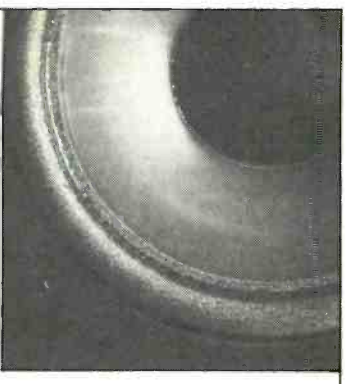

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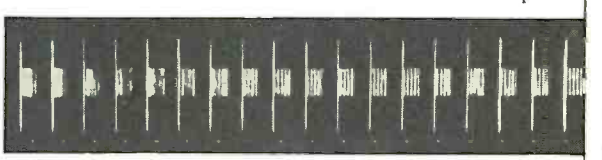

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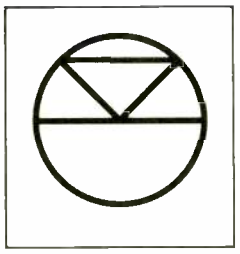

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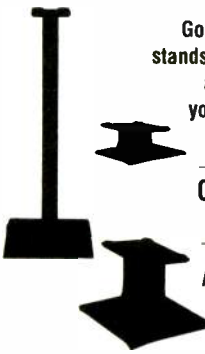

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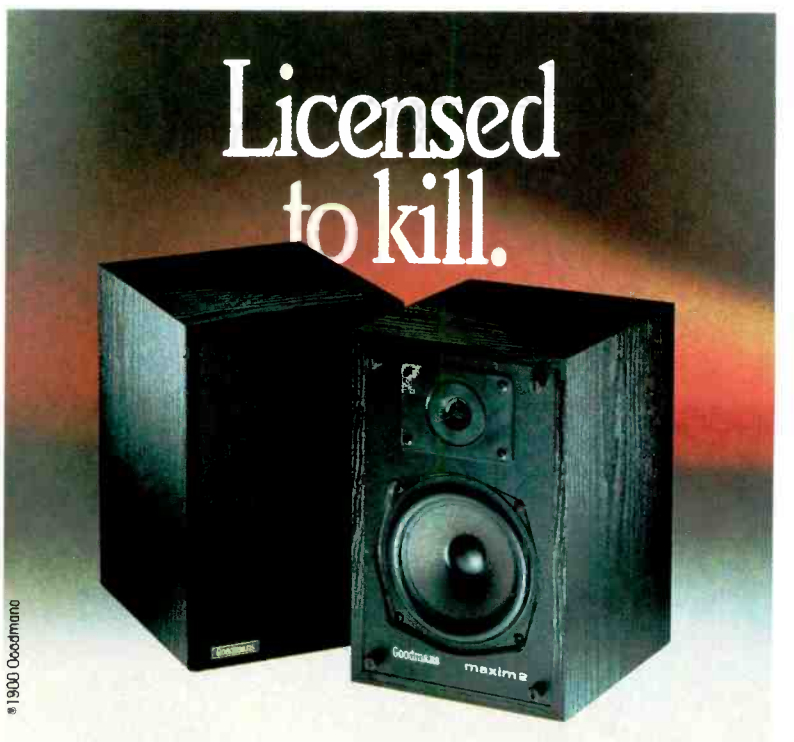

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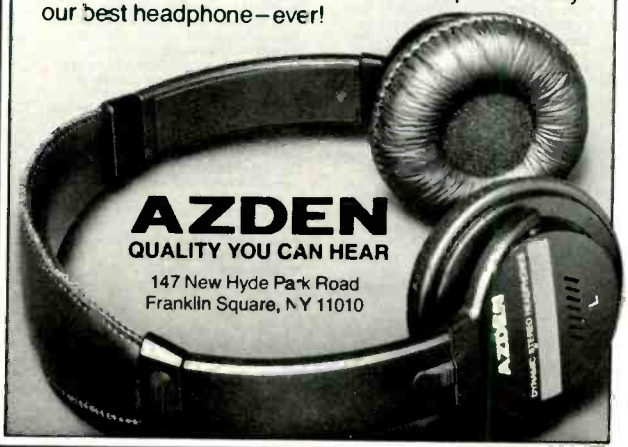

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