Audio

JANUARY 1985 • $2.00

JOHN HAMMOND
FIVE DECADES IN MUSIC

STREETS MODEL 950 BASIC POWER AMP
RELIABLE EXCELLENCE

TESTED:

/20 EQUALIZER
E TO COMPLETE
MATION

ER SX-V90 RECEIVER
O-VIDEO MARRIAGE
TIGHTER

Mitsubishi Brings New Meaning To The Term Stereo Separation.

What separates the Mitsubishi E-404 from conventional systems isn't the fact that it includes a digital audio disc player, or a linear-tracking programmable turntable, or a dual-transport cassette recorder, or, for that matter, a digitally-synthesized tuner/receiver with graphic equalizer.

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You can even arrange to have a program of up to 9 selections recorded on a blank cassette, each cut evenly spaced for professional sounding results.

A MEANINGFUL DIALOGUE.

Though the possibilities presented by the E-404 may at first seem overwhelming, its operation is, in fact, quite simple.

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HEARING IS BELIEVING.

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The E-404 is designed to interface with a personal computer. It even offers a self-test program that lets you know if every function is performing properly.

The AM/FM stereo receiver, delivering 35 watts minimum RMS per channel,* offers auto search with 18 station presets.

The compact disc player employs a three-beam optical pickup (in place of the conventional single beam) ensuring stable, error-free tracking.

Its speakers are three-way bookshelf type capable of frequency response from 40 to 25,000 Hz.

The E-404's twin cassette decks feature Dolby® B noise reduction with logic-controlled transport and cassette-to-cassette dubbing at double speed.

With its completeness and full programmability, you can guess the price of the Mitsubishi E-404 audio system. Or you can visit your Mitsubishi audio dealer.

And be very pleasantly surprised.

MITSUBISHI

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AUDIOCLINIC

JOSEPH GIOVANELLI

Letter Writing

I try to reply to every "Audioclinic" letter—yes, even those which do not find their way into this column.

Unfortunately, however, some letters never get answered. Not counting possible loss in the mail, the major reason is that their authors do not enclose stamped, self-addressed envelopes as requested in each column. And there are many letter writers who are in such a rush to pen their thoughts to paper that they never put their return addresses on their letters. Had they sent the return envelope, properly filled out, I would at least have a way of tracking their addresses down.

Even if the envelope does have a return address, it is better to put your address on the letter itself. The volume of my mail is quite heavy. If an envelope strays away from a letter, I may fail to answer the letter or may waste precious time in attempting to head off such disasters.

These simple precautions will enable me to serve you better.—*J.G.*

Litz Wire and Amp Shut-Down

Q. Many loudspeaker cable manufacturers use one variation or another of something known as "Litz" wire. What is it? I understand that this wire has low d.c. resistance, and I have been told that, because of this low resistance, the amplifier with which it is associated will shut down. Any comments on this?—Carlos Estrada, Jr., Tampa, Fla.

A. Litz wire is stranded wire, with each strand in the bundle insulated from every other strand. This wire has been used for years in such items as high-quality loop antennas and i.f. transformers. Losses caused by "skin effect" are kept low in these r.f. applications.

As designed for loudspeaker cables, Litz wire has low d.c. resistance. That low resistance cannot shut an amplifier down, unless its two conductors are shorted together. However, many premium speaker cables, probably including some Litz types, have high capacitance, and this can shut some amplifiers down—permanently, in a few cases.

Such occurrences are rare and probably becoming rarer as amplifier and cable designers have grown aware of the problem. But it still would make some sense to find out the cable's capacitance; check with your amplifier's manufacturer about it, unless you know someone who already uses that amplifier/cable combination successfully.

Center-Tuning Meter Problem

Q. The test equipment I have on hand consists of a Radio Shack FET VOM and an Eico Model 482 20-MHz oscilloscope. My receiver is not in warranty. Its center-tuning meter does not work; it remains centered as I tune across the dial. At one time this was an intermittent problem, but now the meter never operates. The receiver works fine in all other respects. Can I make repairs, given the equipment I have on hand, or do I need more elaborate equipment?—J. D. Williams, Jr., Waycross, Ga.

A. The first thing to look at in a case like yours is the meter itself. The next component to examine is the IC driving it. Because the problem was at first intermittent, you should initially check solder connections of all components and wires related to this circuit.

Meter circuits of this type operate as follows: The detector, when a station is properly tuned, will produce 0 V. If a station is mistuned, the detector will produce a d.c. voltage having some given polarity. If the station is mistuned to the opposite side of center, the polarity of the d.c. voltage at the detector will be reversed. The IC meter driver derives its input from the detector. At this point there will be a time constant whose purpose is to smooth out instantaneous voltage changes resulting from the received station's audio modulation. This keeps the meter from jiggling, especially at bass frequencies. The IC is connected directly to the center-tuning meter.

The test equipment you have will be more than adequate for trouble-shooting this circuit.

Impedance of A Two-Way Speaker System

Q. Not long ago I was in an audio shop looking at loudspeaker systems. One of them, consisting of an 8-ohm woofer and an 8-ohm tweeter, caught my attention. The tweeter was wired in series with a nonpolarized 4-μF capacitor. I asked the salesman what the impedance of this system was, and he said it was 8 ohms. I asked, "How can this be when the two speakers are in parallel?" and the salesman replied, "The capacitor keeps the impedance of the system at 8 ohms." How can the impedance be 8 ohms when the speakers are wired in parallel?—Richard Roy, Dalhousie, N.B., Canada

A. The salesman was correct. The impedance of that loudspeaker system is 8 ohms.

You are right in saying that, when two loudspeakers are wired in parallel, their combined impedance must be different from that of a single speaker. In the case of the system you have described, however, there is a capacitor in series with the tweeter. A capacitor must not be considered merely as a piece of wire. Because of the electrical properties of a capacitor, the tweeter is effectively not wired into the system for low frequencies; it is "reconnected" at high frequencies. Of course, there is nothing in this simple circuit to "disconnect" the woofer at high frequencies, so its effects will still be present. Chances are that the impedance of the woofer rises at frequencies above the point at which the tweeter begins to operate. The tweeter and its associated capacitor will result in a falling impedance at the crossover point and above. Of course, this drop is limited by the impedance of the tweeter. Much depends on the characteristics of both the woofer and the tweeter, but it is possible that, in the vicinity of the crossover frequency, the impedance will dip below the 8-ohm, nominal value. However, we still can say that the impedance of the system is 8 ohms *nominal*.

Headphone Sensitivity

Q. I have a question concerning headphone impedance. My receiver is capable of 70 watts output per channel, and I am using a CD player with fixed headphone volume. I have two sets of headphones, one having 150 ohms impedance and the other, an

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

Insufficient headphone volume seldom stems from differences in impedance but is usually caused by differences in sensitivity.

electrostatic/dynamic combination, having an impedance of 400 ohms. I must advance the volume control considerably past its midpoint if I am to get sufficient volume from the 400-ohm phones as compared to the setting of that control when using my 150-ohm phones. Will I damage my amplifier by running it at such a high volume? (The amplifier is not clipping at this volume control setting.)

Neither pair of phones, when connected to the headphone jack on the CD player, provides enough volume. The fixed output level from the CD player is 5.1 V at 600 ohms and, I believe, 0.66 V at 8 ohms. Should not there be sufficient output from the CD player with 5 V driving the headphones?

I am, therefore, confused about the impedance ratings of headphones. I have seen some phones rated at 50 to 70 ohms which work fine with my player, but they are inexpensive and do not provide good audio quality.—Frank Fabian, San Francisco, Cal.

A. The problem isn't the headphones' impedance; it's their relative sensitivity. As with loudspeakers, some headphones require more—sometimes much more—power than others to achieve a given listening level. Electrostatic phones, in particular, require a lot of signal, as the amplifier's output is sometimes used to supply polarizing high-voltage power for the electrostatic transducers as well as to supply a driving audio signal.

I do not believe you will damage your amplifier when operating it in the way you have described, especially because it is not clipping. Because of the circuitry in the amplifier, the high impedance of the phones and the fact that loudspeakers are not connected during headphone operation, the amplifier is not being called upon to supply power so much as to supply voltage. To be on the safe side, check with the manufacturer to see if the output circuit can operate with a minimal load and at advanced volume control settings which could drive the system to near clipping.

Record Cleaning Mistakes

I have had considerable difficulty eliminating extraneous noise when playing records. There were two reasons for the problem, both having to do with the way that I have used my Discwasher in the past. Because anybody could make the same errors, I present the following to keep others from falling into the same pits.

First, always use the Discwasher in a well-lit area. I do not know how much dust I left on my records in the past simply because I could not see it. Second, make sure that the brush used to clean your discs or your stylus is itself clean, for otherwise it's like trying to clean a window with a greasy rag. Also, after putting the required drops of fluid on the pad, use the side of the bottle to smooth it evenly over the record's surface.

Boy! Was I glad to find out that the flaw in my music was not *in my audio system.*—Brian Campbell, Lindenhurst, N.Y.

Hearing Loss

After having reread "A Sense of Loss" (Audio, *July 1983), I felt compelled to share an experience with fellow readers.*

Just about a year ago I visited a local doctor to have my left ear cleaned of wax, which sometimes clogs that ear and temporarily causes a hearing loss. The doctor used a water stream device which, I believe, burst my eardrum because of too high a pressure. Although I still could hear, frequencies below 300 Hz were lost and I was in severe pain for several days.

Last winter, a second doctor (an ear specialist and a microsurgeon) patched the hole in my eardrum, and I regained some of my low end. I have a low-level, constant ringing in my left ear, but this is masked for the most part by everyday ambient noise. I am learning to accept the noise. I am fortunate that no greater damage was done and that modern medical technology was able to minimize my loss.

I have written this to make others aware of our gift of hearing, so that they will not take it for granted. I have a higher regard for my hearing now, having been through this experience. We go to great lengths to obtain our high-fidelity systems in order to enjoy our music. Let us not forget the component we cannot *replace.*—Joseph Ombres, Toms River, N.J.

I get lots of mail from readers wondering if their music systems can provide enough sound level to take advantage of the wide dynamic range of CDs. If you are already listening to music at sound levels approaching the threshold of pain, you do not need, and should not want, more sound level—whether from digital discs or from any other sound source. I have received some letters from teenagers who have lost hearing sensitivity just by playing their music at high sound levels.

Bass, Midrange and Treble

Q. A typical crossover network may have a 400-Hz crossover point between bass and midrange and a 5-kHz crossover point between midrange and treble.

Is there a numerical point in the 20 Hz to 20 kHz audio spectrum where bass ends and midrange begins? Is there a numerical point where midrange ends and treble begins? Or is everything so gradual that there are no exact points assignable to these divisions?—David Baldwin, Colonial Heights, Va.

A. There is no real, physical point separating bass from midrange and midrange from treble. After all, the spectrum is one continuous sweep, with no breaks or discontinuities which audio equipment designers can use as dividers. You can see, therefore, that the terms bass, midrange and treble are arbitrary.

The only way to determine where crossover is to take place in a complex speaker system is to study the characteristics of the drivers to be used. The crossover point for a woofer would be chosen so that no peaks or serious dips took place in that portion of the spectrum assigned to it. Thus, if a woofer's inherent roll-off started at about 600 Hz, with serious peaks occurring at about 700 or 800 Hz, we would cross it over no higher than 400 Hz, so the effect of the peaks would be reduced to virtual inaudibility by the combined driver and crossover roll-offs. The midrange speaker chosen to work with this hypothetical woofer would have to have a low-frequency limit below the 400-Hz crossover point. The crossover between midrange and tweeter would be treated similarly.

TAPE GUIDE

HERMAN BURSTEIN

Trading Up

Q. I own a three-head, direct-drive cassette deck, about three years old, which is loaded with features. Its frequency response is specified as 25 Hz to 21 kHz with metal tape. The meters go to +8 dB. Signal-to-noise ratio is 67 dB with Dolby B NR. The deck makes fairly good tapes, but the solenoids are noisy, as they have been ever since the deck was new.

I have been looking at a deck made by another manufacturer. Its frequency response is specified as 20 Hz to 24 kHz with any tape. It has three heads, Dolby C NR, HX Pro, dual-capstan drive, twin flywheels, fader control, meters that go to +10 dB, a switch to prevent overloading the tape, and silent solenoids. Should I trade up to the new deck? Will it make better tapes and sound better? I play mostly rock music at about +3 dB.—John DeRosa, Mattapan, Mass.

A. Apart from the fact that you failed to give the signal-to-noise specification for the new deck you are contemplating, it appears that both decks provide very good performance. With Dolby C NR, the new deck probably has S/N in the mid-70s or so, and, with HX Pro, it is more immune to tape saturation and consequent treble loss. In sum, the new deck probably *measures* better than the old one.

On the other hand, this doesn't necessarily mean that its *audible* performance will be superior. For example, if you listen to rock music, which ordinarily has rather limited dynamic range, the superiority in S/N may not be audible. You really have to base your decision on listening to both decks. If the new one is clearly better to *your* ears, it becomes a candidate for purchase.

Awkward Starts

Q. On playing one of my cassettes I heard the kind of intermittent and distorted sound that is usually made by a very defective phono cartridge. I'm sure the culprit is the cassette. I found that some of the coating was missing, enough so that one could see through the edge of the tape for the first 20 feet, after which all seemed normal; that is, the tape then looked and behaved fine. I checked a number of other cassettes and found that most of them played back with some distortion at the start—for about the first minute—and then settled down to proper behavior. What is causing this? Is the tape stale? Is the deck's take-up tension too great? Is the tape stretched at the end of rewind?—Leo D. Dulberger, Staten Island, N.Y.

A. Of course, if parts of the magnetic coating on the tape are worn thin or worn completely, this would cause intermittent and distorted sound. Good tape, however, should be able to go through several hundred passes before reaching this condition. In many cassettes, the way the tape is attached to the hub leaves a slight bump in the tape pack at each end. This may cause problems in the first moments of use. In most cassette decks, the tape is held against the head by the pressure pad built into the cassette; in a few decks, the pressure is exerted by tape tension. I have no way of knowing whether pressure is excessive in your case. Rewind and fast forward are usually slow and gentle enough not to cause stretching of the cassette tape. If you experience problems with cassette tapes of high quality, it would be advisable to have your deck checked by a qualified service shop.

Snap, Crackle, and Pop

Q. I recently purchased a high-quality cassette deck in order to tape my records, but I have a common problem—"snap, crackle, and pop" when playing the discs. I've had the experience of playing side one of a disc without cleaning anything but the stylus, and having the disc sound fine. Then, when I played side two, this produced the familiar "SC&P." My records are 5 to 10 years old but have been played only once or twice. I use a recommended record cleaner, which I apply before playing a record. I have also washed the records with water and have tried using compressed air, but to no effect. How can I get rid of this problem?—Julius I. Levin, Glencoe, Ill.

A. The snap, crackle, and pop may be recorded in the grooves, in which case you can do nothing with the record itself. However, you can buy a click and pop filter, such as that made by SAE. Or, the SC&P may be due to foreign material in the grooves, possibly there because of static attraction. Several devices deal with static, such as the anti-static mats and anti-static sleeves made by various companies, the Zerostat instrument sold by Discwasher, and those Shure phono cartridges which come with a special brush that both reduces low-frequency resonance and combats static. See what your local audio dealers have.

(*Editor's Note:* If Mr. Levin has this problem far more often on side two than side one of a record, the problem might be dirt in his turntable mat, against which side two presses while side one is playing.—*I.B.*)

Slow Tape Speed

Q. I am dissatisfied with my tape deck because the speed is slow. Do you have any information or advice on what I should do?—Anthony J. Lauria, Copiague, N.Y.

A. Seldom is a tape deck exactly accurate in speed. Good decks usually are within about 0.5% of correct speed, and very few human ears can detect such an error. Keep in mind that a semi-tone represents about 6% deviation in pitch; this may help you appreciate what a small deviation is represented by only 0.5% departure from correct speed.

If your deck is substantially more than 0.5% off speed, you are probably entitled to have something done about it. The first step is to make sure of your grounds by having the speed checked by your audio dealer or an authorized service shop. (Your dealer or the manufacturer can provide the names of the nearest authorized shops, which can make such repairs as are warranted.)

On the other hand, how do you know your deck is slow? If its speed varies, there is definitely something wrong with it. But any tape's speed will sound correct if it is played back on the same deck it was recorded on. If tapes made on another deck sound slow, the problem may be that the deck which made the recording was too fast. If tapes made on several other decks sound slow, then it's usually safe to assume the problem is in your deck.

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.

Elcaset and 3¾-ips compact cassettes did not die because they weren't permitted, but because they weren't really needed.

Choice of Tape Type

Q. I recently purchased my first cassette deck and am having trouble deciding which tape to use. I found a Type I that was particularly great and compared it with a well-known Type II tape, which sounded dull in comparison. However, another Type II sounded real close to the Type I. Thus, my question is about the quality of Type I (ferric oxide) versus Type II (chromium dioxide or ferricobalt). To my ears, the Type I and Type II tapes that I tried appeared to have equally low noise levels. In the long run, would I be better off with Type II even though the Type I that I tried has an audible edge over the others?—David E. Fincher, Knoxville, Tenn.

A. Although at one time it appeared that Type I tapes would be significantly outdistanced by the other types, the Type I tapes have nevertheless kept improving so that the margin between them and Type II tapes remains scanty. In fact, it appears that Type I often has an advantage over Type II with respect to low distortion.

Tape decks with fixed bias and equalization settings for the several tape types can offer only an approximation of correct bias and equalization, which differ somewhat from one tape brand to another. Therefore, the usual advice is to try several brands and types of tape and settle for the one that works best with one's deck. In your case, it appears that a particular brand of Type I tape works best, and I can see no good reason not to stay with it. (Of course, decks which automatically match the tape's bias, equalization, and sensitivity requirements tend to give their best performance with a wider range of tapes.)

Bells, Whistles and Cassettes

Q. With all due respect to the vast improvements in cassette technology, I'm not holding my breath waiting for the ultimate cassette deck. The supposed advantages over open-reel usually turn out to be a battle of the bells and a war of the whistles, while more basic functions and necessities have been neglected.

Why can't a C-60 cassette be fast-wound from end to end in 60 S or less? Sometimes, I'd rather be flipping a scratchy record.

Why must we suffer the lack of fidelity inherent in the dismally slow 1⅞-ips speed? Hanging on to this instead of 3¾ makes distortion the rule rather than the exception, technology moving three steps backward. Philips imposed stringent cassette mandates and ruled out the fast speed, while the promising Elcaset was promptly removed from the market.

As far as I'm concerned, Dolby NR colors the sound. No tape subjected to Dolby or any other NR system sounds as true as a straight recorded tape. And HX Pro causes high-end distortion in metal tapes, which were intended to minimize such distortion.

In my opinion, the only true advances in cassette decks have been solenoid, feather-touch controls, asymmetrically diffused capstans, and perhaps introduction of three heads instead of two. Everything else is pure gimmickry, and mostly junk.—Paul C. Macaluso, Phoenix, Ariz.

A. While I do not totally disagree with you, for the most part I do not agree. I think you may have a point in deploring the emphasis on bells and whistles instead of good performance—wide and flat frequency response, low noise, low distortion, and steady and accurate speed.

On the other hand, I feel that the top-quality cassette decks have achieved something very close to true high-fidelity performance. I do not know what decks you have been listening to, but there are several which have elicited very favorable reviews in terms of *basic performance*.

Fast wind and rewind speeds are deliberately kept moderate in order to obtain smooth wind and avoid undue tape stress. I believe that some decks do take less than 60 S for a C-60.

The 3¾-ips cassette deck disappeared for at least two reasons other than pressure from Philips. First, it provided too little recording time, except on C-120 tape, which is extremely thin and makes good results difficult to achieve. Second, steady improvements in the state of the art with respect to tapes and decks have made it possible to deliver performance at 1⅞ ips which previously could be had only at 3¾ ips. The Elcaset also disappeared for that reason and because there was too little market for it.

I have had extremely few complaints from readers—perhaps two in the last five years—about coloration or other audible effects due to noise-reduction systems. I have no trouble with them, and colleagues with greater hearing and musical sensitivity than mine on the whole seem satisfied. This is not to deny that side effects are caused by NR systems, but such side effects appear to have been tamed to the extent that very few listeners can detect them and find them objectionable.

Quality Complaint

Q. The quality of prerecorded cassettes is bad because of poor quality shells, poor quality tape, slow speed in playback, high duplicating speed, and azimuth and zenith mismatch. Will the same problems occur with open-reel decks? I have a source of prerecorded open-reel tapes, and I would like to know the score before buying an open-reel deck.—Robert B. Mugrdechian, Ridgefield Park, N.J.

A. In every respect—frequency response, noise, distortion, wow and flutter, etc.—performance tends to improve as tape speed increases. Therefore, if you intend going from 1⅞ ips cassette to 7½ ips open-reel, this should bring a definite improvement. For example, consider the results of azimuth misalignment. A 12-minute error, which produces a loss of nearly 8 dB at 15 kHz at 1⅞ ips, causes a loss of only slightly over 1 dB at 7½ ips.

On the other hand, I can't promise that prerecorded open-reel tapes will be good enough to suit you. They, too, have their duplicating problems for reasons the same as, or similar to, those you have listed. I suggest that you borrow or buy a prerecorded open-reel tape and listen to it on open-reel decks at an audio store in your area—then make your decision.

Not all prerecorded cassettes are as bad as you describe. Some of their purveyors are trying to do a conscientious job, and the number of these appears to be on the increase. Watch the reviews in audio periodicals to see which one might be worth buying. Be prepared to pay more for tapes of better quality, particularly those duplicated on a real-time basis, that is, duplicated at 1⅞ ips instead of a speed much, much faster.

TDK 50 YEARS OF GOLDEN ACHIEVEMENTS

TDK's Working Guide to Better Recordings

Introduction Many guides to magnetic tape recording prepared by recording tape manufacturers concern themselves with how fascinating and difficult tape is to make. However, established tape manufacturers such as TDK also know a great deal about how fascinating—and, yes, how sometimes difficult—tape can be to use. Somehow, though, there never seems to be enough time to share this "hands on" part of their expertise with the rest of the world. Consequently, TDK Electronics has decided to make this guide a little different from the rest. Of course, it explores the history of tape and the products that TDK manufactures, which we believe best demonstrate what tape recording products are about today. But TDK's "Working Guide to Better Recordings" also probes the day-to-day experience of living with tape and using it to its fullest potential. Some of the information our guide imparts may already be known to you, and some of its advice may come as something of a surprise. In either case, it demonstrates that TDK considers recording tape not just a product to be sold, but an experience to be enjoyed.

Some Background About TDK

It was 50 years ago that TDK scientists first developed and commercialized the use of a magnetic material called ferrite, which has become the foundation for magnetic tape products. Through the years, TDK's commitment to research and development has enabled it to expand the role of this magnetic material from use in fairly simple ferrite motor cores to highly sophisticated magnetic media such as audio and video cassettes as well as flexible computer diskettes.

TDK's technological leadership and companywide commitment to quality have enabled it to earn its status as the leading manufacturer of audio and video recording tape worldwide. Today, on its 50th birthday, TDK boasts the industry's broadest range of technologically advanced audio and videotape products designed to meet every need, from those of the most demanding professional studio to those of your living room. TDK's products are distributed and used all over the world. For TDK, continued leadership in all phases of the magnetic recording field is not merely a matter of good business. It is a matter of pride and tradition.

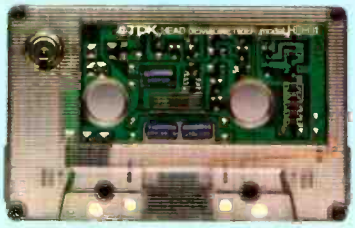
Our current line of audiotapes and related accessories continues in the TDK tradition of quality and reliability in state-of-the-art recording technology. The tapes are available in two defined levels of performance—the Professional Reference Series for professional and audiophile applications and the Reference Standard Series for non-professional uses.

Keep Your Deck Clean

As a vital first step, be sure that your audio cassette deck or open reel recorder is demagnetized and *clean*. For cassette decks, TDK's battery-operated cassette head demagnetizer HD-01 is a quick and effective demagnetizing device. The unit fits simply into a tape deck like an ordinary cassette. A hand-held demagnetizer like TDK's HD-11 will do as well if used carefully. *Remember the job requires close attention.* The HD-11 features a plastic-covered pivoting tip that discharges magnetic buildup, even on the most inaccessible heads as well as to the guides and support structure of the transport.

There is no substitute for careful eyeball inspection. TDK's HC-I is a convenient cleaner for routine maintenance and provides an effective way to keep recording heads free of oxide buildup, dust and dirt. Its use is recommended after every eight hours of play, and it is also packaged in a cassette configuration.

Before every recording project, use cotton swabs touched up with



a few drops of solvent (pharmaceutical alcohol is safe with virtually every modern machine, but be sure to check with the manufacturer if in the slightest doubt.) Pay especially close attention to the areas where capstan(s) and pinch rollers(s) make contact. Put the machine into the "play" mode and apply your swab to the right side (where the tape feeds out) of the assembly. Keep at it until the swab comes out absolutely clean. Don't let cotton fibers break loose from the swab and take a trip through the mechanism. When you're finished, you should be able to *see* cleanliness which, in this instance is definitely next to perfect recordings.

Set Up Your Tape

At this point you're clean and loaded with tape (exactly *which* TDK tape is a subject we'll get into later). You can, if you wish, run the tape through the transport for its entire length (at PLAY speed, and with record mode engaged). This is an old professional practice, unnecessary with many modern tape formulations such as TDK's, but it does give the tape a bit of polish and ensures that the tape pack is winding smoothly on *your* machine.

If you're using a cassette, flip the tape and start your recording on side B. Don't go into fast rewind, or you might pack the tape too tightly or disturb the careful alignment that a wind at play speed will give you. While you're working with side A, and if you have the patience, it's not a bad idea to record a minute or two of actual material (from FM, or anything else you've got) using normal recording practice. Then go back, using the machine in RECORD with no input, and see if you can successfully erase the signal you just laid down. If you can't, there are possibilities of machine/tape incompatibility.

If you can, you're okay so far. You should be doing all this, incidentally, as close to the time and place that you want to make your "keeper" recording as possible. Just carrying a loaded tape machine across the street can, occasionally, have important effects on the winding integrity of your carefully prepared tape pack. By the way, TDK carefully inspects each cassette and open-reel tape before it leaves the plant to ensure continual smooth-running performance.

Capture Your Program

Now to confront the actual program material, and the ways in which your recording level meters and controls can assist you in capturing it. In this, there is one rule, and only one: you always want to record at a high level, but not so high that you can hear the effects of distortion and, in the case of cassettes, especially, the high-frequency losses characteristic of tape saturation.

Let's discuss the subject in a little more detail. First of all, the main idea with a modern tape of high quality is to avoid the distortion and/or high-frequency losses that will occur if your recording levels go "over the top." Too low a level will result in more noise than is strictly necessary, but the noise-reduction facilities provided in all cassette decks with pretensions to quality should keep you

out of serious trouble. Otherwise, a level on the tape that is lower than the maximum achievable is no problem at all. You just turn up the amplifier to compensate.

However, be constantly aware that distortion and high-frequency losses that wind up on the tape can be compensated for by nothing. They're permanent and ineradicable. The wise recordist therefore avoids incurring them at all costs.

Considering the vagaries that arise in interpreting the readings of record-level indicators (see the following section), it is essential that the recordist learn to use his ears as a guide. A bit of training is required for this, and the best way to proceed is to select a very high level musical source (big crescendoes on LP should be good, and the same on CD even better; avoid using FM for this purpose) and experiment.

Continued on last page

A Word About Meters

Are recording level meter systems then useful at all? Of course. Although it would take many years' experience to learn how to record well with meters alone, they do remain indispensable guides in charting your progress and getting you back to where you were a moment or a week before. It's difficult to generalize about meters because they differ so much in type and calibration, and their readings don't necessarily mean the same for one tape as for another.

However, as the general rule, modern cassette decks are equipped with either peak-reading or VU meters, and the most important thing to keep in mind about this distinction is that recording levels for peak-reading systems will, with transient material, indicate levels that read roughly 7 dB higher than VU types will. Determining which meter type your machine employs is not always obvious, but after a bit of experience you will be able to distinguish between them easily just by watching their behavior with acutal music material.

Again, this is not terribly difficult, but it is exacting. The more experience you gain with different music, machines and tape, the sooner you'll be able to copy quickly with a change in any or all of the three, and to use the meters in a fashion that will let you know what you'll probably hear in the finished recording.

Most cassette decks employing Dolby noise reduction bear markings on their meter-system faces indicating Dolby level, which by convention corresponds to a recorded level of 200 nanowebers per meter (nW/m) on the tape. The Dolby indexes are placed at +2 dB in most cases, but occasionally they turn up at 0 or even −2 dB. What this information tells you is that, in general, it may be safe and even advisable to use correspondingly higher recording levels on the average with the first type of machine, and to be appropriately conservative with the others.

However, this rule can only be approximate, and the actual results achieved will depend greatly on the overall recording characteristics of the machine, and even more greatly on the performance capabilities of the tape. Naturally, we expect you'll find TDK tape able to tolerate higher recording levels without strain, and to exhibit higher maximum output levels before distortion occurs, particularly at high frequencies, than many other tape formulations.

Today, tape is so good that level manipulations are unnecessary except in the most critical circumstances, when the recordist feels instinctively that he can't do a satisfactory job without resorting to them. Tape is also good enough to render the slightest clumsiness in a gain-riding effort immediately audible and objectionable. On the whole, it's probably better to set levels correctly for the recording project at the outset, and not meddle with them afterward. For this application, the use of metering systems is reasonably straightforward, if not competely illuminating.

Recording from LP's

It takes only a few seconds to visually inspect the playing surface of an LP and discover where the highest recorded levels are. These should be test recorded in advance, with very aggressive recording levels (don't worry; nothing will break), to determine the absolute maximum level your recording system will tolerate before audible distortion/saturation occurs. That's the optimum level. It will differ from LP to LP, and you'll find, if you're using cassettes, that the highest levels of high-frequency information will be the most useful guides. Use your meters to learn what these levels look like, and take mental notes accordingly. They won't teach you everything about recording, but they'll be a good start.

Always listen as you're watching the meters, so that you can keep track of the kind of signal they most actively respond to. Certain meters will let you know with vigorous activity when a crash cymbal is struck. Others will barely move. All will strongly register the presence of a deep organ pedal, but experience will probably teach you that you can get away with surprisingly high levels of deep organ pedal if they're not accompanied by huge outbursts of brass and/or that inevitably worrisome cymbal crash.

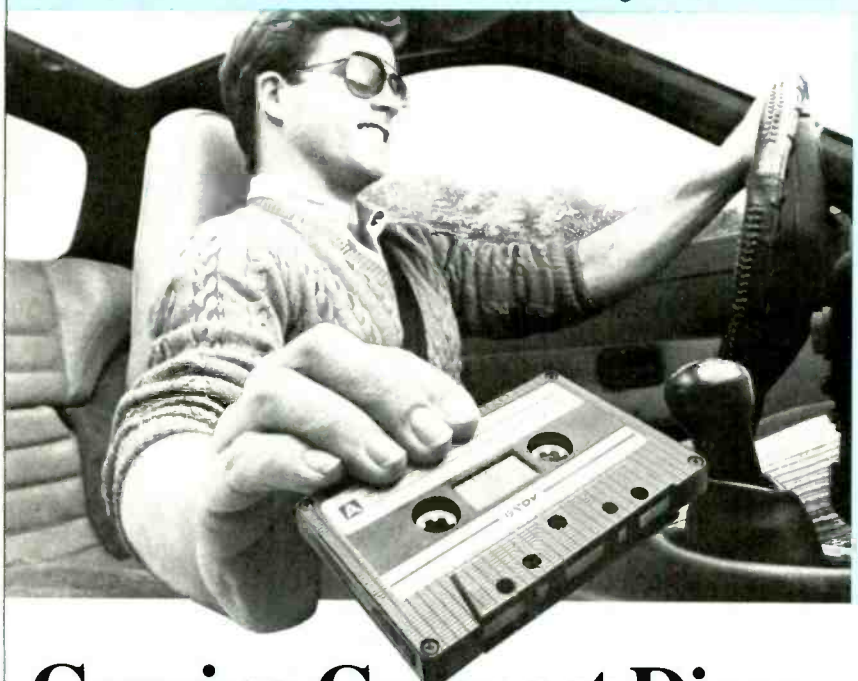
Beyond that, there's little to do except punch the RECORD button and go, except for a subtle problem that occasionally crops up. Some recordplaying systems become unstable when encountering severe record warps, and will deliver a signal too low in frequency to be heard *per se*, but strong enough to overload a recording system to the point of gross distortion, even though the rendition might sound perfectly acceptable when played with no attempt made at recording it. The symptoms, heard when you play back the recording just made, will normally be a shocking "garble" distortion recurring at the rotational rate of the record, and eyeballing that rate while listening to the result is what will let you identify the difficulty. A filter introduced somewhere between turntable and recorder will fix you up temporarily, but the only real fix has to be applied at the record player itself.

...and from FM Radio

Most of the foregoing still stands, except that, in theory, you should be able to use the same record level for every FM broadcast you'll ever have access to; unless, of course, the signal is too weak to achieve full limiting, or you change tuners, recorders, or tape. The reason is that broadcast strength is restricted by law, and while virtually all competent broadcasters use all the strength they're allowed to the maximum, relatively few of them cheat enough to become conspicuous, and the cheating could never amount to more than a dB or so.

Therefore, your best procedure is to find the loudest, most obnoxious source of high-energy, compressed rock/disco in your locality, set your recording levels to the maximum before you hear loss of high frequencies, and use that recording level for everything thereafter, including the most delicate presentations of clavichord performances. You have to depend on the technician in the broadcast studio to take care of the rest. You don't have enough control to do much more.

An exception exists in the case of stations broadcasting Dolby FM. Because they're probably quality-conscious, their signal should be pretty good—good enough to be worth trying some tricks with that this article cannot, alas, be long enough to detail. But unless you're prepared to research and undertake serious technicalities, the best advice would be to treat Dolby FM broadcasts as you would any other (although, of course, decoding them appropriately if your tuner has the means to do so).



Copying Compact Discs

Some have said it can't be done, but you can indeed copy the content of a compact disc onto a cassette with excellent results. The most significant difference between dubbing an LP and dubbing a CD is that you can't locate the CD's highest recorded levels by eye. If you don't know the music (and even if you do), you're going to have to work your way through everything you want to record by ear and meter, test recording the more difficult passages as you go along. This may sound tedious, and will be the first few times, but CD's are restricted by technology to a maximum level, and you should begin to get a feeling of what that means for your recorder in fairly short order. CD's are indifferent to frequency-versus-level considerations, so expect a few nasty surprises. But also expect a few pleasant ones. At worst, recording from a CD is not any more difficult than recording from a live performance. **TDK's award-winning H-XS tape, the first metal formulation which records in the high bias position, is particularly recommended for recording from digital discs, as are TDK MA and MA-R metal tapes.**

HX-S, the first metal tape for the high-bias position.

Live

But not always, and it remains generally true that, for live recording, cassettes may not be the medium of choice. Their great advantage is portability, which is so persuasively attractive that even professional recordists on their days off will walk around with a personal-portable cassette recorder just to see what they can pick up from clubs and street musicians. Also, demo tapes, made so a record producer can get an idea of what an unknown band sounds like, are very often in cassette form. However, for commercial release purposes, reel-to-reel still owns the business, largely because of its greater headroom and editability.

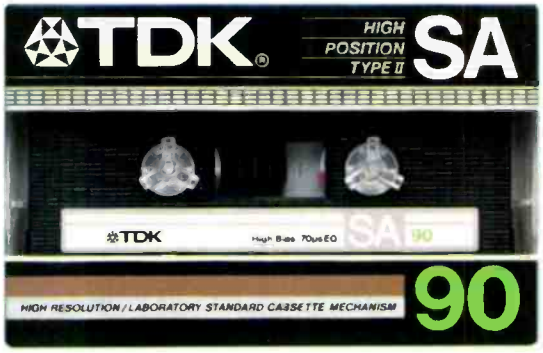
Live recording is, of course, much too large a subject for treatment in a few paragraphs. But all the above guidelines generally apply. However, you should be aware that TDK offers some exceptionally advanced tapes for the open reel format, including **SA (Super Avilyn) EE** tape made for high-end component systems with EE (extra efficiency) ½-speed position and GX-Pro Quality for standard speed recordings.

The Right Audio Tape

Different tape formulations and types co-exist, not only to give you the most cost-effective choice for your needs, but also because there is such a huge population of recorders in the world that no one tape, no matter how good, could possibly be perfect for all of them. With all these choices, how do you pick the one to fit your deck? First, right away, we have to understand what "fit" means. Take some FM interstation noise and record it at a level of perhaps −10 dB on the meters. If the ideal "fit" is there, the recording on playback should be an audibly perfect facsimile of the original. In practice, the recording will tend to be a little brighter or a little duller. This is no necessary reflection on the quality of either your tape or your machine. It simply suggests that the two don't quite fit each other, and that there will therefore be some mistracking problems with certain popular noise-reduction systems, and possibly a few other difficulties, not obvious at first, but upsetting to discover down the line.

When you don't have a precise fit, the readiest tactic is to try another tape presumably, but not necessarily, from the same IEC group you've selected for your application. (Normal Bias, Type I; High Bias, Type II; or Metal Bias, Type IV.) If the results of the FM-noise test are discernibly different, even though not perfect, there is cause for optimism, because your recorder is showing signs of being in good condition. If every tape you try is, say, a little duller than the original, the time to think about repairs or a new machine has come.

When you get a satisfactory fit (and you might very well get it with a number of tapes), then the sorting for actual performance quality begins. Record all the tapes, at very high record levels, with musical test passages that include both very loud cymbal activity and very soft material. Listen for lack of distortion with the former and lack of noise with the latter. Do not hastily jump to conclusions for one tape begins to distort at levels of +3 dB while another seems impossible to overload. Select your levels for what seems to achieve the best (or avoid the worst) from each individual tape, and then listen to the results as if you were just playing music for enjoyment.



TDK's NEW IMPROVED "SA" SUPER AVILYN audio cassette is the newest generation of TDK's premium "SA" formulations. SA, which made its debut nearly 10 years ago, continues to lead the way in premium high-bias audio tapes.

With some tapes you'll be conscious of more noise during quiet moments. With others you'll be aware that distortion on high-level passages is more difficult to avoid than you suspected when you made the recordings. On a number, you'll discover that cymbals you thought you were capturing fully have somehow become more subdued.

What you'll learn from this test, if carried out exhaustively, will tell you more about the right tape for your machine than ten thousand more words. It should not, however, dissuade you from performing the same test next year, and the year after, as new tapes emerge. AT TDK, the understanding of the tape/machine interface is acute, and a tape that fits most machines and otherwise performs with true distinction is probably more easily found within the TDK product line than any other.

Why Two Levels of Tape?

TDK has developed the two reference levels to help users evaluate and choose the best tape for their particular needs. Although both levels have been developed using the same concern for quality that goes into all TDK products, there are differences in the performance capabilities of each product that make it best suited to more specific applications.

The Professional Reference Series, with a variety of products to meet all professional requirements,

represents the highest level of achievement in recording-tape technology. Each tape sets a standard for sonic excellence. That's one reason they're the choice of the most discriminating audiophiles as well as most hardware manufacturers, who use TDK as a reference for bias calibration.

The TDK Reference Standard Series provides outstanding premium quality for a wide variety of recording needs. Each cassette is a product of TDK's advanced tape technology and offers maximum reliability, performance and value.

About Bias

It was discovered in tape recording's infancy that a constant ultrasonic signal applied to the tape along with the audio signal to be captured, vastly improved the linearity of the recording process and optimized the sensitivity of the tape for audio frequencies. It was then discovered, that different tapes benefitted most from different bias strengths.

Your present tape recorder undoubtedly has a tape-type switch that adjusts the machine for the tape formulation you wish to use, but that doesn't guarantee that the IEC Type II position will be right on the button for every Type II tape you'll ever buy. Minor variations exist between brands of tape, and even between production batches of the same brand. The "facsimile recording test," discussed in "The Right Tape" section of this article, is the logical way to find out if the bias provided by your recorder is correct for the tape you are using. Employ that test faithfully.

There is something more that it's useful to know, however. For various reasons, some tapes are less sensitive to the effects of minor bias errors than others, and this can be a comfort when you're forced to choose between unfamiliar tapes for a rush recording project. For example, the effect of underbiasing a tape will be both a rise in high frequencies and an increase in distortion and modulation noise. There's not to much that can be done about high frequencies and distortion, but if the tape is carefully designed for physical and magnetic uniformity such as the way TDK tapes are, the modulation noise will be low to begin with, and it won't be subject to catastrophic increases when the recording conditions are not quite right.

The importance of a good tape is an overriding consideration for any recording project, but it is an especially crucial consideration if there's any doubt at all about the match between bias and tape characteristics. If you ever encounter such doubts, choose a premium tape such as those by TDK which excells in overall characteristics. These tapes will come through for you, no matter what your application.

TDK Bias Selector Guide

Cassette	Recommended Bias/Eq	Recommended for: Mastering	High Fi Recording	General Purpose
MA-R	Metal/ 70μS	●	●	
MA	Metal/ 70μS	●	●	
SA-X	High/ 70μS	●	●	
HS-X	High/ 70μS	●	●	
SA	High/ 70μS	●	●	
AD-X	Normal/ 120μS		●	●
AD	Normal/ 120μS		●	●
D	Normal/ 120μS		●	●

VCRs and the Audiophile

Almost all audiophiles know more about VCRs than they think they know. Even if they don't know all of the theory, they know the basic rules: The higher the frequency response needed for a signal, the faster the tape must travel past the tape head; a signal that is close to the saturation point of the tape will be less troubled by noise than a signal recorded at a lower level; etc.

Video signals do require a very large bandwidth of at least 3 megahertz for a picture as good as a standard color TV, so the tape-to-head speed must be in the order of 6 meters per second. To achieve such speeds, it is more efficient to move both the tape heads and the tape. One way of doing that is to put the heads on a rotating drum. The color signal is broken into two parts: color and brightness. In consumer VCRs, the brightness (luminance) is put on the tape as an FM signal at about 3 to 5 megahertz and color signal (chroma) is recorded as an AM signal at about 600 kilohertz using the FM luminance signal as bias. The exact frequencies are slightly different in Beta and VHS recorders, the two widely used consumer formats.

When you buy a machine, the characteristics of the machine are already set but you can still exert some control over the quality of the recordings you make by the tape you select. It is there that TDK's 50 years of experience in making magnetic tape helps you. Audiophiles are already accustomed to the idea of choosing from many types of tape for the best match between the material to be recorded, the recorder speed and the type of tape. TDK offers five grades, in both Beta and VHS formats, and the best one to use for a particular task can be made on the basis of manufacturer, application, and cost.

That the quality of the tape you get depends on cost should come as no surprise. Since you seek the highest quality, buy the best grade you can afford for your most important application. For video recordings chroma and luminance, (usually called video) S/N, and the dropout count are the most important criteria in choosing a grade. The S/N determines the graininess of the recorded picture and dropouts (areas where the magnetic particles are missing) cause the white or black streaks of missing picture on playback.

TDK tapes are renowned for their already low dropout count which gets even better as the grade gets higher. The S/N also improves as the grade gets higher. Each step-up grade offers a S/N about 2 dB better than the one below it. There are similar increases in audio quality as you step up. So the difference between the lowest and the highest grade is about 10 dB. The grades we offer (from lowest to highest) are: Standard Super Avilyn, HS High Standard, EHG Extra High Grade, Hi-Fi, and HD-Pro.

PCM Digital Audio Recording And Your VCR

For some years now recording audio in digital form, PCM (Pulse Code Modulation), has been available in recording studios. Two years ago it became available to the audiophile with the introduction of the PCM adaptor for video recorders. PCM samples the audio signal 44,000 times a second and records that instantaneous voltage as a number in digital form. Those numbers have 14 or 16 bits each in their binary form and whatever machine is used to record them must have a frequency response greater than 16 times 44,000 at minimum. No recorder commonly available to the videophile has that type of frequency response except VCRs, so they've been pressed into double duty.

As always, the system is not perfect. For perfect replication the number must be identical, but two problems arise. First the numbers may be misread, mutilated or mistranslated, but the encoding scheme allows for elaborate error correction. However, the numbers may be entirely missing because of dropouts on the tape. There are similar error correction devices (dropout compensators) in a VCR which minimize the effect of dropouts, but they cannot be relied upon to function effectively for digital audio purposes. So the only reasonable solution is to use a tape with the lowest dropout count. Over the years, TDK has earned the reputation for the lowest number of dropouts.

In PCM recording uniformity is of paramount importance. The digital information must be a constant uninterrupted stream with 1's always having the same value and 0's must maintain theirs. In spite of how critical these values are, the uniformity of TDK's tapes ensures that the signals will maintain their vital integrity.

TDK tapes are made with unusually small magnetic particles that permit a higher number of them to be contained in the same volume than with other tapes, yielding a generally higher BET value. This dense packing of the magnetic particles also yields a higher RF output, further reducing the probability of erroneous reading. Normal noise levels are not likely to cause erroneous readings, but a higher signal level makes such readings an even more remote possibility.

Uniformity from tape to tape throughout production is also a TDK strength. The same high performance level is maintained with each new batch of binder (particles, adhesives, etc.), and the result is a tape of consistent properites from batch to batch. The result is predictability. You can be sure of the performance of a tape with the TDK name on it.

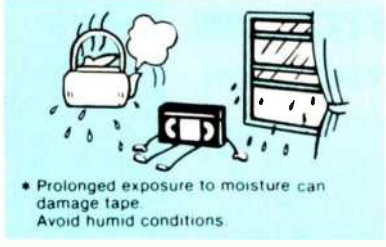
You may make PCM recordings at any VCR speed, but the fastest available speed, Beta II or VHS-SP, will yield the best results. The reasoning is simple. With the tracks closer together, actually overlapping, at VHS-SLP speed the likelihood of having the same dropout affect adjacent tracks is greatly increased.

Among TDK tapes, the higher grades have the lowest dropout counts, highest outputs and highest BET values. (The higher the tape's BET value, the more particles packed per square inch, which means improved clarity.) They also have lower S/N. As with video, use the highest grade you can afford for digital recording. But remember that every dropout is a problem. Choose the grade of tape for digital work carefully, based on how critical the material you record is. HD-Pro has the fewest dropouts among TDK's tapes, and with TDK's EHG Hi-Fi a close second, both are an admirable choice for the critical task of recording PCM.

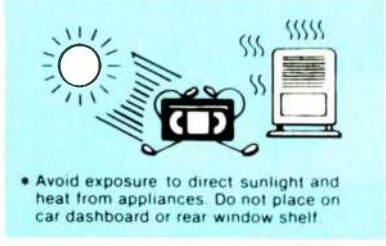
Care of Your VCR and Tapes

In addition to buying the best grade of tape for a specific application, you can ensure that you get the best recording possible by keeping the VCR in the best working condition. First protect it from dust by covering it. If a plastic cover is not supplied with your VCR, buy one. VCRs are also sensitive to heat and moisture, so keep yours away from radiators and direct sunlight; and if you can control the humidity, keep it low. Both VCRs and tapes like to be kept at temperatures about 60 to 70 degrees Fahrenheit and at a relative humidity of about 50 percent. Both are also affected by magnetism, so don't put them on TV sets or near motors or speakers.

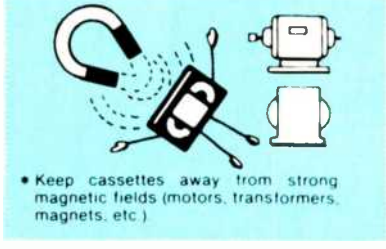
• Avoid dusty or dirty places.



• Prolonged exposure to moisture can damage tape. Avoid humid conditions.



• Avoid exposure to direct sunlight and heat from appliances. Do not place on car dashboard or rear window shelf.



• Keep cassettes away from strong magnetic fields (motors, transformers, magnets, etc.)

Last, clean the heads periodically. You may use one of the cassette-type cleaners, but using solvent and swabs works better. Use only materials intended for cleaning VCRs and follow the instructions with those cleaning kits. Above all pass the swabs across the heads horizontally as indicated in the instructions with the cleaning kits. If you rub the heads vertically, you'll put them out of alignment.

Other precautions that ensure consistent high performance are:

1. Take up any slack in the tape by turning the hub on the bottom of the cassette manually until the tape is just snug.
2. Allow the VCR and tape to adjust to temperature changes after transporting them—about an hour.
3. Inspect cables periodically for fraying and signs of internal damage (soft spots and kinks). Also make sure that connectors mate snugly.
4. Follow the hardware manufacturer's recommendations on cleaning, placement and air flow as outlined in your owner's manual.

Why Five Different Video Cassettes?

TDK's VHS and Beta video cassettes, ranging from standard cassettes for most video applications to the highest-quality HD-Pro for professional-level recording, all use TDK's world-renowned Super Avilyn magnetic material for precise performance and reliability.

The five levels of formulation grades have been developed to meet the needs of all video applications and to enable users to choose from among a range of products so they can get the most for their money. Each cassette mechanism is built to a tolerance 2½ times that of industry standards and is microscopically checked at almost 2,000 different points to assure you of perpetual, error-free performance.

These specially designed cassette mechanisms consistently maintain proper tape tension, preventing jamming and snapped leaders. They also provide optimal tape-to-head contact, which prevents skewing, jitters and dropouts. Stainless steel pins support the guide rollers for ultimate accuracy, providing better alignment and tape-edge protection than the plastic pins used by some tape manufacturers. In addition, TDK even builds its own video cassette shell halves to micron tolerances for an exact top and bottom match. That's precision. And it all adds up to give you the best picture possible with trouble-free performance.

Capture Your Program...

Using the same passage for each sequence of the test, make a recording at a moderate level (perhaps around 0 dB on peaks) and listen carefully to it. It should sound fine, if perhaps a bit noisy. Then, using a recording level that is one or two dB higher, record the passage and listen again. Raise the level a bit more and do the same, and so on, until the point arrives when you can hear the raspy harshness of distortion and the dulling of the sound on high-level cymbal material. At this point you've gone too far, so back off on levels to find the point where acceptable becomes unacceptable.

This is about where you want to set your final record levels for music of this type; but if you find you can't quite identify the precisely right point by ear, err on the side of undistorting (that is, lower) levels.

Incidentally, this experimentation will also teach you the value of a good tape (such as TDK) in its properties of forgiveness. A small error in setting levels will be tolerated by such a tape because the maximum output levels afforded, especially at high frequencies, provide a cushioning margin to keep you out of trouble when musical events get a little more violent than expected.

Need further information? Contact Bob Fontana, Customer Service Department, TDK Electronics, Box A.M., 12 Harbor Park Drive, Port Washington, NY, 11051.

TDK

EDWARD TATNALL CANBY

CONVENTIONAL THOUGHTS

One of the strangest conventions in this country of ours is the Convention, that biggest of annual get-togethers. The Audio Engineering Society calls theirs "Technical Meeting and Professional Exhibits," but like many others it is a monumental festivity which provides, for a few brief days, the total emphasis we need on our own special world-within-a-world, brought to its ultimate splendor—isolated, insulated, outshining all else like some supernova in a galaxy. The Convention is *big*—as big as we can make it. Also, curiously, it is the ultimate club meeting, where boys of a feather flock together (also girls), out of sight of the rest of the world.

For all its size, the Convention is intimate, even cozy. Who knows the name of that Other Convention going on next door, like somebody else's noisy party? Some alien race, talking mumbo and jumbo. If you've ever bumbled into the wrong bailiwick, you'll know what I mean. I once went to a large audio press luncheon at a New York hotel, picked up my drink at the bar, sat me down at a table, ate the grapefruit and melon course with relish, and then found I was at the wrong press conference. Dentists or something. Don't remember how I got out, but at the right party (audio) I skipped the grapefruit and jumped right into the roast beef, back on schedule. Two worlds, one floor apart.

Thus, if you want to measure the size and influence of a given field, any one of thousands, the very best thing you can do is to take in their annual or semiannual Convention. Whether it's for model airplanes, or maybe toweling and fabrics, or parapsychology, the rule holds. The Big Show tells all. So it goes in our own area. As you may know, the Audio Engineering Society Conventions are now absolutely enormous, which is a measure of our present and ever-increasing importance.

Of course, the AES, a professional organization, officially does not concern itself with so-called "consumer electronics." But unlike, say, dentistry, our pro and our con (consumer) aspects are so intertwined at every level that, as at the old hi-fi shows, the AES Convention has a fascination for the lay public that you would not believe if you hadn't seen it—witness thousands of high school and college kids who pay good money to jam themselves into the miles of AES Professional Exhibits. Sometimes I think they outnumber the pros, and maybe it's a good thing, too. As we always say, the future is theirs.

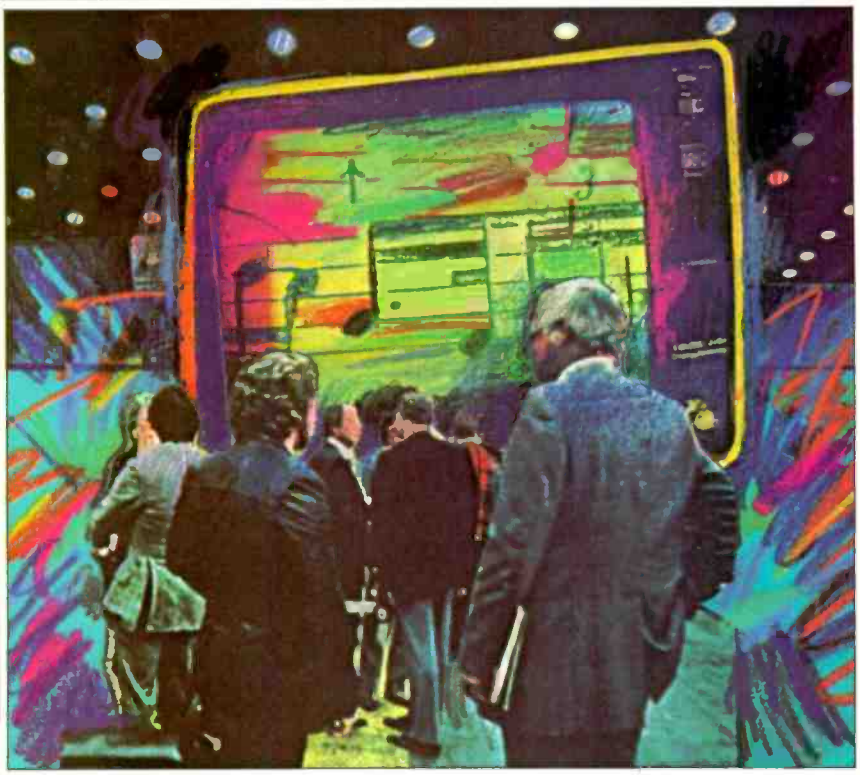


Illustration: Jane Sterrett

So this past October I armed myself, grabbed a huge breath, took two aspirins, and managed, in one exhausting day, to see at least a hundredth of the AES "do," sprawled all over the huge New York Hilton. (Last year I left a bag at the *Audio* booth and spent half an hour trying to find the booth again when I was ready to leave.) Even 1% of the show was a lot, and impressive. After all, no one could see and hear the whole of it simply because there were lectures, seminars, workshops, demos, press meetings and miles of exhibits, all going at once. Unbelievable! Exciting! And such volumes of sheer gab, in every cranny of the place, with average spacing between human sound sources approximately 3 feet. All to the good, I say, and highly educational. The exhibits are fine—the gab even better. How could anyone go home, i.e., to the larger world outside, not knowing something new and vital?

Do I now propose to give you a rundown of leading items in detail, à la Bert Whyte? Not on your life. That would be quite beyond me. Nevertheless, on this very partial look-see and listen, I somehow got a distinct impression of difference this year. There was a new, higher voltage feel, sparked by the startling changes and enlargements of concern now churning up this special world that centers on audio. In previous years, the AES seemed to me much more the "conventional" gathering of specialized pros, especially back in the early years. This is exactly as it should be, of course, in the professional papers and the extensive interchange of highly technical information. But in those first years it was also true of the AES Convention exhibits, which, as I remember, were of relatively minor importance. As time flew on, the exhibits grew and grew in number but still remained thoroughly idiomatic, as we in the music and arts fields would say. I seem to remember, for instance, seeing row upon row, off into the distance, of those huge studio or broadcast mixing boards with their hundreds of sliders and buttons and

The audio field is now sliding into intimate embraces with those who make optical recordings and perform optical "electronics."

meters—they were the very mark of professional audio and definitely *not* the sort of equipment an audio consumer picks up for his home hi-fi system. I cannot ever figure out how these behemoths got into what one might call production, let alone into mass production, and I continue to wonder how so many manufacturers are, indeed, viably in business.

At this last Convention, the big mixing boards were still evident—they are the Grand Central and Penn Stations of our audio network. But there is now so much *else* available and so much of it *novel,* if not unprecedented, rather than just new. At least new at our Conventions. Of course, negatively speaking, there might have been a temporary dearth of big boards simply because all those old ones were analog and therefore poison; it takes more than overnight to switch the monsters to all-digital. But, I felt, this was merely incidental. The impressive, overwhelming thing is that the whole complex of digital thinking, plus computer-type development and instrumental control, has brought our audio very far and very fast into relationships with other areas that we formerly pretty much ignored, or merely tolerated.

Audio, I have been aware, is one of the last major "fields" to get involved in, shall I say, chip-itis, a disease that is always hectic, sometimes benign but almost as often auto-destructive, especially in the early stages. It is not so much that we are catching up; what matters is that now we are deeply involved in other people's chip-itis and, necessarily, in other people's equipment too, both professional and consumer and everything in between. TV, video, was merely the beginning. We are now sliding into intimate embraces with those who make optical recordings and perform optical "electronics"; we are almost on hugging terms with the music synthesizer, and with its promoters, designers and users, people who used to be pretty much outside the audio field as we know it. (Yes, they have been around at recent Conventions but definitely with a feeling of being off on their own, guests, so to speak, of a foreign power.) All this is most exhilarating and stimulating! As I write, for instance, I've just answered a press invitation from that impeccably audio-minded concern, Nakamichi—to announce the First Commercially Available Optical Memory System Capable of Recording and Reproducing a Variety of Optical Recording Media (caps are Nakamichi's). Wow—what next? And don't think this won't tie straight into your present "consumer" hi-fi world before you can turn around and buy another amplifier.

Indeed, I recklessly look forward to the first all-optical hi-fi system *with not even a trace of electronic signal,* and lots and lots of laser power. (Speakers? Well, er, maybe. The impossible takes a little longer.)

Several years back, I will now have to mention, I went with a group from the AES San Francisco section on a field trip to visit an elaborate electronic music research lab that is a part of Stanford University. The lecture demo for the audio people had to do with some highly abstruse "pure research" into the exact nature of a few brief bits of recorded sound, which, though playable in a few moments, were occupying numerous man-years of careful study. This in itself was hard to comprehend for the AES people, who, naturally, tended to be either commercial pros or well-versed audio amateurs. Quite legitimate—it takes all kinds, after all, and somebody has to do the basic research into the nature of sound as we now use it. But what was really disconcerting at that meeting was the total ignorance of each other that these two groups displayed. I confidently presented my "credentials" to the lecturer—he had never heard of me nor of *Audio* magazine but quickly informed me that I should, of course, subscribe to *his* official journal, which in turn was totally unfamiliar to me. Ugh. Such a lack of intercommunication. Worse, the lecture (in a cramped, hot room with the air-conditioning system turned off—med-fly spraying) began, to a stunned silence from AES, with a long grade-school explanation of audio fundamentals as though we knew nothing in this esoteric region! Even I was flabbergasted. The AES members were admirably polite, and the lecturer was quite in earnest, but finally, one AES stalwart, sensing the moment, asked a quiet question so profoundly technical that the lecturer was rocked on his heels. All this, mind you, in perfectly good faith—nobody was mad or nasty. At that point the grade-school fundamentals ceased abruptly and the "real" lecture began. By its end, heat notwithstanding, there was the beginning of some real fraternization. Surprise, surprise! It turned out they had quite a lot in common! And, just incidentally, there was a third element in common which was especially mine—music. Sometimes I wonder whether in all this new excitement the art of music will survive. Like the opera that we kids used to call "The Battered Bride."

It was at this same Stanford session, by the way, that another lecturer, a "practical" guy and no advanced researcher into theory, demonstrated what I thought was a really miraculous new synthesizer with memory. That thing could manufacture minutes, maybe hours, of varied music from a handful of original notes, and remember the entire thing. All you did was manipulate the transformations.

Well, at this past AES Convention, some years after the Stanford visit, there was the same idea but now it was a part of *our* show. I will mention no brand names because I am aware that there are plenty more of the same general type of music synthesizer with similar capabilities which I have not personally inspected. Suffice it to say that this newer device or, rather, collection of models into various optional systems to taste (or to ear) practically knocked me over. The system not only created, recorded and played back all sorts of elaborate music at length, but it *wrote* music, displayed it on a monitor, and printed it out on paper in so many notes. So we've come to that!

No matter that musical notation is not ever literal but more in the nature of a code with reminders—for those who know. Even so, to play a simple little piece on a keyboard, hear it in sound, watch it grow on a monitor screen full of notes, and subsequently get edited, changed, rehashed—both in the sound *and* on the screen in notes—is a startling experience for any musician.

The guy at the AES demo took one measure of a Bach Invention and turned it by degrees into a couple of minutes of blues. Right on the screen. And in playback, out of memory. That's Greater Audio, today, and it happened at our very own Convention.

THE EXPERTS SAID THEY HEARD EXCELLENT FREQUENCY RESPONSE, A HIGHER MOL, AND GREATER DYNAMIC RANGE.

BUT NOT IN THOSE WORDS.

Wicked lows. Manic highs. Nasty passages. It all translates the same.

Music sounds better when it's recorded on Maxell XL-S cassettes.

That's because we've improved our crystallization process. So we can now produce magnetic particles that are both smaller in size and more uniform in shape. Which allows us to pack more of these particles on the tape's surface, in turn, making it possible to record more information within a given area of tape.

AC bias noise is reduced by 1dB. And maximum output levels are increased by 1.5dB on XLI-S and 2dB on XLII-S.

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So if you want to hear your music the way it was meant to be heard, put it on Maxell XL-S.

Because recording tapes just don't get any better.

Or any badder.

IT'S WORTH IT.

WHAT'S NEW

Nova Preamplifier
The Nova CPA-100 preamplifier is a Class-A, J-FET design using only discrete devices and film capacitors. A gold-plated socket accepts an optional PPA-202 J-FET pre-preamplifier with adjustable input impedance and gain. Controls include absolute phase, −20 dB mute, and tape record-out enable/disable. Finish is aluminum (black on special order) with walnut or oak end-panels. Prices: CPA-100 preamp, $1,695.00; PPA-202 pre-preamp module, $295.00.
For literature, circle No. 100

Nady Headphones
Infrared light transmits information to the Nady IRH-210 cordless stereo headphones. The phones are rated from 50 Hz to 15 kHz, and any number of phones can be used within 35 feet of the matching, IRT-200 transmitter; so can the IRSR-220 receiver, for use with ordinary headphones. Prices: IRH-210, $45.95 each; IRT-200, $53.95; IRSR-220, $39.95.
For literature, circle No. 103

DCM Loudspeaker
The QED 1A is a compact, floor-standing speaker using an 8-inch woofer, plus a ¾-inch dome tweeter with acoustic lens and Electronic Correction Circuitry to optimize frequency and time response. The enclosure is wrapped on all four sides with dark brown grille fabric and has solid oak end-pieces. Sensitivity is rated at 90 dB for 2.8-V input at 1 meter, and amplifiers between 20 and 200 watts per channel are suggested. Price: $657.00 per pair.
For literature, circle No. 101

Vector Research Cassette Deck
The VCX-650, a three-head/three-motor cassette deck, has a five-band equalizer that can be switched for use in either playback or recording. Other features include Dolby B and C NR, a multi-skip Music Search system, and repeat of program blocks or segments. Price: $499.95.
For literature, circle No. 102

Sansui Receiver
A 3.5-mm jack on the front panel of the S-X1070 receiver is designed to allow a pocket portable tape player to be used as a signal source, for dubbing, or when there is no other cassette deck available. The receiver has six AM and six FM tuning presets and a built-in, five-band graphic equalizer. Power output is 55 watts per channel. Price: $400.00.
For literature, circle No. 104

Advent Loudspeaker

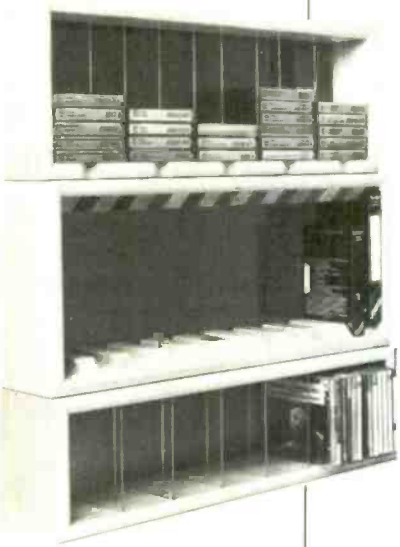
The Baby Advent uses a 6½-inch woofer and 1¾-inch ferrofluid-filled tweeter. Specifications include frequency response from 60 Hz to 25 kHz, ±3 dB; 8-ohm impedance, and maximum power handling of 150 watts, with THD less than 1.5% above 100 Hz at 1 watt. The 13-pound speaker has walnut-finished hardwood end-caps. Price: $198.00 per pair.

For literature, circle No. 105

ADS Car Subwoofer

Slightly larger drivers (7½ versus 7 inches), a long voice-coil Linear Drive System, and a light and rigid Stifflite cone material give the ADS CS700 subwoofer system 30% more air-moving capacity than the SC400 subwoofer system it replaces. The CS700 is designed to be used with a separate, high-powered amplifier; a 125-Hz electronic crossover, the AX2, comes with the two drivers. Response is rated as 30 to 125 Hz, ±3 dB. The speakers are flush-mounting, with black wire-mesh grilles. Price: $259.00 per system.

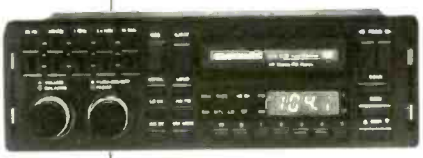
For literature, circle No. 106



Michael Blume Media Cabinets

Matching cabinets for cassettes, Compact Discs, and videocassettes are offered by Michael Blume Framemaker & Woodcraftsman. All are 24 inches long, handmade of solid ash and plexiglass, mitered and joined with ash splines instead of nails, and then lacquered and hand-rubbed. Prices: 50-cassette unit, $89.00; 20-videotape unit, $109.00; 49-CD unit, $89.00.

For literature, circle No. 108



Sparkomatic Car Stereo

Predictions that AM stereo would bring more attention to other AM circuits appear to be borne out by Sparkomatic's new SR 430 car stereo unit, which has selectable AM bandwidth to cope with congested reception areas. The tuner section also has seek and scan tuning, plus presets for five AM and five FM stations. Other features include auto reverse, a built-in five-band equalizer, DNR noise reduction, full nightlighting, a loudness-compensation switch, and a digital clock. Price: $249.95.

For literature, circle No. 107

RGR Preamp

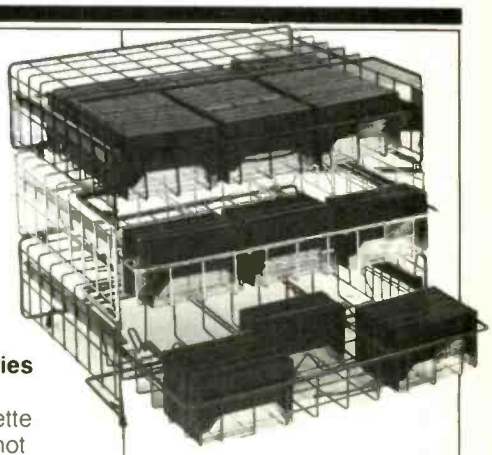
The M4-2 preamplifier, from RGR, has switchable phono gain (36 and 59 dB) for MM and MC cartridges. It also features bass and treble controls (rare in audiophile preamplifiers), two tape loops with bidirectional dubbing, LED input and monitor indicators, and rack-mounting design. Price: $850.00.

For literature, circle No. 109

Benjamin Cassette Changer

Benjamin's ACC-15 cassette changer can play for up to 15 hours, holding 10 cassettes in quick-change loading racks. The deck also features auto reverse, automatic music sensor, EQ selector, Dolby B NR, repeat play of any selection up to 10 times, a front-panel headphone jack, and blank skip. Contents of each loading rack can be written on a label area provided. Price: $395.00.

For literature, circle No. 110



Sound Accessories Cassette Rack

The C-42 cassette organizer holds, not surprisingly, 42 cassettes in a pullout drawer. Up to three drawer units can be stacked. The C-42 is available in chrome, black, red, white, gray, blue, and brown. Price: $27.95.

For literature, circle No. 111

NEC Video-Sound Control Amp

Several features mark the NEC AV-200E stereo amplifier as being designed for use with video systems: The input selector has positions for "Tape," "Tuner/AUX," "TV" and two VCRs, but no phono; video and stereo audio input and output jacks for the "VCR2" input are on the front panel, and there are stereo-synthesizer and video image-enhancement circuits. Flexible switching allows video dubbing and recording FM simulcasts (with suitable VCRs). The amplifier delivers 12 watts per channel and has a single tone control. Price: $199.95.

For literature, circle No. 112

Infinity Speaker

The Infinity RS-11 is a compact, two-way bookshelf speaker system using a 4-inch polypropylene woofer with long-throw voice-coil and a 1½-inch polycarbonate tweeter. The cabinet is only 7½ inches deep and weighs only 6 pounds, allowing it to be wall-mounted using optional brackets. Price: $112.00 per pair.

For literature, circle No. 113

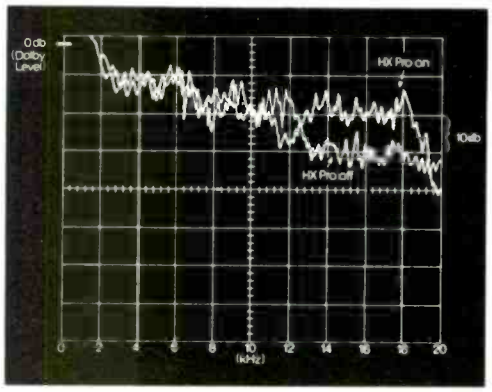
Nakamichi CD Player

Nakamichi's first Compact Disc player, the OMS-7, features 24-selection programmability (by track or index number), two-speed cueing, repeat play of the disc or of the program memory, and wireless remote control. Digital filtering and oversampling allow the use of gentler, more phase-coherent analog filters at the output. Both channels have separate D/A converters and separate electronics, powered by separately grounded, independent supplies. The transport is built on a diecasting which floats on coil springs to isolate it from external shocks. Price: $1,295.00.

For literature, circle No. 114

Dolby® HX Pro

Dolby HX Pro™ headroom extension is a program-adaptive bias technique which can significantly improve the quality of cassette recordings. High-level frequencies can be recorded more accurately, without sacrificing signal-to-noise ratio, while such side effects of tape saturation as distortion are reduced. For both the home recordist and the duplicator of pre-recorded cassettes, Dolby HX Pro improves the performance of good conventional tapes to match that of costlier, more exotic formulations, and even the more expensive tapes benefit from Dolby HX Pro.



Spectral analysis of two high-speed (32 times) cassette recordings of the same selection of rock music show the highest levels accumulated over time at each frequency. Both recordings were made on conventional iron oxide tape of the type favored for commercial cassette duplicating; in this example, the high-frequency headroom improvement provided by Dolby HX Pro is as much as 10 dB.

The problem of self-bias

Even when a cassette deck is adjusted for the nominally optimum bias for a given tape, performance is nevertheless compromised under some signal conditions. In particular, music which is rich in high frequencies has what's called a self-biasing effect. The musical high frequencies act in and of themselves as recording bias on the tape, effectively adding to the external bias supplied by the recorder's bias oscillator. The net result under such signal conditions is momentarily too much effective bias, which leads to the familiar symptoms of tape saturation. The highest frequencies don't get recorded at all, and considerable IM distortion is generated at lower frequencies.

How Dolby HX Pro deals with the problem

Dolby HX Pro uses a special circuit which constantly monitors the total effective bias — a combination of bias from the recorder's oscillator and self-bias contributed by the musical signal — while the recording is being made. If it senses the total bias increasing beyond the optimum level as a result of high frequencies in the music, it instantly compensates for the increase by lowering the bias from the recorder's oscillator, thus keeping the total effective bias constant. Even on music with a great deal of high-frequency energy, the tape remains optimally biased, and so tape saturation and its side effects are significantly reduced. The improvement in high-frequency headroom can be 6 dB or more, depending on the particular tape formulation. No decoding is necessary to realize the benefits of Dolby HX Pro.

Improve both the cassettes you make and those you buy

Dolby HX Pro technology, developed by Bang & Olufsen with the assistance of Dolby Laboratories, is provided along with Dolby noise reduction in home cassette deck models from Aiwa, B&O and Harmon-Kardon. Just as important, Dolby HX Pro can be applied to high-speed cassette duplication, where its ability to improve good conventional tape formulations is economically, as well as sonically, significant. Commercial duplicating facilities are now equipped, and the first pre-recorded cassettes made with Dolby HX Pro (as well as Dolby noise reduction) are available from the following labels: Capitol, Liberty, EMI/America, Angel, Warner Brothers, Electra/Asylum, and Atlantic.

For further information, including a complete technical explanation of Dolby HX Pro, contact Dolby Laboratories at the address below.

DOLBY HX PRO

Dolby Laboratories Licensing Corp., 731 Sansome Street, San Francisco, CA 94111, 415-392-0300.

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KEN POHLMANN

OPTIMUM OPTICS

The Compact Disc system impresses the heck out of me. I've been fooling around with digital audio for 10 years, listening critically to recorded music for 15 years, and I've never heard it this well. I dismiss most of the claims against the CD as being space-cadet musings of quacks or nefarious alarms of people with heavy investments in analog. It is a full-fidelity system better able to preserve and reproduce music than any other consumer system. As a musician, I am fully sold on its musicality in every respect—from expression of nuance to undistorted fortissimos. But my admiration doesn't stop there; as a computer systems designer, I am filled with admiration for the system's engineering excellence.

Good engineering doesn't mean complexity or impenetrability of design intent—far from it. A suspension bridge gracefully spanning a canyon or an elegantly conceived computer CPU card each illustrate good engineering. A good design is essentially simple, almost purposefully sparse to make the product reliable and affordable. In my mind the Compact Disc system exemplifies this. Very tricky obstacles have been overcome through high technology to achieve the kind of elegant solution that looks obvious once you've seen it done. Perhaps the best example of this lies in the optical technique used for the discs and the players. For the next several months I would like to explore the design of the optical pickup, its automatic tracking and automatic focus systems, as well as the nature of the optical track on the discs themselves.

Let there be no mistake: The Compact Disc system is a remarkable engineering accomplishment. The high-density storage and contactless data reading make it one of the most advanced storage mediums available. One of the secrets of this system is the optical pickup used to read the data from the disc. A disc might contain 10 billion pits precisely arranged on a spiral track; the optical pickup must focus, track, and read that data track. The entire lens structure, a combination of the laser source and the reader, must be small enough to glide laterally beneath the disc, moving in response to tracking information and user random-access programming. Engineers have solved these pickup design criteria admirably; the CD pickup shown in Fig. 1 is a beautifully conceived piece of work. Although design particulars vary among manufacturers, they are generally very similar.

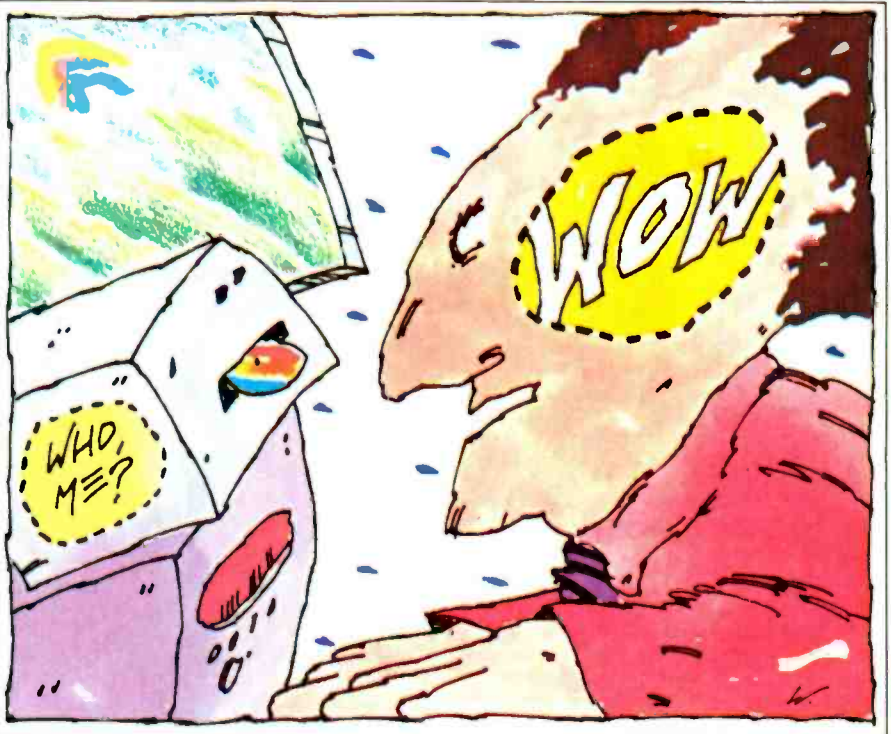

Illustration: Thomas H. Waters

A conventional gas laser would be too bulky for use as a pickup; instead, the CD pickup uses a semiconductor laser with a 5-mW optical output irradiating a coherent-phase laser beam with a 780-nm wavelength. The light-emitting properties of semiconductors have been utilized for many years; for example, light-emitting diodes (LEDs) use this mechanism to emit ordinary light. However, laser light is significantly different from ordinary light since it is coherent in phase. Because the initial level of the light is low, several amplification steps are needed to raise the output. This is done by adding forward bias to a PN transistor junction and then recombining the emitted light. The recombining requires a modified semiconductor, one which has a "carrier" inserted in the activating layer, which is made of AlGaAs (aluminum, gallium, and arsenic). The activating layer is sandwiched between layers of material which have refraction ratios which are different at both boundaries, and the crystal surface towards the emitted light is made reflective. The result is a light resonator with constant wave emission.

A monitor photodiode is placed next to the laser diode to control power to the laser to compensate for temperature changes. The monitor diode conducts current in proportion to the laser's light output.

For tracking and reading, the light from the laser point source (in most players) passes through a diffraction grating, which is a screen with slits spaced only a few laser wavelengths apart. As the beam passes through the grating, it diffracts at different angles; when the resulting collection is again focused, it will appear as a single, bright, centered beam with a series of successively less intense beams on either side. The pickup system uses the center beam for reading data, tracking, and focusing, and the two first-order beams only for tracking.

The next part of the optical system, a polarization beam splitter (PBS), directs the laser light to the disc surface, then angles the reflected light to the photo sensor. The PBS consists of two prisms with a common 45° face, sepa-

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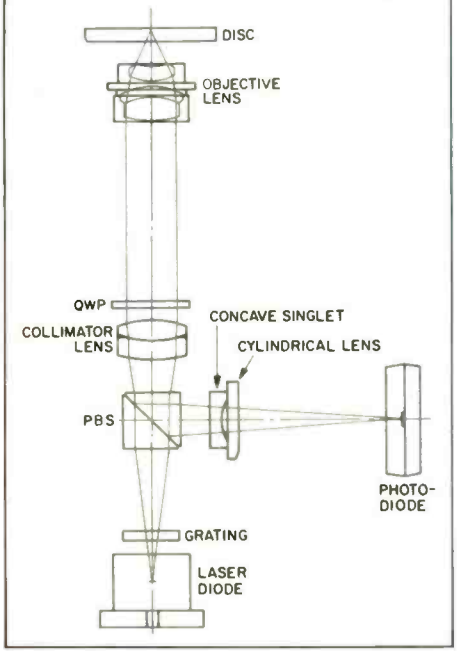
Good engineering doesn't mean complexity—far from it. A good design is essentially simple, almost purposefully sparse.

rated by a membrane. That membrane acts as a one-way mirror; the coherent, polarized light from the laser passes through it to the disc surface, while the light returning from the disc, which has the opposite polarization, is reflected and angled toward the side of the prism facing the photo sensor which eventually reads the digital data.

A collimator follows the PBS (in some designs, it precedes it). Its purpose is to make the divergent light rays parallel. The light then passes through a quarter-wavelength plate (QWP), a special crystal material which controls the polarization of the light beams to make the PBS work. The light's phase is shifted 90° each time it passes through the QWP, once en route to the disc and again on its return. The reflected light is thus 180° out of phase relative to the incoming light at the beam splitter, so the PBS will properly deflect it.

The final piece of optics in the path to the disc is the objective lens; it is used to focus the beams on the disc surface. The main spot is about 0.8 mm in diameter on the outer surface of the transparent polycarbonate layer. The refractive index of the polycarbonate layer is 1.55 and its thickness is

Fig. 1—A typical CD-player optical system.



The result of design simplicity is a reduction in size and cost, which breeds further advances in design simplicity.

about 1.2 mm, so the spot is narrowed to 1.7 micrometers at the reflective surface, slightly wider than the pit width of 0.5 micrometer. The objective lens is attached to a two-axis actuator and servo system which moves it up and down for focusing and laterally for tracking.

The data encoded on the disc now determines the fate of the laser light. When the spot strikes an interval between two pits, the light is almost totally reflected; when it strikes a pit, one with a depth in the transparent layer of about a quarter wavelength of the laser light, interference causes less light to be reflected. (Though the spots encoding the data are commonly called pits, because they're pressed into the disc's upper surface, they are actually bumps as seen by the laser, which reads them from below.

The varying-intensity light beams return through the objective lens, the QWP (for their second 90° phase shift), and the collimator lens to strike the angled surface inside the PBS. There, they are deflected 90° and pass through a singlet lens and a cylindrical lens en route to the photodiode.

The cylindrical lens is part of the focusing servo system. As the disc surface deviates (as much as ±0.6 mm), the laser image passing through the cylindrical lens changes shape from round (if the disc is in focus) to elliptical (if it's out of focus). A four-quadrant photodiode senses this and sends that information to the servo system, to keep the objective lens focused at the proper depth of ±2 μm.

The center beam, which carries the data from the disc and controls autofocusing, has been accompanied by the two secondary beams since the diffraction grating. The tracking beams also struck the disc surface and were reflected, and their varying intensity is now used at two separate photodiodes mounted alongside the four-quadrant photodiode. When the central beam is properly tracking the pit track, their intensity is equal. The tracking beams have unequal intensity when the central beam has deviated. Then, a servo system uses the output of the tracking photodiodes to bring the beam back on track. Both auto-focus and auto-tracking involve clever ideas; we'll cover them in later columns.

The Compact Disc pickup is thus a fairly simple device after all—nothing that a sharp high-school physics major couldn't have dreamed up. The resulting simplicity breeds reductions in cost and size. Pickups now account for about one-third the cost of the total player, but that will fall fast, especially as volume of production increases. New pickups less than 2 cm high now permit car and portable CD players. In the CD pickup, engineers have come up with an elegant design. And that, as I have noted, is the mark of outstanding engineering: When a complicated problem is solved—compactly.

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BERT WHYTE

DASH WITH PANACHE

The 76th Convention of the Audio Engineering Society was held October 8th through 11th, 1984, at the New York Hilton Hotel. This was the second year at this venue, and the hotel remains starkly commercial, making me yearn all the more for a return to the gracious and civilized ambience of the Waldorf. No doubt spurred by the ever-growing interest in digital audio, attendance was gratifyingly high. While there were no industry-shaking breakthroughs, many interesting new products were displayed.

You may recall that in last January's issue I noted that a consortium of Sony, MCI, Studer, and Matsushita had agreed to the adoption of DASH (Digital Audio Stationary Head, a digital audio recording system. I explained the system and the number of tracks possible at 7½, 15, and 30 ips on quarter- and half-inch tape. All digital recorders that use the DASH system are supposed to be compatible with each other. At this convention, both Sony and Studer introduced their own versions of DASH digital recorders. While similar, there are certain differences, which prompted some less than friendly remarks from respective company spokesmen. As reported in the *Pro Sound News Daily* (a convention newspaper), Studer claimed that "Sony's guidelines for DASH are 'too restrictive' " and that they "have 'differing views' about components that should be features in DASH machines." "One difference," said *PSND*, "is that the Sony system is driven by an auxiliary track, while the Studer system is driven by a digital track."

Sony PCM-3102

The Sony PCM-3102, a two-channel DASH recorder operating in the slow (7½-ips) mode, affords 2 hours of digital recording on quarter-inch tape on a 10½-inch NAB reel. It uses 16-bit linear quantization with sampling rates switchable between 44.1 and 48 kHz. The PCM-3102's two analog tracks can be used for recording in the event of a failure of digital recording capability. Digital and analog tapes are recorded in-line, and this permits manual cueing and razor-blade editing. An SMPTE time-code track is provided to allow accurate synchronization with film and video applications.

The Studer D820 also operates in the DASH slow mode and has the same sampling frequencies. The D820 uses what are claimed to be virtually "adjustment-free" in-line ferrite heads in a die-cast head block. Twelve in-line tracks are recorded on the quarter-inch tape (eight for digital audio, one for time code, one for reference data and two for digital cueing, one of which can later serve as Compact Disc subcoding). Two-hour recordings are possible on a 10½-inch NAB reel and in excess of 4 hours on 14-inch reels. Control of the D820 is through a network of microcomputers under supervision of a master control. As with the Sony PCM-3102, the Studer D820 can also be used as an analog recorder. The D820 machine features newly developed A/D and D/A converters and audio filters. Time-code synchronization is also available, and both electronic and razor-blade editing are similarly possible.

Both the Sony and Studer DASH recorders are technical tours de force, with Matsushita's machine still waiting in the wings. A number of companies which manufacture digital recorders did not join the DASH ranks. One of them, Mitsubishi, needled the DASH group in a prominent ad in the convention *Daily*: "Mitsubishi, 74—DASH, 0"

Studer D820

the ad proclaimed, stating the company had delivered 74 of their X-80 digital recorders against no deliveries of a DASH machine. However, in another ad, Mitsubishi goofed in stating they had "the only 32-track digital recorder." Obviously, they forgot the 3M 32-track recorder, which is still very much alive. (My recording associate, Frank Dickinson, is currently using four of them in his Digital by Dickinson recording service.)

In spite of the glamor and excitement of digital recording, there were a surprising number of new analog recorders introduced at the convention. Although most classical recordings these days are digitally mastered, apparently there are enough applications for high-quality, two-channel analog recorders to warrant the manufacture of new models. Of course, it must be said that with the availability of microcomputers and other advanced technology, these new analog recorders have performance parameters and operating conveniences far beyond the best analog machines of just a few years ago.

A case in point is Studer's new A820 analog mastering recorder. This unit, which accepts 14-inch reels, has a completely new transport with multiple microcomputers for control and monitoring of all functions. Approximately 40 user functions can be programmed, and there are new phase-compensat-

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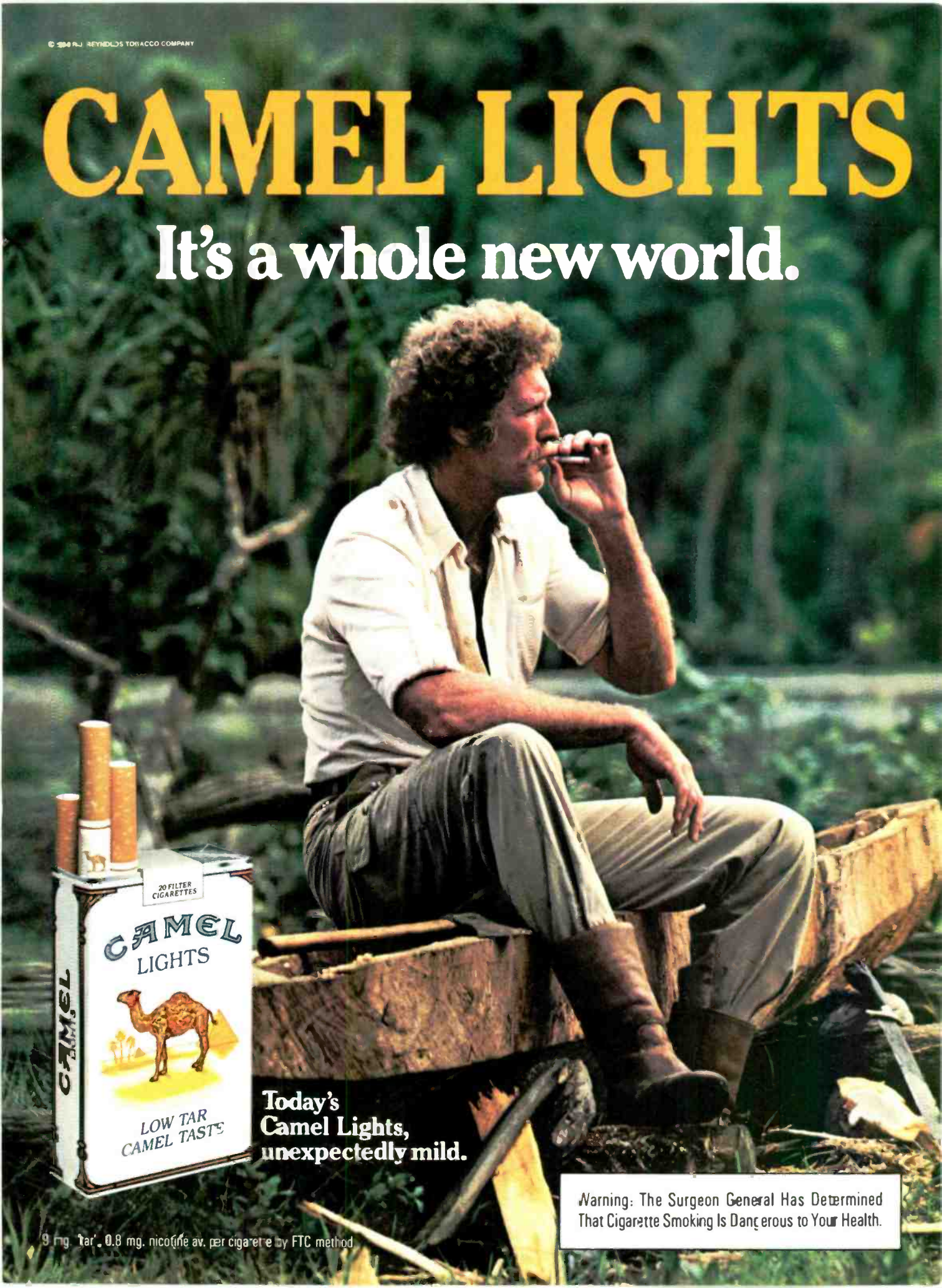

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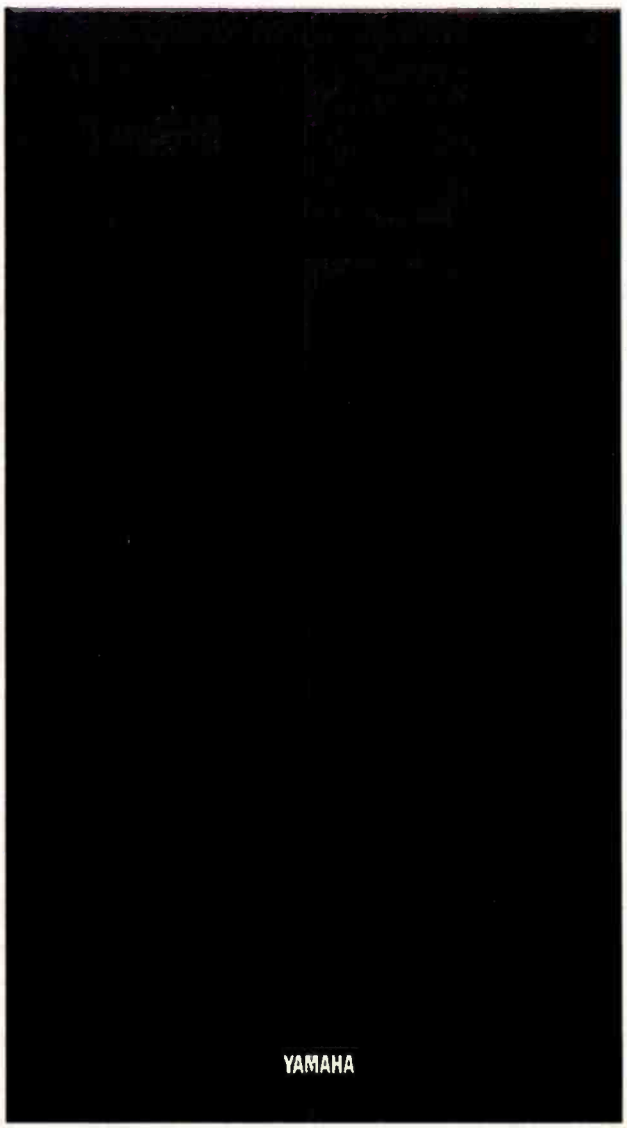


In spite of the glamor and excitement of digital recording, many new analog recorders were introduced at the 76th AES Convention.

ed audio electronics. Inputs and outputs are available with either transformers or advanced active balancing circuitry. Such parameters as bias, level, EQ, etc. are set and stored digitally. Options for the A820 will include center-track time code and a serial interface for external computer control. The price for a two-channel, quarter-inch A820 in a console will be approximately $10,000, with delivery slated for mid-1985. An A820 handling half-inch tape will also be available.

Directly competitive with the Studer A820 is Otari's MTR-20 mastering recorder. This, too, is a very modern machine utilizing microcomputers for many functions. It offers tape speeds of 30, 15, 7½ and 3¾ ips, with switchable NAB/ICC/AES record and playback equalization. A really nice feature is the record alignment system: Record level, bias level, high- and mid-frequency EQ, and phase compensation are automatic. Eight record alignment memories store setups for two tape formulations in each of four speed/EQ combinations. SMPTE time code is available, as is an optional interface for external computer control. The MTR-20 is available in two-channel, quarter-inch and two- and four-channel, half-inch configurations.

Still another competitor in this area is Tandberg's TD50, a professional, quarter-inch mastering recorder. Tandberg has a long history of producing excellent consumer open-reel recorders, but this is their first entry into the true professional recorder market. The design of the TD50 incorporates some innovative ideas. For example, all mechanical components of the transport are mounted directly to a 10-mm thick plate of special Alcoa "Alca Plus" aluminum alloy. This alloy is molded by a proprietary process which is claimed to result in exceptional flatness and a memory that enables the alloy to return to its original shape after stress. Tandberg also uses a microprocessor for many control functions, with SMPTE time code and an external computer interface available. The TD50 has 15, 7½ and 3¾ ips tape speeds, and it can use 10½-inch reels or 12-nch pancakes. The three-speed capstan motor is controlled by a quartz reference oscillator. Settings for bias, level, and EQ are controlled by the microprocessor. Tandberg is particularly proud of the TD50 electronics: Only discrete components are used (no ICs), with a minimum number of polyester capacitors in the signal path and minimum use of negative feedback. The head block is also made of the "Alca Plus" alloy, and tape guides are solid ruby. The TD50 is obviously a well-thought-out machine, built to withstand the rigors of professional recording. Price will be around $8,000.

Tandberg TD50

Tandberg also introduced the TCD910, an elaborate professional cassette recorder, and the TCCR530 computer-controlled cassette recorder. The TCD910 should get a warm welcome from studio engineers who have been frustrated by consumer cassette recorders.

One last item before I close: The Kurzweil 250 synthesizer. One of the hits of the convention, this is a mind-boggling instrument which, in the hands of an expert, can not only create the exotic sounds normally expected from a good synthesizer but give very lifelike, believable simulations of musical instruments. The 250 has an 88-note keyboard, as does a normal piano, and it processes 12 channels with a dynamic range of over 100 dB. The complexity of the microprocessor system is staggering. As Kurzweil so whimsically puts it, "resident instruments" include concert grand piano, violin, viola, cello, and bass string sections; plucked acoustic bass, snare drum, bass drum, crash cymbals, and other percussion instruments are available. There's also trumpet, baritone horn, valve trombone, nylon-string acoustic guitar . . . I could never describe all of the effects! The Kurzweil 250 comes with 40 factory-installed keyboard setups, and many more are user-programmable. The unit may be interfaced with an Apple Macintosh computer.

Tandberg TCD910

It is the sounds the 250 makes that are so remarkable. The piano is outstanding, with sharp, precise transient attack and a well-developed harmonic structure. The same can be said for percussion. Trumpet and horn are extremely realistic, again with good harmonic structure. Of course, the electronic players in this orchestra can produce dynamics and explore frequency extremes beyond the capabilities of mere men! Up to six layers of sound can be programmed, and it was quite startling to hear a single demonstrator play piano, with percussion accompaniment, plucked string bass, etc. The 250 is an incredibly versatile instrument, costing slightly over $10,000. I don't know beans about playing an instrument like this, but I do know that I would have a great time just diddling around with one!

IVAN BERGER

THE BUCKS START HERE

Illustrations: Michael Donato

Getting Off Cheap

What did you spend for your stereo system—$1,000? $10,000? (Our average reader's system is worth about $4,000.) Whatever its cost, sooner or later someone—probably someone near and dear to you—is going to say, "You mean you spent that much for a *record player?*"

When that happens, tell them that your system was cheap . . . compared to what you could have spent on it. If you bought the most expensive item in each category of our recent Annual Equipment Directory, you would have wound up spending a lot more than what you've spent already—probably more than you've ever dreamed of spending.

For example, the most expensive turntable system you could get would be the Goldmund Reference turntable ($10,900), the Goldmund T3 linear arm ($2,800—but save $800 if you opt for a pivoted Mod Squad Triplanar arm, instead), and the Kiseki Lapus moving-coil cartridge ($3,500). That's $17,200—and you can't even hear it yet.

To remedy that, get the Burmester 808 preamp ($8,450) and a pair of Stax Lambda Professional headphones ($800). Assuming those will work together (I haven't had the courage to look), we now have a nice-sounding, if rather private, phonograph for just $26,450. Now, don the headphones to drown your family's screams, and pick up your calculator for the next lap.

You want a full complement of sound sources, naturally. So add Sony's CDP-5000 professional CD player ($6,500), the Sequerra tuner ($5,000), the Revox B710 Mk II cassette deck ($2,000), and the Mark Levinson ML-5 open-reel deck ($14,400). Total so far, $54,350.

For digital recording capability, we'll want the dbx 700 digital processor ($4,600) for its 110-dB dynamic range. But since the dbx 700 uses a unique recording system, we'll also want a Sony PCM-F1 ($1,900) to stay compatible with those friends of ours who make regular PCM tapes.

Then we'll need a video recorder to take down the digits—a VCR with Hi-Fi sound, so we can use it for good analog taping too. It should also be portable, to take advantage of the PCM-F1's portability. I don't know, offhand, of any Beta Hi-Fi portables, so, despite a possible need for plug adaptors, let's make it the VHS Hi-Fi Quasar VP5747XE, at $1,600. (So what if it's not in our Directory. Live a little!)

That foray into digital added $8,100, bringing the total so far to $62,450 . . . and still no one but you can hear it. So now for amplifiers and speakers: We already have that Burmester preamp, so next we need Esoteric Audio Research power amps, 500 watts per channel, a mere $10,000 per pair.

For speakers, my eye lit first on the Mavrick Audio MAM-1 system, for $50,000—but that includes its own amplifiers, which would bring us back into the budget category, relatively speaking. So I guess our choice is the Wilson Audio Modular Monitor, or WAMM, for $42,000. (The Infinity Reference Standard III is only $31,500 per system, hardly worth talking about.)

That brings the total system cost to $114,450, with the speakers taking up a reasonable 37% of the total. But are we done?

Hardly. Since a system like this will reveal every defect in the source material, we'll need gadgets to conceal those defects again. So we'll get a Packburn 323 noise suppressor ($2,450), which combines click and pop reduction with dynamic noise suppression; we'll get a dbx 4BX expander ($800), too. To equalize the program material's frequency response, we'll get a Sony Esprit SE-P900 parametric equalizer ($1,750); to equalize our room, we'll get the 31-band Klark-Teknik DN360 ($1,500). And while we're adding accessories, we'll get a dbx 224X noise reducer ($250) in case we want to make or play dbx recordings

There we are, just $121,200.

Of course, that doesn't count delay systems, cables, turntable mats, tape and record storage, equipment cabinets, record cleaners, and (in most states) sales tax. Not to mention sound-conditioning for our listening room, whether it takes the form of acoustic panels or Persian rugs. But here you're on your own, for these don't appear in our Directory. And we hear four-channel might be coming back . . . .

If you have any change left, buy a record.

Electronics Is 80–Or Is It 101?

The first electronic tube was made in 1904 by J. A. Fleming in England. It was soon used as a detector in radio-telegraphy. So we could say that this is electronics' 80th anniversary.

But we could also say, with equal justice, that it is 101 years old. For it was in 1883 that Thomas Edison noted a puzzling effect: An electric current could be made to flow across the empty space between a lightbulb filament and a tinfoil coating on the inside of the glass, and that current would flow only in one direction. It was more than a decade later before J. J. Thompson showed that the Edison Effect was due to the passage of electrons.

Of course, there will be those who date the birth of electronics not from Edison's observation or from Thomson's diode but from Lee de Forest's triode (1906). For them, electronics will be 78 years old.

Happy birthday, anyway, whichever one it is.

Kitfalls

Kit-builders should not assume that they've done everything correctly just because their newly built equipment runs. It can take years for some assembly errors to manifest themselves. I've had kits stop working after five years or more because of semi-cold (cool?) solder joints that took all that long to become nonconducting, and wires not even soldered which took equally long to work their way loose. If a kit-built component dies of presumed old age, double-check your workmanship before you start hunting for sick parts.

Ask for the Estimate

After 15 years, the preamp in my bedroom system went dead in one channel, so I sent it back to its maker for repair. Back it came promptly . . . with a $95 C.O.D. charge.

Would I have had it fixed if I'd known the price? Maybe, maybe not. It's still a better preamp than I could buy for $95, though probably not as good as one I could get today for $250 or so. I would have preferred some time to think about it.

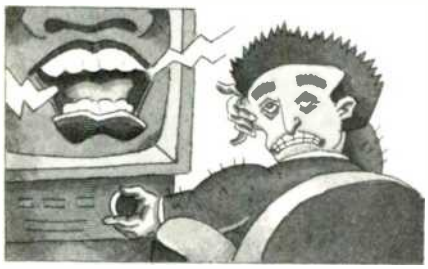
I'd have had that time, if my letter to the service department had asked for an estimate. Some service shops automatically give estimates, others give estimates only when the cost of repair looks disproportionately high to them, while still others only estimate when told to. Be on the safe side—ask for an estimate before servicing.

Even the estimate should cost you something. To estimate the cost of a repair, a shop has to open the component up and diagnose it, and diagnosis often takes more time than replacing the affected parts. However, reputable shops will tell you the cost of getting estimates before you commit yourself even that far.

Gain vs. Pain

Mostly, our volume controls just control volume, and all we have to do is adjust them till the sound level is right. But when we have two volume controls in series, the positions of both controls count.

I got a reminder of that when I hooked up an old preamp and amp to my new component video system. I hadn't realized video sound was that distorted . . . till I figured out that I was overloading my preamp's input stage by feeding it too strong a signal from the video tuner. Turning down the tuner volume got rid of the distortion; turning the preamp's volume up restored normal sound level.



If the tuner's output had been too low, of course, I would have had to turn my preamp's gain up higher, giving me noise instead of distortion. Most of us know this stuff; we just forget to apply it sometimes, at least for a minute or two.

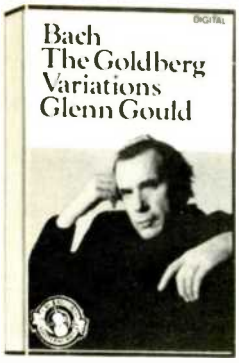
Best in the Neighborhood

To get the finest audio system in the neighborhood, some audiophiles spend months shopping and listening. But there are shortcuts: You can always find someone to select and assemble your system for a fee.

Speaker designer Richard Shahinian has done a few such installations in the past. One was for someone who'd heard a neighbor's $8,000 system and wanted to outdo it. He didn't specify what the system should contain—just that it should cost $11,000.

When the system was completed, the customer complimented Shahinian, gave him a $100 tip, and then told him: "Remember, you don't do any more $11,000 installations in this town—$8,000, $10,000, okay, but no more $11,000 jobs!"

THE CLASSICS



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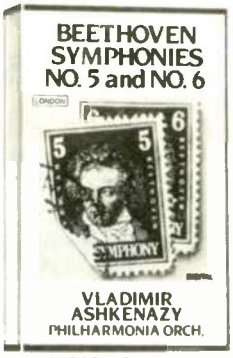


323170-393173 *(Counts as 2)*

321851

318451

326553

BACH

326983. Bach: Organ Masterpieces—*Toccata & Fugue in D Minor*, etc. Anthony Newman (Sine Qua Non)

171504. Switched-On-Bach—Moog versions of *Air on a G String; Wachet Auf*; etc.—played by Wendy Carlos (Columbia)

319434. Bach: Sonatas for Viola De Gamba and Harpsichord—Yo-Yo Ma, cello; Ken Cooper, harpsichord *(Digital*—CBS Masterworks)

306464. Little Bach Book—Glenn Gould plays favorites from *French Suite*; many more (Columbia)

316216. Bach: Suite No. 2 for Flute; Telemann: Flute Suite in A Minor—J. Baker, A. Newman, Madeira Festival *(Digital*—Vox Cum Laude)

328054. Bach's Tops—*Gavotte; Sleepers Awake*; more. Kapp, Philharmonia Virtuosi of New York (CBS)

BEETHOVEN

273409. Beethoven: 3 Piano Sonatas—(Moonlight, Appassionata, Pathetique) Horowitz, piano (Columbia)

326918. Beethoven: Piano Sonatas No. 3 & 23 (Appassionata)—beautifully played. Andre-Michel Schub *(Digital*—Vox Cum Laude)

325340. Beethoven: "Hammerklavier" Sonata; 11 Bagatelles—Rudolf Serkin (Masterworks Portrait)

322362. Beethoven: Piano Trios No. 1 & 3—three virtuosi: Barenboim, DuPre, Zukerman (Vox Cum Laude)

315457. Beethoven: Symphony No. 3 (Eroica)—Szell, Cleveland Orch. (CBS Great Performances)

252874. Beethoven: Symphony No. 9 (Choral)—Ormandy and the Philadelphia Orch. (Columbia)

325654-395657. Beethoven: Piano Concertos No. 1 & 5 (Emperor)—Brendel, piano; Mehta and Boettcher, cond. (Counts as 2—Vox)

230425. Beethoven: Violin Concerto—Isaac Stern; Bernstein, New York Phil. (Columbia)

173674. Beethoven's Greatest Hits—*Ode to Joy*; excerpt from *Moonlight Sonata*; etc. Various artists (Columbia)

BRAHMS

307884. Brahms: Double Concerto—Zukerman, Harrell; Mehta, New York Philharmonic (Columbia)

328039. Brahms: Symphony No. 3; Haydn Variations—Mehta, New York Phil. (CBS Masterworks)

329110. Brahms/Schoenberg: Piano Quartet—a masterful transcription! Comissiona, Baltimore Sym. *(Digital*—Vox Cum Laude)

312439. Brahms: Liebeslieder Walzer; Neue Liebeslieder Walzer (complete)—L.A. Vocal Arts Ensemble *(Digital*—Nonesuch)

CHOPIN

246843. Chopin: Mazurkas, Etudes, etc.—Vladimir Horowitz, piano (Columbia)

306183. Chopin: Piano Concerto No. 1—Murray Perahia, Zubin Mehta and N.Y. Phil (Columbia)

DEBUSSY

322826. Debussy: La Mer; Nocturnes—Michael Tilson Thomas, Philharmonia Orch. *(Digital*—CBS Masterworks)

328005. Debussy: Images (complete); **Estampes;** etc—Ivan Moravec, pianist *(Digital*—Vox Cum Laude)

296830. Debussy: Quartet; Ravel: Quartet—Tokyo String Quartet (Columbia)

328401. Debussy: Sonata for Flute, Viola and Harp; Syrinx for Solo Flute—plus works by Ravel, Faure, etc. Orpheus Trio *(Digital*—Vanguard Audiophile)

191874. Debussy's Greatest Hits—*Clair de lune, Reverie*, etc. Bernstein, Ormandy, etc. (Columbia)

GERSHWIN

318295. Gershwin Live!—Sarah Vaughan sings *The Man I Love*, etc. Thomas, Los Angeles Phil. (CBS)

321471. Gershwin: Piano Concerto in F; An American in Paris; Rhapsody in Blue—Andre Previn and the London Symphony (Angel)

HAYDN

326561. Haydn: 3 Favorite Concertos—Cello in D (Yo-Yo Ma), Violin in C (Cho-Liang Lin); Trumpet in E Flat (Wynton Marsalis (CBS Masterworks)

257956. Haydn: Symphonies No. 101 (Clock) and **No. 103** (Drum Roll)—Bernstein, New York Phil. (Columbia)

MAHLER

314369. Mahler: Symphony No. 1 (Titan)—Maazel, Orch. Nat'l de France (CBS Masterworks)

317685. Mahler: Symphony No. 4—Ameling, Previn, Pittsburgh Sym. (Angel)

325357. Mahler: Das Lied von der Erde—soloists, N.Y. Phil., Bruno Walter (Masterworks Portrait)

MOZART

294264. Mozart: Piano Concerto No. 21 (Elvira Madigan) and **No. 17**—Ashkenazy plays, conducts Philharmonia Orch (London)

325365. Mozart: Eine Kleine Nachtmusik; Symph. No. 40—Casals, Marlboro (Masterworks Portrait)

318311. Mozart: Symphonies 36 (Linz) **38** (Prague)—Rampal, Mostly Mozart Orch. (CBS Masterworks)

314955. Mozart: Symphonies No. 40 & 41 (Jupiter)—Szell, Cleveland Orch. (CBS Great Performances)

326975. Mozart: Violin Concerto No. 4; Adagio; Rondos—Zukerman plays, conducts St. Paul Chamber Orch (CBS Masterworks)

SCHUBERT

322487. Schubert: "Death and the Maiden"; "Quartettsatz"—Tokyo String Quartet *(Digital*—Vox Cum Laude)

317677. Schubert: Symphony No. 8 (Unfinished), **Rosamunde Overture and Ballet Music**—von Karajan, Berlin Philharmonic (Angel)

321729. Schubert: The Impromptus, Op. 90 & 142—Murray Perahia, piano *(Digital*—CBS Masterworks)

325092. Schubert: Sonata in B Flat; etc.—Alicia de Larrocha *(Digital*—London)

320432. Schubert: String Quartets Nos. 12 & 13 (Quartettsatz)—Juilliard Quar. (CBS Masterworks)

TCHAIKOVSKY

312777. Tchaikovsky: Capriccio Italien; Rimsky-Korsakoff: Capriccio Espagnol; etc.—Bernstein (CBS Great Performances)

308874. Tchaikovsky: Piano Concerto No. 1—Gavrilov; Kitaenko cond. Moscow Radio/TV Sym. Orch. (Col./Melodiya)

231563. Tchaikovsky: Swan Lake and Sleeping Beauty Ballet Suites—Ormandy, Philadelphia Orchestra (Columbia)

329169. Tchaikovsky: Symphony No. 4—Lorin Maazel, Cleveland Orch. (CBS Masterworks)

245399. Tchaikovsky: Symphony No. 6 (Pathetique)—Ormandy and Phila. Orch. (Columbia)

304352-394353. Tchaikovsky: The Nutcracker (complete)—Andrew Davis, Toronto Symphony (Counts as 2—Columbia)

173666. Tchaikovsky's Greatest Hits—*Waltz Of The Flowers, 1812 Overture*, more Bernstein, N.Y. Phil. Ormandy, Phila (Columbia)

293191. Tchaikovsky: Violin Concerto; Meditation—Stern, Rostropovich, National Sym (Columbia)

BAROQUE

323543. Handel: Royal Fireworks Music; Oboe Concertos 1-3—Karl Munchinger, Stuttgart Chamber Orch. *(Digital*—London)

324087. Handel's Top Tunes—Richard Kapp and Philharmonia Virtuosi of N.Y.! *Arioso, Largo*, etc. (CBS)

329615. Handel: Water Music—Malgorie, La Grande Ecurie & la Chambre du Roy *(Digital*—CBS Masterworks)

326595. Music For The Kings of France—harpsichord suites by Marchand and Couperin. Igor Kipnis (Nonesuch Silver Series)

316406. Pachelbel Canon & Other Baroque Favorites—Boyd Neel, Toronto Chamber Orch. *(Digital*—MMG)

324525. An Isaac Stern Vivaldi Gala: Concertos For 2 and 3 Violins; etc—Stern, Zukerman, Perlman, others (CBS Masterworks)

MODERN

325274. Berg: Lulu Suite—also Schoenberg, Webern Ormandy, Philadelphia Orch (Masterworks Portrait)

263293. Bolling: Suite For Flute and Jazz Piano—Rampal, Bolling (Columbia)

240473. Copland: Appalachian Spring (complete)—Copland conducts London Symphony (Columbia)

309500. Copland: Rodeo; Billy The Kid—popular ballet scores played by Bernstein, New York Phil. (CBS Great Performances)

326439. Copland: Rodeo; Dance Symphony; El Salon Mexico; Fanfare for the Common Man—Dorati, Detroit Sym. *(Digital*—London)

329060. Falla: Nights In The Gardens Of Spain; Three-Cornered Hat (Suite No. 2); etc.—Osorio, piano, de la Fuente, Xalapa Sym. *(Digital*—Vox Cum Laude)

319004. Glass, Philip: The Photographer—"Some of his best music to date"—*Time* (CBS)

201665. Grofe: Grand Canyon Suite—Ormandy, Phila. Orch. (Columbia)

326272. Holst: The Planets—Bernstein, New York Phil (CBS Great Performances)

326256. Ives: Symphony No. 4; Robert Browning Overture—Stokowski, cond (Masterworks Portrait)

318246. Orff: Carmina Burana—Muti, Philharmonia Orch. & Chorus (Angel)

318691. Prokofiev: Love For Three Oranges Suite; Lt. Kije Suite—Thomas, L.A. Phil (CBS Masterworks)

324533. Respighi: Feste Romane; Pines & Fountains Of Rome—Dutoit, Orch. de Montreal *(Digital*—London)

326223. Schoenberg: Pelleas & Melisande—Barenboim, Orch. de Paris (CBS Masterworks)

324046. Shostakovich: Cello Concerto No. 1; Kabalevsky: Cello Conc. No. 1—Yo-Yo Ma, cello, Ormandy, Philadelphia Orch *(Digital*—CBS Masterworks)

281493. Stravinsky: Rite Of Spring. Zubin Mehta, NY Phil (Columbia)

326405. Stravinsky: The Firebird (complete ballet)—Dohnanyi, Vienna Philharmonic *(Digital*—London)

326322. Varese: Density; Ionisation; Integrales; etc—Craft, Columbia Sym (Masterworks Portrait)

ROMANTICS

325308. Berlioz: Lelio—Boulez conducts soloists, London Symphony & Chorus (Masterworks Portrait)

325282. Bruch: Violin Concerto; Lalo: Symphonie Espagnole—Francescatti, Mitropoulos, Schippers, cond (Masterworks Portrait)

326454. Dvorak: Cello Concerto; Bruch: Kol Nidrei—Harrell, Ashkenazy, Philharmonia Orch *(Digital*—London)

326926. Dvorak: Legends—Zinman, Rochester Phil. *(Digital*—Nonesuch)

325381. Grieg: Piano Concerto; Schumann: Piano Concerto—Leon Fleisher, Szell, Cleveland Orch. (Masterworks Portrait)

228684. Grieg: Peer Gynt Suites 1 and 2; Bizet: Carmen Suites—Leonard Bernstein and the New York Phil. (Columbia)

321190. Liszt: Hungarian Rhapsodies 1, 4, 6; Rakoczy March; etc.—Boskovsky, Phil. Hungarica (Angel)

305730. Mendelssohn: Symphony No. 4 (Italian), **Overtures**—Andre Previn, London Symphony (Angel)

309492. Mussorgsky: Pictures At An Exhibition; Night On Bald Mountain—Bernstein, New York Phil (CBS Great Performances)

310698. Offenbach: Gaite Parisienne; Saint-Saens: Danse Macabre; Dukas: Sorcerer's Apprentice—Maazel, Orch. National de France (Columbia)

245043. Rachmaninoff: Piano Concertos No. 1 & 2—Ashkenazy, Previn, London Symphony (London)

176578. Rachmaninoff's Greatest Hits—*Vocalise, Piano Concerto No. 2; 3 Preludes*, etc. Various artists (Columbia)

318436. Rimsky-Korsakov: Scheherazade—Svetlanov, London Symphony (Angel)

325100. Saint-Saens: Carnival of the Animals—also works by Debussy, Satie. Philip Jones Brass Ensemble *(Digital*—London)

300871. Saint-Saens: Piano Concerto No. 3; Africa; more—Entremont, Plasson, cond (Columbia)

314260. Salieri: Sinfonia Veneziana; more—Pesko, cond (CBS Masterworks)

234237. Schumann: Piano Concerto; Mendelssohn: Piano Concerto No. 1—Rudolf Serkin, Ormandy, Phila. Orch. (Columbia)

225888. Smetana: Moldau, Bartered Bride Overture, Dances; Dvorak: Carnival Overture—Bernstein, NY Phil (Columbia)

310870-390872. Johann Strauss' Greatest Waltzes Ormandy, Szell, Bernstein (Count as 2—Columbia)

320424. Richard Strauss: Ein Heldenleben—Dicterow, violin, Mehta, NY Phil *(Digital*—CBS Masterworks)

202796. Richard Strauss: Also Sprach Zarathustra—Bernstein, New York Philharmonic (Columbia)

326660. Suppe: Overtures—*Poet and Peasant, Light Cavalry*, etc.—Solti, Vienna Phil. (London/Jubilee)

326447. Verdi: Overtures—*La Forza del Destino, I Vespri Siciliana; Nabucco*, etc. Chailly, National Philharmonic *(Digital*—London)

321844-391847. Verdi: La Traviata—Original Motion Picture Soundtrack. Stars Domingo, Stratas (Counts as 2—Elektra)

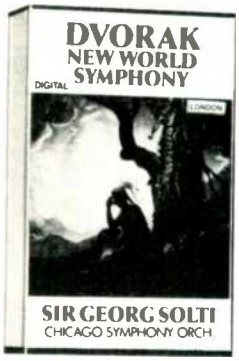
323733. Wagner: Orchestral Music from "The Ring"—*Ride of the Valkyries*, etc Mehta and New York Phil *(Digital*—CBS Masterworks)

310086. Wagner: Overtures—*Flying Dutchman; Rienzi*, etc. Maazel, Philharmonia Orch (Columbia)

ON CASSETTES!

Many available in stunning DIGITAL sound —and all also available on records

327551



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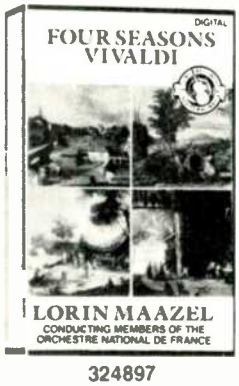

324897

FROM BAROQUE TO BOLLING

...and BACH, BEETHOVEN, BRAHMS too.

324780

VIRTUOSO!

325886. Liona Boyd—Live In Tokyo. Works by Dowland, Soler, Falla, etc *(Digital*—CBS Masterworks)

305714. Canadian Brass—Royal Fanfare. Works by Bach, Joplin, Mendelssohn, Des Prez, etc (Vanguard)

329128. Wendy Carlos' "Digital Moonscapes"—an exciting tour de force *(Digital*—CBS Masterworks)

203745. Horowitz Plays Rachmaninoff—*Sonata in B-Flat, Prelude G-Sharp; 3 Etudes-Tableaux* (Columbia)

327007. Patrick Gleeson's Computer Realization of Vivaldi's Four Seasons *(Digital*—Varese Sarabande)

328112. Lili Kraus Plays Bartok—*Hungarian Peasant Songs & Folksongs, Rondos, Sonatina,* etc (Vanguard)

326413. Alicia de Larrocha Plays Granados—*Danzas Espanolas* (London)

313767. Ruth Laredo Plays Ravel—*La Valse, Miroirs,* etc (CBS Masterworks)

326603. Ivan Moravec plays Schumann & Brahms. *Kinderszenen, Intermezzi,* more *(Digital*—Nonesuch)

280610. Jean-Pierre Rampal Greatest Hits—Debussy's *Girl With The Flaxen Hair,* Handel's *Largo,* etc (Columbia)

319582. Jean-Pierre Rampal Plays Scott Joplin. *The Entertainer,* etc (CBS)

329151. Renaissance Brass performing works by Byrd, Gibbons, Farnaby (Argo)

309237. Daniel Varsano—Erik Satie Piano Music. *Gymnopedies, Sonatine Bureaucratique,* etc (Columbia)

319848. Andre Watts—Live in Tokyo. Works by Ravel, Brahms, Debussy, Haydn, etc *(Digital*—CBS Masterworks)

320895. Portrait of John Williams—*Theme from "The Deerhunter", Fool On The Hill,* etc (CBS Masterworks)

VOCAL AND ORCHESTRAL COLLECTIONS

292003-392001. Curtain Raisers—World's Favorite Overtures. *Die Fledermaus, Carmen, William Tell,* etc (Counts as 2—Columbia)

329524. Peaches & Cream—Dances & Marches by John Philip Sousa. Erich Kunzel, Cincinnati Pops *(Digital*—Vox Cum Laude)

328856. Placido Domingo—Always In My Heart. Spanish songs by Lecuona, *Malaguena,* more (CBS)

311472. Placido Domingo With John Denver—Perhaps Love. Also *Annie's Song, Yesterday,* etc (CBS)

322347. Marilyn Horne—Live At La Scala. Music by Granados, Handel, Copland, etc (CBS Masterworks)

326108. Mormon Tabernacle Choir—Faith Of Our Fathers. Traditional hymns *(Digital*—CBS Masterworks)

303453-393454. Pavarotti's Greatest Hits. Works by Bellini, Puccini, Verdi, etc (Counts as 2—London)

326421. Leontyne Price Sings Verdi—arias from *Aida, Otello,* etc (London)

321463. Beverly Sills and Andre Kostelanetz—Music of Victor Herbert. *Ah, Sweet Mystery of Life,* etc (Angel)

326397. Sutherland/Horne/Pavarotti—Live From Lincoln Center. A truly grand program *(Digital*—London)

316570. The Tango Project—*La Cumparsita, Adios Muchachos,* etc William Schimmel, accordion, etc *(Digital*—Nonesuch)

324772. Kiri Te Kanawa—Songs of the Auvergne (by Canteloube), English Chamber Orch *(Digital*—London)

320887. Kiri Te Kanawa—Verdi and Puccini Arias. Pritchard, London Phil. *(Digital*—CBS Masterworks)

329722. Wagner: Lohengrin (Highlights)—Peter Hofmann, tenor, Bayreuth Festival Orch & Chorus (CBS Masterworks)

329136. Waverly Consort—Sephardic Songs; songs by Gombert, de Victoria, etc (CBS Masterworks)

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Credit Account

Dear Editor:

I have yet to hear the CD of The Rolling Stones' *Tattoo You,* but judging from the analog disc I'm sure it would generate all the aural excitement praised by Paulette Weiss in her review in the November *Audio.* But please, credit where credit is due! Nearly all the sonic effects she praised were the work of mixing wizard Bob Clearmountain, a *Wunderkind* who does similar work for Bruce Springsteen, Huey Lewis and The News, and Hall & Oates, among others. Bob is a modest guy who accepts his name in small print, but sometimes small-print names step out in front of the big-name stars. Apparently this CD is a case in point.

Sam Borgerson
Studer Revox America
Nashville, Tenn.

Suffering Comparisons

Dear Editor:

Audio does some of the best equipment tests I have seen. The record reviews are excellent too, and at least you do more CD tests than most of your competitors.

Your tests of CD players and related gear have had one glaring problem, however. You have yet to do a really comprehensive A/B listening test between competing units. For example, in the September issue, Leonard Feldman claimed the Revox player sounded better than other CD units he had tested. However, he made no direct A/B comparison between it and any other, more conventional unit, because he had none available! What does he listen to *between* tests? Let him compare the Revox, or any other units under test, with that item. Just compare something with something, instead of making vague generalities about how it seemed to sound better than he remembered other units sounding. What kind of science is that? This kind of rigor is necessary in light of growing claims regarding phase distortion. Does increasing the sampling rate really make a difference? A simple listening comparison between old-style and new-style units, while not giving definitive results (because of limitations in the whole reproduction chain), would give your readers more to go on than simple, vague observations.

Similarly, in your July issue, you printed an article on the Dennesen phase-correction device, written by someone with a vested interest in the unit. Obviously, he thinks it works. When Richard Heyser had a chance to really test the unit (by really listening to it), we get a set of vague measurements and the comment that he "cannot positively say how effective it is." Why didn't he listen to it in operation? How hard would that be to do? A manufacturer friend of mine tried one out at a hi-fi show, in order to see if it would correct problems with a Sony CDP-101 (this was early in CD history, and the main problem was poor recordings). No one, not even the Dennesen engineer who was there, could hear any difference!

Also, some friends of mine hooked up the Revox, a Technics SL-P10, and a Marantz CD-73 and did an A/B/C comparison, using Crown amps and Ohm Walsh 4 speakers. No one could hear any difference, once the outputs were equalized. All players were in sync, and the program was three identical CDs. If rank amateurs can do this kind of test, why can't you guys?

Howard Ferstler
Tallahassee, Fla.

Pro Analog

Dear Editor:

I wish to comment on Ken Pohlmann's article, "A Binary Beginning," in the April issue. I, too, am an engineer, with much experience in both analog instrumentation and high-speed data acquisition systems, and I found the article very misleading and technically incomplete. First, he would have done well to give a fair and total comparison between analog and digital signal processing capabilities and limitations, instead of just saying "analog is a mistake." The interface of the stylus and conventional disc is the limiting factor. The electronics of a well-designed analog block will usually be more accurate, have better resolution, and be less costly than the equivalent digital block. Also, analog techniques have much higher bandwidths.

Digital processing, specifically digital replication of random analog events, such as music, has its share of limitations. As some manufacturers are discovering, the Nyquist sampling theory isn't sufficient for upper audio frequencies, and present 40+ kHz sampling rates are too low. Higher sampling rates may also reduce the complexity of the error correction and other "housekeeping" circuitry. But cost/performance is still a problem—high-speed D/A and A/D converters are expensive. Some interpolation will still be required, however, because, at best, with today's technology, digital sampling techniques give an approximation. Most of the events to be measured or evaluated in the real world are analog in nature, and digital technology serves nicely to interface the real world to computers, but to imply that digital itself is a superior method is totally incorrect. It would be nice to see *Audio* publish some good "nuts and bolts" articles on the subject so that the readers can get something out of it. Isn't that what *Audio* is all about?

Charles Blaisdell
Essex Junction, Vt.

Author's Note: I agree that my column, "A Binary Beginning," was incomplete; it is indeed difficult to present a "total comparison between analog and digital signal processing capabilities and limitations" in 1,000 words or less.

Otherwise, I strongly take issue with your comments. It is my opinion that analog technology has served us well; however, it is no longer adequate for today's standards of audio recording and reproduction. From an engineering standpoint, music is information, and it is clear that digital technology offers superior techniques for data storage and processing, as has been so dramatically demonstrated by the proliferation of digital computers. Contrary to your statements, digital audio technology is more accurate than analog technology; a comparison of the performance measurements we use to evaluate accuracy in audio components will demonstrate this. Furthermore, with circuit integration, the cost of A/D and D/A converters is now diminished within a system context, a digital system can have higher resolution and bandwidth and lower cost, and present standards for sampling rate and quantization are sufficient for the complete enjoyment of high-fidelity audio and rival the best analog has to offer.

DENON RECEIVERS DO NOT COMPROMISE FIDELITY FOR CONVENIENCE.

Most receivers are designed as if the person desiring a compact, convenient component obviously cares less about sound quality. The DRA-Series Receivers, like all Denon products, place sonic quality above all. Their power sections incorporate Non-Switching Class-A circuitry (with no negative feedback on the DRA-750) and heavy duty power supplies, temperature-controlled by liquid-cooled heat sinks. Infinitely variable loudness control now ensures full listening pleasure at *all* volume levels.

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Master tapes made with the phonograph's limits in mind will probably sound better on the LPs for which they were meant than on CDs.

My enthusiasm for digital audio stems from the fact that whereas analog technology has reached its full maturity, digital audio has just been born. It is clear that both in theory and practice, digital audio is already superior to analog, and in the future only our expectations and understanding of technology's potential will be the limiting factors.—*Ken Pohlmann*

CD Potential, LP Reality

Dear Editor:

Bert Whyte's "Behind the Scenes" in your August issue highlighted some rather provocative issues regarding the advent of digital disc technology and, in particular, the role of the audio critic. Having been deeply involved in the development of the phonograph medium for the last 48 years, Shure has naturally taken great interest in the progress of the digital disc. I should like to offer a few comments that relate to Bert Whyte's column and how we at Shure view the future in the phono and digital disc business.

In the phonograph medium, there is a long, complicated process that starts with converting sound into electricity during the original recording and eventually proceeds to the conversion of record modulation into electricity during the playback. At the beginning of the process, the recording technique involves both aesthetic and technical activities to create a master tape. After the master tape has been prepared, numerous processes are employed to create a phonograph record. The latter are purely technical processes, many of which have limitations that can affect the final reproduction.

In each part of the process, a great effort has been made to minimize the limitations. For example, in designing phonograph cartridges, our objective has been to make a product that translates the information from the disc into an electrical signal with maximum fidelity. Similar goals have been set in the mastering and record production processes. Even with those objectives in mind and with the enormous amount of effort and accomplishment that has been achieved in reducing distortion and other effects that would change the quality of the sound, there remain certain limitations in the phonograph process.

Since the chain of functions required to create the entire process is a long one, and since each function has some limitation, it is very difficult, if not impossible, for the audio critic to determine which particular function has affected the reproduction of the sound. The audio critic must essentially evaluate a finished product. I am always impressed when a critic, such as Bert Whyte, can pinpoint a problem to a factor such as microphone placement. I suspect, however, that even a man with Mr. Whyte's experience can only make that judgment in the case of a fairly significant deficiency.

Hundreds of thousands of LP phonograph records have been created, and, as we know, many of these records are superb and of outstanding aesthetic and technical value. Over the years people have learned how to optimize the phonograph medium in spite of its limitations. The master tapes for those records were created with that medium in mind; simply attempting to reproduce them on digital disc will probably not create a product as satisfying as the phonograph records for which they were intended. What is needed now is an entirely new library of recordings that have been recorded specifically for the digital disc. Development of the library is going to take a fair amount of time because recordings for many years will be made during an evolutionary period in which the technology will be changing. What is recorded today may not be optimum five years from now. It is for that reason that I believe the phonograph medium will be here for years to come.

The potential we see for the digital disc would be the elimination of many of the limitations we now have in the phonograph process (although I doubt that we are at that point at this time). Ultimately, we would hope that the electrical signal that comes out of the digital disc player will be so close to that which is on a master tape as to make the difference inaudible. When that occurs, the role of the audio critic will be essentially one of commenting on the aesthetic and technical quality of the recording technique. At that time, I believe the qualifications for an audio critic will be, as implied in your August issue, that of people such as Bert Whyte and Angus McKenzie, who really understand both the aesthetic and technical requirements of making a recording.

How to judge the quality of a recording is, of course, a personal matter for each of us. If we wish to use the advice of an expert, we depend on a reliable critic. While some of the critics of today can provide purely aesthetic commentary, I am certain that the critic for the ever-improving technology of tomorrow will need to have a strong technical orientation as well. In particular, the critic of tomorrow must have knowledge of microphone technology and the acoustics in the recording process.

James H. Kogen
President
Shure Brothers
Evanston, Ill.

Quality Control for CDs

Dear Editor:

I have had my Compact Disc player for a little more than eight months and now have over 100 CDs in my collection. I have noticed some very positive and negative trends occurring with CDs. On a positive note, there is a growing selection of discs for me to chose from. I am also pleased with the more affordable prices; today I pay no more than $12.99 for most discs. And of course, the sound on a well-produced disc is terrific.

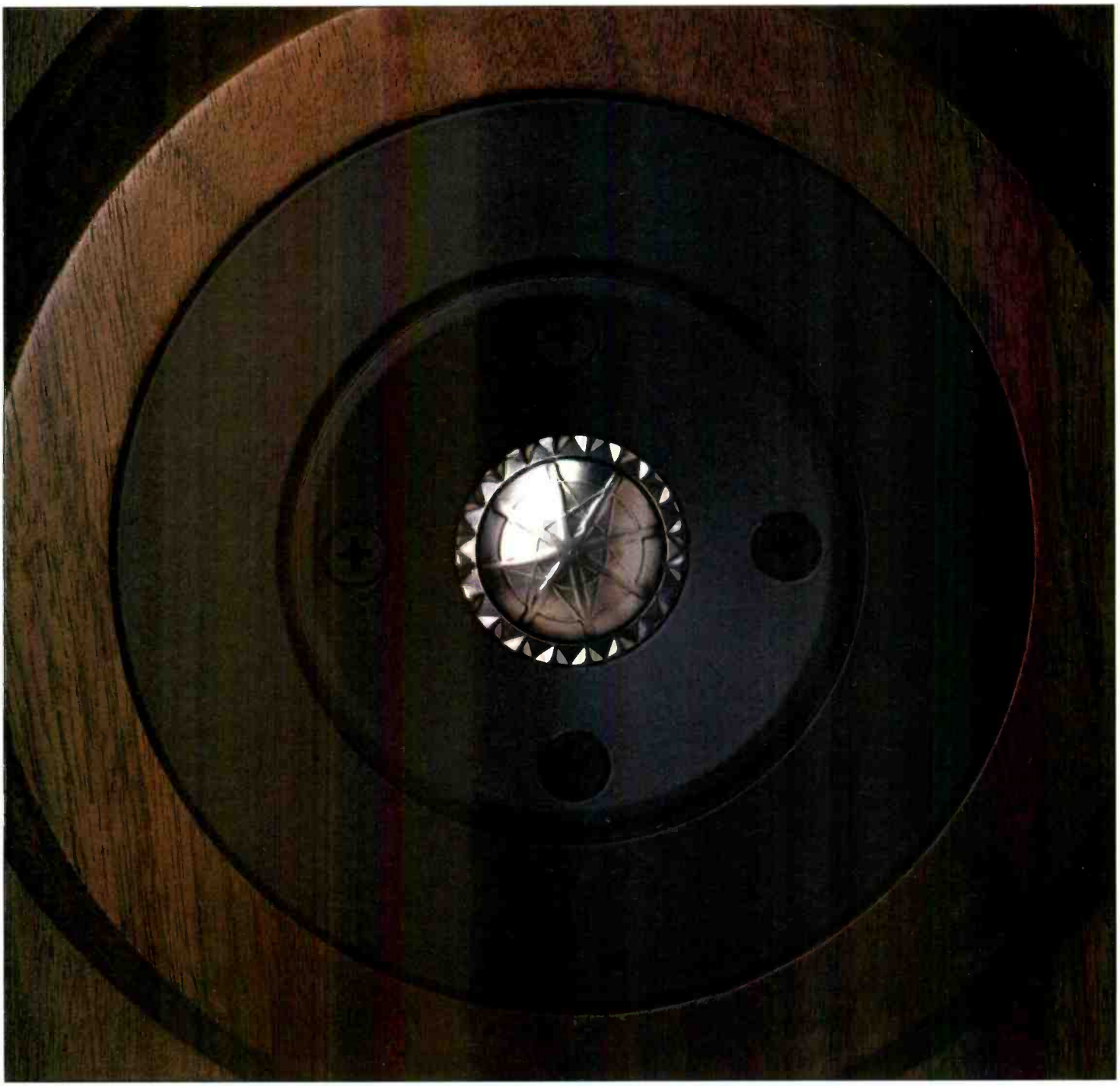
The problem which now disturbs me is that more and more of these discs are defective. Two out of the last three I bought this past week would mistrack. (One was a Mobile Fidelity CD.) These discs were sealed when purchased, but upon close examination, I noticed small indentations and scratches as well as more than a normal amount of dust. Even after brushing the foreign particles off a disc, it would still mistrack in the same place.

My concern is that with this storage medium that can accurately reproduce the original studio tape, the CD will be treated like any other mass-produced vinyl record. I stopped buying records and started buying CDs to eliminate the problems of dust, bad pressings, and mistracking. I returned the defective discs, but if quality control is not kept at a stricter level, I will be forced to stop buying CDs altogether.

Michael A. Steinberg
Rosell Park, N.J.

JBL

Ti SERIES
LOUDSPEAKERS



Enter No. 29 on Reader Service Card

JBL introduces The Titanium Series. To tell the truth.

For some loudspeaker manufacturers, the passing of the seasons is heralded by the passing of the speakers. Last year's glittering "technological triumph" is consigned to the dustbin to make way for this year's glittering "technological triumph." Buzzwords replace true breakthroughs, as the unwary music lover is promised space age answers to age old needs: Beautiful music, reliable equipment. Lately, the carrot being dangled in front of would-be loudspeaker purchasers is "digital ready." Enticing? Without a doubt. New? Assuredly not.

For more than forty years, JBL has persevered in the design and development of precision loudspeakers—loudspeakers capable of translating the fullest range of electro-acoustical impulses into the most accurate sound. In a word, JBL loudspeakers were "digital ready" long before digital was ready. This unwavering homage to accuracy, coupled with granite-like durability, has made JBL loudspeakers the overwhelming first choice among professional recording studios, recording engineers, and professional musicians, as well.

Why then the introduction of a new line of JBL loudspeakers? Because in our constant search for greater accuracy, greater neutrality, greater reliability, we have developed new techniques, new materials, new components, and new designs that afford a truly significant improvement, to satisfy the most demanding audiophile. The new Ti series is not another glittering "technological triumph." It is a true breakthrough. Beginning with computer optimization of design and componentry, through to the unique new pure titanium dome high frequency transducer, the Ti series represents the finest JBL loudspeakers ever made, and the new benchmark for musical accuracy. Titanium tells the truth.

Enter No. 29 on Reader Service Card

Ti

1,000 Gs ACCELERATION

The basic notes for most music and voice occur in the middle and lower frequencies. And yet, it is the higher frequencies that provide the character that separates, let us say, a high C on a piano from a high C on an oboe. The fundamental character of musical instruments is often defined by these higher, sometimes unheard, frequencies. As a result, the reproduction of the music from a particular instrument is often determined by the high frequency element in a speaker system. In this regard, the JBL Ti series is without peer.

To reproduce these higher frequencies accurately, a driver (in this case, a one-inch dome) must travel over exceedingly small distances at enormously fast speeds. That rapid back and forth movement creates forces as great as 1,000 Gs, a thousand times the force of gravity.

The driver must be light enough in its mass to respond instantly to musical transients. Yet it must be strong enough to endure crushing force. For this purpose, JBL has selected titanium.

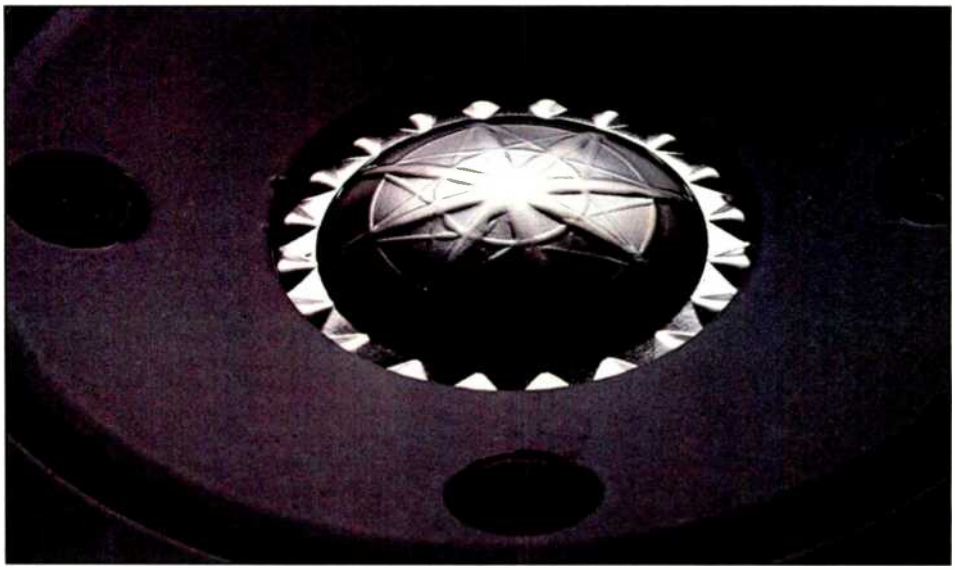
A LESSON LEARNED FROM ORIGAMI

A further inspection of the new titanium dome driver reveals not only a network of ribbing embossed into the dome, but also a pattern of diamond shaped creases or folds surrounding the dome. Although these are admittedly attractive, the specific designs are by no means a decoration.

Every driver has its resonant frequencies. In general, the resonant frequencies of the dome itself are different from the resonant frequencies of the surround, but both can be excited by the input signal to produce uncontrolled response. What is heard is tonal distortion and strain. The objective is to control the reponse of these resonant frequencies.

Typically other manufacturers have dealt with the problem by using a soft dome and half roll surround. The resonances are controlled by high internal damping, but the sacrifice is often a softening or blurring of transient detail.

By using a hard metal dome and surround, we have retained the transparent



Titanium has an extremely high strength-to-weight ratio. But until recently, it could not be fabricated thin enough, light enough, to produce a dome. JBL solved that by developing a unique process that swirls compressed nitrogen gas against a film of titanium, only 25 microns thick—thinner than a human hair. The process forms the dome perfectly and without causing stress fractures.

Being that thin, however, made the dome subject to deformation. And so we solved that problem by creating an intricate network of ribs modeled directly into the dome. This ribbing increases the structural rigidity without increasing the thickness. And so, a 25 micron-thick dome can be as strong as one that is 250 microns thick.

The final dome is capable of responding faster, more precisely, and more often with no material fatigue. The sound is unstrained, clear, clean.

transient detail. And by the pattern of ribbing in the dome that adds strength tenfold, we have also shifted the resonant frequencies of the dome to well above the 20,000 Hz limit of audibility. The dome pattern and the diamond pattern on the surround were conceptualized at JBL but owe their existence to the lessons learned from the Japanese art of paper folding—Origami. By creasing or folding the metal in various ways, the weight remains unchanged, but the stiffness can be concentrated rather than spread evenly. This in turn permits independent control of first and second resonances. The first is now below the operating range of the dome, and the second is shifted to a point below 30,000 Hz.

The result for music lovers is a high frequency response that is flat to 27,000 Hz and absolutely smooth, effortless, and neutral in sound character through the critical range of 3,000 to 20,000 Hz.

18 Ti

Two-way system designed for optimum performance when placed on bookshelf. When free-standing in a room and placed on speaker pedestals, the effect of bass rolloff is ideal for use with subwoofer. Features 1 inch HF driver, 6½ inch LF driver, 5-way gold binding posts, floating grilles, and oiled teak finish.

Specifications

Maximum Recommended Amplifier Power	200 watts per channel
Nominal Impedance	8 ohms
Crossover Frequencies	3 kHz
Sensitivity SPL: 2.83 V at 1 m	88 dB

LF Loudspeaker

Nominal Diameter	6½ in (162 mm)
Voice Coil	1½ in copper
Diaphragm Material	filled polypropylene
Magnetic Assembly WT	3 lb (1.3 kg)

High Frequency Dome Radiator

Nominal Diameter	1 in (25 mm)
Voice Coil	1 in aluminum
Diaphragm Material	titanium
Magnetic Assembly WT	2 lb (0.9 kg)
General Dimensions	14¾ in x 9⅜ in x 7³⁄₁₆ in 375 mm x 238 mm x 183 mm
Weight	17½ lb (8 kg)

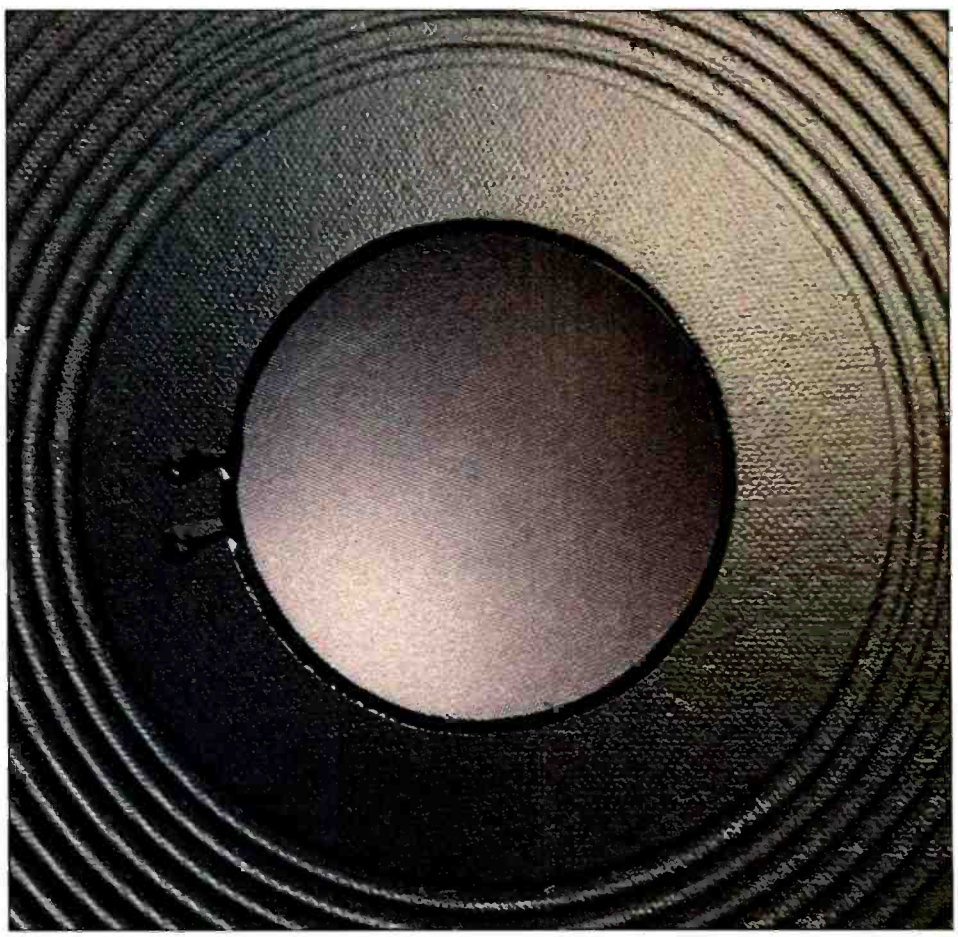
TITANIUM, POLYPROPYLENE, AND AQUAPLAS

While titanium has proven to be the most satisfactory material for reproducing the higher frequencies, at higher power levels, without fear of break-up, the engineers at JBL examined a wide spectrum of other materials for use in the mid- and low-frequency transducers in all the new Ti loudspeaker systems. And as a consequence, you will note that each of the various individual transducers makes use of a separate material best suited to the intended function.

The new midrange unit has been in development some years now, and the final cone material selected is specially derived polypropylene—surprisingly for some who believed that JBL was reluctant to use this material. In truth, we have long recognized that polypropylene provides high internal damping for smooth response, but this virtue was far outweighed by the fact that commonly used polypropylene offered poor stiffness-to-mass ratio. This resulted in a softened impulse response, and a tendency to compress or distort under high power input. The grey polymer cone used in the Ti series midrange transducer employs a secondary filler material that markedly improves stiffness, yet retains the same internal damping effect. The result is a midrange that is smooth, uncolored, excellent on transients, and resistant to the distorting effects of high power. Accurate and uncommonly strong.

The lower frequencies are handled by transducers whose cone material is constructed of fiber and aquaplas laminate. This composite is not new to JBL, but has been used successfully for the past several years in other JBL low-frequency drivers. The material has proven to have the optimal combination of internal damping and strength through the assigned frequency range. With excursions as great as ⅝," these low frequency drivers exhibit linearity to within 10%, and the smoothest natural high-frequency roll-off of any such drivers we know.

By this selective use of materials to satisfy the frequency ranges and engineering objectives, we have been able to generate the most accurate signals, with utmost reliability.



120 Ti

Three-way system supplied in mirror imaged pairs and designed for optimum performance when free-standing in a room and placed on speaker pedestals. Features 1 inch HF driver, 5 inch midrange, 12 inch LF driver, 2-position switch level controls (fixed attenuators introduce no distortion) for midrange and HF drivers, 5-way gold binding posts, floating grilles, and oiled teak finish.

Specifications

Maximum Recommended Amplifier Power	250 watts per channel
Nominal Impedance	8 ohms
Crossover Frequencies	900 Hz, 4 kHz
Sensitivity SPL, 2.83 V at 1 m	89 dB

LF Loudspeaker

Nominal Diameter	12 in (300 mm)
Voice Coil	3 in (76 mm) edgewound copper
Diaphragm Material	aquaplas laminate
Magnetic Assembly WT	10¼ lb (4.7 kg)

Mid Range Loudspeaker

Nominal Diameter	5 in (130 mm)
Voice Coil	⅞ in (22 mm) copper
Diaphragm Material	filled polypropylene
Magnetic Assembly WT	1⅝ lb (0.74 kg)

High Frequency Dome Radiator

Nominal Diameter	1 in (25 mm)
Voice Coil	1 in aluminum
Diaphragm Material	titanium
Magnetic Assembly WT	2 lb (0.9 kg)
General Dimensions	24½ in x 14¼ in x 11 in 622 mm x 362 mm x 333 mm
Weight	56 lb (25.5 kg)

Ti

THE SYSTEM IS GREATER THAN THE SUM OF ITS PARTS

Under test conditions, and within the precise limits of their assigned frequency ranges, each of the Ti series transducers is impeccable. But it is the critical function of the dividing network to distribute the various frequencies to those respective drivers, and in so doing "orchestrate" the interaction that changes exceptional components into exceptional music.

The dividing networks of the Ti series loudspeakers are multi-element and quite complex, making use of conjugate circuits that cause the varying impedances of the separate transducers to appear relatively smooth, for better matching and smoother transitions.

Another unusual aspect is the use of bypass capacitors, a technique commonly seen only in advanced electronics design. These smaller value elements correct for some of the nonlinear effects which exist in the larger network capacitors.

The resulting systems afford the listener smooth response and effortless transitions from the deepest pipe organ fundamentals to the clear open air at 27,000 Hz.

A CABINET IS NOT A BOX

As distinguished as the sound is, so too the cabinetry of the Ti series. Designed to satisfy both sonic and esthetic criteria, the cabinets represent the combined efforts of computer optimization, old world craftsmanship, and critical listening.

Each of the loudspeaker systems is contained within space and materials that are in themselves an essential component. The inner size is determined by component needs and the computer models. The space is then surrounded, if you will, by a material that is sufficiently rigid not to add any of its own harmonics. In this case, we use ¾ inch extra-high-density compressed wood, internally crossbraced.

The components are carefully located on the front baffle of the cabinet to minimize distortion, aid in dispersion, and enhance stereo imaging.

Two more characteristic JBL features of the Ti series are the fine carpentry and cabinetry skills that are apparent. Carefully selected and matched veneers are skillfully applied to front, sides and top for an appearance that is both classic and contemporary and more than holds its own alongside the finest furniture likely to be found in anyone's listening room.

The final touch is the floating grille for less obstruction and interference, better dispersion.

240 Ti

Three-way system supplied in mirror imaged pairs, and designed for optimum performance when free-standing away from walls and corners. Low frequency driver is precise height from floor to give best balanced bass response. Features 1 inch HF driver, 5 inch mid-range, 14 inch LF driver, 2-position switch level controls (fixed attenuators introduce no distortion) for mid-range and HF drivers, 5-way gold binding posts, floating grilles, and oiled teak finish.

Specifications

Maximum Recommended Amplifier Power	300 watts per channel
Nominal Impedance	8 ohms
Crossover Frequencies	900 Hz, 4 kHz
Sensitivity SPL, 2.83 V at 1 m	89 dB
LF Loudspeaker	
Nominal Diameter	14 in (360 mm)
Voice Coil	4 in (102 mm) edge-wound copper
Diaphragm Material	aquaplas laminate
Magnetic Assembly WT	18¾ lb (8.5 kg)
Mid Range Loudspeaker	
Nominal Diameter	5 in (130 mm)
Voice Coil	⅞ in (22 mm) copper
Diaphragm Material	filled polypropylene
Magnetic Assembly WT	1⅛ lb (0.74 kg)
High Frequency Dome Radiator	
Nominal Diameter	1 in (25 mm)
Voice Coil	1 in aluminum
Diaphragm Material	titanium
Magnetic Assembly WT	2 lb (0.9 kg)
General Dimensions	36⅝ in x 18 in x 12 in 930 mm x 457 mm x 305 mm
Weight	85 lb (38.6 kg)

Ti

OVERBUILDING IS A JBL WAY OF LIFE

Wherever you choose to look at any of the Ti series loudspeakers, internally or externally, you will see ample evidence of JBL's continuing commitment to utmost reliability. Without this, there can be no confidence in the accuracy and musical purity of any loudspeakers.

On the 44 acres of college-like setting in Northridge, California, a team of computer specialists, transducer engineers, structural engineers, model makers, cabinet makers, tool and die makers, assemblers, every one of them, is imbued with one overriding concern. Building the best. Nothing less.

The selection of titanium for the high frequency drivers spurred a search for new methods to mold it, new techniques for strengthening it to be sure it performed and performed and performed.

The selection of polypropylene, long after other manufacturers had endorsed the use of less reliable composites, testifies not to caution, but to conviction.

The low frequency drivers employ JBL's unique SFG (Symmetrical Field Geometry) magnetic structure, which reduces second harmonic distortion below 100 Hz. The magnets themselves are substantially heavier than those typically found in loudspeakers.

These drivers also have voice coils formed from flat wire wound on edge, a design which packs more wire into the voice coil gap for better transient response and improved power handling.

Internal connections in the Ti series are made with thick, heavy gauge audiophile cable, instead of conventional thin wire, and all connections are hard wired. This construction contributes to better current transfer and lower distortion. Additionally, there are no L-pads in the signal path. Mid- and high-frequency level adjustments in the three-way models are made via fixed attenuators, switch-selectable. In the 250Ti, the fixed attenuators are selected through bus bars.

The external connections to the Ti series are made through five-way gold binding posts, for multiple options and cleaner linkage.

Even the back of the cabinet, finished in black, shows the same high degree of craftsmanship as the other surfaces. Perhaps not really necessary, but a reassuring sign that all aspects are built with care.

WHEN DO WE STOP TESTING?

The search for musical truth is ongoing with musicians as well as for JBL. But for the moment at least, and for the foreseeable future, the Ti series represents the most ambitious of the JBL achievements and the most accurate loudspeakers available to the most demanding audiophiles and music lovers.

The actual testing for this series began years ago, with the search for new materials and new designs that could better meet the needs of recording studio professionals. In studios, every detail, every note, every nuance of the recorded music must be played back at high volume in an endless examination by recording engineers. Before the music is finally committed to tape master and then records, cassettes, or digital compact discs, it must be heard clearly and precisely. The loudspeakers must be not only precise, but also unvarying in that precision.

One of the first steps was the development of the titanium compression driver by JBL. Further refinements to various components occurred in the ensuing years. In fact, the primary elements of the Ti series were tested in field and laboratory situations for more than five years.

Those qualities of uncanny accuracy, virtually non-existent distortion, smooth response, and wide dynamic range, which took years to develop, can be enjoyed now. And because the Ti series is made by JBL, you can be assured that those qualities will remain pleasing for years to come. And that is the final test.

250 Ti

Finest expression of JBL product philosophy, this is a no-compromise four-way system supplied in mirror imaged pairs. Designed for optimum performance when free-standing away from walls and corners. Low frequency driver is precise height from floor to give best balanced bass response. Special pyramidal enclosure provides optimum baffle width for each driver to minimize diffraction effects, further improve imaging. Features 1 inch HF driver, 5 inch midrange, 8 inch lower midrange, 14 inch LF driver, special level controls for HF and midrange and lower midrange drivers incorporate fixed attenuators in the form of bus bars, 5-way gold binding posts, floating grilles, and oiled teak finish.

Specifications

Maximum Recommended Amplifier Power	400 watts per channel
Nominal Impedance	8 ohms
Crossover Frequencies	400 Hz, 1.4 kHz, 5.2 kHz
Sensitivity SPL, 2.83 V at 1 m	90 dB
LF Loudspeaker	
Nominal Diameter	14 in (360 mm)
Voice Coil	4 in (100 mm) edge-wound copper
Diaphragm Material	aquaplas laminate
Magnetic Assembly WT	18⅜ lb (8.5 kg)
Lower Midrange Loudspeaker	
Nominal Diameter	8 in (200 mm)
Voice Coil	2 in (50 mm) copper
Diaphragm Material	aquaplas laminate
Magnetic Assembly WT	6 lb (2.7 kg)
Mid Range Loudspeaker	
Nominal Diameter	5 in (130 mm)
Voice Coil	⅞ in (22 mm) copper
Diaphragm Material	filled polypropylene
Magnetic Assembly WT	1⅝ lb (0.74 kg)
High Frequency Dome Radiator	
Nominal Diameter	1 in (25 mm)
Voice Coil	1 in aluminum
Diaphragm Material	titanium
Magnetic Assembly WT	2 lb (0.9 kg)
General Dimensions	52 in x 22½ in x 14¼ in 1321 mm x 572 mm x 362 mm
Weight	150 lb (68 kg)

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Phoenix, AZ 85012
(602) 263-9410

Jerry's
1050 E. Camelback Road
Phoenix, AZ 85014
(602) 234-3221

Jerry's,
5750 E. Broadway
Tucson, AZ 85711
(602) 747-7267

In California:

Casa Moore
710 Kentucky Street
Bakersfield, CA 93305
(805) 327-2627

Casa Moore
3833 Ming Avenue
Bakersfield, CA 93309
(805) 832-6311

Radio Lab
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Glendale, CA 91204
(818) 246-1605

Sound Advice
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Eureka, CA 95501
(707) 442-4462

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Los Angeles, CA 90024
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San Francisco, CA 94127
(415) 661-2525

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Miami, FL 33176
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Sarasota, FL 33577
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West Palm Beach, FL 33409
(305) 689-5255

In Indiana:

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New Haven, IN 46774
(219) 493-1522

In Michigan:

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Flint, MI 48503
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(313) 881-1877

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Albuquerque, NM 87110
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155 East 45th Street
New York, NY 10017
(212) 599-2630

Lyric Hi-Fi
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New York, NY 10028
(212) 535-5710

Square Deal Radio & TV
456 Waverly Avenue
Patchogue, NY 11772
(516) 475-1857

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Sioux Falls, SD 57116
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1921 West Grand
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For the name of an audio salon near you that can demonstrate the JBL Titanium Series loudspeakers but may not be listed here at the time of printing, please call JBL direct at (818) 893-8411.

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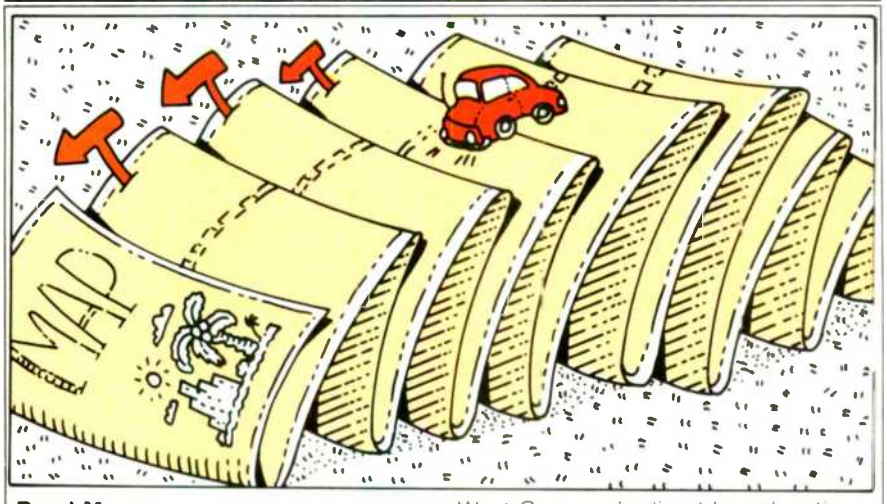
IVAN BERGER

ROUTE 66, WHERE ARE YOU?



Illustrations: Teresa Anderko

Road Maps

We already have (at least in a few cities) Blaupunkt's ARI road-information system to tell us how the traffic is. The next step may be systems to tell us where the roads we want are. I know that Ford, GM and Honda are working on in-car electronic map display systems; I've even had a quick glimpse of GM's. West Germany's direct-broadcasting TV satellite, due in 1985, may beam maps or driving announcements to drivers below. And in-car maps are one of the applications envisioned for CD-ROM, the data-storage format for Compact Discs.

Now if the maps will only show us where the gas stations (and record stores) are . . . .

Competition from Snoopy?

To quote Jimmy Durante, "Everybody wants ta get inta de act." So it wasn't that much of a surprise to see Snoopy giving car stereo advice in a Sunday "Peanuts" strip a while back.

"Dear Joe Expert," began the letter Snoopy read to his pal, Woodstock. (Does that sound like it should have been from Giovanelli's "Audioclinic" mail?) The problem was that the writer's car stereo played only in the evening, never in the day. Did Snoopy think the problem could be the speaker?

"Yes," said Snoopy. "It is obvious that you have an after-dinner speaker."

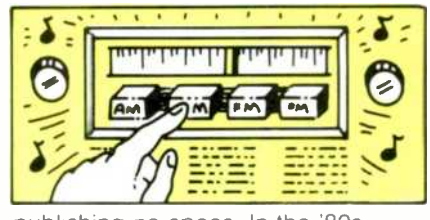
Will Detroit Have Its Day Again?

There was a time when the best car radio you could get was the one that was in the dashboard when the car came from the factory. The Delco in my 1954 Pontiac, for example, is still the standard to which I compare today's AM radios. My first good AM/FM stereo radio was a Philco-Ford unit bought at the suggestion of one of Dynaco's tuner designers. (I put it in a Fiat, by the way, which wasn't easy.)

But those were the days when aftermarket radios sold mainly to those too cheap to buy the factory-installed models, those who hadn't been able to afford the radio's added cost when they bought the car, and those who picked up either used cars or showroom demonstrators which had come through with only AM, or no radio at all. "Detroit" (strictly speaking, places like Philadelphia and Kokomo) set the pace, with innovations such as signal-seeking.

But in the '70s, that changed. Home hi-fi companies such as Pioneer and Sanyo entered the field, with radios and tape players offering more features and, for the audiophile, performance backed up by specifications (not that all car stereo specs are met by actual performance, even now).

For a long time, car manufacturers ignored the trend, minimizing features, sticking with 8-track tape well into the cassette era, and



publishing no specs. In the '80s, though, that started changing, as Detroit began to realize car entertainment systems were no longer a source of extra revenue that they could count on without competition, and that the systems could become a bait for car sales, too.

The Delco-GM/Bose system is the most spectacular example of this, so far, but I note other encouraging straws in the wind. For example, Ford is now advertising its car stereo units, headlining such features as Seek/Scan tuning and Dolby noise reduction, and pointing out such others as auto-reverse cassette drives, regular/CrO_2 equalizer switches (my applause for not calling the latter position "Metal"), and separate controls for bass and treble. There's even one lonesome specification ("low-distortion amplifiers . . . with up to 80 watts RMS power") buried in the ad copy.

There are still areas where I'd like to see improvement: It would be nice if Detroit made full specs available (though it would make little sense to detail them in the ads). And for urban-area dwellers like me, it would be great to have more than the four station-preset buttons which market surveys tell American car companies are all the "average" driver needs. Shucks, my '54 Pontiac's radio had five buttons (though it only brought in five AM stations). And preset buttons, in those days of mechanically linked analog tuners, cost more to put in.

John Hammond Five Decades In Music

Ted Fox

The Encyclopedia of Jazz by Leonard Feather, the standard reference in the field, gives nearly a page of accolades to a non-musician—John Henry Hammond, Jr. The slot for listing his instrument shows "critic"; while he is arguably the single most important writer on jazz, Hammond has made even larger contributions as a recording director, and sometime impresario, during a career which has spanned more than 50 years. He is credited with bringing to the recording studio such important musicians as Fletcher Henderson, Teddy Wilson, Meade Lux Lewis, Charlie Christian, Count Basie, Benny Goodman, and Billie Holiday. Moreover, at an age when most men have been retired for a decade, Hammond's ears are still so open, alive, and growing that he is able to hear, and accurately judge, such strongly contemporary artists as Bruce Springsteen and Stevie Ray Vaughan.

Feather says that Hammond is a "man of intense opinions on almost every subject—he has rarely been heard to express faint praise or mild displeasure at anything or anyone. . . ." Ted Fox, whose entertaining book *Showtime at the Apollo* appeared last spring, recently interviewed Hammond, who is as feisty—and interesting—as ever. *E.P.*

Is this really something you're thinking of doing? George Benson and Stevie Ray Vaughan together?

Oh, yeah, sure, that's one thing, and the other thing is that I think we might be able to get George back to CBS because his Warner Bros. deal is up next year. That would be wonderful. George wants to play jazz and Warner Bros. won't let him.

They're pushing him into more of a pop thing?

Oh, yes, completely. He's done some marvelous jazz things and they won't release them. They don't want to tarnish his image.

But he's got that Frank Lloyd Wright house in New Jersey, and he didn't get that playing jazz.

No. He got that from playing pop.

So isn't he kind of committed now? Doesn't he have to keep doing this?

No way. He built a $300,000 recording studio in Hawaii, and his investments have been very good.

Ah, ha. So now he's able to do what he wants to do.

Exactly.

How did you meet George Benson?

On 125th Street. I was walking to the Apollo. Nineteen years ago. And I looked in the window of the Palm Cafe, and it said, "Introducing the World's Greatest Guitar Player: George Benson." I just had a feeling I ought to go up and hear him. At the same time, I had gotten a letter, sort of an illiterate scrawl from a guy who turned out to be his manager—a great person called Jimmy Boyd. So my wife and I went over that night to the Palm Cafe. There were big signs saying Go-Go Dancing. People had described me to George so he knew what I looked like. As soon as Esmé and I walked in he drew a band signature, because they were really playing for dancing there, and the Go-Go girls suddenly disappeared, and George starts to play real jazz. I really hadn't heard anybody like him since Charlie Christian.

Did he remind you of Charlie Christian, who was also one of your finds?

Walter Gieseking and Josef Szigeti in 1926 (top) and the Fletcher Henderson Band in 1934

Photograph: Ebet Roberts

Photographs: Collection of Frank Driggs

Buck Clayton, Lester Young, Charlie Christian, Benny Goodman, Count Basie, and John Hammond at a Columbia Records studio in 1939

Charlie was one of his main influences. George's father was a Charlie Christian fanatic. He built George's first guitar out of cigar boxes. George is extraordinary. I'm sure glad I was on my way to the Apollo that day. I signed him the next day to CBS.

One of the things* Audio *readers want to know about are recording techniques, and of course you've been the producer for some of the most incredible sessions of the past 50 years.

Well, I'm basically a one-mike mono man, you know. I make adjustments, obviously, for rock. But, I like natural sound. I hate overdubbing. Fortunately, in Stevie I have a guy who agrees with me.

How would you record someone like Stevie Ray Vaughan?

The last album we made was at the Power Station. It's a wonderful studio on West 53rd Street. I told them what I wanted. I didn't want Stevie isolated, and I wanted the impact of the group. It's only a trio, you know. We added, on some sides, his brother on another guitar, and a tenor man. Stevie, like George, accompanies himself. He doesn't overdub vocals.

But you've worked with other artists.

I've worked with Lawrence Welk, if you want to call him an artist . . . .

You've worked with other artists who you'd think would want to do something simple, but ended up doing something much more elaborate.

Well, you know, stereo came in and set back the record business 20 years, I think, with isolation and all that.

You really feel that stereo set the recording business back 20 years?

Now that digital recording has come in, and Compact Discs, we're discarding all that stereo technique that was used. Because the more mikes you have open and everything, the more distortion there is. Yeah, I have my definite feelings about this.

You've said that one of your favorite sessions was a '36 session you did with Basie, and you also said that was one of your most technically inept sessions.

The studio was so terrible. It was a little second-story studio in Chicago, across from the Drake Hotel. You couldn't record the bass and the bass drum at the same time. So, Jo Jones, it was his first recording date, and Walter Page was on bass. We decided we didn't need the bass drum. We just used snares and a hi-hat. However, it was one of the few perfect recording sessions I ever had. There wasn't a reject. All perfect. It was done in the morning after the guys had gotten finished working at the Grand Terrace. It was just a little sextet. Jimmy Rushing was on vocals, and Basie, Jo Jones, Walter Page, Lester Young, and Buck Clayton had a split lip that day, so we used another trumpet player from the band, Carl "Tatti" Smith. We called it Jones-Smith Inc., because Basie had just signed that underscale Decca contract, and we couldn't use [his name].

I guess you weren't a big fan of '50s jazz, and you also said you didn't feel that it was as well recorded as classical music.

No, and that's how I got with Vanguard. The Vanguard Recording Society was started in the early '50s, after long-playing records came in. Both Seymour Solomon and Maynard Solomon were musicians, good musicians. In fact, Seymour and I had been old pupils of the same violin teacher. I wrote an article for *The New York Times* in '53, decrying modern recording techniques. So Seymour, whom I hadn't seen since he was a student, called me up and said, "John, I'm going to give you the opportunity to do exactly what you want to do." He said, "I've uncovered an incredible concert hall in Brooklyn, the Brooklyn Masonic Temple, and we can bring over portable equipment and record there. The only trouble is we have to record at night because we're right next to a school and the noise of basketball tryouts and everything is hopeless in the daytime." And I said that's fine by me. So we started going over there, and we had to haul in a Steinway grand. If we had to do it today it would cost about

Photographs: Collection of Frank Driggs

$500; it cost about a hundred then. I made, I still think, some of the best records, stereo and mono, that I've ever made in my life.

Which ones?

Count Basie with a fantastic all-star band. Vic Dickenson, Mel Powell—he used to be Benny Goodman's pianist—Edmond Hall, all sorts of things.

Did you do any classical recordings there?

No. They did a whole lot of chamber music, and I used to sit in on those sessions.

I guess Columbia Masterworks was the classical label you were most closely associated with.

Yeah, I guess so. Because I made my first Columbia classical records with Joseph Szigeti back in 1937. And again, one of the worst studios ever, the old Brunswick Studios at 1776 Broadway, and we made the first recordings of a recently discovered Mozart divertimento. The playing was sublime. Of course, this was years before there was tape, and Max Goberman was the conductor. Max, who was a good leftist, didn't believe in using anything but unemployed French horn players, and two of the most important French horn parts in the history of chamber music were in that divertimento. There were bloops on practically every side, and there was no way we could edit them out. So it stayed, bloops and all, and it's still in the catalog. See, tape didn't come until after World War II.

So how did that affect things, aside from obviously improving the quality of the sound?

Well, not that, because it made it possible to make more dishonest records than there had ever been, through splicing.

You've come out pretty strongly against splicing, especially in classical recording. In fact, I think you uncovered some famous overdubs that wouldn't have otherwise been known. Is that correct?

Well, I mean, for instance, Horowitz, who was a perfectionist, wouldn't allow any technical errors on his recordings when he was with Columbia. So Columbia would have to record rehearsals, you see, so that there could be splices made.

Backups?

Yeah, backups, exactly. But, the unfortunate thing was there was a famous record dealer in New York, who shall be nameless, who used to bring a little Nagra recorder to concerts and he would compare what was on the record, as a live performance, with what he had on his tape. Somehow or other it came out in *The New York Times*, about this controversy. Tom Frost nearly lost his job; he was Horowitz's producer. Horowitz figured that Tom Frost had squealed. But it wasn't; it was our friend on 43rd Street.

Playing devil's advocate: If a piece on a record is going to be played over and over again, and will stand forever, isn't it fair that the artist wants the piece to be the best it can be?

Only if you don't advertise it as the actual concert, and *that's* where they came a cropper. Now, for instance, Glenn Gould would edit, and in his later years Szigeti had to edit. When Columbia dropped Szigeti, I got him a contract with Vanguard immediately, and he did the unaccompanied Bach sonatas. And I think there's something like 800 splices on that series of six LP sides. It couldn't have been done without it.

But he wasn't advertising it as a live performance?

No way. Well, I've recorded Gieseking, and Gieseking was an honest man, and there's a wonderful story here. He was my favorite pianist, and the only record he ever made in America, I was the supervisor of: The Second Book of Debussy Preludes. I couldn't get there in the morning for the rehearsal, but I met Gieseking for lunch at Child's before the actual session started. I said, "How did it go?" He said, "John, we wasted an awful lot of time this morning." I said, "How?" He said, ' Trying to get the Middle Western accent out of the Baldwin." Because Gieseking was a Baldwin artist, you see. I said, "Well, you know, Mr. Gieseking, we have the most beautiful Boston Mason & Hamlin in the studio." He said, "You *do*?" I said, "We certainly do." So we waited until the Baldwin man left. Baldwin now makes a marvelous piano since they bought Bechstein, but in those days they were made in Cincinnati and they were not what they should have been. So we waited until the Baldwin man left, and then, on this ravishing piano,

I knew Billie Holiday was unique the first time I heard her. I can't say my finding her was any big deal; I just happened to be around at the right time.

Billie Holiday at the Offbeat Club in Chicago in 1939 (top) and Count Basie with John Hammond

Photograph CBS Records

Photographs: Collection of Frank Driggs

Gieseking recorded the Second Book of Preludes.

He got what he wanted.

He sure did. I also found out why his records sounded so much more satisfactory than he did in person. Gieseking had terribly small nostrils, and he was a very passionate player. And you would hear [*sniffs*]. We had a regular setup for him, and it wasn't any good because all you heard was his breathing. So I started experimenting, putting the microphone further and further back. Finally, about 22 feet away, I said, "Now I think we've got it." Because we had the overtones from the studio and so forth. I said, "How did you do this in Europe?" He said, "We found out it came out better when the microphone was away."

So were you able to apply what you learned from him on other sessions?

A lot. Absolutely, particularly in regard to piano sounds. This is another thing wonderful about the Vanguard studios. At the present Vanguard studios in New York, they have a 9-foot concert grand, the last made before accelerated action came in. A friend of mine who had been a chief technician at Steinway rebuilt the piano for Vanguard, and they have the best piano in New York. Accelerated action, most people think, was a step back—the way stereo was in the record business, a step back in the history of Steinway.

Frankly, I don't know what accelerated action is.

Well, nobody else does. It was a gimmick that Steinway used in 1933, and they're stuck with it.

The old ones are almost like Stradivarius violins, I guess.

Exactly. You can't improve on the original.

What was it about moving that mike back that improved the sound?

Usually, it gives more air and breath to the sound. I don't use it in every case, obviously. In the old days I used to record big bands, and I used to record them on a B44 RCA mike. I'd have the piano and vocals on one side of the mike, and the rest of the band on the other.

No 24 tracks?

No, and no tape. We didn't start using tape until after I got out of the Army in 1946. I worked first for Columbia, which didn't have any tape, and then I worked for Majestic, which didn't own any tape. But luckily, Bob Fine, who was chief engineer for Mercury, was a friend of Buzz Reeves, Hazard Reeves, who has the Reeves studio, and they had the first great tape recorders made in America, which were made by Fairchild. This is pre-Ampex. And then when Ampex came out with their line, we used Ampex. That Olympian series on Mercury, the classical series with the Chicago Symphony and Kubelik, those were all made with a one-mike technique. They were made in Chicago. The Orchestra Hall, the acoustics weren't good enough, so we went to Louis Sullivan's Auditorium Theatre, which was around the corner. It just turned out beautifully.

Where would you go today to do the third Stevie Ray album?

Our next one is being recorded at Carnegie Hall, where Stevie's doing a concert. There's one wonderful thing about Carnegie Hall—the acoustics are so good that the more amplification you have on stage, the worse the acoustics become. I took Stevie through Carnegie Hall last summer and let him hear how amplification destroys the good sound of the hall, and he was convinced. So his concert is going to be done with a minimum of amplification. There's such horrible distortion on these electric guitars.

How about when you did the "From Spirituals to Swing" concerts at Carnegie Hall?

That was done with two overhanging mikes. No, one overhanging mike, that's all. That was recorded by Zig Franck; this was back in '38 or '39. He owned a little studio upstairs in Carnegie Hall, and we just ran a line down from the studio.

Did you amplify those concerts in Carnegie Hall?

No, that was all acoustic. You didn't need any amplification there.

How did you get involved with Stevie Ray Vaughan?

He sought me out, if you can believe it. He sought me out because he worshipped Charlie Christian, and he knew that I was the first guy to go to Oklahoma City to find Charlie Christian and put him with Benny Goodman's sextet. He knew my son, who was a blues singer, and he figured if he met me I would understand what he was trying to do. And I did. He had already recorded some things out in L.A. but they were not well balanced, so we rebalanced his original tapes. Stevie and I got to be good friends.

Was he with Bowie when he first came to you?

No, that was before he was with Bowie. Then he went with Bowie and did that

Bob Dylan and John Hammond

Bob Dylan came to CBS Records because I had signed Peter Seeger when he was blacklisted. Bobby figured he couldn't go wrong, and he didn't.

Let's Dance album and toured with Bowie. But Bowie was interested in Bowie, and he wasn't interested in promoting another artist.

I understand he wasn't willing to pay too much either.

No, he wasn't. But why should he? You know, he's a businessman. But Stevie is a businessman too. I got him a contract with Epic Records, and I'm amazed that I did because Epic was pretty square in those days. But there was one great A&R man, Greg Geller, and as soon as Epic signed him, Geller was fired and went to RCA. He's a good man.

When you came to them with Stevie Ray, did they say, "Oh, Jesus, another white Texas blues player"?

No, there were no white Texas blues players at that time.

Johnny Winter, and his brother Edgar.

Well, Johnny was on Columbia, not Epic, and as good as he is, Johnny was not comparable with Stevie Ray. The head of Epic is Don Dempsey, a terribly nice guy, and that's why when I'm signing people I sort of favor Epic over Columbia. They proved with Michael Jackson that they can sell more records than any other record company in history.

I want to talk for a bit about your great career . . . .

Don't let me be too libelous, because I'm likely to be libelous.

Okay, we'll stay away from that. Tell me, do you hear things no one else hears?

I don't think so.

But you've discovered so many greats.

Oh, but I've been around so long. The most important thing for me, really, is that I had a classical background. I played in a string quartet for 14 years. I was one of the more miserable viola players in history, but at least I could play with people better than I. So I got a sense of ensemble, and of what I wanted to hear.

Okay, but for instance, you heard Basie—the famous story of you hearing Basie over your car radio from Kansas City . . .

That was a good radio.

Thank God, it was. And you then brought Benny Goodman out in the car with you to listen, and he didn't like Basie. He didn't think he was any big deal. What did you hear that he didn't?

In the first place, I had known Basie when he was a piano player with Bennie Moten's band, and then Basie used to hang out in a speak-easy in 1931 in back of the Lafayette Theater. They had an upright piano there, and I was able to hear what Basie could do. He was, aside from James P. Johnson and Fats Waller, the greatest stride piano player that ever had been.

Did you know that when you heard him in the speak-easy?

Oh, of course.

But he was just plain old Bill Basie from Red Bank, New Jersey.

No, that horrible Count thing did not get added until about 1934, '35. I heard him first with Moten's band, then Moten's band was having trouble, so Basie started a small band. Well, I just knew from the sound of the little nine-piece that I heard on the radio that day that there was no other sound like that in history.

You knew it was Bill Basie?

I sure did, couldn't help it. And he was all over the keyboard then, you know. As Basie matured, he got more economical in the sound that he had. He was a genius.

You know, this is one criticism I've heard about Stevie Ray. Some have said he plays too much guitar.

Well, listen, when a guy has got overpowering technique, this sometimes happens. They like to display it. But, we've been pretty careful on these records. I mean, it's not display just for display's sake. Stevie happens to be a damned good singer, which you don't expect out of a guitar player, and he knows the sound he wants. Also, like George Benson, he is his own ideal accompanist. George also, as a singer, is an incredible accompanist to himself. Of course, these commercial records he makes nowadays aren't like that.

He has a voice like Stevie Wonder, I always thought.

To a degree. No, George's idol was Nat Cole. There were other influences in George's playing. One of them was Wes Montgomery, but I have a feeling that as a guitar player, George far excels Wes Montgomery. But the vocal style really came from Nat. Just two days ago I was doing this documentary with George, and that's what he said. 'Be sure to realize, John, that I learned so much from Nat Cole."

Let's go back to what we were talking about before. So, Bill Basie had been around for years, and thousands and maybe millions had heard him from his radio broadcasts just like you had.

No, because it was a little experimental radio station, off the regular part of the dial. It was called W9XBY, and it was 1,550 kilocycles.

And you could get this little station in Chicago?

I did indeed. It was a clear-channel station, and after midnight all the awful stations thereabouts were off the air. So I was truly lucky.

You're not going to give me a chance with this at all. You're not going to let me say that you hear stuff that other people don't hear. How about Billie Holiday? She was singing in clubs for years . . . .

No, I heard Billie Holiday before any-

Photograph: CBS Records

Aretha Franklin

body else heard her. I heard her just when she had come up from Baltimore. I went to a speak-easy on 133rd Street one night, and I was going there to hear a singer called Monette Moore. But Monette was working with Clifton Webb in a show downtown, and she wasn't there for the set, so she had this 17-year-old girl filling in for her. I couldn't believe it. In the first place, you couldn't have a microphone in a speak-easy because the noise might filter out into the street. So Billie was just singing tables, to customers at tables. She was doing a number, and she sang the same song at each table completely differently. I had never heard a really improvising singer until that time. So I knew that she was unique. I can't say that it was any big deal. I just happened to be around at the right time.

Yeah, but you sure are around at the right time a lot of times. How about Aretha Franklin?

Well, I loved gospel music and I loved jazz, and I knew she was the ideal combination of both.

You first heard her . . .

. . . On a demo record. The composer brought in a bunch of his tunes, and Aretha had sung one of them. This was an extraordinary story. There was one tune called "Today I Sing the Blues." I loved it. I knew it sounded vaguely familiar, and I had recorded that tune with Helen Humes 14 years before for Mercury. I had forgotten the name of it. Then this demo comes in and I hear this girl. Aretha was 18. I called up Curtis Lewis, who wrote the tune, and I said, "Where do I find this girl?" He said, "Oh John, she's in Detroit. Her father is a very famous minister, and she's been in the gospel choir for years. She's a hell of a singer, isn't she?" I said, "She sure is." I sought her out and signed her for Columbia in '61, I think it was.

The demo wasn't even for Aretha.

No, it was for the composer to show off his tunes. We made that tune on our first session with Aretha.

She went on to a rather lackluster deal at Columbia.

Well, I made two albums with Aretha, both of which were wonderful musically but were not particularly commercial. Columbia decided that they might have a hot pop artist. So, they wanted to record her with strings and big bands and everything.

Was that Mitch Miller's idea?

No, indeed. Somebody named David Kapralik. So, he said, "You can produce Aretha for albums, but we want to do something different with her for singles." I said, "Whatever she wants." So they did it. The relationship deteriorated for about three years until, finally, thank goodness, Aretha was signed by my friend Jerry Wexler at Atlantic. I asked, "Jerry, how did the first date go?" and he said, "John, we put her back in church." And then he found Otis Redding and other wonderful people to write for her. Columbia would never have thought of that, because Columbia didn't know what real R&B was. Only the OkeH division put out R&B records.

How long did OkeH last?

Once in a while they still reissue these. That was one of the original . . . Otto Heineman left Germany after World War I, and he started OkeH. It was a hill-and-dale record when they first

Photographs: Collection of Frank Driggs

Aretha Franklin was the ideal combination of jazz and gospel music. George Benson is like no one since Charlie Christian.

came out because Victor and Columbia had a cross-patent agreement and they prevented anybody else from making lateral-cut records until Brunswick, in 1920, sued them for restraint of trade and opened up lateral-cut records to everybody. I have a couple of copies of the original OkeH label, which had a large O, and then a small ke, and a big H at the end. That was for Otto Heineman; that's why the label was spelled that strange way. They started making lateral-cut records, and in 1920 they came out with the first big-selling race record, which was "Crazy Blues" by Mamie Smith.

Let's talk about another artist who came to Columbia through your efforts, Bob Dylan. He had been around the Village for a bit in the clubs, and he was just one of the crowd. But you saw something in him that set him apart.

Well, it was partly that my politics are left, you see, and Bobby was in his protest days when I first heard him. He was not respectful of the Establishment. My two big buddies at CBS were Goddard Lieberson, whom I had brought to CBS in 1939 to work in the Masterworks department, and Mitch Miller, who had been our recording director at Mercury. These were two very progressive guys. I never had any trouble with Mitch on Bob Dylan. Never. But, at the same time I hated the kind of crap that Mitch was putting out on Columbia, "Sing Along with Mitch." Mitch was one of the greatest oboe players I had ever known, and I had recorded him in the Cimarosa oboe concerto and the Vaughan Williams oboe concerto for Keynote when I was briefly president of Keynote Records back in '46. Mitch's ears were so fantastic I decided that, since we did not have a good pop A&R department at Mercury at that time, Mitch ought to have a chance to work doing pop dates. I had a terrible time convincing the people at Mercury that an oboe player could be the head of pop A&R. But I said, "Trust me." And they did.

So Mitch was receptive to Bob Dylan?

Oh, yes. But Goddard was enchanted by Bob. I mean, it was Goddard who was my real backer as far as Dylan was concerned. And Goddard at that time was running Columbia, so he was a very good ally to have. On Bob's second album he did "Blowin' in the Wind," which sort of turned pop music around in the '60s, and turned CBS around. And the only reason Bobby was willing to come to CBS was that I had signed Pete Seeger when he was still blacklisted. Columbia Records proved its independence from CBS by signing Seeger. So Bobby figured he couldn't go wrong if he went to CBS, and he didn't go wrong.

Now, you signed him as a minor, and that created some problems almost, didn't it?

It sure did. He got a manager whom I didn't like, Albert Grossman. And Albert Grossman tried to break the contract because he didn't have a piece of the record action. That was why he tried to do that. He wrote a letter to Columbia, and that was my first real acquaintance with Clive Davis because he had just started as an underling in the legal department at Columbia. He asked, "John, what's all this about?" I said, "My God. It's the first artist who ever double-crossed me."

Bob had said that there would be no problem with him signing as a minor?

No, we had discussed it. I told him, "You're only 20, your mother or father should sign this." He said he didn't have a mother or father but did say, "I have an uncle who is a dealer in Las Vegas." So I said, "I guess that means you don't want me to pursue this any farther." He said, "John, you can trust me." Famous last words. Well, after I was finally able to locate Bobby, I persuaded him to repudiate the letter that had been written by a lawyer named Pete Pryor. It ended up making Bobby rich and making Grossman rich, unfortunately.

You had another, ah, unusual relationship with another manager of another one of your finds, Bruce Springsteen.

Yeah, well, let's not go into that. In the first place it's a well-known story anyway . . . .

That's Mike Appel. Bruce must have been an ear opener when you first heard him.

Oh, exciting, really exciting, still is.

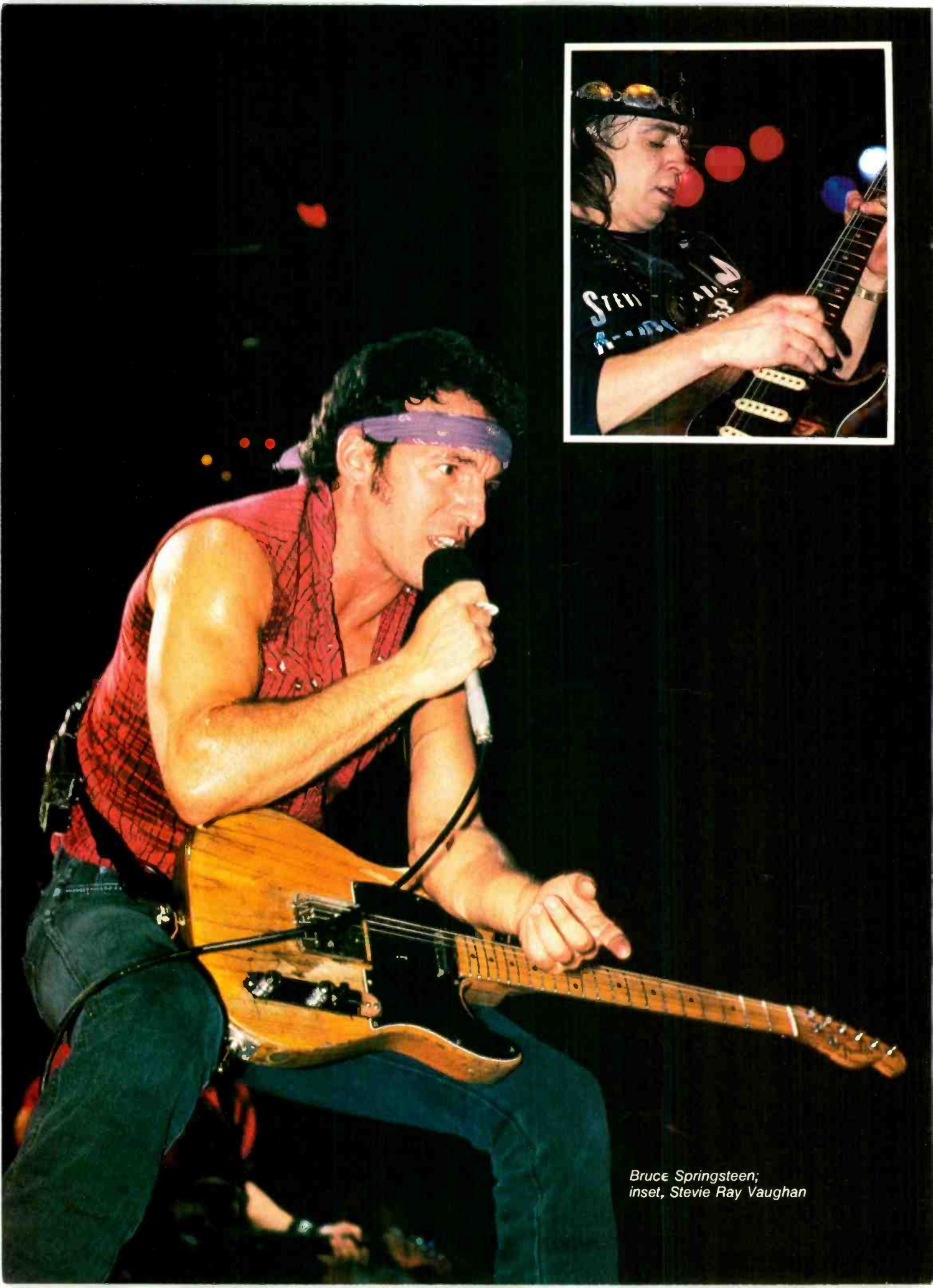
Did he remind you at all of Dylan when you first heard him?

No, no way. Appel tried to sell him as someone better than Dylan. But when I first heard Bruce, I knew there was no relationship at all between the two of them. In the first place, Bruce is a marvelous guitar player and a wonderful harmonica player, which Bobby was not. Though, like Dylan, he was a true poet. The best thing I ever did with Bruce was ask, "Have you ever written anything you wouldn't dare record?" He said, "Yeah, as a matter of fact I have." So he started playing a song called, "If I Was a Priest." He'd never recorded it, except in our demo, the tapes of which I still have. Suddenly a big bulb lit for me, and I said, "Bruce, were you brought up by nuns?" He said, "Of course." I had assumed that, like Bobby, he was Jewish, and he said he wasn't—that he was a good Catholic boy from New Jersey. And he was a very lapsed Catholic.

You never actually produced any of Bruce's records.

No, I went to his first sessions, and his manager, Mike Appel, didn't want me around. I was too much of an influence, and I hated what Bruce was do-


George Benson



Bruce Springsteen;
inset, Stevie Ray Vaughan

ing at that Studio 914 in Nyack. He wanted to track everything, so he was working with earphones. I just figured this was no way to record a great artist. That was the first album, *Greetings from Asbury Park*. That was Bruce's title. I said, "Gee, that's a strange title. I don't think that's going to sell many albums." He said. "Yeah, well, that's what I want it to be. That's where I hang out."

What would you have done differently?

If you notice, on that first album we had all the lyrics printed, because you couldn't understand the lyrics from the record alone. So that's one of the things I would have done different.

Do you think it's important in rock and roll to be able to understand the lyrics?

If you have a poet like Springsteen writing those lyrics, it's all-important.

Sometimes you still can't understand his lyrics.

Oh, yes, you can.

Yeah?

Oh, yeah. You listen to *Born in the U.S.A.* and you can understand everything.

That's a great record.

And how.

Did he change his style?

Oh, yeah, finally because he had to.

At your request?

Not necessarily at mine; everybody said the same thing.

E-nun-ci-ate?

Communicate, not enunciate. And Bruce is *the* communicator of this world.

Did you go out to the Meadowlands to see him perform?

Twice. I was there at his last concert. It was supposed to be family night, with his mother and sister onstage, but they had already left. It was still one of the best concerts I've ever heard of Bruce. He did a 20-minute acoustic set just of stuff from *Nebraska*, and it was so great. I got the royal treatment on Monday night because Jon Landau saw to it that we had a parking pass and an all-access sticker. Then I had a wonderful talk with Bruce in the intermission. And he's doing my television show in two weeks.

Tell me about the television show.

It's "Fifty Years of Popular Music with John Hammond." I started making records in 1931, and I've got a lot of the people I've worked with on the show. In all, about 45 minutes or one hour of raps between me and the artists. Alberta Hunter. Pete Seeger. Bob Dylan. Bruce in two weeks. George Benson. Gangs of people. It's my association with various artists whom I have produced on records.

Is this going to be a cable show?

I think CBS may wind up owning it. Almost all the artists are CBS artists, because I worked with CBS longer than any other company. And I'm back with them again now, so it makes sense. There's a lot of history that people don't know about. We have a marvelous sequence with Pete Seeger. We took our equipment up to the Clearwater sloop, and recorded on the sloop when it was docked in Hudson, New York. We were able to take on topics such as his blacklisting, which has never been on television before.

Are you back with CBS now as a consultant?

Mmmhmm. And also as a producer.

What are you going to be doing with them?

A whole lot of things, primarily aimed at the Compact Disc market.

New products?

Uh huh. And, some of the older products that are still in such good shape that they can be transferred to digital.

What are you going to be doing from the old stuff?

Jazz. I can't talk about a lot of sessions now; they're not out yet.

Will we be able to hear some of the great Basie sides, perhaps?

I hope so. And I think we may be able to put out that Basie-Ellington so-called battle that came out on records.

What's involved in redoing an old session for digital?

Patience and good ears. Since the tapes are still in good shape it's not as bad as if we were working from old masters, old acetates, which you would have to de-pop and de-click until the cows come home. There is also a wonderful machine called a Packburn. I don't know how it's done, but you put on an old record if you're transferring a 78. It senses which side of the next groove is better, and automatically switches from one to the other. I persuaded CBS to buy one of these machines when we were doing the Bessie Smith reissues many years ago now. They have two of them. Very few people even know of its existence. It was developed by two guys in the GE laboratory, and it's a marvelous machine. Almost all the Time-Life reissues were made with the Packburn. You don't smooth out everything, but about 85% of the part that is on the record you can get out.

If you have a poet like Bruce Springsteen writing rock and roll lyrics, understanding those lyrics is all-important.... Bruce is *the* communicator of this world.

Is CBS eager to expand the Compact Disc market? Is that something that is really going to be taking off?

Good God, they've opened the first Compact Disc pressing facility in the country out in Terre Haute. That's where all the Columbia House Record Club products are packaged. CBS and Sony are operating this jointly, and Sony knows a lot about pressing decent Compact Discs. They've not been made in this country before. Only the Japanese, and Philips does a lot in Holland, and I think they have a pressing facility in England now, too.

Is the Compact Disc going to be the next wave in audio?

No question. No question at all. It's almost made the cassette obsolete, and certainly the regular LP. I mean, there are still things they can do, it's only a one-sided disc, and they can still get an hour on a side. Do you have a Compact Disc player?

No.

Oh, I have one. A Sony 701, a wonderful machine.

Are you an audiophile? Are you really into your home system?

No, my home system is so antiquated now.

What do you have? Go ahead, tell us.

I have the Fisher 9X speakers, these big huge speakers that Avery developed many years ago. I have a young cousin now who's designing for Bose, and Bose is coming out with some wonderful product now; I'll have those soon. I still use my old Dual player, uh, changer, because it plays 78s, 45s and 33s, and it's got a good hysteresis

Photographs: Ebet Roberts

The important contribution I made was getting black and white musicians together ... through the Benny Goodman trio and quartet, and really every recording session.

motor. I also have highly developed modern players.

And electronics?

I think Kenwood's. It's not terribly advanced. It was good 20 years ago.

Well, I guess for a man who prefers to record with one mike, there's no reason why the old stuff can't still work at home.

Well, it does. And I have a good little cassette machine next to my bed, and I listen to a whole lot of things. I like to have good metal-based cassettes. But I listen to most things through a good three-speaker Sony cassette player. Three speakers in front and one in the back, and it's pretty good. And of course, I couldn't live without my Aiwa portable machine with the earphones, and Bose has now made new speakers you attach either to the Sony or the Aiwa, or any good taping machine that has its own power supply. They're wonderful.

I was curious whether you had some killer system at home.

No. No killer system. My wife has never really adjusted to the long-playing records. She likes 78s. Because that's how she bought her records, and that's how I bought my records. I had a fabulous collection of records—early chamber music and blues and everything else. I sold my 78s to Bob Altshuler, a record company executive, and he makes them available to schools and colleges and collectors who need copies. Bob is so principled. He's a fanatic. He's got every piece of equipment in the world.

Let's change the subject completely. Your first break as a producer was recording Fletcher Henderson. And you really tried to rebuild his career, but he didn't always cooperate when opportunities were presented.

His personal life was a shambles. He drank and he liked girls. He had a lovely wife who was a friend of mine. Now, I was brought up a Christian Scientist, until I learned better, and we found out we had shared the same practitioner. She was a gung-ho Christian Scientist. Leora and I got along wonderfully, but there was no way of getting Fletcher's personal life together. It was too late. But the great thing I did with Fletcher was to get him together with Benny Goodman. I don't think Benny Goodman's band would have made it without Fletcher's arrangements. The important contribution that I made, I think, was getting black and white musicians together. I did that through the Benny Goodman trio and quartet, and every recording session, really. I had at least a token white. Maybe more than a token white.

What were some of the kinds of resistance you met in those days?

Oh, complete—from the union, among other things.

What kind of excuse did they give, other than we don't want to play with blacks?

That was one of the things, the other was that although New York had a theoretically integrated union, the left wing of the union wasn't interested in integration at all; they were interested in higher scales. When I helped start Cafe Society and we had integrated bands, there were actually union business agents who'd come to us and say, "You don't want to have this going on. That guy there is a communist or thus and so." We asked, "What other class-A jobs are there for black musicians?" We stonewalled them.

You have a crusading history.

I was on the executive board of the NAACP when I was in my early twenties. I was the youngest member of the board by far, and I was one of the more radical members of the board.

Given all that, how do you feel about the position of blacks in the music business today?

It's not good enough. It's a hell of a lot better than it was. But you try and get black artists on MTV and see how far you get.

Is it just racism, or are they worried about racism out in the country?

The music industry is controlled by whites, and they don't know, they really don't know. It's ignorance, really, more than anything. They think the public isn't ready. I think that's mainly it. And yet Michael Jackson's success must give them all pause.

It just blows my mind because over and over again . . . Michael Jackson, Prince, George Benson, Stevie Wonder, Ray Charles . . . is it ever going to change?

Sure. I live in hope. It may not change while I'm still alive, because I'm 73 now, and it's late. . . . No, I've been through this all for so long. People used to be very bored with me because I was prematurely interested in civil rights.

And they didn't want to hear about it.

They sure didn't.

Have you tried to deal with MTV?

Sure.

And what do they say to you about it?

"We have a policy." I mean, they obviously had to do something about Michael Jackson. It's hard to combat CBS on a thing like this. CBS is pretty good about this, you know. Goddard was wonderful. There was really the great man of the contemporary record business. I'm very thankful to CBS because they gave me lots of opportunities, and I didn't hurt them too much.

I think lots of people have thought that John Hammond is a rich guy . . . .

I'm not. I never made any money off of musicians. It was a policy of mine and it still is. I never participated in any royalties on any of my artists at CBS.

You could have, but you chose not to?

Yeah.

Would a lot of these stars have had careers if you hadn't been willing to put your own money into them?

Quite possibly. I don't want to take too much credit for that. I was getting my kicks too, in developing artists.

How do you stay modern?

Artists like Dylan and Aretha and Benson and Springsteen come along and I guess I was sort of pulled along with them. I did recognize, one of the reasons I'm back at CBS, I know, is because Bruce's new album is so huge that I guess they feel that maybe they owe me something.

Why aren't you a record company president or something now? With all the sessions and people and things you've been involved in?

I'm not a businessman. To be perfectly frank with you, it's one of my lapses. I started out by being agin the Establishment, and I guess I still am.

Photograph: Ebet Roberts

LIVING WITH CDs

LEONARD FELDMAN

Some of us have owned Compact Disc players for nearly two years now. Others have only recently taken the plunge, while many more readers of *Audio* are, no doubt, still holding out for a variety of reasons. My own reactions (almost entirely positive) to laser-optical digital audio discs were formed early on in the brief period that players and discs have been on the market. Those opinions haven't changed much since I purchased the first CD player I could get my hands on (the one I still own, incidentally). But it has occurred to me that my opinions might be colored by my access to some of the best CDs around, as well as by my opportunity to obtain some discs for nothing or next-to-nothing, as a reviewer and tester of equipment and as a member of the audio press. I wondered what the serious audio enthusiast was thinking about CDs and CD players—now that both have been available to us for some while.

Lacking the financial resources to conduct an official, meaningful poll, I saw no easy way to get a sample of opinion from audiophiles across the country. Then, a fortunate thing happened. I was asked to deliver a talk in some 22 cities around the U.S. as part of a seminar about digital audio and other advances in audio and audio-related video technology. After working out an itinerary that called for visits to three or four cities per trip over a period of three months, I agreed. And as a result I was able to communicate on a one-to-one basis with hundreds upon hundreds of interested audio enthusiasts, many of them with questions about CDs they had been unable to get answered satisfactorily. Many, too, had been fed misinformation by a variety of sources, ranging from uninformed sales personnel intent on selling the new CD technology even if they had to stretch the truth a bit, to quotes from advertisements created by over-enthusiastic ad agencies who obviously hadn't checked back with their clients' technical people.

Because I came away from this period with a clear impression of what people want to know about CDs, I thought it might be a good idea to share some of the questions raised during this extended tour around the U.S. Some of the answers I gave are simply factual, while others, clearly, are my own opinion, formed after two years of familiarity with a variety of CD players and a good sampling of CDs. My purpose here is to help others make up their minds about the Compact Disc system—whether to purchase a player now, later, or even perhaps never. I'll present the material as a question-and-answer session—much as I did during the actual seminars.

Q. When will the price of Compact Discs come down—and by how much?
A. Don't expect CDs to ever cost as little as mass-produced LPs. At present, manufacturing costs run about five times those of an LP. Remember, though, that CDs can contain more than an hour of music, as opposed to 30 to 45 minutes on an LP. Furthermore, high-quality audiophile LPs sell for prices comparable with CDs and always have—and, of course, CDs sound a lot better and last a lot longer than even the finest audiophile LPs.
Q. I've heard that CDs are indestructible. Is it true that you can scratch them or allow dust to land on them and that the laser will still read through these defects?
A. The ability of the laser pickup in a CD player to read around minor defects in a disc is truly remarkable, a result of the laser beam's focusing *beneath* the transparent surface of the disc. Sophisticated error-correction circuitry—an inherent part of the CD standard—also help. Because of this circuitry, the laser beam, in effect, has more than one chance to read the digital information if a dropout is encountered owing to an opaque scratch or dirt spot on the disc.

It should be emphasized, however, that these factors only work *up to a point*. If scratches are severe, or if dirt and dust are allowed to accumulate on the disc surface, any CD player will mistrack. The result will either be a momentary muting of the music or skipping parts of the music, or even repeating the same phrase of music over and over again. *The same care should therefore be taken in handling CDs as you would take in handling your best LPs.*
Q. When will the price of CD players come down to $200 or even $100?

A. Prices for CD players have already fallen dramatically, as manufacturers introduce more economically fabricated second- and third-generation machines and as LSI chips are designed to take the place of more and more discrete circuitry. But you must be careful when you shop. Ultra-low prices for CD players may also result from skimping in such important qualities as error-correction capabilities and laser-tracking stability, not to mention omission of convenience features found in the more expensive players.

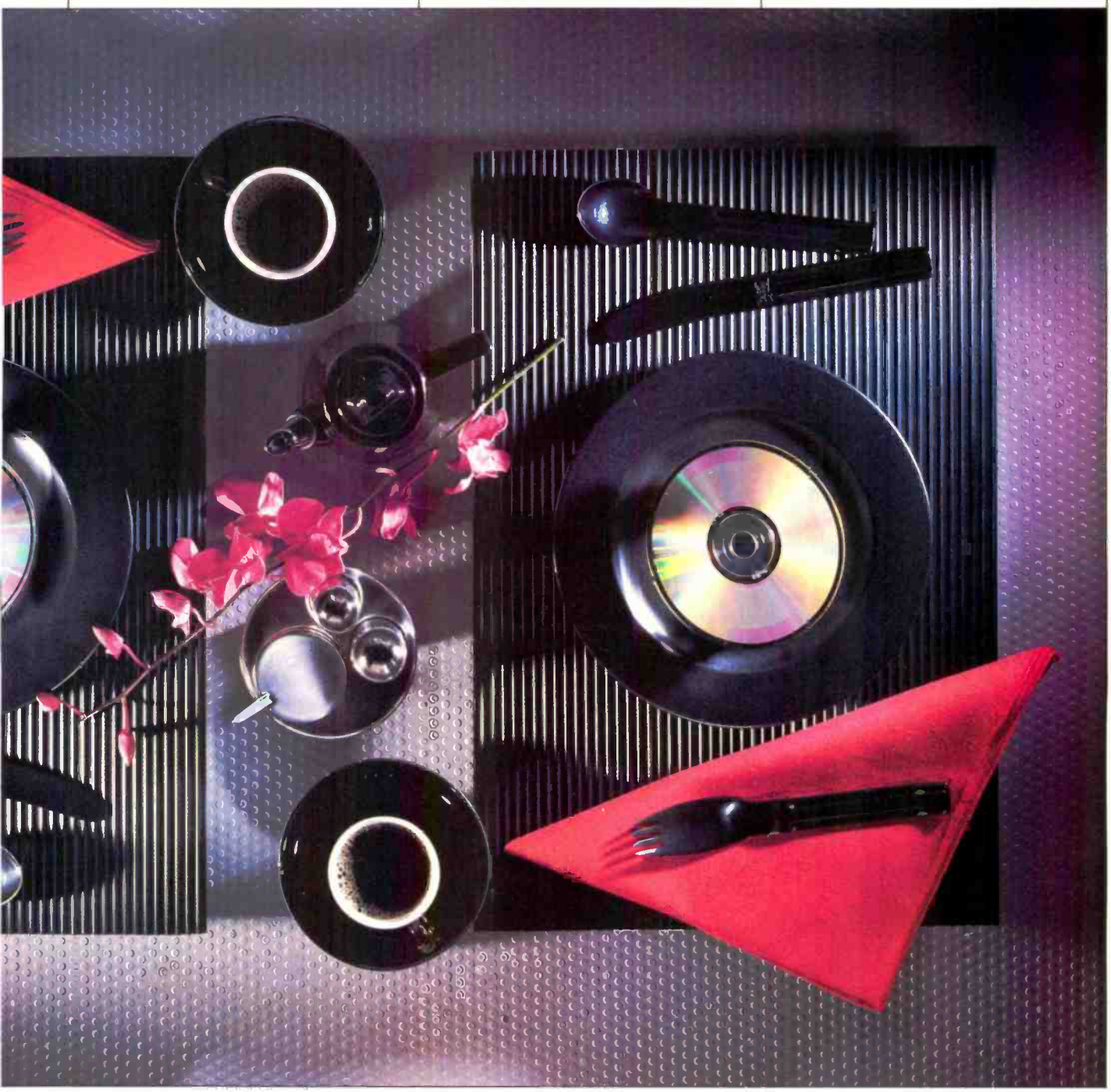
Q. So, what *are* the major differences between CD players? Does one model sound different from another?

A. There seem to be some subtle sonic differences between different players, but these are relatively minor. Major differences involve programmability, the time it takes to access a given track, tracking stability, and ability to overlook minor defects in the disc through elaborate use of an individual unit's error-correction circuitry and techniques built into the CD standard. Resistance to mistracking caused by external shock or vibration is another factor that varies from one player to another.

Q. Some CDs have come out that were made using *analog* master tapes. Isn't that something of a rip-off? Shouldn't CDs be digital all the way from master tape to finished product?

A. *Many* fine-sounding CDs are being made from analog masters, and, frankly, there's nothing wrong with this practice if the original performance was worth preserving and the master tape technically well recorded. A good analog master tape can have more dynamic range than can be contained in an LP, so CDs made from such tapes do sound better and have more dynamic range than the LPs made from the same masters.

Q. Will we ever be able to record onto CDs, as well as using them just for playback?



Photograph: Robert Lewis; table settings courtesy of D.F. Sanders & Co., New York City

Two-sided, two-hour CDs are possible but not probable. Just the royalty rates on so much music would make the cost prohibitively high.

A. I'm always puzzled by this question. Why should we expect to be able to record CDs at home when no one ever asks about being able to record LPs at home? At present, PCM processors enable anyone to make digital audio recordings using a videocassette recorder. Many large firms, including 3M, Sony, Philips, Sansui and Sanyo, are investigating this, however.

Q. With all that extra dynamic range in CDs, how much extra power will I need in my amplifier to take full advantage of CDs?

A. There's no one answer for this question. It depends upon how much amplifier power you now have, how efficient your speakers are, and at what loudness levels you like to listen to music. In general, though, somewhat higher amplifier power or a trade-up to more efficient loudspeakers, or both, is usually in order.

Speaking of dynamic range, it's worth noting that when CDs are played in cars, their dynamic range will be too great for on-the-road enjoyment. Ambient noise in automobiles is so high (often as high as 70 dB SPL, even with the windows closed) that, in order to hear the softest passages of music, the volume will have to be turned up so high that the loudest passages will either overload the typical car stereo system or be deafeningly loud. Many manufacturers of car CD players are expected to offer—either built into the CD unit or as an optional add-on—electronic compressors to reduce these dynamics to a manageable range. Philips has already showed such a player in Europe. Of course, the CDs will continue to deliver their full dynamic range when played at home or with the players' compressor circuits turned off.

Q. I've heard rumors that we're going to see combination disc players that will play both laser videodiscs and CDs. When will such players be available?

A. The rumors have finally borne fruit—the first quarter of 1985 should see such players brought to market by Pioneer (and by Sony and Technics, selling units actually made by Pioneer). Pioneer's dual-purpose machine, however, is not only more expensive than a CD player alone, it's a good deal more expensive than a CD player and a LaserDisc player together, though the combination unit takes up less space than the two single units it replaces.

Q. Isn't it possible to produce CDs with music on both sides? If so, why aren't record companies making two-sided CDs?

A. Yes, it is possible and provisions for such discs were made when the standards were set. Still, you're not likely to see two-hour, two-sided discs in the foreseeable future, for two reasons. First, although the yield of discs now exceeds 80% (eight out of 10 CDs that come off the molding machines pass quality-control tests), sandwiching two discs together, back to back, would automatically double the quality-control problems, dropping the yield rate to around 60%. Second, a double-sided disc would have no space for a label, and it might not be compatible with existing players and pressing equipment. Then, too, in the case of popular-music recordings, the extra royalties for the additional selection needed to fill two sides of a CD would raise the cost of such discs prohibitively, thus reducing sales.

Q. Why isn't there at least the hour of playing time that can be put on a single-sided CD? Most CDs seem to have no more music on them than regular albums.

A. Consumers have a valid complaint here. Unfortunately, most record makers simply transfer the programs used for making LPs (whether from digital or analog master tapes) onto CDs. A few (especially in the classical field) have seen fit to append a short selection after the main musical program, such as an overture to a disc containing a symphony or two by the same composer. In the popular-music field, record companies would run into the same problem of additional royalties for added songs that they would if they made double-sided discs. But if you want more music on your CDs, you should make your voice heard at the record companies, by requesting that those companies fill out their CDs to full length more often.

Q. There is a vast amount of unused storage space in CDs. What can this extra data storage space be used for, and when are we likely to see CDs that include such additional data?

A. There are several areas of unused storage space in CDs as they're currently made. So called "subcodes" bearing the identifying code letters R through W are available for a variety of data storage. Among the kinds of data being considered are digitally generated graphics, not unlike those available on home computers and teletext. A CD has enough data storage space left, after including stereo audio and track/time display information, to generate approximately 250 still-pictures during the course of an hour's worth of recorded music. Such pictures, displayed on a TV screen with an add-on "black box" connected to the CD player, might show the lyrics of a song, the libretto of an opera, or scenes appropriate to the music—in fact, almost anything you can imagine.

Q. Some CD players apparently use a higher digital sampling rate—does this result in better sound? What's the story on this?

A. Another source of confusion. There's only one sampling rate for the CD system: 44.1 kHz. For that matter, there's only one "bit" count for CDs too: It's a 16-bit standard. Talk of 88- or 176-kHz sampling rates has to do with the way in which various CD players decode or read the information contained in the disc. Some, for example, read the same sample two or four times, in a technique called oversampling. Others use a 14-bit D/A (digital-to-analog) converter but end up achieving the full dynamic range and other characteristics inherent in the 16-bit system. Each approach claims sonic superiority, and you are invited to judge that for yourself. But the basic world standard set for CDs employs one, uniform sampling rate and a 16-bit sampling system.

While these dozen questions may not answer everything you want to know about Compact Discs and CD players, the important thing to remember is that CD technology is scarcely two years old. By contrast, we've been dealing with analog audio recording in one form or another for more than 108 years. It will take a little more time till we have all the answers for a technology this new. I, for one, am willing to wait while I enjoy the better sounds I'm getting—even with my first-generation CD player.

Controlling MC Cartridge Response

Mile Nestorovic and Glenn White

Moving-coil cartridges in general have an ultrasonic resonant frequency, usually in the range from 20 to 60 kHz. This resonance can result in a response peak amounting to 20 dB or more. Normally, this is not visible on the published response curves because they go only to 20 kHz, and the resonance may result in a rise of only 1 or 2 dB at this frequency.

It may be thought that a rise in the response above the audible frequency range is insignificant; however, the increased output of ultrasonic noise due to the peak places severe demands on the preamp. Intermodulation distortion between this ultrasonic noise and the signal produces difference tones, which *are* in the audible range. The sonic result is a distorted midrange, with reduced definition, a blurring of the stereo image, and a "metallic" quality to sounds between about 3 and 7 kHz. In addition to this, the response peak, although occurring at ultrasonic frequencies, causes large phase shifts in the audible range, and this also affects stereo imaging ability.

Manufacturers usually recommend a low-impedance load for moving-coil cartridges, sometimes as low as a few ohms. This reduces the amplitude of the peak but does not prevent the cartridge from ringing at the resonant frequency as a result of transient signals, nor does it correct the phase shift.

We have developed an alternative solution to the problem, consisting of a passive network to be connected between the cartridge and the preamplifier. This circuit creates an anti-resonant dip with the same "Q" and amplitude as the cartridge peak. Its phase response is complementary to that of the cartridge, resulting in flat phase response for the combination. The network has three different overall characteristics, selected by a three-position switch, allowing optimization for almost all moving-coil cartridges. The network also presents the cartridge with an extremely low impedance at the resonant frequency to improve its damping without affecting its sensitivity within the audible range.

A cartridge's ultrasonic resonance can make a difference in audible distortion, phase response, and stereo imaging. The MCC Network plugs between an MC cartridge and a pre-preamplifier to flatten phase and ultrasonic frequency response.

Mile Nestorovic is President of Nestorovic Laboratories, Kirkland, Wash. Glenn White is with Brüel & Kjaer in Seattle, Wash.

A passive network, with resonance and phase response complementary to the cartridge's, can counteract ultrasonic problems.

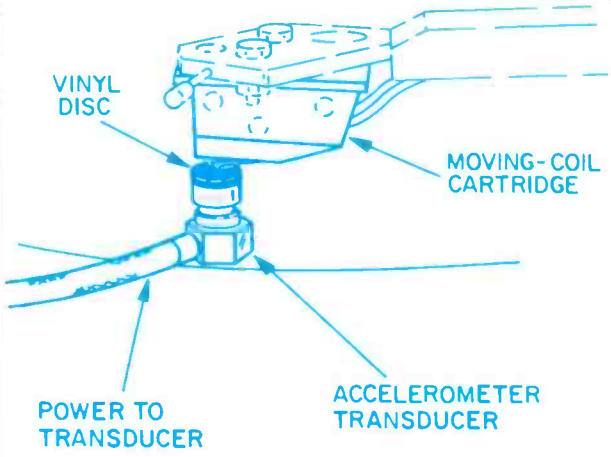


Fig. 1—The basic test setup, using an accelerometer transducer as a miniature, ultrasonic shake table.

ON THE TESTBENCH

To evaluate the Nestorovic MCC Network, I inserted it between a van den Hul Type I phono cartridge and a pre-preamplifier. A special test record with a 4,870-Hz square-wave signal recorded at constant velocity (without RIAA pre-emphasis) was used, permitting evaluation of the frequency response above 20 kHz. Figure B1 shows the response of this cartridge to the 4,870-Hz square wave without the MCC Network, and Fig. B2 shows response with the network in use.

I have used the MCC Network with a variety of moving-coil cartridges, and always noticed the subjective enhancement of massed string sounds and choral passages (e.g., operatic choruses or choral works). When playing the superb Japanese pressing of *Flutes de Pan et Orgue* (Georges Zamfir, Philips 28PP-30) without the MCC network, the pan pipes accompanied by organ seemed somewhat blurred compared to hearing them played live. However, when the network was introduced, the resultant sound was absolutely unbelievable—as if the pipes were actually being played in the listening room. It is doubtful that the sonic clarity of this record and cartridge could be further improved.

B. V. Pisha

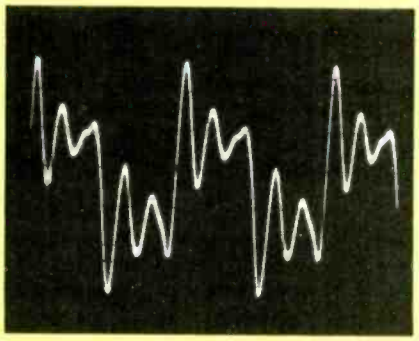


Fig. B1—Response of van den Hul Type I cartridge to 4,870-Hz square wave.

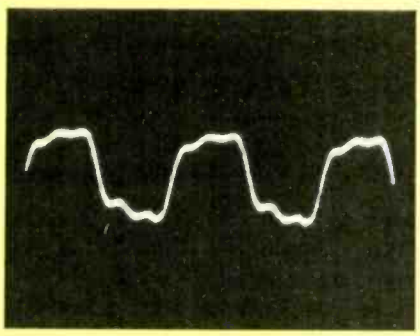


Fig. B2—Test as in Fig. B1 but using Nestorovic MCC Network.

In order to measure frequency and phase response of cartridges, we borrowed a technique developed by Poul Ladegaard of Brüel & Kjaer Instruments in Denmark [1]. He uses a modified piezo-electric accelerometer as a miniature shaker by applying a high-voltage a.c. signal to the piezo element. Because the shaker has constant displacement and phase for signals up to 70 kHz, it is possible to measure frequency and phase response of the cartridge in this frequency range. To ensure that the mechanical impedance presented to the stylus is typical of what it sees when playing a record, we introduced a small piece of vinyl between the shaker and the stylus. The vibration is thus transmitted through the vinyl to the stylus tip.

The test setup is shown in Fig. 1. Figure 2 shows the frequency and phase response of a very popular moving-coil cartridge, plotted wth an expanded vertical scale to show the resonant peak. The peak at 80 kHz is the resonance of our miniature shaker. The phase shift of 90° at 40 kHz indicates the resonance of the cartridge, corresponding to the peak in the amplitude response. Figure 3 shows the same two curves of the same cartridge, but with the new network inserted between the cartridge and the preamp. (Frequencies below 5 kHz were of no interest in this work and so were not measured.) The frequency response above 20 kHz is now much flatter and the resonant peak nearly eliminated. Similarly, the system's phase response is also flattened.

The primary reason for using our miniature shaker instead of a test record is that phase response cannot be measured with a record—there is no phase reference to compare to. The shaker, however, does not simulate the geometry of the stylus sliding in the record groove. Therefore, we also made tests using the B & K QR-2010 test record, which contains a frequency sweep from 1 to 45 kHz recorded at constant velocity. This means it is to be played back without RIAA equalization. We played the record at 45 rpm, extending the frequency sweep to 60.75 kHz. When playing this record, all cartridges showed less extended frequency response, with a smaller peak, than our shaker revealed. We

The improvement caused by the network can be graphed, seen on square waves, and heard, especially in massed string and choral passages.

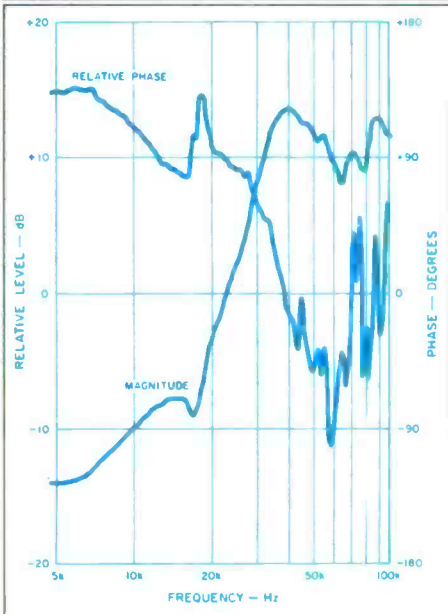


Fig. 2—Frequency and phase response of a popular moving-coil phono cartridge.

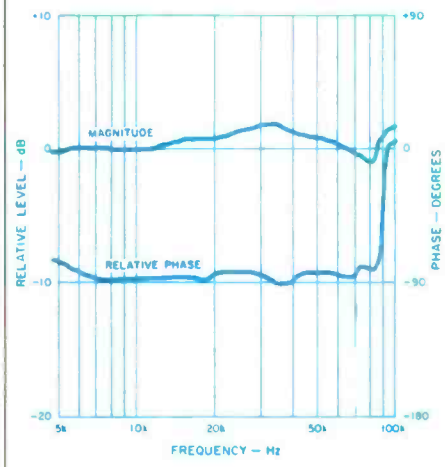


Fig. 3—The same cartridge as Fig. 2, with the Nestorovic network in use, switch set to "Max."

Front and back views of the MCC Network show its simplicity. The passive network needs no power source. This version is for high-impedance MC cartridges; the version for low-impedance cartridges is externally identical save for its front-panel designation.

believe this is due to the tracing error of the finite stylus radius riding in the groove. The greatest similarity between shaker response and record response was with cartridges using the van den Hul stylus. This is understandable because this stylus design has very small side radii, about 3.5 microns, allowing it to more accurately trace the very small groove gyrations at high frequencies.

Using the new network, we had occasion to compare the same cartridge with both the van den Hul and a hyperelliptical stylus, and we found the van den Hul reproduced details in the upper midrange much more accurately. A good test record is *Cantate Domino* (Proprius Records, older version, No. 7762). Choral passages were reproduced without blurriness, while elliptical styli caused significant blurring.

To evaluate the transient performance of the cartridge/network system, we have produced a special test record with a 4-kHz square wave recorded at constant velocity. This allows us to evaluate transient response above 20 kHz without using the standard RIAA playback curve. When using the test record, the cartridge and network were connected to a linear preamp, one flat to over 80 kHz, much like a high-quality microphone preamp. Figure 4 is the response of the cartridge without the network, and Fig. 5 is the response with it. It can be seen that the overshoot is reduced and the ringing is eliminated. Very high-frequency noise is also reduced, lessening the chance for intermodulation products in the audible range. As mentioned before, our listening tests show subjective improvements in definition, especially in massed string sounds and choral passages. Ambience is improved in those records which contain recorded ambience. High-frequency noise is reduced also. We will make the network and the square-wave test record available commercially in the near future.

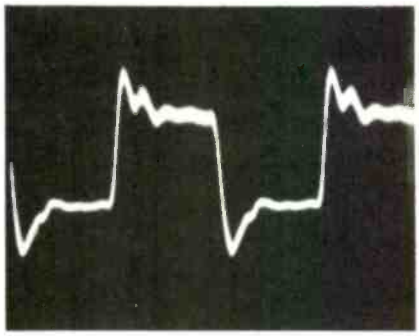


Fig. 4—Response to 4-kHz square wave of the cartridge used for Figs. 2 and 3.

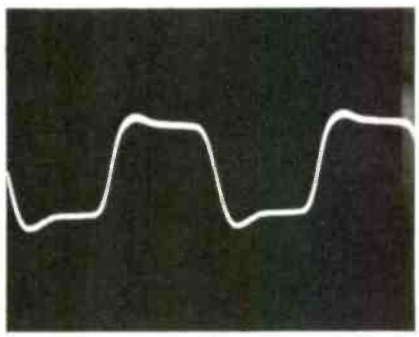


Fig. 5—Square-wave response of same cartridge with Nestorovic network in use, switch at "Max" position.

Reference

1. Ladegaard, Poul, "Phonograph Cartridge Evaluation Using a Minishaker and TDS," presented at the 74th AES Convention, New York, October 1983.

F. Alton Everest

John Charles A Matter Of

Illustration: Paul C. Gioni

What was that fellow doing out there in the courtyard? He would clap his hands, listen intently, and then move, first toward and then away from the west wall of the old Smithsonian Building.

The year was 1854. The man was Joseph Henry. What he was doing was conducting the first psychoacoustical experiment in what has become known as the "precedence effect" or the "Haas effect," although Henry was a hundred years before Helmut Haas.

Henry was listening for echoes of his handclaps from the side of the building. He found that when he was less than 30 to 40 feet from the building he heard no echo, but if farther than this a distinct echo was heard. He concluded that a delay of 1/20th to 1/16th of a second was necessary for the ear to distinguish between two successive sounds. For shorter delays the "echo" was fused with the original sound and was not discerned. Characteristic of Joseph Henry, he applied this important information in the design of an auditorium in the old Smithsonian Building on which Congress had asked him to collaborate.

Scores of researchers have dealt with this important aspect of human hearing, both before and after Haas [1], each making a contribution to the total fund of knowledge on the subject. One of the latest contributions comes not from an established professor in a well-heeled psychology department but, rather, from the 1981 master's thesis of a 27-year-old electrical engineering student at the University of Colorado. The name on the thick thesis is John Charles Cox, but he answers readily to "Jack." He is now Senior Acoustical Engineer at International Jensen in Schiller Park, Illinois.

Jack was born in Evanston, Illinois, but, as a child, moved with his family to Janesville, Wisconsin, a small town south of Madison. Upon Jack's graduation from high school, his father, re-

Cox Precedence

cently retired, decided that the family should move to Colorado Springs "to enjoy a more salubrious climate" (have you ever seen the records for cold weather and depth of snow in this part of the Rockies?). With characteristic vigor, Jack plunged into the academic program of the University of Colorado at Colorado Springs and Denver.

As it plays a central part in your research on the so-called Haas effect, tell us something of your background in music.

My major interest is music. I have been a drummer for almost 20 years now. I started in the public-school music program when I was in the fifth grade and participated in the public-school music program in concert band, jazz band, orchestra, and stage plays until I graduated from high school. In high school, I also played in a rock band called Tarsus, which achieved some notoriety and a little financial success. I marched with and was drum-section leader and percussion arranger for the Green Beret Marching Band of Janesville, Wisconsin. I have also marched with the Kilts Drum and Bugle Corps of Racine, Wisconsin. I was percussion instructor with the Boulder High School Marching Band and helped organize the first drum-line competition ever held in Colorado. Upon returning to the Midwest, I joined the Chicago Highlanders Bagpipe Band. Incidentally, my experience in participating, arranging, and judging the musical cleanness and uniformity of drum lines is central to my thesis because it has given me a unique training in perceiving echoes.

You did both your undergraduate and graduate work at the University of Colorado in electrical engineering. Did this signal a decreasing interest in music?

Not at all, quite the reverse. After three years on the Colorado Springs campus I moved to the Denver campus, and one of the reasons was the rapidly expanding Music School. Most of the second floor of the new Fine Arts Building housed a recording studio large enough to hold a full-sized symphony orchestra and chorus and two control rooms, each large enough to accommodate an entire class for witnessing a mixdown. I took elective courses under Prof. Roy Pritts, who also directed the recording facility, along with the standard engineering courses. In this way I received hands-on experience in such things as recording, reinforcement, programming of synthesizers, *musique concrète*, etc.

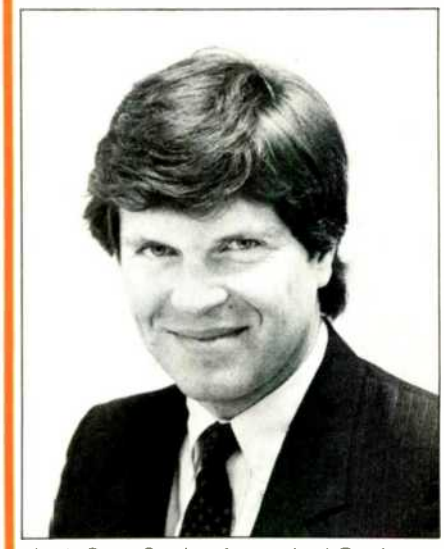
Professor Robert Ashley, formerly of the University of Colorado and now with Sperry in Florida, has been considered by some as something of an iconoclast. Did your association with him lay the groundwork for a career of toppling traditional dogmas?

I have enjoyed my association with Bob Ashley, both as a professor of electrical engineering and as a friend. He got me interested in architectural acoustics, pointing out problems with coherent echoes in some of the concert halls and auditoriums in the Denver-Colorado Springs area. He planted the seed, as my advisor, and okayed my thesis subject, but he pretty much let me do my own thing. He does tend to be an independent thinker and it is very stimulating to be around him.

Why are echoes so important to you?

The first line of the first page of my thesis states, "Echoes are the most serious problem in architectural acoustics today." That says it! They garble announcements, ruin entertainment events, and profoundly inhibit the ability of entertainers to perform. Echoes are an extremely grave problem today, with great expanses of painted drywall surfaces in places of public assembly. Ornate interiors which create diffusion, as in Boston's Symphony Hall, are now fiscally prohibitive.

Echoes garble announcements, ruin entertainment events, and profoundly inhibit performers.



Jack Cox, Senior Acoustical Engineer at International Jensen, Schiller Park, Illinois

There are things you can hear which can't be measured well and things you can measure and correct which make no audible difference.

Fig. 1—Cox's test setup, here with delayed speaker in front of listening position.

What stimulated your interest in psychoacoustics?

I became interested in psychoacoustics from my interest in music and found a big gap between that which is measured in engineering and that which is audible to the paying public. There are things you can hear which can't be measured well; there are things you can measure and correct for that make no audible difference. The ultimate test is not whether it has flat frequency response or is minimum phase or is time-aligned or any of those other buzzwords. It's whether it sounds good to the consumer who shells out the money. The big gap here can be closed only through psychoacoustical research.

Your master's thesis is entitled, "The Effects of a Single Echo on the Intelligibility of Speech and Music." This is very similar to the title of Haas's 1949 doctoral dissertation. Was it your intention to rerun Haas's experiments?

No, not at the beginning, but it became necessary to do so. The initial results of my thesis investigation were presented at the ICASSP [IEEE International Conference on Acoustics, Speech and Signal Processing] meeting in Denver in 1980 [2]. In my early literature search, it seemed that all references to single-echo effects pointed either to Georg von Békésy [3] or to Helmut Haas [4].

In studying Haas's paper, I found a lot of loose ends. The data was there, it just needed more coherent interpretation. Another reason for repeating Haas's experiments was that his work had been done back in 1949, with equipment quite primitive compared to the equipment I had.

What were you trying to find out?

I wanted to check two aspects of the influence of echoes, the effects of delay time and angle of incidence.

Haas had studied auditory forward inhibition, the tendency to integrate a direct sound with its echo. When two similar sounds are of equal amplitude, and one follows the other by 20 mS or less, you hear only the first sound, not the second, even though they are two distinct sonic events. This is the precedence effect, which is often called the Haas effect.

As to angle of incidence, it's been claimed that echoes coming at you in the same lateral plane as your head are more clearly perceived than those from higher or lower points. Many concert halls were built in the late '70s using this design philosophy of lateral reflections; they were, by and large, disasters, developing bad reputations very quickly.

Describe your research setup.

Envision a hemisphere with your seat at the center, a speaker right in front of you, plus another, movable speaker which carries the same signal as the fixed speaker, but delayed. You can move that second speaker to any point of the compass, and any angle of azimuth from ear level to directly overhead.

I set up such a system [Fig. 1] in my apartment. I checked carefully to make sure any echoes flying around the room were very low in level, comparable to Haas's situation on a roof. I measured these echoes on a storage 'scope, to be sure.

In my tests, I used drum taps as impulse test signals, fed them through a digital delay line [Fig. 2], and then to the amplifiers and speakers, with the movable speaker given the greater delay. It would have been simpler to delay only one signal, but I had to run both through the delay line to make sure that any hum, noise, or other side effects affected both signals equally.

My amplifiers, loudspeakers, and other components were of far higher quality than those available to Haas in 1949. He used a crude, analog tape-delay device, while I used a high-quality digital delay line loaned by Mahlon Burkhard of Industrial Research Products. God bless his patience! I kept it two years!

Why did you use drum taps as signals?

Well, von Békésy used rectangular envelope tone bursts. Haas used a talker speaking nonsense syllables but abandoned this in favor of continuous text so he could evaluate the effect of speed of speaking on intelligibility. Both of these signals are so fraught with practical problems that I decided to use clear-cut, reproducible musical signals with which I was very familiar, percussion taps. I recorded myself playing on six different surfaces to get six different percussive timbres: Small and large wooden planks and a Remo

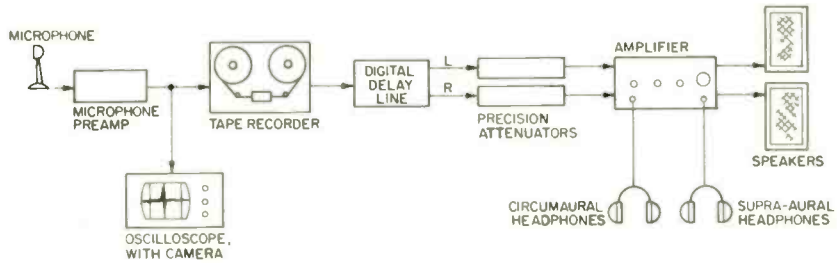


Fig. 2—Block diagram of Cox's test setup. (See text.)

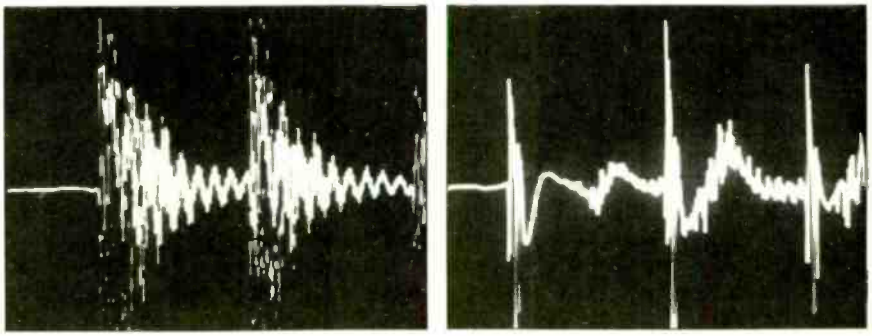


Fig. 3—Drum-tap waveforms.

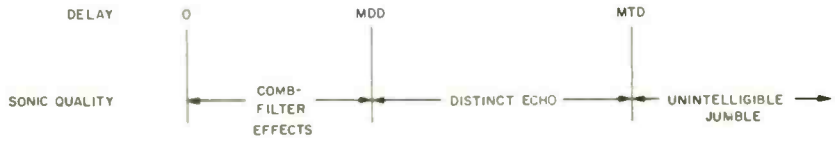


Fig. 4—Sonic effects of signal delay, showing minimum detectable delay (MDD) and maximum tolerable delay (MTD).

practice pad with low and high tension, muffled and unmuffled. I used all these signals and averaged the results for the six different surfaces. It was easy to record signals of different repetition rates: For example, quarter notes (0.500 second/note), quarter-note triplets (0.333 second/note), and on down to 32nd notes (0.063 second/note), the fastest a percussionist is ever required to play.

And you were the listening jury?

Yes, primarily, although I used one corroborating listener. When you consider the vague and complex responses von Békésy and Haas required of their listeners, it is easy to account for the spread of their data and the statistical complexity required to offset it. It has been demonstrated that trained audio professionals are far more sensitive to transient intermodulation distortion than are laymen. So, I figured I could get more precise results with only myself as the listening jury.

An important point here is that all my experience in playing, teaching, and judging drum lines ideally fitted me to judge whether an echo is present or not. In that drum line, if one player is a few milliseconds late, it is discernible to the trained, attentive ear. This is what drum-line competition is all about.

Now that we have all this background on techniques, procedures and equipment, what are the results of your research?

I have a problem here. I'm in the process of reporting the results of my tests to the scientific journals, and it isn't appropriate for me to jump the gun on them. However, there is no reason why general conclusions cannot be revealed at this time.

There are two distinct phenomena [Fig. 4], the minimum detectable delay (MDD) and the maximum tolerable delay (MTD). Let's take MDD first. The minimum detectable delay is the equivalent of what Beranek [5] called the "initial time delay gap," which is the time between the arrival of the sound from the stage and the arrival of the first reflection at a given seat in the audience. I found this to be 20 mS for drum-tap music for all but the very fast taps [Table I and Fig. 3]. Beranek found that concert halls receiving the highest ratings had initial time-delay gaps of 20 mS or less if used for symphonic music, which is precisely confirmed by my MDD. I think this is really significant. Here I was doing a purely psychoacoustical test involving human perception, directly, and Beranek arrived at his conclusions indirectly, through opinions of concert-hall quality from experienced users of the hall. He did make physical measurements in each hall for correlation with opinions. Dave Klepper of Klepper, Marshall, King talked to me about this. He was enthusiastic about Beranek's findings being confirmed through two very different methods and confirming his own 24-mS value for opera houses.

And how about MTD?

MTD is that delay at which drum taps, representative of music, become hopelessly confused and speech becomes unintelligible. I found this to vary from 20 mS for very fast drum taps to 84 mS for slow ones [see Table II].

As I studied your thesis it seemed to me that, perhaps, one of your major contributions was your pointing out what you call the "one-third rule."

Well, it sure makes it easy to predict the maximum tolerable delay. All you have to know is the musical staccato interval or the spacing of speech syllables. For example, English language spoken at a normal rate turns out to be about 5 syllables per second, which gives an interval between syllables of 1/5th of a second, or 200 mS. Dividing 200 mS by 3 gives a maximum tolerable delay of about 67 mS. This is very close to the way the measurements turn out [Table II], and it works on Haas's and von Békésy's data as well.

In general, your results seem to agree fairly well with Haas but not with von Békésy; is that right?

My findings contradicted von Békésy. When I found, just before defending my thesis, that he was a Nobel laureate, my knees nearly folded.

Table I—Minimum detectable delay (MDD) for delayed and undelayed signals of equal level.

Tap Signal Interval, mS	Minimum Detectable Delay, mS
63	15.8
83	16.8
125	20.0
167	20.0
250	20.0

Table II—Maximum tolerable delay (MTD) for delayed and undelayed signals of equal level.

Tap Signal Interval, mS	Maximum Tolerable Delay, mS	Estimated MTD Using ⅓ Rule, mS
63	20	63/3 = 21
83	28	83/3 = 28
125	44	125/3 = 42
167	56	167/3 = 56
250	84	250/3 = 83

I couldn't verify von Békésy's assertion that there would be backward inhibition, that a delayed signal could erase our perceptions of the undelayed signal preceding it. My data simply did not support his conclusions: For delays of 4 to 12 mS, the undelayed-signal loudspeaker sounded much louder than the delayed-signal one, which contradicts von Békésy. I understand that Blauert,' in Germany, also observed auditory forward, but not backward, inhibition.

I did not know von Békésy was a Nobel laureate until minutes before I was going in to defend my thesis, and my knees almost folded. What would my committee think of an upstart like me contradicting a Nobel Prize winner? Fortunately, one of the members of my committee, trained in psychoacoustics, could tell the others that I was not alone in questioning this particular conclusion of von Békésy, which came long after his Nobel Prize. But, this is what science is all about, isn't it? Like Jack Webb used to say on TV, "Just give me the facts, ma'am."

The Haas effect is well recognized among hi-fi aficionados; will there now be a Cox effect?

[*Laughter*] I'll dodge the implications of that one and compare Haas's and my work. The precedence effect is my minimum detectable delay. What Haas really measured was the maximum tolerable delay. So, I feel that associating Haas's name with the precedence effect is incorrect. I should add that I consider the terms minimum detectable delay and maximum tolerable delay preferable to other terms which have been used, because they are clear and self-explanatory.

It is interesting to me that other researchers have had substantiation for the one-third rule right before them without pointing it out in their papers. This is the rule that maximum tolerable delay is one-third the repetition rate of the events—one-third the time between notes in music, one-third the time between syllables of speech. With speech, of course, this must be the average over 1 or 2 minutes.

Okay, we will call this Cox's rule. Now, what is the significance of all this in the design of concert halls?

I hate to appear so negative, but I must question the whole philosophy that lateral reflections are more easily perceived than reflections from higher angles. Designing a concert hall based on this philosophy makes the hall very narrow and very shallow, so the initial time-delay gap of the lateral reflections is very short. Then, in order to get the necessary 2.1-S reverberation time required for Romantic symphonies, the ceiling must be very high.

Haas researched this point and concluded there is no discernible difference in maximum tolerable delay, or what he called "critical transit time," with respect to echo angle of incidence. This means that it doesn't matter whether the echo comes from the side or from directly overhead; it is all the same. I have found the same thing for the minimum detectable delay, so we have all the bases covered there. Reflections from the ceiling, balcony faces, rear wall, or side walls—all are important, and they can be just as disturbing.

If lateral reflections are more pleasant to hear, or are more acceptable to laymen because of past or present auditoria design, that is another question entirely. But I must point out that reaction from musicians and the paying public to auditoria designed on the lateral-reflection philosophy has ranged from apathetic to vitriolic. We may argue the fine points of acoustics, but it is the public that votes with its feet.

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B&W's newest star is in the spotlight.

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The television picture tube and associated components are seriously affected by stray magnetic fields. The magnets employed in TV loudspeakers are shielded to prevent magnetic interference but if large magnets required to produce true high fidelity are used, then shielding is only partially effective.

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Behind the successful development of these video acoustic monitors lies B&W's world leadership in loudspeaker technology and design. B&W's Model 801 has been selected by famous recording companies, orchestras and conductors worldwide as their classical music monitor. For both the professional recording artists and the critical music lover, B&W has dedicated itself to the pursuit of perfection in the recreation of live sound.

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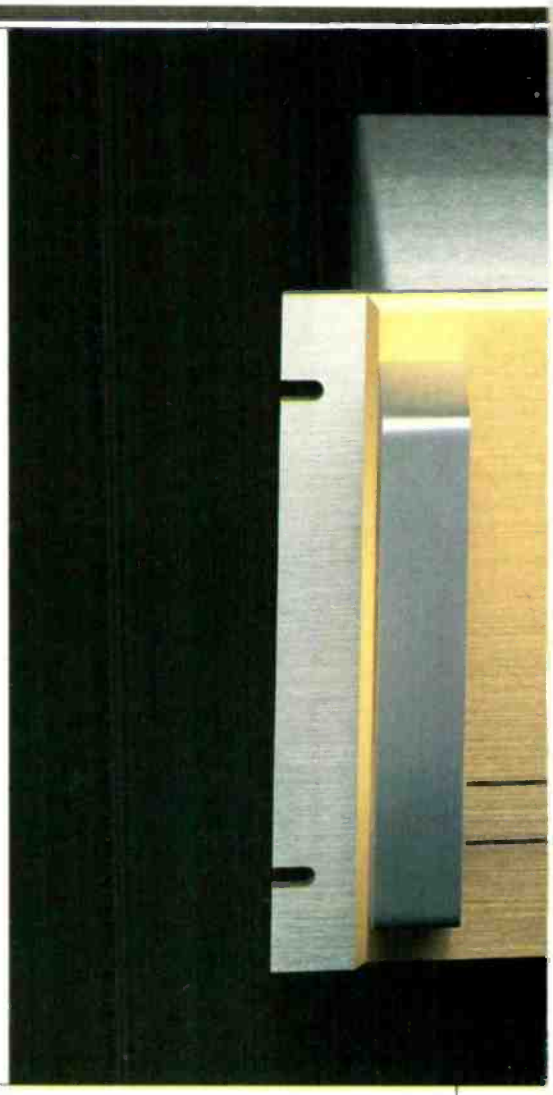
1

STREETS ELECTRONICS MODEL 950 POWER AMP

Manufacturer's Specifications

Power Output: 95 watts per channel, 8-ohm loads, 20 Hz to 20 kHz.
Rated THD: 0.1%.
Frequency Response: 1 Hz to 80 kHz, +0, −3 dB, at 1 to 95 watts rms.
Current Drive Capacity: 60 A, impulse current; 15 A, continuous current, no protection.
Reserve Energy Storage: 160 joules.
S/N Ratio: 90 dB, referred to rated output.
Input Impedance: 35 kilohms.
Input Sensitivity: 1.6 V for rated output, normal speaker output, noninverting.
Slew Rate: 70 V/μS.
Damping Factor: 250, from 20 Hz to 20 kHz.
Channel Separation: 70 dB.
Minimum Output Load: 2 ohms.
Protection: A.c. line fuse, power-supply rails fused separately for each channel, and output fuse; no V-I limiting.
Dimensions: 16½ in. (41.9 cm) W × 8 in. (20.3 cm) H × 16 in. (40.6 cm) D; 19-in. EIA rack-mountable.
Weight: 55 lbs. (25 kg).
Price: $2,295.00.
Company Address: P.O. Box 2797, Livermore, Cal. 94550.
For literature, circle No. 90



The Streets 950 is a solid-state power amplifier rated at 95 watts per channel into 8-ohm loads. Physically, the unit is large for a Class-AB design of its power rating. The large size is necessary to house the large heat-sinks and power supplies; this unit is unusual among power amplifiers in that it utilizes a fully regulated power supply for each channel.

The front subpanel is a beefy 0.225-inch thick piece of aluminum with another piece of 0.2-inch thick gold-anodized aluminum placed in front. A single, lighted power switch is the only control on the front panel.

On the rear panel are two gold-plated RCA signal-input connectors (each paralleled by a three-pin XLR female connector for potential professional use), three five-way binding posts per channel for speaker connections, a speaker fuse for each channel, the power-line fuse, a three-wire a.c. power-cord connector, a cooling fan, a two-speed fan switch, and a pair of handles.

The unit is constructed around a U-shaped chassis that forms the bottom and sides. The sides of this piece have large rectangular cutouts that expose the heat-sink fins. The front subpanel and back panel are separate pieces that bolt on to the main chassis. Another U-shaped piece covers the top and sides, with slightly smaller openings in its sides rather than on the bottom chassis. The heat-sinks are quite large, having horizontal fins and some 1,400 square inches of radiating area in each sink. Outside air is drawn into the enclosure by the rear-panel fan and exits around the ends of the heat-sinks, where it passes across the fins and out the side openings.

A very large toroidal power transformer is bolted to the front subpanel. A full-wave bridge rectifier, mounted on the bottom of the main chassis, feeds two 25,000-μF, 75-V capacitors that form the basic ±68.5 V unregulated supply for the input to the regulators. These large capacitors are mounted to the bottom in the center of the chassis. A large, thick copper plate is mounted on the top of the main filter capacitors to form a low-resistance ground connection for them and to connect the grounds of four more 6,400-μF, 60-V capacitors that surround the main capacitors and are connected to the outputs of the voltage regulators.

Each channel's plus and minus voltage rails are separately fused and regulated, with the four fuses in two, dual fuseholders mounted atop the ground plane. These feed the regulator inputs via two thick wires in parallel for each connection, providing high current capacity without being unmanageably stiff. The regulator outputs come back to the four, 6,400-μF capacitors via insulated-braid buss wire. These four capacitors are all bypassed with 10-μF, 50-V film capacitors.

Mounted on each heat-sink are six output transistors, plus four additional power transistors used as series pass transistors for the regulators. A carrier p.c. board on the back surface of the heat-sinks serves to interconnect the power transistors and to mount emitter resistors, output chokes, etc. Two separate p.c. boards are mounted to each heat-sink with standoffs. One is for the front-end and driver section of the power amplifier; the other is for the voltage-regulator circuitry.

The Model 950 is beautifully constructed, and parts quality appears to be excellent.

Circuit Description

The overall circuit topology of the 950 is very similar to that of many other solid-state power amplifiers.

The signal input is coupled to the first stage through a 10-μF Wondercap polypropylene capacitor. A series resistor and shunt capacitor serve as a first-order, low-pass filter to limit the bandwidth into the first stage. A pot for overall d.c.-offset zeroing is connected to the ground end of the input d.c. return resistor.

The first stage is a complementary, bipolar differential amplifier with current-source diodes and emitter-degeneration resistors. Output of the first stage is direct-coupled to the second stage, which is a complementary, Darlington-connected, common-emitter amplifier. The collectors of this second stage are tied together through a two-transistor bias regulator which has its first transistor mounted on the heat-sink for temperature sensing. Resistors from each collector of the second stage to ground control the open-loop gain and provide a lower source impedance to the output stage.

The output stage is a triple, complementary emitter-fol-

Bass definition and impact were excellent, with a wallop that belied the 950's rating of 95 watts per channel.

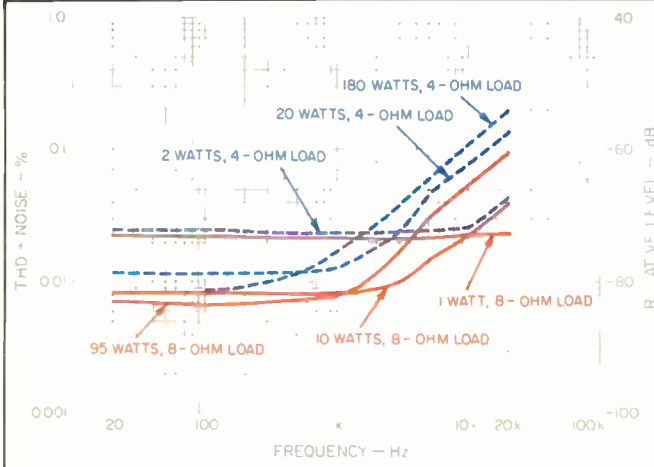


Fig. 1—Total harmonic distortion plus noise vs. frequency and power.

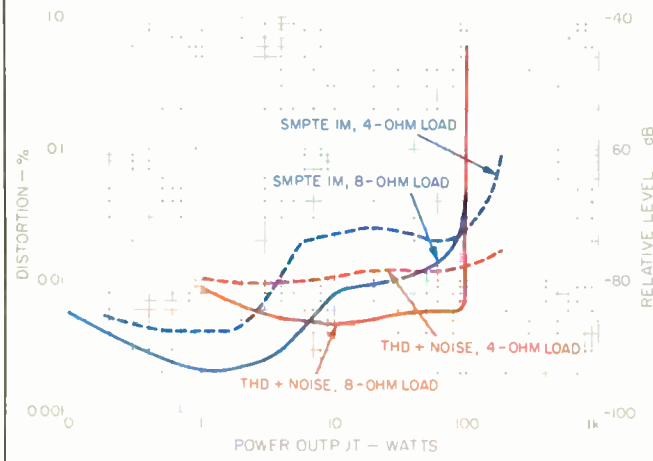


Fig. 2—Total harmonic distortion plus noise, and SMPTE IM, vs. power output.

lower arrangement, with the first and second transistor pairs mounted on the front-end circuit board and the output transistors on the heat-sinks.

Overall negative feedback comes back to the inverting input of the input stage and is fully d.c.-coupled, without the usual shunt feedback-path series capacitor. This means that the low-frequency response only has one roll-off provided by the input network.

As previously mentioned, there are three binding posts per channel for output connections; one red for plus output, one black for normal speaker return, and a third, in white, for an alternate speaker return that provides some negative current feedback. The shunt feedback resistor returns to the white output terminal, which is connected to the black terminal through a piece of wire that serves as a current sampling resistor. The black terminal is returned to power-supply signal ground (more on this under "Measurements").

The idling current is set fairly high in this design—some 0.45 A, which causes an idling power dissipation of about 44 watts per channel. This allows for a theoretical Class-A power output of 3 to 4 watts per channel into 8-ohm loads before going into Class-AB operation.

The power-supply regulators are relatively conventional and consist of op-amp error amplifiers driving an emitter-follower, followed by two paralleled Darlington power transistors that act as the series pass regulating elements. Regulated output voltage is ±49 V d.c.

Measurements

The Model 950 was first run for one hour at 33% of rated power, or about 32 watts per channel into 8-ohm loads with a 1-kHz test signal. With the cooling fan on low speed, the heat-sinks got very hot but the amplifier didn't thermally shut down. With the fan on high speed, heat-sink temperature was at a lower, more desirable temperature.

Voltage gain was measured and found to be 17.3×, or 24.8 dB into 8-ohm loads. The IHF sensitivity for 1 watt into 8-ohm loads at 1 kHz was 0.164 V.

The IHF signal-to-noise ratio, which is A-weighted noise referred to 1-watt output into 8 ohms, measured −90 dB for the left channel and −92 dB for the right.

Figure 1 shows THD plus noise versus frequency and power output for 4- and 8-ohm loads. The results for the right channel are plotted; it had slightly higher distortion than the left. Figure 2 shows THD versus power output at 1 kHz, with 400-Hz and 80-kHz filters switched in, and also shows SMPTE-IM distortion.

Crosstalk versus frequency was measured by driving one channel and measuring the resultant leakage in the other channel, with the unused input terminated by a 1-kilohm resistor and not connected to any external ground. It was found to be better than −90 dB from 20 Hz to 3 kHz, rising to −85 dB at 10 kHz, −81.4 dB at 20 kHz and peaking to −35.6 dB at 55 kHz. Connecting a clip lead between input grounds, which is more like using the amp in a normal stereo hookup, caused the crosstalk to deteriorate to −69.5 dB at 20 Hz, −66.0 dB at 1 kHz, −51.8 dB at 10 kHz, −46.7 dB at 20 kHz, and −19.2 dB at 55 kHz. These figures are for the right-to-left direction. The left-to-right direction was some 3 or 4 dB better. The peaking of the crosstalk at 55 kHz is symptomatic of a slight peak in the 950's frequency response, which also shows up as slight square-wave ringing and, of course, in the actual frequency response.

Figure 3 illustrates square-wave responses for the Model 950. The top trace is for 10 kHz into 8 ohms. The middle trace shows the effect of adding a 2-μF capacitor across the 8-ohm load. The bottom trace is for 40-Hz frequency and shows very little tilt, indicative of excellent, extended low-frequency response.

The 1-watt frequency response into 8 ohms and 2-watt

The Streets 950 is a very well-constructed and attractive power amplifier that should be reliable when driving difficult speaker loads.

response into 4 ohms (both at 2.83-V output) are shown in Fig. 4.

Damping factor versus frequency, using the normal red and black output terminals, is plotted in Fig. 5. The effect of negative current feedback is to raise output impedance and reduce damping factor. When using the red and white output terminals, the output impedance at 1 kHz rose from about 0.046 to 0.145 ohm on the right channel and 0.038 to 0.132 ohm on the left. This corresponds to damping factors of 55 and 60 under these conditions.

Rise- and fall-times at ±5 V output were 3 μS into 8 ohms and 4 μS into 4 ohms. Furthermore, these response times were essentially constant right up to clipping, which is an excellent (and rare) characteristic for a power amplifier.

Dynamic headroom measured 0.22 dB coming from a burst onset of clipping power of 100 watts in relation to rated power of 95 watts into 8 ohms. Steady-state power at onset of clipping was also 100 watts, giving a clipping headroom of 0.22 dB. The small value of these numbers and their identity for dynamic and clipping conditions are due to the regulated power supply used in the 950.

In a new test to determine some idea of peak output current obtainable from the 950, I set up a signal consisting of one cycle of 100 Hz, repeating at a 100-mS rate, and fed this into the amp, which was terminated in a 1-ohm load. Under these conditions, with one channel driven (I didn't have another 1-ohm power resistor), the 950 produced about ±30 A, peak, before clipping. I'm impressed.

In a final test of the power-supply regulators, I found that the 950 would put out 100 watts per channel at a.c. line voltages down to 103 V. Below 103 V, the regulators become saturated, and their output voltage and obtainable output power begin to drop.

Use and Listening Tests

Equipment used to evaluate the Streets 950 included an Infinity air-bearing turntable and arm with a Koetsu EMC-1B "Black" cartridge, GC/BHK and Audio Research SP-10 reference preamps, Quicksilver Mono tube and MLAS ML-9 solid-state power amps, Infinity RS IIA speakers, and Stax SR-X/Mk3 headphones.

The 950 was first listened to on the RS IIA speakers, using the Audio Research preamp. Bass definition and impact were excellent. The wallop certainly belied the amplifier's power rating. Compared to the Quicksilver and ML-9 amplifiers, there was more textural detail revealed, which made low-level sounds stand out more noticeably. Along with this effect was some additional brightness and a small bit of higher frequency edginess. But spatial replication and localization were judged to be less precise than with the other amps used, and, as beguiling as this increased apparent detail resolution was, the overall effect was a bit unmusical, with the other power amps giving a more believable overall musical presentation.

When I used the GC/BHK tube reference preamp to drive the 950 into Stax phones, the sound had excellent bass definition and quality. Mid- and high-frequency definition were good, again giving the feeling of being too good, resulting in a slight sense of artificiality. Overall feeling of space in the reproduction was one of less size than with the better tube power amps that I've used with this preamp and headphones.

The unit functioned flawlessly in testing and use and had no glitches or operational faults.

In summary, I feel the Streets Model 950 is a very well-constructed and attractive power amplifier that should be reliable when driving difficult speaker loads. Regarding my comments on its sonic properties, I continue to urge prospective buyers to listen to whatever I've reviewed in as many situations (combinations of components and rooms) as possible. *Bascom H. King*

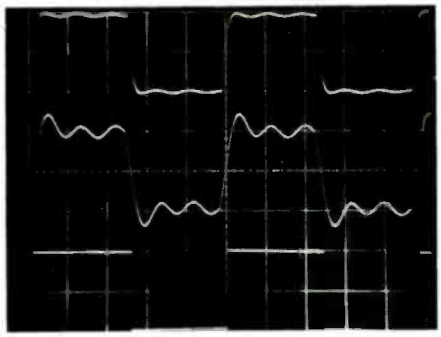


Fig. 3—Square-wave responses at 10 kHz into 8 ohms (top); same, with 2-μF capacitor across the load (middle), and at 40 Hz into 8 ohms (bottom).

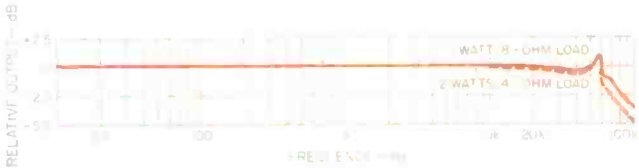


Fig. 4—Frequency response at 1-watt output into 8 ohms and at 2-watt output into 4 ohms.

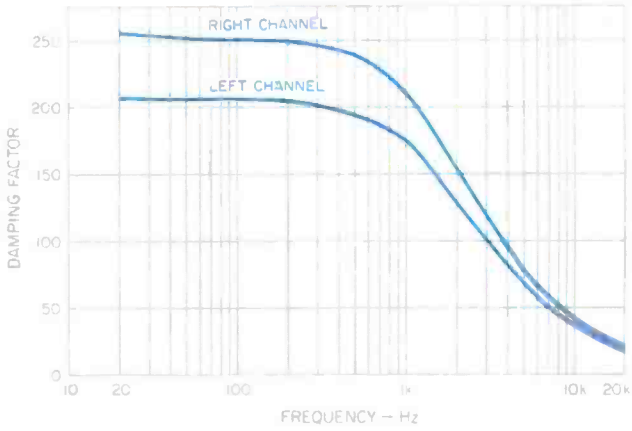


Fig. 5—Damping factor vs. frequency.

2

KENWOOD DP-1100B COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 2 Hz to 20 kHz, ±0.5 dB.
Dynamic Range: Greater than 95 dB.
Total Harmonic Distortion: Less than 0.0015% at 1 kHz.
Channel Separation: 90 dB.
Output Level: 2.0 V.
Number of Programmable Selections: 16.
Wow and Flutter: Below measurable limits.
Dimensions: 17.3 in. (44 cm) W × 3.46 in. (8.8 cm) H × 12.2 in. (31 cm) D.
Weight: 15 lbs. (6.8 kg).
Price: $899.00.
Company Address: 1315 East Watsoncenter Rd., Carson, Cal. 90745.
For literature, circle No. 91

Some companies rushed right in to the CD foray, offering first-, second- and even third-generation CD players within the first year of Compact Discs' availability. Others chose to wait a while, preferring to see what features and configurations met with the greatest success and acceptance by those audio enthusiasts ready to plunge in to digital audio. Kenwood falls into the latter group. Their first full-featured CD player, the Model DP-1100B, turns out to be a good example of careful design and layout, with operating controls that are simple to use and logically placed.

As for operating features, the DP-1100B can be programmed to play as many as 16 tracks, in any order. Furthermore, you may specify a desired selection by index number within a track number. This is handy, as more record companies begin to subdivide longer selections into smaller, indexed segments. The numeric keypad found on the player's front panel (and on the supplied remote control) permits you to quickly access any track on a CD, even up to track 99, in the unlikely event that a disc contains so many tracks. (One of my test discs actually does have more than 90 separate tracks on it, but it's hardly typical.)

This CD player can be made to play the next track or the previous one at the touch of a button. It can find a desired track within a couple of seconds and then either play it, or pause until you instruct it to proceed. It can be instructed to repeat-play an entire disc or any portion of the play program stored in memory. If you change your mind about the tracks stored in memory, touching a single button returns you to manual (non-memory) play. In short, whether at the front panel or with the supplied wireless remote control in hand, you have total control over the music you want to hear and the order in which you'll hear it.

Control Layout

The on/off switch is located at the upper right corner of the front panel. Below this switch is a stereo headphone jack, and immediately to its right is a slide-type headphone output-level control. The now-familiar disc-loading drawer, with an "Open/Close" switch on its front surface, is near the top of the panel; just below are 10 tiny numeric keys which are used either to select tracks to be played or, with the aid of a nearby "Memory" switch, to program tracks and index numbers for playback in random order. A "Memory Read" switch, when depressed one or more times, sequentially displays the track and index numbers stored in memory. A "Clear" button to the right of the "Memory Read" button is used to clear the currently displayed track number. This same switch, when depressed along with the "Memory" button, will clear the entire stored program.

When the DP-1100B is first turned on, the time indicator in the display area shows the ongoing playback time of each track as it is being played. Pressing the "Time" button makes the display show the elapsed playing time of the disc, while pressing this button a second time shows remaining time on the disc.

Controls located below the display area include the "Repeat," fast-forward and fast-back buttons and a pair of forward and reverse "Music Search" buttons. When either the fast-forward or fast-back switches is depressed *during playback*, the player performs cue or review functions, with

Fig. 1—Frequency response, left (top) and right channels, at 0-dB level.

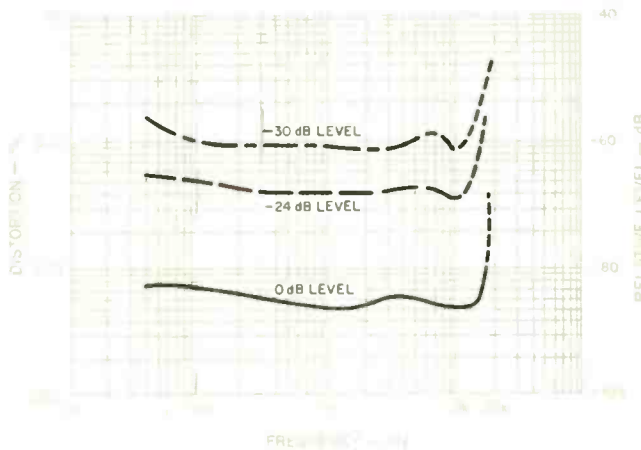


Fig. 2—THD vs. frequency at three signal levels.

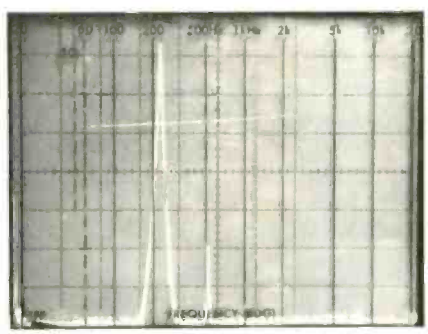


Fig. 3—Spectrum analysis of 20-kHz test signal shows the usual, inaudible 24.1-kHz beat tone, here 53 dB below the desired tone.

The versatile display informs you of virtually everything the machine is doing, has done, or is about to do.

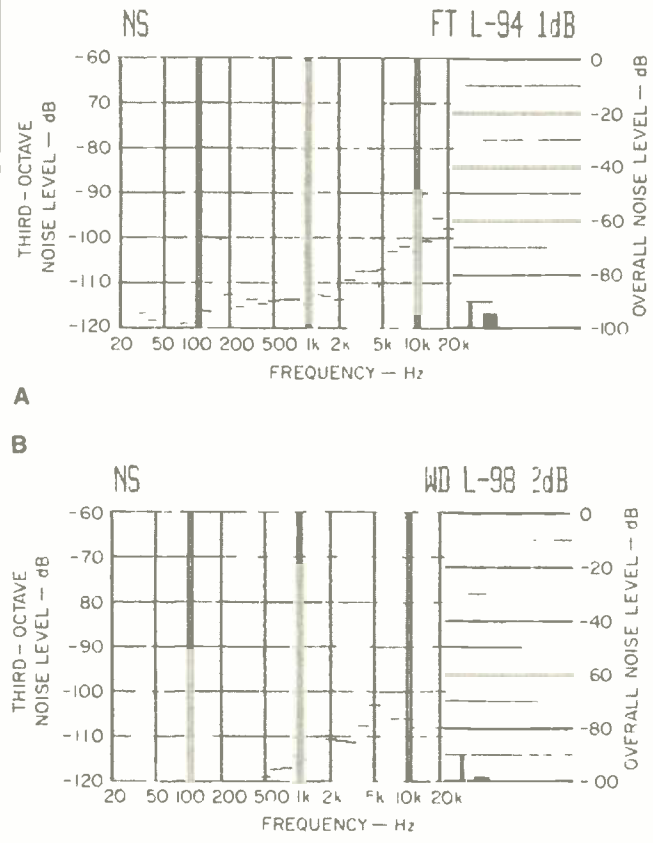


Fig. 4—S/N analysis, both unweighted (A) and A-weighted (B).

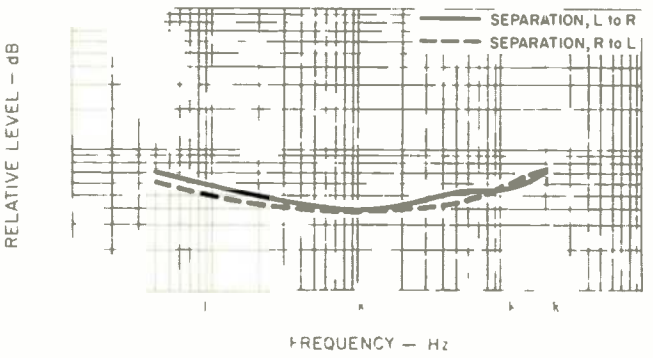


Fig. 5—Separation vs. frequency.

music audible at lower levels as the laser pickup rapidly scans the disc. The "Music Search" switches are used to advance track numbers or to return to the beginning of the current selection or even to skip tracks in reverse. The "Stop," "Pause" and "Play" buttons are at the right end of the front panel, and an indicator light near the "Play" button illuminates when a disc is actually being played.

The display area gives the user a lot more information than just track and index numbers and time notations. A "Disc" light illuminates if a disc has been loaded into the drawer, and an "M-Play" light is on during memory playback. Numbers along the lower edge of the display light up to indicate which track numbers have been stored in memory. An "M-Scan" light comes on when the scan key on the remote control is activated. "Memory Indicator" blinks to show how many tracks can still be programmed into memory; during memory play, it shows which programmed selection is being played back. Finally, a "Repeat" indicator lights when the "Repeat" switch has been depressed and the unit has entered the repeat mode.

As comprehensive as the display is, and as elaborate as the available functions of this player are, the front panel is surprisingly uncluttered, thanks to the multiple-function switches and buttons and to the intelligent layout devised by the DP-1100B's designers. The rear panel is equipped with nothing other than a pair of output jacks and, of course, the a.c. power cord.

Measurements

Figure 1 shows a plot of frequency response for both the left and right channels of the DP-1100B. The vertical scale is 2 dB per division, and the sweep, from left to right, extends from 20 Hz to 20 kHz. Frequency response was quite flat, exhibiting a very slight rise at the extreme high end (between +0.3 and +0.5 dB at 18.5 kHz).

Harmonic distortion for maximum output varied from 0.005% to around 0.008%, depending upon the test frequency being measured. A plot of THD versus frequency up to around 10 kHz, measured at various recorded levels, is shown in Fig. 2. Above 10 kHz, I encountered the now-familiar rise in apparent THD. As can be seen in Fig. 3, however, this rise is not actually an increase in THD but, rather, is caused by a "beat" frequency occurring outside the range of hearing, above 20 kHz. In Fig. 3 a test tone of 20 kHz was used (the tall spike in the 'scope photo), and to the right of this primary tone can be seen the beat tone at approximately 24.1 kHz (interaction between the 44.1-kHz sampling rate and the 20-kHz tone being reproduced). This secondary tone was more than 50 dB below the desired 20-kHz tone and would therefore not be likely to cause problems with wide-band amplifiers and wide-range tweeters.

Unweighted signal-to-noise ratio measured 94.1 dB and is illustrated in Fig. 4A; with an A-weighting filter included in the measurement, signal-to-noise ratio increased to 98.2 dB, as shown in Fig. 4B. At maximum recorded levels, IM distortion measured 0.0025%, increasing to 0.02% at −20 dB recorded levels. Linearity was accurate to within 0.4 dB down to −80 dB. Stereo separation (Fig. 5) ranged from 83 dB at the low and high frequency extremes to around 88 dB at mid-frequencies.

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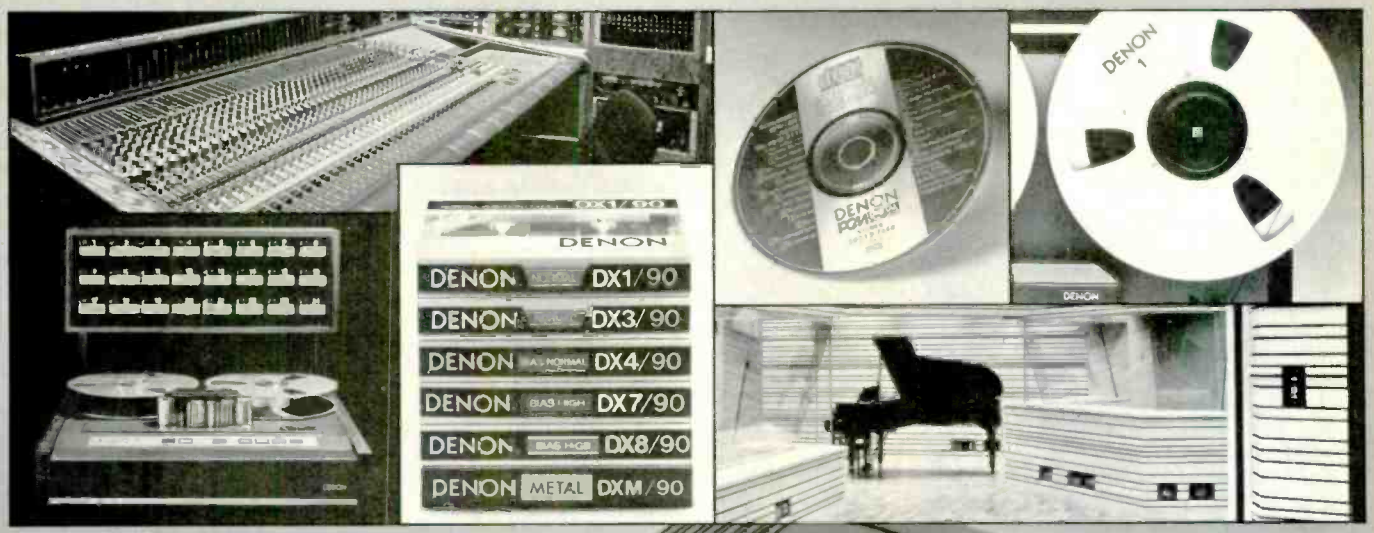
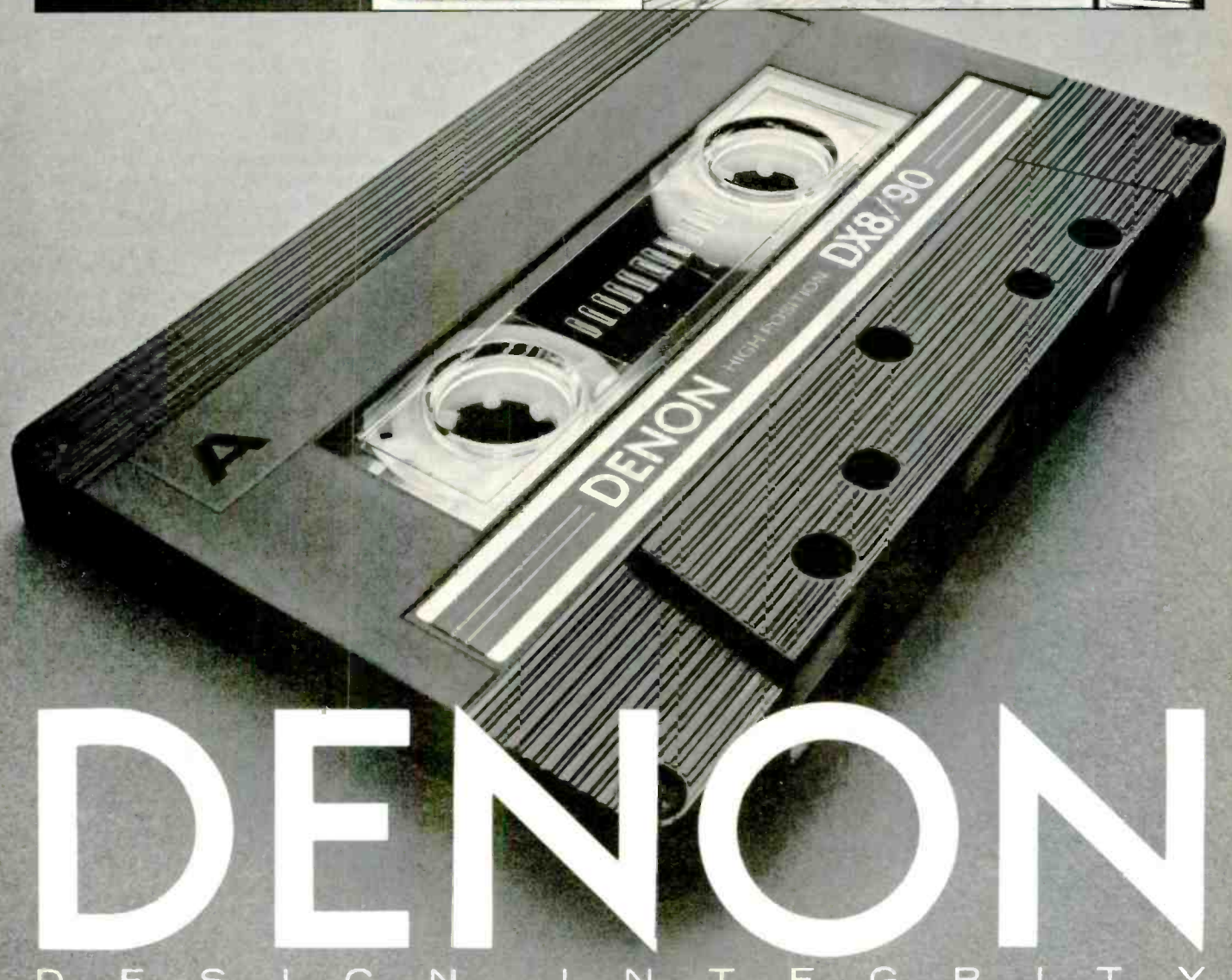
When other companies talk about being "digital-ready," remember that Denon is the Company that also builds professional digital studio tape recorders and is credited for having *invented* the PCM recording process in 1972. Denon has recorded more digital material than *any* Company in the world. It is only natural that Denon simultaneously developed the cassette formulation most suitable for making digital-to-analog recordings. The formulation is Denon DX-8. The ultimate non-metal cassette tape.





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The DP-1100B had trouble tracking my torture-test "defects" disc, but no mistracking occurred during the listening tests.

Reproduction of a 1-kHz, digitally generated square-wave signal (Fig. 6) was typical of that encountered with CD players which use multi-pole, steep analog filters following digital-to-analog conversion. The same was true of the reproduction of a digitally generated unit-pulse signal, as shown in Fig. 7. Negligible phase shift between a left-channel, 200-Hz test signal and a right-channel, 2-kHz test signal was observed in the 'scope photo of Fig. 8, though greater phase shift would have been evident at higher test frequencies. Perfect phase linearity in this test is represented by a positive crossing of the zero axis at the same time for both test frequencies.

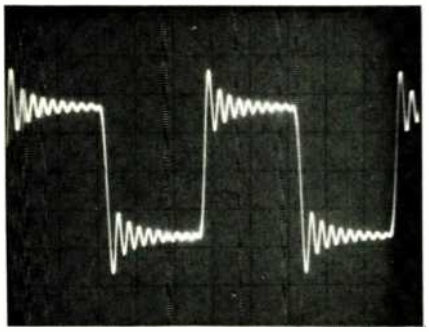

Fig. 6—Square-wave reproduction, 1 kHz.

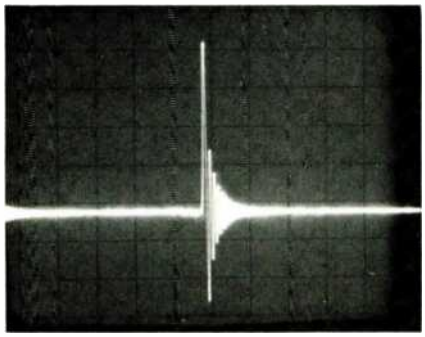

Fig. 7—Single-pulse test.

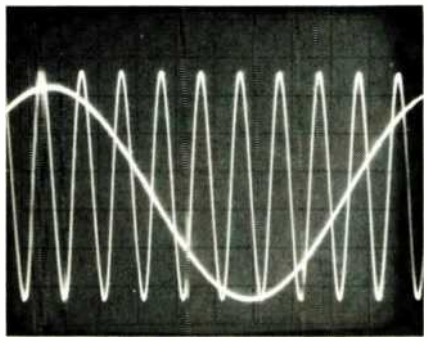

Fig. 8—Twin-tone phase test (200 Hz and 2 kHz).

Although the Kenwood CD player had no difficulty playing through the entire simulated fingerprint on my special Philips test disc, I was surprised to find that my sample did mistrack when attempting to play through the opaque wedge incorporated on the surface of this same disc, beginning to mistrack when the wedge reached a width of only 500 microns. The same sort of mistracking occurred when I attempted to play through the simulated dust spots on the test disc. Again, mistracking occurred when the laser beam encountered a dot having a diameter of only 500 microns. There was no easy way for me to determine whether this mistracking was caused by misadjustment of the servo-tracking system in the particular sample I tested, or whether it was due to inferior error-correction circuitry in the player.

Use and Listening Tests

The fact is that, during subsequent listening tests, using a wide assortment of CDs which have been played countless times (I do have my favorites!), no mistracking of any kind occurred. I'm not altogether certain that checking every single CD player with the specially designed Philips defects disc is entirely definitive, but for the moment I have no alternative.

Reviewers such as myself desperately need test discs that will tell us more than the few such CDs available now. Only weeks ago, a committee was formed under the aegis of the EIA (Electronic Industries Association) to develop uniform testing standards for CD players. Such a standard would be similar in format to earlier standards now in wide use for evaluating tuners, amplifiers, phono cartridges, turntables, and tape decks.

Operating the Kenwood DP-1100B was fairly easy after quickly skimming through the well-organized owner's manual. The more I play with CD players that offer wireless remote control, the more I appreciate the luxury of being able to send commands from a comfortable listening position. Although much of my preferred listening is classical, even when listening to long works I often want to skip to a later movement; being able to do so at the press of a button or two while seated across the room beats having to jump up every time to accomplish this.

Sound quality of the Kenwood player was about the same as that of most other recently tested CD players using this type of D/A conversion and analog filtering. Feed well-made CDs into the drawer of the DP-1100B, and you will be greeted by musical reproduction that is thrilling, to say the least. If you try playing some of the early CD releases, however, you'll conclude that digital audio is not what it's cracked up to be. Whatever you do, don't blame digital audio *or* the particular player you happen to be using at the time. Put the blame where it belongs, and credit the CD player (such as this one from Kenwood) for being the marvelous engineering feat that it is. *Leonard Feldman*


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3

DBX 10/20 COMPUTERIZED EQUALIZER/ ANALYZER

Manufacturer's Specifications

Equalizer Section

Center Frequencies: 31.5, 63, 125, 250, and 500 Hz and 1, 2, 4, 8, and 16 kHz, ±9%.
Adjustment Range: ±12 dB, with ±1.4-dB tolerance.
Adjustment Accuracy: ±0.4 dB/step.
Frequency Response: 20 Hz to 20 kHz, ±0.5 dB; with low-cut filter, −3 dB at 12 Hz and −20 dB at 5 Hz.
Distortion: Less than 0.03%.
Dynamic Range: 112 dB.
Maximum Input/Output Level: 5 volts.

Analyzer Section

Accuracy: Relative, ±1 dB; absolute, ±3 dB.
SPL Range: 50 to 110 dB.
Line-Input Calibration: 100 dB equals 1 volt.
Dynamic Range: 25 dB shown on screen, reference selectable in 10-dB steps from 60 to 100 dB.

Pink-Noise Generator

Accuracy: ±0.5 dB.
Level: 1 to 300 mV, adjustable with slider.

Microphone

Frequency Response: 20 Hz to 20 kHz, ±1 dB, after input equalization.

Computer

Automatic Equalization: 15 iterations in all 10 bands within 40 S.
Memory: 10 EQ-curve memories, with battery backup.
Averaging: Multiple EQ curves can be averaged, and stored if desired.

General Specifications

Input Impedance: 50 kilohms.
Output Impedance: 620 ohms.
Dimensions: 17⅛ in. (435 mm) W × 3½ in. (89 mm) H × 11⅞ in. (302 mm) D.
Weight: 11.9 lbs. (5.4 kg).
Price: $1,200.00.
Company Address: 71 Chapel St., Newton, Mass. 02195.
For literature, circle No. 92

The dbx 10/20 replaces the earlier 20/20 (*Audio*, January 1982), which was probably the first home equalizer/analyzer combination with totally automatic, computer control. The specifications above, even though somewhat abbreviated, indicate the complexity of this unit. The automatic equalization process requires a pink-noise source (built-in) and an accurate measuring microphone (supplied). Another attractive and important feature is the memory, which can store up to 10 separate EQ curves (both left and right), any of which can be recalled with the simple push of a button. In addition, any combination of the stored curves can be averaged, and that average can be put in memory for future use.

The black front panel has white designations that are easy to read under any normal room lighting. The "Memory" pushbutton keypad is at the left end, above the power switch. There are three columns and four rows for memory-location buttons "1" to "10" and buttons for "Set Flat" and "Enter Memory." The "Set Flat" button erases the EQ currently in use, removing all boosts and cuts with a single push. It does not, however, erase or affect curves stored in the 10 memories. To erase a memory, you must store a new curve (even a flat one, if desired) in its place. This is done by pressing the "Enter Memory" button and then the button for the memory you wish to program, which automatically stores the current equalization. A red LED next to

each memory-location button shows which one has been selected.

Five buttons to the right provide even more flexibility in the handling of stored EQ curves. With "Enter" actuated, any number of EQ curves (up to 10) selected out of memory can be averaged, and *that* result can be stored. The LEDs help the user keep track of the selections made before pushing "Compute" to make the average. Any curve can be given more weight in the averaging by simply pushing its memory button more than once. The "L + R Average" button averages together the current left and right EQ curves, readjusting both curves accordingly. These matched curves can then be entered into memory if that is needed. The "HFR Curve" button (HFR stands for high-frequency roll-off) gives the user a one-push means of adding a smooth roll-off of the highest frequencies: −1 dB per octave above 1 kHz. This is a nice feature and a very convenient way to reduce the extra brightness that goes with flat response, the result more closely approximating concert-hall conditions.

"Auto EQ" is the last button in this group of five, but it accomplishes mighty things. One gentle push, and the computer-controlled system/room equalization process begins. First, there is automatic checking to make certain that the pink-noise source is turned on, flashing its LED if it isn't. A check is also made to ensure that the sound level picked up by the microphone is high enough for the auto-EQ. Then, each filter of the digitally controlled EQ is boosted or cut so that the compensating EQ makes the total response flat. The unit can be set to do left and right separately or together, another difference from the earlier Model 20/20. The 10/20 automatically keeps the system's average level after EQ close to its original, unequalized level, an important feature that helps prevent excessive boosts or cuts. Automatic equalizing stops when the measured response is within ±1 dB or after 15 iterations of adjusting all 10 bands, with a maximum time of 40 S. This is an excellent application of microprocessor/computer technology because it is both faster and better than what most users could do.

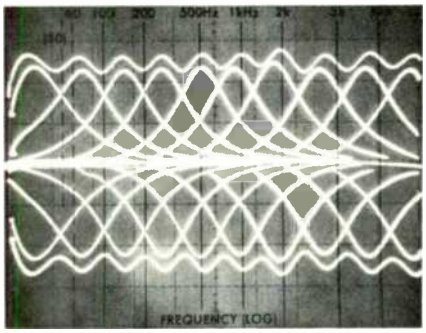

Fig. 1—Swept-frequency responses of each filter section at maximum boost and maximum cut, and with all sections at maximum boost and maximum cut.

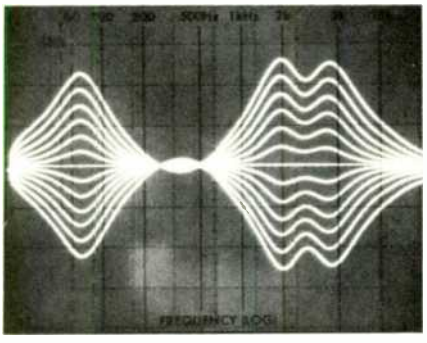

Fig. 2—Swept-frequency responses with 63-Hz, 2-kHz, and 4-kHz filters set successively for 2-dB steps from −12 to +12 dB. Small overshoot around 300 to 600 Hz (see text) has no significant audible effect.

A group of six pushbuttons just to the left of the display selects tape "EQ" ("Pre" or "Post"), "Monitor" ("Source" or "Tape") and "Pink Noise" ("On" or "Off"). All choices have indicating LEDs, with the exception of pink-noise off. I'm glad to see the inclusion of EQ for recording or playback, and it is a worthwhile addition to the previous 20/20 unit. A convenient horizontal, pink-noise level-control slider is below this group of buttons.

A large, horizontal-LED bar display dominates the center of the front panel. Each of the 10 frequency bands has 25 LEDs in a vertical column, which illuminate one at a time to show response or level from −12 to +12 dB, in 1-dB steps. The display, when in EQ mode, shows what EQ is being applied in the 10 bands. Each LED step is labelled, so boosts and cuts in dB can be read. Below the display, at the bottom of each column, are spring-loaded toggle switches which step the equalization up or down in 1-dB steps or, if held in for about a second, ramp up to a quick rate.

At the right, the display shows whether the EQ (selectable) is "L," "R," or "L + R." There is also a helpful indicator which is marked "L = R" that shows when the left and right EQs are the same, even if just one has been selected. A "0" appears at the center reference level in EQ mode, but this changes to SPL reference numbers in RTA mode (more on this later). At the very right in the display is an LED column for "dB SPL" from "64" to "110" in 2-dB steps.

At the upper right of the front panel are two buttons for EQ selection ("L" and "R") and eight for RTA control: Mode ("Peak Hold" or "Avg"), sensitivity ("Auto" or "Fixed"), fixed-sensitivity adjust (up or down), and source ("Line" or "Mic"). Simultaneous left and right EQ is obtained by pushing "L" and "R" at the same time. The fixed-sensitivity reference can be set anywhere from 60 to 100 dB, in 10-dB steps. In "Auto" the display is automatically shifted up and down over a range of 50 to 110 dB SPL. This centers the average of the levels in all of the bands, with 1-dB resolution. With a line input, 100 dB is equivalent to 1 V. Most of the time, the "Avg" RTA mode would be used, but peak holding is sometimes of interest for checking music levels. A push of "Peak Hold" automatically switches the display to its fixed-sensitivity mode.

The calibrated-microphone jack at the lower right is duplicated on the back panel, but the front-panel jack has precedence. The supplied cable is 20 feet long, which should be enough for most situations, but dbx makes the helpful note that the cable can be extended for up to 100 feet while main-

The dbx 10/20 can store ten automatically or manually set EQ curves, average those curves, and store the average in memory for later use.

taining performance. Also on the rear panel are the phono-jack stereo in/out pairs for connections to a preamp or receiver and a tape recorder. Thumbscrews on the battery-compartment door provide easy access to the two AA cells which save the EQs in memory when power is off.

I examined the interior with interest—and appreciation, as the two large p.c. boards, positioned one above the other, were made of high-quality glass epoxy; many recent products from other companies have used poorer quality material for the boards. The soldering was excellent, and interconnections were made with multi-pin cabling. There was one fuse in a clip, and the power transformer was just warm after use. The box-like chassis was fairly rugged, and it was even more rigid with the steel top and side cover back in place. Adaptors are supplied for 19-inch rack mounting.

Equalizer Measurements

With each of the filter bands set to zero, the frequency response was within 0.9 dB from 20 Hz to 20 kHz. The 3-dB down points were at 11.6 Hz and 38 kHz. The lower frequencies were rolled off by 22.5 dB at 5 Hz, which would give good rejection of disc-warp effects. Figure 1 shows the frequency responses of each of the filters at maximum and minimum settings and the results with all of the filters at maximum settings. The center frequencies were all within 5.5% of standard, and most were within 1.9%—very good indeed. The maximum boosts were 11.3 to 12.1 dB, and the maximum cuts were from 11.4 to 12.3 dB—all quite consistent. The boost for a bandwidth of one octave was 11 dB, while the boost for a Q of 1 was about 6 dB.

Figure 2 presents the swept responses obtained with the 63-Hz, 2-kHz, and 4-kHz filters set successively in 2-dB steps from −12 to +12 dB. The evenness of the steps is very apparent, a good aspect of the 10/20's performance. The small bulge between the large peaks shows that the highest settings cause a little overshoot in adjacent bands, but its effect is not important.

The maximum input/output levels were at least 5.6 V from 20 Hz to 20 kHz, even with a 10-kilohm load. As would be expected, boosting reduced the maximum input levels. The input impedance was very close to the specified 50 kilohms, varying slightly with frequency. The output impedance measured 670 ohms, which is plenty low enough for any normal use.

Even with the inclusion of noise, distortion measured 0.04% or less (usually half as much) from 20 Hz to 20 kHz. There was no slew-rate limiting observed, even at 2 V and 100 kHz. With all of the filters set to zero, the noise was about 101 dBA below 1 V. With some of the curves generated in testing, the noise level was higher, around −90 dBA—still excellent.

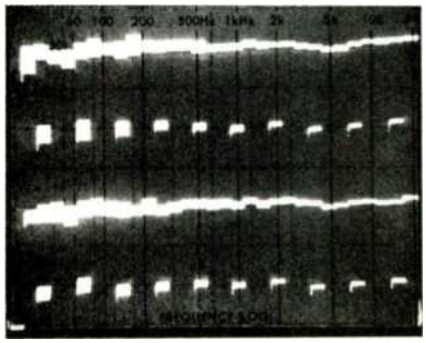

Fig. 3—Pink-noise spectra: Pink noise from dbx 10/20 (upper two traces) matches response of Ivie IE-20B generator (lower two traces) quite closely. Upper trace of each pair is third-octave response, lower trace is octave-band response (see text).

Analyzer Measurements

The filter centers for the RTA section were quite accurate; most were within 1.6% of standard. The peak responses for most bands were within ±1 dB of that for the 1-kHz band; 2 and 4 kHz were off just a bit more. The crossovers between adjacent bands for equal response were about 4 dB down, and the response in the center of the adjacent band was 9 dB down. For the intended purpose, I consider these filter shapes superior to many others that are very pointed in-band. With a pink-noise input getting zero level in all 10 bands, and a reference level of "70," the SPL LED column was correct with an indication of "80." (SPL equals band level plus 10 times the log of N, where N is the number of bands with equal level.)

The level thresholds from −11 to +12 dB were very accurate, measuring 0.96 dB/step on the average. As "−12" is always turned on, it cannot be considered useful as a level indicator. The SPL column thresholds (2 dB/step) averaged 1.94 dB apart, and most were within 0.1 dB.

The maximum pink-noise output was 195 mV, quite far below the specified 300 mV, but the measured level is high enough for substantially all testing situations. The level was easily controlled with the slider, all the way down to less than 0.1 mV. Figure 3 shows the noise spectrum as measured by an Ivie IE-30A, first in the ⅓-octave mode (top trace) and then in octave-band mode, to show how closely the 10/20's generator response would match up with its octave-band equalizer. For comparison, the next two traces show the ⅓-octave and octave-band spectra from an Ivie IE-20B noise source. Discrepancies between the two are very small, and dbx's generator appears to be flat within ±0.5 dB. The 10/20's display response time was about 1.5 S at the lower frequencies, dropping to about 150 mS by mid-frequencies.

It was not possible to get an exact calibration on the supplied microphone because of its nonstandard, 0.575-inch diameter. A number of sound level checks, however, made me feel confident that the dbx 10/20's SPL indications were within 1.5 dB of absolute—much better than many units tested. The line-input sensitivity for an indication of "100" was 1.06 V, substantially right on spec.

Use and Listening Tests

The owner's manual is one of the best that I have seen on any product, with considerable detail and good explanations of the many functions of the 10/20. There are lucid discussions of the RTA display and of equalizing and sound in rooms, which includes the very important comment that equalization cannot fix difficult acoustics or solve poor placement of loudspeakers.

For its high price, the 10/20 has little to fault and much to enjoy, and it's better and less expensive than its predecessor.

A block diagram would be a helpful addition for some.

I spent a little time watching the RTA display with a music input, and it was satisfactory, but the dynamics aren't of the peak-responding nature I prefer—and a bar-graph display is better for this purpose. Automatic equalization is the name of the 10/20's game, and that's what was rewarding and fascinating even though I had used dbx's earlier Model 20/20.

The display showed that the mike had the desired low directivity, with little sensitivity to exact pointing. Most RTA mikes are claimed by their manufacturers to be omnidirectional, but they peak at the high-frequency end when pointed at the speaker. I generated a number of EQ curves, including one for my favorite listening position, another for my second-choice spot and a third by averaging a set of curves for the general area. I used the "HFR" slope on all three, then manually added some slight boost (about +1 dB at 4 kHz and +2 dB at 8 kHz) to brighten the general-area sound. Everything worked exactly as it should have, and the results were very satisfying. I generated a few more curves to better match my preferences with certain types of music. Then, a simple push of one button recalled a sound balance I'd have had to work out again with other equalizers.

The dbx 10/20 can insert EQ before or after a connected tape recorder, and that is good. I do wish that the unit had the switching required to feed the built-in pink noise to the recorder, with EQ before or after, and with the playback fed to the RTA. This would facilitate recorder checks and response trimming when needed. Well, maybe next time.

As it stands, the dbx 10/20 delivers excellent system/room equalization that is close to complete automation. The flexible memory scheme enhances the usefulness of the device with a good means of compensating for differences from one point to the other. For its high price, the 10/20 has little to fault and much to increase enjoyment. Finally, it is no small achievement that dbx has not only improved on the earlier 20/20 unit, but has reduced the price 20% at the same time.

Howard A. Roberson

4

ACOUSTIC RESEARCH AR98LS SPEAKER

Manufacturer's Specifications

System Type: Four-way, bookshelf or floor-standing.
Drivers: 12-in. (300-mm), acoustic-suspension woofer; 8-in. (200-mm), acoustic-suspension lower midrange in sub-enclosure; 1½-in. (38-mm), dome, upper midrange, and ¾-in. (19-mm), dome tweeter.
Frequency Response: −3 dB at 39 Hz and 32 kHz.
Sensitivity: 87 dB SPL for 1 watt, 90 dB for 2.38 V, at 1 meter on-axis.
Recommended Amplifier Power: 15 to 250 watts.
Impedance: 4 ohms, nominal; 3 ohms, minimum.
Crossovers: 200 Hz, 1.1 kHz, and 5.5 kHz.
Controls: Two-position ("Floor/Shelf") switch.
Internal Volume: 1.49 cu. ft. (42 liters).
Finish: Oiled-walnut veneer.
Dimensions: 29½ in. (749 mm) H × 15½ in. (394 mm) W × 10⅝ in. (269 mm) D.
Weight: 63 lbs. (29 kg).
Price: $1,150.00 per pair.
Company Address: 10 American Dr., Norwood, Mass. 02062.
For literature, circle No. 93

The AR98LS is designed to be used either as a bookshelf speaker system or as a free-standing floor system. Four drive units, mounted in a vertical array, handle a separate frequency range. An unusual aspect of the design of this system is the use of a unique Dual Dome driver, in which the two highest frequency units are closely spaced on a single magnet structure. The remaining two drivers consist of a 200-mm (8-inch) acoustic-suspension lower midrange driver, which handles the frequencies from 200 Hz to 1.1 kHz, and a 300-mm (12-inch) acoustic-suspension woofer, which takes the spectrum from 200 Hz to well below 40 Hz.

Although not physically very large, these speakers are firmly constructed and are far heavier than their appearance might suggest. They easily pass the Heyser "heel of the

hand" test everywhere except near their input connections. Striking the middle of a speaker-enclosure panel with the heel of the hand will produce a drum tone if the cabinet has resonance in the bass region (which, of course, it should not have). Of some speakers it can be said, after eliciting a musical tone by this procedure, "If you like that note, you'll love this speaker." The AR sounds, and feels, like you are striking a brick wall when you try to elicit a tone from sides, top and back. Only near the rear-panel electrical connectors can you hear a truly distinct tone. The good news is that these speakers are solidly built; the bad news is that they are really too heavy to be safely considered a bookshelf speaker, even though their size might make that possible.

Electrical connection is made to a well-marked, five-way binding-post assembly mounted in a recessed cavity on the rear of the enclosure. A two-position switch, also mounted in this cavity, allows the user to tailor the response of the system for either "Floor" or "Shelf" placement.

The instruction manual supplied with this speaker is brief and well written. It outlines exactly what the user needs to know in order to get the best performance from this system, and it's written in clear English.

Measurements

Figure 1 shows the measured magnitude of impedance which the AR98LS presents to a power amplifier. As stated by AR, the lowest value is 3 ohms. There is very little difference in impedance between the "Floor" and "Shelf" rear-panel switch positions, so the complex impedance plot (Fig. 2) is presented for only the "Shelf" switch selection. Following a very small change at around 5 Hz, the dominant bass resonance of impedance occurs at 31 Hz. Subsidiary "pigtails" of complex impedance occur at 110, 250, 875, 3,500, and 7,500 Hz. Although low in magnitude, the complex impedance of the AR98LS should offer no unusual or difficult drive requirements for any power amplifier capable of driving a 4-ohm resistive load at full power.

The complex *admittance* plot for a constant voltage drive of 2 V rms is shown in Fig. 3. This is a somewhat new concept in speaker measurement and requires a brief explanation. Figure 3 represents the amount and phase of amplifier current which the AR98LS demands for a constant voltage drive of 2 V rms, the voltage level which corresponds to 1 average watt into the stated nominal impedance of 4 ohms. It is amps per volt of amplifier drive. Admittance values above the horizontal axis correspond to current demands which *lead* the applied voltage and represent capacitive components, whereas values *below* the axis are lagging and inductive. Unlike impedance measurements, which are normally made at very low voltages, this admittance measurement is made at a *normal system drive level*. The farther away the curve is from the origin in this plot, the harder the speaker is to drive. This speaker is hardest to drive at around 180 Hz, with a slightly lagging current of 5°, and becomes easier to drive at higher frequencies. As things go, it is a fairly easy speaker to drive.

One small consequence of testing at normal drive levels, rather than very small currents, can be seen in the "pigtail" that occurs around 875 Hz. The driving characteristic at 1 kHz is resistive at low drive levels (Fig. 2) and slightly

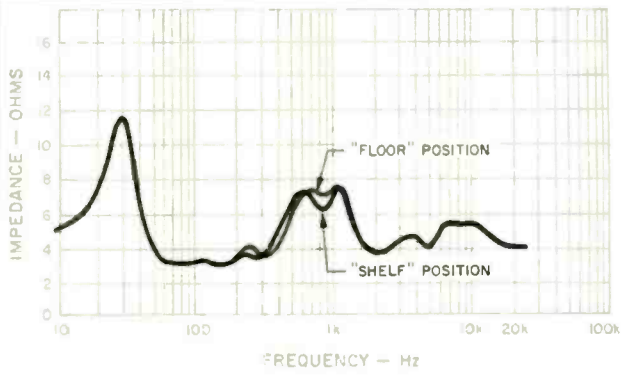

Fig. 1—Impedance for two equalizer settings.

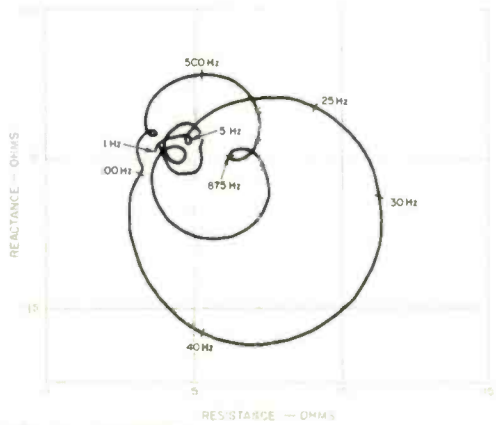

Fig. 2—Complex impedance for the "Shelf" setting of the equalizer.

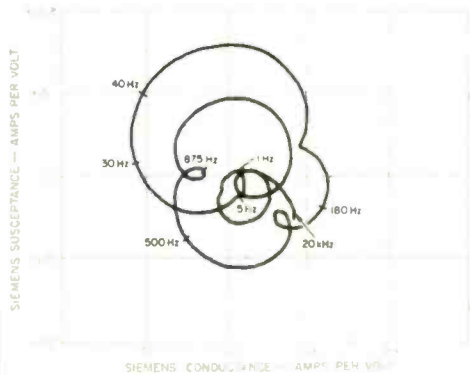

Fig. 3—Complex admittance for 2 V rms drive with the "Shelf" setting of the equalizer.

A new test for this review is of admittance, which ferrets out speakers whose drive properties change—the AR didn't.

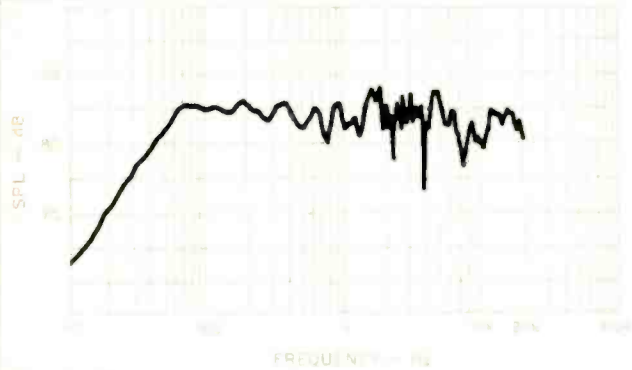

Fig. 4—One-meter on-axis sound output level with a constant drive level of 2.8 V rms.

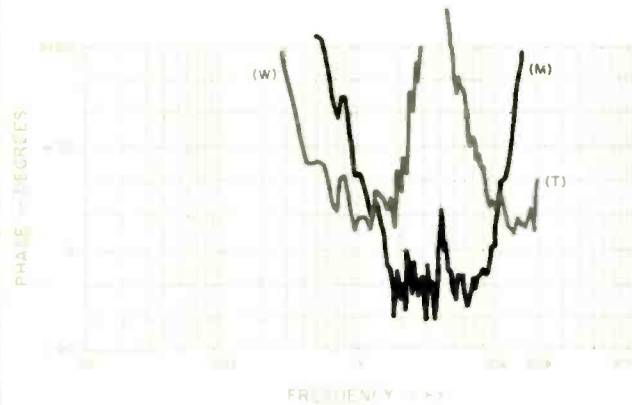

Fig. 5—One-meter on-axis phase response, corrected for three air-path time delays; (T) is mean average time of tweeter, (M) is 93-μS delay from (T), and (W) is 460-μS delay from (T).

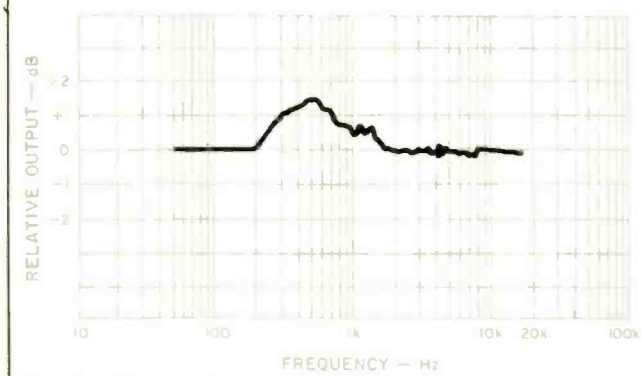

Fig. 6—Change in response caused by moving equalizer switch from "Shelf" to "Floor."

inductive at 1 average watt (Fig. 3). While this effect is totally inconsequential in the drive properties of the AR98LS, it does illustrate the sensitivity of a test method that can be used to ferret out speakers whose drive properties can change with power level and music content. The AR is very good in this respect. Others, which I have tested for admittance change with drive, have been seen to be quite poor. This is another example that the loudspeaker load can be a dynamic entity, not the simple load resistor which some amplifier manufacturers presume.

The 1-meter, anechoic, on-axis frequency response is plotted in Figs. 4 and 5 for a constant drive level of 2 V rms. My measurements indicate a free-field response that is down 3 dB at 49 Hz, relative to the average value in the octave from 100 to 200 Hz, and quickly approaches a low-frequency asymptotic slope of around 8 dB per octave. The measurement in this particular case is performed at a physical distance of 1 meter, which may account for the discrepancy between my measured −3 dB value and that cited by AR. In any case, the bass response is quite good.

Although the amplitude response is essentially uniform throughout the audible spectrum, the phase response departs from an otherwise linear slope at discrete frequencies which roughly correspond to the crossover frequencies in the AR98LS. This indicates a minor difference in arrival time for the sound from the separate drive units. The phase response measurement (Fig. 5) is corrected for three separate time delays in order to show the major response contribution from the separate drivers. The highest frequency response, from 10 to 20 kHz, arrives first, with the 2-kHz to 10-kHz range arriving 93 μS after the tweeter response, and the lower midrange from 1 to 2 kHz arriving 460 μS after the sound from the tweeter. The mean average phase of each driver is within 30° of an in-polarity convention; this means that, after removing the corresponding time delay from each driver, a positive-going voltage applied to the speaker terminals produces a nearly in-phase, positive-going sound pressure wave at the listening location. Thus, while there is some difference in the arrival time of musical partials, the phase relationships among those partials is essentially maintained by the AR98LS.

The rear-panel switch marked "Shelf" and "Floor" produces a very small change in sound in the 200-Hz to 2-kHz frequency range. Figure 6 is a plot of this change in response for the "Floor" position relative to the "Shelf" position. The maximum change is 1.4 dB at 500 Hz, and this measurement indicates why it might be very difficult to sense any difference in response when switching between these two positions.

By contrast, Fig. 7 shows the change in response caused by adding the grille assembly to the design. The scatter from the frame of the grille causes an upper register irregularity whose peak-to-peak variation is higher than that introduced by the "Floor/Shelf" switch. If taste in decor allows, I recommend removing the grille assembly for more accurate sound from this speaker.

The 3-meter room response is shown in Fig. 8. In this case, the AR98LS was placed, as recommended by AR, with its back against a wall such that the middle of the cabinet was approximately level with the listener's ear. The

The anechoic frequency response shows the AR98LS to be down 3 dB at 49 Hz, so bass response is quite good.

upper curve was measured at a position 3 meters in front of the enclosure, while the lower curve (which was placed 10 dB lower on this plot for clarity of presentation) was for a position at the same distance, but offset 30° so that the speaker was in a conventional left-channel-stereo listening position. The rear-panel switch was set to the "Shelf" position for this measurement and the grille was in place. The measurement of Fig. 8 is the frequency spectrum of the first 13 mS of sound that reaches the listener's location. The vertical spread of sound from these speakers causes floor and ceiling reflections. These first reflections are of sufficient energy to interfere with the direct sound, causing the pattern shown in this measurement. Because of this effect, the AR98LS should definitely not be placed directly on a hard floor or beneath an overhanging shelf. The measurement indicates that, for a typical stereo configuration, this system will require a slight increase in high-frequency drive for a better-balanced direct sound at the listening location.

Figures 9 and 10 show the horizontal and vertical polar-energy plots, respectively. Vertical sound is definitely hotter for sound which is directed upward from the geometric center line of the enclosure. This will work well for a floor-mounted configuration, in which the listener will essentially be on the principal sound axis, but shelf mounting may cause some directional problems. In particular, if the speakers are placed on shelves, they should be laid horizontal, with the tops (where the tweeters are) nearer the listener's position. Horizontal dispersion is excellent and indicates good stereo lateralization.

Figure 11 shows the measured harmonic distortion of the AR98LS plotted as a function of drive power for the tones of E_1 (41.2 Hz), A_2 (110 Hz), and A_4 (440 Hz). Harmonic distortion rises uniformly with drive power and, with the exception of low-bass second harmonic, remains reasonably low throughout the normal power range of this speaker. The second harmonic of 41.2 Hz rises uniformly from a value of 0.08% at 0.1 watt to a maximum level of 10% at 60 average watts drive level.

Because the low bass driver handles only the lowest registers in this system, I used the tones of Middle C (262 Hz) and E_1 to measure bass intermodulation distortion. Figure 12 is a plot of the crossmodulation in Middle C caused by E_1, when both are reproduced at the same drive level. As shown in this measurement, the IM remains quite low throughout the full power range of the AR98LS. At low power levels, the IM is principally composed of a phase modulation of Middle C by E_1 (vibrato). With increasing power level, there is a gradual reduction of the average level of Middle C, compared to what it should be, caused by the presence of the lower tone. This is coupled with a small increase in time delay of Middle C relative to its lower power value. At 10 average watts, this reduction in level is 0.5 dB, and the time delay corresponds to a 4° phase shift in Middle C. Intermodulation at 40 average watts is composed of 7% peak-to-peak amplitude modulation (tremolo) and about 5° peak-to-peak phase modulation (vibrato) of Middle C by the lower tone.

Acoustic transfer linearity is exceptionally good. The tones of A_4 and Middle C change less than 0.1 dB from their proper level throughout the drive level from 100 mW to over

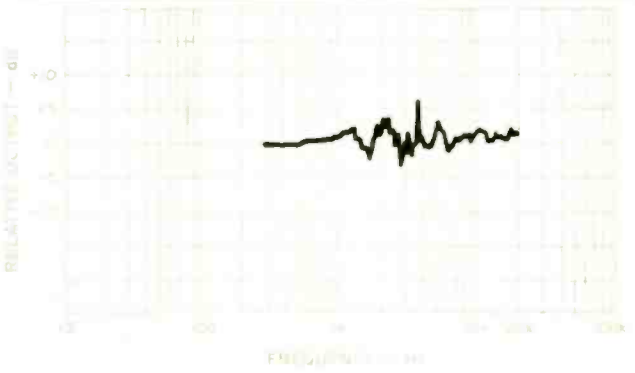

Fig. 7—Change in on-axis response caused by the grille assembly (0 dB is system without grille).

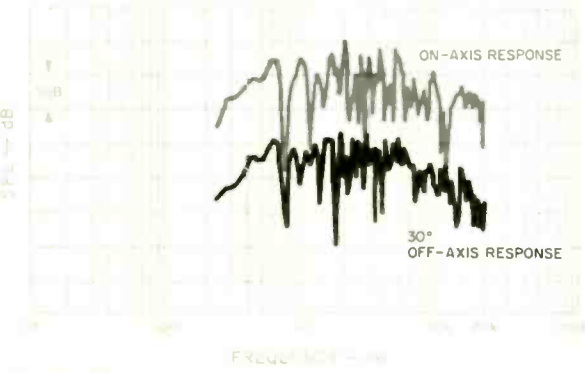

Fig. 8—Three-meter room response.

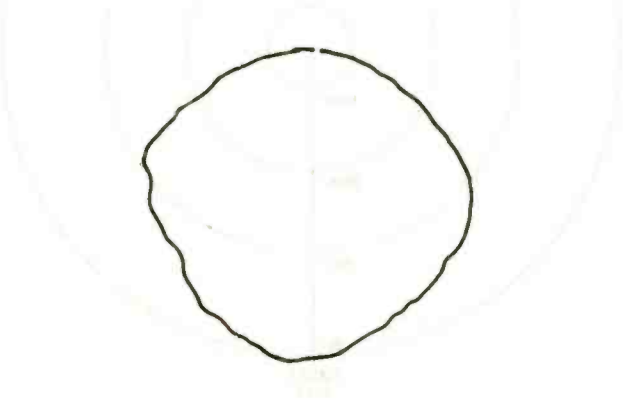

Fig. 9—Horizontal polar-energy response.

The sound of the AR98LS seemed best when placed on the floor. The system is really too heavy for shelf mounting.

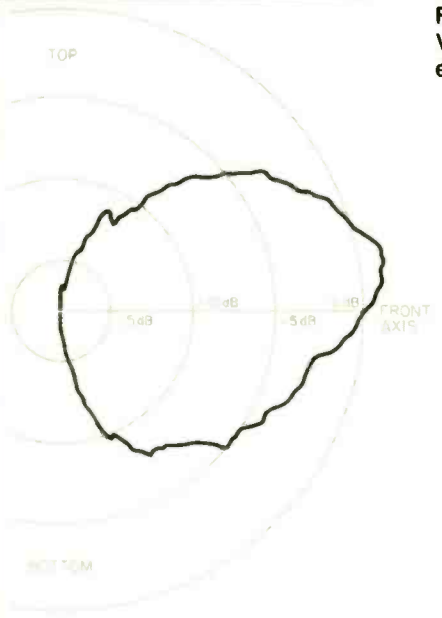

Fig. 10— Vertical polar-energy response.

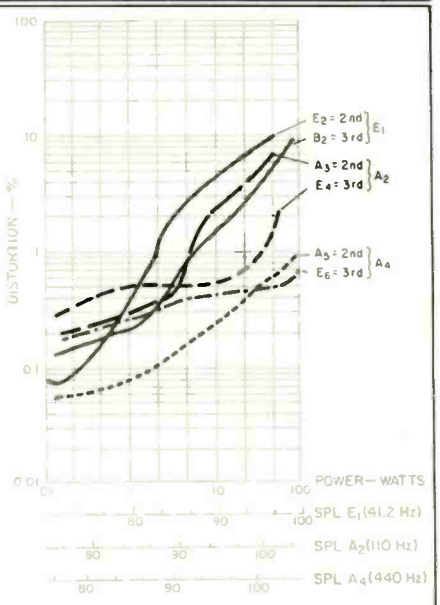

Fig. 11— Harmonic distortion for the musical tones E_1 or 41.2 Hz, A_2 or 110 Hz, and A_4 or 440 Hz.

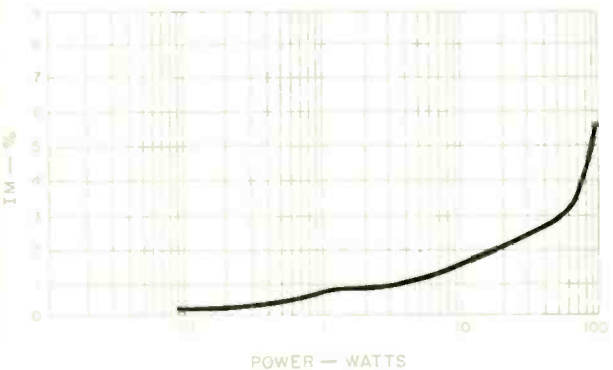

Fig. 12—Intermodulation of Middle C caused by addition of E_1 or 41.2 Hz in a one-to-one drive ratio.

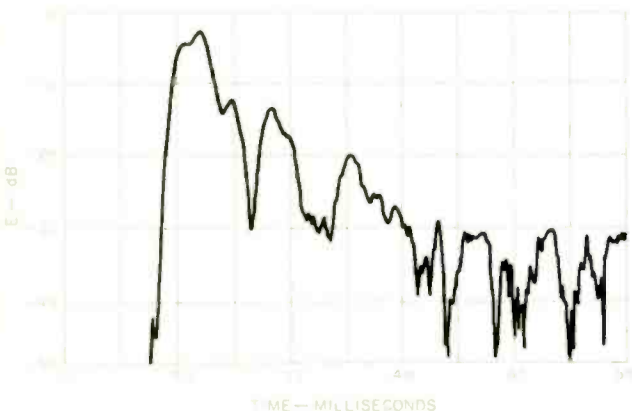

Fig. 13—Energy-time curve taken at 1 meter with grille in place.

60 average watts. This indicates that musical timbre will not change with dynamic level. The crescendo test is equally impressive, with inner musical voices retaining their proper level even when speaking under other musical peaks whose level is 20 dB higher. This holds right up to the peak-power handling capability of these speakers.

The 20-kHz, band-limited, amplitude energy-time curves, with and without the grille, are shown in Figs. 13 and 14. These curves represent the amplitude of the Fourier transform time response corresponding to the 20-kHz bandwidth frequency response shown in Figs. 4 and 5. Hamming weighting is used to compute these curves in order to preserve the highest frequency components without introducing unnecessarily large ripples due to truncating the response above 20 kHz.

The significance of these curves lies in the fact that they represent instantaneous sound energy as a function of time and show the manner in which a sharp pulse of electric energy from the power amplifier may be spread out in time by the loudspeaker.

Without the grille, the basic amplitude ETC of the AR98LS is reasonably tight, with the majority of sound energy arriving within 0.5 mS of the first sound. The sound from the tweeter and upper midrange arrive at very nearly the same time, giving rise to the first peak of energy. The arrival of sound from the lower midrange driver produces the peak at around 3.4 mS, with the lowest components of frequency arriving at around 3.5 mS.

The effect of the grille may be seen by comparing the difference in response between Figs. 13 and 14. The grille causes no delay in the arrival time of the first sound from the drivers, but does spread out the response after that first arrival. Other measurements (not presented in this review) made of the phase as well as amplitude of the ETC, and at different listening angles, show that the grille frame is at fault and not the fabric. I recommend that the grille assembly be removed for more accurate sound.

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Overall spectral balance is reasonably good to my ears, and I was impressed with the system's ability to belt out high levels.

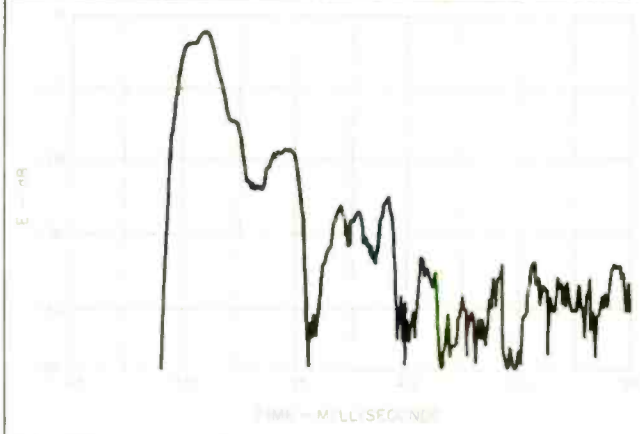

Fig. 14—Energy-time curve also at 1 meter but with grille removed.

Use and Listening Tests

I preferred the sound of the ARs when placed on the floor and against a wall. My overall impression is that the system produces a reasonably uniform spectral balance. On some material, the upper midrange has, to me, a "tizzy" characteristic that gives a somewhat exaggerated brightness. Bass is reasonably robust, but somewhat dominant in the registers in the octave below Middle C. Moving the system away from the wall eliminated this dominance, but reduced the deep bass.

I could not honestly tell any difference when the rear-panel switch was changed between its "Floor" and "Shelf" positions. I could, however, sense that I did not like the coloration introduced with the grille in place. To me, having the grille in place caused the stereo illusion to be more diffuse than my senses tell me it should be. Most of my listening was done with the grille removed.

Piano is slightly bright, as is female vocal. Overall, however, the spectral balance is reasonably good to my ears.

I was favorably impressed with the ability of this system to belt out clean sound at high level. The lower impedance notwithstanding, crescendos are easily handled with no sense of distress on the part of the loudspeaker.

Stereo imaging is excellent so long as one stays within a reasonably narrow listening area, perhaps plus or minus a meter from the central position between the two speakers. Imaging progressively deteriorates as one moves away from that area. The sonic illusion which this deterioration produces, to my ears, is that of a reduction in stage depth along with timbral changes of off-center sources.

Richard C. Heyser

5

PIONEER SX-V90 AUDIO/VIDEO RECEIVER

Manufacturer's Specifications

FM Tuner Section

Usable Sensitivity: Mono, 10.8 dBf.
50-dB Quieting Sensitivity: Mono, 16.2 dBf; stereo, 37.7 dBf.
S/N Ratio: Mono, 88 dB (at 80 dBf); stereo, 82 dB (at 80 dBf).
THD at 65 dBf: Wide, 0.02% at 1 kHz, 0.04% at 100 Hz, and 0.07% at 6 kHz in mono; 0.04% at 1 kHz, 0.08% at 100 Hz, and 0.08% at 6 kHz in stereo. Narrow, 0.15% at 1 kHz in mono and 0.5% at 1 kHz in stereo.
Capture Ratio: Wide, 1.0 dB.
Alternate-Channel Selectivity: Narrow, 85 dB.
Stereo Separation: Wide, 60 dB at 1 kHz and 45 dB from 30 Hz to 15 kHz.
Frequency Response: 20 Hz to 15 kHz, +0, −1 dB.
Auto Tuning Level: 29.3 dBf.

AM Tuner Section

Sensitivity: 220 μV/meter; external antenna, 10 μV.
Selectivity: 60 dB.
S/N Ratio: 50 dB.

Video/VHF Section

Input Sensitivity and Impedance: 1 V p-p, 75 ohms unbalanced.
Output Level and Impedance: 1 V p-p, 75 ohms unbalanced.
R.f. (VHF) Input and Output Impedance: 75 ohms unbalanced.

Amp and Preamp Sections

Power Output: 125 watts per channel, 20 Hz to 20 kHz, 8-ohm loads.
THD: 0.005%.
Input Sensitivity (For Rated Output): MM phono, 2.5 mV; MC phono, 0.25 mV; high-level inputs, 150 mV; power amp input (at preamp/main terminals), 1.0 V.
Phono Overload: MM, 150 mV; MC, 14 mV.
Frequency Response: Phono (RIAA equalization), 20 Hz to 20 kHz, ±0.3 dB; high level, 5 Hz to 100 kHz, +0, −3.0 dB.
Tone Control Range: Bass, ±8 dB at 100 Hz; treble, ±8 dB at 10 kHz.
Subsonic Filter: 6 dB per octave, 20-Hz cutoff.
Muting: −20 dB.
Loudness Contour (Volume at −40 dB): +6 dB at 100 Hz; +3 dB at 10 kHz.
S/N Ratio (A-Weighted): MM phono, 86 dB; MC phono, 67 dB; high level, 100 dB.

General Specifications

Power Requirements: 120 V, 60 Hz, 360 watts.
Dimensions: 16-9/16 in. (42 cm) W × 5⅞ in. (15 cm) H × 17-3/16 in. (43.7 cm) D.
Net Weight: 33 lbs., 1 oz. (15 kg).
Price: $799.95.
Company Address: P.O. Box 1720, Long Beach, Cal. 90801.
For literature, circle No. 94

If you had any doubts about the so-called "marriage" of audio and video, all you have to do is take a look at (and a listen to) Pioneer's top receiver. In addition to offering just about every imaginable feature you would expect to find in a full-featured, high-powered AM/FM stereo receiver, the SX-V90 can serve as the central control unit for such video components as a VCR, a videodisc player, and even a video game or personal computer. Recognizing that not all video program sources offer stereo sound channels *or* high signal-to-noise ratios, the SX-V90 incorporates a stereo simulation circuit, plus Dynamic Noise Reduction (DNR), to help reduce such noise as the tape hiss on conventional VCR audio tracks.

While incorporating many switching and control features that will appeal to the video enthusiast, Pioneer has not overlooked the important basics of AM/FM tuner, preamplifier and power amplifier design. The amplifier section incorporates Pioneer's "nonswitching" circuitry, a high-speed servo system that automatically adjusts bias current at the power stages to suit input-level requirements. The output devices are never allowed to be switched off entirely, so the system delivers Class-A performance with the efficiency of a Class-B amplifier design.

Quartz PLL digitally synthesized tuning is incorporated in the tuner section, and as many as 10 AM and 10 FM stations can be preset for instant recall. Alternatively, you can tune up and down the dial and have the tuner lock onto acceptable signals automatically, or you can tune manually. When you preset an FM station, you can also preset its i.f. bandwidth (wide or narrow), so each time you call up that station, the tuner's bandwidth will be set accordingly. The microprocessor also allows you to preset two favorite listening levels (e.g., for day and late-night listening). It also lets you preset sensitivity individually for each input, to compensate for differences in output levels between program sources so it won't be necessary to readjust the volume when switching between them.

As for the video facilities, the SX-V90 provides three separate sets of inputs (video, stereo audio and r.f.) and two sets of outputs (one video and audio, the other video and r.f.) for video equipment, even allowing simultaneous video feed to a TV monitor and r.f. feed to an ordinary TV set. This input/output flexibility is matched by front-panel switching facilities so versatile that you can even dub videotapes from disc or a second VCR while listening to any audio source.

Control Layout

The most striking thing about the front panel is the total absence of protruding rotary controls. The many functions of the receiver are all handled by light-touch buttons or, in the case of the tone controls, by horizontal sliders. The power switch is located at the lower left of the panel.

Alongside are a stereo headphone jack and two speaker-selector pushbuttons. Just above these controls are the aforementioned, sliding tone controls, and to their right are "Tape 1" and "Tape 2" monitor switches. Large, nearly square touch pads to the right of the monitor switches are used to select "CD/AUX," "AM," "FM" or "Phono" inputs. Below these large selector buttons are five smaller pushbuttons which are used for tape-to-tape dubbing, subsonic filter activation, connection of any kind of adaptor or decoder that needs to be incorporated into the audio signal path (e.g., equalizer, time-delay unit, or decoder), wide/narrow FM i.f. selection, and moving-coil/moving-magnet phono cartridge selection.

A multi-purpose display occupies nearly half of the upper portion of the front panel. I found some of the bright green displays a bit garish (there's no way to turn them off), though I suspect many users will appreciate the vast amount of information presented. Output power is displayed as a sort of geyser-like green fountain which increases in height as power output increases, with separate indications provided for left and right channels. Volume settings are shown by a calibrated scale having 22 increments, and this same horizontal green scale is used for indicating channel-balance setting. A signal-strength meter also appears as a green display, with the AM or FM frequency indications to its right. (The FM frequencies are displayed to two decimal places.) Other illuminated indicators tell you which preset volume level you've selected, whether loudness or audio muting functions are engaged, whether you are in the manual or auto tuning modes, which speaker systems ("A" or "B") have been selected, and whether or not an FM broadcast is being received in stereo. The rightmost section of this large display area tells you which of the several video and audio program sources has been selected and which, if any, of the tape monitor circuits is active. All in all, there's not much that can take place within the SX-V90 that won't be shown by one of the many elements of this elaborate display.

To the display's right are three large touch pads that select video input sources. Below these are smaller keys that turn on the "DNR" noise-reduction circuitry and the "Simulated Stereo" circuit. A large rocker pad adjusts volume level; two volume levels may be preset (when used with the "Memory" button) and selected with the "A" and "B" buttons just to the volume rocker's right. Separate "L" and "R" buttons are used to alter channel balance. When both are touched at the same time, balance is returned to its electrical "center" (equal signal levels to both channels). To the right of the balance pushbuttons are the "Loudness," stereo/mono, and "Muting" switches.

The upper-right corner of the panel is devoted to the tuning options. "Auto/Manual" and "Memory" switches are positioned to the left of a large "Down/Up" rocker switch;

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So, if all you want to hear is the music you record, this little message should be music to your ears. BASF Chrome. The world's quietest tape.

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The quality never fades.

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Despite its many features to appeal to video enthusiasts, the SX-V90 doesn't overlook the important audio basics.

above these are 10 small "Station Call" keys and indicators which select previously memorized AM or FM stations.

The last little surprise offered by the front panel of this versatile receiver is to be found behind a little removable panel at the lower right corner. When this cap is removed, "Video Disc Output" jacks are visible. These enable you to copy the contents of a videodisc (or any other audio/video source connected to the rear-panel "Video Disc" inputs) onto a VCR. This can be done even when the receiver is switched off, as the jacks simply provide a convenient passive connection to the rear-panel disc inputs.

The rear panel of the SX-V90 has a full set of jacks for both audio and audio/video program sources. On the audio side are the "Phono" and "CD/AUX" inputs, plus input and output jacks for two tape decks and an "Adaptor"; there are "Pre Amp Out" and "Power Amp In" jacks, too, connected by external jumpers.

On the video side, things get more interesting. The three video inputs ("VCR 2/Game/Computer," "VCR 1/(TV Ant)," and "Video Disc") are equipped to take either VHF-channel r.f. signals (via standard F-connectors) or video plus stereo audio; the two "VCR" inputs also have "Stereo/Mono" switches, with the left-channel audio jack designated for mono use.

The main "Output" provides both a VHF r.f. feed to a conventional TV set and a composite video feed to a TV monitor, both of which can apparently be used at once. The audio signal corresponding to this video output would go through the receiver's speaker and tape output jacks. Another set of output jacks provides video and stereo audio signals from whatever is hooked to the "VCR 1" input; confusingly, though marked "For Copy (From VCR 1)," it is grouped with the "VCR 2" inputs.

The audio/video and r.f. circuits are apparently switched in parallel. The SX-V90 does not demodulate r.f. signals into audio and video—or do the reverse. So, if your output screen is an ordinary TV, you'll have to take r.f. signals from your VCRs, videodisc player, computer or game in order to feed it; if your screen is a monitor, without a tuner, you'll have to use the audio and video connections. You'd probably do this in any case, but it does open up interesting possibilities for tricky, simultaneous switching of two different A/V systems, one using r.f. and the other audio/video signals.

There are also r.f. connections for the audio side, of course: 75- and 300-ohm connections for FM and, above them, a jack for possible connection to a future AM stereo decoder. An external AM antenna terminal is near the left end of the rear panel, and an accessory AM loop antenna, which can be remotely mounted from the receiver, is supplied with the SX-V90.

Two switches near the antenna terminals adapt the receiver's tuner section to the broadcast standards of different countries. A slide switch near the antenna terminals selects the incremental tuning steps of the frequency-synthesized tuning system. You can choose 9- or 10-kHz steps for AM (9-kHz steps are used in many parts of the world other than the U.S.) and 50- or 100-kHz tuning steps for FM. This is an extremely useful feature not only because you may want to use the receiver in a foreign country, but also because

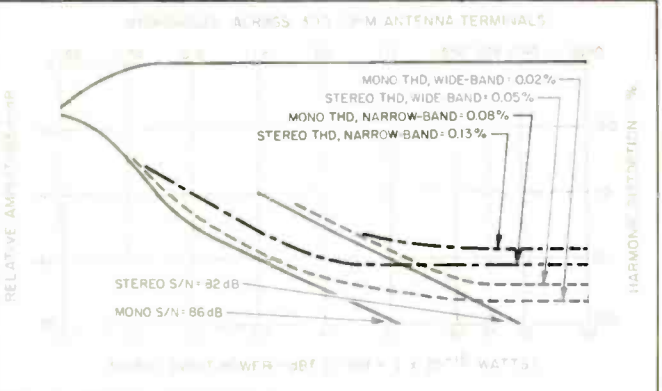


Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

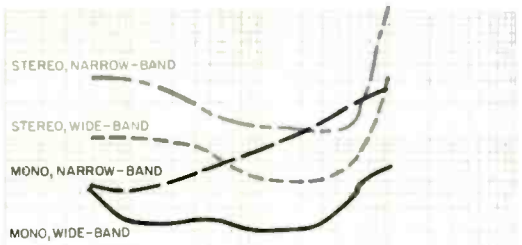


Fig. 2—THD vs. modulating frequency, FM tuner section.

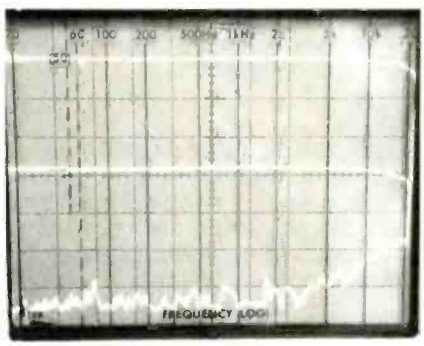
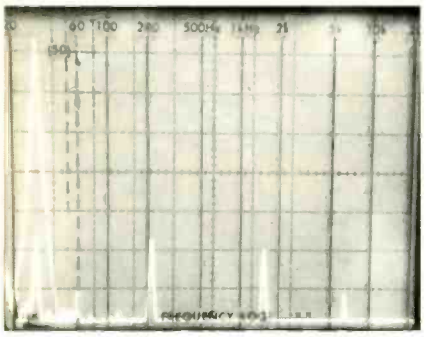
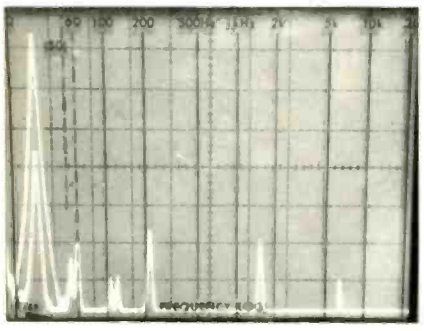


Fig. 3—Frequency response (upper trace) and separation (narrow i.f. position, center trace; wide i.f. setting, bottom), FM section.

The display is garish, but it shows vast amounts of information, including all major control settings and instantaneous power output.



A



B

Fig. 4—Analysis of 5-kHz distortion and crosstalk in wide-band i.f. mode (A) and in narrow-band i.f. mode (B).

some cable TV companies that provide FM stereo service do not always position FM stations at standard 100- or 200-kHz increments on the dial. A 50/75-μS de-emphasis selector switch is positioned near the frequency-increment selector.

Speaker terminals for the two sets of speakers, as well as three a.c. convenience receptacles (one switched, two unswitched) are near the right end of the panel.

Tuner Measurements

Figure 1 shows signal-to-noise ratio and distortion as a function of input signal strength. While signal-to-noise remained essentially unchanged when I switched from the wide to the narrow i.f. mode, distortion increased significantly in the narrow i.f. mode, as might be expected. I measured an incredibly high 86 dB of signal-to-noise in mono. (I suspect that my test setup is not capable of measuring the full 88 dB claimed by Pioneer, so don't be too concerned about the slight discrepancy.) In stereo, S/N reached a maximum of 82 dB, as claimed. THD in mono, using the wide-band i.f. setting for a fully modulating 1-kHz signal, measured a very low 0.02%. I was impressed as much by this lower reading from the tuner section as I was by the ability of my generator to produce a signal that contained so little THD to begin with! Switching to the narrow i.f. mode, the THD was still comfortably low, with readings of 0.08%. In stereo, once again using the wide-band setting, THD for the 1-kHz test signal measured only 0.05%, but when I switched back to the narrow i.f. mode, the reading increased to 0.13%. Usable sensitivity in mono measured 10.8 dBf, as claimed; in stereo it was determined by the switchover function from mono to stereo, which occurred at around 28 dBf.

It took an input signal of 18 dBf to achieve 50-dB quieting in mono and 38 dBf of signal to achieve that quieting level in stereo. A plot of distortion versus modulating frequencies is shown in Fig. 2 for mono and stereo, for both the wide and the narrow i.f. settings of the front-panel bandwidth switch. Even in the narrow i.f. position, THD at 6 kHz in stereo was only 0.14%.

As might be expected, stereo separation suffers when the bandwidth switch is set to the narrow i.f. position. As shown in the spectrum analyzer 'scope photo of Fig. 3, however, separation remains amazingly constant over the entire audio spectrum, yielding an acceptable separation between channels of around 30 dB. With the bandwidth switch set to the wide i.f. position, mid- and low-frequency separation measured a very high 60 dB, decreasing to a bit less than 50 dB at 10 kHz.

Figures 4A and 4B illustrate what happens to crosstalk, separation and distortion components when operation of the receiver is switched from the wide-band to the narrow-band i.f. mode. In these 'scope photos, sweep is linear from 0 Hz to 50 kHz. The tall spike near the left edge of each photo is the desired 5-kHz output from the modulated channel. The shorter spike within the taller one is the 5-kHz component seen at the output of the unmodulated channel. Note how much smaller this undesired output is in Fig. 4A (wide-band mode) compared with its amplitude in Fig. 4B (narrow i.f. mode). Note, too, that while the 19- and 38-kHz "spikes" (seen further to the right in each photo) remain essentially the same regardless of i.f. bandwidth, the second- and third-order distortion components of the 5-kHz modulating signal appearing in the unmodulated channel output (just to the right of the 5-kHz spikes) are much greater when the receiver is in the narrow i.f. mode than in the wide i.f. mode.

Capture ratio in the wide i.f. mode measured exactly 1.0 dB, as claimed. Alternate-channel selectivity measured 87 dB in the narrow mode but, as might be expected, decreased to 53 dB in the wide mode. It goes without saying that, if it is at all possible, the receiver should be operated in its wide i.f. mode. Only if you encounter interference from adjacent channels should the tuner be switched to the narrow i.f. mode, since separation is much poorer and distortion tends to increase. It is to Pioneer's credit that even when the SX-V90 is operated in the narrow mode, the distortion and separation figures remain good enough for most listening purposes.

Spurious rejection, image rejection, and i.f. rejection were all better than 90 dB. Overall FM frequency response was absolutely flat to 10 kHz and down only 1.0 dB at 15 kHz. Stereo threshold, as noted earlier, occurs with an input signal level of 28 dBf. SCA rejection was better than 65 dB, while 19- and 38-kHz suppression was also on the order of 65 dB, referred to 100% modulation levels.

Video facilities include both audio/video and r.f. switching, plus DNR noise reduction and a stereo synthesizer circuit.

I didn't spend too much time measuring the performance of the AM tuner section, but I was happy to find that it exhibited a very flat frequency response characteristic all the way out to 4 kHz, as shown in the 'scope photo of Fig. 5.

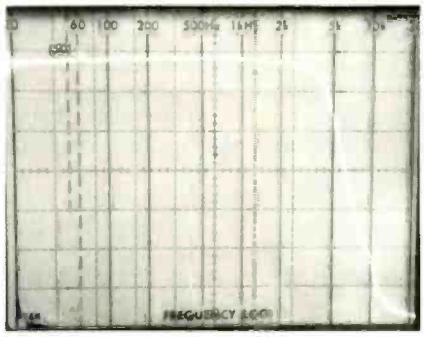


Fig. 5—Frequency response, AM section.

Amplifier Measurements

The power amplifier section of this receiver delivered 144 watts per channel before clipping. Dynamic headroom was a modest 0.8 dB above the rated value of 125 watts per channel.

I had difficulty obtaining the ultra-low 0.005% THD readings claimed by Pioneer, but this may well have been a function of my test equipment. I note that Pioneer uses an audio spectrum analyzer to obtain their low readings, rather than a meter-equipped distortion analyzer. It may well be that my test setup was reading noise and other components that are not, strictly speaking, harmonic distortion. Whatever the reason, the best I could do was to get readings of 0.01% at rated output, and the measurements were about the same at 1 kHz, 20 Hz and 20 kHz. I would hardly fault the amplifier design, even if my results are accurate for this sample. A 0.005% THD specification is something of an exercise in engineering specsmanship and bears little relationship to how good the amplifier will sound, as all of us have come to learn over the years.

Damping factor for the power amplifier section measured 45. The CCIF-IM (twin-tone) distortion was a low 0.038% at rated output, while IHF IM measured almost as low, with a reading of 0.0513% for rated output.

Phono input sensitivity measured 0.2 mV (for 1-watt output) at the moving-magnet cartridge input; in MC position, sensitivity was 0.02 mV. A 12-mV signal at the high-level inputs produced 1 watt of output into 8-ohm loads. Phono overload for the MM phono input, using a 1-kHz test tone, was 175 mV, well above the 150 mV claimed. For the MC inputs, overload was 15 mV. Overall frequency response was flat within 1 dB from 11 Hz to 60 kHz and within 3 dB from 5 Hz to 100 kHz, exactly as claimed by Pioneer. The RIAA equalization was a bit off at both the low- and high-frequency ends of the spectrum, deviating from the standard curve by a maximum of +0.2 dB at 50 Hz and +0.3 dB at 15 kHz. The range of the bass and treble tone controls is illustrated in the spectrum analyzer 'scope photo of Fig. 6.

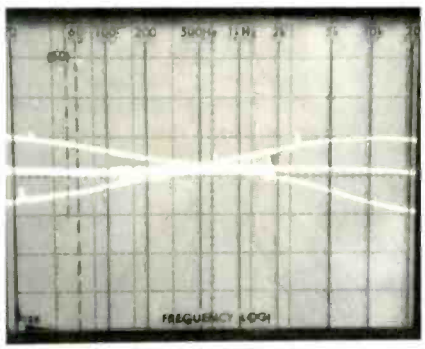


Fig. 6—Bass and treble control range.

Signal-to-noise ratio in phono, referred to a 5-mV input signal at the MM inputs and with the volume control adjusted for a 1-watt reference output signal, measured a very respectable 82 dB. An identical signal-to-noise reading was obtained for the high-level inputs, this time referred to a 0.5-V input signal and a 1-watt output signal. Switching to the MC phono inputs, I obtained an S/N reading of 68 dB. All measurements were A-weighted. Residual noise with the volume control at minimum was 89 dB below 1-watt output. Both the loudness control and the subsonic filter operated in the usual manner.

Use and Listening Tests

I must confess that I spent perhaps too much of the time I assign to hands-on use of a product in exploring the SX-V90's potential as a control center for audio and video equipment. I rather liked the idea of being able to hook my VCRs (a portable and a table-top model) and my laser videodisc player to one central component. Since I already have a TV monitor and a TV tuner/controller in my listening/viewing room, I ran into some facilities duplication as I tried to integrate my audio and video systems. Still, the versatility of the SX-V90 receiver as a central component for handling video and audio program sources is awesome. Audio enthusiasts who are about to create their own audio/video entertainment center are sure to appreciate all of this receiver's switching and connection capabilities.

After I had my fill of connecting everything I own and trying out every switching combination made possible by the SX-V90, I settled down to some serious listening. I was particularly interested in the DNR and stereo-synthesizing circuits, since I had not as yet traded in my early mono VCRs for either VHS Hi-Fi or Beta Hi-Fi stereo. If any of you are in my situation (as far as VCR equipment is concerned), you know how noisy and hissy the soundtrack from videotape can be, and how dull and flat it can sound in the absence of stereo. Well, I have tried DNR before on other equipment, but I must say that it is particularly effective as

The SX-V90's versatility as a central component for handling audio and video sources is awesome, and its sound quality ranks among the best.

incorporated by Pioneer in the video sections of this receiver. Some old videotapes (which I know to have no better than a 40-dB signal-to-noise ratio) sounded almost acceptable with the DNR circuitry operating. Of course, there are times when the musical content can trick the DNR somewhat, but after all, it is only a single-ended noise-reduction system. As such, it worked very well.

Even more interesting was the stereo synthesizer. I expected it to be another comb-filter type synthesizer that simply introduces a series of nulls and peaks into the response of each channel (never at the same point in left and right channels) to create a pseudo-stereo effect. Much to my surprise, when I measured the response of each channel with "Simulated Stereo" turned on, it was still perfectly flat; there were none of those peaks and valleys so characteristic of some stereo simulators. And, when listening to musical programming, the simulator did provide a pleasing, if moderate, stereo effect. I suspect that Pioneer is, in some controlled way, fooling around with phase, but I still haven't figured out exactly what they're doing. In any case, I didn't find it at all objectionable. With some types of programming it was downright pleasant!

I have one minor criticism: The volume-control arrangement can cause problems. Suppose you leave it set, say, at a very loud level (because you were listening to an audio program source that delivered a low signal voltage) and then turn the power off. When next you turn on the receiver, the volume level will be set at that same high level. This time you may have switched program sources to a CD player or even the self-contained tuner, both of which may provide greater signal voltages. After power-supply stability has been attained (a few seconds), you will be blasted with very loud sound. True, the indicators in the display show you that the volume control is set high, but you don't have enough time to correct it with the volume-control rocker switch, which alters volume rather gradually. The solution, of course, would be to lower the volume setting every time you are through listening to the receiver—but how many of us will remember to do that?

So, what about the sound quality of this receiver? To that I can only say that it measured up to the best of them. There's enough power here to handle the wide dynamic range of new digital audio program sources with the ability to drive medium-efficiency speaker systems to adequate sound pressure levels. The FM tuner section is sensitive, and stereo FM reception was particularly clean and distortion-free. Given its great sound, and its tremendous flexibility and versatility as an audio/video control center, one can hardly balk at the price of the SX-V90. Pioneer's design group must have spent a great deal of time coming up with this receiver, and, in my opinion, the time was well spent.

Leonard Feldman

You'll know why we're first, the second you hear us.

First it was DC. Then DD/DC and Super Feedforward. Now Sansui astounds the audiophile with the greatest improvement in an amp. X-Balanced circuitry. It cancels out external distortion by eliminating the transformer to chassis ground; and decisively removes IHM.

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There's more worth hearing about these great Sansui components. Write: Consumer Service Dept., Sansui Electronics Corp., Lyndhurst, NJ 07071; Carson, CA 90746; Sansui Electric Co., Ltd., Tokyo, Japan.

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HIGH FIDELITY FOR YOUR EYES™

VCD-1000 - Having set the sonic standards for home audio, Harman Kardon now enters the world of home video by introducing high fidelity for your eyes! Harman Kardon applied its 30 years of technical expertise to an extraordinary new home entertainment product: The VCD-1000 VHS Hi-Fi.

A breathtaking audio product with high quality video, the VCD-1000 is the perfect link to an integrated audio / video system.

As with all renowned Harman Kardon products, the critical issues of the quality of the circuitry, construction and layout of components were expertly addressed. The VCD-1000 utilizes an advanced record / playback system which FM encodes the audio signal. This FM signal is recorded and played back via high speed rotating heads (1800 rpm), resulting in wide, flat frequency response (20Hz-20kHz, ±3dB), virtually non-existent wow-and-flutter (0.005%), and 80dB dynamic range.

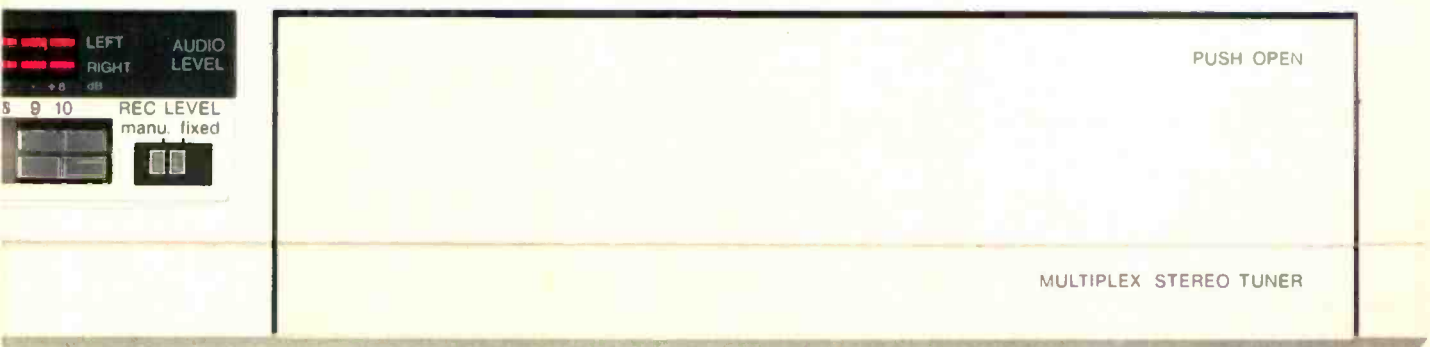
Custom-designed discrete filters are precisely tuned in production to extend frequency response, critically align noise reduction and reduce high frequency distortion.

Applications of Harman Kardon acclaimed amplifier philosophies that are evident in the VCD-1000 are the use of discrete components for reduced distortion and the use of low negative feedback.

Stereo TV Tuner - The VCD-1000 incorporates a built-in 105 channel cable-ready stereo TV tuner, and is capable of receiving, recording and playing back high fidelity stereo TV broadcasts (with bi-lingual channel capability), even if you don't own a stereo TV yet. There is an independent audio tuner section resulting in improved sound quality from these stereo broadcasts.

The video section offers 4-event / 14-day programming; still frame; high speed forward and reverse picture search; full digital displays; slow motion and an infra-red remote control that duplicates all front panel functions.

H A R M A N / K A R D O N



VM-100 Video Monitor- To further refine the audio / video vista, Harman Kardon is introducing the VM-100... a 25" diagonal, high resolution video monitor. The VM-100 combines exceptional linearity and superb transient response to deliver a picture that can only compliment the high fidelity sound.

When incorporated with Harman Kardon's unparalleled audio components, your world of high fidelity audio / video enjoyment becomes boundless.

Experience the Harman Kardon line of audio / video products... They're pure high fidelity for your eyes.

harman/kardon

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Simulated TV Picture.

ACOUSTIC RESEARCH SRC STEREO REMOTE CONTROL

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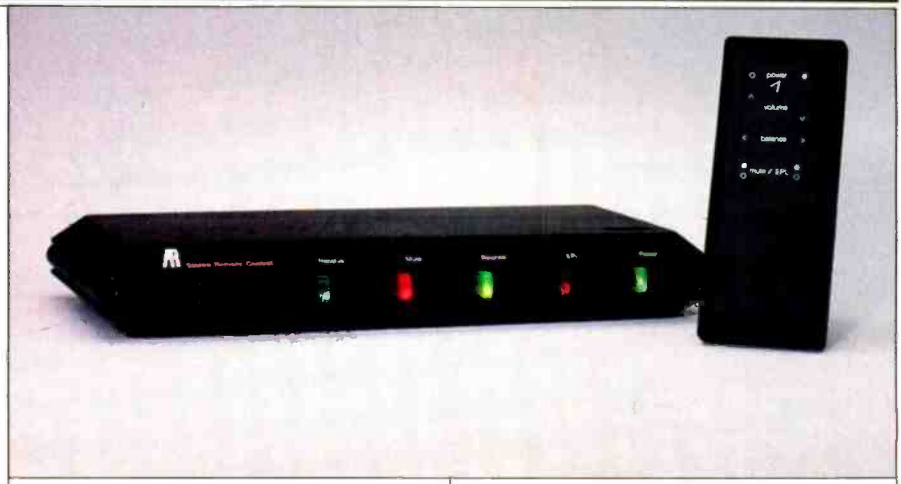

A variation on that old put-down, "If you're so smart, why aren't you rich?" is one that goes something like: "If your audio system is so great, how come you can't remote-control it like I can my TV set?"

This brilliant critique was delivered, of course, just prior to the advent of CD players, many of which do have remote control, and wireless at that. But even with a CD player so equipped, the rest of the system is not. You still have to heave yourself out of your chair to change signal levels or balance channels, etc.

The effort can become annoying if you, like I, do a fair amount of work at a desk, and in a place where you are fortunate enough to be able to have a stereo rig at the other end of the room. If the telephone rings or someone knocks at the door, you simply have to haul yourself across the room to crank down the volume or shut it all down. Have the designers of our wonderful stereo gear secretly intended for us to get exercise as a condition of enjoying their handiwork? I get my walking daily at the end of a leash holding a giant poodle, thank you, and I do not need or relish quick trips across a room as part of the stereo listening experience.

Acoustic Research, a company with some creditable innovations in its history (the acoustic-suspension speaker, the common-suspension arm-and-turntable), has moved "once more unto the breach, dear friends" with a petite device that can add the same kind of pizazz to your stereo system that TV owners enjoy. The Model SRC (for stereo remote control) is a two-piece affair. The main control unit measures 11½ × 5½ × 1⅜ inches and weighs under 2 pounds. Its companion piece, a hand-held remote "sender," is 2¼ × 5⅝ × 1⅛ inches and weighs 3½ ounces. The set lists at $160. The main unit is connected to the sound system and sits with it; the smaller r-c unit goes with you and lets you transmit instructions from across the room.

Along the rear of the main unit are six stereo pairs of signal jacks for "Main In," "Tape In," "Tape Out," "EPL (external processor loop) In," "EPL Out," and "Main Out." There's also the a.c. power cord and a switched convenience outlet. On top of the unit is a tape-select button which may be used to manually replace the tape-monitor function of your receiver or amplifier if you use that tape-monitor loop to bring the SRC into the system. You can, alternatively, interface the SRC with a stereo system via the latter's preamp-out, power amp-in jacks, in which case your original tape loop remains "as is." The latter hookup actually expands the capability of the SRC since it is left with two external loops (its own tape loop which still may be selected via the topside button on the main unit, and the EPL option which may be selected on the hand-held r-c unit.)

Buttons on the hand-held unit control power, volume, balance, muting and the EPL. That's obvious enough. But built into the SRC is a "shift key" option that enhances the capability of the controls and gets the SRC to do some useful tricks. One is to serve as a sleep-timer—with the shift key engaged, you can arrange to have power to a stereo system shut off after 30 minutes, by which time you have presumably been lulled to slumber.

Another shift-key possibility is to convert the volume control from its basic 1.5-dB steps (up or down) to rapid action. Yet another changes the balance control from its 1.5-dB steps (to right or to left) to instant all-right or all-left. Still in shift-key mode, you can return to exact balance-center (both channels balanced) by hitting the EPL button. Finally, shift key can change the mute control from its nominal 20-dB attenuation to full silencing of the audio system.

The AR SRC does all of this smoothly, silently, and without degrading the audio signal. And "remote control" in this case means distances of up to 40 feet over a fairly wide angle. The control signal actually can be bounced off reflective surfaces and still reach the main unit—when whimsy seizes you, aim it at a window, for instance, and see how well you can gauge incidence-and-reflection angles.

As I put this device through its paces, that old question arose: "How did we get along before without it?" If nothing more than a well-designed convenience gadget, the SRC merits plaudits. But it slowly came to me that there's something more involved here.

Let's say you connect the output of a CD player into the SRC's main-in jacks, and run the SRC's main-out jacks directly into a power amp. You also can connect line-in and line-out cables from a tape deck via one of the SRC's external loops, and a tuner to the in-jacks of its other loop. Remember, both loops are functionally the same; the only difference between them is that the one AR labels "tape" is manually controlled by the topside button on the main unit, while the EPL facility is re-

A MASTERPIECE OF HIGH FIDELITY

The hk690i is Harman Kardon's unique expression of ultimate artistry in high fidelity. In it are found the same control of technique, mastery of detail and creative excellence inherent in every great and enduring work of art.

The hk690i receiver is exemplary of the technological strokes of genius created and perfected by Harman Kardon throughout its more than 30 year history. 45 Amps of High Instantaneous Current Capability allows the hk690i to develop up to 150 Watts per channel into 2 Ohms under peak conditions. An Ultrawideband Frequency Response of 0.2Hz to 150kHz delivers extremely fast and accurate transient response. Low Negative Feedback results in the virtual elimination of TIM distortion. An exclusive Sample-And-Hold Multiplex Decoder decreases high frequency switching noise while eliminating the need for much of the filtering normally required in FM processing. And, the use of Discrete Components demonstrates Harman Kardon's inherent technical integrity.

With this dedication, Harman Kardon stands ready to deliver the ultimate in high fidelity listening pleasure with every model in their entire product line.

Harman Kardon . . . Dedicated to mastering the fine art of high fidelity.

SPECIFICATIONS ☐ Power Output, (FTC) RMS, per channel, both channels driven into 8 Ohms, 20-20,000Hz: 60 Watts per channel @ <.06% THD ☐ 4 Ohms, 1kHz, IHF Signal (Dynamic Power): 120 Watts ☐ 2 Ohms, 1kHz, IHF Signal (Dynamic Power): 150 Watts ☐ Negative Feedback (overall): 12dB ☐ HCC (High Instantaneous Current Capability): 45 Amps ☐ Power Bandwidth, at half-rated output, 8 Ohms: <10Hz-100kHz ☐ Frequency Response, at 1 Watt output, +0/−3dB: 0.2Hz-150kHz ☐ TIM: Immeasurable ☐ Slew Rate: 200V/μsec ☐ Usable FM Sensitivity: mono (dBf/μV-75 Ohms): 10.8dBf/0.95μV ☐ Stereo Separation: 1kHz, 65dBf, 100% mod: 55dB ☐ FM THD: mono 1kHz, 100% mod: 0.06%; stereo: 0.08%.

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AR's SRC remote control may well prove to be a bellwether for a new breed of audio product.

motely controlled by the hand-held unit.

Do this, and you will have set up a normal, full stereo system, much of which not only is remotely controlled, but which also has obviated that audio component, or portion of a component, we know now as the preamplifier.

Think about this for a while, and about its possible implications for today's "audio purists" and for tomorrow's general audio consumer.

You insist on tone controls and filtering? Fine—add them via an outboard equalizer patched in before the power amp. Since this particular device does not normally require too much control-changing, it's no great shakes if it is not remotely controlled. You want to keep your analog turntable in the act? Okay, install a small outboard preamp next to it, and feed the output into one of the SRC's loops or through a line-level selector box which feeds the SRC. And so on.

My guess is that as this potential application diversity sinks into our collective "audio consciousness," a whole new class of audio component will arise. It will be a remotely controlled selector with the SRC's functions, and a few more loops to accommodate at least the same number of signal sources and signal processing devices that today's preamps and preamp sections can handle—but in a format more compact, lower in cost, and less susceptible to the noise and distortion that equipment designers have to battle when creating low-level, high-gain circuits for today's high-quality equipment.

In this sense, the AR SRC may well prove to be a bellwether for a new breed of audio product. In any event, and that illustrious potential role notwithstanding, it is one handy device to have around. Without leaving my chair I can mute the sound when the telephone rings; from my vantage listening position I can compare the sound of one channel with the other; I can switch in tape-monitor while recording; I even can A/B two different CD players, or a CD album with the analog version, and so on.

What is more, I can at last answer that old put-down. My stereo system now is as up-to-date as any TV.

Norman Eisenberg

A MASTERPIECE OF HIGH FIDELITY

In a true masterpiece, subtle details combine with unique design to become the ideal. Harman Kardon has achieved this ideal with the introduction of the technologically advanced T65C Turntable.

An example of disc reproduction excellence, the T65C incorporates a sophisticated 3-point suspension system, counter-balanced to center the moving mass at the platter spindle. This keeps the platter, tonearm, and belt drive system isolated from vibration. The T65C's AC sine-wave driven motor is crafted to turn with pure harmonic motion, a dramatic improvement over conventional turntables that use a series of DC pulses, resulting in high frequency deviations in platter rotation.

The T65C's tonearm exemplifies Harman Kardon's technological know-how. A straight, tapered tube to suppress natural resonances, it features a weight and wire anti-skating mechanism for additional precision. Its high mass pivot assembly acts as a high frequency vibration filter, and a lateral balancer on the tonearm compensates for unlevel surfaces. A carbon fiber headshell provides low resonance and vibration damping. The T65C's massive 3.3 pound platter, disc stabilizer, capacitance trim and optically-sensed auto-lift further illustrate Harman Kardon's commitment to the art of high fidelity. A commitment that is reflected in all Harman Kardon products.

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SPECIFICATIONS: ☐ Wow & Flutter (WRMS): 0.025%. ☐ Rumble (DIN-B WTD): -70dB. ☐ Pitch Adjustable Range: ± 3%. ☐ Effective Tonearm Mass: 9.5 Grams. ☐ Stylus Overhang: 18mm. ☐ Offset Angle: 25.5%. ☐ Effective Tonearm Length: 216mm. ☐ Tracking Error: ± 2° ☐ Phono Capacitance: 70/170/270. ☐ Tracking Force: 0-3 Grams.

harman/kardon

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STAX SR-LAMBDA PROFESSIONAL EARSPEAKER SYSTEM

Company Address: 940 Dominguez St., Carson, Cal. 90746.
For literature, circle No. 96

Let me start off with a mild paradox. The item under review is the Stax SR-Lambda Professional Earspeaker system, which costs $800. I do not particularly like listening to headphones. Every experience I've had has reinforced my impression that a bad speaker provides a more musical listening experience than a good headphone. The paradox is that although the Lambda Pro is a headphone, I find it an excellent system for reproducing music.

The Stax Lambda Pro system is one of the few products unique enough to rise above the issue of its particular technology (of which it is an outstanding example) and be compared on a no-holds-barred basis with the best high-end components around. It also serves as a good introduction to the kind of musical reproduction that normally costs at least a thousand dollars more, and is uniquely suited to audiophiles who want to keep their high-end systems from dominating their homes or surplus incomes.

The key to this paradox is that the Lambda Pro "breaks the mold" in enough areas to emerge as a very special product. In order to appreciate its merits, however, it is necessary to understand my generic indictment against headphones. Most provide unnatural imaging with no center-fill, unrealistic and compressed dynamics, uncomfortable and erratic coupling to the ear, and a lack of depth, air and natural reverberation. Their frequency response is unusually irregular, lacking in bass and even the lower mid-bass. Dynamic phones exhibit a relatively significant loss of details, and electrostatics have a hard and often spitty treble.

Enter the Stax SR-Lambda Professional. This system consists of an advanced version of the Stax Lambda electrostatic earphones and a direct-coupled (transformerless) Class-A amplifier unit called the SRM-1/MK2 Professional. The advances in the earphone include higher polarizing voltage, an exceptionally thin diaphragm, a wider electrode gap, and probably a great deal more besides. The key point is lower distortion and more dynamic range.

So much for the wonders of technology; it is human engineering and sound that count. To start with human engineering, the Stax Lambda Pro gets the basics right. The headphones are light, comfortable, and free from artificial restrictions on head movements. There are no problems because the cables are too heavy or stiff, or because the phones don't fit properly. The open design allows prolonged and relatively fatigue-free listening. They cover the entire ear but don't seal you off from the sounds around you, and this helps minimize the "dead" or isolated character that earphones give to music.

The fact that the Stax Lambda Professionals are driven by a Class-A direct-drive amplifier means they don't interfere with the speaker-amplifier interface, a curse which often seriously degrades the sound of the loudspeaker. The system approach also makes the Lambda Pro unit flexible and portable. The drive unit has a volume control that adjusts for channel balance, and you can listen to anything with a high-level output without a preamp. That means you can easily set up an "armchair" system to listen to FM, tape, CD, or (with a preamp) even records. If you live in an apartment or have a family, you probably have severe constraints on when, where and how loud you can play music, and how well you can protect your high-end components from inexperienced or overenthusiastic hands.

This should have a powerful effect on any consideration of the Lambda Pros' cost-effectiveness. While they're truly expensive as earphones, they are

"Sherwood products offer excellent performance at very reasonable prices."

Leonard Feldman, *Audio Magazine*

The occasion of Mr. Feldman's comment was his review of our S2680-CP top-of-the-line receiver. His statement was sparked by the fact that, while quite affordable, the S2680-CP, like all Sherwood receivers, is designed and built with the care, precision and innovation which have become Sherwood trademarks.

A tradition of affordable quality. More than three decades ago Sherwood was founded on this philosophy: Through innovation, make quality audio equipment more affordable. That philosophy has been nurtured throughout Sherwood's history and is the foundation of our newest line of receivers.

We never cut corners on sound. All five Sherwood receivers deliver true high-fidelity performance. Even our budget-priced S2610-CP sounds better than many separate components. And the entire group is laced with features that can make significant differences in your listening enjoyment. Ultra-low-bass EQ, multi-deck dubbing, auto-scan digital tuning and discrete phono preamp circuitry are standard on several Sherwood models, yet missing from many other brands, regardless of price.

Certified Performance. Sherwood is the only manufacturer to test and certify the performance of each individual receiver. On the outside of every carton you will find a certificate showing the measurement details of the power amp, phono preamp and FM tuner sections of each receiver. These are not just the rated specs; these are the actual measured performance data of the individual unit, *so you know exactly what you're buying.*

Find out what the experts say. Get the whole story on why Sherwood receivers—in Mr. Feldman's words—"...offer excellent performance at very reasonable prices."
To get your own copy of his review of the S2680-CP and to find out just how much quality and innovation you can afford, visit your nearest Sherwood audio specialist today. To find him, call (800) 841-1412 during west coast business hours.

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The headphones are light and comfortable, with an open design that minimizes the "dead" or isolated character earphones give to music.

cheap when viewed as the essential components of a second or personal high-end system. A comparable amplifier, preamp, and pair of high-end speakers would set you back at least $2,000—probably well over $3,000.

I also use the word "comparable" advisedly. I did my listening to the Stax Lambda Pros during a period when I was comparing the Stax F81 Acoustat 1+1, and Quad ESL-63 electrostatic loudspeakers. The Stax Lambda Pros offered trade-offs that made them competitive with these very high-quality speaker systems and, in fact, with any dynamic system I have yet heard.

Let's begin with bass. The Lambda Pros don't eliminate the earphone curse. They can only match the better full-range loudspeakers down to about 100 or 200 Hz. While there's no precise way to measure the apparent loss in bass power, such a loss begins in the mid-bass and becomes more apparent in the deep bass. At the same time, the bass is extended, flat, and faster than most speakers. The feeling of bass "power" may be lacking, and bass dynamics a bit constricted, but the Lambda Pros do go way, way down into the deep bass and they're insensitive to room effects. Only the few audiophiles lucky enough to have extremely expensive speaker and amplifier systems, and rooms that allow them to perform their best, will get decisively better bass from their loudspeakers than you can get from the Stax Lambda Pros.

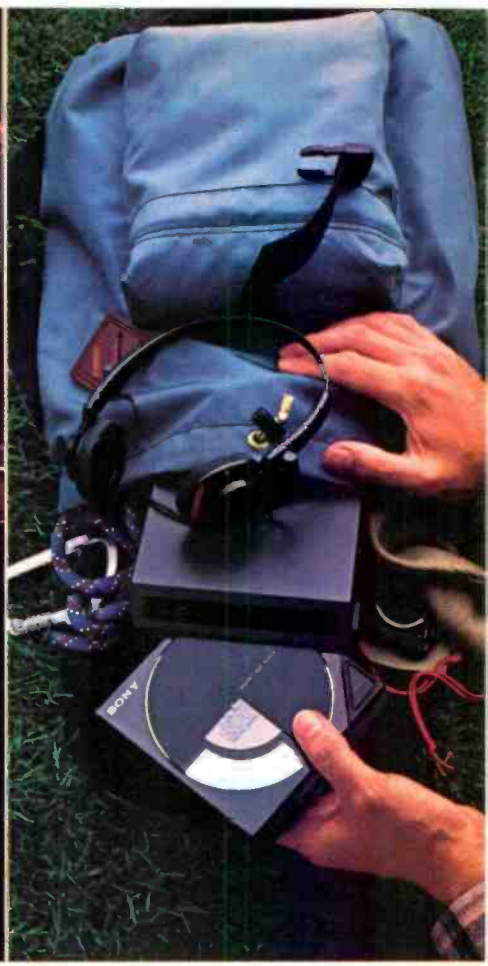
If you give these phones a chance, you'll also find that psychoacoustics are on their side. If bass is deep, flat and clean, the mind tends to correct for bass amplitude unless it is forcibly reminded of the contrast between a reduced and proper level. This is not true when the bass is merely excessive, particularly with the bass peaks and valleys common in most systems because of loudspeaker/room interactions. Flatness helped make the Lambda Pros' bass more listenable than that of many of the speakers I review, and enabled them to outperform the bass on the Stax F81 loudspeakers. It also made the Lambda Pros an ideal monitoring system when I wanted to check the timbre of bass on a record, or be sure I was not listening to room effects or speaker coloration in the bass. The Lambdas may not give you the most exciting sound from Telarc or Sheffield records, but they answer a lot of questions about exactly how the drum and bass viol on such records sound.

Moving on to the midrange, there still is some loss of the reverberation, air, and natural warmth common to live music and the best speakers. The loss, however, is less apparent than in any other earphones I have heard, including the regular Stax Lambda Pros driven by a switch box connected to a power amplifier. The midrange is also detailed, flat, and natural. The Lambda Pros will not surprise you with etched transients or some temporarily exciting variation in the music. They don't do anything unusual to the midrange.

The Lambda Pros do not have the apparent rise in the upper midrange of the Stax F81 electrostatic speakers. They don't have the apparent roll-off of the Acoustats. They do sound "close in"—let's say Row C in the concert hall—but you can listen to the midrange for a long, long time without hearing the Lambda Pros caught out in terms of sound quality.

If you like the midrange of such speakers as the Quad ESL-63s, the Thiels, the Vandersteens, the Martin-Logans, the Fuseliers, etc., you will find the midrange of the Stax Lambda Pro to be a good overall match in clarity and timbre, and an interesting point of comparison. Further, the Lambda Pros' midrange again offers exceptional freedom from room effects. If they sound slightly dead in terms of depth and air, they also free the sound from the characteristics of the room you're in. If you prefer to hear the midrange of the concert hall or performance as recorded on the source material, you will hear it on the Lambda Pros.

I should also note that the SRM-1/MK2 drive system is one of the least problematic Class-A amplifiers I have heard. It is definitely a transistor unit, which tube lovers will recognize immediately, but it is clean and extended. It may not be a match for the latest Krell power amplifiers, but it rivals the high-end transistor amplifiers I've heard in recent months, including the Thresholds. This became very apparent in comparing interconnects. The Lambda Pros merit the best Monster Cable Interlink Reference, Peterson, Livewire,



Sony revolutionizes

The Lambda Pros minimize the excess treble in most electrostatic phones, without the dullness and grain of dynamic and electret earphones.

Discrete Audio, or Straightwire interconnects. They also—as Bert Whyte pointed out in the November 1983 issue of *Audio*—reveal every detail of the source material and equipment used to drive the SRM-1/MK2.

The highs are extended, clean, and very musical. My Koss electrostatic earphones tend to burn every bit of hiss and upper-midrange and upper-octave hardness right into the ear. The Stax Lambda Pros minimize both the excess treble in most electrostatic phones, and the dullness and grain of dynamic and electret earphones.

The specifications for the Lambda Pros show a rise from about 4.5 kHz to beyond audibility. But listening to a wide range of music reveals a steady—though slight—roll-off beginning somewhere around 3.5 kHz. Given the proximity of the driver to the ear, this ends in making the upper octaves of the Lambda Pros sound relatively flat up to about 17 kHz. My guess is they're not flat much beyond this frequency, and start to exhibit a sharp roll-off, but the meters on my golden ears aren't accurate enough in this part of the top octave for me to know. In any case, the Lambda Pros have enough response far beyond 17 kHz to provide the nearly subliminal consciousness of extended highs that is only present in the best supertweeters, or in a few ribbon and specially designed electrostatic speakers.

There is an old joke about an audiophile who walked into a concert hall to hear live music for the first time and wondered where all the highs and sharply etched imaging went. He will have the same experience if he wanders into the Lambda Pros. Like the midrange, the highs are best characterized by those old audio chestnuts, "sonically neutral" and "musically natural." That may not be "exciting" if you love sound, but it is very exciting if you love music.

As for imaging and depth, the Lambdas do not rival loudspeakers. They have more center-fill and spread than most earphones. They can sound exciting and reasonably natural with the few binaural tapes that are available, but they never "float" an image in a perfectly natural way. They do have depth if the recording has depth (try some of the Reference Recording, Opus, Wilson Audio, Lyrita, and Proprius records), but not enough source material has the natural depth to compensate for the depth that most listening rooms add to loudspeakers' sound.

The Stax Lambda Pros do reproduce the entire dynamic range. They easily outperform Quad ESL-63s in this regard, and rival even most big dynamic loudspeakers. They reproduce soft passages nearly as well as the Quad ESL-63s and Fuselier 3.3s, which are both outstanding in this respect. They do not, however, have the feeling of power or "air" that is natural in live music or in the very best loudspeakers operating in a room. Nonetheless, the Stax Lambda Pros have a different kind of sound from speakers. If you listen long enough to get used to the changes, you'll notice that at no point does the room begin to interact with the sound and color it. You win a few points and lose a few points.

To put it personally, I used to have a pair of LS-3/5As in my equipment room and a pair of small Spendor speakers on my test bench. They were awkwardly located on shelves in the wrong area, and I finally tired of trying to use them to fine-tune equipment, compare given components, or (as a desperate last resort) listen to music. The Stax Lambda Professional Earspeaker system does all of these jobs quite well. It moves easily between equipment room and test bench. Most importantly, the SR-Lambda Pros allow me the vice of Vivaldi after my wife imposes her official sonic curfew. The system is cheaper than any single combination of a small monitor speaker and amplifier that I've used previously—and it's more musically satisfying.

Anthony H. Cordesman

WHAT'S A GUITARIST FROM NEW JERSEY DOING WITH AN AMPLIFIER FROM NEW ZEALAND

He's listening to the sweetness of his own pure sound on Perreaux.

World renowned jazz guitarist Al Di Meola, who spends much of his time at his home in New Jersey wanted to buy new audio components for his system. He chose Perreaux of New Zealand.

Although the country of origin may seem ludicrous, given the Kiwi, would you believe that Perreaux of New Zealand is the only facility in the world that completely handcrafts its audio components. Each Perreaux is custom crafted under the supervision of Peter Perreaux, as it has been for over ten years.

Al Di Meola, who has earned a sublime reputation for his mercurial dexterity and finesse playing jazz guitar, appreciates the work done by craftsmen at the Perreaux factory. Handcrafting is necessary for the attention to detail demanded by the Perreaux design. From the cutting, drilling and anodizing of the rigid aluminum chassis, to the testing, matching and soldering of the transistors. Perreaux's sonic quality is unattainable by mass production.

Al Di Meola's obsession with the highest quality of music reproduction will be evident on his new album *21st Century Guitar* due to be released in January 1985 on Manhattan/EMI and pressed on the finest virgin vinyl. If you don't own a Perreaux audio component, you probably won't hear every nuance Al Di Meola has intended for you to hear.

Perreaux Power Amplifier 1150B

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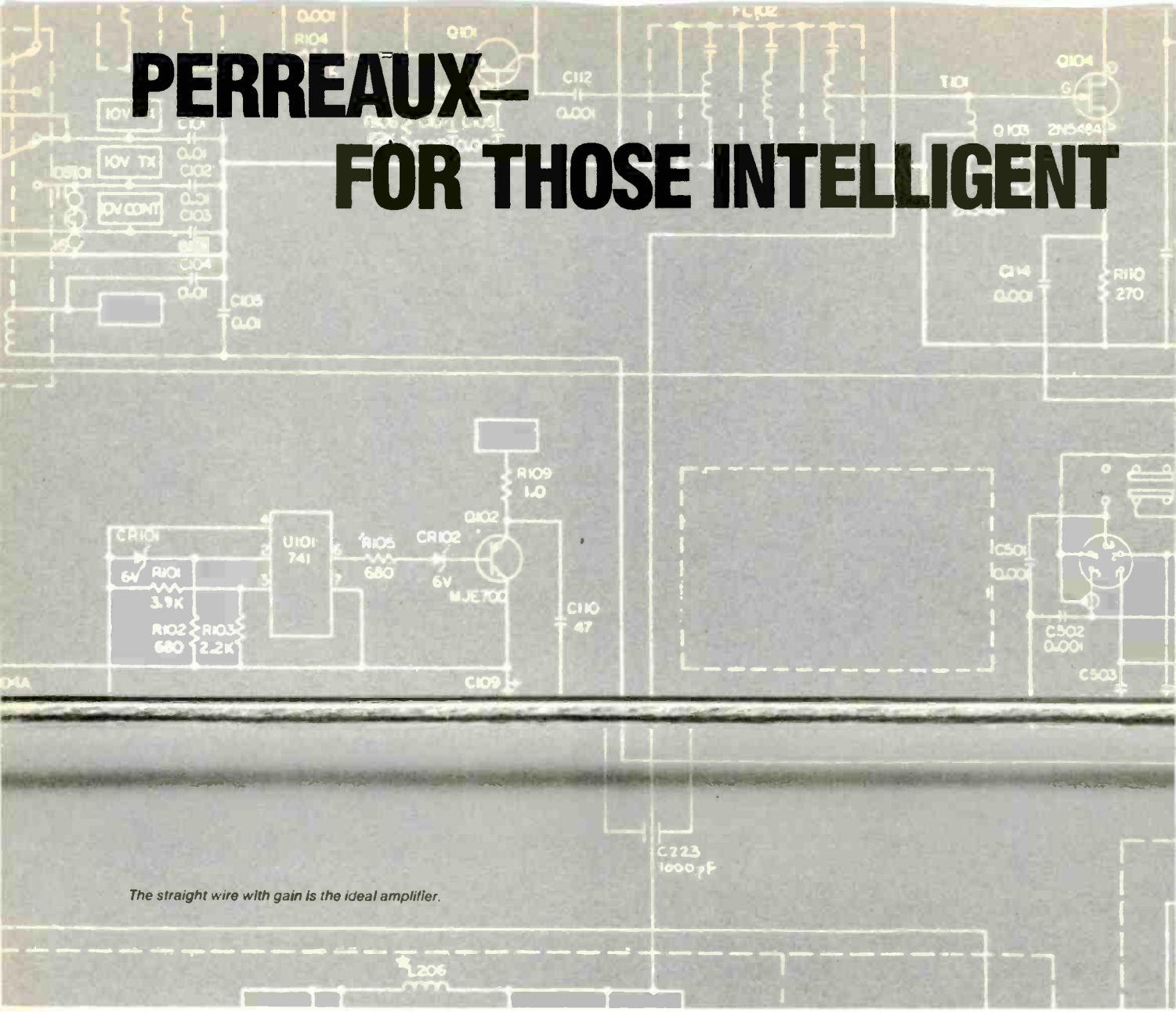
PERREAUX— FOR THOSE INTELLIGENT



The straight wire with gain is the ideal amplifier.

It has been said that the history of the progress of man is the ability to do more with less—Perreaux of New Zealand concurs wholeheartedly.

In the world of audio components, Perreaux does more than anyone else, with far less. In fact, Perreaux accomplishes more *because* it uses less.

The "less" that comes between you and the original music signal, the more it sounds like the original music. In audio, this concept is known as "straight wire with gain". The ideal amplifier would have *no* parts other than a wire between the source and the speakers. Perreaux comes closer to this ideal than any other audio component ever created. The renowned British magazine HI FI FOR PLEASURE says: "There is little more that I can add about the 'sound' of the Perreaux as it can't really be said to contribute any particular character of its own to the musical performance—it is as *innocent* a component as I have ever been privileged to hear."

Perreaux circuits are so simple that a single integrated circuit chip usually contains more circuitry than a Perreaux component. No integrated chips or trick circuits are used by Perreaux. Each circuit has been refined over and over again until it accomplishes its task with the shortest circuit path and the fewest parts. Perreaux simply designs the most refined audio components in the world.

Other manufacturers use additional parts to correct for differences in transistors, Perreaux tests, calibrates and matches every transistor. Others use additional parts to block radio interference, Perreaux plates its circuit board with 24 karat gold, creating the most conductive ground plane possible to "absorb" and isolate interference. Others require complex protection circuits to prevent their amplifiers from self destructing, Perreaux power amplifiers require no protection circuitry whatsoever—the stability is inherent in

ENOUGH TO BE SIMPLEMINDED

the design. While other manufacturers require additional circuitry to boost the gain of a low output moving coil phono cartridge, Perreaux preamplifiers accept moving coils without any additional pre-amplifier circuitry.

Perreaux has even created an amplifier capable of harnessing all the electricity your power company can supply to your home—the PMF5150B. Its brute strength is also derived from elegant simplicity. Perreaux can deliver more massive power than any other home amplifier with only five transistors in the driver stage and twelve transistors at the output. The filter capacitors and power transformer can deliver over 2,000 amps to the circuit, eliminating the need for dual transformers which cause severe phase shifts.

Every Perreaux component reflects its internal beauty and simplicity with its external design. Perreaux has no flashing lights or panels that glow in the dark.

Perreaux has no need to shout its authority.

Perreaux Power Amplifier 5150B

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PERREAUX—

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Every Perreaux is handcrafted in New Zealand from the finest parts the world has to offer.

Transistors are custom made for Perreaux in the United States. Filter capacitors are built in Japan to Perreaux's specifications. Power transformers are custom built in New Zealand. Polypropylene capacitors in the signal path are carefully selected in West Germany.

Perreaux places each of these superlative parts through stringent test procedures. Over 90% of the transistors tested for use in Perreaux preamplifiers are rejected as not meeting the demanding requirements.

When a circuit is nearly completed, Perreaux continues the quest for perfection by inserting critical circuit elements at the very last, thus "tweaking" each amplifier individually for ultimate performance.

By the time each Perreaux audio component reaches its final quality control stage, it has been through over 100 quality control checks of sonic performance.

The Chassis

Only the finest quality aluminum is used to create a Perreaux chassis. Each aluminum component is blasted with chemically inert glass beads, etched and anodized. To achieve the smooth, even finish of Perreaux, the metal must be completely free of imperfections such as grain pattern. You will see no sanding marks that hide imperfections on a Perreaux front panel. (Other component manufacturers just aren't willing to go to the same expense for the level of craftsmanship that Perreaux demands for a part as basic as the front panel.)

The heat sinks are one of the most com-

APART FROM THE REST

Over 90% of the transistors tested are rejected for use in Perreaux preamplifiers.

plex extrusions in the world. Designed by Perreaux for maximum heat dissipation, each fin contains over 60 ribs per inch. This attention to the smallest chassis detail maintains the relative temperature of the output devices within ±1°C. Knobs are individually machined from solid aluminum, rather than molded plastic, as on many other supposedly high quality components. All this prompted STEREO REVIEW magazine to say of Perreaux's construction: "This sort of 'no-holds-barred' approach to doing a first rate design and manufacturing job is uncommon in all walks of life these days, and the result is an audio component of which both the manufacturer and the lucky owners can be justly proud."

Perreaux—awarded the Hi Fi Grand Prix for "its Mercedes-like construction" by AUDIO/VIDEO magazine.

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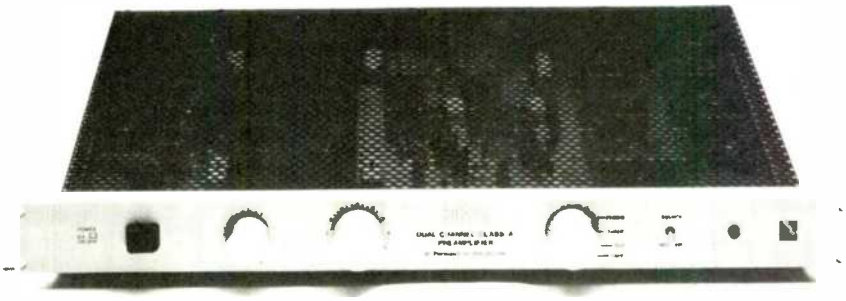

Perreaux Preamplifier SM-2

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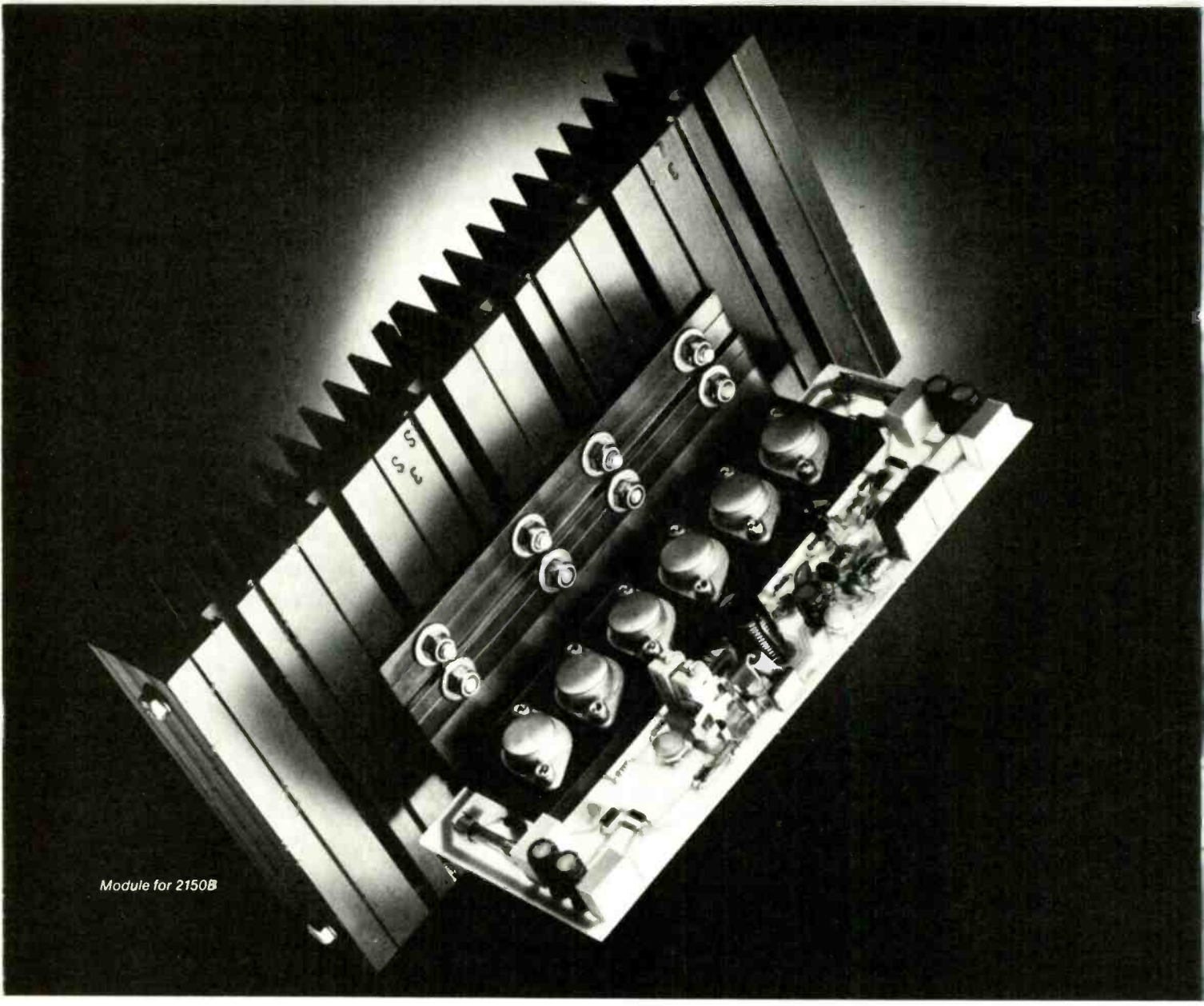

PERREAUX INTRODUCES THE OBSOLESCENCE OF PLANNED OBSOLESCENCE

When you acquire a Perreaux audio component, you enter into a company. Our future does not lie in throw-away components, since the components we manufacture do not become obsolete. Our future does not lie in trendy styling, but in the enduring elegance of fit and finish. Perreaux understands that performance can become obsolete by an advance in technology. In fact, Perreaux has been responsible for significant design and manufacturing breakthroughs:

- The first high power MOS-FET amplifier
- The first high power amplifier requiring no protection circuitry
- The first wide bandwidth amplifier (3,000,000 Hz)
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- The first passive RIAA phono section with low noise
- The first pre and power amplifier combination with ±1° phase accuracy.

When Perreaux develops a new circuit, it makes certain that existing Perreaux amplifiers and preamplifiers can be upgraded to the new technology for substantially less than the cost difference of a new component. Perreaux's classic styling will never appear out of date. You do not purchase Perreaux...you invest in Perreaux.

With your investment in Perreaux, comes the assurance of the highest level of service.

Perreaux is available only at the finest audio specialists. Personnel, trained by Perreaux, both sales and service, have a thorough understanding of each component. They will be happy to install a Perreaux system in your home and be sure it is operating properly. If by chance, your Perreaux should require service, it is backed by the longest warranty period in the industry. We assure you in writing that Perreaux's value is unsurpassed.

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GOING AGAINST THE GRAIN

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etc.

How can Belles Research, an American manufacturer, compete against all these products from the Orient? Quite easily.

Belles Research audio components are all *handcrafted*. Each transistor is tested, calibrated, and matched by Belles. No cost cutting integrated chips are used in the signal path or power supply. Costly polyester and polypropylene capacitors are used throughout. All resistors are metal film with 1% tolerances. Connectors are machined nickel cadmium, knobs are machined from solid aluminum. Belles power amplifiers require *no protection circuitry* whatsoever and can therefore deliver high current into *any speaker load*. Belles preamplifiers accept low output moving coils straight through with a single gain stage.

Which of these competitors from the Orient offer you all of this? None, not a single one. Some are even more expensive than Belles, considerably more.

What's accomplished quite easily by us, must be difficult for them.

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"THE HOLY GALE!"
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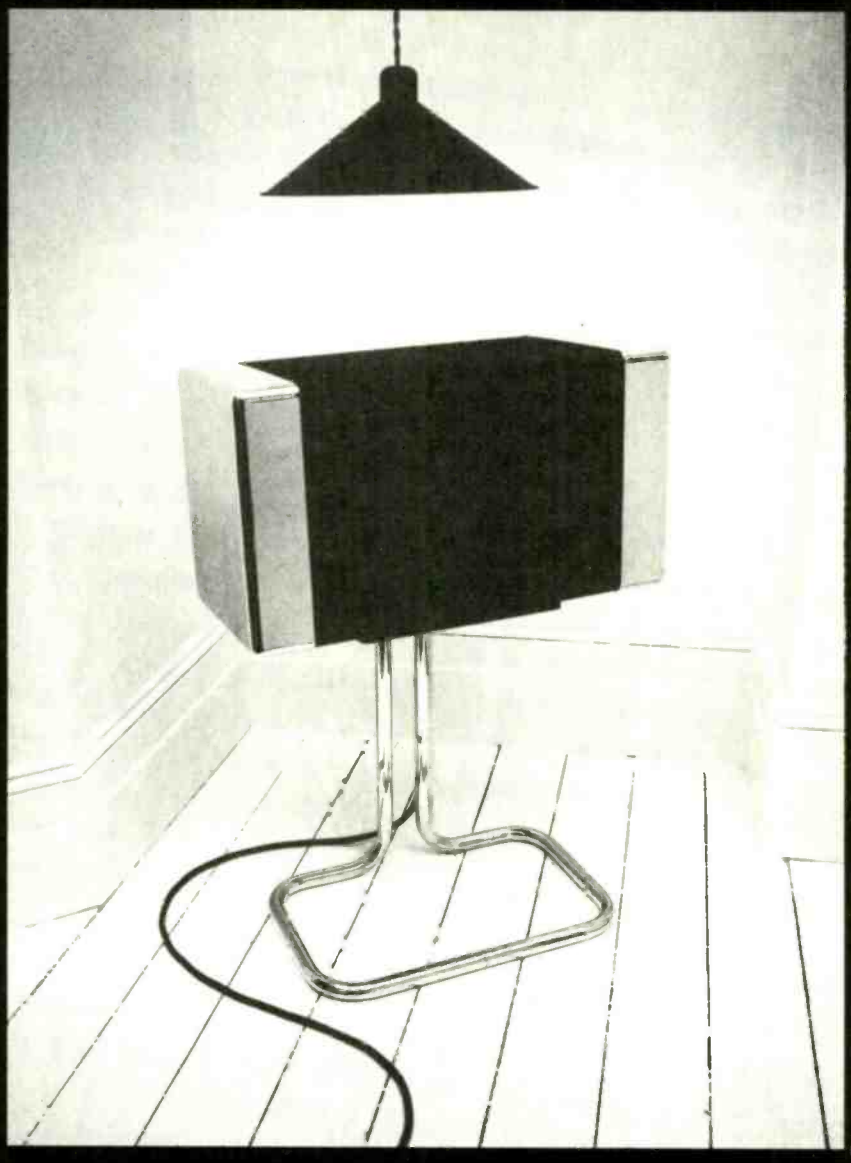

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TWICE-TOLD TROIKA

Stravinsky: The Soldier's Tale; Shostakovich: Piano Concerto No. 1; Prokofiev: Classical Symphony. The Los Angeles Chamber Orchestra, Gerard Schwarz; Carol Rosenberger, piano.
Delos D/CD 3021.

Some record companies are beginning to respond to complaints from consumers who object to CDs having very short playback times. This new Delos CD certainly addresses the problem by providing a whopping one hour and 58 seconds of music. Furthermore, the program is very interesting and well-balanced, not just a compilation of some fillers. It begins with Stravinsky's "The Soldier's Tale," continues with Shostakovich's spritely and sophisticated "Piano Concerto No. 1," and the Compact Disc concludes with the delightful "Classical Symphony" of Serge Prokofiev.

All three works are recorded with demonstration-quality sound. There have been some comments in the British press that "The Soldier's Tale" was recorded too close-up; however, I quite disagree with this viewpoint. I have heard many recordings of this work done with a more distant perspective, which just doesn't work. The interplay between the seven musicians is quite intricately scored and must be recorded so as to provide absolute clarity. When I made a digital recording of this work for Matsushita, with the Marlboro Festival Chamber players, I employed just about the same high-presence miking perspective as engineer Bruce Leek has done here. In neither my recording nor Bruce's is the sound clinical—we both wrapped our highly detailed sound in a warm, spacious ambience. The sound on "The Soldier's Tale" does, indeed, have good clarity, along with sharp transients and fairly wide dynamic range.

The "Piano Concerto" and the "Classical Symphony" were recorded by my dear friends Marc Aubort and Joanna Nickrenz, classical recording engineers par excellence. They lent these two works an entirely appropriate perspective and balance which afford a most natural sound, yet maintain good definition. In the "Piano Concerto," a fine balance is struck between the piano and orchestra, so that one never

swamps the other. Marc and Joanna have also managed to record the extra bass notes on the Bösendorfer Imperial Concert Grand piano with fine articulation and great sonority. Carol Rosenberger provides a really insightful performance of this infrequently performed piece, and Stephen Burns displays brilliant trumpet work in the frenetic finale of the last movement.

Gerard Schwarz, virtually Delos' house conductor, gives well-balanced, musically satisfying performances of these works, and his Los Angeles Chamber Orchestra is obviously a very polished ensemble. Interesting music, good performances, exemplary sound—it all adds up to a winner!

Bert Whyte

Stravinsky: The Soldier's Tale; Shostakovich: Piano Concerto No. 1; Prokofiev: Classical Symphony. The Los Angeles Chamber Orchestra, Gerard Schwarz; Carol Rosenberger, piano.
Delos D/CD 3021.

Most classical record companies issue the same program sequences on CD as on LP and cassette. However, Delos is, where possible, tailoring their newer Compact Disc releases to the inherent one-hour-plus playing time that this medium can easily handle. The first of these is a combination of Russian masterpieces previously released on two LPs. Delos is to be commended for this, and the consumer should now begin to take note that minutes-per-dollar may eventually make the CD, even at present prices, a better bargain than the LP!

Two of these works have been reviewed previously in LP form, and on CD we hear them even clearer and cleaner. Ms. Rosenberger's rich piano sound is a near perfect foil to the incisiveness of Stephen Burns' trumpet obbligato, and the fullness of the orchestral texture belies the modest size of the group. The "Classical Symphony" is given a quick performance, perhaps the shortest on disc, but one that works. Schwarz has found the delicate boundary between brisk and rushed playing and has stayed on the right side

One of the great strengths of the Los Angeles Chamber Orchestra is the caliber of its principals. The Stravinsky piece is presented in a near flawless performance, with the precision of attack and accuracy of intonation characteristic of a chamber septet that has played together for years.

Highly recommended.

John M. Eargle

Classic Caféhaus Music. The Salon Orchestra.
Pro Arte CDD 136, digital source. (Available from Pro Arte Records, 14025 23rd Ave. North, Minneapolis, Minn. 55441.)

This is the second CD I've heard from the extensive collaboration between Germany's Harmonia Mundi and America's Pro Arte Records.

The music harks back to the gentler times when the famous coffeehouses

Telarc's CD of excerpts from *Romeo and Juliet* has awesome sonority and impact, with quite possibly the widest dynamic range of any CD yet released.

of Vienna and Berlin featured salon orchestras. One would partake of sinfully rich pastries topped with mounds of *schlag* (whipped cream), washed down with copious cups of *moka-java*. The accompanying music was as saccharine as the pastries and could be more generally described as "schmaltz."

This CD has as literal a re-creation of that music as I've ever heard, from the Salon Orchestra of Cölln. Corny though it may be, it is a very good digital recording. The strings and woodwinds are exceptionally clean, and one can notice a bit of sharp, accurate percussion in a few numbers. The most familiar piece on the program is "Jalousie" (Jealousy), while the other works are of the I-know-it-but-can't-remember-its-name type. This music is not for everyone, but for older folks of European lineage, it may rekindle fond memories of a better time. *Bert Whyte*

Prokofiev: Romeo and Juliet, excerpts from Suites 1 and 2. The Cleveland Orchestra, Yoel Levi.
Telarc CD-80089.

There are many recordings of excerpts from Prokofiev's *Romeo and Juliet*—some of them of considerable sonic merit. This Telarc recording of 11 excerpts from the ballet, with Yoel Levi conducting the Cleveland Orchestra, is a simply stunning and overwhelming sonic experience. Levi's performance, which is quite good, is not quite on the inspirational level of Sir Georg Solti's, Andre Previn's or for that matter the fine performance of the complete ballet conducted by Lorin Maazel with the same Cleveland Orchestra.

Jack Renner and producer Bob Woods have been championing the conducting of Yoel Levi, who was Resident Conductor (not to be confused with Music Director, who is the principal conductor) of the Cleveland Orchestra from 1980 to 1984. I can understand their enthusiasm, for he is showing great promise at an early stage in his career.

Renner used his familiar three omni Schoeps mikes in a spaced array. The venue was Severance Hall, where Jack has made many recordings. He knows how to get the best sound from this good, but tricky, space.

Using Telarc's Soundstream digital recorder, Jack has given us a recording of awesome sonority and impact, with quite possibly the widest dynamic range of any CD yet released. There are, of course, many lovely, tender, ethereal moments in this fabulous music, which the Clevelanders play like angels. Then, I give you fair warning, there are truly terrifying parts; for example, on cut eight, "The Death of Tybalt," the music careens at you at a frantic, frenetic pace, the strings and other instruments playing furioso. This develops into huge fortissimo passages, with blaring trumpets, French horns, growling bass trombones and tuba, all accented by cataclysmic thunder from bass drum, crash of cymbals and a huge tam-tam that explodes into a zillion harmonics! In other words, a real speaker-killer, so play with caution. The overall sound is clean and well-balanced, with superb definition. One other point: Much of the high string scoring in this music is marked to be played with great vehemence and searing intensity, so don't mistake this sound for a digital glitch.

This is the sort of recording that justifies the Compact Disc format. A most satisfying and exciting musical and sonic experience from Jack Renner and Telarc. *Bert Whyte*

Stars & Stripes: The Cleveland Symphonic Winds, Frederick Fennell.
Telarc CD-80099.

Telarc recordings featuring Frederick Fennell and the Cleveland Symphonic Winds always receive an enthusiastic reception. In his new *Stars & Stripes* CD, Freddie has another blockbuster. In looking over the contents, I see works familiar from the recordings he made for Mercury years ago, such items as Samuel Barber's "Commando March," Sousa's "Stars and Stripes Forever," "Anchors Aweigh!" and two favorites of mine, Ralph Vaughan Williams' "English Folk Song Suite" and Percy Grainger's "Lincolnshire Posy." (I recently did some experimental digital recording with our local high-school wind ensemble playing "Lincolnshire Posy." Their enthusiasm outweighed their skills of execution, but they are great people, the hall is good and the music is wonderful.)

THIS MONTH'S BIG EVENTS ON CBS COMPACT DISCS.

JANUARY

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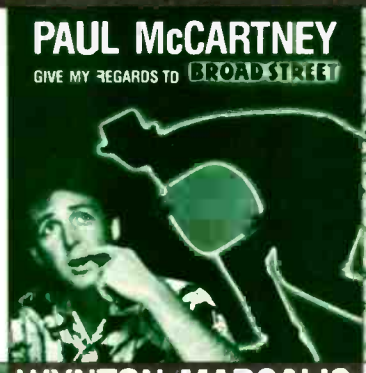

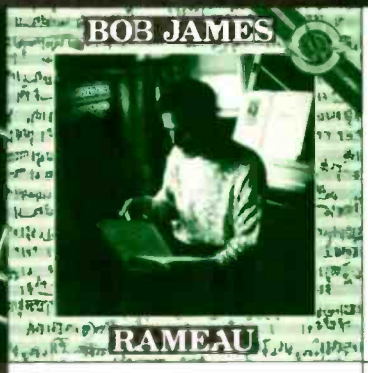

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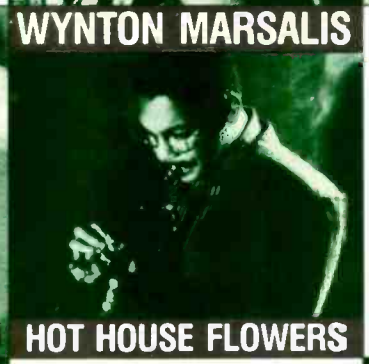

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16

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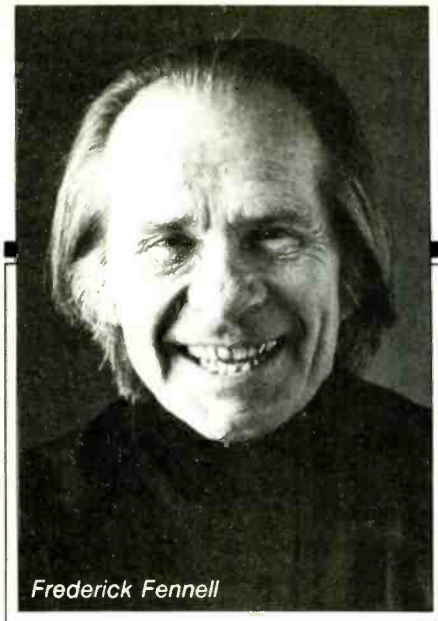
Frederick Fennell

Frederick Fennell has another blockbuster with *Stars & Stripes*; the brass fanfares and huge drum thwacks are positively visceral.

This CD starts with the well-known "Olympic Fanfare," which Telarc obviously felt was quite appropriate for 1984.

Jack Renner used Severance Hall as his recording locale, but apparently slightly modified his familiar three omni Schoeps mikes in spaced array by using Brüel & Kjaer mikes. I do not know if these were in addition to the Schoeps or merely used as substitutes. In any case, the acoustic perspective is slightly more distant than Jack usually employs. There is a bit more air around the instruments, but I hasten to add that playback at higher levels provides the proper impact.

As usual, the Cleveland Winds make a great sound, and there are brass fanfares and huge drum thwacks that are positively visceral! Freddie has a way with this music, and his performances are as insightful as ever. In spite of the massive weight of some of the climaxes, everything remains clean. This is big loudspeaker/big amplifier music and, heard in this manner, it is a thrilling experience. If you have a lease to break, this CD is highly recommended. *Bert Whyte*

William Walton: Symphony No. 1. The Scottish National Orchestra, Sir Alexander Gibson.
Chandos CHAN 8313.

William Walton's monumental symphony from the '30s has rarely made it successfully onto disc. Outside of Walton's own monophonic version with the Philharmonia Orchestra on EMI, the only other really successful version is Previn's now-deleted mid-'60s performance with the London Symphony Orchestra on RCA.

There are two problems. First, the work is fiendishly difficult and requires more rehearsal time than most recording companies are willing to allow. Second, pacing is very critical. The fast sections must maintain their drive; otherwise, no momentum is generated. There is also a tendency, as in the case of this recording, to take the slow movement a little faster than it should be taken.

While not the first-rate recording that I am looking for on CD, the present version will more than adequately serve to introduce this powerful work to those who do not know it.

The recorded sound is excellent and the playing serviceable.

John M. Eargle

Discovered Again: Dave Grusin
Sheffield Lab CD-5.

This was a highly regarded recording in the original direct-to-disc release. The CD, derived from the analog master reference tape, is an excellent transfer. In comparison to the original, it does not quite match the immediacy of the transient attack on piano, vibes, and percussion; bass is also a bit fuller and more extended on the direct disc. However, I'm splitting hairs, for the sound is really first-class and has the advantage of no impulse noises or other record surface anomalies. A slight amount of tape hiss, evident at fairly high playback levels, betrays the analog origin of the tape.

Dave Grusin wrote all of the fine arrangements for the music on this CD and also composed "Keep Your Eye on the Sparrow," "Sun Song," and "Adeus a Papai." "A Child Is Born" is by jazz great Thad Jones, and the spritely, upbeat samba, "Captain Bacardi," is by Antonio Carlos Jobim, well-known for his music and his collaborations with Frank Sinatra. David plays most expressively on a lovely sounding Steinway Concert Grand piano. His top-notch sidemen include Ron Carter on full-sized acoustic bass (its rich sonority is beautifully recorded), the great Lee Ritenour on guitar, Harvey Mason on drums, and Larry Bunker on percussion.


Dave Grusin

The sound is recorded close-up but is softened by some moderate reverb. All elements are very clean and articulate. In the selections where vibraharp is used, especially the opening of "A Child Is Born," there are some very high-frequency, high-energy transients that could raise havoc with some loudspeakers if the playback level is too hot! If you liked the D-to-D or missed it when it was first released, you'll be very happy with this version.

Bert Whyte

Greatest Hits: Joan Baez
Vanguard 811 677-2.

Finding old folkie material by Joan Baez on a Compact Disc at first seems as incongruous as seeing a barefoot hillbilly hopping a ride on the Concorde. Nevertheless, the advanced technology of the CD nicely complements the simplicity of these early arrangements, adding clarity and presence to this classic American music.

Baez's gorgeous soprano is captured splendidly on this CD of her 1983 analog *Greatest Hits* package. For the most part, these 16 selections spotlight Joan and her own acoustic guitar accompaniment. The material from the early '60s tends to present only Baez's piercingly clear, silvery voice, floating dead in the center, with just a murmuring wash of her guitar, while the later material is gussied up with bass, drums, pedal steel guitar, vocal backup, and, occasionally, horns. Yet even in these later, more orchestrated recordings, such as "The Night They Drove Old Dixie Down," Joan's voice—darker and richer, more golden than silvery—remains the aural focal point.

Just once, on "Will the Circle Be Un-

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— Norman Eisenberg, *Ovation*

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Ohm makes much of the imaging qualities of this speaker, and it certainly lives up to those claims. A demo record produced by Ohm provides convincing evidence that the Walsh 4, playing a variety of commercial music recordings, is capable of generating distinct spatial images that are apparent from almost any position in the room. For example, Leroy Anderson's musical typewriter moves with the impressive smoothness between the speakers, with not a trace of the vague, uncertain, or erratic position shifts that we observed with some other speakers.

In case I have not made the point sufficiently clear, this is a superb-sounding speaker — not inexpensive by any means, but worth every cent of its price.
— Julian Hirsch, *Stereo Review*

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Joan Baez

The gorgeous soprano of Joan Baez is captured splendidly on *Greatest Hits*, and CD technology complements the simplicity of the early arrangements.

broken," the great traditional folk tune associated with The Carter Family, Baez's voice is permitted to fall back and blend with a massed chorus of voices. On Bob Dylan's "It Ain't Me Babe," her voice is shunted to the side, almost arbitrarily pushed into the right channel; there seems to be no sound reason for this peculiar production choice. This cut is further marred by the strange, compressed quality of the singer's voice, standing in marked contrast here to the clarity of her guitar, which sqeaks maddeningly and persistently as Baez runs her fingers over the strings.

Tape hiss is a bit of a problem throughout this recording as well. Although it is generally unobtrusive white noise in most cuts, occasionally it becomes a conscious annoyance. The noise in that classic lament, "House of the Rising Sun," battles Baez's beautiful tones for the listener's attention. These few problems pale in the shadow of the generous quantity of extraordinary music (almost 54 minutes worth) offered here. This digitally engineered trip into America's recent musical past will leave you soaring in the stratosphere, right up there with Baez's high-flying vocals.

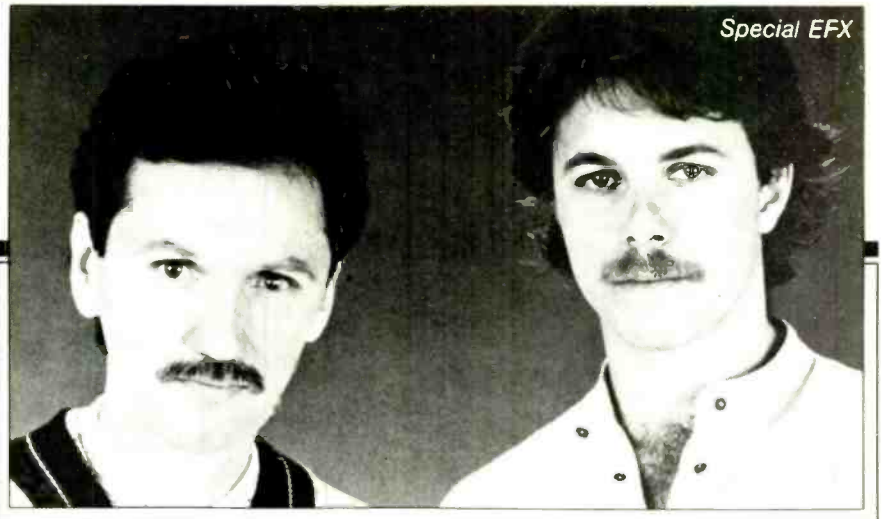
Too bad the album jacket provides no information on these now-historic recordings. Baez doesn't perform much anymore; new listeners coming fresh to this material, some of it two decades old, might find even more riches here knowing the context in which it was created. The other musicians involved deserve some credit too. The CD is unquestionably an outstanding vehicle for music, but its packaging can still be pretty down-home primitive. *Paulette Weiss*

Special EFX
GRP Records GRP D-9505.

This is a delightful digital discovery: Light, sparkling jazz fusion with a twist of Brazilian, African, and Latin percussion. It is one of the still-rare pop offerings in the CD format that is an original digital recording, and the resultant quality of the sound is a real treat.

Special EFX is headed by Chielli Minucci, guitarist and chief composer, and George Jinda, percussionist and composer. Both have extensive experience performing and recording with numerous established jazz and pop artists. They are supported by four talented New York studio musicians. With this background, it is hardly surprising that *Special EFX* is awash with the highest technical proficiency. Don't let the slickness of the surface fool you

Special EFX has subtle instrumental interplays and aural special effects that bubble up from below and tickle the pleasure centers of your brain.



into thinking this is merely attractive jazz-flavored background music, though. There are depths here that are revealed and enhanced by the clarity of GRP's superb digital presentation.

Besides the obvious beauty of some of these melodies—"Forever Hold Your Peace," "Sambuca Nights," and "Much Too Soon" will quickly lure you back for second and third rounds—there are subtle instrumental interplays and aural special effects that bubble up from below and gently tickle the pleasure centers of your brain. The wonderful percussion effects on "Forever Hold Your Peace" will draw your listening well below the pretty surface. Particularly intriguing here is an almost subliminal percussive echo in the right channel which creates a feeling of space and distance. One of the so-called percussion instrumentals on this delicious cut is actually created on a keyboard; Robbie Kondor adds the neat synthesized tabla to this already heady brew.

For a change of pace, "The Slug" creates a world of crawling, crackling, twittering insects with a variety of shakers, whistles, and birdcalls, as well as with some standard instrumentation. The digital recording is particularly impressive here, the tiniest of chirps and rustlings come through vividly, and the sense of space expanding in all directions is brilliantly created with sensitive left-right channel placement and consciously crafted depth perspective.

This CD's extended dynamic range is a knockout as well. From the belly-to-the-ground movements of "The Slug" to the thumping drums and swelling instrumentals which guide "Safari" through a fantasy jungle, this little CD handles it all with finesse and without a hint of distortion.

Special EFX is a group of bright, talented, young musicians whose only fault may be in trying to distill too much music into too few selections. These eight cuts were originally uncorked under the stewardship of producer Chris Hinze on an LP called *Special Delivery* on Holland's Keystone label. GRP's Dave Grusin and Larry Rosen brought this "import" back home via Japan, where the CD was manufactured. I'm glad they did. *Paulette Weiss*

EDWARD TATNALL CANBY

THINK OF TWO

Think of One: Wynton Marsalis
Columbia FC 38641.

Trumpet Concertos: Haydn, Hummel, L. Mozart. The National Philharmonic Orchestra, Raymond Leppard; Wynton Marsalis, trumpet.
CBS IM 37846, digital.

This dual review is late—I took one look at the pair, "classical" and "pop," and put them aside for some intense study, when I had lots of time. It was going to be time-consuming, especially if I disliked one or the other.

Far from that! I began, of course, with the jazz record, *Think of One*. I am a very casual jazz listener, especially to that generously large category, "modern jazz," much of which is now less modern than The Beatles. To use an equally ancient phrase, it doesn't turn me on very often. But, in this case, every bit of my musical sensibility was instantly turned on. Yes, a fabulous trumpet technique, in the fullest tide of youth. But so much more: The sheer *musicianship*, to use one of our favorite words, is just astonishing. So much, so simply. The most wonderful sense of rhythm, of exquisitely, casually exact longs and shorts and, notably, silences! I'm far from the first to say so, but here I felt in the presence of sheer musical genius, recorded. Not always spectacular, either—there is a curiously right humbleness in the man's playing, an understanding of the whole music, not just his own solo role, and thus an ability to get out of somebody else's way when the moment is right. Then—in the fast items—the tempestuous, incredible drive! I played the record twice *before* I turned to the classical disc.

I had expected the worst in the *Trumpet Concertos*. How many dozen "virtuoso" renderings of these trumpet works had I heard, each performance more routine than the last? But after the jazz disc I was prepared for what I found. Perfection. Total perception and understanding.

What *is* wrong with the three easy-going concert showpieces (bridging the "Mozart" style from Mozart's father, Leopold, through to the then rather old-fashioned Hummel work, 13 years after Mozart's death) is not with Wynton Marsalis but in the "classical" orchestra. His playing is impeccable; the orchestra's is, by contrast, sloppy. The well-known conductor does what he can, but the musical phrasing and shaping is never more than so-so, as though this were a first run-through of the notes. Maybe it was just that? As a classical soloist, Marsalis puts these classical professionals to shame.

Genius appears in all sorts of ways and places, but it does have a common characteristic in every case—an incredible, intuitive and almost effortless understanding, as well as technique, where others of lesser ability labor for years to accomplish half as much. You want to hear genius in the flesh (live on tape?), try this man. And get both recordings.

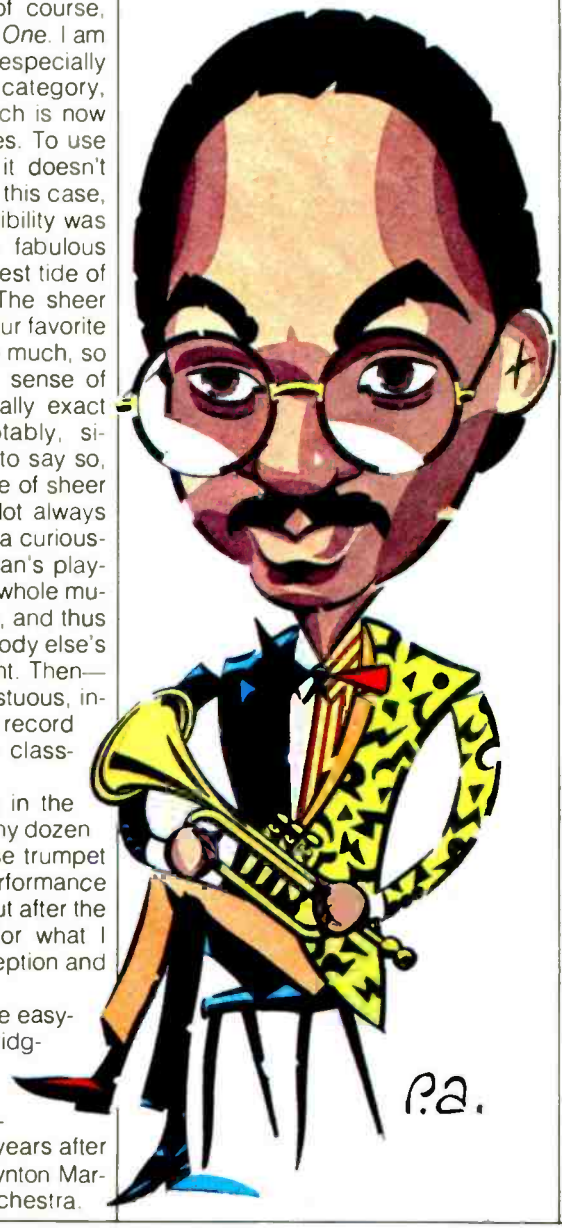


Illustration: Philip Anderson

The Iberian Baroque Organ. Esteban Elizondo-Iriarte.
Titanic TI-41, $10.00.

This is a most unusual organ recording, offering vivid sounds of an organ of 1761 inside an ancient and picturesque Spanish church, for an almost barbaric splendor of tone color.

The organ is a curious one, a few more than a dozen discrete stops—including such Spanish oddities (not counting the Mighty Wurlitzer!) as sleigh bells, drums and bird sounds as well as bells and a battle trumpet, many of these effects playable on only half of the single, very short (45-key) keyboard. Except for maintenance, the organ would not seem to have been revised in these more than two centuries—astonishingly, it still evidently depends on human wind pumps. I didn't know there were any such man-powered organs left.

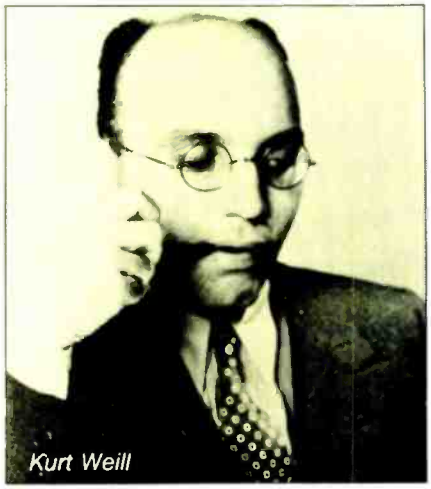
But the sound of this small instrument is gigantic and powerful, in a selective way, dominated by the great trumpet tones and an echo effect of impressive impact. No wonder the organ was the King of Instruments—such powerful noises, far beyond any other music, controlled by a single human being with no more than a simple, light touch! In that age before our industrial beginnings, this was the Machine of Machines, rivalled only by the instruments of war, the cannons and guns and bombs.

As the above implies, these sounds are gorgeously recorded on this disc. The space seems enormous, the organ overwhelmingly vast, the echo miles deep. Very long reverb helps, but mike placement is superb. The music begins on side one with rather unfamiliar early stuff, for the most part strange to the ears but interesting. On side two, later and more familiar music builds to greater interest and variety. All of the music seems overlain with a "Spanishness," an almost primeval, outlander coloration that easily relates, in the mind, to the familiar Spanish qualities in other art forms.

Kurt Weill: String Quartets in B Minor (1918); Quartet No. 1, Op. 8 (1923). The Sequoia String Quartet. **Nonesuch 79071,** digital, $11.98.

Nonesuch has been broadening our sonic knowlecge of this now well-known composer with some remarkable new material—see *The Unknown Weill* for songs. Of course, you must understand that, at the beginning, Weill was 100% a "classical" composer. He made his transition to more popular (modern sense of the word) sounds and to theater music by degrees, in fits and starts, going back even before the *Three Penny Opera*. These are indubitably string quartets in the long "chamber music" tradition, but, if you know Weill at all, you will hear fascinating hints as to what was to come in these works of his youth, composed when he was 18 and 23.

The original "B Minor Quartet" (known only after the 1960s and from a copy of a copy) suddenly turned up, stashed away in secret—even from Lotte Lenya, Weill's wife—by Weill's sister-in-law. It's lovely; you can't help liking it. At 18, this youth was a brilliant, wide-open student of such as Busoni, and was doing his master and the other musical big shots in his world the usual student obeisance, with superb and lively imitations. You'll hear Strauss, Mahler, fugues out of Busoni or Reger, the whole German post-Romantic bit, but in an effervescent, youthful way. And such expert writing for the string medium! It sounds out beautifully.


Kurt Weill

Why is the later quartet "No. 1"? Easy to guess. By 1923, the Roaring Twenties were off to a noisy, blatty start and Weill's early, juicy idiom was already very much out of date. It had tail fins. He was embarrassed; he wrote a new piece which has a little bit of everything that was newer, including Hindemith (quite a lot) and Schoenberg (just a trace). It was a much more mixed product, expert but not nearly as cohesive, as sure of itself. But even so there are tidbits out of the later Weill that will speak to you if you are a Weill fan, including one of the first of the famous marches that stalk through so many of his theater works.

The Sequoia String Quartet, known for its special ability in all sorts of contemporary music, is really very fine here, entering wisely into the spirit of this music, especially the earlier quartet on side one. Nothing dry and academic about this group! They play with heart.

Note that the early quartet had never been recorded, was probably never publicly performed in Weill's lifetime, and is still unpublished. This performance comes from copies, in Weill's handwriting, of the original, rediscovered manuscript. Almost 80 years later! The parallel with Schubert's "Unfinished" is inescapable. That work, too, was hidden by a relative (Schubert's brother) and unknown for decades after his death until the inquisitive Sir George Grove, of *Grove's Dictionary of Music*, managed to get his claws on it for its first performance. But now, typically, we hear the Weill in a recording, which gets it "out" and into circulation far faster than any live performance could do. Are recordings important for music?


Photo courtesy of The Asia Society

Drums and Voices of Korea. Samul-Nori. **Nonesuch Explorer 72093-1,** $5.98.

South Korea is not exactly part of the well-known Eastern Bloc, but in cultural terms it operates as though it were, at least in the export of folk and traditional arts. This disc was hardly recorded "in the field"—it originates at Right Track Recording, New York City, where the professional traveling company stopped off en route. The sounds, then, are the result of the usual transmogrification, from the ancient product of local farmers and the like into a slick and effective international road show. By no means a bad thing! The timeless, persuasive essences of these cultural traditions surely are made as accessible as they ever can be to the outsider, unless you are an anthropomusicologist (better known as ethnomusicologist) who goes out to live with the ancient peoples.

It's no accident that most such traveling companies go in for elaborate costumes and decorative instruments, as well as plenty of dancing or other lively motion. Definitely, it's a matter of sound and sight for the audience. And here we have the sound only. That sums up this recording: It is somewhat monotonous because the visible element is missing, notably on the rather tedious and repetitive first side—after

Emanual Ax is always a forceful, outgoing, and strong pianist. I would buy this record just for the wonderfully hearty and intelligent playing.

all, and even with the accompanying account, we don't really know what is going on. Just a lot of drums and very loud gongs, plus occasionally a wildly excited male voice which we hear half singing, half shouting, incomprehensibly. What else?

Even so, these four young Koreans put out such phenomenal amounts of energy that before the frenzied end of side two you will have been carried right along. And the recording, as in all of Nonesuch's innovative Explorer series, is of top quality. Particularly good transients for the gongs and drums.

Weber: Grand Duo Concertant, Op. 48; Schubert: Arpeggione Sonata. Richard Stoltzman, clarinet; Emanuel Ax, piano.
RCA ARC1 4825, digital, $12.98.

First, it has to be said that this top-of-the-LP-line digital recording is, in my copy, one of the worst LP pressings I have heard for years. And at such a price? Pops and ticks, loud pistol reports throwing my stylus out of the groove in no less than four places, and a barrage of noise at the beginning of side two. Are big companies too big to keep up standards of quality?

I incurred some wrathful scorn when I did not much like Richard Stoltzman's clarinet in an earlier recording. He's a celebrity. I find some of the same here, though he does indeed have a good technique in the fingers and in the all-important breathing. But his clarinet sound is "different"—a thin, sharp,

Emanuel Ax

pointed tone (probably not easy to record) that becomes piercing in the high register. Matter of taste, of course, but I do feel here a tight, not very expressive nor easy musical personality who, at least in this mellow early Romantic music, simply does not "let go" in a musically persuasive way. It is intense but chilly playing. Perhaps a part of the clarinet's nature? Surely, yes, to an extent. And yet there are more human players, hundreds I would say, even including old Benny Goodman, not the greatest "classical" clarinetist, but at least with the courage of his confident personality! Stoltzman is surely more idiomatically at home in contemporary and mystical-type music, on the lines of Tashi.

As for Emanuel Ax, he is always a forceful, outgoing and strong pianist—curious partner for Stoltzman. I would buy the disc (pops and ticks aside) just for his wonderfully hearty and intelligent playing.

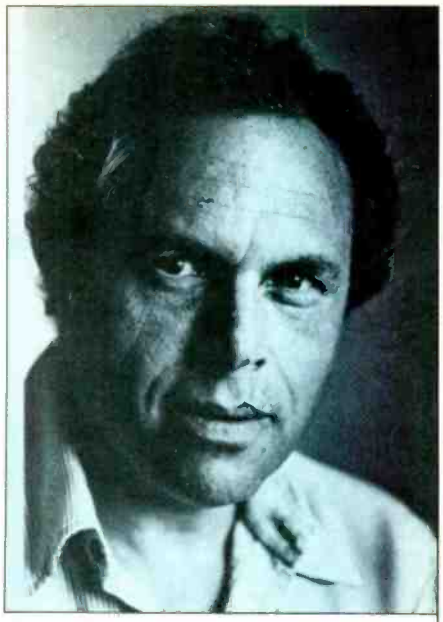
Note that the "Arpeggione Sonata" of Schubert, written for an instrument that never got off the musical ground—a cross between a guitar and a viola da gamba—was composed in Schubert's usual modest way for a friend who was promoting the instrument. The music is now usually heard on the cello, which has a range more or less like that of the nutty arpeggione, but it has been transcribed for other and higher instruments, violin, etc., and turns out to make a good clarinet piece in spite of a few somewhat clumsy spots that, so to speak, the clarinet doesn't like. Not one of Schubert's greatest sonatas, but anything by that composer is worth a listen.

P.S. This album is not brand-new—maybe RCA has since improved its Europadisc pressings to an acceptable grade. Europadisc is certainly capable of fine work, for RCA as well as for other labels.

Michael Colgrass: Déjà vu; Light Spirit. Jacob Druckman: Aureole. The Saint Louis Symphony Orchestra, Leonard Slatkin.
New World Records NW 318, $9.98.

It is good to find—and hear—that "contemporary" music is indeed slowly edging towards a wider acceptability without any necessary compromise.

Michael Colgrass



Jacob Druckman

Colgrass photo: Arnold Matthews; Druckman photo: Patricia Argiro

Popular taste may be low, as it always is, but it is in itself always "contemporary," too, in profound ways. A meeting of minds, and ears, is thus always possible—one might say, in spite of the traditional standoffishness of the professional composer.

No compromise with popular taste in these two composers, with two works for orchestra, one of them a sort of *concertante* with four percussion soloists, plus a "chamber" piece for a few instruments that sounds almost the same, at least on records. (The volume level is the same.) If we can enjoy and understand Beethoven without too much technical knowledge, so can we enjoy these sounds—they are wonderfully modern and highly colorful, as well as clean and bright via excellent recording. Background music? Much too energetic for that—but you will want to listen in the foreground. You will be persuaded to listen that way.

Both composers are percussionists of long standing and the music has that slant, which is pleasing to the modern ear. Terrific sonics, terrific virtuosity. With a very sizable orchestra on hand, these sounds and colors are fascinating even if they don't come over exactly like your local "beautiful music" FM station. More guts.

Colgrass, is his early 50s, looks like a grizzled sailor man, tough as they come, but he is both fierce and gentle, primarily the latter. His music is full of liquid colors, notably the watery sound of the vibraphone—you will guess that the man started out in jazz. His "Déjà vu" brings back a sort of evanescent theme or tune, vaguely heard all the way through and once in distant Victorian harmonies in faint strings—a fine synthesis of old and new. Splendid piece. Incidentally, it won a Pulitzer Prize a few years back—but don't let that discourage you. His other work, for a small group, is a decade earlier and a bit more didactically modern but not by very much (he was just moving away from a severe "serial" phase). I like Colgrass for his unusual combination of extreme technical complexity, in the writing and performing, and especially, of course, in the percussion. Yet this is combined with an easygoing and relaxed expression that gains your confidence.

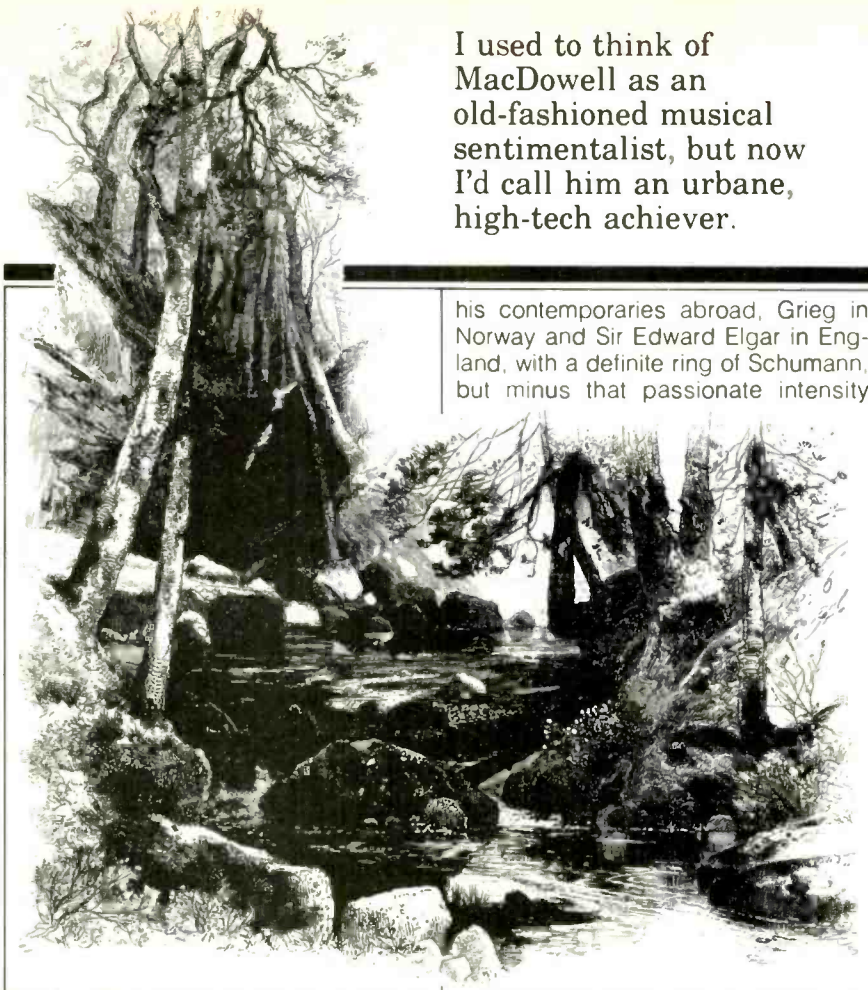
Jacob Druckman, out of a similar percussion background and with similar sonic forces, is more of a two-fisted man, a bit on the belligerent side, you could say. Common enough in percussion players! His music is somewhat harsher and bangier and at times really raucous—I didn't mind.

As I say, it is a beautiful recording from engineers Aubort and Nickrenz. Also, I should add, a gorgeous LP pressing, the quietest I've ever heard. No ticks, no rumble.

MacDowell: Woodland Sketches, Op. 51; Sea Pieces, Op. 55. Charles Fierro, piano.
Nonesuch 71411, $5.98.

My generation of music students cringed at the mere mention of MacDowell—that old-fashioned musical sentimentalist (so we might have said) who wrote about water lilies and wild roses. His kind of music was hideously out of favor—but then, so was Tchaikovsky for plenty of us. Not to mention Beethoven. A time of great prejudice. Just like us today, only different.

Nonesuch's MacDowell series sparked my interest—what would the



I used to think of MacDowell as an old-fashioned musical sentimentalist, but now I'd call him an urbane, high-tech achiever.

old boy sound like now, to my current ears? And what of our very young listeners?

Well, about what you might expect. An ambitious, hard-working pianist and composer, he was chosen to found the Music Department at Columbia University—as were composers Horatio Parker at Yale and, the first of all, John Knowles Paine at Harvard. (Paine Hall—what a name for a music building! That's where I learned my stuff.) MacDowell also had a brilliant and industrious wife who had plenty to do with his music, you may be sure. It was she who rescued "To a Wild Rose" from the wastebasket. She also founded the famed MacDowell Colony for artists and musicians, still very much in operation.

These men and a few more were our first school of classical composers, around the turn of the century. For any music at all to come from an American was then considered a small miracle and MacDowell rode high on it, writing the most popular music (in a classical sense, of course) of the day.

What do you hear? A big, fat piano, well recorded—put that first in our mag! A batch of short pieces, couple of minutes each, sounding fat, well nourished, a bit overly rich, sometimes *very* rich. The man curiously combines his contemporaries abroad, Grieg in Norway and Sir Edward Elgar in England, with a definite ring of Schumann, but minus that passionate intensity which makes Schumann so genuine in his feeling. I'd call MacDowell an urbane, high-tech achiever. That's what he'd be if he were around now. The music leaves me mostly indifferent though I'm aware of its very competent construction.

In any case, the school of turn-of-the-century American composers is now coming back, even the once little-known Griffes. Soon there will be Parker, Paine, Loeffler, Chadwick and Mrs. H. H. ("Ha Ha") Beach, the grande dame of Boston music. Between them all, there's plenty of hi-fi to come.

Michael Murray: Bach. Organs at First Congregational Church, Los Angeles.
Telarc DG 10088, digital, $12.98.

Eureka! With the establishment of the CD, the digital LP has come down to earth and at reasonable prices, though the discs are better than ever. Telarc has lopped $5 off its longtime and astronomical $17.98 per LP, for a now-average $12.98. London now puts out digital at $6.98 on its "second line" Jubilee label. Non-CD owners thus can rejoice for a while.

This LP is one of those I shouldn't have liked, being of a different philosophy than Michael Murray, at least in principle. But I did like it. Keep an open mind! You never can tell.

Murray is a French-style virtuoso, a late student of Marcel Dupré, and he plays best, and virtually always, on the larger, electrified Romantic-type organs (or the semi-composite, "classic," play-everything organs), from the great, early French types right up to the present. The old Baroque organ, modeled on those of Bach and earlier, is seldom for Murray, and one must admire his strength in not weakly giving in to current fashion.

The four Bach works played here, including one Vivaldi transcription and the well-known "Toccata and Fugue in D Minor," come forth from an organ that is decidedly not "authentic" to Bach's time. Inappropriate? It all depends. Depends on the organ and on the player. Whenever he wishes, Murray uses the big organ for all it can give, but, yes, the bigness is implied in the music, though it had a different sound in Bach's day. Moreover, these organs (two, electrically linked) strike my ear as fine instruments of their type and very well placed, so far as I can judge from the recording, in the large pseudo-Gothic church. There is surprisingly little muddy, long reverb, as one expects in any Gothic space: Is this one of those churches which were faced up with fake-stone sound proofing during the '20s? If so, the present die-away is plenty to avoid any dead effect, allowing the details of the music to come through superbly well. Again, these organs, or this organ, has lovely, shiny, clean tone colors to project the tiniest details of the musical texture, where many big old organs just roar, mostly unintelligibly. Not bad for Bach. (Is this Telarc recording trickery? I doubt it. A so-so organ is not going to be improved by close microphoning; it will sound so-so at any range.)

If you want real musical warmth as well as virtuosity, turn to Michael Murray's recordings of later music intended for large organs, 19th and 20th centuries. That's where his dedication goes. If you like high-tech, fine organ sound, good acoustics, remarkable fingers and toes—and top-notch digital recording—try this. Far as I know it's available as a CD, but don't think that the LP is that much inferior. It's a whiz of an LP.

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MICHAEL TEARSON
JON & SALLY TIVEN

LONG-PLAYING LEGACY

Illustration: Rick Tulka

Artistic Hair: Steve Goodman
Red Pajamas RPJ 001, $8.98.

Affordable Art: Steve Goodman
Red Pajamas RPJ 002, $8.98. (Available from Red Pajamas Records, P.O. Box 233, Seal Beach, Cal. 90740.)

Sound: B Performance: A

I knew Steve Goodman a little bit over the years. He was the most entertaining guitarist I ever saw go before an audience alone. He was a warm, funny, loving man devoted to his family. He kept his leukemia hidden from his fans as long as he could, and when he couldn't he courageously went public to try and inspire others similarly afflicted. He never gave self-pity a thought as he kept plugging along.

These are the last two albums Steve released before his death in September 1984, both on his independent label, Red Pajamas.

Artistic Hair is a collection of live performances gathered over a stretch of time. You really get a feel for the special magic Steve Goodman projected to an audience during his live shows. Steve never worried much about being slick or perfect, often playing stuff impromptu—as he does with "Winter Wonderland." He played a wonderfully diverse bag of tunes. Here, they range from the folk balladry of "The Water is Wide" and Shel Silverstein's hilarious "Three-Legged Man" through "When the Red, Red Robin Comes Bob Bob Bobbing Along," played hot, to such Goodman originals as "City of New Orleans," "Chicken Cordon Bleus" and "You Never Even Called Me by My Name," his sendup of weepy country music. The sound quality varies from track to track, but clarity is never a problem even if some numbers were before small, intimate club audiences and some in packed concert halls. *Artistic Hair* is the essential Steve Goodman album.

Still, *Affordable Art* is nothing to sneeze at either. It is part live performances (most notably the infamous "Dying Cub Fan's Last Request"), part studio stuff. Goodman's new songs on this album are his usual mixed lot. They range from the sentimental "Old Smoothies," which recalls the elderly Ice Capades waltz teams Steve saw as a child with his folks, to the whimsical "Talk Backwards" and the blackly humorous post-holocaustic "Watchin' Joey Glow." One nonoriginal is a duet with longtime friend and comrade John Prine on John's "Souvenirs." The album is a rewarding one, all the more so since Steve Goodman is gone now.

From what I hear, there is one more Steve Goodman album in the can that will be released. Until it is, you can mail-order these two if you can't find them in stores. *Michael Tearson*

Neville-Ization: The Neville Brothers
Black Top/Rounder BT-1031, $8.98.

Sound: B– Performance: B

The Neville Brothers are a crack, funky band from New Orleans that can play nearly anything. From the Little Willie John standard "Fever" through Duke Ellington's "Caravan" (taken at a slinky lope) and brother Aaron Neville's great hit "Tell It Like It Is" to Bobby Womack's "Woman's Gotta Have It," the second-line rhythm of "Big Chief" and The Meters' funky "Africa," The Neville Brothers display dazzling and diverse chops.

The album was recorded live on September 24, 1982, at Tipitina's, one of the top clubs in New Orleans. That live-performance party feel is what elevates *Neville-Ization*. Fans of that special brand of New Orleans rock and funk won't want to miss this. It may not quite have the killer edge I was looking for, but it has the groove nailed down cold. If The Neville Brothers can't make your feet move, you've got no soul left. *Michael Tearson*

Rickie Lee Jones

Country Boy: Ricky Skaggs
Epic FE 39410.

Sound: B+ Performance: A

Ricky Skaggs has emerged as a bona fide country-music superstar with his staunchly traditional approach and his tart, unsweetened recording work.

Country Boy is an exemplary Ricky Skaggs album. Even though he didn't write any of the songs, he makes them his own. Highlights are rampant, as there isn't a duff track here. Still, I feel obliged to mention the performances on Albert Lee's "Country Boy," with its breakneck guitar part; Peter Rowan's "Rendezvous," and the Bill Monroe instrumental, "Wheel Hoss," which features a guest appearance by Bill Monroe himself.

Country Boy is a beautifully recorded album that warms my heart. It is a class act from end to end, inside and out. It doesn't pull punches, representing country music at its sincerest and purest. *Michael Tearson*

Down South: Doc and Merle Watson
Sugar Hill SH-3742, $8.98.

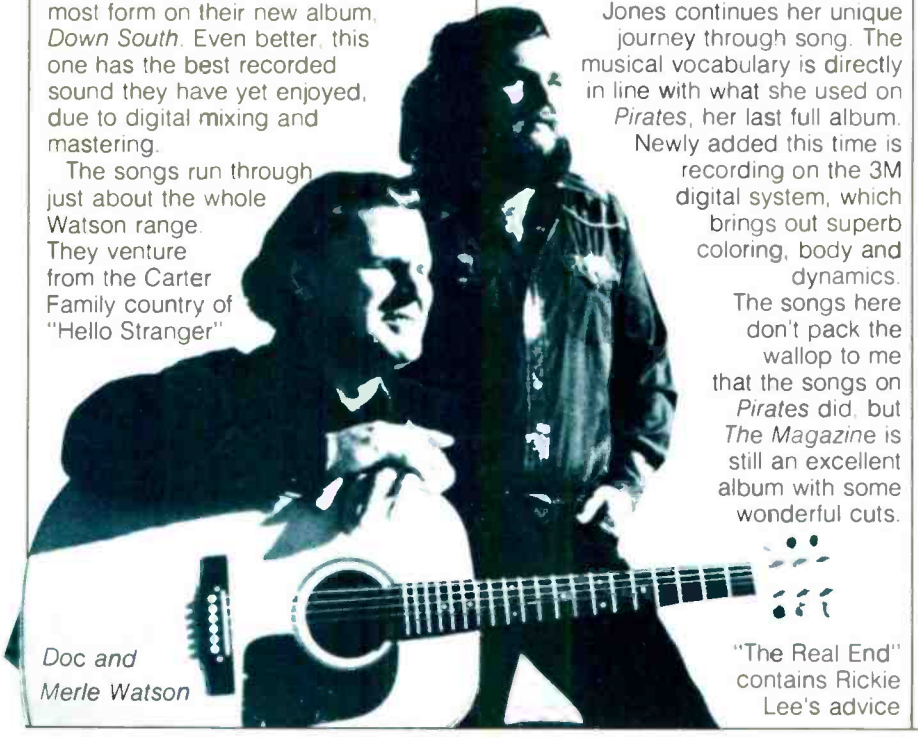
Sound: A– Performance: A

Doc and Merle Watson are in topmost form on their new album, *Down South*. Even better, this one has the best recorded sound they have yet enjoyed, due to digital mixing and mastering.

The songs run through just about the whole Watson range. They venture from the Carter Family country of "Hello Stranger" and "Coal Miner Blues," through lots of traditional gems like the funny "Fifteen Cents" and "Hesitation Blues," to a sad "Cotton Eyed Joe" and a reverent "What a Friend We Have in Jesus." We even get an instrumental showcase for the Watson guitar wizardry in "Twin Sisters," which also features Sam Bush on fiddle.

The pickin' is absolutely first-rate, but to me the excellence in recording technique is the real star of the record. It projects closeness, intimacy, and warmth.

Down South is one damn fine record, without pigeonholes like folk or country. It is an essential Doc and Merle Watson album. *Michael Tearson*



Doc and Merle Watson

The Magazine: Rickie Lee Jones
Warner Bros. 25117, $8.98.

Sound: A– Peformance: B+

With *The Magazine*, Rickie Lee Jones continues her unique journey through song. The musical vocabulary is directly in line with what she used on *Pirates*, her last full album. Newly added this time is recording on the 3M digital system, which brings out superb coloring, body and dynamics. The songs here don't pack the wallop to me that the songs on *Pirates* did, but *The Magazine* is still an excellent album with some wonderful cuts.

"The Real End" contains Rickie Lee's advice to the lovelorn modern woman on how to keep her man secure and guessing at the same time, and it's backed with a perfectly glorious melody. "It Must Be Love" has the effervescence of a real hit. These are pop songs, but that is not all the lady is up to here. She stretches out on broader canvasses with the suite "Rorschachs," which covers much of side two. Part spoken, part sung, part instrumental, it is a risky piece that may not be completely, satisfyingly successful, but the raw daring of it all and the evocative imagery are examples of why I am so outspoken a Rickie Lee Jones fan.

The Magazine is probably Rickie Lee Jones' most gratifying album, coming as it does hard on the heels of a swamp of personal problems. It reveals her as a full-fledged survivor. *Michael Tearson*

EB 84: The Everly Brothers
Mercury 822 431-1, $8.98.

Sound: C+ Performance: A–

EB 84 marks The Everly Brothers' return to the recording studio after more than 10 years. Produced by life-long Everlys fan Dave Edmunds, it is all anyone could hope it would be. They've got great players behind them, people like Edmunds, Albert Lee and Phil Donnelly on guitars, the wonderful Pete Wingfield on keys and synthesizers, Terry Williams and Gerry Conway

The Everly Brothers

on drums, and John Giblin on bass. Of central import, they have found some super material. The net effect is that the reunion stands on its own merits without the imperative of nostalgia.

Paul McCartney, another lifelong Everlys nut, has contributed one of the best songs he has penned in a decade, "On the Wings of a Nightingale." It is an eloquent, upbeat love song in the rich lyrical tradition of "Devoted to You" and "Let It Be Me." Jeff Lynne of ELO delivers a lovely ballad, "The Story of Me," which gets the full production treatment behind a grand arrangement devised by Lynne and ELO mate Richard Tandy. Paul Kennerly's "The First in Line" is yet another gorgeous ballad. Frankie Miller's "Danger Danger" fills the need for a raucous, rude rocker and has a surprisingly up-to-date, full sound. Bob Dylan's "Lay, Lady, Lay" proves a natural for The Everlys. Then there are the three songs Don Everly has written for the album, the ballads "Following the Sun" and "Asleep," plus the jaunty reggae of "You Make It Seem So Easy."

What is most remarkable is how fabulously well Don and Phil Everly are singing now. There's real maturity here in what Edmunds calls "the best instinctive singers I've ever heard." Their harmonies ring as true as true can be. They are the role models for two-part harmony singing in pop music.

EB 84 is a big relief for me. I've loved these guys' singing for about 25 years, and I dearly wanted *EB 84* to be a wonderful record. It is. Even more, it is a real class act. *Michael Tearson*

The Wild Life: Various Artists
MCA 5523, $8.98.

Sound: B Performance: B+

The past few years have shown a remarkable resurgence of the movie soundtrack as a viable way to launch new artists and sell loads of records. In the case of *Footloose*, it was an opportunity to bolster an otherwise undistinguished film with a few hit songs, the result being a monster hit movie and a multimillion-dollar record album. Irene Cara seems to have made a career out of singing theme songs to teen appeal films (*Fame*, *Flashdance*, and *D.C. Cab* to name but a few), and, through similar channels, Michael "Maniac" Sembello briefly attained stardom and then just as quickly regained obscurity.

Which brings us to *The Wild Life*, the soundtrack to a motion picture which we haven't seen but which apparently stands on its own as an interesting collection of one-offs. Mostly it's an introduction to a bunch of new artists MCA Records wants to give the big push to, as well as quirky solo projects by a few big names. Eddie Van Halen delivers a punchy instrumental entitled "Donut City" which is infinitely more listenable than anything on his group albums; Andy Summers sings "Human Shout" and doesn't stray too far off The Police mark. A duet by Louise Goffin (Carole King's daughter, and a fine talent in her own right) and The Go-Go's Charlotte Caffey almost comes off until they get to the awkward chorus of "No Trespassing," while newcomer Charlie Sexton serves up a tasty update of the 1966 Rolling Stones classic, "It's Not Easy," backed by Ron Wood and Keith Richards. Critical faves The Three O'Clock impress with "I Go Wild," Hanover Fist do their heavy best with "Metal of the Night," and, generally speaking, even the less exciting moments of the album are quite listenable. There may not be a blockbuster hit single on this album, but as a collection of tracks it's both credible and representative of today's music. *Jon & Sally Tiven*

Too Tough to Die: The Ramones
Sire 25187, $8.98.

Sound: C+ Performance: C+

After a string of patently unsatisfying albums, The Ramones are again doing what they do best. On *Too Tough to Die*, they play top-energy, head-bashing rock 'n' roll. Part of the credit for their resurgence must go to ex-Ramone Tommy Erdelyi, who has returned to coproduce with longtime studio engineer Ed Stasium. The sound is as subtle as a buzz saw, but that's The Ramones for you.

The boys are as adorably stupid as ever. Most of their songs still have their trademarked 1-2-3-4 interchangeability and delivery. There is a certified highlight just before "Danger Zone," as one Ramone asks, "What song are we doing?" Still, they stretch their formula with tinkly synthesizers on "Chasing

The Ramones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Roger Hodgson has maintained Supertramp's vivid, high-tech production, but his weighty, portentous lyrics don't help.

the Night," not to mention goofy keyboards and bells on "Howling at the Moon (Sha-La-La)."

As a return to their roots, so to speak, *Too Tough to Die* is a surprisingly good-natured and engaging romp through The Ramones' unique barbed-wire sensitivity.

Michael Tearson

In the Eye of the Storm: Roger Hodgson
A&M SP-5004, $8.98.

Sound: B+ Performance: C

If Roger Hodgson's first solo album after leaving Supertramp sounds like a continuation of that arty band's stuff, don't be surprised. Hodgson's seven selections here retain the bright, fluffy, lightweight confectionary feel of much of Supertramp's *oeuvre*. So, too, does the 7-minute (plus) length of four of the pieces. The lengths are a bit of a problem, as several of these tracks feel unnecessarily extended and drawn out. Less restraint in the editing would have helped. Hodgson's weighty, portentous, self-important lyrics don't make things any easier. On the plus side, he has maintained Supertramp's level of vivid, high-tech production even if it does seem a mite treble-happy here.

This one's strictly for the already converted Supertramp fan who misses the group in action. *Michael Tearson*


Roger Hodgson

. . . all the rage: General Public
I.R.S. SP-70046, $8.98.

Sound: B– Performance: B

Dave Wakeling and Ranking Roger formed General Public after The English Beat, which they used to front, went belly up in the summer of '83.

General Public is a natural progression from the sound of The English Beat. Just as The Beat evolved from energetic, jerky ska rhythms to a smoother, more sophisticated style, General Public enters with a bigger sound on record than The Beat ever used. They really try to project, with musical strength and confidence to back them up, but there is still an island feel permeating the album that is the connecting link to the previous band. Thus, alongside slick-feeling songs like "Hot You're Cool," the seductive "Where's the Line?" and the spooky "Anxious," you find real punchy ones like the timely "Matter of Fact" and the anthemic "General Public." Then there is the gorgeous heart song, "Tenderness."

General Public has begun its own evolution, but I do believe that with what they've shown the first time out, they will be around and about for a good long time and a long good time.

Michael Tearson

Metropolis
Columbia JS 39526.

Sound: B Performance: D–

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The Waterboys smooth a folkish, humanist overview atop deceptively simple rock riffs, elaborately performed.

director's original vision is a valiant and praiseworthy quest. Adding color through computer wizardry may or may not be. Adding a new electronic soundtrack as composed by Giorgio Moroder has not proved to be brilliant. While the electronics may dovetail beautifully into the thrust of the film, the sappy, stupid techno-pop songs Moroder has cowritten and produced do nothing but intrude. True, Moroder employed lots of available singing stars, people like Queen's Freddie Mercury, Pat Benatar, Jon Anderson of Yes, Bonnie Tyler, Adam Ant, Billy Squier and Loverboy, but there isn't much substance here at all. Instead, it is an album of relentless, dull music.

Michael Tearson

Small Town Romance: Richard Thompson
Hannibal HNBL 1316, $8.98.

Strict Tempo!: Richard Thompson
Carthage CGLP 4409, $8.98.

Sound: B– Performance: B

Now that Richard Thompson has signed with a major label (Phonogram) and his new album is due out momentarily, his former label has started to put into release all the material they've got on the guy. As if there's going to be a tremendous run on Richard Thompson albums once he's got a *real* record out—not likely, but the thought is nice. Richard Thompson makes nice, cultish records, and these two are perhaps the least accessible he's made in recent history. *Small Town Romance* is Thompson accompanying himself on acoustic guitar without the benefit of a band; *Strict Tempo!* is a collection of instrumentals. Neither one is all that accessible except to the most diehard Thompson fans.

If there was justice in this world, Richard & Linda Thompson's *I Want to See the Bright Lights Tonight* would have gotten released here when it was issued. Then they'd be big stars instead of divorced/separated, and we wouldn't have to talk about Richard Thompson as if he were some sort of Celtic cult musician. One can only hope that his next record is truly astounding, and that he will be able to live up to the low-level hype he has accumulated over the past few years. Albums like these only diminish his legendary status, at least at this point in time.

Jon & Sally Tiven

This Pagan Place: The Waterboys
Island 90190-1.

Sound: C+ Performance: A

The control and preciseness of techno-pop seemed a reaction to the histrionics of punk and the resurgence of heavy metal. Now, maybe in reaction to the visual overkill of rock videos, there's a scent of folk-inspired lyrics and lyricism in the wind. If The Waterboys, Scottish rockers, can overcome the treacherous Dylan comparisons that crop up whenever thoughtful lyrics join impassioned, rough-edged vocals, they could be the model for the vanguard.

Mike Scott of The Waterboys

For one thing, the quartet's American debut shows none of the fence-straddling that epitomized most folk-rock bands of the '60s. There's no trying to have it both ways here. Rather, lead vocalist/songwriter/producer Mike Scott smooths a folkish, humanist overview atop deceivingly simple rock riffs elaborately performed. While that frame seems as if it would produce a catchy single or two, there are none in sight. The best Scott gives us are, instead, existential ballads, such as the portrait, "Red Army Blues," of a WW II Russian soldier sent into exile as part of a political game.

The Waterboys' strength is evident in the album's cohesiveness, a miraculous feat considering the LP was self-produced over the course of a year-and-a-half with almost half-a-dozen en-

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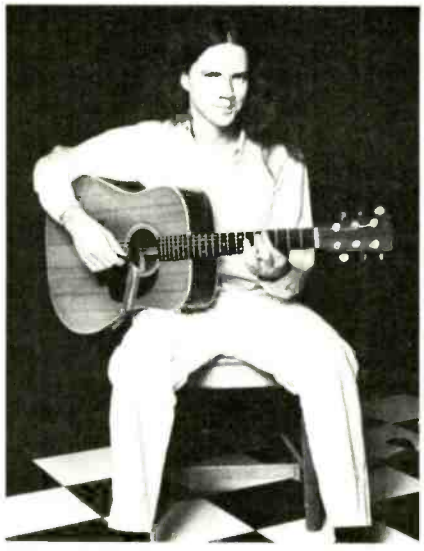
gineers. Some scratchiness afflicts the soft moments, and the high end could've been brighter, but Scott should continue virtually everything else he's doing, both in front of the glass and behind. *Frank Lovece*

Aerial Boundaries: Michael Hedges
Windham Hill WH-1032, $9.98.

Nightnoise: Bill Oskay and Mícheál Ó Domhnaill
Windham Hill WH-1031, $9.98.

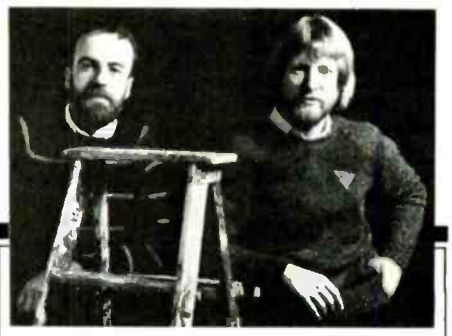
Sound: A Performance: A

These two new releases from Windham Hill bring special joy to me. The Windham Hill people are so obviously concerned with technical and sonic excellence and clarity in their recordings that, if they weren't careful, the technology would overshadow the music. Windham Hill's music is mostly acoustic and mellow. The label has been called an American analog (no pun intended) to Germany's ECM, but is dedicated less to abstract music than ECM. Windham Hill music emphasizes rich melodic values as well as technology and tries to mate the two.



Michael Hedges

At their best, Windham Hill's records approach the point where sound technology disappears; the music sounds so real that you can close your eyes and see the musicians in your living room. These new releases are excellent examples of their philosophy.



Bill Oskay and Mícheál Ó Domhnaill

Aerial Boundaries is essentially a solo guitar album with digital recording most of the time and digital mixing or live-to-two-track master the rest of the time. It is all Hedges' guitar, save for a duet with Mike Manning's fretless bass for the only nonoriginal piece, Neil Young's "After the Goldrush," and a trio with Manning plus Mindy Rosenfeld on flute for "Ménage à Trois." The album's tone is reflective and meditative. It flows ever so effortlessly, buoyed by the spectacular sound.

Nightnoise is a more elaborately produced work, recorded in Billy Oskay's home. Oskay plays mostly violin and viola, with occasional piano and harmonium, while Ó Domhnaill, a veteran of Ireland's wonderful folk outfit, The Bothy Band, plays guitars, whistles, piano and harmonium. Tommy Thompson adds bass on two selections. The two musicians have a marvelous sympatico that can only add to a sumptuous musical experience. They are at their best on the two longest pieces, "Bridges" and "The Cricket's Wicket."

The music blends diverse elements of classical chamber music, jazz and traditional folk music, particularly Irish, into a romantic soufflé. Again, the recorded sound on *Nightnoise* is spectacularly clear even without digital technology.

Each of these records is highly recommended, with special note of how effective they can be as tonics for the excesses of civilization and reality.

Michael Tearson

Rock 'n' Roll: Rag
Albert/Atlantic 7 80179-1, $8.98.

Sound: B+ Performance: B+

What is it about Australia that inspires such a high proportion of great rock 'n' roll bands? The land that gave the world The Easybeats has now spawned several handfuls of forceful, gutsy, hard-rocking outfits like Choirboys, The Divinyls, Midnight Oil, AC/DC, Rose Tattoo . . . the list goes on. The latest from the Albert stable (a production house run by ex-Easybeats

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Greatest Hits Live comes from an Animals reunion concert; they obviously enjoyed the hell out of it.

Vanda & Young) is Rag, a group of sorts run by Ray Arnott. No other players or singers are credited, but from time to time we think we hear the backing vocals of Stevie Wright (former lead singer with the The Easybeats and a mighty presence in his own right—check out his mid-'70s LP *Hard Road* for the evidence). The record is much in the ZZ Top mold—blistering, blues-based rock—and the guitar playing in particular is very exciting.

Altogether a fine debut for this act, and we only hope that the group—if it is indeed a group—can continue in the same vein and build a major following.

Jon & Sally Tiven

Greatest Hits Live: The Animals **I.R.S. SP-70043,** $8.98.

Sound: C– Performance: B

This snapshot of a live album was recorded last New Year's Eve, late into the 1983 reunion tour of the original Animals. As these lively performances of their classics show, they enjoyed the hell out of it. Most of their hits you can name are here: "House of the Rising Sun," "It's My Life," "Don't Bring Me Down," "Don't Let Me Be Misunderstood," "We Gotta Get Out of This Place," "Boom Boom," and others. Pianist Alan Price even gets to sing his theme from *O Lucky Man!*

The most important element here is the power that vocalist Eric Burdon can still generate after all the abuse he's heaped on himself over the long haul. His fire and passion are much more vivid than I had expected. The band—the original five of Burdon, Price, Hilton Valentine, Chas. Chandler and John Steel, augmented by Steve Grant's guitar and Zoot Money on keys—plays far, far better than I had hoped.

Recording the album at one concert naturally leaves some warts in the performance. But these, instead of detracting, just lend humanity and spontaneity. The sound is a bit boomy, but it captures the band well.

With classic oldies there can be no question that the originals are still the greatest. However, hearing these guys together again, against big odds, and playing this well, provides enough thrills to make *Greatest* . . . a very enjoyable live set. *Michael Tearson*

LEARNED LISTENING

Spatial Hearing by Jens Blauert. MIT Press, $40.00.

There are two kinds of hearing. One kind is the hearing we are born with, a remarkable process extremely sensitive to small differences in the spectral content and timing of sounds. The other kind of hearing is learned, and develops as an elaborate form of pattern recognition in which the ear and brain cooperate. Among other functions, such as identifying a telephone caller from only the first few spoken syllables, this acquired hearing allow us to estimate the apparent direction, size and distance of sources of sound. The richness of this auditory space, much of it based on cues at or below the edge of conscious awareness, is explored in great detail by a distinguished expert in *Spatial Hearing*. It is a technically thorough, clearly presented review of almost everything known about that subject.

Spatial Hearing should be of particular interest to audio professionals because objective, standardized audio test procedures have largely ignored the spatial qualities of sound systems. Perhaps this is because these qualities may have been thought to be too subjective to be measured rigorously. As the book shows, this is no more true of spatial than of spectral measurement; it is a matter of knowing what to measure. But it has been difficult, if not impossible, to review the large, rapidly growing and multi-lingual literature on the subject, distributed through many journals, conference proceedings and unpublished dissertations, in order to arrive at an understanding of how such standards might be created. Even salesmen at audio dealers' shops are often able to discuss the relative merits of measuring a loudspeaker's spectral output anechoically or in a reverberant room, because these subjects have been dealt with and debated in popular technical publications for decades. On the other hand, authoritative information about the spatial aspects of hearing is only now becoming accessible to engineers and others who do not read the academic literature, but need and want such information. It is not too soon, as these effects have already been the basis of stereophony, binaural reproduction, so-called time-delay or ambience systems, and many other applications in electroacoustics.

Spatial Hearing should not be thought of as a popular book, but it contains an enormous amount of information essential to anyone working or writing professionally in audio. In fact, the book has been an important and useful reference to many such readers for as long as 10 years, but only for those able to read it in the German original or in its Russian translation. Now, at last, this book has come to us in English, with a special bonus: A new 80-page section, added for the first time in the English edition, that is almost a small book in itself. In the new section, Blauert reviews the extensive research in the field carried out since the original manuscript was completed in 1972, including a number of experiments and theories with considerable significance to audio professionals. Fortunately for such readers, the author has a more than passing personal interest in both sound recording and sound reproduction.

Although *Spatial Hearing* is a technical book, it is not difficult to read, partly because of the excellent translation by John Allen, and partly because of the large number of clear, well-produced diagrams, charts and tables that supplement the text. Nevertheless, most owners of the book will probably use it primarily as a reference or to learn about a specific aspect of the subject, as I have used my German edition, rather than as a text to sit down and read through. On the other hand, it is the kind of book that owners will want to pick up and read from time to time, because it is chock-full of interesting information.

Spatial Hearing is divided into three main parts, and each of these is organized quite systematically. There is also the newly added fourth and final section that brings the first three parts up to date.

The first part is a brief review, perhaps too brief and compact for readers who know little about the subject, covering the concepts and experimental methods used in psychophysical research. It is an adequate introduction to the material, however, and in it Blauert explains the terminology and methods used in psychoacoustics research, especially research dealing

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I wish some audio reviewers would read Blauert's comments on how to tell whether a subject has really heard something.

with spatial perception. There are references to a number of other books and papers dealing with psychological research methods, some useful information about the mathematical and perceptual properties of test signals, and a rather detailed description of the in-the-ear probe microphone apparatus used by Blauert and his students, complete with a schematic for an equalizer to be used with the B & K microphone capsule.

Apart from this latter topic, presented in unusual detail, the section is quite general and can, in fact, be profitably studied as an introduction to the science of psychoacoustics. (Those who want to pursue the subject should obtain *Introduction to Hearing*, by Prof. David Green of Harvard.) Among other subjects, there is a good, clear discussion of methods used to establish, with good statistical confidence, when a subject in an experiment has, in fact, heard something. My personal wish is that certain reviewers of audio equipment, specifically those who have been able to hear greatly clarified "depth of imaging" after setting their turntables on granite slabs, should be forced to memorize this section, preferably while suspended from their shock mounts.

It is in this first section that the reader is introduced to the firm scientific viewpoint that informs the entire book:

> It is certainly true that the position of the auditory event and the position of the vibrating body that radiates the sound waves (the sound source) frequently coincide. Nonetheless, the conclusion that the position of the sound source is also the intrinsically correct position of the auditory event is, at the very least, problematic. The sound source and the auditory event are both sensory objects, after all. If their positions differ, it is an idle question to ask which is false

The point of this, of course, is that sounds do not automatically appear in the "right" place, and to make them do so in a recording or broadcast requires more than straightforward placement of a microphone. Blauert continues:

> The telecommunications engineer, of course, is especially interested in just those cases in which the positions of the sound source and the auditory event do not coincide The telecommunications engineer seeks to reproduce the audi-

Sounds do not automatically appear in the "right" place, and to make them do so requires more than straightforward mike placement.

tory events that occur at the point where a recording or transmission originates, using the smallest possible number of sound sources (e.g. loudspeakers). Sound events must be generated at the receiving end of the electroacoustic telecommunications chain in such a way that auditory events occur in the same directions and at the same distances as at the point of origin. Auditory events must, therefore, also occur at other positions besides those of the loudspeakers.

What Blauert does not say here is that recordings, including classical music recordings, now more and more frequently involve the producer and engineer in the creation of a space for the sake of the music, since such an auditory space does not arise automatically by following cookbook rules of microphone placement. The satisfying sound of a good recording is substantially dependent on an understanding of spatial cues that is not common.

The second part of the book deals with spatial hearing in the presence of a single sound source and covers what is basically known about localization, the process by which a listener assigns a position in space to the source of sound. Charts are used here, as everywhere in the book, to summarize research on specific topics, allowing the reader to see at a glance the different results obtained by different investigators of the same effect. On page 39, for example, one can quickly scan the findings of 12 major studies of localization blur—the change in direction of a sound source that listeners are just able to detect reliably. The range of lowest values goes from 0.75° (Klemm, 1920, using impulses) to 3.2° (Haustein and Schirmer, 1970, using broadband noise); values for speech, incidentally, appear to fall within this range as well. Turning over the page, we can see a diagram on page 41 that shows us exactly how the subject was positioned in relation to the sound sources for the 1970 study, with the notation that as many as 900 subjects were tested. This is typical of the book's clarity and thoroughness. Diagram after diagram amplifies the explanation in the text, showing experimental layout, equipment used and its method of interconnection, and graphs that compare one investigator's results to another's.

This section also reviews the physiology and acoustics of the external ear, and it contains a complete and illuminating review of work done on the measurement of the sound field at the ears of a listener for both a plane wave and a diffuse sound source. Beautifully drawn charts show how the spectrum of a sound at the entrance to the auditory canal varies with the direction of its incidence. The graphs are fascinating. How do the ear and brain of a listener retain the impression of an unchanging source of sound when so much of the sound changes with a simple turn or tilt of the head?

Another extremely interesting section deals with the illusion that sounds of some frequencies, when emitted by a source centered on the midline of a listener's head, are coming from locations above or behind the subject. Blauert reports his own surprising first encounter with this effect:

> Sitting before a loudspeaker radiating a sinusoidal signal whose frequency continuously rose from 200 Hz to 16 kHz, I noticed that the auditory event moved back and forth several times on a path from front to rear over the top of my head.

For many of us, the experience might have meant that the time had come to replace the tweeter and let it go at that. This observation, however, fascinated Blauert and led him to undertake a series of experiments. The results provided useful clues about the way in which the shape of the outer ear allows a listener to establish the elevation of a sound source. As with other aspects of spatial hearing, each of us learns to associate subtle spectral and timing cues with the direction of a source, these cues being based on the shape, size and detailed form of our own ears. The reflections from the folds and curls of skin, and the "personal resonances" these produce, allow us to find sound sources remarkably well, especially if we train ourselves to listen carefully. When we listen with someone else's ears, on the other hand, or to a binaural recording made with sculpted artificial ears, the cues that we have learned by listening all our lives through our own ears are changed or are missing entirely. The most common result is the confusing illusion, when listening to binaural recordings, that

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An auditory experience that might just lead one of us to replace a tweeter is the kind of thing that fascinates Blauert and leads him to experiment.

sounds we know to have originated in front of the head seem to be coming from behind us.

Blauert describes a series of clever experiments in which subjects listened to sounds through modified outer ears, instead of their own. In the simplest of these experiments, short rubber hoses were inserted in the subjects' ears so as to eliminate the effects of acoustical cues provided by the pinna (the outer part of the ear that protrudes from the head). The result was that the subjects lost much of their ability to localize sounds. Other experimenters later used short brass tubes, then tried short brass funnels, then tubes with artificial pinnae facing backward. All of the changes, interestingly, usually produced rearward localization regardless of the angle of incidence of the sound. This front-back problem is familiar to anyone who has ever tried to make a binaural recording. I have only covered a small part of Blauert's review of work on this interesting problem, which is covered extensively and very clearly; an entire book could be written on this subject alone.

Other pages in this second section deal with ways in which differences in the signals at the two ears of a listener produce information about the location of the source. This is the heart of the subject of spatial hearing, of course, and it is treated very comprehensively, not only as regards coverage of experimental work but also in reviewing various theories of how auditory data is processed in the brain. Again, there are clear schematic diagrams to help the reader grasp these theories, and ample references for those who intend to look more closely into some of the work discussed.

The third part of the book concerns the perceived spatial qualities of complex sounds produced by multiple sources and in enclosed spaces. These, of course, are the sound fields that normally form the setting for music recording and reproduction. A series of interesting diagrams show where listeners hear sound coming from, under many experimental conditions, in each of which some specific kind of cue has been studied. Studies of a listener's ability to center sounds produced by a pair of loudspeakers, for example, are followed by the effects on perception of many kinds of binaural and stereophonic presentations of echoes and delayed repetitions of signals from various directions.

One section describes an experiment in which Blauert tried an idea of his own, in which he attempted to make a sound appear to whirl around the listener's head. The method involved systematically modulating the delay and amplitude of the signals coming from six speakers. It worked, but with a strange and unexpected twist to the whirl; see page 273 of the book for the surprise. Another section

Continued on page 167

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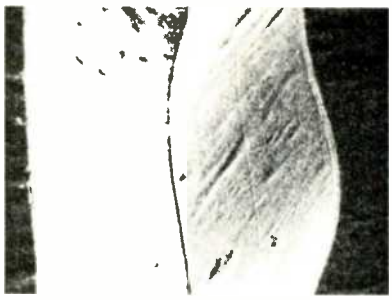

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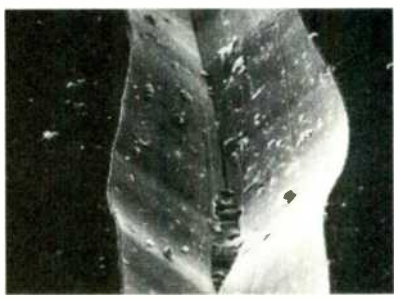

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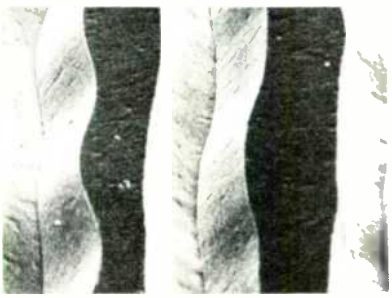

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MAXIMUM MUSIC AT MINIMUM COST

STEP NUMBER **3**

KEEPING YOUR RECORDS CLEAN (...WITHOUT MAKING MATTERS WORSE)

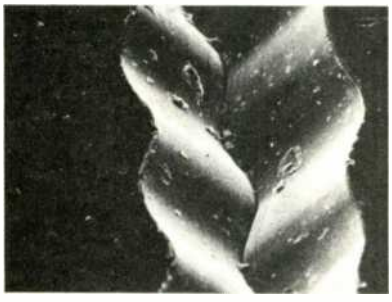
We admit that at first glance, "record cleaners" look pretty much alike, and they all seem to do just about the same thing: get the dust off.

The problem is not so much what the record cleaner will get off your record, but what it *leaves on* in the way of residue. Unfortunately, many music lovers get distracted by the aesthetics of walnut-handled brushes and polished aluminum brushes, when it's the record-cleaning fluid that will go on and in some cases, stay on the record.

LAST System Formula 3 All-Purpose Record Cleaner is formulated to maintain a clean record surface, without any trace of residue. It is easy to apply, dries quickly and is extremely economical, since one kit will clean hundreds of records. As the name implies, LAST All-Purpose Record Cleaner is for regular use, safe for use every time you play a record. Each kit contains a scientifically-designed applicator with an optimum surface area made with light-colored microfibre so you can see how effective the cleaning action is.

Perhaps most importantly, LAST System Formula 3 All-Purpose Record Cleaner is an integral part of the LAST System Formula Series of Record and Stylus Care Components. Each formula works together, guaranteed to be effective in bringing you unparalleled sound from your present system.

We recommend that for maximum results, you first use LAST System Formula 1 Extra Strength Record Cleaner to remove all stubborn contaminants that get between you and your sound...second, *wear-protect* your records with LAST System Formula 2 Record Preservative to keep your records sounding new for 200 plays or more...and third, use LAST System Formula 3 All-Purpose Record cleaner to maintain the clean, wear-protected surface free of annoying "pops" and "clicks."



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WE KEEP YOUR RECORDS SOUNDING BRAND NEW

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MAXIMUM MUSIC AT MINIMUM COST

STEP NUMBER **4**

CLEANING YOUR STYLUS (...BUT WHY BOTHER?)

In the "old days" it was a fairly common sight to see someone "clean the needle" of the phonograph with a fingertip.

Today's technologically advanced stylus/cartridge assemblies have made that a very bad idea, indeed. But the problem still remains... how to clean the stylus?

The real problem is much worse than it looks, because deposits on the stylus are almost impossible to see except under magnification, but these tiny deposits can cause big problems, like increased friction, noise, greatly increased record wear, and scratchy-sounding groove damage. (See below)

So what? A dirty stylus can change some of the music on your record into noise...permanently. Not only that, but a dirty stylus doesn't track properly, so no matter how you look at it, you're just not getting all the music from your record. Your stylus becomes very hot (in excess of 350°) so deposits are literally "baked" on the tip, particularly if the record hasn't been *deep-cleaned* and *wear-protected*. (See "Step #1" and "Step #2")

But it's so easy and economical to solve this problem with LAST System Formula 4 Stylus Cleaner. And since LAST Stylus Cleaner doesn't contain alcohol, it's completely safe for *all* cartridge assemblies. Each kit costs so little, yet contains a stylus cleaning brush with enough formula to clean your stylus hundreds of times.

As with each product in the LAST System Formula Series, LAST System Formula 4 Stylus Cleaner is guaranteed effective...guaranteed to safely remove all stylus deposits. To our knowledge, it's the only product that is *guaranteed to work*.

STYLUS WITH "BAKED-ON" DEPOSITS

SYSTEM FORMULA 4: STYLUS CLEANER

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MAXIMUM MUSIC AT MINIMUM COST

STEP NUMBER **5**

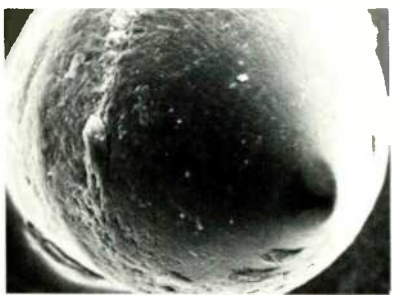
TREATING YOUR STYLUS TO A MILE OF MUSIC

Fact: Your stylus travels about one mile through record grooves every time you play an album. Add to that the fact that the pressure of the stylus on the record groove is measured in "*tons* per square-inch" and you've got some idea of what your stylus is going through in order to make the music you're hearing.

Consider also that the stylus is the very point at which musical information enters the stereo system, and that if you expect absolutely perfect sound, the contact between the stylus and the record has to be perfect. In other words, a small problem with your stylus makes for big problems with getting all the music you want to hear. And a worn stylus not only doesn't work very well, but can gouge a record groove so as to change music into noise ...permanently.

The good news is that it's easy and inexpensive to solve these problems once and for all...with LAST System Formula 5, STYLAST™ Stylus Treatment. Not only does LAST Stylast Stylus Treatment improve that all-important contact between stylus and record groove, but it's guaranteed to extend stylus life up to ten times normal while maintaining the critical flexibility of the stylus suspension.

Using the LAST System Formula Series of products is just about standard operating procedure at places like the Consumer Electronics Show and whenever people who know good sound want to hear what's really on the record and want to hear the same great sound the same way every time. And why not? Using the entire LAST System Formula series costs only about a penny per play.



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Blauert found that when listeners' ability to localize sounds is diminished, the sounds seem to come from behind them.

THE BOOKSHELF
Continued from page 160

deals with a half-dozen methods of producing pseudo-stereo from a monophonic signal. Looking at the neatly laid out page of diagrams, clearly showing the operation of each of the systems under consideration, I could imagine many readers uttering an involuntary, "There goes my idea!" Many readers of *Spatial Hearing* will have this experience, I am sure. I would say there is a good chance that most of my best ideas that I have not yet found in any of Olson's books are likely to turn up in Blauert's, one by one, especially those concerned with binaural/stereo developments. On the other hand, the book is bound to stimulate a torrent of new ideas, because it is so full of descriptions of experiments and effects that set one thinking.

The final section of the third part, originally the end of the book, covers multi-channel sound, including quadraphony. Among other material relevant to audio, there is a description of the TRADIS system, developed by Damaske and Mellert during the 1960s. In this sytem, left- and right-channel signals are phase-inverted, attenuated, delayed by about a half-millisecond, and then mixed with the signals of the opposite channels for loudspeaker presentation. When the values are just right, and especially if the room is acoustically "dead," the leakage around the head of the right channel to the left ear (and vice versa) are cancelled and the stereo loudspeaker sounds spring to life in a panorama across the room. For a while, in the early 1970s, Deutsche Grammophon apparently considered releasing stereo/binaural records with this type of processing already encoded in the two signals—at least I heard a test recording that had been circulated to evaluate listeners' reactions at that time. Someone has said, but I am sure it's wrong, that since holography had not yet been invented at the time, there was nothing to name the process after, and that is why it was dropped by DGG. In any case, the history of the technique can be traced through Blauert's references, beginning with the announcement of the idea by the late Ben Bauer of CBS in 1961. It is interesting, to say the least, to see where these ideas have come from, and to discover how much intensive research work it has taken to gain an understanding of the perceptual processes involved. Too much of it has been hidden in places difficult to reach.

The last part of *Spatial Hearing*, "Progress and Trends Since 1972," covers an exceptionally productive and exciting period in the history of psychoacoustics, partially because of the enormous influence of computers and digital methods in generating test signals, especially low-noise delayed signals, and in analysis of data. New measurements of listeners' localization

Browsing through Blauert's bibliography is like visiting a great technical library with all its information summarized.

acuity are reviewed here, as are recent studies of the perceptibility of delayed echoes and comb-filter effects. There is a section on spaciousness and its importance to concert hall design, and the cues that contribute to it. Another section reviews the most recent theories of localization and of new, updated versions of classical theories. Among these is a description and diagram of a modified version of the "coincidence model," based on an idea of the widely known teacher and theoretician Lloyd Jeffress. The theory, in the form shown, applies biological "and" gates and timing circuits in an elegant way to produce a mechanism that is simple but surprisingly effective in doing what ears and brains do when they locate a sound. In fact, the explanation is so clear that I was able to sit down at my microcomputer and program a simulation of the coincidence model just by looking at the diagram. What a fascinating subject! The section of the book on theories of binaural processing in the brain concludes with examples of "correlograms," plots that show the interaural cross-correlation of signals as a function of frequency, which are a kind of "snapshot" of the localization process; later work has turned these into "movies."

The final section includes examples from architectural acoustics and closes with a good treatment of binaural recording. Blauert proposes a binaural mixing console that would allow the conversion and mixing of conventionally miked signals to binaural material, using signal processing methods. He accepts and describes the conclusions of others who believe that the most successful dummy head recordings are obtained when no attempt is made to duplicate the ear canal or the eardrum impedance, and microphone capsules are simply coupled to the entrances of the auditory canals so as to achieve the best possible signal-to-noise ratio. But, as Blauert concludes, the definitive solution to binaural reproduction remains to be found, perhaps in the form of a personal "equalization box" that would allow each listener to add the time and frequency effects of his own outer ears to a standardized recording. In the era of the "walk-person" cassette player, this topic forms an appropriate last word on audio reproduction as well as spatial hearing.

An additional feature of the book that cannot be praised too highly is the immense bibliography that goes on for 45 pages. Scanning its pages, one sees familiar names among the unfamiliar: Edgar Villchur's work on earphone calibration, Floyd Toole's papers on localization, Ben Bauer's investigations of stereo. Here one can find the original source of every subject discussed in the book. Browsing through the bibliography is like walking along the shelves of one of the best technical libraries in the world, with the advantage that everything in it has

Anyone wanting to know about Bob Marley, the Man, as opposed to Marley, the Pop Star, will find it in *Catch a Fire*.

been reviewed, even if only briefly in some cases, in this remarkable and valuable book.

Spatial Hearing is not light reading, as I have said. It is a carefully assembled technical text aimed at students and specialists in the field. However, it is understandable and is not too difficult to read, even if some paragraphs or the few mathematical expressions are challenging. It is likely to become a fixture on the bookshelf of everyone concerned with the design of loudspeakers or headphone listening systems, or involved in sound recording, who wants to know and use what science has learned about human spatial perception. Imaging, like everything else about human sensory development, is an endlessly interesting process, and that is what *Spatial Hearing* makes clear. *Bob Berkovitz*

Catch a Fire: The Life of Bob Marley by Timothy White. Holt, Rinehart and Winston, $9.95.

Although the '70s had its share of popular music heroes, few had as strong a worldwide impact and were as generally misunderstood as Robert Nesta Marley, the man responsible for popularizing and pretty well inventing reggae. In a mere 36 years he was able to cross the boundaries created by his cultural, musical, and religious differences with Western culture and make a mark that will be felt for generations. Much has been made of his superficial trappings, and many wear the Rasta locks without fully comprehending what he was all about. Author Timothy White pretty much leaves Marley's recorded work to speak for itself, chronicling his musical develooment as a given. But the man behind the music and the culture that nurtured him are explored in depth and with dedication. If one wishes to know about Bob Marley, The Man, as opposed to Bob Marley, Pop Star, *Catch a Fire* is The Source.

White obviously has spent much time in Jamaica and is familiar with the country's politics, the Rastafarian system of beliefs and lifestyle, and also the traditions which came before Emperor Haile Selassie of Ethiopia that were the basis for Marley's original inspirations (who knew what the meaning of "Duppy Conqueror" sprang from?). To Americans, Bob Marley's struggle was always once-removed, and this book brings a coherence to a lyrical language which, although often resembling English, demands a great comprehension of the local politics.

In addition, the personal battles Marley experienced as a major figure caught in a national power struggle, as a sensitive human being looking for spiritual answers, and as a music maker trying to find his audience, are explored in depth. The author was no newcomer to the Marley camp, and personally conducted more than 20

Bob Marley was a seeker of truths and tried to be a righter of wrongs, and this is what's explored here.

lengthy interviews with Bob over the course of 10 years. These interviews shed much light on the dark mystery which surrounded Marley in life and death. White was also able to get to Marley's closest relations, and much of the book describes not only his youth but the lives of his parents. There is more here on Marley's formative years than on the recording sessions, Wailers tours, and musical information than one would expect from such a book.

As it turns out, this is the most interesting story—Bob Marley was a lot more than just another songwriter/guitarist/singer, although one should not slight his contributions in those categories either. Marley was a seeker of truths and tried to be a righter of wrongs, and this is what's explored. Even if you were only a marginal fan, the story of his life, the Jamaican culture, and the religious matters are of major importance. Given that Bob Marley is perhaps one of the five or 10 most original and influential music makers of the past 40 years, this book seems essential. *Jon & Sally Tiven*

Unsung Heroes of Rock 'n' Roll by Nick Tosches. Scribner's Sons, paperback, $8.95.

Nick Tosches is a real smartass. He's also one hell of an entertaining writer. Right in the opening lines of the foreword, Stan Stasiak sets the tone of Tosches' wild new book, *Unsung Heroes of Rock 'n' Roll*, letting the reader know what he's in for: "This book will not increase the size of your penis . . . . Such matters are paltry and laughable, however, compared to the hermetic wisdom contained in these pages. Check it out, chump . . . ."

Well, fellow chumps, I have checked it out and I'll tell you it's about time someone wrote and published a book like this. Many of the people Tosches writes about are almost totally unknown today. Have you ever heard of Roy Hall? Wanda Jackson? Jimmie Logsdon? Others like Big Joe Turner, The Clovers, Amos Milburn, and Screamin' Jay Hawkins may be somewhat better known, but have also suffered grievous neglect. They may not have known it at the time, but these folks created rock 'n' roll, and all of us who love this music owe them a debt of gratitude. This book is a crazy down payment on that debt, but Tosches' homage is, as he writes, "not always of the most pious sort."

It is all done with tongue firmly implanted in cheek, but someone is bound to be offended, and that is partly the book's point. For instance, Big Joe Turner, writes Tosches, "wasn't always the big fat fuck that he became in later years." Johnny Ace, who shot himself or was shot in the head (depending on what story you believe), is profiled in a chapter titled, "Number One, With a Bullet." He plays very fast and easy with words like nigger,

Tosches' characterizations are irreverent, offensive and frequently sexual, and they often made me laugh out loud.

greaseball, and broad. Rock 'n' roll was never meant to be taken too seriously, and neither is this book.

Tosches' characterizations are irreverent, quite often sexual, and quite often made me laugh out loud. Here's Tosches waxing weird and poetic about Merrill Moore's, uh, shall we say, influences: "When he was eight he made his debut on WHO. Then came Mrs. Gunn, a piano teacher, a fancy lady from the Oberlin Conservatory in Ohio. And what of her breasts? Did they linger, warm and rife, against the nape of young Merrill's neck, fill his tender being with the intoxicating liquor of their perfume, as she bent over his shoulder to guide his hands across the keys? Mr. Moore makes no mention of this . . . ." Skeets McDonald, we're told, "took to music and female flesh at an early age." We are also told that Denny Trenier, one of the Trenier twins, "in between ejaculations, played the baritone horn with the Excelsior Band."

Yes, there are a lot of yuks in this book, and more than the usual number of people are going to be offended, but there is a lot of good, solid journalism and analysis too. One of the great things Tosches does is deflate some of the many myths surrounding rock 'n' roll. Rather than add to the debate over which was the first rock 'n' roll record, he wisely states that there is "no first rock 'n' roll record any more than there is any first modern novel." Simply, but not simplistically, he says, "Rock 'n' roll was not created solely by blacks or by whites; and it certainly did not come into being all of a sudden. It evolved slowly, wrought by blacks and by whites, some of them old and some of them young, in the South and in the West, in the North and in the East. Its makers were driven not so much by any pure creative spirit, but rather by the desire to make money." I've interviewed enough of these people to agree. The early heroes of rock had no idea they were creating a new music, they had no desire to create a new order, and they certainly had no inkling that their music would have a significant impact on society. Perhaps it was their genuine naiveté that made their music so successful.

In *Unsung Heroes* you'll also find the most comprehensive explanation of the origins of the term rock 'n' roll that I've ever seen. There is a discography of the profiled heroes that is written to be read by ordinary people instead of discophiles. And Tosches has also written an often amusing "Chronology of the Coming of Rock 'n' Roll." It begins in January 1945 when " 'Tell Me You'll Wait for Me' by Johnny Moore's Three Blazers (Atlas 107) is released," and runs through 1955, where the November listing records the portentous move by Elvis Presley from Sam Phillips' Sun Records to Col. Tom Parker and RCA: "Presley's first RCA session is scheduled for January 5 [1956] in Nashville "

Ted Fox

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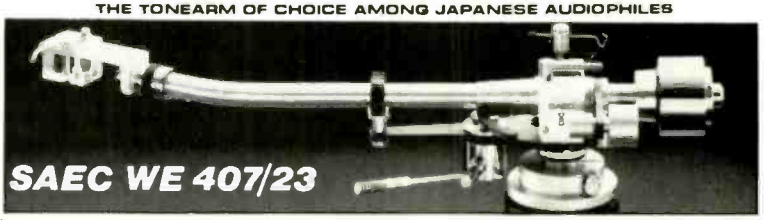

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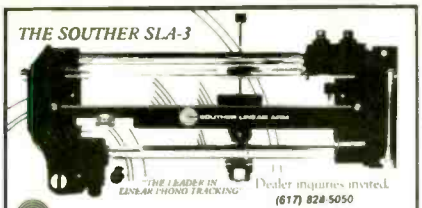

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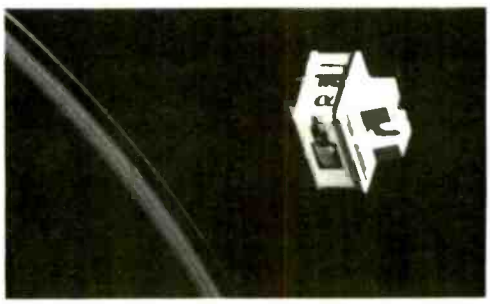

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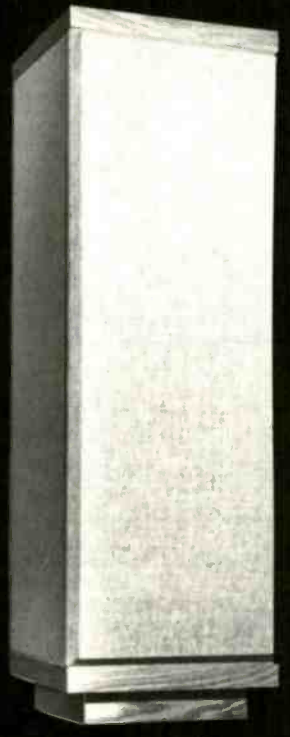

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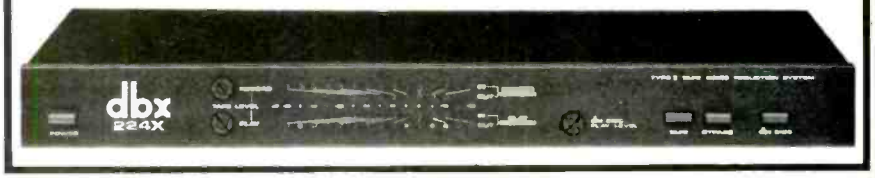

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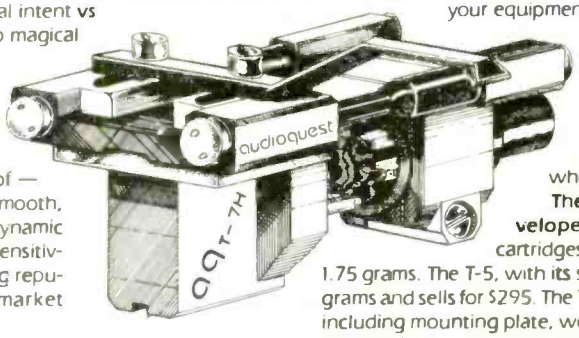

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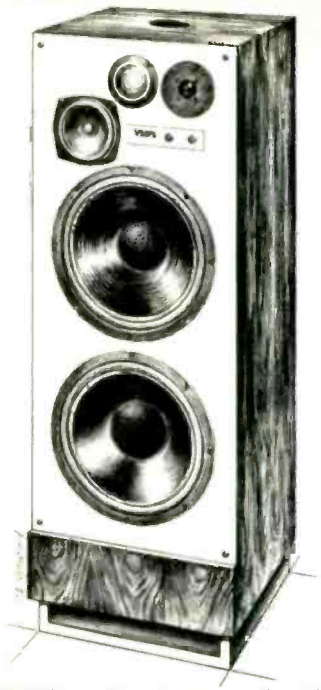

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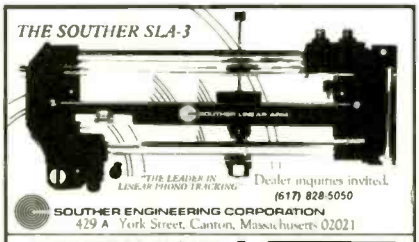

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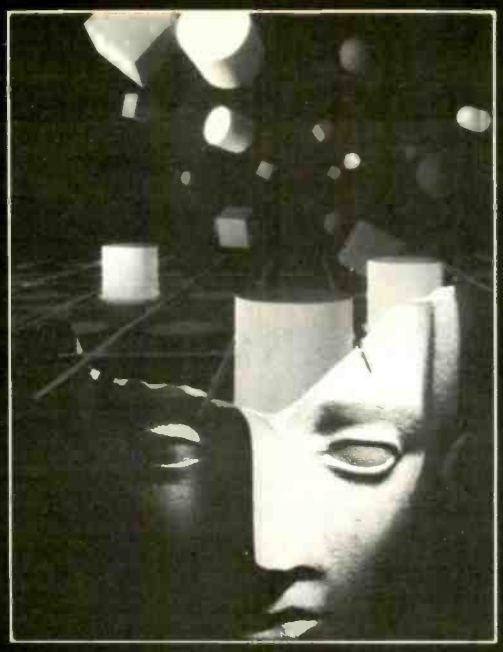

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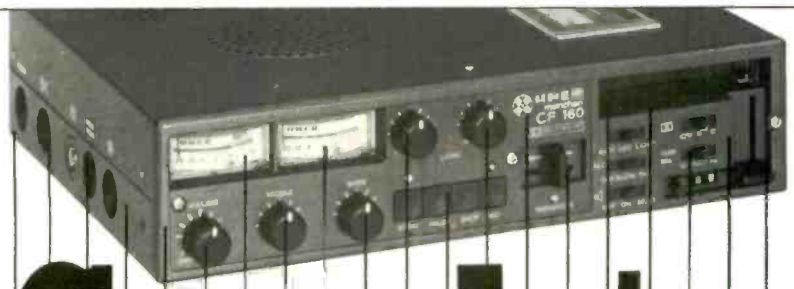

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