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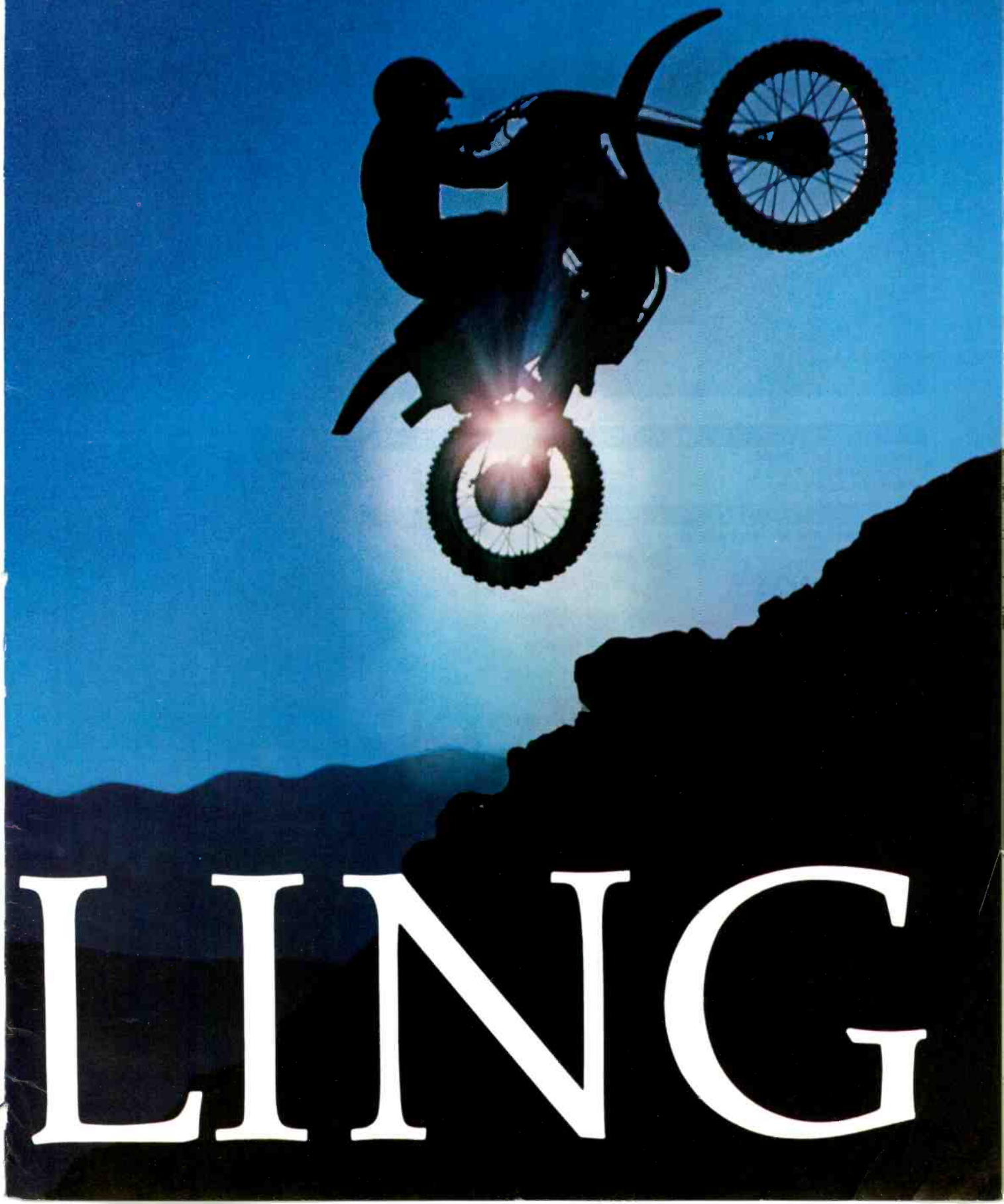

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FEATURES

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MUSIC REVIEWS

DEPARTMENTS

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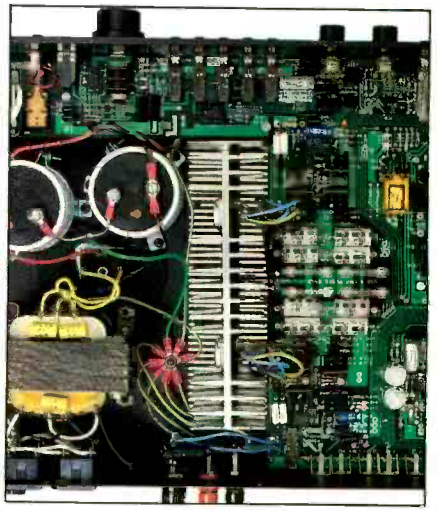

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EDWARD TATNALL CANBY

ARTS AND GRAFTS

Illustration: Teresa Anderko

I need to edit myself a new term before I can go on to more audiobiography: *Sound working*.

I'm tired of "edit"; it's getting to be like "software" or "processing." I sometimes go for processed cheese, but I'm already allergic to processed words. Then there are the oldies like "time" and "live," now stretched to their elastic limits. *Real time?* Is there any other kind? Of course, so we talk about the real thing as though it were somehow abnormal. *Live on tape?* Well, if it's on tape it isn't alive, but even so . . . . *Time warp?* Could be. Black holes, or is it white holes?

We need to confine "editing" before we begin to "edit," say, press conferences. Or bouquets of flowers, or a gourmet dinner. It's like musical "software"—you may remember I drew my own line when it got to Beethoven. He did *not* write software for symphony orchestra. Nor, I should add, does the Met run software on its big New York stage. It produces operas, thank you. Enough is enough.

Editing was once entirely for the printed word, books and magazines, literature. Then the movies took it over for the film assembly line, followed by audio tape and then video. This new technological sense is well-established and useful in the great present complexes of film, video and audio—it is always the actual physical process of snipping and cutting and assembling, joining up segments through a variety of technical systems that is in itself bewildering. That's enough, for our type of editing.

So let's divide the process in two: We'll confine "editing," when it goes beyond the printed word, to the purely technological sense of assembly, from razor blade and EdiTall to time codes, wave matches, Dolby, and a dozen syncs on a grand scale. *Sound working*, then, is more the arts and crafts side, a matter of aesthetics. *To work*, transitive, is a splendid oldie full of pleasant memories: Woodworking. Working in clay, oils, pastel, bronze, sheet metal, acrylics, wrought iron—we can "work" sound, too, into sonic shapes both useful and beautiful. That's my idea.

When I first had glimmerings of this idea of working sound, shaping it, there were no tools, no tape, only the early talkies. If you edited the picture, you had to edit the sound. We had only the disc, which is why it took me 40 years to edit a wedding recording I made in 1940 (see *Audio*, May 1984). But at least we younger music teachers (which I was) could pick out a musical "theme" on a record and play it, excerpted, with minimum squawks and blats, which was a kind of sound editing. By 1940 I already had four fat years of this behind me, and I enjoyed it. You got so you could "read" the record grooves in a strong light and drop the pickup exactly where the tune began, then use the volume control to fade out at the end. Or, with the right equipment, you could cue up, the table turning at speed while you held the disc motionless.

But you could not thus "slip" records on any existing home phono, nor those in most classrooms. Not enough torque, even with a felt slip pad underneath the disc. Automatics were out, of course. You pick up the pickup and it takes itself instantly away and turns the machine off, even in "manual" mode. We haven't progressed very far here in 40 years or more. Consumers are still frustrated trying to transfer selected parts of an LP onto cassette. And have you tried to cue a cassette player that turns on its electronics with the "play" button? Push "play"—and no sound. Not at the cue point! There's silent play for an exasperating second or two. That's enough to spoil your cue if you are shaping an accurate musical time.

Very soon after 1940, the summer of that wedding recording on disc, I made some startling discoveries in sound working. It was, quite indirectly, via FM. The students at my college were putting on a radio drama. I have not the faintest memory of what it was about, but the Dramatics prof (female) asked the Music Department (me) whether I could fix up some musical bridges for this show, out of all those records I had. Seems she had made contact with a new radio station, some new system called MF, was it? And she had their studios for a production on the air.

Much as I hated musical bridges, especially "classical," how could I refuse? I had never been in a radio station. My knowledge of radio ended at the AM receiving antenna. But, oddly enough, I had listened to this new "MF" radio sound, which was of course FM. That way, at least, I was a small jump ahead of the drama class.

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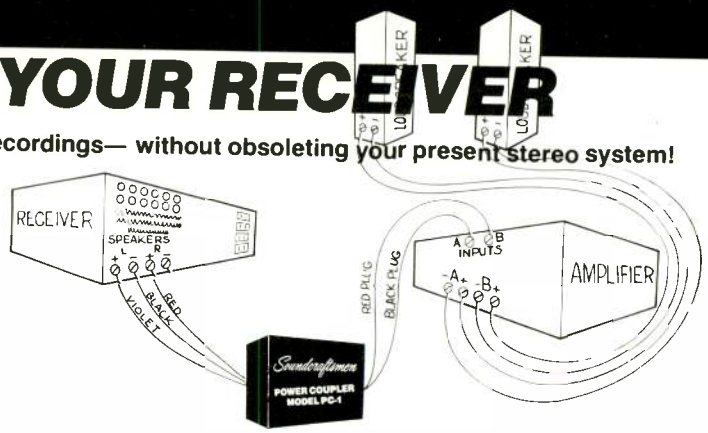

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On my first visit to a radio station, what hit me were the sounds I could put together with *two* interlinked turntables instead of one.

And so in that spring of 1943, at the bottom of the big war, with New York fully blacked out (even to the subway cars) and my volunteer job of air-raid warden very seriously taken, I barged into my first radio station for this utterly inconsequential little show. Perfectly good—just not earthshaking. I brought along records. I gave them to the engineer, who played them, mostly in the wrong places. No great matter; it was only bridge music. The show was rehearsed, and went on the air. Five minutes later it was forgotten.

But there was I, in a real *studio*. For the first time I gazed upon enormous professional turntable consoles with big, 16-inch castings revolving on top and long, strange-looking arms equipped with very strange pickups—the Western Electric 9A, featuring a built-in diamond stylus. This pickup not only produced real, audible highs (when they were on the record, which was seldom) but, with a flip of a switch, could play either lateral or vertical grooves. The latter were on gorgeous, big, transparent-red plastic, 16-inch, 33⅓-rpm ETs ("electronic transcriptions") from a rental library available to radio stations. This in 1943!

Stereo? None of us yet had heard of that, in particular the lateral-vertical combined groove that is now standard for discs. But surely, with a bit of rewiring, that pickup could now play a modern LP in stereo, full range, though with a certain steely sound that I expect would be frowned on today. (That would have been partly a matter of equalization; there was then no standard and plenty of different recording curves.)

Detailed knowledge of these pickups came later—this was the station where I was to spend the next three years, ending up (before the Big Bust) as Music Director with several of my own shows on the air. But on that first visit I was all eyes and ears, especially for one thing I had never imagined: Not one but *two* giant, professional turntables in every studio, side by side, and switches and faders to mix with mikes. Commonplace, of course, even then. But who outside of the business ever saw such things?

What hit me in a flash was the range of experiments I could do, the sounds I could put together, with *two* interlinked tables instead of one. That possibility had never occurred to me. I think I began to sense my destiny that very day. Sound working! This was it—or could be.

Downstairs in the duplex apartment that had been converted for radio was the Director, a woman who understood things. She was unbelievable. An experienced radio hand from Chicago, a musician who had worked with James Petrillo of the musicians' union, she was strictly a union lady. (Ask your daddies who Petrillo was—they'll know.) How she got to New York and into FM I do not know, but I have a feeling she was related to Paul De Mars, an early FM big shot whom many oldsters will remember. Anita De Mars was perfect for wartime FM—experimental radio, on the make, minus audience (maybe 400 sets?), minus profit, but full of ambition and forging into new sonic territory in the new hi-fi medium. Her ears were wide open to any ideas floating around. She had been quietly moseying about as we rehearsed that student show, and I think she saw my excitement. She was nearby when I got into difficulties with her engineer over which music I wanted to play. Trifling or no, by the end of that broadcast I was so worked up I was almost hysterical, what with all the hi-fi blossoming around me and the business of actually putting a show out on the fabulous FM air.

As I came down the stairs from "Studio A" (the ex-penthouse living room), about to leave the station forever, De Mars took me aside. "Eddie," she said (she never called me anything else), "how'd you like to try a show yourself?" I gulped. I reeled, the world whirled around me. *Would* I? "Okay," said she, matter-of-factly. "You have 25 minutes and an engineer to do the records while you talk about the music. Write me a script, anything you want. Make a copy for the engineer with the music cues on it. [Oh boy, was that going to give me trouble.] Come back in two weeks and let me see what you have."

What a talent scout, that Anita De Mars! My "talent" was no more than a glint in the eye and maybe a feverish look. But she got the idea even so.

I can come to a quick conclusion on *this* episode. Disaster. I worked until I was dizzy for those two weeks and came back with a fine script and lots and lots of music, on many pounds of 78 discs. After an hour of futile rehearsal, the union engineer blew her top. It was awful. What did I think she was, an octopus? A circus acrobat? How many records did I think she could hold in only two hands? This show is *impossible!!* said she, departing.

De Mars was hovering nearby, as usual. She had seen it all. I had set up approximately 34 classical cues, off the middles of as many fragile 78 discs, for some 25 minutes of air time! On paper it was a good show—with 28 turntables and 16 working engineers we could have had it on the air that very day.

De Mars was not flapped. "Eddie," she said quietly, "you have another week. Just go home and use a little common sense, if you have any. Come back next week and we'll try again." Cool as a cucumber. Then, I suppose, she went out to placate her ruffled engineer. She succeeded; later on we were great friends and made a good broadcast team.

The next week that show went on the air. I tell you, I never worked harder nor learned so much. It was my practical introduction to real sound working. I did it on radio for decades thereafter and for long years before tape editing appeared—we worked "live" from records (two turntables) right on the air. When the tricks didn't work, I would casually apologize—we'd better try that one again—while my engineer sweated buckets but usually did it right on the second try.

Noble efforts! Those guys (and gals) got so they could do incredible tricks with music, foreshadowing the things DJs have been doing in more recent times. One of my assistants was Edgar Schuller, younger brother of Gunther Schuller, Third Stream music man, top man at the New England Conservatory as well as a prolific composer and traveling conductor. His brother was a whiz, with a splendid ear. Another was Jac Holzman, who had to leave me to found his Elektra Records and, later, Nonesuch. A third was John McClure, who graduated to CBS and rose to the very top of the record pile, where he still operates. So you see that the early art of sound working, even in this corner, has been in very good hands.

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AUDIOCLINIC

JOSEPH GIOVANELLI

Usable Volume-Control Range

Q. I recently purchased a clock radio/tape recorder. Its volume control is the slide type, with positions numbered from 1 to 10. I find that if I advance the control to 1, the volume is as loud as I would ever want. Thus, my effective use of the control is very narrow, making it difficult to adjust volume.

Can I make this control less sensitive by placing a resistor in series with it, or perhaps placing a resistor in series with the loudspeaker in order to lower the speaker's efficiency?—Scott A. Kracen, Sycamore, Ill.

A. To solve this problem, first measure the resistance of the volume control with an ohmmeter. (Disconnect the "high" side of the control and lower the setting to zero. Otherwise, you may obtain an erroneous measurement.) Next, place a resistor, about equal to the measured resistance of the control, in series with the high side and its original connection.

Unfortunately, many controls of this kind are mounted on the printed circuit board containing the rest of the circuitry. If this is so in your case, you must cut the foil associated with this terminal and bridge the added resistor across the break.

I do not recommend that you add a resistor in series with the loudspeaker because you may then have insufficient volume available from the loudspeaker before distortion sets in. I have noticed that some of these clock radios have more audio gain than can be handled by their output stages. Therefore, overdriving the output stage is a real possibility when you decrease the efficiency of the loudspeaker circuit.

Insufficient Phonograph Volume

Q. I have just connected a new turntable to my old Electrophonic system, hoping to upgrade my system's performance. I tried playing a record with the volume control set to a low level, and I heard nothing from the loudspeakers. It turns out that for me to hear music at all, I have to turn the volume control to maximum. Please give me your professional opinion as to the nature of my problem.—Mark E. Clement, Greensburg, Pa.

A. Your low signal problem is not hard to track down. Your player's amplifier was designed to accept what is known as a ceramic cartridge; your new turntable, however, contains a magnetic cartridge.

Ceramic cartridges produce much larger signals than magnetic cartridges, so the latter need more amplification. Magnetic cartridges also need special equalization in order to deliver a flat frequency response; this is not the case with a ceramic cartridge.

All is not lost! There are some phono preamplifiers made to do just what your sound system calls for. They both amplify and equalize the tiny signals produced by magnetic phonograph cartridges, bringing sufficient signal to the input of a sound system like yours so that proper performance is restored. Thus, the upgrade you had hoped for is really effected. (These units are manufactured by Shure Brothers, Stanton, Radio Shack, and others.)

Installation is simple. Merely connect the unit between the turntable and the input of the Electrophonic unit normally used to accept signals from the original cartridge.

Tonearm Cueing Problem

Q. I have a problem with my new turntable. I was careful to set it up according to instructions for balancing, stylus overhang, etc. As a last step, I used a very accurate bubble level to level the turntable front/back and left/right.

The problem is that the cueing does not work properly. When the "up" control is pressed, the arm rises and then moves inward approximately 1/16 of an inch. This means that the arm will not be at the same point on the disc when I lower it again.

Following the maker's instructions, I adjusted the level until the cueing problem was solved, but the level was off by a few degrees! Which setup is correct, and is something wrong with my turntable?—Peter DeMeo, San Bernardino, Cal.

A. It sounds as though the lever which actually lifts and lowers the tonearm may be bent, not absolutely parallel to the turntable. Thus, if it tends to dip toward the center of the record, it may cause the arm to slip in that direction. If you are mechanically oriented and willing to mess with it, bend the lever so that it is now parallel to the record surface. Be sure to level the table properly.

It also occurs to me that if you have your anti-skating compensation set incorrectly or if it is miscalibrated (which amounts to the same thing), the tonearm may have a natural tendency to move inward, even with the turntable correctly leveled.

Of course, you did solve your problem to some extent by just knocking your system out of level. If this adjustment does not result in excessive anti-skating force, it probably does not make much difference that you have a slightly misadjusted level. Chances are, if you continue to operate the turntable off-level, you will need to reduce your anti-skating force.

Multiple Tweeters With a Crossover Network

Q. I am designing my own loudspeaker systems, using four 8-ohm tweeters. Two are wired in series, and the next two are also wired in series; these two groups are wired in parallel to produce 8 ohms of impedance. By wiring several tweeters in this way, will the performance of the crossover network be affected? Will there be a danger to my tweeters?—Loren Gade, Virginia Beach, Va.

A. The crossover network will not care how the 8-ohm impedance which it expects to "see" is obtained. You have done everything correctly.

Improving AM Reception

Q. Is there any way for me to improve my AM reception? I live in a rural area in Wisconsin, but I enjoy a Chicago AM station—WGN—50,000 watts, clear channel. This station, located 368 miles southeast of my home, fades at about 7:00 in the morning.

I have a 62-foot television tower and a 10-foot satellite dish. Is there a way to use either of these for radio reception?—R. G. Yancy, Bruce, Wisc.

A. Aside from using your TV tower as an anchor point for an AM antenna, your tower and dish won't be too helpful. But before answering your question

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.

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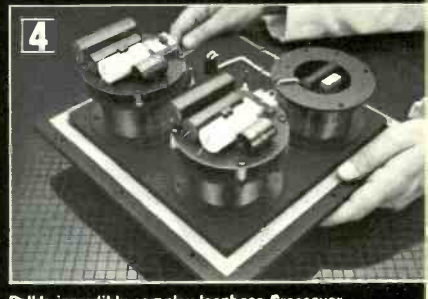

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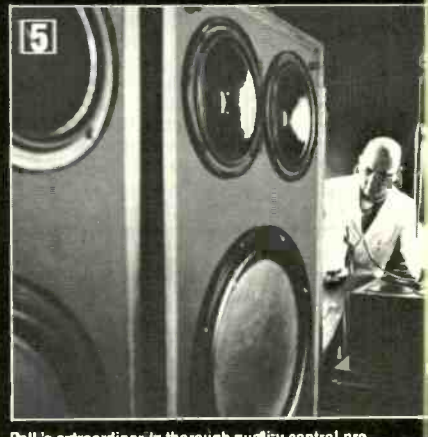

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See dealer listing on page 122

Changes in audio quality and signal strength are simply facts of life with long-distance, nighttime AM radio reception.

fully, I need to know more about the fading you mention. If the signal disappears completely, little can be done to salvage the situation. If the signal is still present, but is much weaker, then you may be able to do something to make it more usable.

Connect a length of wire to your tuner's AM antenna input terminal. Run this antenna so it is clear of surrounding objects, and attach it, using some kind of insulator, to a tree or other object on your property as far as possible from the house, so your wire can be as long as possible—about 50 feet, minimum. Your TV tower might well serve as an anchor point if it is far enough from the house.

I cannot guarantee perfect reception once you add this wire. TV sets in the neighborhood can cause problems; someone vacuuming a carpet can cause problems. Summer storm static can be troublesome, too, and if there are any local broadcasts nearby, they may introduce sufficient signal to overload your receiver.

Usually a station operating at the lower portion of the broadcast band will not tend to fade during daylight hours, once its minimum signal level has been reached. You can definitely expect a constant fading in and fading out of the signal at night, with changes in audio quality along with the variations in signal strength. This phenomenon, known as selective fading, is a fact of life with long-distance AM reception.

The cure sometimes employed by commercial receiving sites is to use two separate antennas, spaced perhaps one mile apart, with each antenna connected to its own receivers. The receivers are interconnected to what is called a voting system. This simply means that the receiver having the strongest signal at any given time is the one allowed to transmit its audio to the main system. This arrangement is known as dual diversity reception.

Headphone Efficiency Problem

Q. My power amplifier has two stereo headphone jacks. I own two pairs of phones, each from a different maker, and use them simultaneously. Should I have a resistor in series with each pair of headphones so that one does not rob volume from the other? One pair has a bit more volume than the other.—Name withheld

A. Resistors can help, but not for the reasons you have suggested. You see, it is not a matter of one pair of phones stealing signal from the other. It is simply that one pair yields more acoustical output than the other from a given amount of input power applied.

Yes, add resistors (whose values must be determined experimentally), but *only* in series with the more efficient pair of headphones. With properly chosen resistance values, both pairs of phones will be equally loud for a given input signal.

TAPE GUIDE

HERMAN BURSTEIN

Residual Magnetism

Q. I have a magnetometer with a range of ±5 Gauss. Using the magnetometer on my tape deck, and allowing for the effect of the earth's magnetic field, I found that the field associated with the heads, guides, and capstans is negligible, probably due to my occasional use of a demagnetizer. It would be helpful to know what level of residual magnetism is considered tolerable in heads, guides, capstans, etc. without appreciable effect on the tape.

I checked the magnetism on a friend's tape recorder, and found that stray magnetism from the unit's speaker, appearing approximately where the tape goes from the cassette guide to the cassette take-up reel, is 5 Gauss. This seems high to me. Can you give me a reference to any article(s) on the effect of stray magnetic fields on recorded audio tape?—H. B. Hoeper, Arlington, Va.

A. As a rough guess, a field of 1 or 2 Gauss might not be harmful. Five Gauss does seem high, but what counts is the distance between the tape and the field. A very slight separation can make a big difference in the degree of tape erasure by the field.

You may find helpful my article "Magnetic Shielding" in the April 1979 issue of *Audio*. Also of interest might be my articles "Focus on Head Demagnetization" in the April 1981 issue and "Refocus on Demagnetization" in the September 1982 issue.

The Music Stops

Q. Three or four of my cassettes sometimes stop while playing. These are all of one brand, recorded on both sides, but played principally on one side and stored after fast-rewind. These tapes have been played about 30 to 50 times each. I have frequently used the auto search feature of the deck, which puts the cassette into fast-wind. When the tape stops, it will not budge if I push the play, fast-forward or rewind pad. I take out the cassette and sometimes find that the tape is tightly wound or that about an inch of slack tape is hanging from the cassette. In the latter case, I wind the tape tight with a pencil. In either case, I then slap the cassette sharply on my thigh, reinsert it, and find that it plays. Examination of the cassette when it stops of itself shows that some edges of the tape protrude. Do you have any recommendations?—Robert Olsen, Madison, Wisc.

A. Fast-forward or -rewind puts the tape under a good deal more stress than normal operation. If the transport mechanism isn't operating properly or if the cassette isn't well-made (and making it well is rather an engineering feat), problems such as yours can arise. Hence, one gets the advice to avoid fast-wind when possible—for example, by storing a tape in the just-played or just-recorded condition.

Still, with a high-quality deck, such problems are abnormal, and a visit to a qualified repair shop is indicated if the deck indeed is at fault. Or the other hand, if the problem occurs with only one brand of cassette and with no others of high quality, the finger of blame points at the cassettes. And the simple solution is to avoid the brand and type in question.

Dropout Problem

Q. Lately I have been experiencing very severe treble dropouts at the beginning of some of my cassette tapes; these are high-quality tapes that I recently began using. I wonder if the cause is my tape deck or the brand of tape. Some of the tapes have worked fine, but others not.—Philip Copeland, Natchez, Miss.

A. The problem could lie either in your tape or in your deck. But if it occurs only with some tapes and not with others, one tends to suspect the tape. The tape pack on the hub tends to be out of round at its beginning, where the tape is joined to the hub, and this can cause problems. You might try skipping the first 15 S of the tape and confining your recordings to the remaining portion. It is also possible that the tape is skewing badly during the early moments, perhaps because of faulty construction of the cassette. Such skewing could also be a fault of the deck, such as improper tension, for example, or inadequate tape-to-head contact. The latter may be due to insufficient tension exerted by the reels or insufficient pressure exerted by the pressure pad.

It has frequently been noted here and elsewhere that some decks and tapes, even though individually excellent, just aren't compatible with each other. This might be true in your case, requiring you to try another brand or type of tape.

Noise Reduction

Q. I listen to open-reel tapes, a few encoded with Dolby A or B, but most without Dolby because they were recorded in pre-Dolby times. This makes tape noise unbearable. Which Dolby system can I purchase that would be compatible with my tapes?—Melvin A. Petersen, Frederiksted, St. Croix, V.I.

A. For tapes without Dolby encoding, you would need a dynamic noise-reduction unit, which applies varying treble cut depending on the amount of high-frequency information in the audio signal. The less the high-frequency content, the greater the treble cut; thus, noise is reduced in the region where noise is most audible. (The February 1985 issue of *Audio* contains plans for building such a device, and lists a source for parts, kits or fully assembled units.)

Presumably, you already have decoders for proper playback of your Dolby A and Dolby B encoded tapes. I hope so, because stand-alone decoders may prove hard to get. Decoders and encode/decode units for the professional Dolby A system are probably available, but, since they're for professionals, even used ones won't be cheap. Dolby B decoders have apparently disappeared from the market, though you might find an old or used one after a long search. However, you can play tapes with Dolby B encoding pretty decently by turning your audio system's treble control down a bit.

Recording from Radio

Q. If you have a portable cassette receiver with no AUX (high-level) input jack, is there still a way that you can record directly from radio? I've noticed that if I try to record directly from the radio via a patch cord, inserting the cord's plug into the deck's microphone input jack, the sound is very distorted on playback. Is there an adaptor or

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.

To record directly from radio to a portable cassette deck, via the deck's mike input, use a cable with a built-in attenuation network.

some kind of device that would let me record through the microphone jack without distortion?—Jimmy Edwards, Greenville, N.C.

A. If you really do mean a "portable cassette receiver," i.e., a combination radio and cassette recorder/player, I don't see the problem. Such units almost invariably provide for recording off the air without external wiring.

If what you have is actually a portable cassette *recorder*, with no built-in radio, then a simple solution is available. Cables are available with built-in attenuation networks to reduce the radio's output signal to the point where it will not overload the recorder's microphone-input circuit. You may have to shop around a bit to find one, especially if you have a monophonic device on one end of the cable and a stereophonic one on the other. Make sure, too, that you get the correct-size plug for each device; some plugs, such as the 2.5-mm micro and 3.5-mm mini phone plugs, are easily mistaken for one another.

You could also build your own resistive voltage-divider network, say 100 kilohms in series with a resistor of 10 kilohms, to reduce the signal, taking the signal for the mike input across the smaller resistor. If you still get distortion, try 5 kilohms or less for the smaller resistor; if the signal is too low to drive the tape deck adequately, try something higher than 10 kilohms—perhaps 20 kilohms.

There are safety considerations, too. If both the radio and recorder are battery-powered, no problems will arise. But if either or both are a.c.-powered, make sure their jacks are isolated from the a.c. line (as they will be, if these devices use transformer power supplies), or else plug the devices into isolation transformers to prevent danger of electrical shock.

Snaps and Pops

Q. I am very pleased with my cassette deck's overall performance, but when I rewind and play or stop in midplay and restart, I hear static in the form of snaps and pops. It sounds like the static you hear when pulling a new record from its inner jacket. I have tried both wand and cassette-type demagnetizers, and I regularly clean the heads and capstans, but to no avail. I use only high-grade cassettes.—Pat Tufts, Westerville, Ohio

A. Static electricity is a mysterious form of annoyance for which I know of no sure cure. However, I can pass along two *possible* remedies which have worked in some cases. One is to give the cassette a sharp rap on a hard surface (not, of course, so hard as to damage either the cassette or the surface). Another is to disconnect all leads to the deck and then reconnect them. (Admittedly this second course sounds strange, but I have been assured that it has worked in some cases.)


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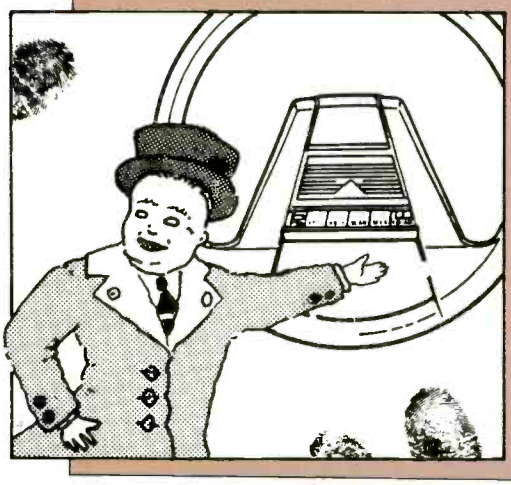
IVAN BERGER

UNDER YOUR THUMB

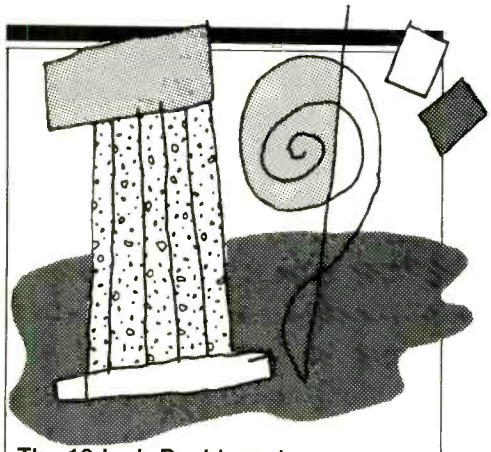
Tom's Thumb

"I was driving along the freeway, listening to the radio, when my wife, as is her wont, began to chat with me," says Tom Bryant of *Road & Track*, our sister magazine. Normally, listening to her would mean reaching over to turn down the radio, but Tom had an easier way: Since he was test-driving a Mitsubishi Galant at the time, he just flicked his thumb down to the hub of the steering wheel, and lowered the volume from there. "I thought it was terrific," says Tom, "because it meant I didn't have to divert my attention as far from the business at hand, which was staying alive."



The same thumb controls of volume, power, seek, scan, and AM/FM band selection are also available on the Plymouth and Dodge Conquests—not so coincidentally, built for Chrysler Corp. by Mitsubishi. Like home remote-control systems, they rely on infrared light to transmit information from the wheel to a receiver in the radio console. The radio in question is a premium model which includes eight speakers and a five-band graphic equalizer.

Meanwhile, I hear that in Japan the Nissan Maxima will come with a radio that monitors ambient noise and adjusts its volume to compensate. I hope it doesn't raise the volume wher your passengers start talking to you—though I've had a few passengers with whom I'd welcome that.



The 19-Inch Dashboard

Studios need playback as well as recording gear. They need high quality. And they're cramped for space. Altec Lansing once made a piece of studio equipment that just met those needs—a stereo cassette player and AM/FM stereo tuner, in a 19-inch rack panel just 3½ inches high. Altec used more ingenuity than engineering to do it: They just rack-mounted a car-stereo unit with a power supply to run the 12-V d.c. unit from 110-V a.c. lines.

Illustrations: Ben Chase

Road Noise and Dynamic Range

Every time I suggest that a sound system's dynamic range should be limited when the surroundings are noisy (on the road, for instance), I get at least one apoplectic letter saying that *not* limiting dynamic range is one of high fidelity's major objectives.

I don't think I'm a heretic (heretics never do, I admit). To me, dynamic range is not an end but a means to an end; to me, *the* object of high fidelity is to let you hear the music (or the steam trains, or whatever) as clearly and naturally as possible. That means full dynamic range when the ambient noise will let you hear it (as in the concert hall) and less range when the ambient noise will not.

In a moving car, ambient noise runs about 30 dB higher than in quiet homes. If you listen to music with wide dynamic range, you have to turn the volume up when you get up to speed, or else miss the quiet passages—then turn it down again when you stop, to restore natural dynamics. (If you listen to music that has no quiet passages, its narrow dynamic range prevents the problem from occurring.)

There are devices to sense ambient noise levels and adjust the stereo system's volume accordingly. But I don't think that's quite the way to go.

What I'd like to see is an ambient-noise sensor that adjusts the sound a bit more elaborately. First, it should ramp up the bass as road noise increases, since most of that noise is low in frequency. David L. Clark, who's doing research on car stereo (among other things), suggests a rise of up to 10 dB below 100 Hz. Second, it should combine level control with some compression, turning up the gain for low-level signals less than it does for high-level signals. If the car were standing still, one might have, say, an ambient noise level of 50 dB SPL and music whose levels varied from 50 to 100 dB SPL. If the car sped up so that its ambient noise level rose to 70 dB, the sound system's gain would automatically rise 'til the music's maximum level reached 110 dB, and compression would raise the minimum level from 60 dB (the result of the 10-dB higher gain level) to perhaps 65 dB.

The figures are pure guesswork on my part, so don't take them as gospel. But do note that, in my theoretical system, neither maximum nor minimum music levels rise as much as the ambient noise does. This is because noise does not mask music on a dB-for-dB basis (most road noise is bass, remember, and we've already compensated much of that, while most music energy is midrange), and because I don't want to endanger the listeners' hearing with ultra-excessive music levels. Hearing specialists might wince at even the 110-dB levels I've guessed at here.

My proposed system would also have a preset gain-shift limit. Overall gain would not be further increased once sound output reached the preset maximum, though further rises in ambient noise would continue to cause increased compression of low-level sounds. This limit is also to protect the users' hearing.

Continued on page 23

COBRA TRAPSHOOTER PRO II/MODEL 4100. Virtually eliminates false signals.

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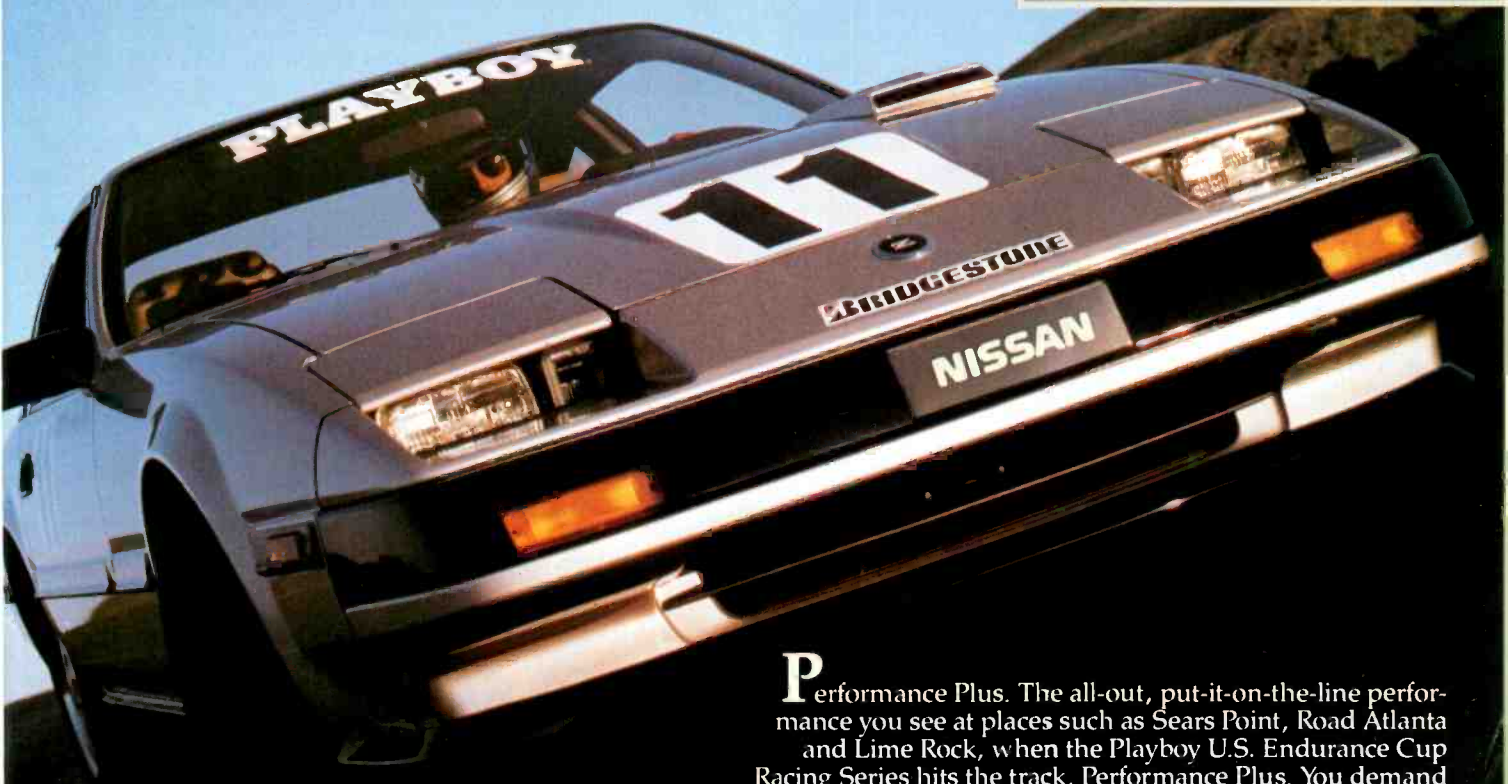

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Serious drivers. That's who Bridgestone had in mind when it developed the Potenza. A serious high-performance steel-belted radial for drivers who take performance seriously. Potenza V- and H-rated radials can trace their lineage straight back to Daytona, Riverside, LeMans. The Potenza 137V is a 60-series tire with an HR speed rating. The 60-series Potenza 147V has a VR speed rating. And the ultra high-performance Potenza RE91 is a 50-series tire with a VR high-speed rating.

All three Potenza models have a straight, water-channeling tread pattern and a racing-like compound for a tenacious grip on the road. SuperFiller, a unique hard-rubber insert around the rim, means a more flexible sidewall for firm, sure footing during hard cornering and braking. Anyone serious about driving needs Potenza, the serious high-performance radial.

Today's high-performance automobile isn't complete without high-performance sound. And no matter your taste in tunes, from hard rock to Rachmaninoff, from The Boss to Bach, no one can fill your car with sound like Jensen can.

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POTENZA 137V. An aggressive tread pattern and raised black letters for looks that match performance.

NISSAN 200SX TURBO HATCHBACK. Blinding performance with a style all its own.

POTENZA 147V. 60-series, VR speed rating. SuperFiller bead for maximum braking, cornering performance.

speaker system, each speaker with its own 20-watt volume-boosting amplifier. Or for the ultimate in high-performance sound reproduction, go for Jensen's 6"×9" Triax® 3-Way speaker system. Each speaker can handle 150 watts of peak power with 80 watts RMS. The 40–25,000Hz frequency response means you'll hear all the music. These beauties are so efficient they even sound great with a standard car radio.

And speaking of high tech, Cobra's new superheterodyne Trapshooters are out there on the leading edge of radar detector technology. Side-by-side lab tests with the competition have proven the unequaled sensitivity of the Trapshooter line. And with special advanced anti-falsing circuitry, false alerts are virtually eliminated. If a Trapshooter goes off, you better back off.

The Cobra Trapshooter Model 3100 is a dual-band, dual-alarm, ultra-compact detector that easily mounts on visor or dash. Lockout feature reduces false alerts. The repetition rate of the alarm increases with signal strength.

The Trapshooter Pro II Model 4100 has Cobra's exclusive Signal Sensor, which effectively discriminates against low-level non-police radar without sacrificing high sensitivity to the real thing. Lockout circuitry and No-false eliminate response to "dirty radar" from radar detectors in nearby vehicles.

For the ultimate in detector sophistication, there's the Cobra Trapshooter Pro II Remote Model 5100. Virtually invisible to thieves, the Pro II Remote consists of an antennae module that mounts under the hood behind the grille, and a small control head that mounts under the dash. The Pro II Remote has Signal Sensor, Lockout and No-false circuitry for the same super performance as the bigger Pro II.

JENSEN 6"×9" TRIAX® speakers, AT2500 stereo receiver and EQA5000 graphic equalizer. Maximum high-performance sound.

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NISSAN 200SX TURBO HATCHBACK. Blinding performance with a style all its own.

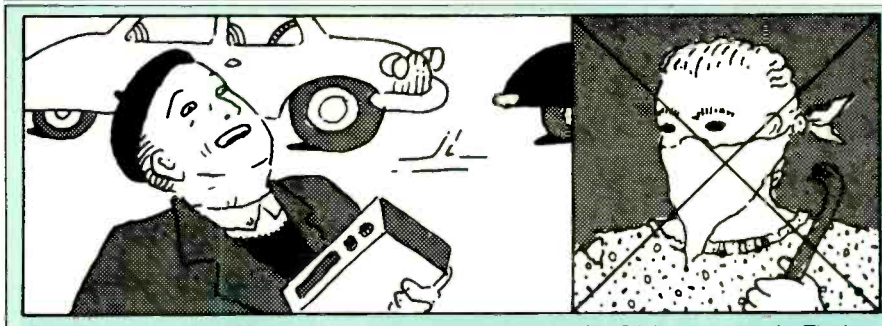
POTENZA RADIALS. Designed for demanding high-performance driving.

NISSAN 300ZX TURBO. It's an all-new design, but there are echoes of the legendary 240Z in the sleek, aerodynamic lines of the 300ZX.

COBRA TRAPSHOOTER PRO II/ MODEL 4100. Dual-band, dual-alarm professional-caliber detector.

Sponsored by: Nissan Motor Corporation in USA, Bridgestone Tire Company of America, Inc. Cobra Consumer Products Group, Dynascan Corporation, International Jensen, Inc.

Continued from page 18



Illustrations: Ben Chase

Anti-Theft, Italian Style

Since I discussed theft-resistant stereo systems in this column last fall, some new approaches have come to light, both from Italy.

One idea comes from Autovox, which may be a new name to most U.S. motorists, but not to me—my first car, a Fiat 850, came with a dull little AM-only Autovox.

The current line is much more high-tech. As tangible proof of this, Autovox sent me a front-panel segment with 21 buttons on it. Their approach to theft-deterrence is removability: The company's entire line mounts in (and easily slides out of) in-dash buckets; they claim to be the world's largest builder of such systems. Extra buckets are available, so you can transfer your unit from car to car, or even into boats.

Britain's *New Scientist* magazine describes another Italian anti-theft idea, for people who hide their car players under their seats. Normally, that makes the players invisible to thieves, but hard to operate while one is driving. Inventor Marco Clementi has recently patented an audio system which slides forward at the touch of a remote button, for easier tape loading, then slides back under the seat. The inventor claims it is "impossible to carry the car radio away without removing the car seat as well."

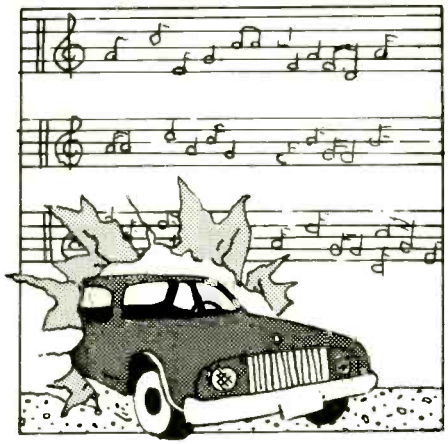
Car, another British magazine, carried a note from a former resident of Italy, P. M. Gadsby, saying that new cars there come without radios, which Fiat and VW dealers (at least) install when the car comes back for its first service. According to Gadsby, the system has two advantages: You get your choice of the "free" system or a better one, and you also get "a better first service, as more teething problems will be apparent . . . having driven an otherwise soundless car."

Octaves and Selective Fudge

The "correct" sound isn't always the right one, under car conditions. As one of many to make that discovery, here's Lewis Athanas, of Genesis Physics:

"The following is a description of my attempt to scientifically equalize the sound in two cars, my fair amount of technical success, and the heavy amounts of subjective fudging needed to make things sound correct on the road. I'm still not sure what the results mean, if anything, but I do know that I don't like the 'correct' sound in either car when actually driving.

"My wife's Peugeot 504 diesel wagon and my Renault Gordini both have their own unique forms of engine and road noise. The Peugeot has an ever-present mid-bass hum/rumble effect, but entirely lacks wind noise, rattles and squeaks. The Gordini, on the other hand, seems to introduce a fair amount of engine whine in the 1 to 2-kHz octave, regardless of rpms, and has an increasing amount of wind noise with speed, due to the large, damaged (and soon-to-be-replaced) sunroof. Both cars have Genesis AM-165 speakers (naturally) mounted high



and forward on the doors, with Concord decks and amps.

"My exotic test equipment consisted of an ADC 10-band graphic equalizer/analyzer. Its pink noise, recorded on tape, proved fairly flat as measured at the Concord's outputs. We played the tape in both cars, with my wife and I sitting mute in the front seats, the mike dangling between our heads, while we observed the system frequency response on the spectrum analyzer. (Both Pamela and I preferred the pink noise to most of the radio stations we receive.) Using that data we made equalized pink-noise tapes for each car, establishing reasonably flat frequency response as played back through the car systems.

"Now for the totally subjective responses. To begin, bass response: Although measured flat, the very low bass in the Gordini was not as apparent as it would seem from the measurement (an effect I've also noted in small rooms), and needed to be boosted, but the mid-bass was too strong and needed to be cut. This was not so for the Peugeot, possibly because of the great difference between the cars' interior volumes.

"I find that, in a moving car, it is not enough to boost the music in the same band where the noise is. After boosting that band, the octaves just above and below it must also be boosted, even a bit more, to make the music sound 'normal.' Maybe this adds apparent detail or clarity to the band troubled by noise; I don't know.

"These adjustments seem to make music sound more realistic, not electronically zotzed up, but I'm totally in the dark as to what I'm actually hearing. I've done stuff in recording studios; I still can't figure it out in cars."

Any of you psychoacousticians out there care to take a flyer on this?

KEN POHLMANN

FILTERS À LA DIGITAL

Last month, as you might recall, filter à la analog was the main course on the menu at the Domain Restaurant. Although the cascaded passive design had a promising, traditional taste, we soon developed a dislike for the spicy phase shift and watery dispersion inherent in the recipe. I think we agreed that brick-wall fare perhaps wasn't appropriate for our more refined digital palates. We wondered: Is there some way of interfacing digital storage with the analog world, without using analog filters? The answer is no, and yes.

The Nyquist Theorem dictates that the input anti-aliasing filter be present before sampling occurs. In other words, filtering must take place on the analog signal before digitization begins; thus, the input filter must be analog. We must carefully observe our design criteria to minimize dispersion, and perhaps employ time correction to compensate for phase shift.

The output anti-imaging filter is traditionally placed after the D/A converter; therefore, it, too, is an analog device. But there's an alternative. It should be possible to implement filtering in the digital domain, before the D/A converter. Voilà—digital filters or, as the technique is sometimes called, oversampling. With clever data manipulation we can alleviate the need for an output brick-wall filter.

The pulse amplitude modulation signal (staircase waveform) is the analog output signal of an audio digitization system. Those sharp staircase edges represent high-frequency content not present in the original audio waveform. Specifically, this high-frequency content occurs as a series of image spectra, which are duplicates of the original, repeating endlessly, as shown in Fig. 1. It is the anti-imaging filter's job to smooth the waveform and thus remove these duplicate images, leaving only the original spectrum. Sharp-eyed readers might question the need to worry about frequencies such as 43 or 176 kHz, since they lie so far above the limits of audibility. The original waveform is reproduced without filtering, but the accompanying image bands cause intermodulation in downstream equipment through which it passes, and that in turn could add audible distortion to the signal.

Illustration: Joyce Raimondo

Rather than suppress these high-frequency image components after the signal has been converted to analog form, it is possible to process the digitized signal before D/A conversion using an oversampler, a transversal filter, and a noise-shaper circuit. A block diagram of the technique, as implemented by Philips in their CD players, is shown in Fig. 2. In this circuit, the 16-bit, 44.1-kHz audio channels pass through a shift register, which oversamples them, multiplying the sampling frequency by, in this case, four. As a result, the 44.1-kHz sampling frequency becomes 176.4 kHz. Four times as many samples are present after oversampling; the intermediate values are calculated at the transversal filter. The same shift register delays the samples so that, after multiplication by 12-bit coefficients and addition, the weighted average of a large number of samples is generated. The filter's coefficients produce a transition region between 20 and 24.3 kHz, and again around 176 kHz, which accomplishes the filtering. The overall effect is the suppression of the frequency bands between 20 and 156.4 kHz. As can be seen in Fig. 3, the bands centered at 44.1, 88.2, and 132.3 kHz no longer exist; thus, filtering has occurred. (The band around 176 kHz will be suppressed in a later circuit stage.)

Oversampling has an additional benefit: By oversampling four times, the noise power is distributed over a band four times as wide as that from which it was originally derived; in other words, the quantization noise from the band of 0 Hz to 22 kHz is extended over a band four times as wide, 0 Hz to 88 kHz. Since only the in-band noise affects us, we can say that only one-quarter of the quantization noise remains. Thus, we are rewarded with a free 6-dB improvement in signal-to-noise ratio.

The output from the transversal filter is a digital bit stream with a word length of 28 bits and a sampling frequency of 176 kHz. A digital noise-shaping circuit is used to improve the signal-to-noise ratio by 7 dB. The 28-bit samples are rounded off to 14 bits; the rounding off is delayed by one sampling interval and added back to the input signal. The result is that noise power is filtered so that quantization noise is no longer uniform over the band from 0 Hz to 88 kHz. In the audio band, from 0 Hz to 20 kHz, the noise power is greatly reduced, and above this band it is greatly increased, as shown in Fig. 4. That's totally satisfac-

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LET'S GET IT TOGETHER...BUCKLE UP

Amplifiers have always had bandwidths much greater than necessary; now, digital designers are apparently following suit.

tory because only the in-band noise level concerns our ears.

Normally, rounding off the samples to 14 bits would yield a signal-to-noise ratio of 84 dB, but with our free 6 dB from oversampling, and our additional 7 dB from noise-shaping, we end up with a maximum S/N ratio of 97 dB. We can use a much cheaper (and less temperature-sensitive) 14-bit converter while rivaling the performance of everybody else's 16-bit converter. The information in the 15th and 16th bits of the signal are transferred to the 14th bit. Full 16-bit information capability is retained because the information capacity of the two "surplus" bits is transferred into the four-times-higher information-transmission level of the oversampled signal. In other words, the averaged value of the quarter-length, 14-bit samples is as accurate as that of 16-bit samples over the original sample period. (Parenthetically, I should mention that Philips uses a very ingenious converter design called dynamic element matching, with outstanding characteristics of its own.)

Our recipe for good sound does not include the image band around 176 kHz which the transversal filter did not remove. This is now suppressed—in the analog domain—by the combination of a sample-and-hold function with a (sin X)/X characteristic and an analog filter.

This anti-imaging filter follows the converter, just as in players without digital filtration. But it is tame compared to the brick-wall dishes we tasted last month. Since the band we must eradicate is so high in frequency, we can use a filter with a gentle, 12-dB/octave curve and a −3 dB point between 30 and 40 kHz. It is a noncritical design; a third-order Bessel type might be employed. Its low order guarantees good phase linearity; phase distortion is reduced to ±0.5° across the audio band. The bandwidth of the filter is also greater than the audio bandwidth. Amplifiers have always had bandwidths much greater than "necessary"; now, digital designers are apparently following suit.

A digital filter design is thus an efficient method of accomplishing the task of anti-imaging without resorting to analog brick-wall filters. While many CD player manufacturers who still employ analog filters might disagree, digital oversampling seems to me to offer a more sophisticated solution. On the other hand, some manufacturers with oversampling designs are guilty of some highly misleading advertising; they imply that the fourfold sampling rate automatically means higher fidelity. Of course, that is not true per se; as we have seen, oversampling is merely a technique internal to the digital filter.

In terms of sonic performance, does digital filtering do a better job than analog filtering? Do CD players with digital filters sound better than those with analog filters? After critical, blind listening, I think I incline toward the digital. I encourage all readers to try the test for yourselves; I guarantee it will give your sensibilities a real workout. Perhaps the difference is so slight as to be merely a question of taste. Your check, sir. A

Reference

Van De Plassche, R. J., and E. C. Dijkmans, "A Monolithic 16-Bit D/A Conversion System for Digital Audio," presented at the Audio Engineering Society's Rye (N.Y.) Conference, June 1982.

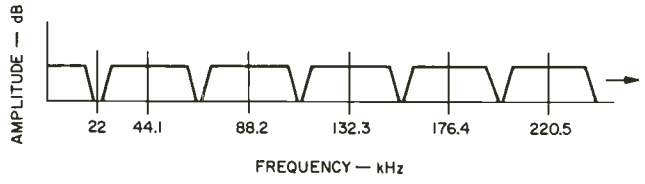

Fig. 1—Frequency spectrum of sampled output signal, showing periodic repetitions of audio band at multiples of the sampling frequency.

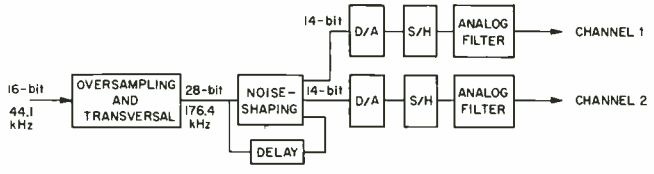

Fig. 2—Digital filtration.

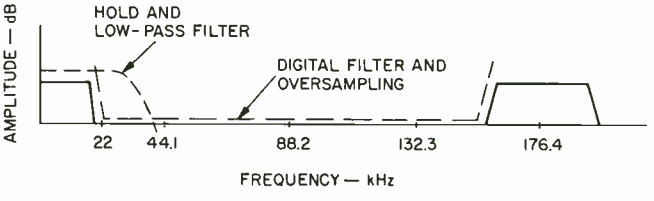

Fig. 3—Frequencies above the audio band are suppressed in two stages. The bands surrounding 44.1, 88.2, and 132.3 kHz are removed by the transversal filter; the remaining band, centered at 176.4 kHz, is removed later by the sample-and-hold circuit and a gentle low-pass filter.

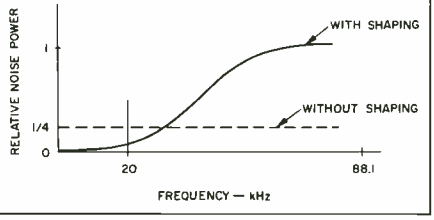

Fig. 4—Noise-shaping reduces noise within the audio band by increasing noise at higher frequencies, which is later filtered out.

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BERT WHYTE

MODERN ENGLISH

B & W's car speaker on the drawing board of J. R. Greenwood

Constructing drivers used in the B & W Modular Automobile Sound System

G. J. Adams setting up laser interferometer test of cabinet resonance

Who was it that said, "Oh, to be in England now that spring is here"? Happily, this quote was quite apropos for a recent trip I took with Associate Editor B. V. Pisha to the B & W Loudspeaker facilities in Worthing, Sussex. Instead of the usual rain and gray bluster, the sun shone brilliantly, the grass was green, the willows were weeping and the lilacs were blooming. Needless to say, such an opportunity to go "behind the scenes" (plug intended) is much appreciated. Being able to meet the designers and engineers of audio products and observe fabrication, measurement, and quality control is always fascinating, instructive, and rewarding.

Since I last visited, in April 1980, B & W has gained a significantly larger share of the high-quality loudspeaker market. The acceptance of their Model 801F as the preeminent monitor for classical music recording by the major record companies has been well documented. Now the mighty Model 808 (discussed here in March 1985) is rapidly becoming the monitor of choice to cope with the high power-handling exigencies of digital recording.

B & W has prospered from the success of their loudspeakers for the consumer market, and all this growth and activity has necessitated considerable expansion of their manufacturing facilities. B & W is one of the most research-oriented companies in loudspeaker manufacturing. By centralizing all of their research and development work in Steyning, a small village six miles north of Worthing, they have gained much manufacturing capacity in their original plants.

The ever-genial chairman John Bowers, company president Peter Hayward, and the irrepressible international marketing director Robert Trunz took us to the Steyning research establishment. Here, B & W maintains a large anechoic chamber and laboratories lavishly equipped with all sorts of exotic Tektronix and Brüel & Kjaer oscilloscopes, signal generators, graphic recorders, FFT analyzers, Time Delay Spectrometry equipment, and other instruments too numerous to mention. B & W pioneered the use of laser interferometry for analysis of vibratory modes in loudspeaker cones and drivers, and their laser interferometer has been further refined. Now housed in a separate temperature- and humidity-controlled room, it is linked to a more modern high-density computer which has extensive graphics for visualizing various test data. The Steyning facility also has a special, acoustically treated listening room, plus a "normal" listening room supposedly representing the kind of environment found in most homes. It was our opinion that the latter was rather more stark and reflective than most American living rooms.

Ongoing tests and studies conducted by John Bowers and his staff of engineers at the Steyning research establishment have resulted in several new product developments, including their first active loudspeaker, the Active 1. This is the initial model in a projected line of such loudspeakers, and a separate new company, John Bowers, Ltd., has been set up to market them. (Like B & W speakers, they will be imported to this country by Anglo-American Audio.)

The Active 1 has three vertically in-line drivers, with electronic inter-unit time-delay correction. Treble is handled by a 26-mm, polyamide, laser-optimized dome tweeter. The bass and bass/midrange drivers are both of Bextrene, with edge-wound ribbon voice-coils on Kapton formers, and can operate safely at up to 250° C.

The electronics—amplifiers, crossovers and contour controls for bass and treble—are mounted in an isolated compartment at the back of each loudspeaker cabinet. The 200-watt bass amplifier, using vertical MOS-FETs, powers the bass and bass/midrange units, while the tweeter is powered by a similar amplifier of 100 watts output. Both amplifiers operate in Class A up to the first 90 dB of acoustical output; beyond that point, they operate in Class AB.

The Active 1 has Automatic Overload Protection Circuits and an automatic on/off a.c. switching system activated by the presence of a signal.

The loudspeaker drivers and the electronics are housed in a 28-liter enclosure made of a very rigid, low-resonance, high-density particleboard and bitumen compound laminate. The enclosure measures 24⅝ in. H × 14 in. D × 10 in. W and is integrated into a pedestal-type stand for an overall

Anechoic chamber and test instruments in Steyning research establishment

Testing of the John Bowers MPA1000 amp; Mr. Bowers is at extreme right

Prototype of the MPA1000 amp, which puts out 1 kilowatt/channel into 4 ohms

height of 33⅞ inches. The Active 1 is available in black ash, natural oak, and walnut veneers. A special version, the Active 1 Limited, has an unusual, very modernistic asymmetrical enclosure, and is sold in mirror-image pairs finished in black or red lacquer.

We auditioned the Active 1 in the "normal" listening room and agreed that the acoustics of this room were too reflective to permit a truly representative evaluation. I have an LEDE (live-end/dead-end) listening room in my home, so perhaps I am unduly sensitive to underdamped rooms. In any case, when the Active 1 loudspeakers were set up in the acoustically treated listening room, it was easy to perceive the very high order of musical realism provided by their unique design. With 300 watts of power per channel properly apportioned among the three drivers, they gave a very convincing demonstration of their capabilities with digital recordings of wide dynamic range. The imaging was impressive, stable and precise, with a good sense of depth affording a spacious dimensionality to the music.

The expected advantages of this type of design in respect to transient response and intermodulation distortion were fully realized. All manner of percussion—drums, cymbals, wood block, bells—and piano transients had an incisive attack and were very clean. Bass response extends down to 32 Hz, thanks to low-frequency equalization employing active filters. Tympani, kick drum and contrabass viols, therefore, were well reproduced, although not with the weight and authority of a Model 808. Smooth, non-peaky response from high strings and soprano voices attested to the evenness of frequency response.

With a wide variety of pop and classical music, the Active 1 is unquestionably a good performing loudspeaker. And for those who desire a "big sound" but cannot afford the space or the cost of 801F or 808 speakers, it is a reasonable alternative. Projected cost in the U.S. will be $2,995 per pair. Of course, another advantage of this design is its neatness and compact size—all one need do is add a good-quality preamplifier, and it's ready to perform. To this end, there is an optional, companion Active Control Unit ($775). This is a rather basic, high-quality preamp with both MC and MM phono inputs, high-level inputs, and volume and other operating controls.

Another new product demonstrated at the research establishment, the MPA1000 power amplifier, is a further example of John Bowers' aggressive move into electronics. A MOS-FET design embodying new and proprietary technology, this brute has a gargantuan output of 1 kilowatt per channel into 4 ohms! Driving a pair of Model 808s in the damped listening room, the prototype amplifier made a most favorable impression, with obvious ease of high power output. On pop/rock material, the impact was visceral. On large-scale classical recordings, the weight and sonority of contrabass, tympani,

John Bowers Active 1 loudspeaker; below, the Active 1 Limited

It was easy to perceive the very high order of musical realism provided by the unique design of the new Bowers Active 1 speakers.

bass drums and organ sounded most convincing and authoritative. High strings and upper-register brass were smooth and sweet, without a trace of harshness or edginess.

We were also given a demonstration of how laser interferometry is used to plot the resonant modes of enclosure panels and to retest them after corrective damping and bracing have been applied. We listened to a test of three identically sized enclosures constructed of different materials but which had identical drivers. One of the enclosures was made of the material currently used in B & W cabinets. Another was made of a much-touted honeycomb material, and one was made of a high-density proprietary material which may be incorporated in future B & W loudspeakers. The test signal was low-level music with a superimposed high-intensity transient signal that sounded like a wood block. The difference in the sounds from the three enclosures was striking. It was easy to perceive a small amount of resonant coloration from the standard B & W enclosure material, and a bit more coloration—of a more peaky nature—from the honeycomb material. The new material was almost totally free of resonant colorations.

Back at the Worthing plant, after having seen the manufacture of various parts, the winding of voice-coils, and assembly and quality-control procedures on all B & W loudspeakers up to the 808, we proceeded to the parking lot. There we heard B & W's new MASS (Modular Automobile Sound System), a group of bass, midrange, and high-frequency modules which permit great flexibility for mounting into the myriad of different car models. One can start with the basic modules, add 801F-type tweeters, and go on all the way to a trunk-mounted subwoofer.

A pair of the basic modules were mounted on the door panels of John Bowers' Porsche 944. These door-mounted modules have a proprietary dispersion device to direct their sound up into the car interior. They are very rugged, with Kevlar cones and exceptionally large magnet structures, and are even fitted with B & W's Automatic Protection Overload Circuit. Sitting in the luxurious bucket seat of the Porsche, and listening to pop and classical music from a Nakamichi cassette

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The B & W car stereo system has a dispersion device that creates a broad panorama of sound above the dashboard. I think it'll cause quite a stir here.

deck, I was really impressed with the effortless high power, cleanness and good bass response. The most unusual thing was that the dispersion device created a broad panorama of sound right above the dashboard, seemingly on the windshield of the Porsche. I think this MASS product is going to cause quite a stir in the American car stereo market.

There were numerous other interesting products and demonstrations at B & W. As always, John Bowers, Peter Hayward and Robert Trunz were the most gracious of hosts, with boundless hospitality. It was nice to receive the good fellowship of such progressive people, who so obviously enjoy the work that they do.

While in Steyning, we were invited to the home of the urbane Alastair Robertson-Aikman, owner of SME, the well-known manufacturer of high-quality tonearms. (The building which now houses the B & W Steyning research establishment used to belong to SME.) Alastair is the quintessential English gentleman, and on the occasion of my last visit, in 1980, I described his fabulous, purpose-built listening room with its 30-ton, reinforced-concrete roof! Gone now are the multiple-unit Quad Model ESL loudspeakers, replaced by Quad ESL-63s, each damped by 80 pounds of added mass. Alastair is very big on opera, and fellow opera-lover B. V. Pisha was simply overwhelmed when Alastair played the Carlos Kleiber recording of *Die Fledermaus* for him. Dr. Pisha says that the truly marvelous acoustics of this room afforded the most realistic presentation of recorded opera he had ever heard. Alastair played this recording using his new tonearm, an all-out design with several pieces of new technology. For example, the arm and headshell are cast in one piece and of a special alloy. Such high-precision casting is hard to find, and I was interested to learn that Alastair has this work done for him by a master artisan in Chicago, who then ships it to England where the complex machining is done in the SME plant. There is no doubt that this arm is jewel-like in its finish and fairly exudes a high-tech appearance. It will be distributed in the U.S. by Dave Fletcher's Sumiko Company, and is expected to sell for $1,500.

FOR THE SHEER LOVE OF MUSIC

There's a big difference between real music and "hi-fi". Unfortunately, as you spend more and more on your stereo system, all you usually end up with is more spectacular "hi-fi". This doesn't have to be the case. With a Linn/Naim system, every additional dollar spent actually results in a musical improvement.

This doesn't mean that a system that can provide *music* in your home must cost a fortune. While the Linn/Naim "Six Pack" system pictured above sells for nearly $20,000, other Linn/Naim systems start at well under $2,000. And, for less than a thousand, substantial improvements can be made to your existing system.

Whether you choose to improve your current system, or start with a complete Linn/Naim system, your Linn dealer, because he fully understands that there is a hierarchy to the system, can see to it that each purchase does indeed bring you more enjoyable music, rather than simply more spectacular "hi-fi".

For additional information on Linn and Naim components and the hierarchy of a hi-fi system, contact your Linn/Naim dealer.

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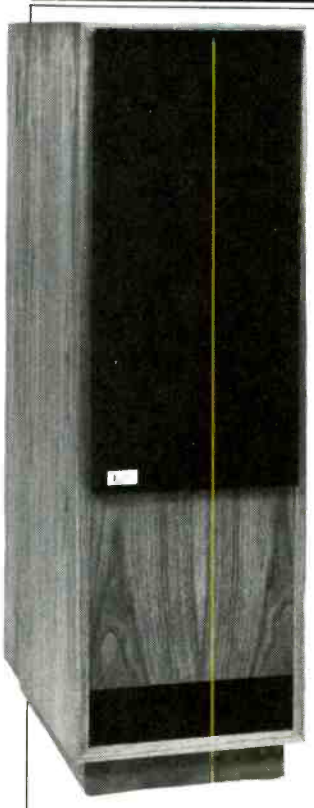
See dealer listing on page 125

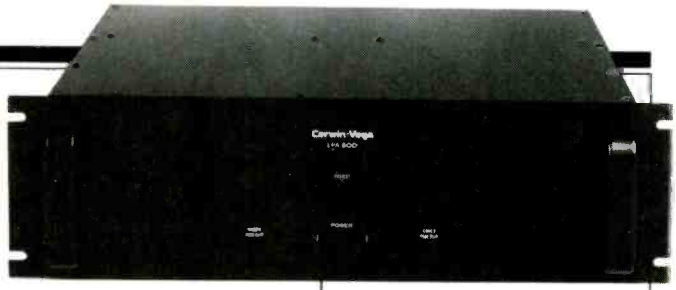


Fried Speaker

The Fried Studio IV uses an 8-inch, duo-cone bass/midrange driver plus a dome tweeter. The lower driver has a vented pole piece and is mounted in a large, "line tunnel" enclosure. This driver crosses over to the tweeters by a series network for phase congruity. For dispersion control, the enclosure is narrow, with rounded front edges; the cabinet's depth is said to help separate direct sound from rear-wall reflections. A tilting device is built into the pedestal. Sensitivity is rated at 90 to 91 dB, and the recommended power range is 20 to 200 watts. Frequency response is stated as 26 Hz to 22 kHz, within 3 dB, and impedance is 8 ohms. Price: $1,150 per pair.
For literature, circle No. 100

Cerwin-Vega Power Amplifier

Designed for both home and professional sound applications, the LPA-600 amplifier delivers 350 watts per channel (at 0.03% distortion) into 8 ohms, 600 watts per channel (at 0.05%) into 4 ohms. For protection against adverse operating circumstances, the LPA-600 has a cooling fan with thermostatic speed switch, thermal overload protectors, and an independent output-protection circuit. Turn-on delay and an instant speaker cutoff prevent "thumps" from reaching the speakers while the amplifier's capacitors are charging or discharging. Peak-clip and protection LEDs on the front panel inform the operator of conditions requiring attention. Other LPA-600 specifications include a power bandwidth of 7 Hz to 60 kHz, 115-dB S/N, and a slew rate of 20 V/μS. Price: $1,700.
For literature, circle No. 101

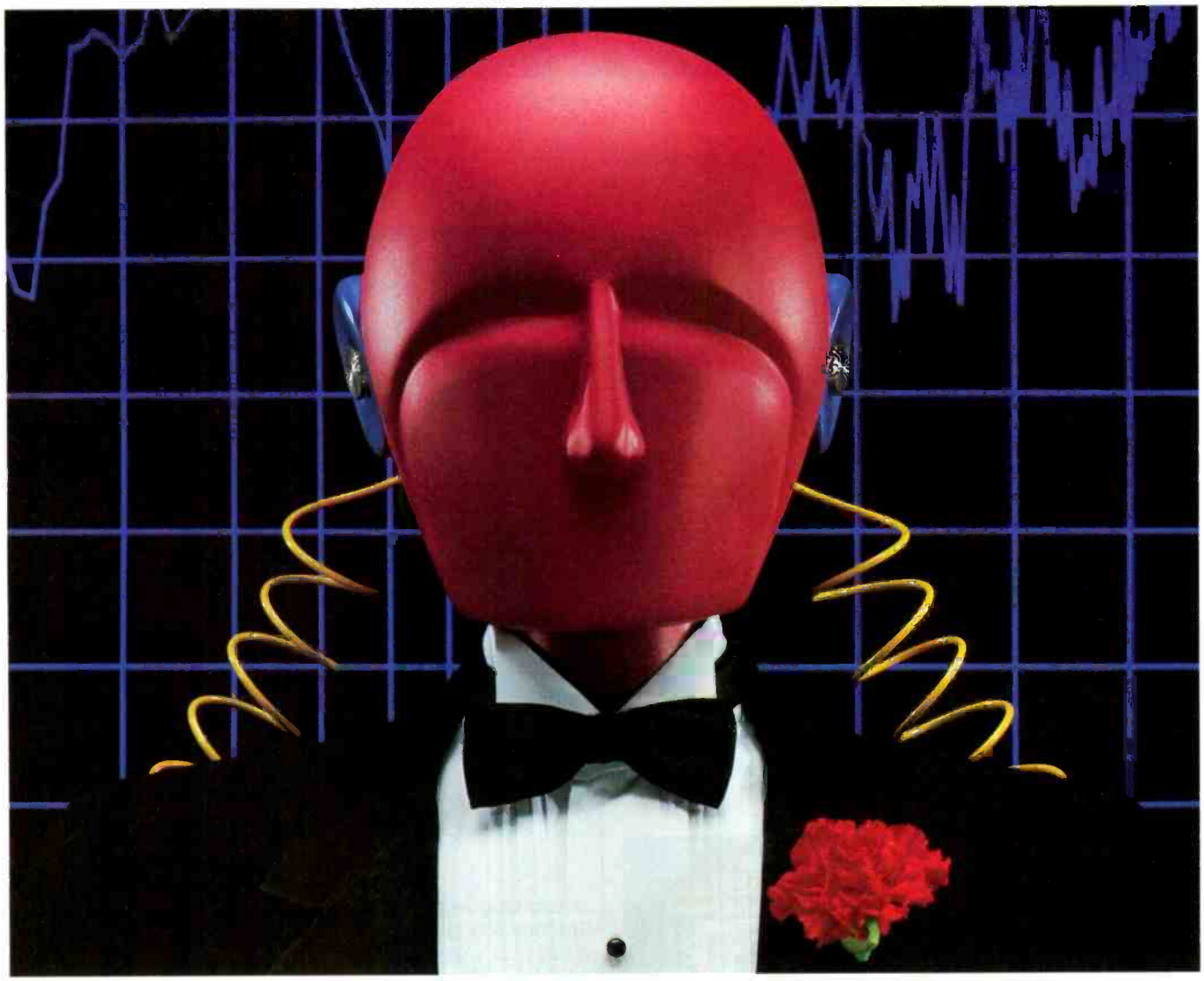


Sound Accessories CD Rack

Holding 12 CDs in each of two matching racks, the SAC #CD-12X2 Stako-Disc interlocks top-to-bottom or side-to-side. The unit is made of smoked plastic. Price: $12.95 per package of two.
For literature, circle No. 102

Denon Preamplifier

An upgraded version of Denon's top preamp, the PRA-2000Z offers three independent phono inputs: One for MM cartridges plus two for MCs. One of these MC inputs has a transformer, while the other has an FET-based pre-preamplifier to provide optimum matches for different MC cartridges. Instead of negative feedback, the five high-level input circuits use Denon's "direct distortion servo" circuits, with slew rates of 500 V/μS. Electronic switching shortens the signal path for all inputs. Frequency response is rated at 10 Hz to 100 kHz, within 0.3 dB, and S/N is 105 dBA. Price: $1,300.
For literature, circle No. 103



"Everytime I read another rave review of the Delco-GM/Bose Music System, I blush."

Morgan

Born in 1958 at M.I.T., Morgan is a vital member of the Delco-GM/Bose Design Team.

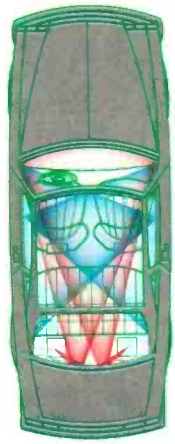
"Have you read how the critics go on about the Delco-GM/Bose Music System?

"A 'concert hall on wheels . . .,' raves **Popular Hot Rodding**. 'If your car is this well-equipped, you won't want to go home again,' declares **Chicago Magazine**. 'It's the one option no one should go without,' claims **Motor Trend**. And, get this, **Popular Science** goes as far as to say, 'it's as good or better than the best home systems.'

"Mind you, I'm not the type to let this sort of uninhibited praise go to my head. But when **Stereo Review** labels it a 'sonic paradise', and **High Fidelity** declares, 'The performance of the Delco-GM/Bose Music System was astounding . . . I can't imagine anyone (buying) one of these cars . . . without the Music System,' the pride simply wells up inside.

"Now I don't expect you to take my word for it. After all, **Popular Mechanics** said 'you have to hear it to believe it'.

"So, I cordially invite you to visit your Buick, Oldsmobile, Cadillac, or Chevrolet dealer to experience the Delco-GM/Bose Music System. Only then will you 'believe every rave you've read, and then some" **(Auto Week)**.



Morgan helps us design a different Delco-GM/Bose Music System to match the individual acoustics of specific GM car models. Each system has four separate speaker modules.

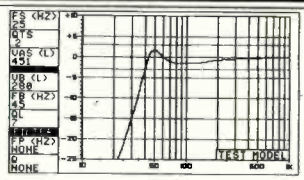
Delco GM BOSE

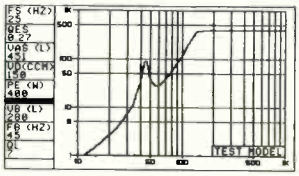
Sound so real, it will change how you feel about driving.

Sound Associates Subwoofer

Flat-panel dipole speakers usually operate from the upper bass to treble ranges; the Enigma dipole, however, is designed for the range from below 20 Hz to a crossover point of 100 Hz. The subwoofer system includes a third-order, active, low-pass crossover; a first-order, passive, high-pass crossover, and a 300-watt, low-frequency amplifier. Other features include signal generators for system balancing, an overexcursion protection system, and a polarity checking system. Price: $2,895; $2,295 without amp.

For literature, circle No. 104





SDS Speaker-Design Software

Computer-Aided Speaker Design, from Scientific Design Software, allows speaker designs to be modelled on personal computers. The program includes a file with data on more than 120 speaker drivers (there is room for a total of 800), plus routines to calculate and plot performance of sealed and vented systems, with and without electronic filters. The program also has routines for crossover design and calculation of efficiency, vent tunings, passive radiator masses, and other common functions. The program is currently available for an Apple II having 64K memory, two drives, and Applesoft ROM; an IBM version is planned. Price: $99.95.

For literature, circle No. 107

Koss Demagnetizer

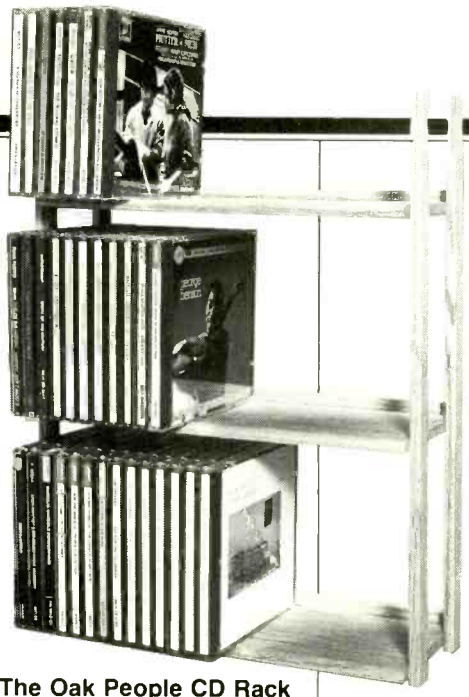
Slip the KED/1 into a cassette deck like an ordinary cassette, and it demagnetizes the deck's heads to prevent high-frequency losses and noise due to magnetic buildup. The process takes 1 S, with a red LED indicating when it's taking place. Price: $16.99.

For literature, circle No. 105

Nakamichi Tuner

With their new ST-7 AM/FM tuner, Nakamichi becomes yet another convert to the Schotz Noise Reduction system for FM. Unlike conventional automatic high-blend systems, SNR varies separation as a function of high-frequency audio modulation level as well as signal strength, to make maximum use of psychoacoustic masking effects. Muting and mono-only reception are separately switched; this allows use of SNR to pick up weak stations in stereo. In addition to manual and up/down search tuning, the ST-7 has 16 station presets (eight preset buttons, with a shift key) which may be used for any combination of AM and FM stations. If an AM station preselect is pushed while listening to FM, or vice versa, the tuner switches bands to accommodate it. The five-segment signal-strength display can be switched to show multipath for additional help in aiming antennas. Price: $595.

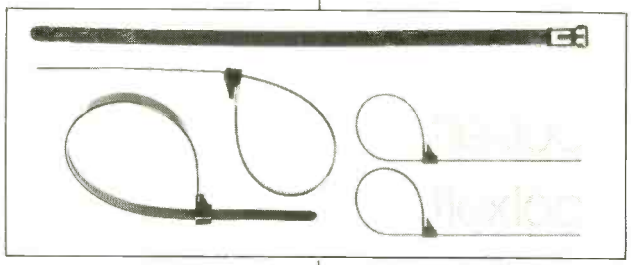
For literature, circle No. 106



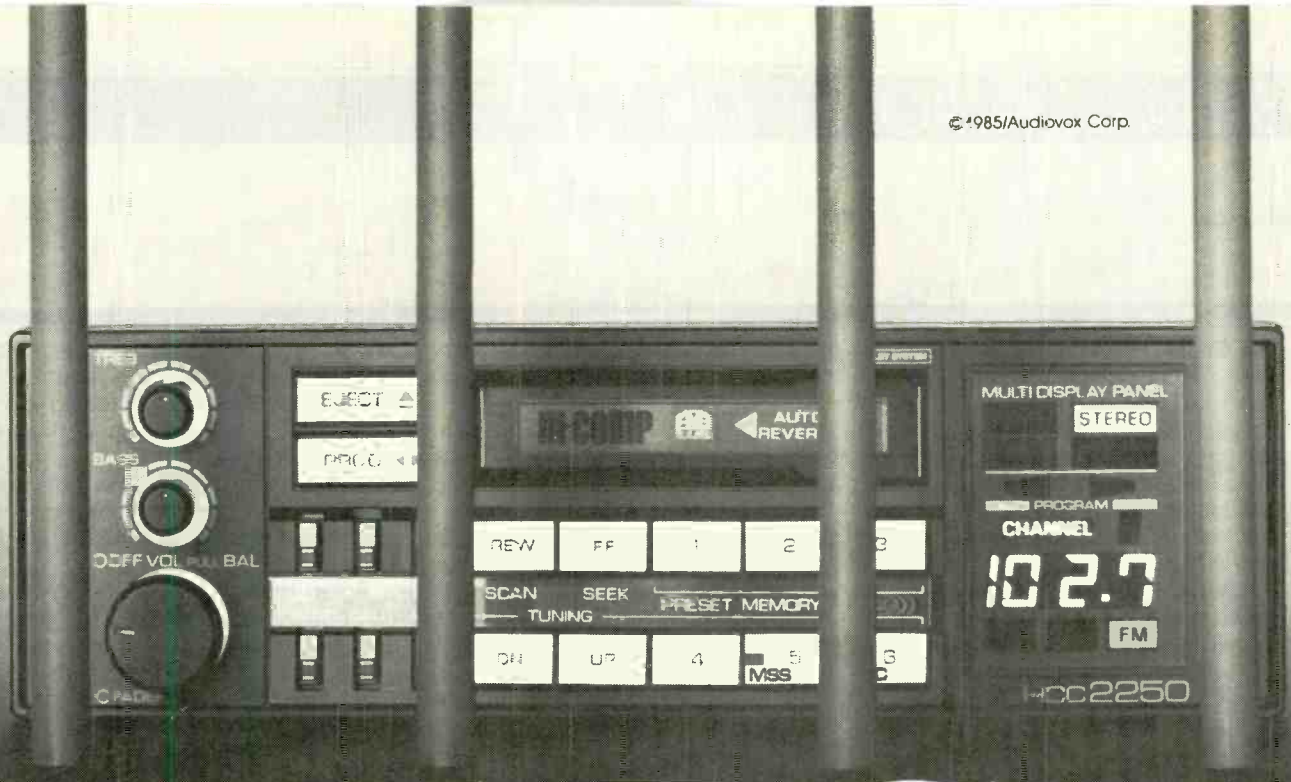
The Oak People CD Rack
Holding 75 Compact Discs, the CD-75 storage rack measures 15 inches high and 11 inches wide, and comes fully assembled. Price: $24.95.
For literature, circle No. 108

Syotex Subwoofer Crossover
An electronic crossover for use with subwoofers, the SWX-12DB may be ordered with any of six crossover frequencies between 75 and 110 Hz, with 100 Hz standard. Both high- and low-pass filters have slopes of 12 dB per octave. The crossover has a self-contained, regulated power supply and includes four low-frequency outputs. Price: $119.
For literature, circle No. 109

Visual Departures Cable Ties
Most of the cable ties sold in electronics stores clamp permanently—fine for assembling electronic components, but less useful for audio systems whose contents are changed periodically. The Flexloc cable ties have quick-release locks, allowing audio-system cables to be bundled neatly while still maintaining system flexibility. The 10-inch ties can contain cable bundles up to 2¾ inches in diameter. Price: $7 per package of 20, including postage and handling.
For literature, circle No. 110



Yamaha Pro Cassette Deck
Designed for studio use, the Yamaha C200 cassette deck has several features common in professional equipment but rare in home gear: Both unbalanced, RCA-type and balanced, XLR-type input and output connectors are provided, with level at the XLR connections switchable to +4 or +8 dBm. A Monitor Erase feature and a fourth head allow selective erasure of program portions during playback. Both Dolby B and dbx NR systems are included, with dual processors for monitoring with full noise reduction encoding and decoding. The four-digit counter reads in minutes and seconds, and there is a pitch control with an unusually wide range of ±15%. The deck is mountable in 19-inch racks. An Alpha-Orbit automatic bias tuning system matches bias to the tape in 2 S, and there are automatic memory, replay and timer functions, with a remote control optional. Performance specs include dynamic range of 100 dB (with dbx NR) and wow and flutter of 0.02%. Price: $895.
For literature, circle No. 111



BEAST.

Introducing Hi-Comp HCC 2250 from Audiovox. Car audio's most civilized manifestation of raw power.
25 watts per channel. Electronically synthesized tuning for optimum reception. Dolby® noise reduction. Metal/CrO2 capable. Discrete bass and treble controls. 12 station memory. Auto reverse cassette with amorphous head and logic transport. Automatic seek and scan. Music search and sensor. Key-off eject. Solenoid soft functions. Full night illumination with dual backlighting. Visit your local Audiovox dealer today. Experience the Hi-Comp HCC 2250 and the full line of Hi-Comp premium car audio components; amplifiers, graphic equalizers and high efficiency speakers.
Cultural enrichment for that little bit of animal in us all.

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The Bucks Keep Going
Dear Editor:

I read, with amusement, Ivan Berger's January 1985 "Spectrum" item on the quest for the most expensive stereo system possible. This is a little game that I have been playing with your Annual Equipment Directory for the last few years.

However, Mr. Berger will have to spend just a little more for his system. I believe the Wilson Audio Modular Monitors require biamplification, so he will need four Esoteric Audio Research 529 power amps—which will cost him $20,000. I also recall reading somewhere that two Mark Levinson ML-2 amps can be strapped together to produce 100 watts. Therefore, if he gets eight ML-2s, he can spend $27,560. Admittedly, this reduces him to only 400 watts total power versus 2,000 watts with the E.A.R. amps, but maybe his hearing will last longer and he can enjoy his investment more.

Now the question is, can all of these goodies be plugged into the Burmester 808 preamplifier at once? Probably not. Perhaps Mr. Berger could commission a custom switching center/patch bay with gold-plated connectors and pure silver wiring.

Stephen M. Smith
Shawnee Mission, Kans.

Editor's Note: You're right about the WAMMs needing biamplification. Strapping the Levinsons smacks, to me, of sadism. And I already have an Audiovisual Systems patch bay with gold external connectors, though not, alas, with silver internal wiring.—*I.B.*

Right-On Reviews
Dear Editor:

Mr. Anthony H. Cordesman should be congratulated for giving precise reviews of various speakers on the market. I am referring particularly to the review of the Celestion SL-600 in the February 1985 issue, in which he states that the speakers are excellent but have certain shortcomings. It is exactly my feeling, especially when it comes to the price of the equipment and the $350 charge for the stands. I find all your reviews very informative, not like the ones found in another hi-fi magazine that never brings out the negatives. When reading your competitor's *kauderwelch*, one gets the feeling that they do not want to hurt a potential advertiser's feelings.

Another point of satisfaction is your complete listing of all equipment available, as done in your Annual Equipment Directory every October. It seems that your staff does their homework and searches the market for every piece of available hi-fi equipment, while *Stereo Buyers Guide* only prints what is readily available without looking for the more unusual type of equipment, well-constructed and considered by some to be the cream of the market.

Thank you for thinking about the consumer when publishing *Audio*, and keep up the good reporting.

William W. Menz
Winston-Salem, N.C.

The Polls Are Now Open
Dear Editor:

Thank you for "The DNR Noise Reducer: How It Works and How to Build It" (by Leonard Feldman and R. Aryana, February issue). I've just completed my unit, and it works better than I had hoped it would. I vote *yes* for more construction and technical articles in your magazine.

As a collector of old blues, jazz and swing recordings, I am interested in all types of single-ended sound enhancement and noise reduction. With all the hoopla over the Compact Disc, let's not forget the thousands of priceless musical performances contained on noisy 78s, LPs, and analog tapes. Anything science can do to rescue these old recordings is to be applauded.

How about an article on this subject soon? I'd love to learn how digital technology may someday be used to "clean up" dirty sound sources, and suspect that the record companies have already done substantial research in this area.

In the meantime, I hope you keep up the good work.

Dennis Mosher
Brea, Cal.

Here Kitty, Kitty
Dear Editor:

With regard to Ivan Berger's item "Live End, Cat End" in February's "Spectrum": As Plinius the Elder wrote in one of his famous books, *De felibus*, his problem with cats is, *"Feles dicto non auditem est!"* Or, you cannot tell a cat a damned thing. Having gone through 25 cats in 25 years, I agree with Plinius.

There are three remedies prescribed: You can either kill the cats, ban them from the music room, or declaw the front paws.

Again following Plinius, *"Felem potius quam hominem amo,"* I chose the third remedy. My cats have now become indoor gentlemen, but, *malgré tout*, still try to scratch everything. However, now they can merely wipe their paws, which is a bit easier to cope with.

However, I found that a greater problem is cat hair. They, the hairs, float through the air and then race onto the shiny surfaces of the 12-inch LPs or the 4-inch CDs with equally deleterious effect. The use of fluids is the only remedy for that, in a place where the humidity approaches zero in summer. "και συ τεκνον," said Caesar when Marcus Brutus stabbed him to death, or, as they used to say in old India, *"tat tvan asi!"*

Paul A. Elias
Fountain Hills, Ariz.

Blazing Players
Dear Editor:

Now that Pioneer has their CLD-900 Compact Disc/Laserdisc player (profiled in the February 1985 issue), the future of the marriage between audio and video looks very bright. In fact, with upcoming versions of such players, we may see the following features:

The ability to read the CD subcode that will soon contain text and graphics data (liner notes, librettos, song lyrics, scenes from operas, etc.) without having to resort to an external converter if such information is shown on a TV screen.

The ability to see on the TV screen what you have actually programmed into the CD or videodisc player (like what the CLD-900 and some video recorders do, only more advanced).

The ability to use all four channels of audio sound (two digital, two AFM) simultaneously to produce fabulous-sounding motion pictures, using the digital channels for front sound and the AFM channels for rear ambience sound. With the help of the Studer/

CORVETTE

THIS AMERICAN WENT EYE TO EYE WITH EUROPE... AND EUROPE BLINKED.

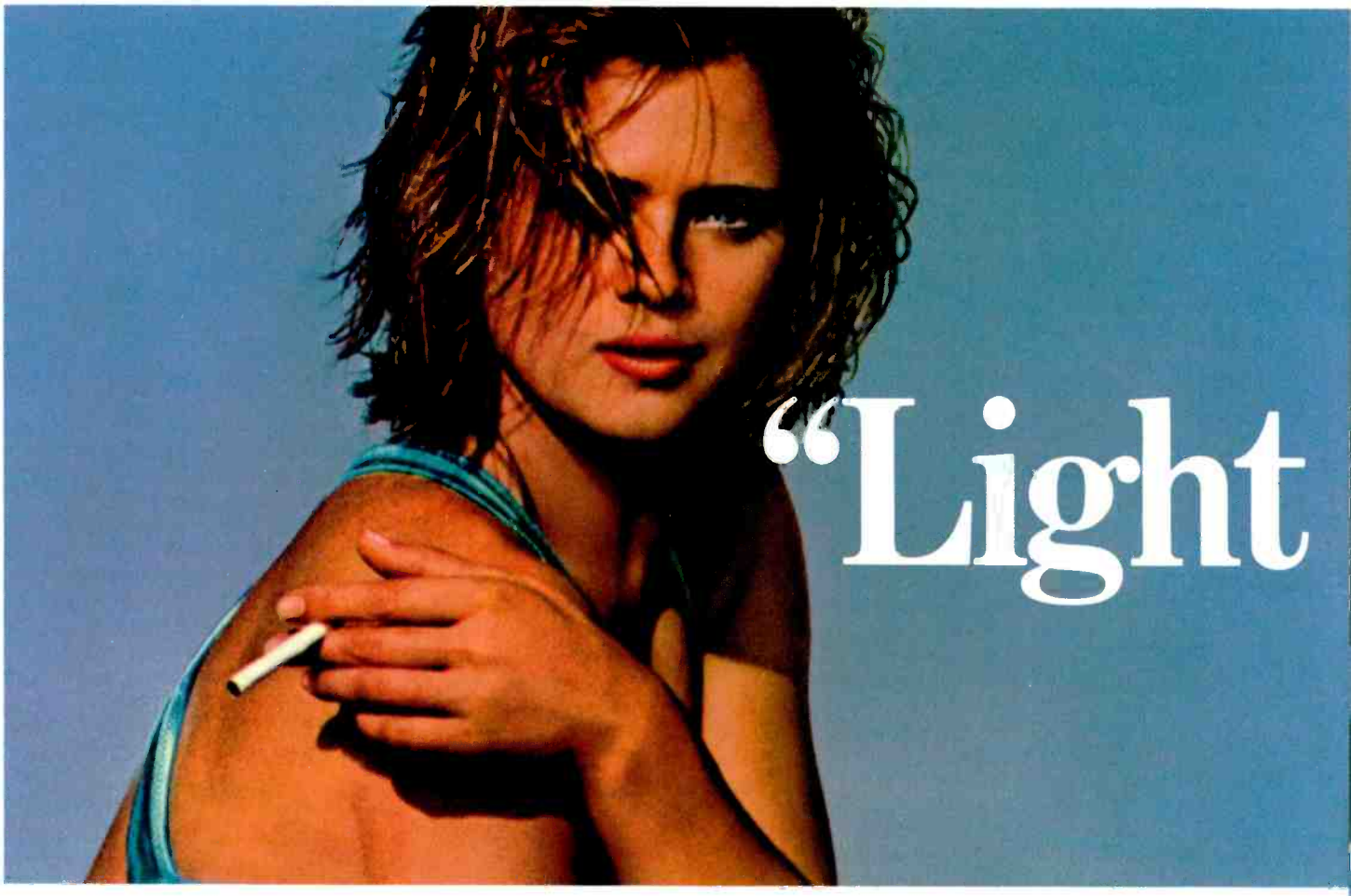
Exotic Europeans have traditionally dominated the high-performance sports car class. But in recent United States Auto Club performance trials, the exotic American was the overall winner. The 1985 Corvette. So please join Ferrari, Porsche, Lotus and Lamborghini in a hearty welcome to a new world-class champion. The 1985 Chevrolet Corvette.

USAC Competitive Rank

	Corvette	Lamborghini Countach	Porsche 944	Ferrari 308 GTSi	Lotus Esprit Turbo	Porsche 928S
Total Points	21	18	14	11	11	9
Acceleration 0-60 (sec.)	4 (6.00)	6 (5.33)	1 (7.95)	3 (6.43)	5 (5.95)	2 (6.66)
Braking 60-0 (ft.)	6 (129.2)	3 (135.7)	4 (135.2)	2 (143.1)	1 (144.7)	5 (135.1)
Slalom (sec.)	6 (6.13)	3 (6.38)	5 (6.33)	4 (6.36)	2 (6.40)	1 (6.62)
Lateral Acceleration (g's)	5 (.91)	6 (.92)	4 (.86)	2 (.83)	3 (.85)	1 (.82)
Price as Tested	$26,703	$103,700	$26,121	$60,370	$50,384	$49,495

Scoring based on an Olympic system in which first place is awarded 6 points for each event. USAC certified tests, January 1985. All cars listed were latest models available for sale in the U.S. at time of testing and were equipped with various high-performance options. Corvette's Manufacturer's Suggested Retail Base Price is $24,881 including dealer prep. Tax, license, destination charges and optional equipment additional.

TODAY'S CHEVROLET



Revox digital signal processor, imagine a George Lucas film done by this method! You'd swear that the battle scenes from *Star Wars* have been moved into your living room. Imagine, movie sound better than a theater's!

In short, thank you, Pioneer. You have blazed the way for the ultimate in home entertainment.

Raymond Chuang
Sacramento, Cal.

Remember When?

Dear Editor:

A well-deserved thanks is in order to *Audio* for taking the editorial space, in the March issue, to explore in detail the problems facing FM today. The willingness of the magazine to bring to its readers greater knowledge, and the ability to do so accurately, makes *Audio* the pre-eminent journal of its kind.

As a veteran broadcaster (who also started at WYBC), I unfortunately have to agree that audio chains have corrupted a superlative medium. Many hours have been spent cajoling engineers to "back off on the compression," only to have program directors and general managers ask why we're not loud enough. Some say all of this started in the AM Top 40 wars when loudness was critical, then carried over to FM when it became financially equal to AM (and equally competitive). At this point, after replacing AM as the music carrier, it is likely that FM is the worst medium for reproducing music that most people are regularly exposed to.

The main problem is no longer technology, but a consistent underestimation of the audience's ability to perceive and appreciate uncolored music. This really amazes me. When it comes to rock, my field, the producers have *already* removed most of the dynamics and have boosted certain frequencies in anticipation that the piece will be heard on an original Marconi wireless. To further process this signal is simply adding saccharin to NutraSweet. Overkill is too tame a word here. Of course, I've had calls from listeners who have no idea what stereo is—and couldn't care less—but that hasn't stopped them from asking why the record they bought sounds infinitely better than the same one we're playing. (We've all heard the rim shot with a sustain that's louder than its attack, thanks to hyper-fast limiters that grab and release the dynamic.)

The good news is that the solution is right here, in every broadcast studio. These same high-tech compressor/limiters can be used to make FM not only better than it is now, but, theoretically, nearly as open as a Compact Disc. If the NAB could agree on a format (a major hurdle), we could use our audio chains as the first leg of a two-ended, companion noise-reduction/dynamic-range expansion system. By setting up the compression at the broadcast end to, say, one of three predetermined levels, the listener, if so inclined, could purchase an expander that would do the same in reverse, but accurately. This way, those with inexpensive equipment or car units in noisy environments would continue to listen to it "loud," while those who really care about signal purity could decompress and restore the natural dynamics. The broadcasters would still be able to choose between hard, medium, or soft compression. This would go a long way towards making FM the medium it was intended to be, while not radically upsetting the status quo.

Of course, getting two stations—let alone 8,000—to agree on anything could be this proposal's undoing. But the alternative, as prerecorded music gets better and better, is losing our audience to listener fatigue.

In the meantime, call your stations and complain. One negative comment is worth a dozen positive ones. Let them know you can tell the difference between a Compact Disc and a 78, as it were. And if you happen to speak to a program director, remind him why the listeners flocked to FM in the first place: Because, at one point, it sounded better.

Paul Rotello
Hartford, Conn.

Take Your Pick

Dear Editor:

In response to your excellent March issue focusing on FM quality, I would like to point out that, theoretically at least, there is a way to satisfy both the audiophile and the general listener. The dominant form of FM processing is compression, similar to the encode function of a tape noise-reduction unit. An audiophile equipped with the complementary expander would not only be able to get the original signal back, but could better the unprocessed channel's dynamic range.

While there is little likelihood that broadcasters would be willing to completely standardize their processing (then everyone would sound the same . . . just like the records), an optimized 2:1 compression, perhaps along the lines of CBS's CX, could be agreed upon as a baseline for processing. The loud stations could process on top of this to get their sound. The audiophile could completely recover the signal from the more moderate stations, and an improved version from the others. The signal could be left compressed for playback in situations where quality is noncritical.

While it is true that noncommercial radio stations do not have the short-term pressure to have a punchy signal, their long-term success depends upon at least the perception of good sound quality (programming has something to do with it, too). To the listener a few miles out, the compressed signal may very well sound better.

John H. Roberts
Phoenix Systems
Stone Mountain, Ga.

Revised Ruling

Dear Editor:

I greatly enjoyed reading the articles in the March issue dealing with FM transmission fidelity. You may be interested to know that since those articles appeared, the FCC has deregulated the annual equipment performance tests and has done away with most of the technical standards governing transmission quality for AM, FM and TV (aural) stations. As regards FM specifically, the FCC requires an annual showing of compliance with the pre-emphasis curve *only*; this was kept to ensure receiver compatibility. Measurements and standards for distortion, separation, noise, and crosstalk were eliminated. Incidentally, the required noise figure for FM stereo transmission was −60 dB per channel, referenced to 100% modulation of audio plus pilot, not the −58 dB alluded to in the article.

A recommendation I would have for FM station engineers is one that any audiophile would also have: Keep it simple! It is a truism in the broadcasting business—where Murphy's law often supersedes Ohm's, Kirchoff's, or any other—that the cleanest-sounding stations are often those in small markets. These stations cannot afford all the bells and whistles that the stations in the larger markets feel they must have in order to remain competitive. The small station usually makes do with one carefully selected processor in the line. Audiophiles already know

At a small FM station where I was chief engineer, our sound was clean and loud though we used only a single processor and *no* composite clipper.

that straight-wire design yields the cleanest audio, and this is equally true in broadcasting. One small station, where I was on staff as the chief engineer, easily measured less than 0.5% THD, complied with the pre-emphasis curve within ±0.5 dB, and had separation measured at 38 dB at 50 Hz, 50 dB at 1 kHz, and 46 dB at 15 kHz. Noise figures were −63 dB in mono and −62 dB per channel in stereo. All this was done with a single processor and *no* composite clipper, yet we were as loud as anyone else on the dial, and regularly received compliments on how clean our audio was.

As was pointed out, enough stations like this would revolutionize FM broadcasting quality. It's worth a try, no?

Sidney C. Schweiger
Chief Engineer
WKOX(AM)-WVBF(FM)
Framingham, Mass.

More on Zero Distortion

Dear Editor:

The article "The Perfect Amp: Zero Distortion," which appeared in your April issue, contains an error. Mr. Dajan is under the impression that zero-distortion amplifiers are a new phenomenon. He should check the Annual Equipment Directory in *Audio*'s October 1976 issue. The Bazoom 2000 manufactured by Rabid Audiophile boasts not only zero distortion but a frequency response of d.c. to light at 1,900 horsepower! Truly a remarkable piece of hardware.

Mike Miller
Bethel, Conn.

Pyramid Power

Dear Editor:

As a new subscriber to *Audio*, I eagerly awaited the arrival of my first issue. In mid-March, my mailbox was blessed with a striking magazine cover, boldly displaying that *Audio* had discovered the perfect amp. I quickly turned to the designated page, and found that not only was the world safe from distortion, but that the real purpose of the pyramids had been discovered. I quickly telephoned my friends; they told me I should have my head and eyes examined. "No," I replied, "Professor I. Lirpa says it works!"

However, after examining the article(s) a second time, I realized my mistake. I certainly sounded foolish telling my audiophile friends who Prof. Lirpa really is.

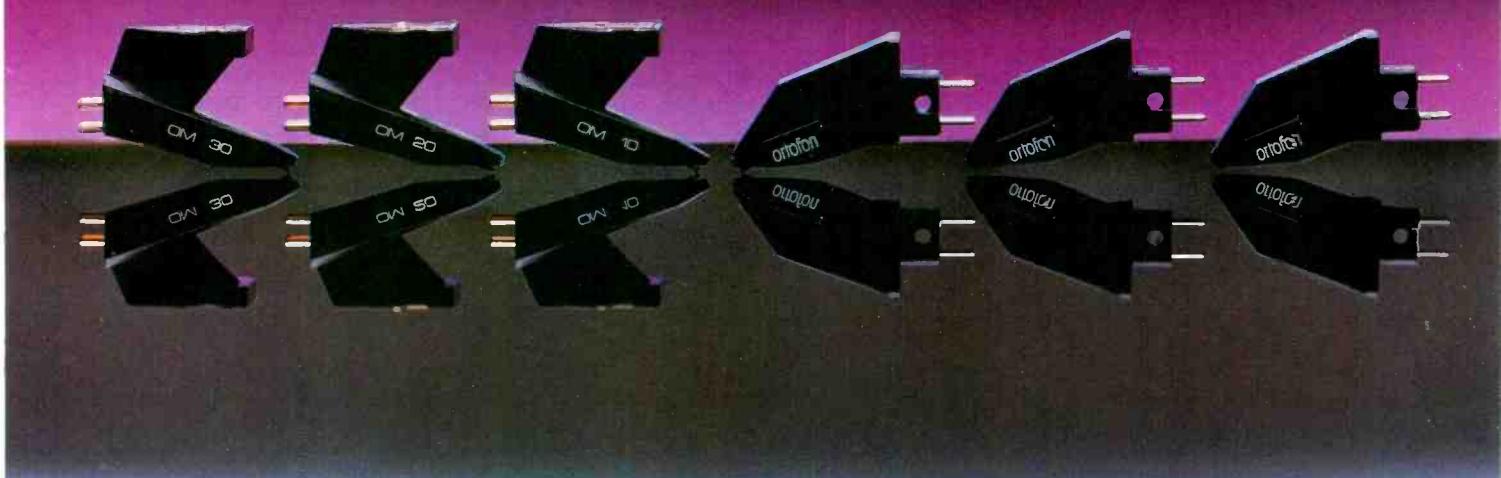
For some reason, I think I'm going to enjoy this coming year's reading.

I.M.D. Cved
Ames, Iowa

Erratum

In the June 1985 "Roadsigns" column, we mistakenly described the power jack on Parasound's CDS-1 input-switcher box, which allows connection of a portable CD player to a car stereo system. The jack's output is 9 V *d.c.*

TAKE AWAY THEIR HIGH OUTPUT ADJUSTABLE MASS, DIAMOND QUALITY, SUPERIOR SOUND AND STYLUS INTERCHANGEABILITY, AND OUR CARTRIDGES ARE NO DIFFERENT FROM THE COMPETITION.



With all of these features and performance benefits, it is no surprise that the OM cartridges are the most successful series ever introduced by Ortofon.

CRITICAL ACCLAIM

Since their introduction, the Ortofon OM Series have consistently received accolades from around the world, for their outstanding value, and performance.

And the Audio-Video International Grand Prix award for product excellence has for two consecutive years been awarded to an OM Series Ortofon Phono Cartridge.

TECHNICAL SUPERIORITY

As the originator of the low mass concept, Ortofon has continually been at the forefront of technical developments in sound reproduction.

Boasting a revolutionary user adjustable mass system, the OM Series provides for "Optimum Match" between the phono cartridge and tonearm system. With superior diamond quality, high output and full line stylus interchangeability, these OM Series phono cartridges deliver superior sound, with any standard mount tonearm in virtually any sound system. And our OMP Series, designed for "plug-in" mount tonearms, make these new levels of performance available to this format as well.

THE GREATEST IMPROVEMENT

Audio engineers and audiophiles agree that perhaps no component can make as immediate and significant an improvement in sound quality than a new phono cartridge.

Considering all of this, along with the modest cost of an Ortofon OM Phono cartridge, it becomes clear that when it comes to making a real improvement in performance of your hi-fi system, there really is no competition.

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IVAN BERGER

INTERNATIONAL AMBIENCE

The Roar of the Crowd

I've just had my first brief tastes of stereo-sound TV, one here and one in Japan. My impressions were fairly favorable but somewhat inconclusive. Here in New York, the only station broadcasting in stereo seems to be WNBC-TV, but *The New York Times* TV page doesn't tell which programs are in stereo (Johnny Carson and *Miami Vice* were the only ones I caught), and my cable service (without which it's almost impossible to get a decent picture here) does not carry the stereo portion of the signal. Faced with the choice between stereo or a clear picture, I used my window antenna just long enough to sample the stereo, then returned to the cable. In Japan, I spent only one night in a hotel room with a stereo set, and there wasn't much stereo broadcasting (though there was a fair amount of bilingual programming) during my few viewing hours.

In both cases, stereo added more ambience than directionality to the signal. With my eyes closed, I could rarely get a feel for where voices were located. That probably will remain the case, since TV's sound engineers must bear in mind that changing camera angles can move a person around the screen at will.

Ambience, however, is nothing to sneeze at (even though it can be simulated). While I've wondered, in the past, why Japanese TV broadcasts sports events in stereo, I now know—in stereo, crowd noises really catch you up in the on-scene audience's enthusiasm!

But it also makes me wonder whether the reason so little TV is broadcast stereophonically in the U.S., so far, isn't the time lag while they pretape enough stereo laugh tracks.

The Extinction of the AUX

The first time I saw an "AUX" input relabelled "Video," I thought it an encouraging sign that the long-heralded marriage of audio and video was beginning. The second time, I thought it a cheap way of making a component look more modern without any functional updating.

But now I see another reason for it: A friend who has acquired his first component system just noticed that his 20-watt receiver has an "AUX" input, and called me to ask whether he should get an AUX to plug into it.

It's easy to forget, sometimes, that everybody (ourselves included) starts out ignorant. While the switch away from the old input designation may offend traditionalists, it does give explicit guidance to the newcomer. On balance, I'd say that's an advantage. Of course, it all depends on whose AUX is being gored.

Illustrations: Thomas Waters

Violins and Valences

One of the reasons I am not a scientist may well be that my high-school chemistry teacher spent less time discussing valences than in debating who was greater, Beethoven or Mozart. (I took the Beethoven side, but I've since switched.)

On the other hand, he introduced me to hi-fi, which probably has had a greater influence on my life than chemistry ever could have. And he also told me something that has long made me suspicious of hi-fi endorsements by musicians. "My brother plays with the Pittsburgh Symphony," he told me. "You'd think he and his colleagues would have great hi-fi systems. But when you go to a violinist's house and listen to his system, all you hear are violins. At the flautist's house, you only hear the flutes. And so on."

I've since met some musicians myself, and their systems actually sounded rather good. But in talking to them, I've discovered that many musicians would be just as satisfied with lesser systems. Musicians, you see, know the sounds of music so well that many can re-create that sonic splendor mentally, from even the tinny cues of a pocket AM radio. No matter what the sound system puts out, it's always hi-fi in their heads.

Even being just a music lover, as I am, can dull your critical listening faculties. Listening to music is fun; by the same token, listening past the music, to hear the system's sonic subtleties, is *work*. The better the music, the harder it is to ignore it and concentrate on the sound. And the better the sound, the harder it gets to ignore the music, too; there's less of a barrier to your enjoyment.

As I think I've said before, this has made unconscious musical enjoyment one of my clues to a sound system's quality. At a show, if I find myself drawn into a booth to ask what record is being played, it's a good sign that the sound was so good that I became unconscious of it. I then shake myself and pay attention to the sound for a while—preferably on music I don't much like. Which is more or less what I had in mind when I told Brian Cheney of VMPS, at one Consumer Electronics Show, "Enough music, already. Let's hear some hi-fi!"

Opinions of Difference

A few years back, when Linn first posited that turntables made a difference in recorded sound, I was skeptical. Then I attended a demonstration at which a record was played repeatedly on several high-end turntables, all equipped with the same models of Linn arms and cartridges, and I clearly heard a difference, every time. I still retained a touch of skepticism (cartridges vary; could Linn have hand-picked the one on the Sondek?), but I was basically convinced.

Yet when the high-end dealers present oohed and aahed over how "major" the difference was, I disagreed. To me, a major difference is one that can be heard clearly and repeatedly, even after a lapse of time and under varying circumstances. By that criterion, the difference between the Linn and the other turntables was worthwhile, but minor. Similarly, differences between most high-quality components of the same general type (amps, for instance) are minor.

Admittedly, I'm using a rubber scale. To me, a major difference is one that *I* can hear under all circumstances. As I learn to hear what I thought were minor differences more clearly, they become major ones . . . to me. I hear some things better than others on the *Audio* staff, and hear other things less clearly.

What about differences *anyone* can hear, without any aural education? They're not major differences—they're gross ones.

Admitting Ignorance

It's easy to assume that any hi-fi magazine editor has heard the particular audio components that interest you. Maybe we have. But it's more likely that we haven't.

Our Annual Equipment Directory listed 3,700 products in 1984. Assuming that only half of them are new in any given year, and assuming we listened to those new items 50 weeks a year, we'd have to audition 37 of them per week—roughly one for every working hour. (Though editors actually work a lot more than 37 hours per week, regardless of what the job descriptions say.) That would leave us no time to put out the magazine.

In practice, we do hear a lot of audio components—many briefly, some at length. But if you're looking for something specific and live within shopping distance of a major city, the odds are that you've heard more components fitting its description than we have.

To turn my computerized list of record-cabinet slots into label sheets, I had only to issue one command. My computer did the rest.

Keeping Track of Tracks

I'm still digging out from my recent move, which means my computer is out in the living room, next to the audio system, instead of back in the bedroom that will soon become my home office. It's proving so handy where it is now that when it does go back where it belongs, my little laptop computer will be moved to the living room as an audio accessory.

I've already written about the program I devised which adds up selection times to see what tunes will and won't fit onto a given cassette. But I have other audio-related uses for the computer, too.

One use is in labelling the slots in my record cabinets. I have over 2,000 records stored in compartmented cabinets, each compartment devoted to a different type of record. Over the years, the compartment boundaries have shifted to reflect my shifting interests, but their labelling has not. So I redid the collection after my recent move, using my computer first to list the compartments as they were, then to rewrite and update the list, and finally to print out new labels for the compartments. To turn the single-spaced list into triple-spaced label sheets with dotted "cut here" lines between each, I had only to issue one command line—my computer did the rest.

Another use is printing liners for the cassettes I dub to play in the car. My word-processing software (Powerscript plus SCRIPSIT, if anyone cares) and my Star Gemini dot-matrix printer let me print in varying sizes within one document—in this case, a cassette label. So I print the album title large, for the spine and header; print the selection titles normal size, underlined and bold, and print subsidiary information in smaller and/or lighter type. If I find a typing error, or rearrange the selections on the album, the word processor makes it easy to redo the liner slip. I find it easier to print on regular paper and glue it to the cassette's original cardboard liner slip than to print directly on the cardboard.

It's also possible, of course, to photocopy the original disc's or tape's jacket or liner slip, and make your slip from that. Machines which can make reduced-size copies give you even more flexibility in this.

For those who want to print cassette liner slips on their word processors (or typewriters, for that matter), the following specifications should be useful: The slips are 4 inches wide, which means your maximum typing line can be 40 characters with pica type (10 characters per inch), 48 characters with elite type (12 characters per inch), and 68 characters for the condensed style (17 characters per inch) on most dot-matrix printers. In practice, you should type a little narrower; margins add legibility.

The slip itself should be either 3¾ or 6⅛ inches long, with folds at 11/16, 1-3/16, and, if you choose the long style, 3¾ inches. That leaves room for four lines of type on the first flap (which goes over the top of the cassette), three lines on the label "spine," 15 lines on the flap which goes under the cassette, and 14 more on the optional flap which folds over the 15-line one.

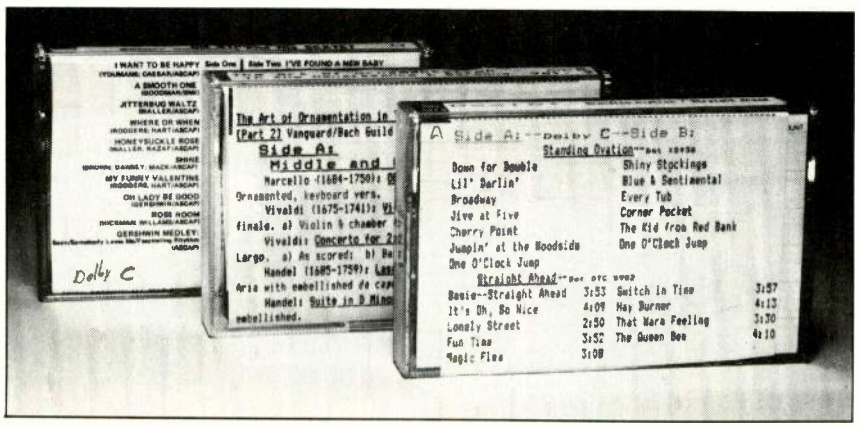


Illustration: Thomas Waters

Reel Helpful

My new living room is smaller than my old, eliminating some of the shelf space I formerly used for 7-inch tape reels. Time to start weeding out the collection. But if I can't weed out enough, colleague Larry Klein suggests another space-saver: Prerecorded tapes make up about half my collection, and many (especially pop-music tapes at 3¾ ips) are short enough so that I can splice two together onto one large-hub reel, and three or four onto one normal-hub reel.

The Dolby-dbx One-Two

Of all common home noise-reduction systems, dbx gives the widest dynamic range. However, on some material you can hear it "breathe" a little, as the noise level in the input signal varies along with the dbx system's compression and expansion. Dolby systems don't breathe—but they don't have as much dynamic range, either.

The obvious solution, pointed out to me by Bill Cawlfield of Vector Research, is to use both at once—dbx for the dynamic range, Dolby to reduce the trace of breathing. (He says Dolby B NR will do this well.) The catch is that, if you have a tape deck with both systems, it won't let you use both at once—a matter of rivalry between the NR-system companies. If you have a deck with Dolby B plus an external dbx adaptor, however, you *can* do it. That, says Cawlfield, is one reason why Vector put a dbx system into its receiver instead of into its matching, Dolby-equipped tape deck; the other reason was to allow decoding of dbx discs.

Though installing a tonearm is a precision job, most arms come only with Stone Age tools to help you.

Arm-Twisting

Ever install a tonearm on a turntable? Fun, isn't it?

The problem is that the tonearm hole must be drilled in precisely the right spot, and the cartridge installed in just the right location in the arm shell, or you get increased tracking distortion.

It's a precision job, and most tonearms come with Stone Age tools to help you with it. Most commonly, in my experience, you get a cardboard template with a hole punched to fit the turntable's spindle, and another punched where the hole should be drilled in the turntable base, often with lines drawn that show where the stylus should rest once it's in the right position.

That's all the information you need to do the job. The trouble comes when you try to use it. First, you have to rest a flat, floppy template on a turntable that usually rises about an inch above the surface you'll be drilling. So you have to prop the template to prevent it from sagging (a sag would shorten the indicated arm/spindle distance), then poke a marker *straight* down through the template to mark where the arm should go. Then, if your only cartridge-position indicator is the lines on the template, you must figure a way to put the template back into position after the arm has been installed. Some templates are cut out to allow this, but others are not. If the template designer has too literally interpreted the stylus/spindle distance as "overhang," the stylus-position line may be just past the spindle, where the cartridge can't be set down because the spindle's in the way. (Truth to tell, I only ran into that problem once, years ago, but it still rankles.)

Some designers do give you more help. Over the years, I've had a few Dual turntables with plastic cartridge-position gauges that fit over the cartridge-mounting slide (more snugly on some models than on others). Shure's V15 Type V cartridge comes with an ultra-dandy mounting jig (usable, alas, for no other cartridges I know of); I understand AKG packs mounting aids with some of its cartridges, too.

There are also general aids for mounting and positioning cartridges, such as Mobile Fidelity's Geo-Disc and the grid on one disc of Telarc's Omnidisc. But I haven't found a great deal of help when it comes to mounting arms.

On the other hand, I haven't mounted every thing on the market (thank goodness!). And since mounting provisions are rarely discussed in ads and catalogs, I'd welcome hearing from readers about arms, cartridges and other products that make the process easier. (If a manufacturer wants to nominate his own stuff, fine, but he should send a copy of the appropriate instruction manual.)

Clive Davis: Finding Songs for Singers

In this conclusion of a two-part interview with Clive Davis (begun in our July issue), the founder of Arista Records and former head of CBS Records talks about aspects—some creative, some controversial—of his wide-ranging career.

You're an interesting case. You don't come from a musical background. You're Harvard Law. How did this creative career happen?

By accident. By necessity. I don't know, it's a talent that I've developed, and I didn't know I had it, and I didn't get into the business because of it. It seems to have worked, and it keeps working. I love it and it just keeps paying off, and it's thrilling, and so I do it. I mean, I'm not trying to be either modest or immodest in answering, I'm just trying to answer in the nice spirit that you ask it. It came out of survival and necessity. I didn't know I had it at Monterey, I didn't expect to ever sign an artist in my life. I would have preferred to operate as most—to hire a head of A&R, to make it. But my heads of A&R were signing no rock groups. We were marginally profitable. I sat there in the midst of a revolution, and was lucky enough to be there.

You seemed to really be getting off on the whole thing.

I did. My whole life changed. I went to Monterey for fun. I went there because a few friends were running the festival. Abe Somer, an entertainment attorney who represented a lot of major artists, was on the board; Lou Adler I had a label deal with, and he was on the board. Simon and Garfunkel and The Byrds were going to perform, and I thought I would have fun. It was the first pop festival. I never thought I'd see new talent; it wasn't billed as a new-talent thing. If I hadn't been there, I don't know when I would have signed my first artist. But I knew I had to, and I was motivated to, and I did. And when it hits out of the gate that way with everything you sign, from Joplin to Blood, Sweat, Santana and what have you, it then gives you confidence to keep trusting your judgment, and then you start living it. Then you start liking it. Then you start getting, if you can, an intuitive feel for it. And that is what I, through evolution, developed.

We were talking about how you get involved in the creative process. You've certainly never been shy about talking to an artist, whether it's Horowitz or Ray Davies, about what you think they should do to change their direction and perhaps become more commercially viable. Has this usually worked out for you?

Do people resent it? Yes. It is the most troublesome thing to do, the most emotionally difficult thing to do. It is a double-edged sword in every case when you do get so involved. It's hard to translate this to the public. I've never been asked this type of question, and it's a great question because it really is the most troublesome part of the way I, at least, personally perform my job. To participate in the creative process . . . . It's accepted in my particular case because of my track record, and it's usually not accepted for most people. And yet, even that is accepted so begrudgingly that you run a delicate line between being a meddler and a participant. It's a very, very, very difficult thing to get into.

You do it only when you feel it's absolutely necessary?

Without question.

You felt it was absolutely necessary to talk to Ray Davies about a change in direction away from the concept albums he was doing?

Well, he solicited that, in order to see what label would be best suited for The Kinks. He wanted my ideas on that subject. He recognized that his sales had fallen way down. It's much easier when people have fallen way down from where they had been, and then they come to you. Then you're welcomed with open arms. So that when Dionne came here or when Aretha came here . . . . I'd always heard that Aretha was a terror. Her sales were not what she or anybody would have wanted at Atlantic. So when she came here, she had heard about me, and, of course, I had more than heard about her. And she wanted to work as a creative team. So it's not in those cases that it's difficult. But in the vast majority of the cases, I'm not God's gift to creativity or to my artists. You take the artist because of *their* talent. So the only areas I get involved in, with the true originals who write their own material, like an Alan Parsons or a Patti Smith, are whether their song is a hit or not and whether my Top 40 ears perceive any of the currently written material as a hit. So I'll come in as a friendly partner. There, it's been peaches and cream.

The problem is in the areas where an artist doesn't have a Top 40 hit, and you've got to tell them that, from what they have written, there is no Top 40 hit and therefore they've got to use outside material. Then it is war, usually. If they don't write, then they're willing to accept that, depending on your relationship.

When you get to that point with an artist, I suppose they don't really have a choice.

Oh, look, I can't tell you the battles.

Sure you can!

There *are* battles. And even when you've done it four or five times in a row, if they write or have written any hits in the past . . . . Well, say, Melissa Manchester. I really have been very

Photograph: Elena Seibert

Getting involved in the creative process is the most troublesome thing to do. You run a delicate line between being a meddler and being a participant. It's very, very difficult.

If something's great, I will trumpet that, unless it interferes with the intregrity of the artist. But the word hype, to me, is an overstatement.

fond of Melissa, though she's no longer on the label. But for years you see an artist going in one direction; she wanted to be a triple-threat star, and you see her as a pop star, because her talent, outside the pop area, for going into R&B, folk or jazz, is not there. So you suggest that she stay with pop. If that doesn't fit her image of where she wants to go, it's very traumatic. If she's written, as she did write, "Come in from the Rain," a beautiful song, and "Midnight Blue," a beautiful song, you sort of suggest that the hallmark of her writing points her in the pop direction. But she wanted to be Linda Ronstadt or Joni Mitchell, you know, the first white-black-jazz-rock 'n' roll star. You've got to let them carry through their dream, until you see it falling into a noncommercial area. Then you say, "There are just no hits, and if the album comes out, it's going to sell 50,000 to 75,000 copies. You must do (for example) 'Don't Cry Out Loud.' " Then she says, "I hate 'Don't Cry Out Loud'!" And you say, "But you must do it." And then you do it, and she does it. Then the next time an album comes around with all her own material, and you say, "Well, there's no hits; I gave you 'Don't Cry Out Loud.' " Well, there's resistance. Even though you keep doing it. I understand that it's not personal. It just happens with any artist who also writes. Now, in the cases where they write well, they don't need me for any of this, and I would never presume or even think about it. They need me for a sense of marketing or career development. But in the creative area where artists don't have hits or are not writing hits for themselves, then you do intrude and it's never easy. They never like any piece of outside material you first play for them. It does become, depending on their outlook towards you, usually more difficult, always painful, never appreciated as much as you would like. It's the most painful area that I have to work on.

Let's talk about something totally different. Let's talk about hype. Do you feel that hype is sometimes something you just have to do for an artist?

I really have difficulty with your premise, because first of all, you take your lead from the artist. With Dylan it was very clear to both of us that there would be no interviews and no discussions. That just the announcement of a Dylan album was sufficient, and anything different from that would be untoward. There was never any hype for Bob Dylan. I have never shied away from trumpeting something as strong, with sensitivity to the artist involved, if I believed in it. But the word hype itself, to me, is an overstatement. I don't believe, in music, that this is like selling a movie, or that we're going to sell it to the public like a piece of product. I am very sensitive to the underlying creativity and take the lead from it. I don't believe that an advertisement, if we're talking advertising now, with just a picture of an album, in most cases, is sufficient. It's sufficient now for Springsteen, for Prince, it always was for Dylan. On the other hand, certain artists need background, like The Alan Parsons Project. Maybe you define as hype the fact that when we launched The Parsons Project, I analogized it to Ingmar Bergman and said here is the first somebody who is assembling a cast of musicians and vocalists, and is coming up with material, and is like the first director à la Bergman. To me that is not hype. It is setting the stage for an appropriate understanding of the magnitude of talent. If I believe someone's great I will trumpet that, unless it interferes with the artist's integrity. The most important thing is to be sensitive to an artist's image, and the integrity of

Photograph: © 1982, Ebet Roberts

AT A 1982 CONCERT, DAVIS AND THE KINKS WITH GOLD ALBUMS OF *ONE FOR THE ROAD*. AT FAR LEFT IS ABBEY KONOWITCH AND AT FAR RIGHT IS MIKE BONE, BOTH OF ARISTA.

JOE SMITH, MO OSTIN, DAVIS, AND BERRY GORDY, JR. AT A 1980 LUNCHEON FOR THE MARTELL FOUNDATION

what they're doing. I'm not saying this because it's a cliché or it sounds good, but I don't believe in being derelict. I believe that there is an art of career development.

You're a very outspoken person. Do you ever get other record-company executives angry at you for things you've said? You will be very specific and criticize something if you feel it's not good for the industry.

I think that there is always a double-edged sword with visibility. If you're very visible, and other executives are not, you can be accused of being on a personal ego trip. There's always that fallout. I, in the trade press, have stuck to issues. And yeah, there have been examples where . . . . I don't take on people as personalities, or I attempt not to. There have been times over the years when people have trumpeted the dying of the record industry, the death of the record industry, the fact that music is dying. And I did rise on several occasions. Once, when Bill Graham was going out of the Fillmore business, he kept saying that rock is dying, or the press kept saying the Fillmore's closing and rock is dying. I took an active role in showing the diversity of music, the strength of music, and put on shows at the Ahmanson Theatre mixing and matching Miles Davis and Loudon Wainwright and The Mahavishnu Orchestra and the range of talent to disprove that. It did get personal a number of years ago, when a number of executives went on *20/20* to say that the aural record was dying, it was all going to be video, that the record business was dead. They were actually singing us out of business because it was a bad time, and it looked like video was going to take over. I couldn't believe it! That they were not only issuing statements to *The New York Times* to that effect, but also to *20/20,* and I said it was crazy. I wrote an open letter to Joe Smith [of Warner Bros. Records], who happens to be a very dear friend of mine, saying, "Hey, this is crazy. I don't believe that it is true. I think it is hurtful to our business." I'm sure there were some misgivings there, but it was never done on a personal level. It was to tell these people not that we should hype our business, but that they were creating a bandwagon idea that we have an obsolete product here, and we don't. Then I gave separate editorials saying that you can't hum a video game, and the video-game fad will be over at some point. I think that where I've chosen to make an issue of these points, the record will show, hopefully, that I've been proven correct.

But you don't have to do it. I'm sure there are other people who share your feelings who won't go out and put themselves on the line . . . .

Well, that's where my legal background, which I don't use in any of my creativity, gives me . . . . I don't fear public speaking if I'm asked to appear on the *Today* show or *Good Morning, America* or to speak on a controversial issue . . . . So often, and until fairly recently, record executives were pictured as finger-snapping and wild-eyed. There was always the Phil Spector "dem, dese, and dose" types. It was an amazing picture of the record executive as compared to the Hollywood types or television types. They're all different, perhaps, in their way. But I did feel . . . . I saw my colleagues—whether it be Jerry Moss [of A&M] or Mo Ostin [of Warner Bros.] or several other people—as bright, articulate, intelligent business and creative people who might, for whatever reason, not be public speakers. I mean, Mo Ostin is marvelously talented, but he is somewhat shy in public, and Jerry Moss is a very private person who is more comfortable not speaking. I grew up not feeling there was any awkwardness in that. So that the lot sort of fell to me. I don't think I'm a ham. I think the record industry needed defense in certain areas, and the reaction was good, and so I've done it. Not to be a martyr, not to be a hero.

People have said that the reason for your problems at Columbia was because you were so out there, so . . . Visible.

. . . That that's what created this sort of Twilight Zone batch of problems for you there.

DAVIS AND LOU REED

I don't think there was a negativity to me at Columbia. What happened is that there was a brand-new president [of CBS Inc.] who had only been there for six months, and we didn't even know each other. You know, I was always considered a candidate for that job and I never wanted to be. I was asked to be the head of their studio and other divisions there, but I am not one to move on to other tasks for the sake of a corporate ladder. I know what I like to do, and I'm gratified that I've found a career that I love. So that even though I've invested in a Broadway show, and hopefully will do one or two or a few movies over a period of years, I love the record business. I'm not the comedian yearning to be the dramatist, or setting up false challenges for myself. I had enough of a challenge coming out of the law proving that I had creative talent, and showing, after I was head of what became the world's largest record company, that I could do it from scratch on my own, in a brand-new enterprise. That's enough challenges, aside from

Photographs: Courtesy of Clive Davis

You never quite make up for the pain you go through. But for me, in hindsight, it opened up opportunities to write a book and start a new company.

doing well in a very competitive business. My prime interest now is to stay in a field I enjoy, and I enjoy this, so I stay in it.

When Alan Hirschfield left Columbia Pictures in the wake of the David Begelman scandals, which David McClintick wrote about in Indecent Exposure, *how did that affect you at Arista? [Columbia Pictures was the founder of, and major stockholder in, Arista Records; Hirschfield was Columbia's president and CEO.]*

Are you asking me, businesswise or personally?

Both.

Well, Alan was a very close personal friend at that time. He believed in me and really was the main reason why Columbia Pictures financed the beginning of Arista. I was affected by it personally because he was a close friend who I felt was not treated well, and treated unfairly. I thought that he was on the right side of the issue, and that it could have been handled better by both sides. I'm not saying I agreed with everything that Alan did. But on the other hand I think that the position in *Indecent Exposure* was pretty accurate. And I did feel a certain sense of alienation from the board of Columbia Pictures, and I motivated, pretty much, the sale of the . . . . I was the costockholder, with Columbia Pictures, in Arista. I really felt, probably, disenchanted and alienated, and I felt those things probably a little more keenly, having gone through the trauma of corporate alienation myself. Seeing this situation . . . . I would not be a passive observer. I came up with a purchaser of the stock of Arista, and recommended very highly to the board of Columbia Pictures that we both sell our interest in Arista to Bertelsmann [the German-based firm Bertelsmann A.G.], the company that bought 100% of the stock.

DAVIS AND RAY PARKER, JR.

Photograph: Courtesy of Arista Records

This was in . . .

In 1979, I believe. So I would say that I was affected personally.

So that the sale of Arista to Bertelsmann was in a way the direct result of Columbia Pictures falling out with Alan Hirschfield?

To me. I mean, I could not cause Columbia Pictures to sell the stock if they didn't want to, but on the other hand I think that, as the head of the company, my recommending it as well as having expressed alienation and disenchantment over the Hirschfield issue pretty vocally, I'm sure that that was a contributing factor.

Well, both you and Hirschfield have both succeeded as well as you could possibly turn out, after your respective crises in business. [Hirschfield is now an investment banker and a consultant to the entertainment industry.] Do you feel vindicated?

On all the legal issues I feel exonerated. You never get the press for the exoneration as for the initial furor. So it's a wound that never fully heals. It's a . . . . the pain you go through you never quite make up for. But in hindsight, it did open up opportunities. The opportunity to write a book, which I never, never, never would have thought of doing. The opportunity to start a new company. The opportunity to broaden my horizons, and to really respond to the challenge of starting a new company and have it live. It recently finished its first decade. If it goes not a day further it will still be an exciting accomplishment.

Truthfully, though, isn't there an aspect of "living well is the best revenge"?

I never viewed this as a personal feud. It was never a personal feud, it was a wound that occurred. There were things that were done that I was very upset about that I've written about in my book from the point of view of [Columbia Records] rewriting history. A corporation has got to show that no one man is indispensable, and that they can go on, and the stock shouldn't go down. That does have a tendency of happening, and when you're on the other side of it, you are

DAVIS, PIA ZADORA, BARRY MANILOW, AND MORGAN FAIRCHILD

Photograph: © 1983, Ebet Roberts

hurt and you fight back. But you're fighting back against an institution. I personalized it to one or two people. So that now the wound is dealt with and recalled. On the other hand, you integrate it into your life. If you're saying now that . . . . I don't feel glad about it, no. But it had its other upside benefits that I never would have been able to experience.

But you know, there's almost a backlash. When you become the underdog, everyone's on your side again. And people must have been saying, "Boy, I bet he's just sitting there thumbing his nose at them now, because he's a success on his own."

It's funny. I'm not saying that I'm bigger or smaller than that. I'm saying that there were, apart from that incident, people who would bet against someone who was a lawyer and a president of a large record company starting his own business. There were an awful lot of people saying, "Hey, he can't do that." And yet those who knew that I was not just a president, that where an artist was signed . . . I looked at 30 artists and said yes to Joplin, and yes to Blood, Sweat, or yes to Billy Joel, or bought the Pink Floyd contract before they broke, etc. . . . So much has happened since I left Columbia. When I started Arista, [Columbia] gave me a million dollars [for mail-order rights] for the Columbia Record Club. Four or five years ago, the Martell Foundation, which is dedicated to the memory of a CBS employee's son and is the industry's main charity, honored me as their Man of the Year. The president of Columbia Records at the time, Bruce Lundvall, spoke to the company and said it was like the McCarthy witch-hunt era, and that I led a lonely battle for the industry . . . and only because of my reputation and my standards and morals and integrity did I come out of it the way I did, and it was of great benefit to the industry. And it was of tremendous note that the award was not only given to me by the then-president of Columbia Records, but that it did, in effect, hopefully speak for CBS. Because knowing that I was the honoree that night, Tom Wyman, the new president of CBS, came and was very warm to me thereafter. So that, you know, there's no war going on. It was an unfortunate coincidence of events, and I was unfortunately brought into it without foundation. It did cause trauma, and it did cause pain, and that won't ever be forgotten. But it has given me the opportunity to do other things. It has worked out great, and it has given me great satisfaction, not so much from a thumbing of my nose at anybody, really, because I don't personalize that to CBS. In fact, the first day I opened my doors at Arista, two dozen CBS executives came with flowers and drinks. And so many executives from CBS have come over at one time or another to work for me. CBS artists have gone on TV specials and honored me. So that aspect of it doesn't continue today.

Today it seems the record business is really dominated by CBS and Warner Bros. How do you, as the president of a large independent, feel about this, and the problem it obviously causes?

Thank God you said large independent. If you had said small, I would have felt very insignificant [laughter]. Look, you have realistic dreams. You can be so large after 10 years. I feel fully able to compete with CBS and Warners. We immediately, I think two or three years after the founding of Arista, became the alternative to those two major companies for an artist to consider. Many artists that have been looked at or bid for, whether it was The Alan Parsons Project, or The Kinks, or Hall and Oates, at different stages of their careers, have chosen Arista. So I feel fully able to compete with CBS and Warners. Over this period of time we have become a so-called large independent, although almost everybody distributes through a branch today. And we're 50% owned by RCA, who bought their interest in the company from Bertelsmann because they've established joint ventures with Bertelsmann all over the world, as a global plan. I feel that we are a legitimate alternative to CBS and Warners, and can focus the spotlight better than they can. I fully believe that over the next decade, after America starts breaking its own artists again, that we have large growth opportunities in front of us. I'd hate to be head of a large company that has to replace the volume for artists that are currently so big, once they are not quite so big. To come up with that volume and budget of 10% bigger every year.

If you were asked by someone thinking about starting an independent record company today—the way you did with Arista—or a total independent with their own resources, what advice would you give them?

I think that there are very few people who could do it. I think that if the person has the goods to do it, I would encourage that person to do it. The goods, meaning . . . . I mean, David Geffen, with his talent, did it and could do it. So if he were thinking of doing it today, I would say do it because David Geffen has an ear for creative talent. If there is someone unknown to me who really is a budding, talented, creative entrepreneur, I would advise that person to do it. Yes, it can be done—more so today than five years ago. Properly bankrolled, not on a shoestring, yes, I do believe it can be done. Unfortunately there aren't too many people around who show the kind of talent that I would bankroll to do it. That's the problem—the dearth of executive talent, which I'm surprised at. I would have thought that there'd be more budding creative entrepreneurs who could do it.

But you don't think it's a closed shop?

I don't believe it is. No.

TAILOR-MADE

RICHARD J. KAUFMAN

In addition to boosting bass, the circuit acts as an infrasonic filter, relieving your system of the task of reproducing inaudible garbage.

Unless your speakers are too big for your living room, your audio system probably does not reproduce the lowest bass octave. To keep cost and size reasonable, design engineers have eliminated the lowest octave; hence, very few speakers respond below about 40 Hz and few bookshelf systems go even as low as 50 Hz. This is unfortunate, for the lowest note on a standard piano is 27.5 Hz, which would be a more desirable goal for low-end reproduction.

The lowest recorded tone that can be called music is 16 Hz, which is produced only by large organs and specially built, 96-key Bösendorfer pianos. Such sounds are felt rather than heard. There are only a handful of recordings with these notes, but most symphonic and jazz recordings contain information between 27 and 40 Hz, if it hasn't been lost in the recording process. With the advent of the digital Compact Disc, such losses are ceasing to be a problem.

The choices open to those who want more bass are not always practical; large, expensive speakers might do the job, as might a separate subwoofer, if one had enough space and money.

Electronics offers another alternative. As Fig. 1 shows, an acoustic-suspension speaker behaves like a second-order, high-pass filter, its bass response sloping off at 6 dB/octave below a frequency that varies with the speaker. If the signal is first fed through an electrical filter network, it is possible to make the speaker respond like a fourth-order filter (which is how a tuned-port loudspeaker behaves). The net result is an extension of bass response by about an octave. I have measured the parameters of many speakers, and have found that "Q" (a measure of response "peakiness" near cutoff) averages about 0.9 for units that aspire to high fidelity, ranging between 0.7 (British speakers) and 1.1. I have designed a filter with a Q that will extend the bass response with any such speaker. Only the resonant frequency of the filter need be adjusted to match the unit at hand.

There are some disadvantages to this method. It will only work with acoustic-suspension designs. Maximum sound pressure level will not be as great as might be obtained by other techniques. In theory, distortion will be greater because of the greater cone excursion. However, this hasn't proven audible in practice, due perhaps to masking effects (in the case of harmonic distortion) and the fact that the increase in Doppler and IM distortion, though measurable, may not be significant. The most serious disadvantage is the need for extra power, roughly double that required without the filter. Unless your amp's power is marginal to begin with, this won't present an obstacle if you don't habitually crank up the bass and volume controls. In any case, you will want to be sure that your speakers are properly protected. A 2-ampere, fast-acting fuse will be adequate; do not use a larger size unless your speaker manufacturer specifically recommends it, and under no circumstances use slow-blow fuses.

On the plus side, this circuit also acts as an infrasonic filter, and so relieves your amp and speakers of the task of reproducing inaudible garbage that can overload them.

Figure 2 is a schematic of one channel and the power supply. IC1B is a buffer that isolates the filter from loading effects of the input source imped-

BASS

ance. Resistors R101 and R102 form a voltage divider to set the overall circuit gain to unity—the filter does introduce some gain, for which this compensates. IC1A is the heart of the filter. Capacitors C101 and C102, in conjunction with R103 through R106, set the frequency, which is variable between 20 and 50 Hz. Resistors R107 and R108 determine the filter Q. The input is directly coupled, but the output uses a blocking capacitor, C103, to isolate the amplifier from the d.c. offset voltage produced by IC1A. If your amp has a blocking capacitor at its input, C103 may be omitted. Almost any standard compensated op-amp will give satisfactory results in this circuit, but FET input devices such as the LF353 or TL072 are superior. Dual devices (two ICs in one package) were used. I suggest mounting the ICs in sockets rather than soldering them.

The circuit was constructed on a dual IC board, Radio Shack #276-159. You may find this somewhat cramped; a larger p.c. board such as Radio Shack's #276-168 may be easier to work with. For the most part, layout is not critical, but keep the following points in mind: All leads to the negative IC inputs should be as short as possible, to minimize noise. Decoupling capacitors C5 and C6 (shown on the power-supply schematic) should be mounted on the same board as the op-amps in order to minimize noise pickup from the power supply. Put these caps as close to the op-amps as is reasonably possible. The transformer should not be too close to the op-amps. Shielded cable was used for the signal leads; twisted pairs of wires will also work, though placement is then more critical for minimum noise. Purists who feel electrolytics degrade signals may want to bypass C103 with a 1,000-pF silver mica cap, or eliminate it altogether. (The latter isn't recommended unless you have some alternate means of blocking d.c. input to your amp.)

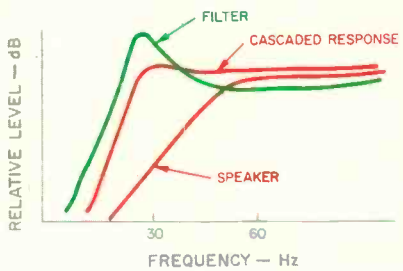
Potentiometer R105-R106, which controls the frequency, is a dual-ganged, preferably log-taper type; however, audio-taper pots, which are much easier to find, work reasonably well. You may calibrate this control by measuring the resistance of one pot, and calculating the frequency thus:

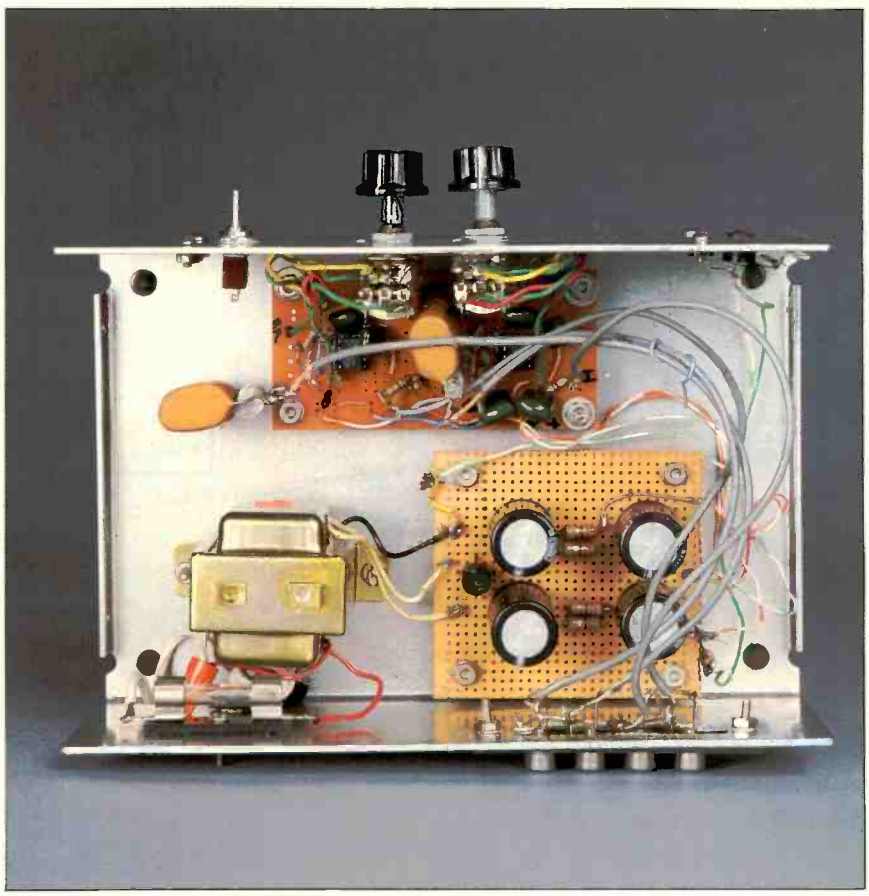
$$F = \frac{159}{0.047 \times (68 + R)}$$

where R is the measured value of R105 in kilohms. If you find the scale too cramped at the upper end, rewire the pot, reversing the connection that shorts the wiper.

Before you connect power, double-check your wiring for errors. The filter can be placed between your preamp

Fig. 1—Response curves for an acoustic-suspension speaker, the filter described in this article, and their combined response.





At a filter setting just below 30 Hz, organ and jazz piano will come alive, and a setting at 50 Hz will add a pleasing bottom to rock and pop music.

and amplifier or in a signal processor or tape monitor loop. You may want to add extra jacks and a DPDT switch to maintain tape-monitor facilities. The setting for frequency is not terribly critical, though for greatest accuracy it should be approximately one-half the speaker's resonant frequency. If loading problems at the output make the circuit oscillate, a 100-ohm resistor in series with C103 (or in C103's place, if it's eliminated) will solve the problem.

You can measure your speakers' resonant frequency if you have a signal generator. Put a 2-watt resistor, between 500 ohms and 1 kilohm, in series with your speaker, and feed the output of the signal generator through your amp. Measure the voltage across the speaker; it will reach a maximum at the resonant frequency.

The speakers that I use have a resonant frequency of 58 Hz, and the manufacturer states the cutoff frequency to be 48 Hz. A setting of 28 Hz gives me the most accurate bass response, reasonably smooth down to 27 Hz—pretty good for an 8-inch speaker. A setting of slightly below 30 Hz will be about right for most 8-inch speakers. Larger speakers are more variable, and experimentation will be required. The most accurate setting doesn't affect the sound, except when deep bass is truly present. Most FM stations roll off their bass below 40 Hz, so this source is not an accurate test. Prerecorded cassettes and most cassette decks give up at this point also. Records, and of course CDs, will allow you to determine the most accurate setting. Organ music and jazz piano will come alive when the filter is properly adjusted. Of course, there is nothing sacred about accuracy. Setting the controls to 50 Hz will give a pleasing bottom to rock and popular music.

Eight-inch speakers can thus reproduce all but the lowest half-octave. If the filter is used with 10- or 12-inch speakers that have a long cone excursion, they will reproduce accurate bass right down to 20 Hz, assuming their present low end is around 40 Hz. With adequate amplifier power, this filter will give you a truly compact subwoofer, electronically.

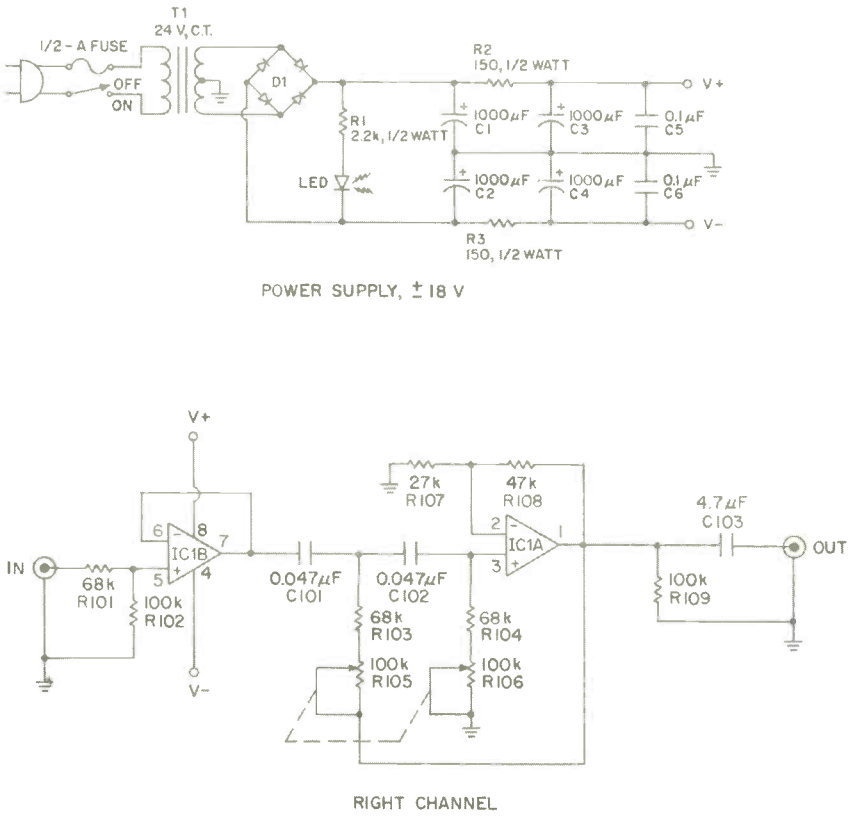


Fig. 2—Schematic diagram of the filter. Left channel is identical to the right channel shown, but uses IC2 and part numbers above 200.

PARTS LIST

All resistors are ¼-watt, 5%, unless otherwise noted.
Right-channel parts are series 100; left channel, series 200.
R1—2.2-kilohm, ½-watt, 10% resistor.
R2, R3—150-ohm, ½-watt, 10% resistors.
R101, R103, R104, R201, R203, R204—68-kilohm resistors.
R102, R109, R202, R209—100-kilohm resistors.
R107, R207—27-kilohm resistors.
R108, R208—47-kilohm resistors.
R105-R106, R205-R206—100-kilohm, dual-gang potentiometers, log or audio taper (see text).
C1 through C4—1,000-μF, 25-V electrolytic capacitors.
C5, C6—0.1-μF, plastic-film (Mylar) capacitors. (Mount near IC1 and IC2.)
C101, C102, C201, C202—0.047-μF, plastic-film capacitors (5% preferred, 10% acceptable).
C103, C203—4.7-μF (or greater), nonpolarized capacitors (plastic-film preferred, electrolytic acceptable).
IC1, IC2—TL072 dual op-amps, or similar (see text).
D1—50-PIV, 1-amp bridge rectifier.
T1—24-V, center-tapped transformer.
Miscellaneous—LED, fuse, switch (optional), wire, phono jacks, line cord and plug, p.c. board, and sockets for ICs.

BEYOND CONVENTIONAL RECORDING

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1

MARK LEVINSON AUDIO SYSTEMS ML-10A PREAMP AND ML-9 AMP

Manufacturer's Specifications

ML-10A Preamplifier

RIAA Equalization Accuracy: ±0.30 dB.

Gain: Phono, 42, 53, or 63 dB, switch-selectable; line, 22 dB.

Distortion: Phono, 0.014% THD and 0.005% IM at 6 V output, 20 Hz to 20 kHz, 63-dB gain; line, 0.004% THD and 0.004% IM at 6 V output, 20 Hz to 20 kHz.

S/N Ratio: Phono, −72 dB, 20 Hz to 80 kHz, re: 1 mV input at 1 kHz, 63-dB gain; line, 95 dB, unweighted, re: 2 V.

Volume-Control Tracking: ±0.50 dB in typical usage range.

Line Input Impedance: 15 kilohms.

Recommended Load: Main outputs, 5 kilohms or more; record outputs, 10 kilohms or more.

Dimensions: 2¼ in. H × 19 in. W × 10⅛ in. D (5.7 cm × 48.3 cm × 25.7 cm).

Weight: 8 lbs. (3.6 kg).

Price: $2,960.

ML-9 Amplifier

Power Output: 100 watts per channel, 8-ohm loads, 20 Hz to 20 kHz; 200 watts per channel, 4-ohm loads.

Distortion: 0.2% THD for 100 watts output, 8 ohms; 0.4% THD for 200 watts output, 4 ohms.

Damping Factor: Switchable, 300, 200, or 100 at 50 Hz, re: 1 watt at 8 ohms.

Input Impedance: 50 kilohms.

Dimensions: 8¾ in. H × 19 in. W × 13⅜ in. D (22.2 cm × 48.3 cm × 34 cm).

Weight: 56 lbs. (25.5 kg).

Price: $3,050.

Company Address: c/o Madrigal, P.O. Box 781, Middletown, Conn. 06457.

For literature, circle No. 90

The ML-10A preamplifier and ML-9 amplifier stand about midway in the hierarchy of Mark Levinson Audio Systems (MLAS) components. Both are typical MLAS designs, save that the ML-10A breaks with the company's tradition of separate power supplies for preamps, as its power supply has been successfully incorporated into its chassis. Like all MLAS preamps, the ML-10A is a no-frills design, with a minimum of amplifier blocks or switches in the signal path.

Both the amp and preamp are rack width, but are not really designed for rack mounting. The preamp's mounting holes are not spaced to match standard racks; the amp has no mounting holes at all, because the makers recommend placing it near the speakers rather than racking it with the preamp. The ML-10A has a front-panel height of 2¼ inches and a depth of 10⅛ inches, a very convenient size for a preamp.

The preamp's front-panel controls are sparse, in keeping with the MLAS design philosophy. From left to right, they include a three-position rotary selector switch; toggle switches for tape monitor and "Record/Defeat" (which prevents the possibility of connected but unpowered tape decks nonlinearly loading the selected source—a good idea); two rotary, stepped, output gain switches which provide balance control; toggle switches for "Mono/Stereo" and "High/Low" output gain, and an unstepped volume control.

On the rear panel are the signal, ground, and a.c. connections. The signal connectors are the Camac type used by MLAS in all their equipment, designed to make shield contact before signal contact, thus preventing transients and hum when changing connections. The a.c. connections are through a device called a Corcom, which provides voltage selection for 100-, 120-, 220-, and 240-V a.c. lines, plus line fusing, balanced LC line filtering and a female receptacle for the a.c. line cord.

Internally, the space is completely occupied by a double-sided p.c. board. On the bottom of this board are two solid, quarter-inch-square bars running the full width of the chassis to lend extra mechanical support. Also notable is the beefing-up of critical ground, signal, and power-supply traces by heavy buss wires and copper bars.

Removing the plate which covers the rightmost 3 or 4 inches of the p.c. board reveals the Corcom; a shielded, toroidal power transformer, and the rectifiers and filter capacitors. The plate keeps fingers out of live a.c. line connections and provides additional shielding.

Editor's Note: The particular units reviewed here were produced by the "old" firm, prior to legal difficulties early this year. However, new samples have been diligently checked by the reviewer, who tells me that bench tests show them to be quite "substantially like the units tested last fall." Bascom further says, "I have also listened to them and find they sound like the original units. I think that we can run the original review with a few words in postscript to that effect." Our company contact tells us that insofar as they are concerned, the only change is in the ownership of the company, and that they have not changed the units inside or out.—*E.P.*

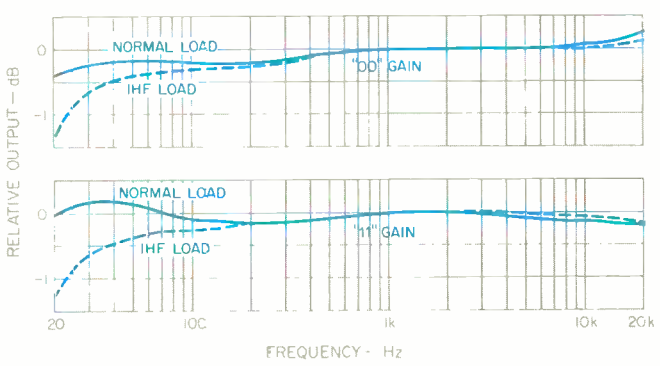


Fig. 1—RIAA phono equalization error for "00" (42-dB) and "11" (63-dB) gain settings, with normal and IHF loads, at tape out.

To the left of this power-supply area are the phono preamps (which take up the whole left half of the p.c. board), the line output amplifiers, and the power-supply regulators.

The volume control is an impressive-looking Penny and Giles unit. Rotary switches are RCL high-conductivity gold-plated units. Connections from the p.c. board to the volume control and toggle switches are via flexible printed circuits. Component quality and construction are first-rate in this unit.

The ML-9 amplifier is rated at 100 watts per channel into 8-ohm loads and, weighing in at 56 pounds, is one of the beefiest 100-watt-per-channel power amps I've seen. (More on the power rating later.) This is a solid, attractive, and well-made piece of audio gear.

On the front panel are a pair of handles and a single rocker-type power switch with an integral red LED indicator. The power switch is, in reality, a circuit breaker switching both sides of the a.c. line. The breaker will trip if the a.c. line current, the heat-sink temperature, or the d.c. offset in the amplifier's output becomes excessive.

On the rear panel are a three-wire, chassis-mounted male socket for the a.c. power cord; fuses for each side of the a.c. line; two Camac signal-input connectors; two pairs of five-way binding posts for output (spaced more than ¾ inch apart to prevent the use of dual-banana plugs); two three-position damping-factor switches, and a second pair of handles to facilitate carrying the amp.

A U-shaped chassis forms the back panel, bottom, and front subpanel. The heat-sink assemblies bolt to the open sides of the U, and a top cover and front panel complete the picture. Within the amplifier enclosure are a number of p.c. boards, including a control board behind the front panel and, inside the rear panel, an output board and two small damping-network boards. The amplifier circuits themselves are mounted on the back of the heat-sinks. A large 1.2-kVA toroidal power transformer and two 36,000-μF/100-V filter capacitors take up most of the interior volume.

The Levinson design philosophy translates into sparse controls, a minimum of amplifier blocks, but many circuit niceties.

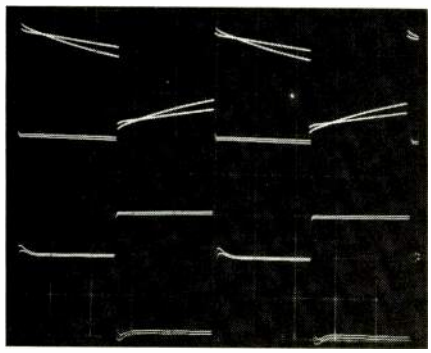


Fig. 2—Phono-preamp square-wave responses at "00" gain setting for 40 Hz (top), 1 kHz (middle), and 10 kHz (bottom). Dual traces show effects of normal and IHF loads.

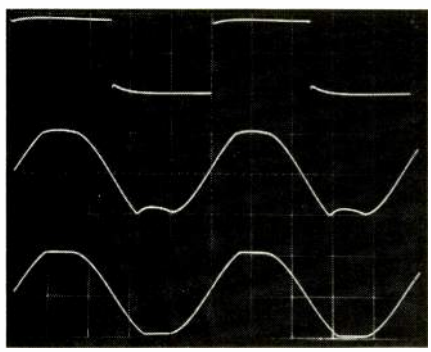


Fig. 3—Additional phono-circuit waveforms. Large-signal square wave (top); sine-wave clipping character at "00" gain setting (middle) and at "11" gain setting (bottom).

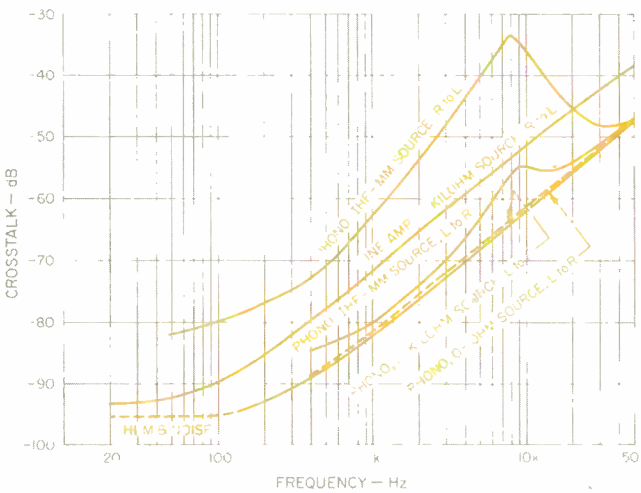


Fig. 4—Crosstalk vs. frequency for line and phono sections. Note that crosstalk is shown in both directions for phono input with IHF-MM source (see text).

Preamplifier Circuitry

The phono preamp circuit starts out with a cascode input stage consisting of a matched pair of bipolar NPN input devices in a common can, whose collectors are connected to the sources of a pair of N-channel junction FETs. A three-device current source feeds the emitters of the input differential pair. The differential output of the first stage is direct-coupled to a pair of NPN emitter-followers whose purpose is to allow high voltage gain in the first stage and provide low output-impedance drive for the output stage. The output stage is a cascode differential amp consisting of PNP devices loaded with an NPN current which converts the differential signal to a push-pull output signal in respect to ground.

An RC feedback network accomplishes RIAA equalization. Two rocker switches on the p.c. board vary the effective value of this stage's shunt feedback resistance to yield three gain levels (42, 53, and 63 dB, at 1 kHz).

Phono input termination is adjusted by a six-rocker, p.c.-mounted switch assembly which allows a normal input impedance of 50 kilohms shunted by 220 pF, an additional 220-pF shunt, a 15-kilohm shunt, an 825-ohm shunt, a parallel combination shunt of 200 ohms and 1,000 pF, a parallel combination of 30 ohms and 0.01 μF, activation of two pairs of plug-in terminals for a user-installed parallel combination, and any parallel combination of the preceding. Flexible input termination, indeed!

For r.f. attenuation, the signal from each phono input connector passes through a 1-ohm resistor with two ferrite beads on its leads.

There are three low-frequency roll-offs in this circuit. The first is an input coupling capacitance consisting of a 2,200-μF electrolytic bypassed with a 0.68-μF film unit. A 66.5-kilohm resistor on the phono input side of the coupling cap and a 200-kilohm resistor on the input-transistor side form a paralleled combination of 49.9 kilohms for the basic value of the input impedance. This input time constant may seem ridiculously long (440 S), but the reason for the large capacitance is to reduce the source impedance to the first stage at low frequencies, in order to get the least possible low-frequency noise. The second low-frequency roll-off is formed by another 2,200-μF capacitor, bypassed by a 0.68-μF film, in series with the shunt feedback resistor. This high value of capacitance is more necessary here to get good response below 20 Hz with the low value of shunt feedback resistance (some 10 ohms or so) at the highest closed-loop gain of 63 dB at 1 kHz. The last roll-off is formed by a 2-μF output coupling capacitor against the nominal line input impedance of 15 kilohms.

The line amplifier circuit is similar to the phono preamp but with a single-case, dual-cascoded J-FET used as the differential amp input stage, here fed from a two-terminal, constant-current source. Output is direct-coupled to the line outputs, as is the input from the volume control. A d.c. balance control in the drain circuit of the first stage allows the output d.c. offset to be zeroed out. A 2.2-μF polypropylene capacitor in the shunt arm of the feedback network causes the d.c. gain of the output amplifier circuit to be unity.

The two rotary "Balance" controls on the front panel each

The ML-9, weighing 56 pounds, is one of the beefiest amps I've seen in its 100-watt-per-channel power class.

adjust one channel's output amplifier gain by ±5 dB, in 1-dB steps, by varying the value of the shunt feedback resistors. The front-panel "High/Low" switch adjusts both channels at once, placing a resistor in series with the volume control and another in shunt with it, to give 9 dB of attenuation without changing the line input impedance.

The power-supply circuitry in the ML-10A starts with the toroidal power transformer feeding a full-wave bridge rectifier producing about ±20 V d.c. into 1,000-μF capacitors. Additional filtering is provided by 2.2-ohm series resistors and two more 1,000-μF capacitors. This unregulated d.c. is fed into an integrated-circuit dual tracking regulator that provides ±12 V as power supply for the error op-amps, +12 V as a source for the reference zener diode, and ±12 V for bias dividers in the actual plus and minus voltage regulators.

The regulator circuitry is unique in my experience, in that it uses a complementary push-pull output amplifier like most transistor power-amplifier output stages. Most voltage regulators use a single-polarity (NPN or PNP) device as a pass element, or use paralleled multiple ones. By virtue of the negative-feedback connection, the pass element tries to keep the output constant as input voltage and load vary. This is fine when the load is increasing: The pass device turns on harder and keeps the voltage up. But imagine what happens when there is some inductance in the load and the load is decreasing: The output voltage would tend to increase beyond the regulated value. All that a single pass element could do here would be to cut off, thereby causing a load-voltage overshoot, a momentary loss of control, and a rise in power-supply output impedance.

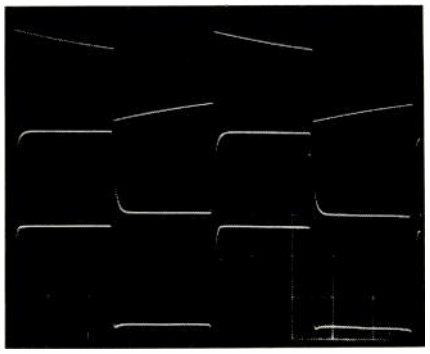
Under those same circumstances, with a push-pull pass element as used in the ML-10A, the shunt pass device would turn on, keeping the output voltage from overshooting and keeping the output impedance active and low.

The circuitry itself consists of a complementary compound circuit with two drivers and two output transistors connected between the unregulated input d.c. voltage and ground. The regulated, ±13 V d.c. voltage is taken from the output-transistor collectors. The error op-amps drive the driver transistors as common-base amplifiers. This is a clever and innovative circuit. Film capacitors are liberally used to bypass electrolytics throughout the power supply. For additional heat dissipation, the top cover bolts to the heat-sink on which the power supply's output and bias transistors are mounted.

Amplifier Circuitry

The ML-9's first stage, like the ML-10A's, consists of a cascode differential amplifier fed from a two-transistor current source. The signal input transistors are a pair of matched NPN devices in a common case. The outputs of these bipolar transistors are direct-coupled to the sources of a pair of N-channel junction FETs whose gates are connected to the corresponding NPN transistor emitters. Degeneration in this composite stage is high, due to 500-ohm emitter degeneration resistors and 3-kilohm FET drain loads. Signal input coupling to the plus input of the input amplifier is via a 15-μF film capacitor with 100-kilohm resistors to ground on the signal-input and transistor sides of the capacitor, forming a basic, 50-kilohm input resistance at low

Fig. 5—Preamp line-amp square-wave responses for 20 Hz (top), 20 kHz (middle), and 20 kHz at clipping (bottom).



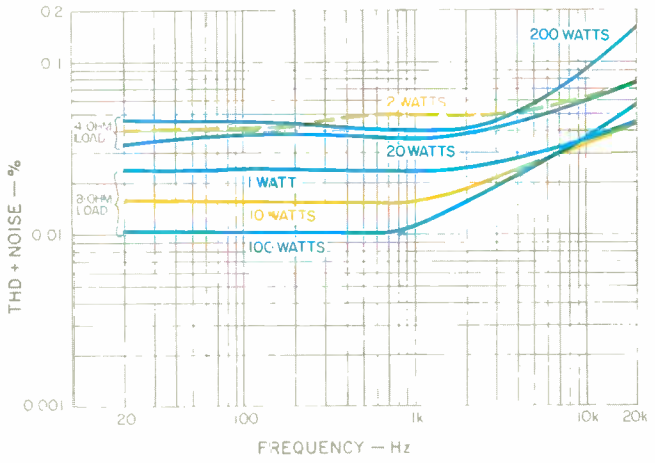


Fig. 6—THD + noise vs. frequency and power, ML-9 amplifier, with 4- and 8-ohm loads.

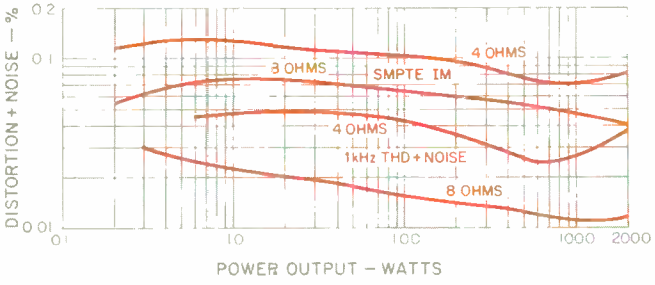


Fig. 7—THD + noise and SMPTE IM vs. power output, ML-9 amplifier.

The preamp's regulator circuitry is unique; it's more like a power amplifier than the usual, simple voltage regulators.

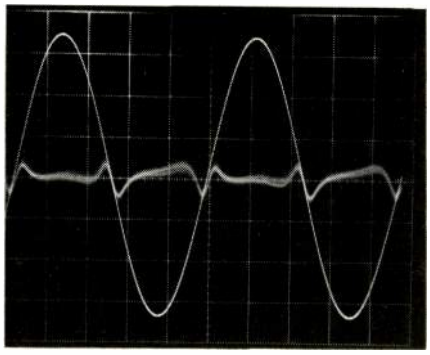


Fig. 8—Harmonic-distortion products.

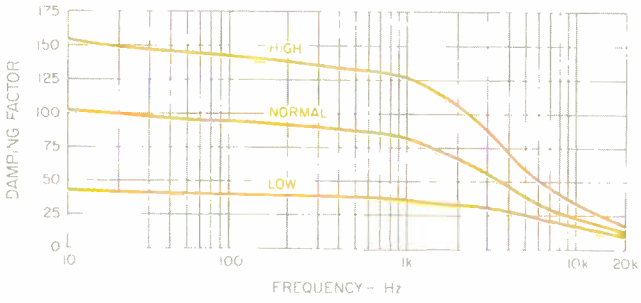


Fig. 9—Damping factor vs. frequency (re: 8 ohms) for three settings of damping switch.

to middle frequencies. A single-pole, low-pass filter having a cutoff frequency of about 80 kHz connects the input coupling capacitor and the plus input of the input stage.

Output of the first stage is direct-coupled to the second stage, which is again a cascode differential amplifier with a current-mirror load. The cascode amplifier part of this circuit uses PNP bipolar transistors, and the current mirror uses NPN bipolars. The net result of this stage is to further amplify the signal and convert the differential output signal to a single-ended output in respect to ground. A bias-spreading network is connected between the output PNP and NPN transistors to provide bias for the output stage (which is a triple complementary emitter-follower arrangement). Four NPN and four PNP TO-3 high-power output devices are used here. The supply voltage for this amplifier is ±80 V d.c., which makes it a 250 to 300-watt-per-channel amplifier into 8-ohm loads. Further, it is claimed that this circuit can put out ±29 A into a 2-ohm load. With this in mind, the rating of 100 watts per channel is very conservative, as the unit will deliver at least that much into any conceivable speaker load.

An energy-limiter circuit operates separately on positive and negative half-cycles of the output signal, and it is said to offer output-stage protection without sonic consequences. Considering the basic volt-amp capability of the output stage, the limiter circuit is probably set high enough to come into action only for such extreme conditions as impedances below 1 or 2 ohms.

The distribution of loop feedback is unusual in this amplifier. The usual single shunt-feedback resistor is actually two resistors in series, with one end of the series combination grounded and the other end going through a 10-μF film capacitor to the inverting input of the input amplifier. Topologically, this is normal and usual. What is different is that most of the loop feedback comes from the output of the second stage to the junction of these two series-connected shunt-feedback resistors. A second loop from the main output comes back through a resistor directly to the inverting input to provide 100% d.c. feedback and some small amount of a.c. feedback.

Even more novel is the variable damping feature. A three-position toggle switch (one per channel) allows for low, normal, and high damping factors to optimally interface with different speakers. The feedback arrangement just described provides the low damping factor; the normal and high damping conditions are provided by an additional feedback network (measuring the drop across the output-buffering RL network) that provides some positive current feedback to lower output impedance even more.

The power supply of the ML-9 shows attention to some unusual details. The a.c. power input immediately goes through a Sprague LC line filter, which filters both sides of the line in respect to the chassis or third-wire power ground. Additional line filtering is provided by a balanced network consisting of a capacitor between hot and neutral, a choke in each side of the line, and another capacitor after the chokes between hot and neutral.

A network consisting of a relay-contact shortable resistance is in series with the transformer primary to reduce inrush current. This relay is operated by a transistor time-delay circuit, which shorts out the series resistance after about 2 S.

A detector circuit on the rear-panel output board monitors the d.c. offset at each channel's output, and it will trip the a.c. line-switch/circuit-breaker if offset becomes excessive. This detector and the time-delay circuit share a small, separate power supply, with its own full-wave bridge rectifier and capacitor filters, which is fed from the switched a.c. line.

Preamplifier Measurements

Circuit gains and IHF sensitivities were measured first and appear in Table I. The three selectable phono gains of 42, 53, and 63 dB are designated as "00," "10," and "11" to correspond with the logical rocker positions of the gain-switch pairs.

Phono noise for different gain settings, weightings and source impedances is shown in Table II. Table III shows IHF S/N ratios; the noise values are quite good for a differential input stage.

Phono THD + noise (Table III) was measured in the "00" gain position, at 6 V rms output, and was less than 0.01%

The amp's power supply makes its rating of 100 watts per channel quite conservative—it will deliver at least that much into any conceivable load.

from 20 Hz to 20 kHz with my normal load (250 pF and 91 kilohms). The IHF loading, at 6 V output, caused clipping distortion at 20 Hz, but at 5 V output, THD + noise was less than 0.01% from 20 Hz to 20 kHz. Measuring distortion at the higher gain settings was frustrated by hum pickup in my measurement setup.

Phono overload versus frequency, for gain settings of "00" (42 dB) and "11" (63 dB), is shown in Table IV. The power-supply voltages of ±13 V are primarily responsible for the overload values mentioned. Although the 1-kHz, "00"-gain input overload voltage of 60 mV is low compared to some other designs, in practice the ML-10A probably won't be overloaded by low- to medium-output moving-magnet pickups (1 to 5 mV at 1 kHz, at standard level of 5 cm/S lateral or 3.54 cm/S stereo).

Phono RIAA equalization error is shown for several conditions in Fig. 1. Pre-equalized square waves through the phono section are shown in Fig. 2 for normal and IHF loading at "00" gain. The overshoot visible in the 1- and 10-kHz traces is due to a resistor in series with the final RIAA roll-off capacitor, a frequent choice of designers.

The clipping character of the phono preamp is different for "00" and "11" gain settings, as illustrated in Fig. 3. Also shown in Fig. 3 is a large-signal, pre-equalized, 1-kHz square wave, having generally excellent symmetry but with some in-band high-frequency compression. This is a severe test for circuit high-frequency acceptance, since the rise-time of the pre-equalized signal is essentially that of the signal generator (in this case some 50 to 100 nS).

I used to band-limit the square-wave test signal to a 50-kHz equivalent, which is obviously easier on the circuit under test. I have decided lately that a non-band-limited signal with short rise-time, severe and musically unrealistic as it is, is still a meaningful test for evaluating phono preamp circuits.

Channel-to-channel crosstalk in the phono section is shown in Fig. 4. Since I started to measure crosstalk in moving-magnet phono gain stages with an IHF-MM source, I have shown the worse crosstalk direction, i.e., right-to-left or left-to-right. Here, however, I have shown both directions, since the effect depends on which channel is driven. This asymmetry may have some effect on high-frequency imaging symmetry with high-inductance moving-magnet pickups. (For the sake of completeness, I should add that the Audio Research SP10 reviewed in the June 1984 issue had this asymmetrical behavior, whereas the Perreaux SM2 reviewed in the July 1984 issue was within a few dB of being symmetrical.) Phono-stage crosstalk for the other two gain settings was about the same as for the "00" setting with source impedances of 0 to 1 kilohm.

Phono input impedance was representable by a parallel combination of 50 kilohms and 250 pF. Phono output impedance was about 600 ohms in series with 2.2 μF.

The line amplifier section was measured for THD + noise, which was found to be less than 0.01% from 20 Hz to 20 kHz at 7 V rms output with either a normal or IHF load. At 20 kHz with 7 V output, distortion was under 0.01% with up to 6,800 pF of extra capacitance loading. Although not recommended by MLAS, it was found that this line amp would drive 600 ohms at 7 V output with about 0.07% THD in the left channel and 0.04% in the right. The nature of this distortion was predominantly third harmonic and fairly constant across the audio band. Impressive performance!

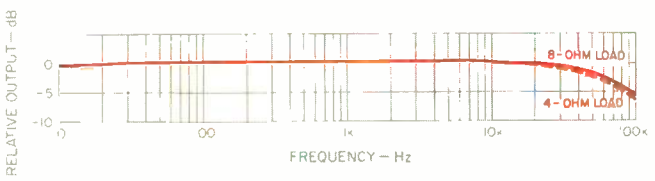


Fig. 10—Frequency response, ML-9 amplifier, at 1 watt output.

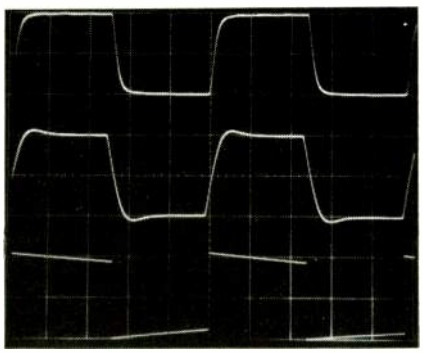


Fig. 11—Square-wave responses, ML-9, for 10 kHz into 8-ohm load (top), 10 kHz into 8 ohms paralleled with 2 μF (middle), and 40 Hz into 8 ohms (bottom).

Rise and fall times of the output amplifier were 1.8 μS at ±10 V output with either a normal or IHF load. Further, the rise and fall times were essentially constant with volume-control attenuation. With either or both balance controls set to +5 dB, the rise and fall times lengthened to 2 μS. Another attribute of this circuit is that the rise and fall transitions stayed constant and exponential up to clipping. A 'scope picture of square-wave responses through the output amplifier is shown as Fig. 5. The 20-Hz tilt in the top trace is caused by the 2.2-μF capacitor in the shunt feedback path. The bottom trace is for a 20-kHz square-wave signal overdriving or clipping the output amplifier.

AUX input impedance measured 14.3 kilohms in parallel with 300 pF. Output resistance was about 85 ohms.

Volume-control tracking was checked by setting the attenuation of the right channel in 5-dB steps and comparing the resultant attenuation in the left channel. Tracking error was within 1 dB to −65 dB, increasing to 2 dB at −70, 5 dB

The ML-9 has a separate power supply for such non-audio circuits as the inrush-current time delay and the d.c. offset sensor.

at −75, and 13 dB at −80, with the left channel always having more attenuation than the right.

Interchannel crosstalk of the line amp is shown in Fig. 4. Incidentally, crosstalk was in-phase for both the phono and line amplifiers.

A final measurement, of the unit's power-supply regulators, showed that correct voltage was maintained down to an a.c. line input of 95 V.

Amplifier Measurements

The ML-9 was first run at 33% of rated power, or 33 watts per channel into 8-ohm loads, for one hour. Even though the heat-sinks got quite hot to the touch, the unit did not thermally cycle off during this test.

Voltage gain was found to be 19×, or 25.6 dB, into 8-ohm loads with normal damping. IHF sensitivity for 1 watt output into 8-ohm loads was 150 mV.

THD + noise was measured for both channels for 4- and 8-ohm loads as a function of frequency and power output, and is shown in Fig. 6. The left channel had higher distortion than the right and is therefore the one plotted. Harmonic and SMPTE-IM distortion versus power output at 1 kHz are shown in Fig. 7. Figure 8 shows the harmonic-distortion products typical of a bipolar output stage with optimum bias. Lower bias (idling current) will produce a crossover notch, caused by gain reduction near the origin. Higher bias will produce a notch of the opposite polarity, caused by a gain increase near the origin. The "best" bias produces the dual-peaked "doublet" shape seen in Fig. 8. Distortion is affected by the damping switch, being lowest with the highest damping factor. For example, at 10 watts and 1 kHz, the left channel produced 0.036%, 0.015%, and 0.01% for low, normal, and high damping positions. In measuring distortion in this amp, I noted a thermal drift of bias which manifested itself in distortion dropping with time when power above about 10 watts was being produced. After running at higher power and returning to lower power, distortion would creep up to its former value at that lower power level after 5 to 10 S. I suppose one could term this thermal hysteresis distortion with a long time constant.

Damping factor was looked at as a function of frequency and damping-switch position. The specs for this unit claim damping factors of 100, 200, and 300 at 50 Hz, at a reference level of 1 watt into 8 ohms. I measure this by injecting 1 A rms from one channel into the measured channel. More specifically, one channel is driven to 8 V rms and connected to the measured channel's hot output terminal through an 8-ohm resistor. Then, to a good approximation, mV across the measured channel output becomes milliohms of output impedance. Results of this are plotted in Fig. 9. Using this method with other amplifiers, I generally measure about the same damping factors as claimed. Here, however, I got about half the specified values.

Frequency response at the 1-watt level for 4- and 8-ohm loads is shown in Fig. 10. The slight difference in high-frequency response for different loading is normal with most power amplifiers.

Interchannel crosstalk versus frequency was found to be better than −85 dB up to 10 kHz, rising to −80 dB at 20 kHz and −74 dB at 50 kHz—excellent, indeed.

Rise and fall times were measured at ±5 V output into 8 ohms. As a function of the damping switch, the values were 5.0, 5.5, and 6.0 μS for high, normal, and low positions.

Table I—Gain and IHF sensitivity, ML-10A preamplifier.

Condition	Gain, dB L	Gain, dB R	IHF Sensitivity, mV L	IHF Sensitivity, mV R
AUX In to Main Out				
Low Gain, Normal Load	7.8	7.8		
Low Gain, IHF Load	7.6	7.6	210.0	210.0
High Gain, Normal Load	17.0	17.1		
High Gain, IHF Load	16.9	17.0	71.5	71.5
AUX In to Tape Out				
Normal Load	0	0		
IHF Load	0	0	500	500
Phono In to Main Out, High Line-Amp Gain				
"00" Gain, Normal Load	58.8	58.8		
"00" Gain, IHF Load	58.8	58.8	0.572	0.572
"10" Gain, Normal Load	70.5	70.5		
"10" Gain, IHF Load	70.4	70.4	0.150	0.150
"11" Gain, Normal Load	80.5	80.5		
"11" Gain, IHF Load	80.4	80.4	0.0475	0.0475
Phono In to Main Out, Low Line-Amp Gain				
"00" Gain, Normal Load	49.5	49.5		
"00" Gain, IHF Load	49.4	49.4	1.68	1.68
"10" Gain, Normal Load	61.2	61.2		
"10" Gain, IHF Load	61.1	61.1	0.435	0.435
"11" Gain, Normal Load	71.1	71.1		
"11" Gain, IHF Load	71.1	71.1	0.139	0.139
Phono In to Tape Out				
"00" Gain, Normal Load	41.7	41.6		
"00" Gain, IHF Load	41.2	41.2	4.3	4.3
"10" Gain, Normal Load	53.4	53.4		
"10" Gain, IHF Load	52.9	52.9	1.14	1.14
"11" Gain, Normal Load	63.3	63.3		
"11" Gain, IHF Load	62.8	62.8	0.362	0.362

Table II—Phono noise, referred to input.

Condition and Bandwidth	Source Impedance, Ohms	Referred Input Noise, nV L	Referred Input Noise, nV R
"00" Gain			
20 Hz to 20 kHz	0	165	350*
400 Hz to 20 kHz	0	95	95
A-Weighted	0	98	100
A-Weighted	100	116	116
A-Weighted	1k	225	230
A-Weighted	IHF MM	690	800
"11" Gain			
20 Hz to 20 kHz	0	135	180
400 Hz to 20 kHz	0	65	65
A-Weighted	0	67	69
A-Weighted	100	90	95
A-Weighted	1k	215	215

* Includes 60-Hz hum

I liked the ML-9 amplifier from the moment I first turned it on. It sounds smooth, detailed and spacious, with power and plenty of punch.

Table III—IHF signal-to-noise ratios, phono and AUX inputs.

Condition	Source Impedance, Ohms	IHF S/N, dB L	IHF S/N, dB R
Phono Inputs			
"00" Gain	IHF MM	−76.6	−75.5
"10" Gain	100	−72.7	−72.6
"11" Gain	100	−74.5	−74.0
High-Level Inputs			
High Line-Amp Gain	1k	−91.5	−91.9
Low Line-Amp Gain	1k	−90.5	−91.0

Large-signal square waves near clipping of the output started to slew slightly, in that the transitions became more straight-sloped than exponential. Nevertheless, the amp produced a large-signal rise and fall time at 100 V peak-to-peak into 8 ohms of 6 μS, for a slew rate of 80 V/6 μS or 13.33 V/μS. A 'scope photo of square waves through the ML-9 appears as Fig. 11: The top trace is 10 kHz into 8 ohms. The middle trace is 10 kHz into 8 ohms paralleled with 2 μF; notable is the small amount of overshoot and ringing for this capacitive loading. The bottom trace is for 40 Hz.

IHF signal-to-noise ratio, which is A-weighted signal-to-noise below 1 watt into 8 ohms, was −92 dB for the right and −95 dB for the left channel.

Dynamic headroom came out to be 5.3 dB, mainly due to the rated power of 100 watts and the burst power in this test of 340 watts/channel into 8 ohms. Clipping headroom was similarly high, at 4.55 dB, and is related to a continuous output at onset of clipping of 285 watts/channel into 8 ohms.

Use and Listening Tests

Camac connectors, although admittedly superior connectors per se, do cause interconnection problems in audio systems which use the usual RCA connectors. MLAS was kind enough to provide enough adaptors and interconnect cables using their silver wire to allow easy testing and system hookup of the ML-10A and ML-9.

Equipment used to evaluate the MLAS components included the following: Infinity air-bearing turntable and arm with a Koetsu EMC-1B cartridge; Audio Research SP10, conrad-johnson PV5 and GC/BHK preamplifiers: Audio Research D70, Dyna ST-35, and Acrosound Stereo 20/20 power amps; Infinity RS IIA speakers, and Stax SR-X/Mk3 headphones.

I received the ML-9 some 4 or 5 months before the ML-10A, so I have had much more exposure to it. I must say that I liked this amplifier from the moment I first turned it on. I find the sound of the ML-9 to be smooth, detailed, and spacious, and without the high-frequency irritation present in most solid-state amplifiers. Surprisingly, it sounds similar to the Dyna ST-35, which is a highly musical-sounding little amp (when its ceramic input-coupling capacitor is eliminated). Compared to the Audio Research D70, the ML-9 is smoother but not quite as revealing of musical texture, detail, and spatiality. Power and punch, it has plenty of—my ears gave up before it did. A critical friend to whom I loaned it thought it was the best solid-state amp he had heard.

Initial listening with the ML-10A was done using the Acrosound tube amplifier driving the Stax phones. Definition was very good, and bass quality and extension were outstanding, although "air" and spatiality were not as good as when the tube preamps were used. There was a noticeable bit of high-frequency edginess present. Subsequent discussion with MLAS indicated that it is really a good idea to warm up the ML-10A for a few days, with the phono inputs shorted or terminated with one's cartridge, before critical listening is attempted. Since the ML-10A is designed to be left on continuously, this warm-up would naturally occur in use. After measuring the unit, I left it on for 5 days before listening again. The sound was definitely better this second time around, with reduced edginess noted.

Using the ML-10A and ML-9 as a combination on the Infinity RS IIAs yielded good definition and spatiality, but I was bothered by an upper mid- to high-frequency irritation. Playing with cartridge loading didn't really help, but turning down the midrange and tweeter controls on the speakers did help a bit. When I would return to the SP10 preamp, for instance, the sound became easier and more musically natural. But then, since musical realism and naturalness in sound reproduction are so much a function of the total combination of elements, it might well be that other combinations of components with the ML-10A would yield superior sound. It really sounded quite good on my headphones.

In summary, the Mark Levinson Audio Systems equipment reviewed here is attractive, solid, and very well-built and should have excellent reliability. As I have said before, the listening comments I have made are essentially my own opinions, and I emphatically recommend that the prospective purchaser go out and audition the equipment in as many circumstances as possible. *Bascom H. King*

Table IV—Phono overload vs. frequency, loading, and gain (input values in mV rms, output values in V rms).

	"00" (42-dB) GAIN			
	Normal Load		IHF Load	
Frequency	E In	E Out	E In	E Out
20 Hz	2.45	6.85	2.5	5.9
100 Hz	15.0	7.2	15.0	6.75
400 Hz	39.5	7.2	39.5	6.85
1 kHz	60.0	7.3	60.0	6.9
4 kHz	127.0	7.25	127.0	6.85
7 kHz	203.0	7.2	205.0	6.85
10 kHz	283.0	7.2	282.0	6.8
20 kHz	520.0	7.05	520.0	6.6
	"11" (63-dB) GAIN			
	Normal Load		IHF Load	
Frequency	E In	E Out	E In	E Out
20 Hz	0.18	6.5	0.18	5.35
100 Hz	1.2	7.1	1.24	6.7
400 Hz	3.2	7.05	3.25	6.75
1 kHz	4.85	7.15	4.85	6.8
4 kHz	10.4	7.2	10.4	6.8
7 kHz	16.8	7.15	16.9	6.75
10 kHz	23.7	7.15	23.6	6.7
20 kHz	43.5	7.0	43.5	6.5

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"Quality is Job 1." A 1984 survey established that Ford makes the best-built American cars. This is based on an average of problems reported by owners in the prior six months on 1981-1983 models designed and built in the U.S.

As part of Ford Motor Company's commitment to your total satisfaction, participating Ford Dealers stand behind their work, in writing, with a free Lifetime Service Guarantee. No other vehicle company's dealers, foreign or domestic, offer this kind of security. Nobody.

See your participating Ford Dealer for details.

Have you driven a Ford... lately?

Ford

Sport GL.

2

NAKAMICHI OMS-7 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 5 Hz to 20 kHz, ±0.5 dB.
THD: 0.003% at 1 kHz.
S/N Ratio: Greater than 92 dB (IHF A-weighted).
Channel Separation: Greater than 92 dB.
Number of Programmable Selections: 24.
Output Level: 2.0 V.
Phone Output Level: 20 mW into 8 ohms.
Power Consumption: 33 watts.
Dimensions: 17⅛ in. W × 3-15/16 in. H × 12⅛ in. D (43.5 cm × 10 cm × 30.8 cm).
Weight: 16 lbs., 9 oz. (7.5 kg).
Price: $1,295.

Company Address: 19701 South Vermont Ave., Torrance, Cal. 90502.
For literature, circle No. 91

Nakamichi takes a cautious stand when it comes to new technology and new products. Best known for its pioneering work in cassette deck design and manufacture, the company now is entering broader fields of electronic endeavor, including such high-tech ventures as the production of a research instrument that can, among other things, record and play back music in CD format, on appropriate discs. This first optical memory system, capable of recording and reproducing a wide variety of optical recording media, is being made available strictly for laboratory research purposes—at a cost of $85,000!

I mention this research instrument simply to point out that Nakamichi does not introduce a new product category casually. They waited a long time to introduce their first CD player, hoping to benefit from the lessons learned by others whose first- and even second-generation CD players left something to be desired in terms of sonic and mechanical performance. As the Nakamichi people explain it in one of their well-written "white papers," they saw three major problems with most first-generation players. The first of these was the players' steep analog brick-wall filters and their attendant phase shift. The second flaw Nakamichi perceived was the use of time-sharing D/A conversion circuitry which introduces a small, but measurable, interchannel phase error. The third problem in early players, says Nakamichi, was poorly conceived drive systems, which had servos that were shock-sensitive and created an excessive error rate or even actual mistracking.

Nakamichi claims to have overcome all of these problems in their OMS-7 and in the less-expensive OMS-5. Digital filtering prior to D/A conversion, plus oversampling at a 176.4-kHz rate (four times the basic sampling rate of 44.1 kHz), allows them to use analog output filters which have a much gentler slope and which provide linear-phase filtration and constant group delay.

The OMS-7 also separates the channels prior to conversion—while they are in digital form—and then uses independent left and right D/A converters to overcome the interchannel phase-angle discrepancy noted earlier. Finally, the OMS-7 drive mechanism is mounted on a zinc-alloy diecasting suspended on coil springs, which floats free of the disc-

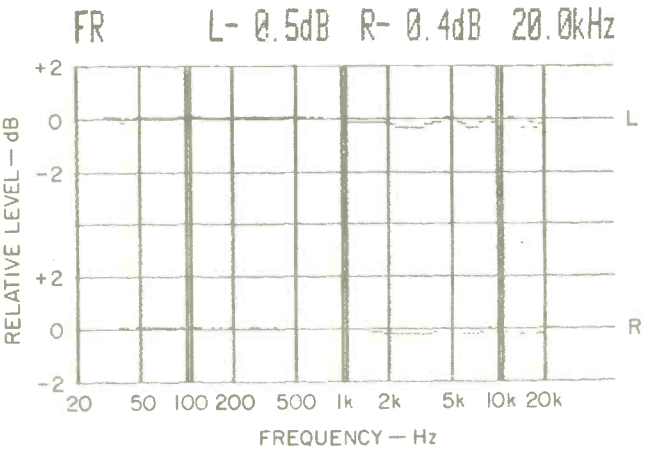

Fig. 1—Frequency response, left (top) and right channels.

loading mechanism and main chassis. A tapered, aluminum spindle centers the disc to reduce track eccentricity and error rate.

Control Layout

The OMS-7's power switch, phone level control, and phone jack are located near the left edge of the front panel. To their right is the disc drawer with its "Eject/Load" button. A display area to the right of the drawer provides detailed status information including track number being played, elapsed time (for each track), remaining time, tracks to be played, and index number. Additional indicators light up to

Sonically and mechanically, I can't fault the OMS-7 in any way, though its measured specs were not quite as good as those of others I have tested.

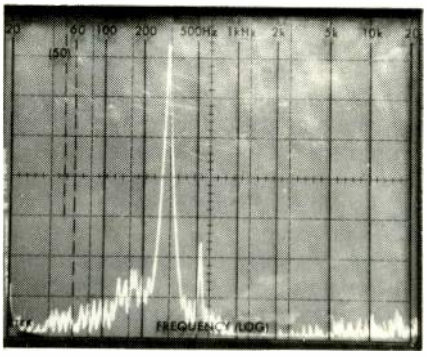

Fig. 2—Spectrum analysis from 0 Hz to 50 kHz shows 10-kHz test signal (large spike) and inaudible beat tone at approximately 24.1 kHz (small spike).

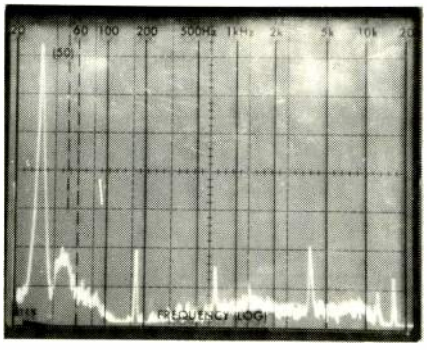

Fig. 3—Spectrum analysis from 10 to 100 kHz shows spurious products at the fundamental sampling frequency and at multiples of that frequency.

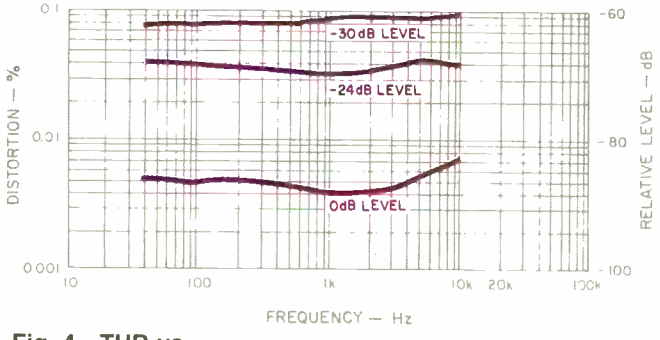

Fig. 4—THD vs. frequency, using low-pass filter, at three signal levels.

show that tracks or index numbers have been stored in the programming memory, that a disc has been loaded into the player, that the player is in standby mode (during track search or while the laser pickup is searching for the beginning of the first track), and when repeat playback has been selected.

Operating controls to the right of the display area have been very logically arranged. A large "Play" bar is at the top; below it are two smaller pushbuttons for "Stop" and "Pause." Below these are four still smaller buttons, two of which are used to skip forward or backward track by track, and two of which permit fast-forward or fast-reverse with audible cueing.

Ten numbered keys near the right end of the panel select track and/or index numbers. Below these are "Memory" and "Clear" buttons, plus four more pushbuttons to call up memory contents on the display, to control index search operations, to initiate repeat play, and to check remaining time and remaining number of tracks on a disc.

A wireless, hand-held remote-control module duplicates the main control functions of the player but does not have facilities for remote-controlled random-access programming; this can only be done via the front-panel numeric keys. In addition to the usual left- and right-channel outputs on the rear panel of the OMS-7, there is a multiple-pin socket which is identified as a "System Remote Terminal." This extra terminal, the owner's manual tells us, will serve for total system remote control when using the OMS-7 CD player with audio components to be introduced by Nakamichi in the future.

Measurements

Test-instrument measurements don't always correlate with listening tests, and the Nakamichi OMS-7 is a case in point if ever there was one. Not that the bench measurements were particularly bad—as with almost all CD players, my measured results were exemplary compared to those I get for analog components such as amplifiers and tuners. It's just that they were not quite as superb as the measurements I have gotten recently from other CD players. Yet, sonically as well as mechanically, I could not fault the Nakamichi in any way. In fact, its sound quality and resistance to shock were as good as any I have tested. The only quality which was marginally poorer than that of some top-of-the-line players I have tested was its tracking/error-correction capability, which I'll discuss a bit later.

Frequency response, shown in Fig. 1, was flat to within the claimed ±0.5 dB over the entire audio range. A small amount of ripple in the response curve can be seen, however, at the upper frequencies; it amounts to no more than about 0.3 dB. (Bear in mind that the vertical scale in Fig. 1 is 2 dB per major division.)

My first problem during the test-measurement phase of this evaluation had to do with harmonic distortion. When I tried to measure this parameter using a single-reading distortion analyzer, I was taken aback by the readings I obtained. When I introduced a low-pass filter (with a cutoff at around 20 kHz), I quickly realized that the supposed "distortion" wasn't harmonic at all, but consisted of ultrasonic "beats" well outside the audio range. These are shown in

The player had trouble with the widest portion of my test disc's opaque wedge, but not with its simulated dust spot or fingerprint.

the spectrum analysis photos of Figs. 2 and 3. In Fig. 2, the sweep extends from 0 Hz to 50 kHz. The large spike is the desired 20-kHz output, while the lower amplitude spike is a beat occurring at around 24.1 kHz. Using an even wider frequency sweep (from 10 to 100 kHz) in Fig. 3 reveals additional beats at the fundamental sampling frequency and at multiples of that frequency. I would have thought that, with the digital filtering and oversampling techniques used in this player, such beats would not be present. They did not introduce any intermodulation or spurious products *within* the audio range; it just seems odd that they are there. I am wondering if they are the result of the presence of multiple "timing clocks" which govern the oversampling rate in various integrated circuits within the player's D/A circuitry.

When I introduced a low-pass filter into the THD measurement chain, the actual THD readings within the audio band were, of course, more like the value claimed by Nakamichi, as shown in Fig. 4. Unweighted signal-to-noise ratio measured a very good 95.7 dB, and the A-weighted measurement was an even better 100.0 dB (see Figs. 5A and 5B). SMPTE-IM distortion measured 0.01% at maximum recorded level, increasing to 0.1% at −20 dB recorded level. CCIR IM (twin-tone, using 19- and 20-kHz tones at the equivalent of highest recorded level) measured a very low 0.0037%. Stereo separation, plotted as a function of frequency in Fig. 6, ranged from 76.2 dB at the high frequency extremes to 87.2 dB at mid-frequencies.

Reproduction of a 1-kHz square wave by this player is shown in Fig. 7. As has been true of other CD players employing digital filters and oversampling, the waveform exhibits no ringing, only a slight ripple along its top and bottom edges. This denotes the absence of higher order harmonics above the 20-kHz audio bandwidth. The appearance of the unit pulse in Fig. 8, as reproduced from my Philips test disc, further confirms the use of digital filtering and oversampling in this player's D/A circuitry.

The OMS-7 fell just short of being able to play through the widest section of the opaque wedge on my special "defects" test disc. During play I heard occasional ticks, indicating that the player was unable to correct or conceal over that 900-micron width of missing data. On the other hand, the player had no trouble playing through the widest simulated dust particle on the test disc, a black dot 800 microns in diameter. Neither did it misbehave at any time while playing through the test disc's simulated, semi-opaque fingerprint smudge.

Use and Listening Tests

The Nakamichi OMS-7 exhibits the kind of smooth, natural sound I have come to expect from CD players employing the advanced digital filtering and oversampling techniques which now are gaining favor with most CD hardware manufacturers. Gone is the unstable stereo imaging of some of the earlier players, as well as what some astute listeners sensed as a somewhat grainy high end. I want to stress that the kinds of audible differences I am talking about here are certainly not great. The casual listener will hear little if any difference between first-, second- and third-generation CD players. They all sound much better, overall, than other program sources. But to an experienced and critical listen-

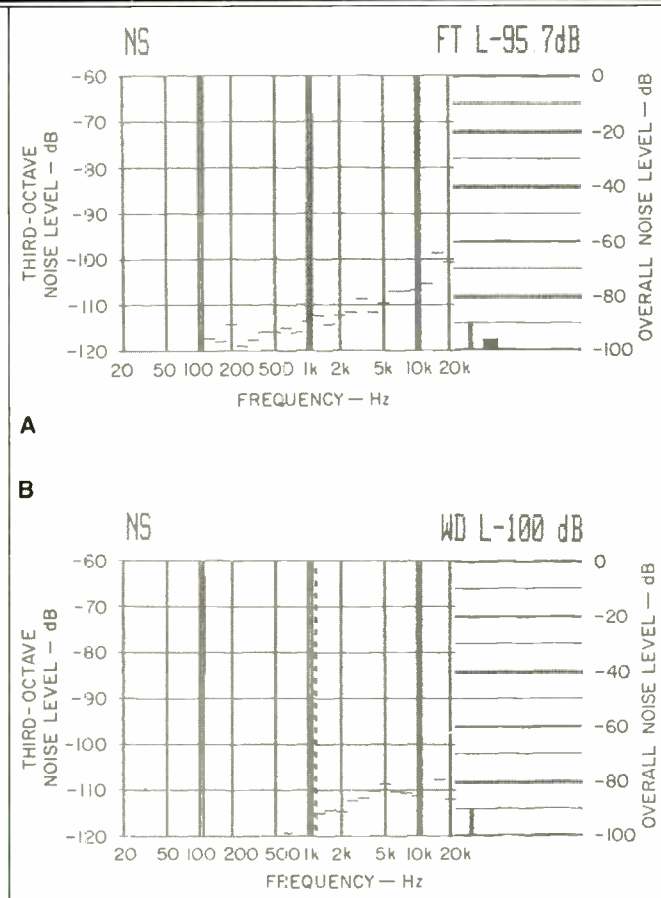

Fig. 5—S/N analysis, both unweighted (A) and A-weighted (B).

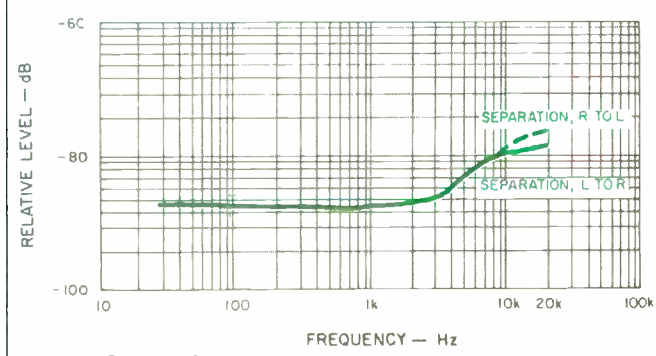

Fig. 6—Separation vs. frequency.

To an experienced and critical listener, the improvement in sound of this and other recent players will be apparent and very worthwhile.

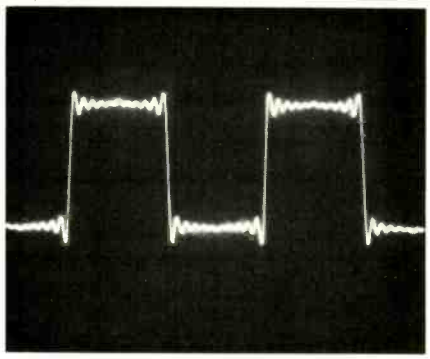

Fig. 7—Square-wave reproduction, 1 kHz.

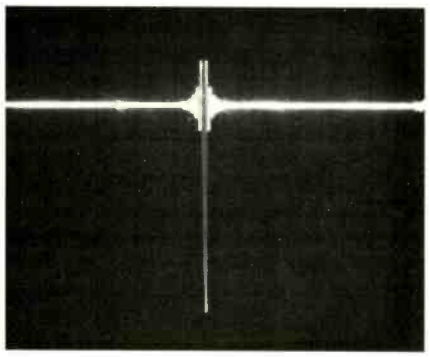

Fig. 8—Single-pulse test.

er, the sonic improvement of this and other recently introduced players is apparent and very worthwhile.

From a purely scientific point of view, I am somewhat troubled by those ultrasonic signal components I detected during the bench tests—but as a listener, I must report that these out-of-band components in no way degraded the musicality of reproduced sound from my favorite CDs. In that connection, if you are a lover of classical recordings, try any of the six discs from Denon which make up a complete set of Beethoven's nine symphonies, performed by the Staatskapelle Berlin Orchestra under the direction of Otmar Suitner. Or, for some real dynamics and musical fun, listen to Telarc's *Ein Straussfest*—a collection of waltzes, polkas and marches of the prolific Strauss family, replete with popping champagne corks, pistol shots, aerial bombs and thunderclaps. If you play this Telarc disc when checking out the OMS-7 or any other CD player, be sure to observe the warning in the album notes about starting out at lower levels for initial playback until a safe level can be determined for the rest of your audio equipment!

Programming the OMS-7 was easy to do and was almost self-explanatory from looking at the front panel. Being able to move the pickup to a specified index point was also a welcome feature, particularly since more and more classical discs are being divided into indexed portions as well as track numbers. In terms of convenience features, it might have been nice if the remote-control unit supplied with the OMS-7 had been able to program selections into memory, considering the player's relatively high price. However, the functions that *can* be performed remotely all worked perfectly, even at distances greater than those specified in the owner's manual.

Nakamichi did not rush into the CD marketplace with just any series of players. The OMS-7 clearly demonstrates the wisdom of the company in waiting until they could do it right.

Leonard Feldman

ONLY THE MUSIC TELLS ME WHERE TO GO.

I'M A PIONEER AND I'M PROUD OF IT.

"When I hit the road, I'm gone. It's like I get this feeling nothing can stop me. It's just me, my machine, and my music to the max.

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3

AMBER MODEL 7 TUNER AND MODEL 50b AMPLIFIER

Manufacturer's Specifications

Tuner, FM Section

Usable Sensitivity: Mono, 11.2 dBf.
50-dB Quieting Sensitivity: Mono, 15.2 dBf; stereo, 37.2 dBf.
S/N Ratio: Mono, 75 dB; stereo, 73 dB.
THD: Mono, 0.08% at 100 Hz and 1 kHz, 0.2% at 6 kHz; stereo, 0.1% at 100 Hz, 0.2% at 1 kHz, 0.3% at 6 kHz.
Frequency Response: 30 Hz to 15 kHz, +0, −2.0 dB.
Selectivity: 60 dB.
Capture Ratio: 1.0 dB.
AM Suppression: 58 dB.
I.f. Rejection: 110 dB.
Spurious Response Rejection: 90 dB.
Image Rejection: 70 dB.
Muting Threshold: 28.7 dBf.
Subcarrier Product Ratio: 40 dB.
Stereo Separation: 48 dB at 1 kHz, 45 dB at 100 Hz, 40 dB at 10 kHz.

Tuner, AM Section

Sensitivity: 300 μV/meter.
Selectivity: 40 dB.
S/N Ratio: 50 dB.
Image Rejection: 40 dB.
I.f. Rejection: 30 dB.

Amplifier, Power Section

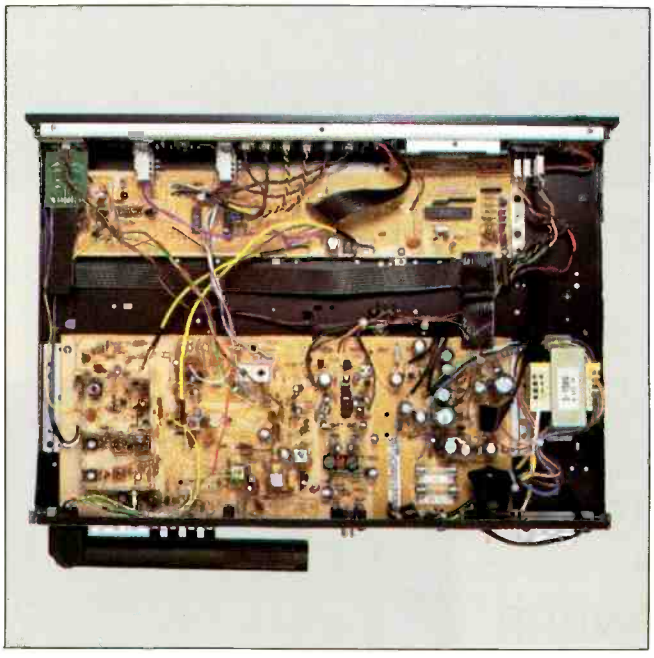
Maximum Rated Power at 1 kHz: 50 watts, 8 ohms; 70 watts, 6 ohms; 90 watts, 4 ohms.
THD: 0.006% at 50 watts, 8-ohm loads, 1 kHz (A-weighted).
SMPTE IM: 0.010% at 50 watts, 8-ohm loads, 1 kHz (A-weighted).
Input Sensitivity: 1.5 V at 1 kHz for 50 watts into 8 ohms.

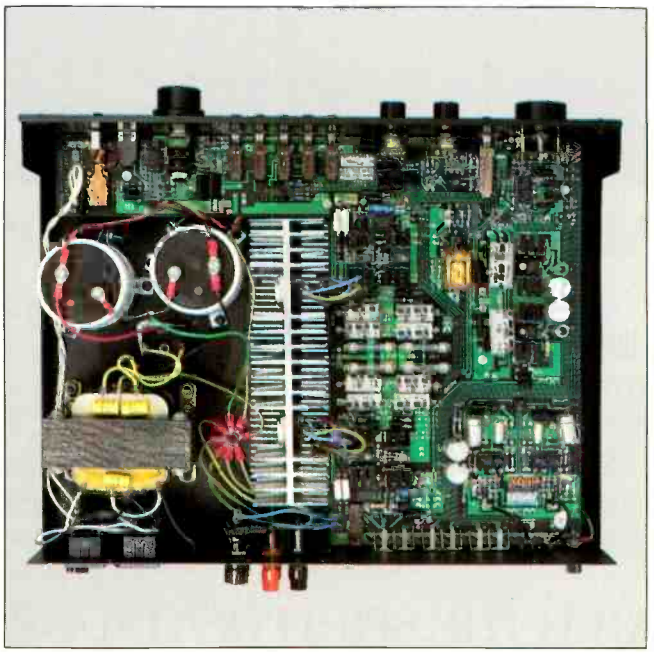
Amplifier, Preamp Section

Gain: Phono, 40.1 dB at 1 kHz, 0.5-V output; high level, 38.7 dB at 1 kHz, 0.5-V output.
Frequency Response: Phono, RIAA from 1 Hz to 100 kHz, −3.0 dB; high-level inputs, 1 Hz to 200 kHz, −3.0 dB.
S/N Ratio: Phono, 78 dB; high level, 90 dB re: 1-V input.
Subsonic Filter: −3 dB at 38 Hz, 6-dB slope/octave.
Tone Control Boost and Cut: 6 dB/octave.
Headphone Amplifier Output: 10 mW into 8 ohms, 1 kHz; 200 mW into 300 ohms, 1 kHz.

General Specifications

Power Requirements: Amplifier, 350 watts maximum; tuner, 9 watts.
Dimensions: Amplifier, 17.5 in. (44.5 cm) W × 4.5 in. (11.4 cm) H × 12.4 in. (31.4 cm) D; tuner, 17.5 in. (44.5 cm) W × 2.5 in. (6.4 cm) H × 11.5 in. (29.3 cm) D.
Weight: Amplifier, 24 lbs. (11 kg); tuner, 8½ lbs. (3.9 kg).
Prices: Amplifier, $699; tuner, $379.
Company Address: 218 Ridge St., Charlottesville, Va. 22901.
For literature, circle No. 92





Amber Electronics has come up with a pair of components that can be purchased singly or treated as a "two-piece" receiver. This tuner and integrated amplifier can, in fact, be mated to each other by making use of a pair of tall, wooden side-panels which firmly join the two components, one above the other.

The first thing that I found appealing about both pieces of equipment was the easy-to-read, white-lettered nomenclature on their black front panels. No subdued lettering or undecipherable "international symbols" here—just good old, legible English words. Though the Models 7 and 50b are made in America, the panel layouts and controls are somehow reminiscent of British or European high-fidelity components.

Control Layout

The slim Model 7 AM/FM tuner has two semicircular pushbuttons at the left of the panel, arranged, one above the other, so as to form an oval. Touch the top half of the oval for "Up" tuning and the bottom part for "Down" tuning, either in the scanning mode (in which the synthesized tuning circuit seeks the next usable signal) or in the manual mode (which tunes in 200-kHz increments on FM and 10-kHz increments on AM). An uncluttered display area shows frequency, relative signal strength, and reception of stereo signals. A series of small, round pushbuttons takes up most of the remaining space on the front panel. The first of these is the "Enter" button for programming up to six AM and six FM station frequencies; these can then be called up by pushing one of the numbered "Memory Access" buttons located nearby. Buttons for selecting mono/stereo, AM, FM, and manual/scan modes, plus a "Power" on/off button at the extreme right, complete the simple-to-use layout.

The rear panel of the Model 7 is as simply configured as the front. There are the usual AM and FM antenna input terminals and a pair of output jacks. That's it!

The Model 50b amplifier sports a large, rotary selector switch at the left of its front panel. To the right of the selector is a small "Tone Engage" tone-defeat button followed by "Bass" and "Treble" control knobs. Additional pushbuttons control a subsonic filter, "Tape 1" and "Tape 2" monitor circuits, mono/stereo selection, and audio muting. Dual concentric knobs handle channel balance and volume. A headphone jack and the main "Power" on/off switch are positioned at the far right.

Have you ever run out of switched convenience outlets on an integrated amplifier? That's not likely to happen with the Amber 50b. There are four such outlets on the rear panel, not to mention a pair of unswitched a.c. receptacles. There are also a pair of fuse-holders, preamp-out and main amp

While 50-dB quieting was better than claimed, the tuner failed to live up to Amber's specs for S/N and distortion.

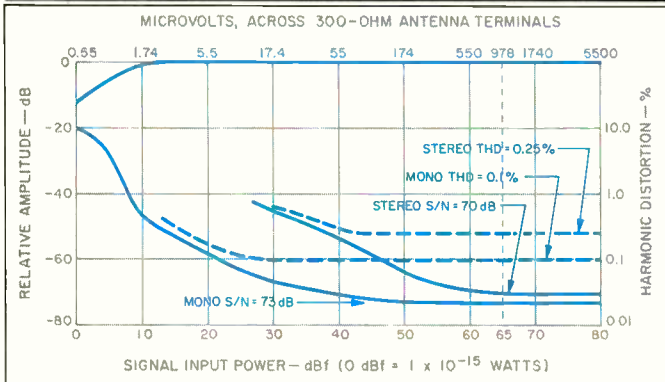


Fig. 1—Mono and stereo FM quieting and distortion characteristics, Model 7 tuner.

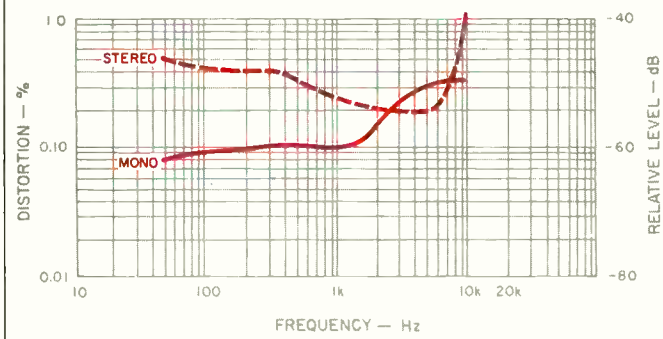


Fig. 2—THD vs. modulating frequency, Model 7.

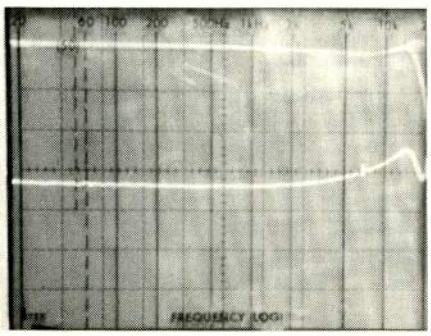


Fig. 3—Frequency response (upper trace) and separation vs. frequency, Model 7.

input jacks, a pushbutton that separates the amp input from the preamp output (so you can interpose any accessory in series with the signal path), and the usual array of input and tape output jacks. A chassis ground terminal near the phono inputs completes this logical layout.

Tuner Measurements

FM mono usable sensitivity of the Model 7 tuner measured 11.0 dBf, a shade better than claimed. Stereo usable sensitivity was governed not so much by the r.f. sensitivity of the front-end as by the muting and stereo thresholds of the tuner, each of which were set at around 27 dBf (12.3 μV across the 300-ohm antenna input terminals). Fifty-dB quieting measured 13.0 dBf in mono and 36 dBf in stereo—again, a bit better than claimed by Amber. However, the tuner failed to live up to Amber's claims in the areas of signal-to-noise ratio and distortion. For a strong signal of 65 dBf, mono S/N measured 73 dB as against 75 dB claimed; in stereo, the best S/N was 70 dB as opposed to 73 dB claimed. Harmonic distortion for a 1-kHz signal in mono measured 0.1% compared with 0.08% claimed; in stereo, the THD was 0.25% for that same test frequency. The curves of Fig. 1 show mono and stereo FM quieting and distortion as functions of input signal strength, while Fig. 2 shows how THD varies with frequency in both mono and stereo modes.

Figure 3 is a 'scope photo showing frequency response (top trace) and separation for a stereo modulating signal. The display represents a logarithmic frequency sweep from 20 Hz to 20 kHz. Note the slight rise in response at the high end, just before the steep roll-off above 15 kHz. This sort of curve suggests a slight mismatch or misalignment of the low-pass filters used. In fact, at 15 kHz, response was down a full −5.0 dB, as against −2.0 dB claimed. As for the separation (lower trace), it was consistently good across the entire audio spectrum, though at 1 kHz it failed to reach the 48 dB claimed by Amber, measuring 40 dB instead. Separation at 100 Hz measured 38 dB against 45 dB claimed; at 10 kHz, it measured 28 dB against 40 dB claimed.

The Model 7 did not provide what I would consider adequate subcarrier rejection circuitry to get rid of residual 19- and 38-kHz subcarrier products at the tuner output. In Fig. 4, I used a 5-kHz, left-only modulating signal (represented by the tall spike at the left) and then measured the output of the right channel over the frequency range from 0 Hz to 50 kHz. The sweep is linear, 5 kHz per horizontal division. You can see that, in addition to the distortion components at 10 and 15 kHz, there is a fairly large-amplitude spike at 19 kHz and an even taller one at 38 kHz. There are also unwanted components at 33 and 43 kHz (38 kHz plus or minus the 5-kHz modulating frequency). Although none of these are audible (with the possible exception of the 19-kHz component, to those whose hearing range includes that frequency), these spurious components should still be more completely attenuated, since they can lead to IM products that *do* fall within the audible frequency range.

Output level from the tuner, for 100% modulation by a 1-kHz signal, was 0.75 V. AM suppression measured 55 dB, and capture ratio was 1.5 dB. Alternate-channel selectivity measured 65 dB, a bit better than claimed. Spurious-re-

What do Beethoven's Ninth, the destruction of the Death Star, Mozart's laugh and rock video's latest thriller have in common?

Uncommon sounds. Sounds that make exceptional demands on your audio system. Because from the crescendo of a massed chorale to the detonation of proton torpedos, the sounds of modern entertainment reward audio high-performance as never before. And nothing performs like Yamaha.

Yamaha's sophisticated new R-9 receiver is designed to make the most of today's home entertainment possibilities. With seven audio and three video hookups, the R-9 can serve as the control panel for your entire home audio/video system. And because it has a separates-quality 125-watt-per-channel* amplifier with Auto Class A Power amplification, it provides the high power and wide dynamic range that add a whole new dimension to your home entertainment experience.

Now you can hear digital recordings and compact discs reproduced with the full clarity and resonance demanded by serious audiophiles. Experience the high-decibel impact of the sound effects that make your favorite films special. And do it through a receiver so advanced it uses discrete circuitry like that found in Yamaha's finest separate components.

The R-9's AM/FM stereo tuner features digital tuning with a unique 5-digit capability that allows you to fine-tune in increments of 0.01 MHz (FM).

This is particularly helpful in obtaining maximum signal quality when tuning relatively weak stations interfered with by stronger adjacent stations.

Combined with our new Computer Servo Lock Tuning System, it gives you the best of both digital and analog tuning capabilities.

The R-9 includes a multi-function infrared remote control. And it is just one in a complete line of advanced Yamaha receivers.

Now that's entertainment.

*125 watts RMS per channel, both channels driven into 8 ohms, from 20 to 20,000 Hz, at no more than 0.015% Total Harmonic Distortion.
Yamaha Electronics Corporation, USA, P.O. Box 6660, Buena Park, CA 90622.

YAMAHA

The amplifier sounds a lot better than it measures, but I could still hear its deviation from correct RIAA equalization.

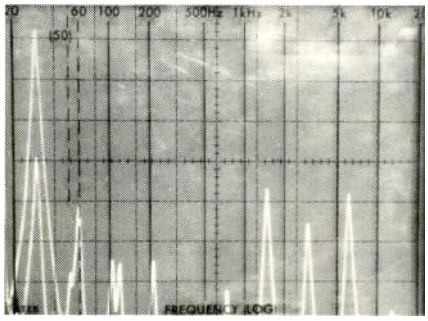


Fig. 4—Crosstalk, subcarrier, and distortion products at output of Model 7's unmodulated channel,with opposite channel modulated 100% by 5-kHz signal. Sweep is linear, from 0 to 50 kHz.

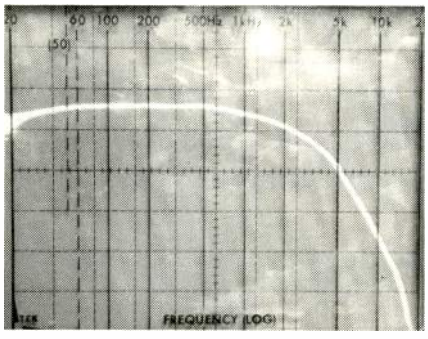


Fig. 5—Frequency response, AM tuner section, Model 7.

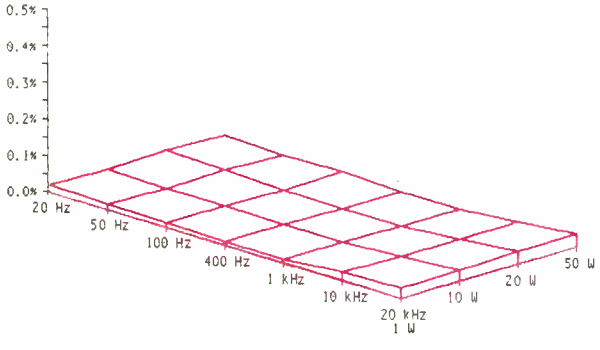


Fig. 6—THD vs. power and frequency, 8-ohm load, Model 50b amplifier.

sponse and i.f. rejection were both in excess of 100 dB, while image rejection was exactly 70 dB, as claimed. Amber claims only 40 dB for subcarrier product rejection, and that's just about all I measured. AM frequency response is shown in Fig. 5.

Amplifier Circuit Highlights

Of the two components that make up this system, the 50b integrated amplifier is by far the more sophisticated in design. Its circuitry begins with a low-pass filter. Voltage amplification is achieved using a complex network based upon National Semiconductor's LM-391N integrated circuit. (This device consists of a differential input stage with constant current sources, followed by level-shifting Darlington networks and transistor-biasing circuitry.) High-current amplification is provided by four bipolar junction transistors arranged in composite-pair, true complementary, Class-AB configuration. Protection circuitry is not used; rather, the circuit was designed to provide a large safe-operating area. Fuses are incorporated in series with the speaker outputs.

The phono section of the 50b begins with insulated jacks to isolate the very low-level phono signal grounds from all other grounds in the amplifier. Ferrite beads are used on the input lines to suppress any radio-frequency interference. An internal, eight-position DIP switch allows the user to select the optimum capacitance for moving-magnet cartridge loading. Phono signal amplification is provided by two gain stages with a passive RIAA equalization network between them. The RIAA network consists of polystyrene and polypropylene capacitors and precision resistors. The entire phono section is d.c.-coupled.

Tone control circuitry used in the 50b employs Baxandall-type, active filtering to provide a small, fixed, first-order wave shaping at variable hinging frequencies. The degree of correction (6 dB/octave slope) is kept constant, while the frequency at which boost or cut begins is altered. Treble adjustment begins at 4 kHz or higher, while bass control action begins at 160 Hz or lower. Since these cutoff points are outside the midrange area, accurate midrange reproduction can be maintained while room acoustics or other problems at the frequency extremes are corrected.

Amplifier Measurements

Considering the care with which this amplifier was designed, I was surprised to find that the owner's manual did not offer a power-output specification that met FTC format requirements. The Federal Trade Commission requires that all power amplifiers for home use have a uniform statement of rated power output. This statement must include the continuous rated power with both channels driven into a specified resistive-load impedance. It must also specify the range of frequencies over which that power can be achieved at a specified rated harmonic distortion. In their listing of specs for the 50b, Amber tells us only that the amplifier will deliver 50 watts into 8 ohms *at 1 kHz*. They further state that the rated THD *at that 1-kHz test frequency* will be 0.006%, and then qualify that statement by saying that the measurement is "A-weighted." Never before have I run into any amp's specification where mid-band distortion measurements are "A-weighted"! Think about this for a

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If not for the price, I would have only high praise. But to be competitive, Amber will have to give more power or charge less.

moment. If you have a 1-kHz signal, the harmonic-distortion components, if any, will occur at multiples of that frequency (2, 3, 4 kHz, etc.). When an A-weighting network is introduced (the one usually for signal-to-noise measurements), the filter curve of such a network *attenuates* treble frequencies above around 1 kHz. So, in effect, any harmonic-distortion components produced by the amplifier, using a 1-kHz test signal, will be attenuated by the A-weighting filter, and the result will be a *lower* overall distortion reading than would otherwise be the case. That kind of spec writing is out of place for an amplifier as intelligently and honestly designed as this one otherwise is.

I used no such A-weighting network when I measured THD for this amp. Even without it, I measured a distortion level of 0.0065% at 50 watts output per channel, using 8-ohm loads. At the frequency extremes, distortion increased to 0.035% for a 20-kHz signal at 50 watts output, and to 0.017% at 20 Hz. Such low distortion levels are nothing to be ashamed of, and I can't understand why Amber chose to quote power output in the strange manner that they did.

Using 4-ohm loads, the amplifier easily delivered 90 watts per channel, with a THD of only 0.015% to 0.02% at mid-frequencies, 0.3% at 20 Hz, and 0.3% at 20 kHz. Clipping occurred at 56 watts per channel with 8-ohm loads and at roughly 100 watts per channel with 4-ohm loads. The "three-dimensional" curves of Figs. 6 and 7 show how distortion varies with output power and frequency for the 8- and 4-ohm load conditions, respectively.

Dynamic headroom of the 50b amplifier measured 1.2 dB using 8-ohm loads; CCIF IM was a very low 0.0016%. IHF IM was well below the 0.03% lower limit of my measuring equipment. The damping factor, referred to 8-ohm loads, was higher than 125.

Phono input sensitivity was 0.2 mV for 1-watt output, while sensitivity via the high-level inputs measured 20 mV for the same output level. Phono overload occurred with 100 mV of a 1-kHz signal applied to the phono inputs. RIAA equalization on the amplifier I tested was off by a maximum of −1.6 dB at 15 kHz and by +0.9 dB at 50 Hz, rather a lot for an amplifier using such high-quality precision parts in its phono equalization networks. Frequency response via the high-level inputs was flat to within ±1.0 dB from 6 Hz to 30 kHz and to within ±3 dB from 2.5 Hz to 50 kHz.

Signal-to-noise ratio of the phono section was a high 82 dB referred to 1-watt output for 5 mV of input at 1 kHz. For the high-level inputs, S/N was a bit better still, 85 dB. The very moderate action of the bass and treble controls at their maximum cut and boost settings is shown in Fig. 8. With less extreme settings of these controls, even less of the midrange is affected, just as Amber claims.

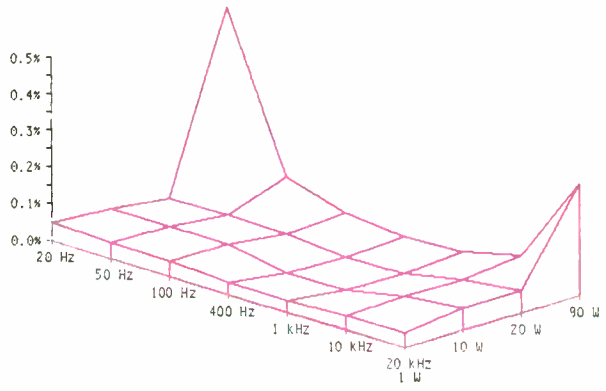

Fig. 7—THD vs. power and frequency, 4-ohm load, Model 50b.

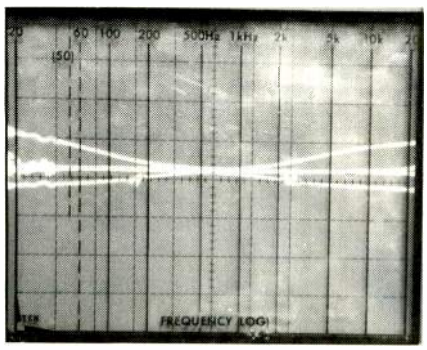

Fig. 8—Bass and treble control range, Model 50b.

Use and Listening Tests

The Model 7's FM sensitivity was excellent, with overall performance adequate if not outstanding. In my location, there was little evidence of interference caused by inadequate selectivity on FM, and I was able to pick up all of the usual signals—about 50 or so—that I expected to intercept. I should point out, however, that these days there are very few tuners that don't do that well, and some of them are priced a good deal lower than the Model 7.

As for the amplifier, I must confess it sounds a lot better than it measures. In conducting A/B tests between this amplifier and my reference amp in the lab, playing identical copies of several LPs on each, I was able to detect the deviation in RIAA equalization exhibited by the 50b. A slight clockwise rotation of the treble control and a slight counterclockwise rotation of the bass control restored proper tonal balance to these records, but if I didn't have a reference amp to tell me that the sound was slightly off on the 50b, I wouldn't have been able to compensate in this manner.

The medium power rating of this amplifier, combined with the moderate amount of dynamic headroom available, makes it suitable for use with high-dynamic-range program sources (CDs, VHS or Beta Hi-Fi, etc.) only if you are using speakers that boast fairly high efficiencies, or are willing to listen to music at moderate sound-pressure levels.

I think what bothers me most about this combination is its price/performance ratio; nearly $1,100 is a high asking price for a two-piece receiver with the power rating it offers. If price were not a consideration, I would have only high praise for these products, despite the "strange" power-output ratings. But if Amber hopes to compete seriously with off-shore competition, they will have to give us a bit more power for the money—or somewhat lower pricing for the power and performance they now provide. *Leonard Feldman*

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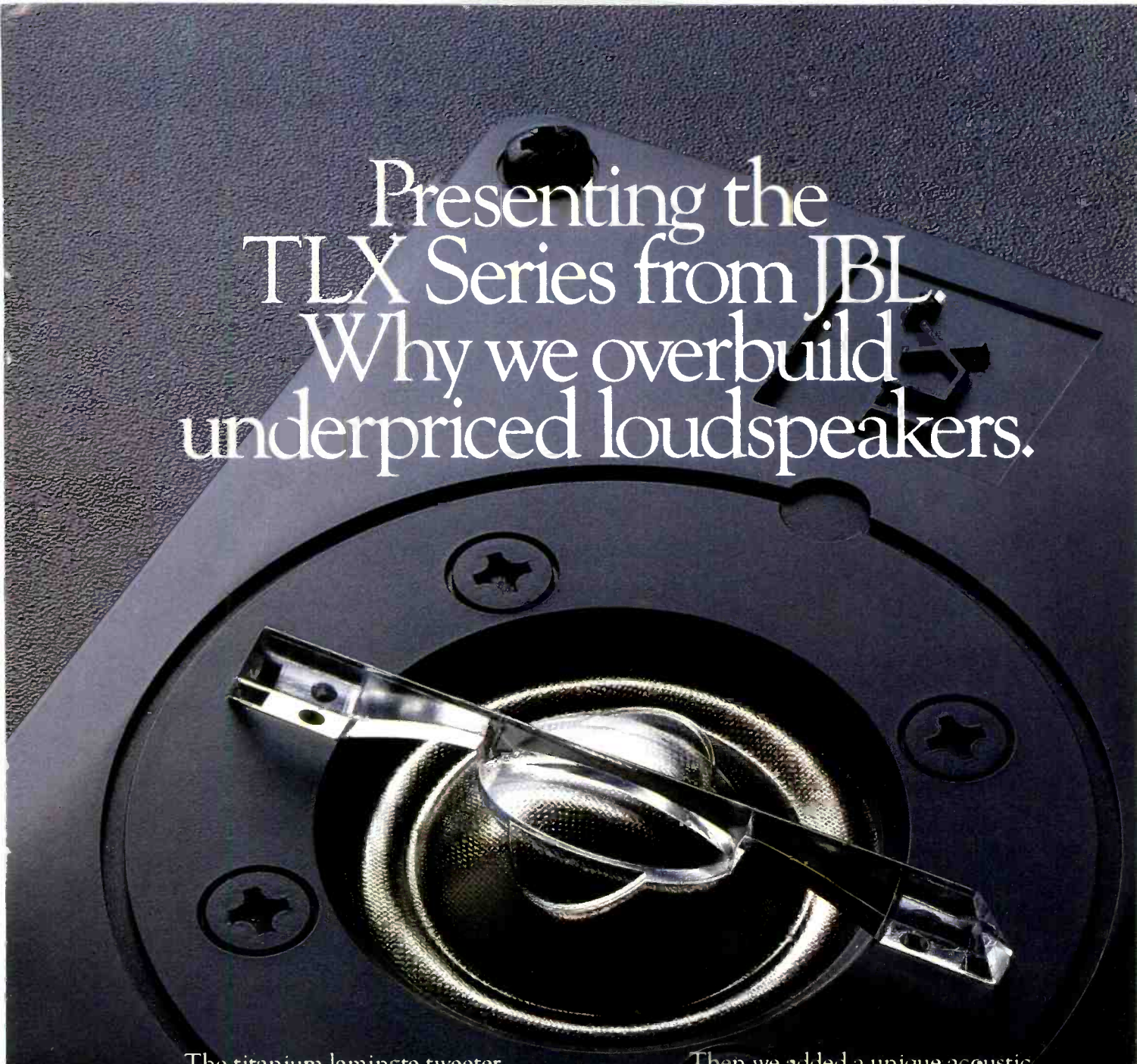

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Picture above: JBL's new titanium laminate tweeter with unique acoustic contact lens.

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4

TECHNICS SL-P3 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 4 Hz to 20 kHz, ±0.5 dB.
Dynamic Range: Greater than 96 dB.
S/N Ratio: Greater than 96 dB.
THD: Less than 0.003% at 1 kHz, 0-dB recorded level.
Channel Separation: Greater than 90 dB.
Number of Programmable Selections: 15.
Output Level: 2.0 V for 0-dB recorded level.
Headphone Output Level: 80 mW into 32-ohm load, adjustable.
Power Consumption: 33 watts.
Dimensions: 16-15/16 in. W × 3¼ in. H × 13⅛ in. D (43 cm × 8.2 cm × 33.4 cm).
Weight: 11.7 lbs. (5.3 kg).
Price: $600.
Company Address: One Panasonic Way, Secaucus, N.J. 07094.
For literature, circle No. 93

More and more companies are now offering third-generation CD players. One of the more recent introductions is Technics' SL-P3, the top model in a group of three totally redesigned units from that company. From the looks of it, the designers sought to incorporate just about every convenience feature imaginable, having now had three years in which to survey the needs of consumers and the features that were available in first- and second-generation Compact Disc players.

Besides a 15-step, random-access programming capability, the SL-P3 offers a multi-function wireless remote control, expanded repeat functions, automatic pause, automatic cueing and an output level control with an associated LED level indicator. The wireless remote-control unit is able to perform the random-access programming functions, and even to adjust volume.

Another new and unusual feature on the SL-P3 is the "Disc Prism." Found on the motor-driven loading drawer, this prism arrangement reflects the image of the spinning CD forward. You can therefore see that a disc has been loaded into the player while you view the front panel, even though the disc is actually oriented horizontally. I suspect that this novel arrangement (including illumination of the prism for easier viewing) was developed to counter the uneasiness of some consumers over the fact that their discs "disappear" inside their CD players, and their doubts about whether the disc will ever be recovered. (Of course, these nightmares are unlikely to happen in reality.)

Control Layout

Major operating controls of the SL-P3 are larger and more easily accessed than the less often-used switches. The lower part of the player's front panel is slanted toward the user, so all control keys can be seen and operated easily. Ten numbered keys and a memory key, positioned on this section of the panel, are used to perform the 15-selection, random-access programming. You can choose which tracks you want to hear in whatever order you prefer; direct access by track numbers can also be performed using these keys, as can programming and direct access by index numbers. (Index numbers are now found on an increasing number of CDs; they subdivide longer tracks, such as movements of a symphony, into recognizable parts—musical themes, for example. For those who want to quickly access a specific theme within a movement, index numbers provide the means.)

The "Repeat" button lets you listen to the entire disc, or programmed shorter sections of the disc, over and over again. The "A-B Repeat" button permits instant replay of any specified section selected during the playing of a disc. Automatic "Music Scan" lets you preview the first few seconds of each track in a disc; the number of seconds can be adjusted by using the numbered front-panel keys, from 1 to 99 S. Sliding a switch, at the lower left of the front panel, to the "Auto Pause" position causes the laser pickup to pause at the beginning of each track. Moving this switch to "Auto Cue" makes the SL-P3 stand by at the beginning of each selection for instant starts at the touch of a button. With auto cueing engaged, the system seeks out the first note on each track and activates a "Cue Standby" indicator when ready.

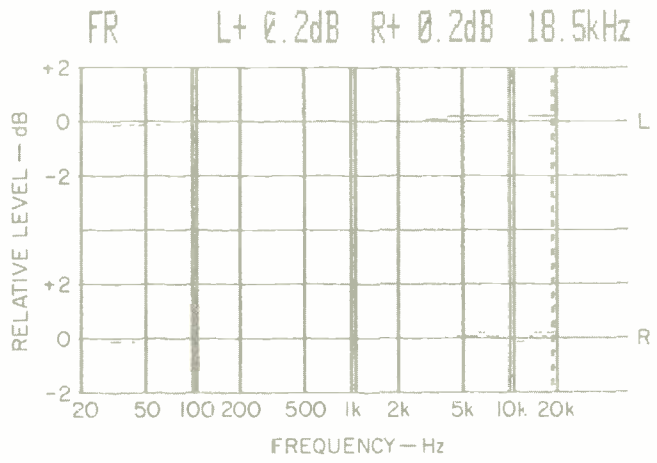

Fig. 1—Frequency response, left (top) and right channels.

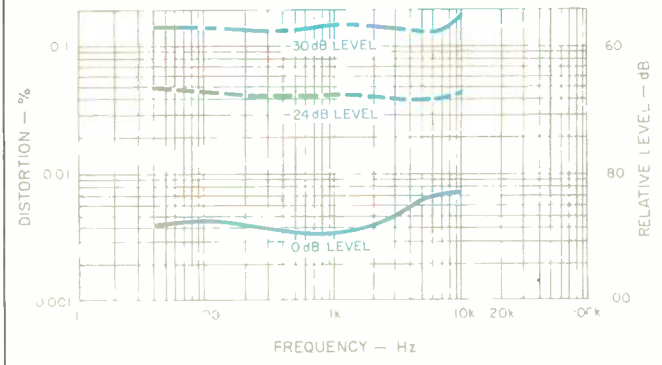

Fig. 2—THD vs. frequency at three output levels.

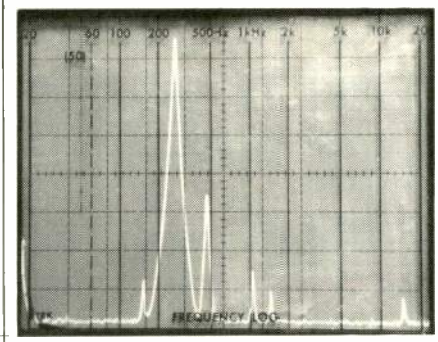

Fig. 3—Spectrum analysis of 20-kHz signal (large spike) shows inaudible beat tone at 24.1 kHz, about 45 dB lower than the desired output.

A "Disc Prism" on the loading drawer makes the spinning CD easily visible, which eliminates any uneasiness caused by "disappearing" discs.

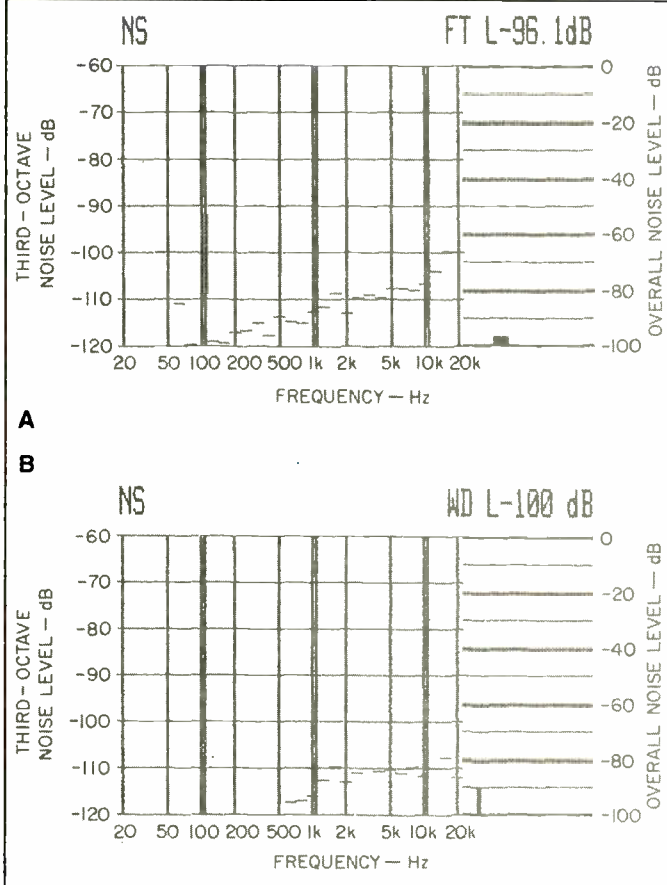

Fig. 4—S/N analysis, both unweighted (A) and A-weighted (B).

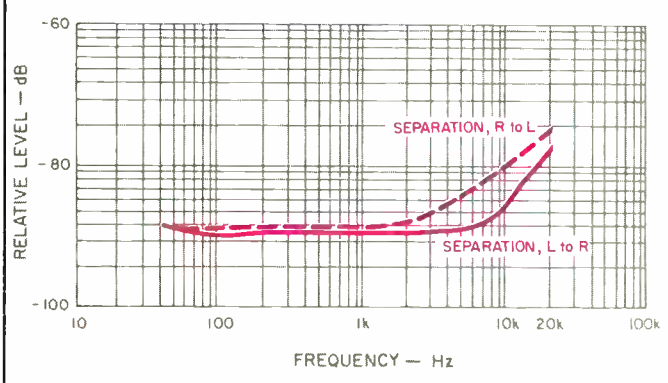

Fig. 5—Separation vs. frequency.

The auto cueing function differs from "Auto Pause," since there may be a few seconds of time between the start of a given track and the actual start of music on that track. The auto-cue feature will be especially welcomed by disc jockeys who use this machine for broadcast, since it will permit more accurate cueing than is possible by simply specifying a track number.

Up/down output level buttons that control volume electronically are also provided on the front panel, while a "Rem Time" key displays the total time remaining on a disc during play whenever it is pressed. The larger, more basic keys include "Play," "Stop," "Search" (bidirectional) and "Pause." The "Search" keys operate at high and low speeds, and let you hear sounds at normal pitch. "Skip" keys move the laser pickup forward or backward over any number of tracks, depending upon the number of times the key is pushed.

The large, fluorescent display includes a 15-bar horizontal graph which indicates which track is playing by blinking the bar corresponding to that track. The display also shows track number and index number, as well as total playing time and remaining play time in minutes and seconds. Indicators are also provided for the repeat function, A-B repeat, music scan, 15-track overrun (in the event that a given disc contains more than 15 tracks), and disc compartment status.

The Technics SL-P3 is also equipped with a headphone jack with its own separate volume control, and an automatic-timer play mode.

Measurements

Frequency response for this CD player, plotted in Fig. 1 for both the left and right channels, was flat within 0.2 dB over the entire audio range, from 20 Hz to 20 kHz. Harmonic distortion at maximum recorded level varied from 0.0035% to 0.007%, depending upon the test frequency used. Figure 2 shows how THD varies with both frequency and reference recorded level. Notice that I did not plot THD above 10 kHz. At high frequencies, my distortion analyzer began to read unusually high numbers which I suspected were not really harmonic distortion. Spectrum analysis revealed that these higher readings were, in fact, super-audible "beats" outside the audio spectrum, and Fig. 3 illustrates this. The range of sweep in this photo is from 0 Hz to 50 kHz, in linear increments of 5 kHz per horizontal division. The tall spike in the display represents a desired 20-kHz signal, while the shorter spike, immediately to its right, is a signal at a frequency of approximately 24.1 kHz. It is only about 45 to 46 dB lower than the desired signal, which explains why the distortion analyzer read nearly 0.5%. Despite the high meter reading of my distortion analyzer, the presence of this ultrasonic beat frequency did not interfere with the sound quality of the player.

Unweighted signal-to-noise ratio measured just over 96 dB; residual noise of the player is analyzed in the graph of Fig. 4A. When an A-weighting network was added to the measurement setup, the signal-to-noise ratio was even higher—100.0 dB exactly, as shown in Fig. 4B. IM distortion at maximum recorded level was only 0.0075%, increasing to a still inaudible 0.017% at −20 dB recorded level. Output

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One way to judge a player is to check its tracking and error-correction ability. In those areas, the SL-P3 won high marks.

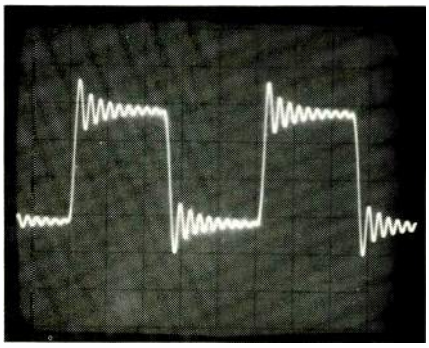


Fig. 6—Reproduction of 1-kHz square wave.

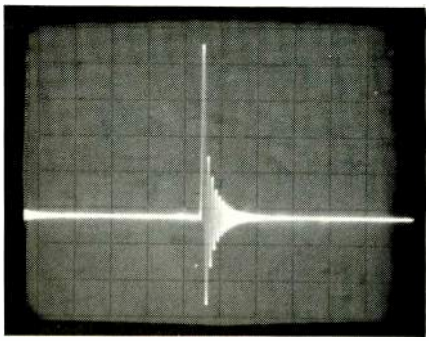


Fig. 7—Single-pulse test.

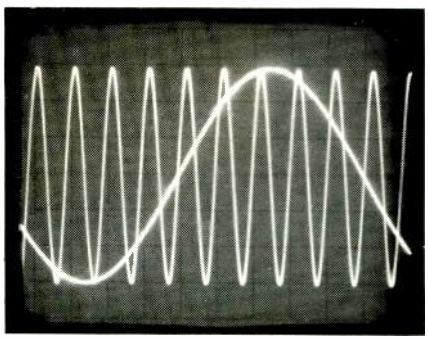


Fig. 8—Phase-error test using tones of 200 Hz (left channel) and 2 kHz (right channel).

linearity was accurate to within 0.5 dB down to −80 dB. Maximum output level was exactly 2.0 V, but, of course, if the player's variable output level control is used, this can be adjusted to suit the needs of any amplifier and to conform with other program sources which the user's audio system may include.

Stereo separation was about what I have come to expect from CD players, ranging from over 75 dB at the high-frequency extremes to nearly 90 dB. A plot of separation versus frequency for both left-to-right and right-to-left channel crosstalk is shown in Fig. 5.

Figures 6 and 7 clearly demonstrate that Technics has chosen to stay with multi-pole, analog output filters. The 1-kHz square wave shown in Fig. 6 exhibits the type of ringing normally associated with such output filters, as does the overhang or ringing seen in the reproduced unit-pulse test signal shown in Fig. 7.

Despite the use of a steep filter, however, the relationship between the 200-Hz signal on the left channel and the 2-kHz signal on the right, reproduced in the 'scope photo of Fig. 8, shows no evidence of any phase shift or phase delay at the higher of the two frequencies.

Since most CD players offer superlative sound quality, assessment of tracking and error-correction ability is one of the important ways to judge differences between models. One of the more noteworthy improvements I've been finding on second- and third-generation players is their ability to handle severe dropouts and other disc defects. In these areas, the SL-P3 won high marks, playing through my "obstacle course" disc—the one with the built-in defects and opaque sections—as if the disc were perfect. The player also resisted mistracking when subjected to moderate external vibration or shock.

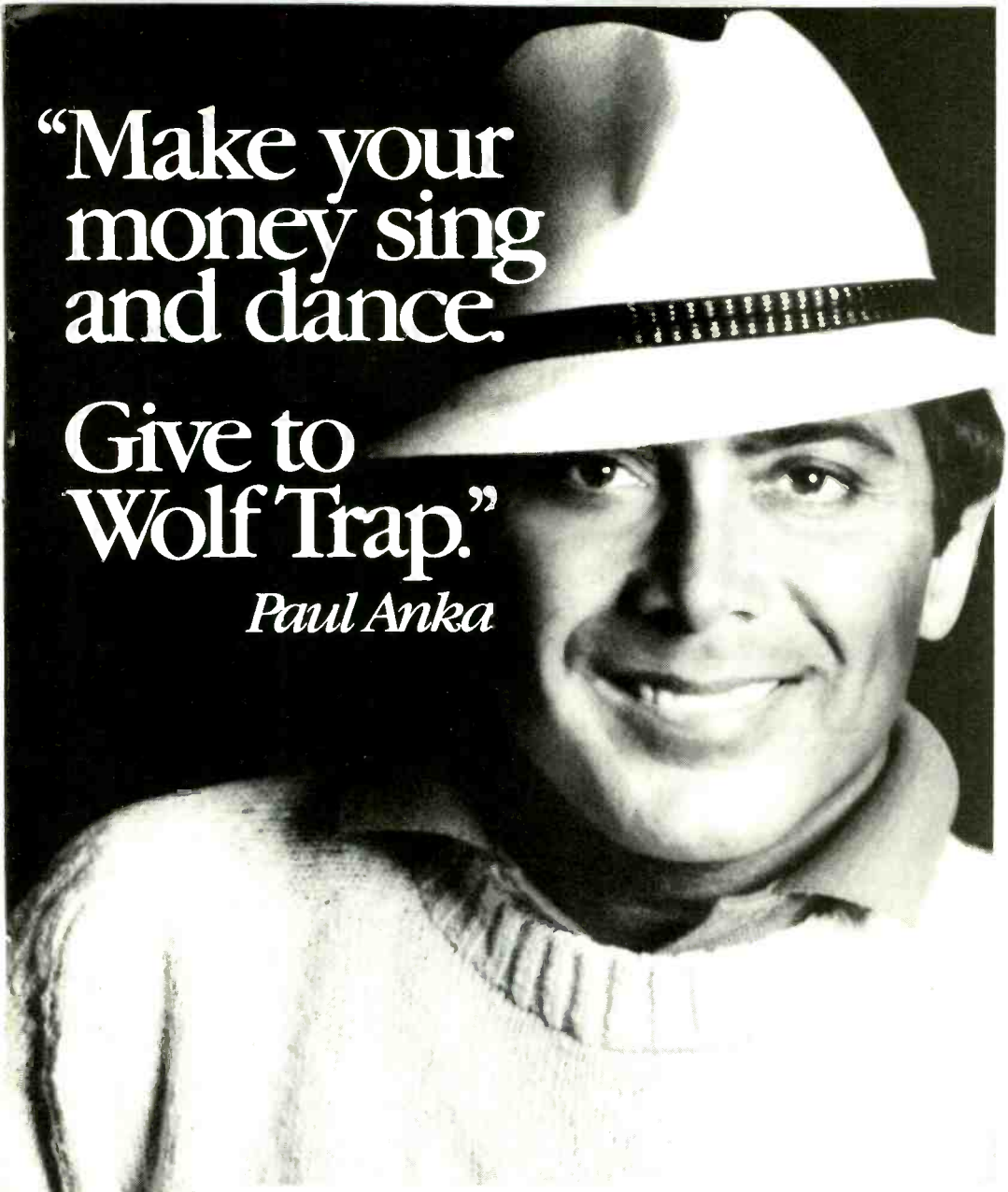
Use and Listening Tests

I found the Technics SL-P3 extremely easy to use and easy to program, despite its rather elaborate programming functions. Controls are logically arranged, and logically and intelligently identified. The lightweight, hand-held wireless remote control performs just about every function you would want to direct from across a room, short of opening the disc drawer itself.

Sound quality was as good as I have come to expect from a well-engineered player. Evidently there's more to making a CD player sound good than simply going to oversampling or to digital filtering (both of which Technics chose not to do in this model). Depth and breadth of stereo imaging was very good, and only some of my older discs exhibited the high-frequency graininess that has been attributed to CDs and CD players in general. Some more recently acquired CDs sounded just fine, and I found that the speed of access, characteristic of the third-generation players, was about 1 S between any two points on the disc.

Perhaps the thing that impressed me most about this new Technics model was not so much its excellent sound quality (I've come to expect that from all late-model players) but rather the number of useful features available. Barely two years ago, a player having all these features, if available at all, would have easily cost twice as much as this one does.

Leonard Feldman



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Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

Mail to: Wolf Trap, Box 5000, Vienna, Va. 22180

5

APT HOLMAN PREAMPLIFIER TWO

Manufacturer's Specifications

Frequency Response: Phono, RIAA ±0.2 dB; high level, 20 Hz to 20 kHz, ±0.5 dB.

Input Sensitivity: MM phono, 1.0 mV; MC phono, 0.2 mV (high), 0.06 mV (low); high level, 80 mV.

S/N (A-Weighted): MM phono, 76.5 dB; MC phono (re: 0.5 mV input), 80 dB; high level, 96 dB.

Input Impedance: MM phono, 47 kilohms; MC phono, 100 ohms; high level, 50 kilohms.

Input Capacitance: MM phono, 50, 100, 150, or 250 pF, selectable; MC phono, 1,000 pF.

Distortion (THD, SMPTE IM, IHF IM, TIM): 0.006%.

Maximum Undistorted Output: Greater than 7.0 V rms.

Input Overload (High Level): 10 V rms.

Output Impedance: Main out, 560 ohms; tape out, 560 ohms; phones, 10 ohms.

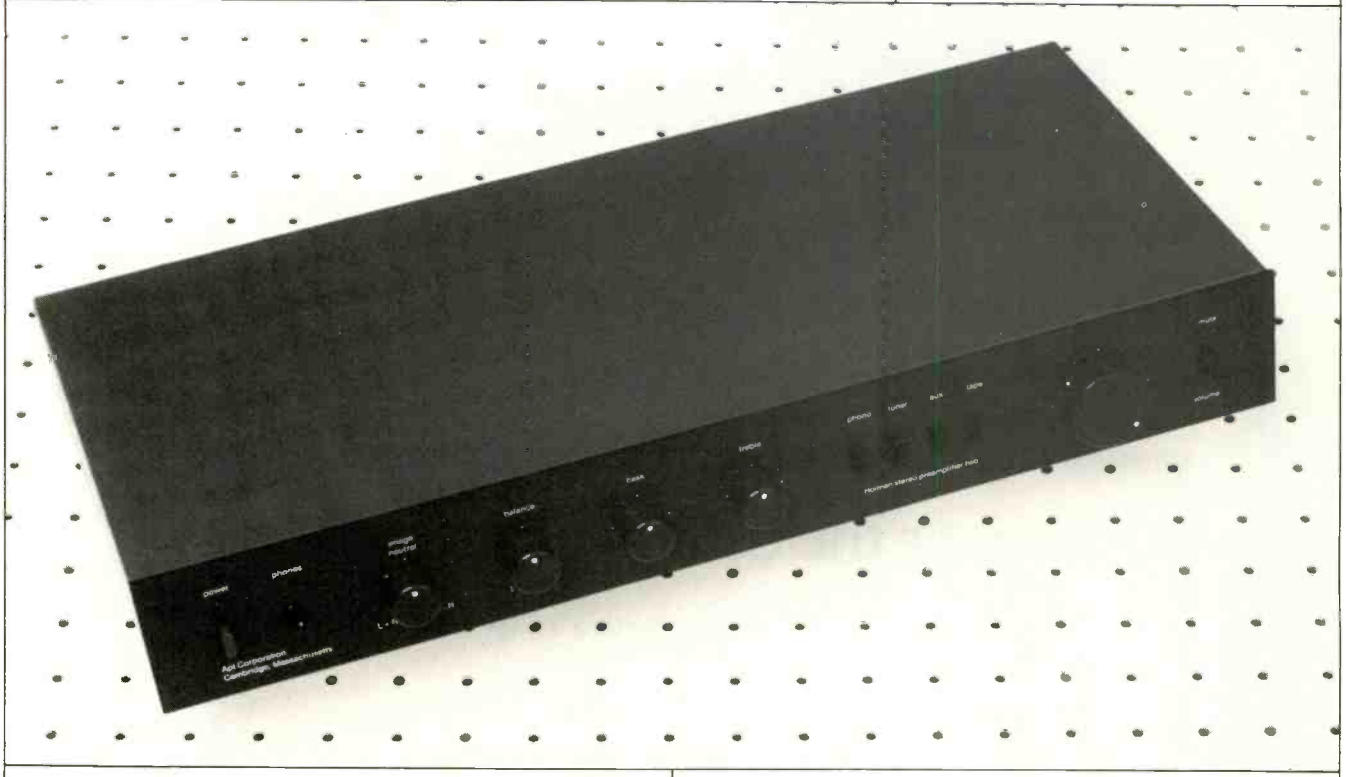
Dimensions: 17 in. W × 2¼ in. H × 8 in. D (43.2 cm × 5.7 cm × 20.3 cm).

Weight: 9 lbs. (4.1 kg).

Price: $417.

Company Address: 176 Walker St., Lowell, Mass. 01854.

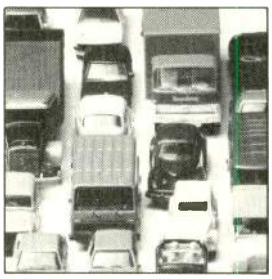
For literature, circle No. 94



Tomlinson Holman is one of those young American engineers who brought to audio design a fresh, innovative approach that combined purity of sound reproduction with simple elegance of product appearance. Mr. Holman's company, Apt Corporation, like so many other small but dedicated audio equipment makers, fell upon hard times a few years ago, and Tom went on to other audio pursuits on the West Coast, where he now works for the Lucasfilms organization. His audio designs, however, have not been lost to the world. In the spring of 1984, all of the assets of Apt Corporation, including the trade name and patents, were sold to Wayne Friedrichs, a Boston-area businessman and engineer. Friedrichs has re-established Apt, rehired key production and technical personnel, and added extra management staff to properly service dealers and handle customers' needs.

The Apt Holman Preamplifier Two, which I tested recently in the lab, is a refined and slimmed-down version of the classic Apt Holman preamplifier I reviewed in 1980; it incorporates much of the same thoughtful engineering and excellent sonic qualities as did its predecessor. The "new" Apt Corporation has come up with this lower cost preamp by simplifying some of the circuitry and deleting controls that many audio enthusiasts do not regard as important, while

HI-WAY HI-FI

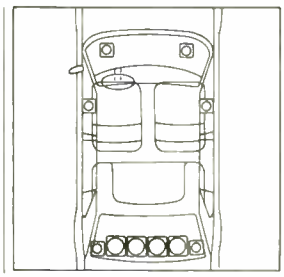


The Deciding Factor

As a "music room," a car presents considerable problems: tight and cramped, half upholstery, half glass – and filled with road noise. What's true in the living room is especially true here: good sound depends upon the loud speakers and their positioning.

New! From Canton

With the new Set 200 and Set 300 line of flushmount woofers and tweeters, Canton now offers added versatility to the installation of automotive sound systems. Whether mounted in the front, the side doors or the back deck, Canton offers you auto fidelity with strong bass, rugged durability and excellent dynamics –



it is these "Sets" that received the highest test awards in Germany's Stereoplay magazine 3/84 for quality in accurate, powerful sound reproduction.

Other Solutions and Complements

To round out our auto sound product line, we offer surface mount speakers as well. Our HC 100 pictured above is also available in a self-contained, bi-amped configuration for added versatility (AC 200). In addition, we offer the Pullman 3-way system for rear deck mounting as another innovative solution to quality auto sound in surface mount configuration.

Comments from Canton

Klaus Dotter, Canton's chief acoustic engineer, stresses that there is no one "right" solution for every auto installation. However, choosing quality components, from the electronics to the speakers, should be first and foremost in your selection of quality auto sound.

Find out more about Canton quality home and auto sound – write or call for our informative full line brochure.

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CANTON

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RIAA accuracy was absolute over the entire range of measurement. There aren't many other preamps that can make such a claim!

managing to retain the most innovative features and sound reproduction accuracy of the older, more expensive model.

At the heart of the Preamplifier Two is a unique MM phono preamp circuit, the input of which employs a differential pairing of an FET input with a bipolar-transistor feedback circuit for low noise and r.f.i. immunity. The FET input ensures against response-altering interaction between the preamp and the high impedance of a moving-magnet cartridge. The high-level portion of the phono section uses an IC op-amp which provides the headroom needed for dynamic phono signals. This IC also provides both a low output impedance, for accurate RIAA equalization, and the high current needed to avoid transient distortion due to the falling impedance of the RIAA network at high frequencies.

A rear-panel selector switch provides several values of phono-loading capacitors and thus is suitable for the vast majority of MM cartridges. The rear panel also has an unusual, dedicated phono balance control. A simple calibration procedure allows the user to precisely "null out" any cartridge balance errors and restore correct stereo imaging without resorting to any test equipment.

The built-in MC pre-preamplifier circuit is a discrete bipolar design in which the base currents have been optimized for lowest noise at the low impedances of MC cartridges. Gain of this stage can be set to either 15 or 25 dB, while its treble response can be adjusted, by means of plug-in capacitors, to correct for the rising high-frequency response of some MC pickups.

Another innovative feature is a full muting switch, which cuts off signal to the main outputs but allows you to listen to dynamic headphones plugged into the preamp's own low-impedance headphone output. There's also a unique stereo imaging knob which gives total control over the proportions of L + R and L − R in any stereo signal source. It allows you to vary the apparent depth and breadth of the stereo spread, from mono to "beyond stereo." While not a totally new idea (I remember using the same principle in some products I designed way back in the early 1960s), its execution here is extremely well done.

Control Layout

The dark gray front panel, with its matching gray knobs and pushbuttons and its low profile, gives the Preamplifier Two an understated, elegant look. A "Power" button is at the left, and alongside it is the stereo "Phones" jack. The stereo "Image" control, with markings at the ends of its rotation for "L + R" and "L − R" and "Neutral" at its center, comes next, followed by rotary "Balance," "Bass" and "Treble" controls. Four oval-shaped pushbuttons select the desired program source ("Phono," "Tuner," "AUX," or "Tape"), and a large master level control is to the right of these buttons. Finally, a single, oval pushbutton at the extreme right of the panel is used to mute the main outputs when headphones-only listening is desired.

Separate MM and MC phono inputs are found at the left of the rear panel, and near them is a screwdriver-slotted selector switch to choose the capacitive loading value for the MM jacks as well as the gain setting for the MC inputs. A screwdriver-adjustable phono balance control is accessible through a small hole on the rear panel. Tape in and out jacks, sets of high-level input jacks, two pairs of high-level output jacks, and three convenience a.c. outlets complete the rear-panel layout.

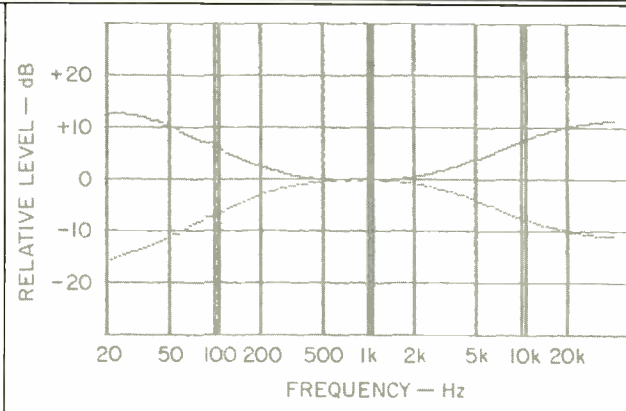


Fig. 1—Tone control characteristics.

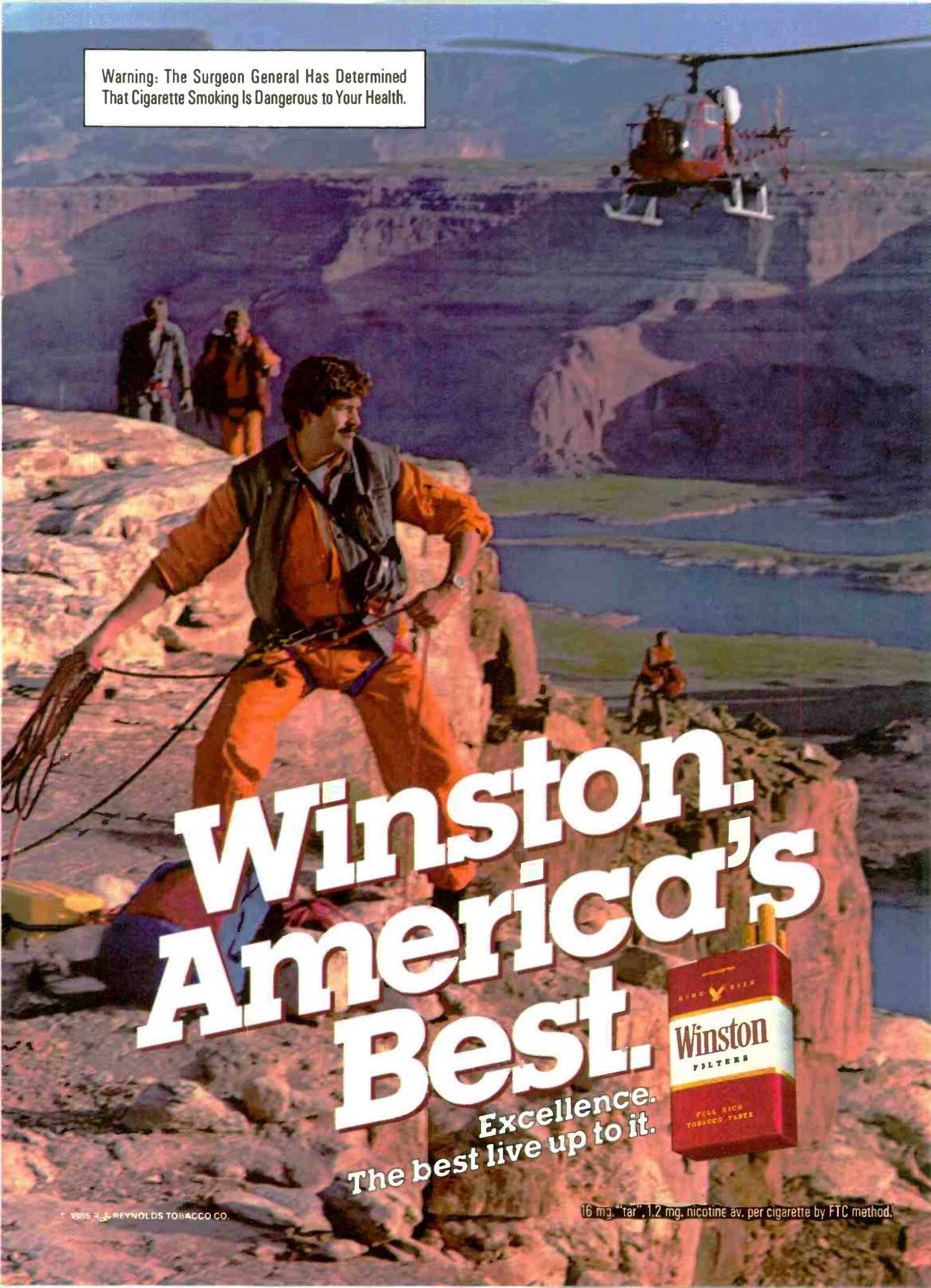
Measurements

My test setup measures RIAA phono accuracy directly. That is, I apply signals which vary in amplitude according to the inverse of the RIAA playback curve. Then I set a digital voltmeter to "0 dB" at 1 kHz and simply read any deviation. When I tested the Apt Holman Preamplifier Two, I thought at first that my meter was hung-up. It kept reading "0 dB" (deviation) for every frequency I used—from 30 Hz to 20 kHz. Only after repeated checks did I realize that the meter was telling the truth. RIAA accuracy was absolute over the entire range of measurement—or at least as absolute as the resolution of my metering system, which is accurate to better than 0.1 dB! I don't know of too many other preamps that can claim this kind of equalization accuracy.

Applying lower level test signals to the MC input, I found that results were not quite this accurate, but almost. While everything above 1 kHz was exactly correct, I did read a +0.3 dB deviation from the RIAA curve at 30 Hz. I don't consider this anything to get terribly upset about. Phono sensitivities were as stated by the manufacturer (1 mV for MM for 0.5 V out, 0.2 mV for the high setting of the MC inputs, and 0.06 mV for the low setting of the MC inputs). Phono overload, not specified, was 135 mV for the high-level inputs and 8.5 mV for the MC inputs (set to high level).

High-level frequency response was flat within 1 dB from 20 Hz to 75 kHz, and the −3 dB roll-off points occurred at 15 Hz and 160 kHz. The low-end subsonic roll-off is deliberate, as Apt has incorporated an infrasonic filter that begins to roll off response below 20 Hz. The filter is built in and cannot be turned off by the user.

A-weighted signal-to-noise ratio of the MM phono section, referred to a 5-mV input signal with the volume control set for 0.5 V output, measured 75 dB, a bit lower than claimed by Apt. With 0.5 mV applied to the MC phono inputs, I measured an A-weighted S/N of 67 dB for the high-gain setting of the pre-preamplifier stage and 69 dB for the low-gain setting. Unweighted S/N for the high-level and tape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With all tone controls set flat and the "Image" control at its neutral position, the Preamplifier Two delivered the kind of uncolored sound that I find most pleasing.

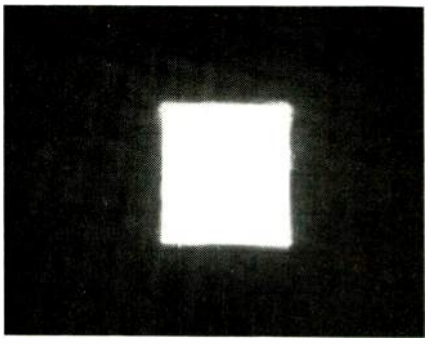

Fig. 2— Display of stereo test tones with "Image" control at "Neutral" setting.

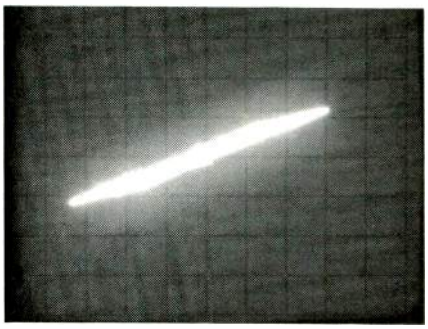

Fig. 3— Same as Fig. 2, with "Image" control at extreme "L + R" setting.

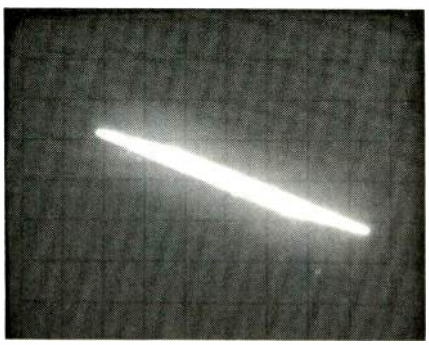

Fig. 4— Same as Fig. 2, with "Image" control at extreme "L − R" setting.

inputs measured 91 dB, increasing to 97 dB when an A-weighting network was introduced.

Harmonic distortion, referenced to 1.0 V output, measured only 0.0035% at mid-frequencies and at the bass end of the spectrum, increasing almost linearly (and insignificantly) to 0.006% at 20 kHz. SMPTE IM measured an even lower 0.0025%, with IHF IM a still lower 0.0009%.

Figure 1 shows the action of the bass and treble controls when set to their maximum clockwise and counterclockwise positions. At 20 Hz and 20 kHz, boost and cut is at least ±10 dB. Notice that the midrange, from around 300 Hz to around 3 kHz, is almost totally unaffected even when maximum bass and treble boost or cut are applied. The shelving action of these newly designed tone controls allows for better tonal compensation of frequency extremes if all you have available are bass and treble controls.

I was especially interested in the action of the stereo "Image" control. As I had guessed, it alters the proportions of L − R and L + R in any stereo program material being amplified by this unit. To put it another way, if you add some out-of-phase "L" signal to "R" and some out-of-phase "R" signal to "L," you can create the audible illusion of increased stereo separation. Carry the trick to extremes, though, and you will end up with what essentially amounts to an all L − R signal coming from each speaker; that kind of out-of-phase mono reproduction will seem highly deficient in bass and will have other problems, too. So, the point I'd emphasize about the "Image" control is that if it is used at all, it should be used in moderation. If you keep the control at its mid-point, it does nothing (stereo reproduction is as it comes from the program source). To illustrate this, I applied a test tone to one channel while a near multiple of that tone was applied to the opposite channel. Using the horizontal and vertical inputs of an oscilloscope to display the left and right signals coming from the preamp, I obtained the display shown in Fig. 2. Turning the "Image" control fully counterclockwise to its "L + R" setting resulted in the in-phase diagonal display of Fig. 3; turning the control fully clockwise to the "L − R" extreme resulted in the typical out-of-phase diagonal display of Fig. 4.

Use and Listening Tests

With all tone controls set to their flat position and with the "Image" control at its mid-setting, the Apt Holman Preamplifier Two delivered the kind of neutral, uncolored sound that I find most pleasing The accuracy of the RIAA equalization characteristic was especially evident with some of my favorite old LPs which I hauled out for these listening tests. Most of us tend to think that minor variations in frequency response caused by deviations of less than 1 dB in the RIAA curve will be inaudible. Nevertheless, when I come across a preamp that is as accurate in response as this one, I find I can appreciate its accuracy in very real and audible terms.

The tone controls, in real-world use, were significantly better in their action than the more familiar Baxandall types, which have a common bass and treble hinge point between 500 Hz and 1 kHz. I switched to a pair of smaller speaker systems expressly to try and compensate for their lower octave of missing bass, and I was more successful in doing so using a moderate amount of bass boost from this preamp's tone-control configuration than I had been with more conventional bass controls. I also liked the action of the step-type master volume control. This, I discovered, is not just a mechanically detented control, but is made up of a discrete, thick-film, precision resistor array, with channel levels matched over the entire range of the control. I should mention, too, that the power switch on the front panel activates only the three convenience outlets on the rear panel and can handle up to 1,000 watts of power. To avoid turn-on thumps, the Preamplifier Two's own circuitry remains on as long as the line cord is plugged in. Since power consumption is not more than would be needed by a low-wattage "night-light," there's really no problem with leaving the preamp plugged in (and active) all the time.

Summing up, I was pleased to see that the original Apt Corporation's penchant for audio purity and high quality has been maintained in its latest incarnation. The Preamplifier Two is not only a credit to its Apt Holman predecessor but is a welcome addition to that select group of audio components destined to become classics. *Leonard Feldman*

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6

ROTEL RC-870 PREAMP

Manufacturer's Specifications
Frequency Response: Phono, RIAA 40 Hz to 100 kHz, ±0.2 dB; high level, 4 Hz to 100 kHz, +0, −3 dB.
THD: High level, 20 Hz to 20 kHz, less than 0.004%.
SMPTE IM: High level, less than 0.004%.
Input Sensitivity: MM phono, 2.5 mV; MC phono, 360 μV; Compact Disc, 450 mV; tuner or tape, 150 mV.
Overload Level: MM phono, 150 mV; MC phono, 20 mV; high level, 5 V.
S/N: MM phono, 78 dB; MC phono, 64 dB; high level, 95 dB.
Power Consumption: 20 watts.
Dimensions: 16-15/16 in. W × 2⅝ in. H × 12½ in. D (43 cm × 6.6 cm × 31.7 cm).
Weight: 11.4 lbs. (5.2 kg).
Price: $299.
Company Address: P.O. Box 653, Buffalo, N.Y. 14240.
For literature, circle No. 95

If the company address shown above surprises you, you may be even more startled to learn that Rotel Audio of America is, in fact, based in Ontario, Canada and simply uses a Buffalo post office box to receive U.S. mail. Furthermore, the parent company is Misobanke International Inc., another corporate entity owned and managed by the same folks who import and distribute the famed B & W line of loudspeakers in this country. So much for corporate infrastructure.

The Rotel audio products have been through several incarnations in the United States, with rising and sagging fortunes depending upon who was marketing them in this country. In Japan, where the company was formed in 1961 under the name Roland Electronics Company Limited, Rotel has enjoyed an uninterrupted history of production and innovation since its founding. And now, under the guidance of Misobanke, they intend to make their mark in North America.

As for the RC-870 preamplifier (Rotel calls it a stereo control amplifier, which is probably a better term for this kind of component), it belongs to the "keep it

simple" school of preamp design. To begin with, there are no tone controls; neither are there such signal-processing or response-altering circuits as high-cut or low-cut filters, or a so-called loudness control. Rotel accurately describes this preamplifier as "slim, simple and pure."

What little information I received with the unit concerning the RC-870's circuitry dealt primarily with the phono preamplifier stages. An input buffer stage is used to isolate the phono cartridge from the following shunt-feedback RIAA equalization amplifier stage. An additional buffer amplifier, optimized for moving-coil cartridges and able to provide the required additional gain, is totally independent of the moving-magnet buffer amplifier but uses the same shunt-feedback equalization stage as the MM inputs.

Control Layout

At the left of the all-black front panel is an oblong "Power" on/off pushbutton, above which is a power-on indicator light. A stereo phone jack is the only other item on the left half of the front panel. Dead-center is a large dual-concentric knob for adjustment of overall volume as well as channel balance. Each control regulates the volume level for a single channel, but because the two controls are friction-clutch connected they can be operated singly (to adjust balance) or together.

Remaining controls to the right of the volume-control pair consist of three small switches. A "Mode" switch selects stereo, mono, or mute, the latter position convenient when using headphones. A five-position "Monitor" switch not only selects either of the two available tape in/out loops, but has settings for dubbing from one tape deck to another in either direction as well as the usual source setting. Program sources are selected by the last of these three switches, the "Input" switch; this four-position control has specific settings for CD, tuner, MM phono, and MC phono.

The rear panel has separate pairs of phono input jacks for moving-magnet and moving-coil cartridges so that, if you were so inclined, you could operate two turntables through this preamp, provided each had a different kind of cartridge. (But you cannot swap cartridge types on a single turntable without re-plugging the phono leads.) High-level inputs and tape outputs, plus the usual main output jacks and a pair of switched a.c. outlets, complete the rear-panel layout.

Measurements

Frequency response of the RC-870's high-level section was flat to within 1.0 dB from 6 Hz to 200 kHz. The −3 dB roll-off points occurred at 3 Hz and 260 kHz, well beyond the 100 kHz claimed in the published specifications. Input sensitivity for the high-level inputs measured 80 mV, as against the 150 mV stated by Rotel. I suspect that this discrepancy is nothing more than a difference in the referenced output to which the sensitivity was measured. The EIA standard calls for a reference output of 0.5 V for separate preamplifiers, while Rotel was apparently referencing all measurements to 1.0 V output. That does not, however, account for the fact that the CD input sensitivity, which Rotel specifies as 450 mV (225 if you translate the number to a 0.5-V output level), turned out to be the same as that of all the other high-level inputs, 80 mV.

When I first noticed the separate CD sensitivity specification, I was pleased to see that the designers had reduced that input's sensitivity to compensate for the fact that CD players deliver considerably more output than other high-level sources such as tuners and tape decks. By reducing the CD input sensitivity, I thought, Rotel had not only insured against possible overload of the RC-870's first stage by the high output of a CD player, but had also made it unnecessary to spring up and adjust the volume control every time you switch from tape or tuner to CDs. Well, the idea is certainly a good one, but evidently someone at the factory forgot to put in the necessary voltage-divider resistor at the CD input jacks to make the lower sensitivity a reality—at least on the sample I tested!

Moving-magnet phono input sensitivity measured 1.0 mV for 0.5 V output, while the MC inputs required 0.15 mV (150 μV) to produce the same 0.5 V of output. Phono frequency response was extremely accurate from 50 Hz to beyond 15 kHz, deviating from the prescribed RIAA characteristic by no more than ±0.1 dB. At 30 Hz, the deviation increased to a still moderate −0.6 dB.

From a measurement point of view, as well as from a listening perspective, perhaps the most noteworthy quality of the phono preamplifier section is its low noise. I measured an extraordinary signal-to-noise ratio of 85 dB for the moving-magnet phono inputs, fully 7 dB higher than claimed by Rotel! This measurement was made referenced to a 5-mV input signal with the volume controls adjusted for the standard 0.5 V output. The MC inputs, with their higher overall gain factor, didn't do quite that well, but still provided a very respectable signal-to-noise ratio of 71 dB (as against 64 dB claimed) referred to 0.5 V input and 0.5 V output. The signal-to-noise ratio for the high-level inputs measured exactly 95 dB, as claimed by the manufacturer. My measurement of this specification used 0.5 V input as a reference signal level, with the preamp's volume control adjusted for unity gain.

Harmonic distortion, although not as low as claimed by Rotel, did measure a completely acceptable 0.024% over most of the audio frequency band, and SMPTE IM was an equally low 0.022%. I could detect no evidence of CCIR or IHF (twin-tone) distortion using my spectrum analyzer, with its 80 dB of available dynamic range. This means that whatever distortion existed in these forms had to be below 0.01%.

Use and Listening Tests

Don't be put off by the simple layout and the absence of circuit frills on this altogether well-designed preamplifier. Anyone, even the most judgmental of golden-ears, should find the sound-reproduction quality of the RC-870 to be beyond reproach. Phono reproduction was silky smooth, and when playing my favorite CDs, there was no danger—or evidence—of overload, despite my concerns about the CD inputs' relatively high sensitivity. This was due to the system's high overload capability (better than 5 V on high-level inputs). That's one of the nice things about CD players; since their maximum recorded level is fixed and well-defined (usually 2.0 V output), you can be certain that so long as the high-

I wish Rotel had followed through on its intent to make the CD inputs less sensitive than the other high-level inputs.

level inputs on your electronic component (be it a preamp, an integrated amp, or a receiver) can handle more than 2 V before distortion sets in, you won't have any overload problems. The RC-870 certainly won't let you down in this regard.

I wish Rotel had followed through, per their published specifications, and made the CD inputs less sensitive than the other high-level inputs, if only so that levels would sound about the same when I switched from one program source to another. I felt, too, that no harm would have been done if Rotel had taken the more usual course of providing separate volume and balance controls instead of the dual-concentric level controls. There certainly was enough room on the relatively empty front panel to accommodate an extra knob, and I find it next to impossible to operate those clutch-type dual controls with any degree of precision if channels are somewhat unbalanced. These are, of course, my own personal preferences.

The flexible tape-monitoring facilities will be welcomed by those who do a fair amount of tape dubbing and editing. But here again, without risking the addition of extra signal-degrading electronics, Rotel might have provided independent monitor/record and input switches so that you could listen to one program source while dubbing or recording another. Some low-cost receivers and most current integrated amplifiers and separate preamplifiers now offer that fairly simple switching circuit—especially when the product contains two full tape-monitor loops, as this unit does.

In short, Rotel offers a preamplifier/control unit that is intended for the music listener who takes his or her signal good and straight—with no additives. If that's the way you like your sounds, the RC-870's simplicity and pure sound quality may be just what you're looking for. Even if you like to mess about with the tonal balance of your system from time to time, that doesn't rule out this unit. After all, you could always drop a graphic or parametric equalizer into one of those tape loops—or even between the preamp's output and your power amplifier's inputs—while your purist friends aren't looking! *Leonard Feldman*

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JBL 250Ti loudspeakers

According to a recent *Billboard* survey, roughly 70% of the nation's recording studios use JBL speakers. Many audiophiles will regard this as a mixed blessing. JBL has long been famous for the dynamic range of its speakers and the quality of its individual drivers, but not for flat frequency response, tightly controlled bass or the smooth pulse and phase response of top-quality audiophile speakers. In fact, JBL has had a reputation for making speakers best for rock music, with more punch than accuracy.

This reputation, however, has always been a bit unfair. True, most JBL speakers have not made many audiophiles fall in love with them or with the thought of records being produced using such speakers as a reference standard. Nevertheless, JBL has always made some speakers, such as the initial version of the 250, that set a high standard for accuracy. What the company did *not* do was keep up with the best high-end competition in imaging, depth, and midrange transparency. Speakers from Fuselier, Quad, Thiel, Snell and Vandersteen offered smoother response, more control, more detail and "air" than even the best JBL speakers, and a more realistic sound stage. Brands like Infinity and VMPS offered a superior combination of excellent dynamic response and overall accuracy.

Well, JBL has made a major comeback! Its new Ti series ranks with the best cone speakers available in their respective price ranges, and the larger speakers in the series have enough bass control, smooth frequency response and musical detail to soothe the heart of even the most jaundiced audio critic.

The improvements embodied in the Ti series are partly the result of a new, high-frequency driver using a low-mass, ribbed titanium dome. I've compared JBL speakers using this driver to the Quad ESL 63 and to the Magnepan MG-IIIs; their upper-octave performance rivals the best ribbons, and outperforms any electrostatic tweeter or full-range panel I have yet heard.

I feel the main improvement in the Ti series, however, is the result of better crossovers and midrange drivers. Glamorous as dome tweeters of exotic metals may be, I suspect that most audiophiles will be more impressed with the smooth, polypropylene-filled midranges used in most of the new Ti series, and with JBL's ability to develop crossovers that make the midrange work in proper combination with the new titanium tweeter and JBL's fiber and Aquaplas-laminate woofer. The Ti series has (literally) some shiny new technology, but its real strong points are a return to fundamentals and a new emphasis on musical accuracy.

The 250Ti

JBL has four speakers in its new Ti series, ranging from a small, two-way speaker to large, four-way systems. The "flagship" is the 250Ti, a floor-standing system which lists for $3,000 per pair. It is superbly styled, with an excellent wood finish and smooth lines that disguise its large size: It stands 52 inches high and weighs 150 pounds. The 250Ti has the new titanium dome tweeter; a 5-inch, filled polypropylene, midrange cone driver (used in all but the smallest of the Ti series); an 8-inch, Aquaplas-laminate, lower midrange cone driver, and a 14-inch, Aquaplas-laminate woofer.

The 250Ti's crossover frequencies are at 400 Hz, 1.4 kHz, and 5.2 kHz. The networks are fairly complex, but the main crossover capacitors are bypassed with high-quality polypropyl-

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The four-driver 250Ti has an open sound normally apparent only on planar or dipole speakers.

ene or polystyrene capacitors, use noninductive resistors, and employ air-core inductors in all but the bass section—where the iron-core inductor can take up to 10 amperes before saturating. The 250Ti is relatively efficient, has a smooth impedance curve with an average of 7 ohms, and can take up to 400 watts.

The rear panel has high-quality, gold-plated binding posts that allow the use of top-quality speaker cables. More importantly, the 250Ti has heavy, screw-on shunts that allow the user to alter the relative level of each high-frequency and midrange driver by several decibels. While the number of possible adjustments is limited, they proved to be well chosen by JBL's designers for home use.

To shift to matters of real importance, the sound lives up to the speaker's size and technology. The height of the tweeter and upper-midrange driver frees the 250Ti from many normal floor and furniture effects, combining with the broad, radiating axis of all four drivers to give the 250Ti an open sound and "air" normally apparent only on planar or dipole speakers.

The listening area is wide and stable. In spite of the various arguments for narrow-angle or omnidirectional speakers, the near-hemispheric radiation of the 250Ti provided an almost ideal sound stage in my room, surpassing that of the Quad ESL 63s in many respects. It proved far more realistic than speakers with narrow-angle tweeters like those in the KEF 105.2. The 250Ti's imaging is also remarkably stable and coherent considering the number of drivers it has, and rivals or surpasses that of many small speakers. The height of the tweeter and the crossover alignment do slightly elevate the sound stage, but this impression is more natural to me than that of looking down at a performance or straight at it. Depth is also unusually good, and there is no tendency to expand or collapse the sound stage in ways which are not natural to the music.

The adjustability of the midrange and high-frequency driver levels allows the 250Ti to be tailored to a given room or high-fidelity system to an exceptional degree, but makes it difficult to talk about frequency response and coherence. The "flat" settings of the treble and midrange drivers, for example, produce a sound close to that of the Thiel CS3, while a −2.5 dB tweeter setting and −1 dB upper-midrange setting bring the 250Ti close to the balance of the Quad ESL 63.

I know that many purists object to any adjustment in speakers, but I welcomed the ability to alter the 250Ti's performance to get the most natural balance and timbre, and to alter the apparent listening position to suit my taste. Few speakers provide a similar opportunity to get smooth, extended response, and I suspect that those who cannot rebuild their listening rooms to suit a given loudspeaker may feel the same way. At the same time, the 250Ti's adjustment range is sufficiently limited that it is hard to make it sound unnatural, and easy to return precisely to a previous setting.

The speaker's power-handling capabilities are superb. Its only rivals I know of, at anything approaching the same price, are the VMPS Super Towers and the Infinity RS IB and RS IIB. This is not simply a matter of being able to play loud; it also means that the 250Ti can provide excellent detail during very soft passages and that it does not change in sonic character as loudness increases. Few speakers at any price provide similar dynamic coherence or a similar ability to "cut loose" to full, mass-orchestral levels without strain and with a single amplifier.

Electrostatic- and ribbon-speaker aficionados will find the 250Ti to have all the upper-octave speed and detail they desire—although I would rank the best ribbon tweeters as having slightly better speed and definition in the top of the midrange and in the lower treble. The 250Ti does not smear the finer details in even the best direct-to-disc recordings. If your record, cartridge and electronics can give you the necessary resolution, the JBL 250Ti will let you hear it. This is true even at moderate to high levels in the area between 50 Hz and 1 kHz, where many competing cone and dipole speakers tend to lose some detail.

The bass is solidly controlled and is very definitely within the high-end tradition. It does not have subwoofer power, but it extended to a room-rattling 37 Hz in my listening room at power levels well above those I'd normally dream of using for organ or full orchestra recordings. Low bass was also relatively directional, and small changes in frequency were unusually clear. This is a sign of truly excellent bass control and linearity. Once again, only a few speakers at any price—such as the Wilson Audio Modular Monitors; Entec, RH Labs, and Janis subwoofers; larger VMPS speakers, and Infinity IRS and RS-IBs—have a similar ability to show that bass can provide the listener with important sound-stage information.

In short, the JBL 250Ti offers an outstanding combination of virtues, remarkably refreshing in a world where so many speakers force the buyer to choose between a good sound stage, high power levels and a clean midrange. The 250Ti is not only "digital ready," it is good enough to be analog-ready. You can take any musical performance I know of, play it through this speaker at a natural level, and get a musically natural result.

This, incidentally, means you should use top-quality speaker cables and electronics. You don't really need more than 70 watts, but you do need a lot of transparency and control. The 250Ti clearly does benefit from the added control which high-power tube amplifiers provide, and from the high damping factor and power reserves of transistor amplifiers. This is not a speaker to be used with low-cost receivers or amplifiers that can't really control a large woofer. You will hear the amplifier's loss of control long before it clips, and lose most of the musical pleasure that true, deep bass can give on those few recordings where it is musically natural.

At the same time, I should note that the 250Ti does not have quite the upper-bass to upper-midrange smoothness and coherence of such top-ranking competitors as the Fuselier Model 5, Thiel CS3, Vandersteen 4, Quad ESL 63, or Infinity RS-IB. Good as the 250Ti is in this respect, these competing speakers have a more seamless quality in the upper midrange, until you reach relatively high power levels. This may indicate that JBL may be able to do still better in the future. At the same time, the 250Ti's weakness in this regard is sufficiently small at longer listening distances, and after proper at-

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The series has some shiny new technology, but its real strengths are a return to fundamentals and an emphasis on accuracy.

JBL 18Ti

JBL 120Ti

JBL 240Ti

tention to speaker placement and driver level, so that I suspect even the most demanding audiophile will find it hard to choose between midrange coherence and the 250Ti's combination of overall accuracy and dynamic range. This may well be the perfect speaker for the fan of full orchestral music, grand opera, high-level rock, and pipe organ. It certainly is an order of magnitude better than the speakers most studios use to make their records, whether they are earlier JBL speakers or some other brand.

The 18Ti

The JBL 18Ti, a small monitor, uses the same titanium tweeter as the 250Ti but has only a single, 6½-inch, filled polypropylene woofer/midrange driver. It sells for $500 per pair; each speaker measures 15 × 9 × 8 inches and weighs about 17 pounds.

The JBL 18Ti does not have level adjustments, but, like all small speakers, its sound character can be varied significantly by altering its distance from the rear wall, its height, and its tilt. Although there is no consensus as to exactly how the treble should coincide with the bass, the effect is far more noticeable in a given listening position on small monitors than on larger speakers.

I found the 18Ti sounded best on stands, without any tilt, about 12 inches from the rear wall. This kept the sound away from any furniture and side walls and kept the midrange driver just below the height of my ear when I was seated. Placement is so room-specific, however, that I strongly recommend you experiment.

Under these conditions, the 18Ti's sound balance is remarkably smooth from about 150 Hz up. It is similar to every small, two-way monitor in its lack of bass power and extension, but the extended range of the titanium tweeter does not burn into the ear or appear imbalanced. The 18Ti has an unusually well-chosen level and crossover. If anything, strings and female voice are a bit distant without being veiled.

The midrange lacks the life and dynamics of the other models in the Ti series, and is not as detailed and transparent as the best competition, such as the Spica TC-50 and Dayton Wright LCM-1. It is, however, better balanced—in terms of timbre, high-frequency energy, and bass—than the Spicas without their new and quite excellent subwoofers. The 18Ti does not have the bass extension of the Dayton Wright LCM-1, but it has slightly cleaner top-octave sound—if you allow for a slight roll in level. The 18Ti lacks the lower-midrange/upper-bass warmth of the LS-3/5A, but it has far better dynamic range and a much flatter and more open upper-octave sound.

In short, the 18Ti proves JBL can compete at the bottom of the high end as well as at the top.

The 120Ti and 240Ti

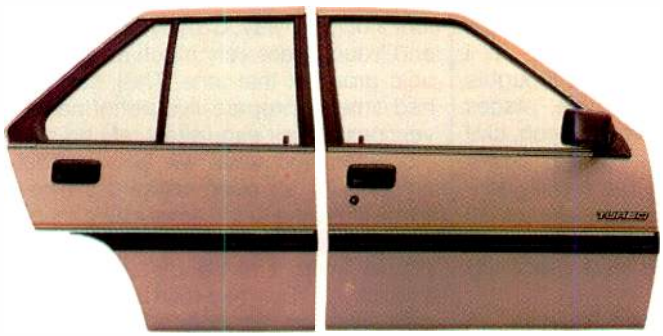
This brings me to the 120Ti, at $1,100 per pair, and the 240Ti, at $1,500 per pair. The strengths in the new JBL Ti series stand out far more clearly as you go up from the 18Ti to the other three speakers in the series. If you can afford it, I'd strongly suggest you go for at least the 120Ti. (The 240Ti, while a natural step up from the 120Ti, is not as dramatic an improvement as the 120Ti is over the 18Ti, or the 250Ti over the others.) A good three- or four-way system can offer more midrange purity, air and transparency than a two-way system. Even the more refined forms of music—chamber music, small instrumental groups, and even solo voice—benefit from every bit of detail and transient speed you can get.

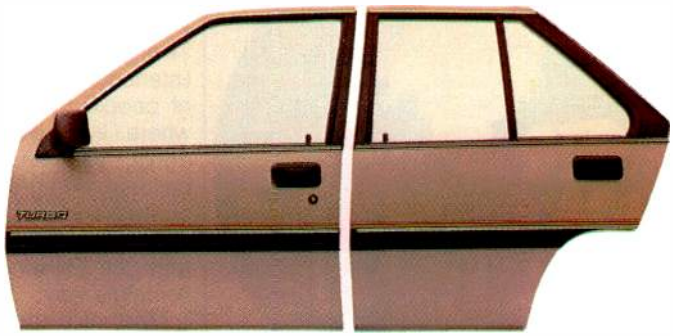
The 120Ti offers this added sound quality in a speaker which, again, has exceptional power and dynamic range, and it uses the same midrange speaker and titanium tweeter used in the 240Ti and 250Ti. Unlike the 18Ti, you do not just hear the music, you participate in it.

I admit that the 120Ti and 240Ti aren't cheap. I also have to say that there is a lot of tough competition in cone speakers from lesser known high-end manufacturers in the same general price range. I think, however, that JBL can stand the heat and that this company merits a place on the "short list" of anyone who can afford to put $900 to $1,600 into a pair of speakers, and who cares enough to really listen. JBL has always had the power, the bass, and the dynamics; it now has all the rest as well.

Anthony H. Cordesman

Something new has been added to the 1985 Colt.





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DÉJÀ VIEW

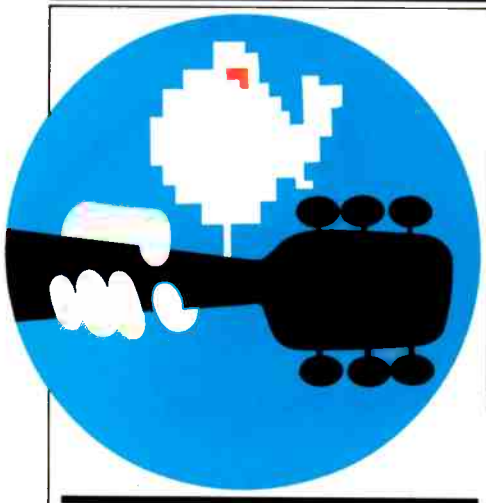


Illustration: Philip Anderson

Woodstock: Various Artists
Mobile Fidelity MFCD 4-816, four-disc set.

Putting the *Woodstock* and *Woodstock Two* albums on CD is a wonderful idea. But could the sound quality be good enough to be viable on CD? Considering all the problems of recording the Woodstock festival, this might have become a very accurate reproduction of a less-than-satisfactory recording. Happily, Mobile Fidelity has made a CD version that is quite enjoyable.

Don't expect to hear perfection in audio engineering, though. All the defects of the original are present: Hums and buzzes from the sound reinforcement system; distortion from unsatisfactory mike placement, occasional equipment mismatches and performers moving around onstage; murky, muddy sound quality; the problems of an analog tape made live nearly 16 years ago (even occasionally bad tape-to-head contact is audible on the CDs); rounded-off attack transients; little sense of depth or dimensionality (after all, this was an outdoor concert, and no walls means no room acoustics); limited dynamic and frequency ranges, and less-than-perfect performances from exhausted performers (balanced by outstanding ones stimulated by the excitement of the event).

If you can set these problems aside and listen to the music, you will be impressed by Mobile Fidelity's success in transferring the *Woodstock* tapes to CD. Woodstock, the event, defined its period. It became the greatest expression of what those times were like, and the musical styles and techniques contained on this four-disc set reflect the way people thought and acted. *Woodstock* and *Woodstock Two* really come to life on CD. As I listened, I could not keep out thoughts of people I knew at the time, places where I lived, politics, free speech, civil rights, Vietnam, peace, love, flower children, and granola. The slightly antiquated sound quality reproduced so faithfully on CD separates Woodstock from the present time in a gracefully nostalgic way.

Most of the best-sounding cuts involve a solo performer or small group and one or two mikes. The big groups like Santana, Jefferson Airplane, and The Who sound muddy, usually because of too many mikes, or the wrong mikes, or less-than-optimum placement. Most of my criticism of sound quality is directed at the original recording (with a sympathetic understanding of the problems involved).

Arlo Guthrie's "Coming into Los Angeles" is one of the more successful cuts in terms of sound quality. The stereo spread is good, the detail from the backup group comes through, and the pickup on Guthrie's voice is smooth, natural and well-centered. The bass is a bit weak compared to other cuts included on the discs. Because of the outdoor setting, not much sense of depth is present.

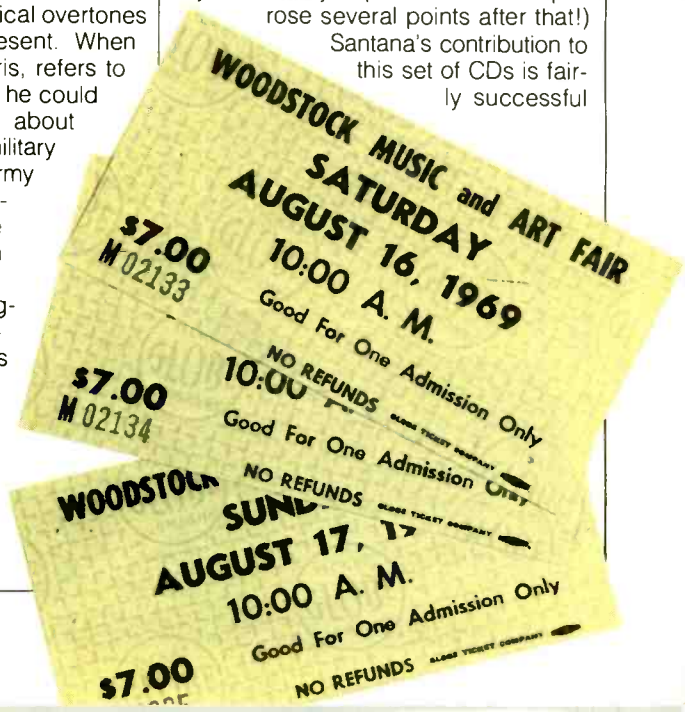
Joan Baez' performance is fascinating. It's a reminder of the '60s folk/protest style, but the political overtones reach right into the present. When her husband, David Harris, refers to "Ronald Ray-Guns-Zap," he could just as easily be talking about the current "Star Wars" military strategy as Reagan's stormy relationship with the free-speech movement at the University of California in the '60s.

Listen to Baez' clear, ringing voice with that wonderfully wide vibrato, which is her trademark, on "Joe Hill." To hear her singing this song at such a momentous occasion, with all the clarity the CD medium can project, sends chills down my spine. The balance of her voice against the acoustic and electric guitars is exactly right.

Woodstock had a few artistic disasters along the way. Crosby, Stills, Nash and Young were very much an embryonic group at that time. They had not had time to prepare live-performance versions of their exquisitely refined studio work, and what we hear almost amounts to an open rehearsal. They admit it, saying to the assembled multitude, "This is the second time we've played in front of people, and we're scared. . . ." But they rose to the occasion, and we are treated to a rare, inside glimpse of a performance in process, complete with rough edges and a few wrong or missed notes.

Santana was virtually unknown before Woodstock, but not after. A few weeks later, I went to hear Arlo Guthrie in Cincinnati. The backup group was Santana, and everyone was wondering what they would sound like after all the clamor at Woodstock. Guthrie wisely came on first, and let them finish off the evening. (I had just finished graduate school and had begun my first job, professing music at Wilmington College. As the evening wore on, I joined a long line of snake dancers and danced until I reached total exhaustion—rock does strange things to people. At that point, two of my students, in similar condition, found me collapsed on the floor, shirtless, huffing and puffing, with rivers of sweat pouring down my chest. My reputation on campus rose several points after that!)

Santana's contribution to this set of CDs is fairly successful



Woodstock is enjoyable not only as a document of an occasion but also as a compendium of musical styles of the '60s.

sonically. The mix is well balanced, but the pickup of individual instruments lacks some clarity and focus. The bass especially seems mushy. Most of the exotic percussion instruments are nearly inaudible, except during a passage (about two minutes into the track) that specifically features them. Mike Shrieve's drum solo really cooks with excitement, and Carlos Santana's second solo wails and soars, but without the polish he would later acquire. Who would have guessed what he and John McLaughlin might do many years later? The seeds are here, though.

Influenced by 18 hours a day of powerful musical experiences, the crowd spontaneously improvised its own music. To me, this is the most significant expression of Woodstock, because it represents the sense of community and "power to the people" that Woodstock brought into focus. Some people sang little rhythmic/melodic fragments, continuously repeating and altering them. Others picked up bottles and cans, turning them into percussion instruments. The musical techniques they used are not too different from what the minimalist composers are doing today. The wonderful thing is that these crowd chants arose spontaneously, in true '60s fashion. The people who recorded the festival deserve praise for being aware enough to get this on tape.

Mobile Fidelity's disc package is acceptable, but suffers from the problems that plague CD album design in general. The original LP made a very strong statement about Woodstock, the event: A triple-fold album cover conveyed a sense of the crowd's size, with a large panoramic photo, taken from the back of the stage, showing the enormous audience ("the largest group of people ever assembled in one place," according to Max Yasgur). Mobile Fidelity should have reproduced more graphics from both LP albums, just to remind us of the size of the event.

However, Mobile Fidelity has reprinted the original souvenir program, and you can order it from them (using a card enclosed in the CD package) for a nominal $4 shipping and handling fee. Ideally, it should be included with the discs, but that would present some distribution and display problems.

This is the first CD set to appear on the market with Sanyo's special acrylic coating on the *data* side as well as the label side. Its purpose is to protect the surface from scratches and warpage. This factor is not especially important to most users at home, but the unfriendly environment (heat, dust, careless handling) of a car will make such treatment more important as car CD players become more common.

One very annoying flaw is that the lists of tracks, titles, and performers printed in the booklet and on the disc labels do not correspond with what actually is on the disc. This makes finding a particular selection a nuisance rather than a pleasure. Obviously, in a project


Erich Kunzel

this large and complex, nailing down all those details is not a very easy task, but this set has too many of these errors to overlook.

Woodstock is thoroughly enjoyable on many levels. It is a document of an important musical/sociological occasion. It also is a concentrated compendium of musical styles of the '60s.

Steve Birchall

Ein Straussfest. The Cincinnati Pops Orchestra, Erich Kunzel.
Telarc CD-80098.

Here is another blockbuster demonstration CD recording from Telarc, replete with label warnings about the imminent destruction of your audio system if you inadvertently start to play it at high volume.

This potpourri of works by the Strauss family does indeed have sections that could raise havoc if caution is not observed. The first number, "Explosion Polka," is true to its name; it begins with a room-rattling bang! The next selection, "Champagne Polka," features the actual popping of champagne corks. (Two cases of California champagne were opened for this sound effect.) "Banditen Galop," the third number, has the ultra-high-energy transients of actual pistol shots, and cut seven, the "Fire Festival Polka," features metallic anvil pounding. Cut eight, "At the Hunt Polka," blasts you with rifle shots, and number 10, "Clear Track Polka," has several startling, high-level train whistles. The finale, "Thunder and Lightning Polka," has a speaker-blowing thunderclap!

The musical values are not subverted by the special effects. Erich Kunzel gives fine performances of the lilting Strauss melodies and really spirited renditions of the more athletic works. The sound is beautifully clean, up to Telarc's usual standard. As always, the balance their engineers maintain between orchestral definition and hall ambience is most realistic. Throughout the works, the robust Telarc bass drum is much in evidence.

If you want a Compact Disc that will give you great music, great sound and great fun, this *Straussfest* recording is it!

Bert Whyte

MICHAEL TEARSON
JON & SALLY TIVEN

BROKEN DREAMS

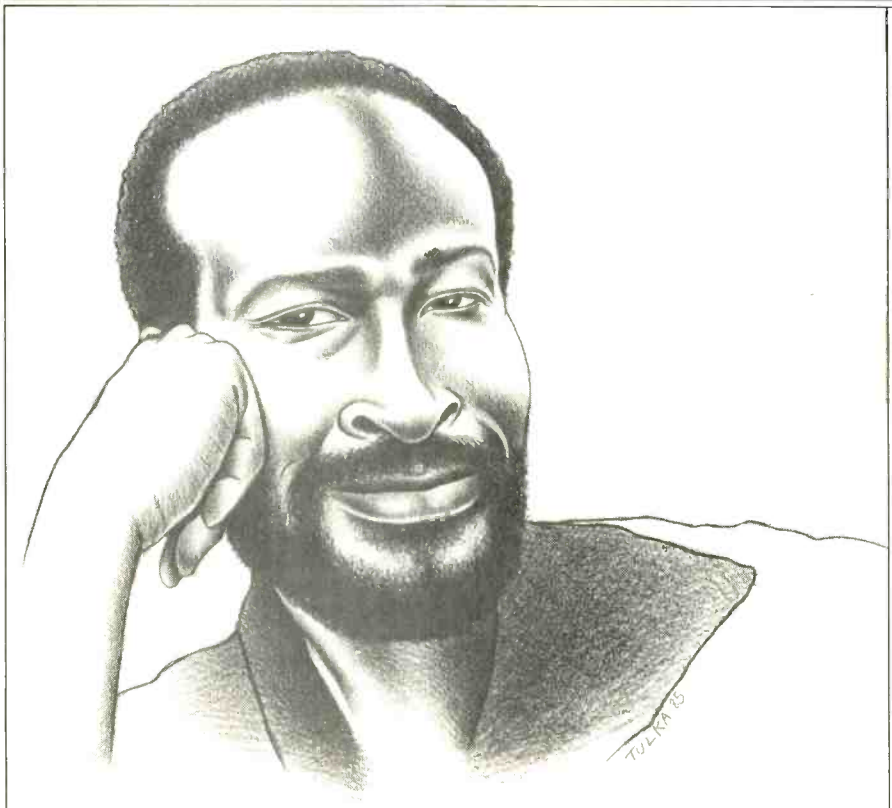


Illustration: Rick Tulka

Dream of a Lifetime: Marvin Gaye
Columbia FC 39916.

Sound: B Performance: A–

Even after his death, Marvin Gaye's records are plagued by the meddling of middlemen. During his last tour he announced that his next record would be sexually controversial, with a title of questionable taste. Someone at the record company convinced him to do a second version of the tune for radio. "Sanctified Lady," as it was renamed, is, of course, the rendition which meets the ethics standards of the record company and gets released. Marvin's last album for Motown, assembled from tapes stolen from his European hideaway, was also released without his approval. But we are talking about a man who had lost control of his life, so why should his records be any different? This is the sad tale of the greatest artist to emerge from the Motown stable, without whom there'd be no Stevie Wonder or Michael Jackson as we know them today. As brilliant and important as Ray Charles was to pre-'70s black pop, Marvin Gaye's blossoming as the premier singer/songwriter of black music, circa *What's Going On*, provided the inspiration and impetus for a revolution in black music as big as the advent of Lennon/McCartney/Jagger/Richards/Dylan in the world of pop.

Unfortunately, Marvin Gaye was ill-equipped to deal with the success and controversy which surrounded him, and his last album is a testament to his less-than-healthy mental state directly preceding his passing. "It's Madness" sums it up candidly: "Everything I see is a crazy kind of mystery to me/I'm flirting with the mother of insanity/Oh, where is my mind?" This is not a light record, nor really a finished record either, and the way it has been prepared for release is not very sympathetic toward the artist. The lyrics have been somewhat purged of sexual content (although there's plenty left), the mix overemphasizes the lush instrumentation (which surely would have played a much more subdued role if Marvin had mixed it), and the vocals are not given the proper treatment to deliver that familiar, time-honored Marvin sound. Instead, the vocals sound thin and flat, as if someone decided that this was the *real* Marvin Gaye, but this sound is no more real than John Lennon without the vocal delay, or Elvis without slap or reverb, or Phil Collins without double tracking. But no amount of posthumous botching can disguise the greatness of Marvin Gaye's talent, or the pain of his final odyssey.

Dream of a Lifetime opens with what sounds like a musical continuation of "Rockin' After Midnight" from the "Sexual Healing" album, *Midnight Love*. "Sanctified Lady" is a sophisticated dance tune with an irresistible beat that proves the author a groovemaster as well as an outstanding vocalist/composer. With a basic track this solid, the unfinished aspects of the mix really don't detract from the song's impact. Although no artist appreciates having his work released before it's completed, in many cases the germ says it all, and is certainly of interest to fans. The same might be said for "Life Opera," a song sketch for an opus that gleans its power from the snowballing of classic ballad chord patterns and the unadorned vocal whose reading is raw and compelling.

In his lighter moments, Marvin could be very playful, as in the '60s-style R&B tune, "Ain't It Funny," which sounds as if it was intended to be a hit in The Pointer Sisters' tradition of close vocal harmonies and upbeat feel. But he really gets his chuckles in the send-up of Rockwell, entitled "Masochistic Beauty." With a British-accented voice monotonously intoning crass sexual lyrics, Marv plays the bad boy with aplomb. Though the mixing and arrangements of some of these tunes may be questionable, the personality of the artist comes across loud and clear, and as a matter of fact these are probably the most revelatory of Marvin's lyrics. Sharing the bleak and hopeful sides of his soul (though sadly not in equal measure), Marvin has left us more breathtakingly beautiful melodies and song structures. No doubt they will be assimilated by contemporary songwriters for many years to come. *Jon & Sally Tiven*

Bad Attitude: Meat Loaf
RCA AFL-5451, $8.98.

Sound: D Performance: C+

I can't rightly figure why people either say they love or hate Meat Loaf—he hasn't recorded that much to get passionate about since his breakthrough second LP, *Bat out of Hell.* Now, three albums later, the Meat's title-cut duet with Roger Daltrey may be as exhilarating and as bombastic as Meat's title cuts usually are, but the rest of *Bad Attitude* is one more trip into teenage nihilism. It's soundtrack music for driving around by yourself on lonely Friday nights when you don't have a date and your friends are all out of town.

You do *need* music for this; otherwise you'd feel ridiculous when you let the wind blow back your hair. Unfortunately, in Meat Loaf's collaboration with lyricist Sarah Durkee and keyboardist/tunesmith Paul Jacobs, the teenage wasteland's gotten crowded with caricatures rather than archetypes, with bravado rather than angst. Only on "Bad Attitude" and in a few moments of the synth-spackled "Nowhere Fast" (one of two songs penned by old collaborator Jim Steinman) does Meat seem to be saying something from the gut and not from rote. The extremely shoddy album pressing (at least of my copy) doesn't help, either.

The irony is that Meat Loaf's vocals, taken on their own, ring with tension and sincerity. He's a one-man show, and with the right direction he might yet become a one-man epic.

Frank Lovece

Sam Cooke Live at the Harlem Square Club, 1963
RCA AFL1-5181, $8.98.

Sound: C+ Performance: A

Through the years, Sam Cooke's influence on singers has been enormous. We're talking about people from Otis Redding and Aretha Franklin to Rod Stewart and Journey's Steve Perry. Cooke's legacy of great songs that he both wrote and sang is more than impressive; it is essential stuff. Personally, I've never been that much of a Sam Cooke fan. I've found his records just too clean and too cute with the hokey Hugo and Luigi production.

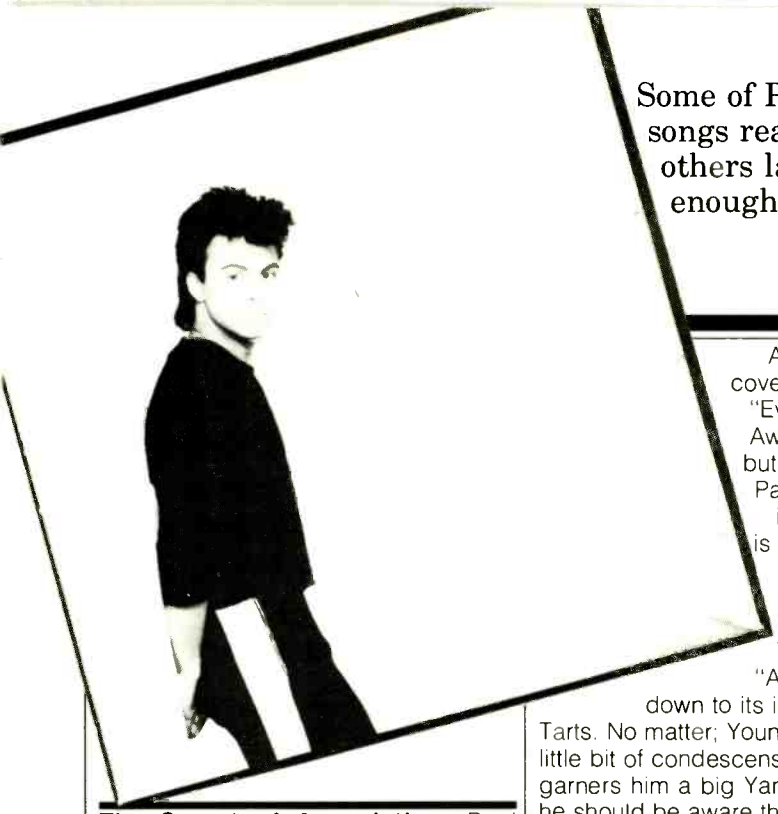
Here we get a very different Sam Cooke. He is grittier, rougher, and more forceful, caught in a fiery January 1963 performance recorded nearly two years before his death in late '64. Here, he *is* the shouter who inspired Otis and the rest.

The tapes, only recently discovered, sound far better than anyone had a right to expect, especially considering that these are '63-vintage three-track tapes. The sound may be a bit clipped, but the electricity is very high voltage and the performances are hotter than hot. Project engineer Rich Rowe and archivist Gregg Geller, who initiated the project, have done a wonderful job in getting the spark onto the vinyl.

For me, hearing this live set was like hearing Sam Cooke for the first time. I'd always suspected that there had to be a wild, rough-and-tumble singer hidden in those oldies but goodies, and now I know just how true that is.

Michael Tearson

Sam Cooke



Some of Paul Young's songs really work well, but others lack a chorus strong enough to match the verse.

The Secret of Association: Paul Young
Columbia 40-26234.

Sound: B Performance: A

No Parlez, Paul Young's debut album as a solo artist, was pretty close to perfect—a singer with the classic English tone (somewhere between Robert Palmer and Bobby Womack) performing tastefully chosen, imaginatively arranged songs. There was a spirit of collaboration on *No Parlez*, with Young's band, The Royal Family, making prominent musical contributions—particularly the brilliant guitarist Steve Bolton (Jimi Hendrix meets Ray Parker, Jr.) and fretless bassist Pino Palladino. Producer Laurie Lathan and musical director Ian Kewley selected songs that were not necessarily obvious hits but compositions open to interpretation, and the result was an album which sold zillions worldwide but only dented the American market. No matter; artistic integrity was preserved, and success in the rest of the world can be highly profitable.

However, *The Secret of Association* is a bit of a change, and certain trade-offs have been made. Bolton left the group during the making of the record and was replaced by former Blockhead, Johnny Turnbull. The Fabulous Wealthy Tarts (Young's female backup duo) went solo, and were replaced by a more mature trio of black vocalists, George Chandler, Tony Jackson and Jimmy Chambers. There is also a deliberate move toward more self-penned songs, and the joint effort of Young and Kewley provides five of the album's 11 cuts. The attempt to get an American hit was covering Daryl Hall's "Everytime You Go Away," a fine song but hardly obscure. Paul Young covering Hall & Oates is somewhat ironic considering that they completely cannibalized Young's style on "Adult Education," down to its imitation Wealthy Tarts. No matter; Young is allowed this little bit of condescension as long as it garners him a big Yankee smash. But he should be aware that his own musical style needs no such dilution, as even The Commodores have nicked a thing or two from the guy for their first hit in years ("Nightshift"). Once he clicks, Young will probably be the most influential artist to come out of England since The Pretenders. He's already held in high esteem by the American musical community, so all his record company has to do now is deliver a bona fide hit single.

Paul Young's songwriting has some pieces which really work well, and there are some for which he couldn't come up with a chorus strong enough to match the verse. ("One Step Forward" is an obvious example of the latter.) "Everything Must Change" is gorgeous in a "Wherever I Lay My Hat" sort of way, and "Tomb of Memories" is just fantastic, although it reminds one a bit of Smokey Robinson's "Tears of a Clown." The choice of songs by other writers is not quite as uniformly astute as it was on the last album, but "I Was in Chains" and "Bite the Hand That Feeds" are fun. It's just that next to "Love of the Common People" (on *No Parlez*), just about anything looks pedestrian.

The tracks with Steve Bolton's guitar are growlers, and Matt Irving's sitar-like tones fit in nicely but just don't have the same kick to them. In this new setup, it's obvious that Pino Palladino is the featured instrumentalist *period*. Considering his revolutionary approach to bass, perhaps that's the way it should be. The sound of the record is hi-fi in every aspect, and seems particularly well-geared toward the tastes of walk-listeners since stereo panning is a major factor in the mix. For value, the English-import cassette is the version to get, as it contains not only an extra track but extended mixes of five of the songs.

And, oh yes, this guy Young sings a *bitch*. *Jon & Sally Tiven*

Steady Nerves: Graham Parker and The Shot
Elektra 60388-1, $8.98.

Sound: B+ Performance: B+

Steady Nerves is something of a return to form for Graham Parker. His last few records have lacked the necessary hungry edge, but it is back on this new one.

The subject matter of Parker's songs is quite varied. Naturally there are love songs, "Mighty Rivers" and "Wake Up (Next to You)." "When You Do That to Me" is a sex song. "Break Them Down" is about missionaries in Venezuela converting Indians to Christianity and destroying their native culture in the process. "Canned Laughter" is about television, while "Locked into Green" is about the game of snooker. "The Weekend's Too Short" is a rocker that speaks for itself, and "Black Lincoln Continental" is a terrific, raucous, rockabilly turn about affluence. (On the CD version of this album, there is also a bonus song, "Too Much Time to Think.") Parker's writing is back on track here, and the little guy has a lot to say.

Graham Parker

With *Change No Change,* Elliot Easton of The Cars shows he has a creative identity all his own.

His new band, The Shot, includes an old face from The Rumour (Parker's original band), sax/guitar man Brinsley Schwarz. There are also newer faces who have worked on more recent Parker albums—George Small on keyboards, Michael Braun on drums, and Kevin Jenkins on bass. They give sturdy, enthusiastic support. Parker's new coproducer is William Wittman, who was associate producer and engineer on Cyndi Lauper's *She's So Unusual.* He introduces Parker to a similarly polished spunk here.

Steady Nerves is an album with a whole lot going for it—solid performances, a very strong and varied group of songs, and excellent recording. Plus, in Graham Parker, a terrific man out front. This is a combination that is hard to fault, and I hope it brings Parker a good dose of the elusive success he has long deserved.

Michael Tearson

Change No Change: Elliot Easton
Elektra/Asylum 9 603931, $8.98.

Sound: B Performance: A

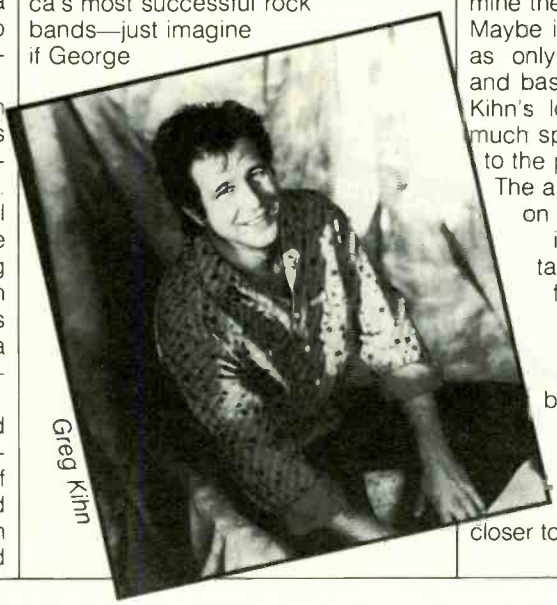
Lead guitarist for The Cars, Elliot Easton is a musician's musician. Economical and concise, Easton's licks give a rhythmic kick and melodic lift to Ric Ocasek's perpetual eight-note rhythm playing, and his influence lends this ultramodern band a pair of bullocks, if you'll pardon the expression. Thanks to The Cars' global dominion, Easton has been given his head with a solo project, and what he's come up with is good reason to run to your record store with a ten-spot in hand.

You might expect a deluge of Van Halenisms and assorted parlor tricks from this overly apt axeman, but Easton's too tasteful for such egoistic filler. Instead, we get an album of real songs, one that suggests an extensive musical education without ramming jazz progressions into pop tunes. With a good ear for melody, Easton comes up with memorable hooks and, like a wise songster, tailors his instrumentation to the composition.

With the chops of a session man and the good fortune to belong to a supergroup, Easton has become a master of both driving Ocasek's pop formula and adding flourishes to it. The music on his own album is much less confined than The Cars', and as a songwriter's showcase, *Change No Change* presents a pretty picture indeed. Although he's never even collaborated on a song by The Cars, Easton's solo outing has a strong creative identity all its own, far superior to Ocasek's LP of a few years back. And he sings great, too!

There's a lot of 1967 in Easton's approach, be it The Hollies of "(Wearing Down) Like a Wheel," the Brian Wilson chord changes of "(She Made It) New for Me," the parentheses in his song titles, or the Brian Jones in his image. Not to discount the modernism—there's some semi-dance-rap stuff, and Ministry (a synthpop outfit from Boston) provides the rhythm section. But Elliot's record is comprised of real songs with distinct parts, far more formalized than some of The Cars' recent recorded work yet with a similar punctuation of signature guitar riffs with keyboard doubling.

We could go on, but chances are this record will become a common fixture on radio by the time you read this. It's just such a joy to find a hidden treasure locked deep in one of America's most successful rock bands—just imagine if George



Greg Kihn

Harrison's first solo album had been *Plastic Ono Band* instead of *All Things Must Pass.*
Jon & Sally Tiven

Citizen Kihn: Greg Kihn
EMI America SJ-17152, digital, $8.98.

Sound: C– Performance: D

When an album by Greg Kihn is as unmemorable as *Citizen Kihn,* there is cause for some serious disappointment. Especially when it marks Greg's debut album for a new label.

The material is one big disaster. The songs are far from what Kihn is capable of. His songwriting is simplified past the point where melody disappears; there's lots of beat but not much more. Can it be that, following the success of "Jeopardy," Kihn is trying to mine the same vein much too deeply? Maybe it is the turnover in musicians, as only ace-guitarist Greg Douglas and bassist Steve Wright remain from Kihn's long-term band. There is not much spark and too much calculation to the performances.

The album was recorded and mixed on digital equipment. Not surprisingly, a fine drum sound is obtained, but the drums are mixed far out front, forcing the vocals to ride way behind them. The filtered sound on the vocals doesn't help, either; the songs begin sounding too much alike. *Citizen Kihn* is a sadly enervated album. Greg Kihn has done much better, and I trust he will again—if he gets back closer to the roots of basic rock 'n' roll.

Michael Tearson

The music from *Birdy* is quite subdued and very mellow. Its most dominant feature is a great wash of synthesized sound.

Instrumental Music from the Film *Birdy*: Peter Gabriel
Geffen GHS 24070-E, $9.98.

Sound: C– Performance: C+

Peter Gabriel's album of music for *Birdy* comes with the disclaimer that "this record contains recycled material and no lyrics." Well, it *is* movie music, isn't it?

Peter has taken the instrumental track, or in some cases the very concept, of several of the songs from his last couple of albums and given them whole new treatments for the Alan Parker film. There are some new pieces, too. The result is mostly along the lines of Brian Eno's *Ambient Music* series, which was more atmosphere than melody, more background sound than up-front listening.

Gabriel enlisted Daniel Lanois as his coproducer for this project just after Lanois had coproduced, with Eno, the U2 album *The Unforgettable Fire*. Gabriel also brought in Eno's *Ambient* collaborator Jon Hassell and the band he usually records and tours with, including synthesizer wiz Larry Fast, bassman Tony Levin, drummer Jerry Marotta and guitarist David Rhodes. In addition, The Drummers of Ekome and session players Manny Elias, John Giblin and Morris Pert appear.

The recording is quite subdued and mostly very mellow. The predominant feature is a great wash of synthesized sound, rather than melody or song, with occasional wordless vocals. While the album is full of fascinating and unusual sounds, it is not up to being the test record for speakers it had the potential to be. The pressing is somewhat noisy, too. In all, a vague disappointment on the technical side.

As movie music, Gabriel's work is interesting if not really ground-breaking stuff. I can't help expecting this record will be of interest most of all to Peter Gabriel devotees, who can tend toward the fanatical side.

Michael Tearson

Playing to Win: LRB
Capitol SJ-12365, $8.98.

Sound: B Performance: D

Little River Band is in big trouble. They are trying for a major image overhaul with *Playing to Win*, attempting, apparently, to move from the mild-mannered music they are known for to some brand of arena rock, Journey-clone style. To that end, they made a smart move in hiring Spencer Proffer as producer. He has always had a feel for that overblown Meat Loaf type of record, and here he has developed a *big, big* sound with loads of thump and self-importance.

Unfortunately, the songs are sufficiently unconvincing and insincere to bring the whole project crashing down to earth. *Playing to Win* is not a good album. Back to the drawing board, lads. *Michael Tearson*

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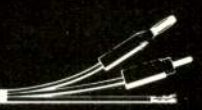

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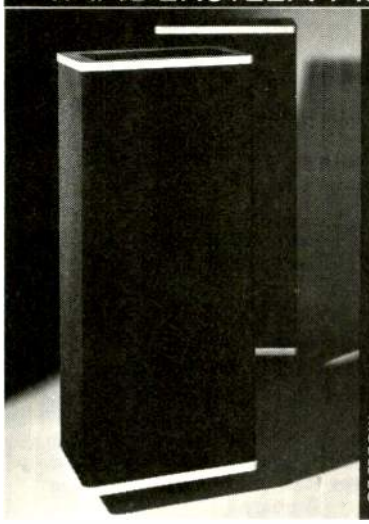

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