

Audio

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THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • MARCH 1978 \$3.25

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CATASTROPHE
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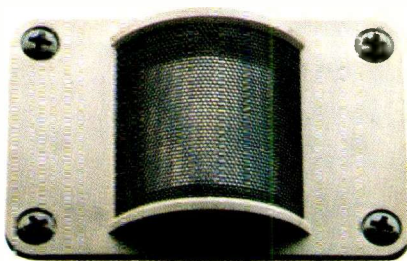
Every HPM speaker has cast aluminum frames, instead of the usual flimsy stamped out metal kind. So that even when you push our speakers to their limit, you only hear the music and never the frames. In fact, our competitors were so impressed, they started making what look like die cast frames, but aren't. HPM speaker cabinets are made of specially compressed board that has better acoustic properties than ordinary wood.

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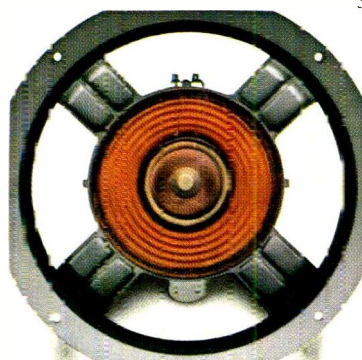
All of which begins to explain why, unlike speakers that sound great on only part of the music, HPM speakers sound great on all of it.

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OF A SPEAKER IS ONLY
AS IMPRESSIVE AS
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Audio

"Successor to **RADIO** Est. 1917"

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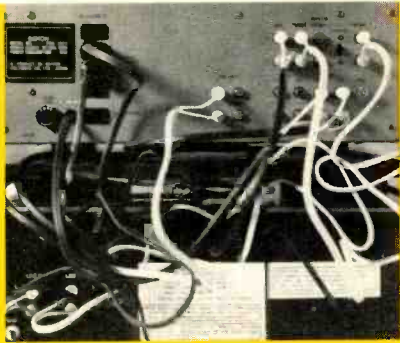
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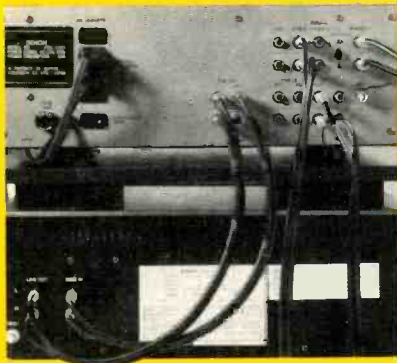
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About the Cover: The proper phono cartridge is a necessary ingredient for extracting all the sounds in the grooves of your favorite disc. For details on cartridges, see the article by S.K. Pramanik on page 33.
Photo by photographic illustrations.



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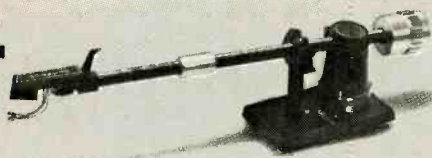
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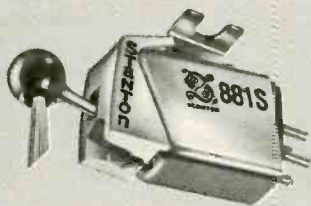
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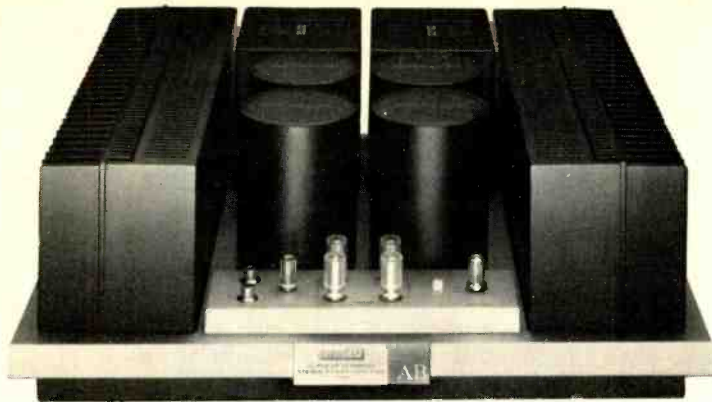
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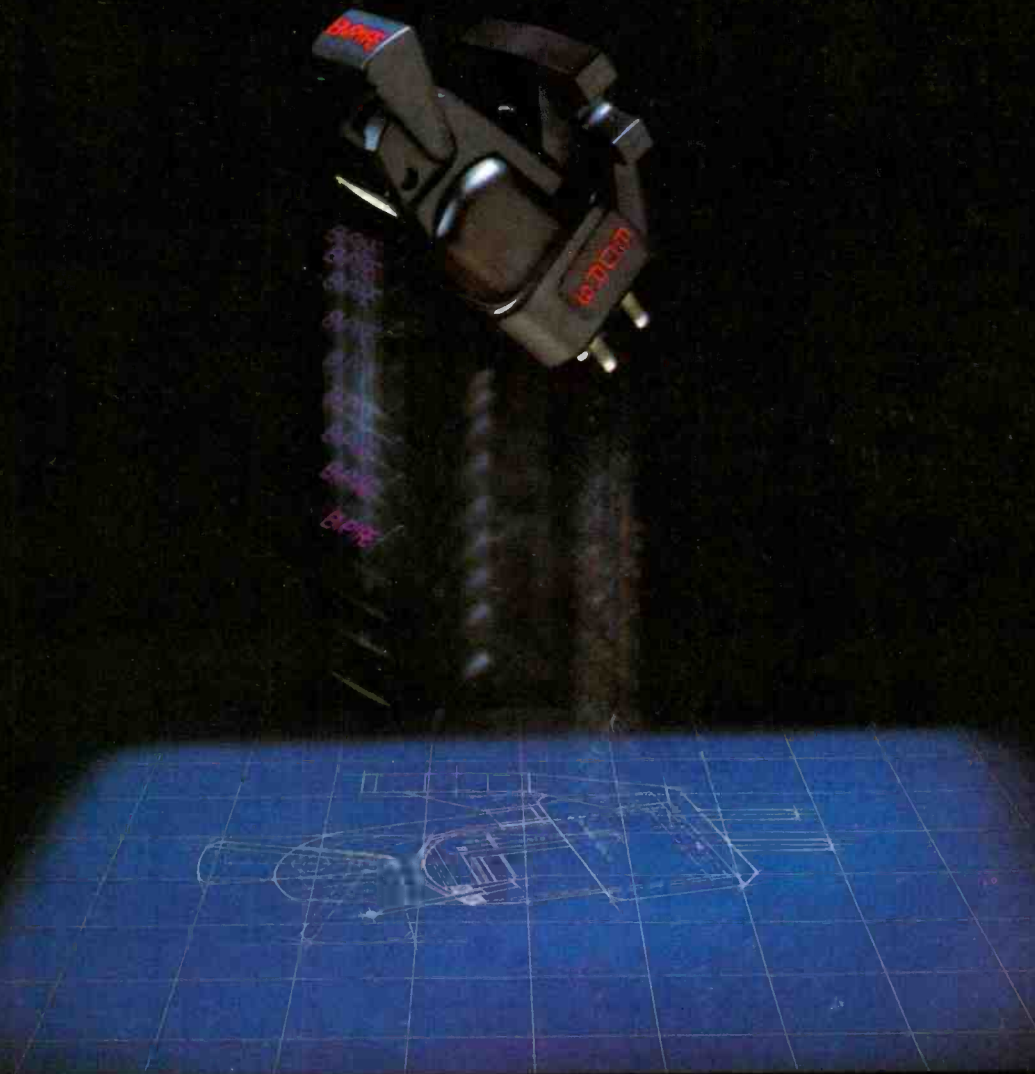
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demanding listening tests—on an equal basis. In effect, it bridges the gap between the ideal blueprint and the actual sound.

The EDR.9 utilizes an L. A. C. (Large Area Contact) 0.9 stylus based upon—and named after—E. I. A. Standard RS-238B. This new design, resulting in a smaller radius and larger contact area, has a pressure index of 0.9, an improvement of almost six times the typical elliptical stylus and four times over the newest designs recently introduced by several other cartridge manufacturers. The result is that less pressure is applied to the vulnerable record groove, at the same time extending the bandwidth—including the important overtones and harmonic details.

In addition, Empire's exclusive, patented 3-Element Double Damped stylus assembly acts as an equalizer. This eliminates the high "Q" mechanical resonances typical of other stylus assemblies, producing a flatter response, and lessening wear and tear on the record groove.

We could go into more technical detail, describing pole rods that are laminated, rather than just one piece, so as to reduce losses in the magnetic structure, resulting in flatter high frequency response with less distortion. Or how the EDR.9 weighs one gram less than previous Empire phono cartridges, making it a perfect match for today's advanced low mass tonearms.

But more important, as the EDR.9 cartridge represents a new approach to cartridge design, we ask that you consider it in a slightly different way as well. Send for our free technical brochure on the EDR.9, and then visit your audio dealer and listen. Don't go by specs alone.

That's because the new Empire EDR.9 is the first phono cartridge that not only meets the highest technological and design specifications—but also our demanding listening tests.

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Tape guide

Abrasive Characteristics

Q. What are the abrasive characteristics of chrome dioxide tape vs. iron oxide? How much wear can one expect over a long period of heavy use? What happens to the performance of a deck as the heads wear? — Alexander Davenport, Phila., Pa.

A. So far as I know, the abrasiveness of chrome dioxide and iron oxide tapes is substantially the same. Permalloy heads are reputed to have a life expectancy of between 2000 and 4000 hours of use, perhaps more in the case of hard permalloy. Tape speed is, of course, a factor . . . the slower the tape speed the more hours of use. Ferrite and other types of long life heads are reputed to have a life expectancy of something like 10 or more times that of permalloy heads, which comes out to about 20,000 to 40,000 hours.

Head wear is of particular concern with respect to playback. Head wear causes the playback head's gap to widen, resulting in a loss of the high frequencies. The slower the tape speed, the higher the loss. A worn record head may result in distortion.

Recorder Redundance

Q. Why do some tape decks (those with separate record and playback heads) have a monitor switch? Isn't this redundant since there's probably a monitor switch on either the amp or the receiver? — Larry Joe, Toronto, Ont., Canada

A. A monitor switch at the tape deck is usually more convenient than having to use the monitor switch of an amplifier or receiver some distance away. This is particularly true in a case where one is checking or adjusting the performance of the deck.

Head Impedance

Q. I read about high-impedance and low-impedance tape heads. Kindly let me know the meaning of these two types of heads. — P. U. Sukhadia, Bombay, India

A. High-impedance heads provide high voltage and low current, while low-impedance heads provide low voltage and high current. A high-impedance head is desirable for playback in order to obtain a playback signal with high voltage, thus maximizing the signal-to-noise ratio. A low-impedance head is desirable for recording in order to permit passage of a large amount of

signal and bias current and, correspondingly, produce a large magnetic field.

Dubbing Loss

Q. When dubbing a 7½ ips tape to a 7½ ips copy, will performing the operation at 15 ips cause one to lose half the frequencies? And if it does, then how do they commercially duplicate tapes at speeds as high as 240 ips? — Alan Korwin, Bronx, N.Y.

A. Chances are that you won't lose "half the frequencies" if you dub at 15 ips. The nature of the loss will depend upon the upper frequency limit of the tape electronics. If the electronics are good, say, to 30 kHz, this will maintain a response to 15 kHz for a 7½-ips tape.

However, if you dub a 7½-ips tape at 15 ips you will run into another problem . . . equalization. The record and playback equalization will not be such as to conform to NAB equalization for a 7½-ips tape.

High-speed dubbing requires that the record and playback electronics be able to handle the high frequencies entailed. If, for example, dubbing is at 10 times the normal speed, the electronics must be able to handle frequencies up to, at least, 150 kHz. Also, the bias frequency has to be greatly increased to avoid beats with the audio frequencies, and the equalization has to be appropriately changed.

Tape Loudness

Q. I have a problem recording tapes from records and maintaining the same volume throughout the full length of the tape. This is true for all three open-reel decks I own. I try to copy the records so they all produce the same readings on the VU meters. Some seem to come out stronger on the tape and I can't understand why. — Steve Jones, Houston, Texas.

A. The apparent loudness of program material depends, in a good part, upon the average level of the material, and the nature of the program material determines the degree to which the average level is below the peak signal indicated by the VU meters. For some program material, the average level may be only 6 to 8 dB below the level indicated by the VU meters, while on other program material it can be as

much 20 dB below the peak levels. Therefore, the loudness levels of recorded selections can be found to vary substantially.

Another possible factor is the frequency content of the material. Sensitivity in the human ear is most pronounced around the vicinity of 3000 Hz. Selections with a good deal of frequency content around 3000 Hz will sound louder than selections with less.

AM Taping

Q. Should you ever use a tape speed higher than 3¾ ips when recording AM broadcasts? — Alan Kuhn, Rochester, N.Y.

A. Generally one doesn't need to, but not necessarily in all cases. A more specific answer depends upon the quality of the tape machine and the quality of the source. If the tape deck performs in mediocre fashion at 3¾ ips, it may be worthwhile to go to 7½ ips even for AM broadcasts. Keep in mind that some AM stations do go out to 10,000 Hz or more, and a few (too few) AM tuners can do justice to such extended treble response.

Running Times

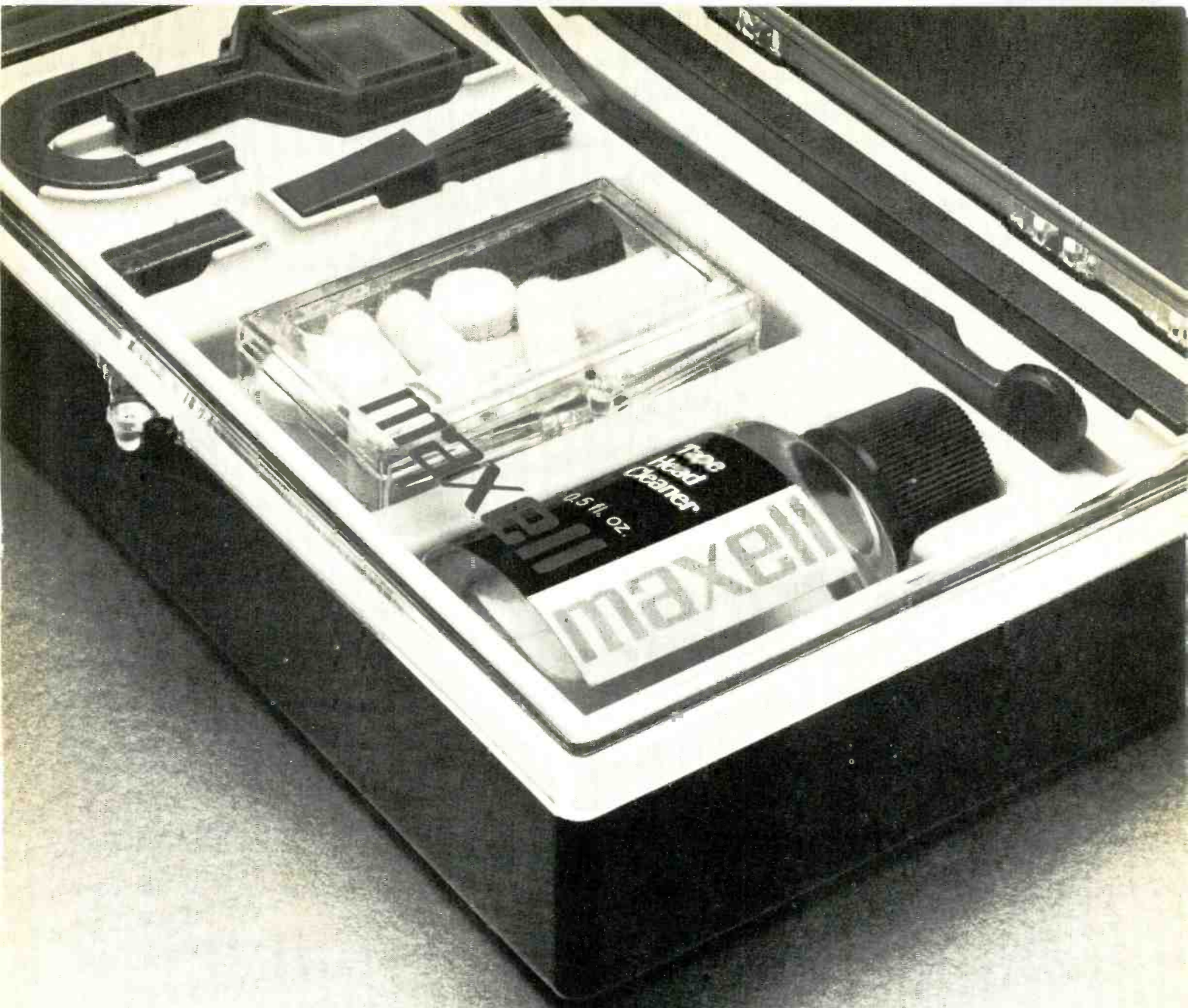
Q. Please give me the running times for 5-, 7-, and 10½-inch reels at the various tape speeds. —Name withheld by request.

A. Let us start with the standard tape speed of 7½ ips on the commonly used 7-in. reel with 1½-mil tape. The reel holds 1200 feet and runs for 32 minutes in one direction. As speed is reduced, running time is proportionately increased . . . thus it runs 64 minutes at 3¾ ips, but would only run 16 minutes at 15 ips. If the reel is run in both directions, then the total running time is doubled.

If a 5-inch reel is used, then the running time is cut in half, while if a 10½-inch reel is used then the running time is doubled, compared to the 7-inch reel.

If 1-mil tape is used, allowing 1800 feet on a 7-inch reel, then the running time is increased by 50 percent. In the case of ½-mil tape, the running times are doubled compared with the 1½-mil tapes.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 401 N. Broad Street, Philadelphia, PA 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.



People who aren't using our new tape care kit should have their heads examined.

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keep even areas you can't see spotless. All of which means you'll be getting maximum performance out of your machine. Year after year.

And if that doesn't sound like a good idea, maybe you need to have more than your tape heads examined.

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Audioclinic

Joseph Giovanelli

Noise in Phono Stage

Q. I have read product reviews in audio publications concerning a certain preamplifier which states that there is virtually no noise in the phono stage. I own this preamplifier and there is an audible hiss when this preamp and its associated power amplifier are operated with their gain controls at maximum. Why is this? — Frank H. Abelson, Brookeville, Md.

A. Any piece of electronic equipment has some noise output. All that matters in the final analysis is that this noise must be well below the lowest program level you expect to encounter. The fact that, with all gain controls set at maximum, you do hear some noise is completely unimportant unless circumstances are such that this is your normal listening arrangement. Such a circumstance might result from having a cartridge with too little output for the preamp, which can occur with some moving-coil cartridges.

It may be that when the controls of the power amp are open all the way, some of the noise you hear is actually generated from stages of the preamp which are in the circuit after the volume control. This is readily checked by turning the preamp's volume controls down to minimum and noting if the amount of noise is substantially the same as when the controls were fully advanced.

Phono Cartridge Output

Q. Why is it that the more expensive phono cartridges put out less signal voltage than the cheaper models and, thus, need more amplifier volume to sound as loud? — Stephen Jones, Bay-side, N.Y.

A. To make an excellent cartridge requires a low stylus mass . . . the better the transparency, the less stylus mass is required. To compensate for this, dimensions in other parts of the cartridge must be held to within very close tolerances. With all of this, however, the output for a low stylus mass cartridge will be lower than for one having a higher stylus mass. One of the electrical reasons for this has to do with the efficiency of the magnetic circuits.

Added Tracking Force

Q. Why is extra tracking force used when a stylus brush is added to the cartridge? — Michael Terr, W. Orange, N.J.

A. Today's tonearms are balanced for the particular cartridge being used. This tracking force represents the entire downward thrust of the tonearm upon the record, which is concentrated on the tiny tip of the stylus. If we add a brush to clean the grooves of the record before the stylus encounters them, we still have the same tracking force now applied to the tip of the stylus and the record cleaning brush both. This means that the stylus no longer has the total tracking force, so more weight will have to be added to the tonearm in order for the stylus to gain the required tracking force.

Eliminating Midrange

Q. I have a reel-to-reel tape recorder and an auxiliary amplifier, and I want to use this amplifier solely for effects. The signal going into each channel to be split into specific segments: Channel one to cover from 30 Hz to 400 or 500 Hz, and channel two to cover from 5 to 16 kHz. The purpose of all this is the elimination of the midrange so that the auxiliary amp will reproduce only the music portion of the tape, eliminating the voices of the singers. — Ronald M. Podrazik, Lodi, N.J.

A. To accomplish the removal of the middle frequencies, you will need a graphic equalizer or a crossover with separate adjustments for each of the two channels. The output of the tape recorder will be fed into the two inputs of the graphic equalizer. The output of channel one should be set to boost the low frequencies, and the output of the other equalizer channel should be set to boost all the high frequencies. The mid and upper frequencies of channel one should be set to their greatest "cut" positions, as should the low and mid frequencies of the equalizer.

Music covers a wide frequency spectrum, including the same frequencies as the human voice. Therefore, if you remove the voice frequencies from a tape, you will also remove the musical

background, except for the bass and treble.

If you wish to remove the voice and leave only the musical background, this can be done by making a mono mix of the two stereo channels, but with one of the channels out of phase. The out-of-phase condition means that any sound placed directly in the center — on both channels — will disappear. Another item which will also disappear is the bass. You can, however, boost the bass on one channel without having the voice reappear, although you might have to touch up balance between the two channels.

Speaker Phasing

Q. How can the phasing of speakers be checked in a bi-amped system? I have several records which contain phasing bands, and according to some of these records, my system is in phase, while with others, not exactly. I wonder if either the low frequency or high frequency sections could be in phase and the other sections out of phase? — Claude Cook, Mullens, W.Va.

A. The phasing of speakers on a bi-amped system is checked just as you would check the phase relationship between a speaker system employing a passive crossover network. A signal within each speaker's frequency range is fed into each pair of speakers with the wires of one of the speakers reversed. You then note whether the signal increases or decreases in volume . . . if the volume increases they are now in proper phase and the wires are now left in their new position. However, if the volume decreases, then the wires must be reversed again. Repeat for each pair of speakers.

The phasing bands on most test records, at least the ones with which I am familiar, are designed to show whether a pair of speaker systems are properly phased. This could not be

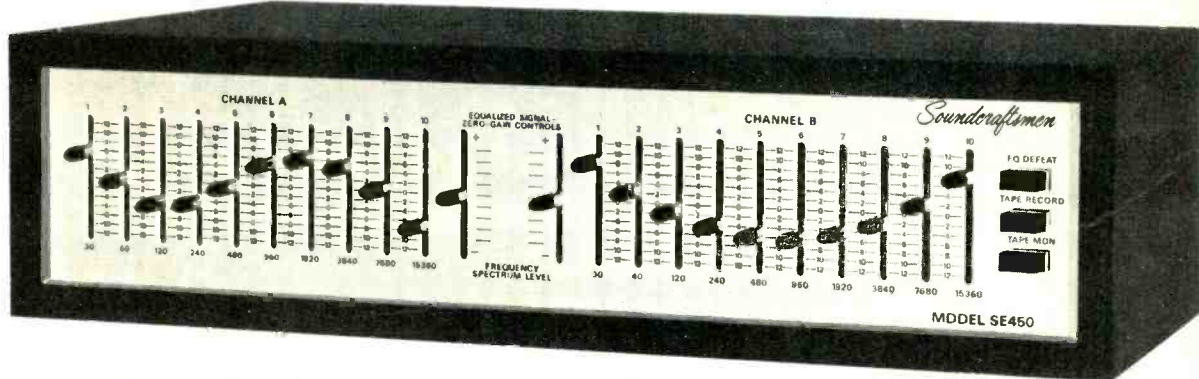
If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 401 North Broad Street, Philadelphia, PA 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.

AUDIO • March 1979

Soundcraftsmen

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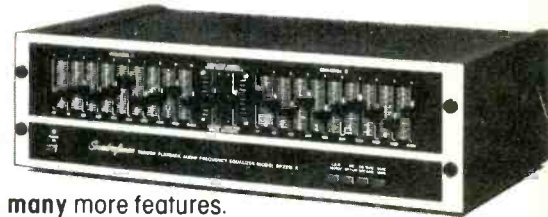
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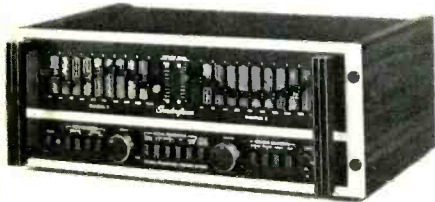


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done with the aid of most test records because the maker of such a record could not know the proper crossover point for your system. What is needed is either a mono record with spot frequencies or a signal generator because it can be set to produce the exact frequency desired for your particular system.

Chirping Receiver

Q. My receiver constantly emits a chirping sound. This noise doesn't come from the speakers, but the receiver itself. It isn't a loud noise, but clearly audible and very disgusting considering the price I paid. What can I do? — William H. Chapman, Detroit, Mich.

A. Chances are that the sound emanating from your receiver is caused by the vibration of the core lamination in the power transformer. Sometimes, not always, this can be eliminated by tightening the mounting screws of the transformer. There may also be some additional screws which hold the transformer itself together, and these should also be tightened.

It may be necessary to replace the present power transformer. If one is not available, then it may be possible to take the present unit apart and dip the innards in hot pitch. When the pitch hardens the laminations will no longer vibrate. In any case, the noise does not mean that the equipment is in any danger of malfunctioning.

Tuning Meter Drift

Q. My tuner and receiver both have center-channel tuning meters which drift when they get warm. They stop drifting after about a half hour, but there is a significant difference in dial location between center tuning when hot and cold. What is the correct center-tune position? Are the meters more accurate when warm or when cold? How should I tune these units for best reception and lowest distortion? — Robert A. Ward, Cleveland Heights, O.

A. The meters on your tuner and receiver do not drift off correct center tuning, the actual tuning changes. The meters simply reflect this fact so that you will know that you have to retune the equipment. If the sound quality does not appear to change from the time the tuner is turned on until it is completely warmed up, you can probably ignore the meter altogether.

Once you know the direction of drift, you can mistune the equipment slightly when first turning it on, and allowing it to tune itself as the warm up proceeds.

AUDIO • March 1979

THE BETTER YOUR HIGH FIDELITY SYSTEM, THE NOISIER IT WILL SOUND.



It's a strange, but true fact—the better your hi fi equipment, the more hiss, hum and rumble you will hear. Just as a quality high fidelity system provides richer music through its wide frequency response and greater dynamic range, it also has a better ability to reproduce irritating flaws contained in the source material. You can make a major improvement in your system by eliminating much of the hiss, hum and rumble that's inherent in the source material itself.

Many noise reduction systems have some success, but only one can silently remove 10dB of the hiss, hum and rumble that is contained in unencoded records, tapes and FM. That one system is the Phase 1000 Series Two.

As you reproduce recorded music, the 1000 Series Two analyzes the millions of incoming waveforms to find signals similar to a sine wave—a highly "correlated" waveform with periodic repetition. Like a guitar note. Or a piano note. Or a vocal note.

The 1000 Series Two electronically analyzes the signal to find fundamental musical tones, and their harmonics. Where these are missing, there is no music. The 1000 can then safely assume there is noise.



THE PHASE 1000 SERIES TWO

If the 1000 Series Two identifies a fundamental waveform, it instantly orders one of its silent bandpass gates to open. If no music is present, the gates remain shut. The 1000 removes a full 10dB of hiss, hum and rumble—without affecting music!

The 1000 Series Two overcomes another flaw—dynamic compression. Live music has great dynamic range, with as much as 100dB between the loudest and the quietest passages. But tape recorders have limited range, so studio engineers compress the dynamic range to less than 50dB. FM broadcasters compress the signal even more, in order to facilitate transmission. The 1000 is the only Noise Reduction System that can correct this compression on unencoded material. It expands dynamic range by a full 7.5dB for a more open, lively sound.

The Phase 1000 Series Two may very well improve your sound more than any

other single component you could add, regardless of the quality or price of your hi fi system. The 1000 is an improved version of the Phase Linear Autocorrelator, now with second generation, low noise, high slew rate integrated circuitry for quiet, distortion-free performance. It's easy to utilize with any stereo receiver, integrated amp or preamp/amp, and is a valuable addition to Dolby* and dbx systems. (These systems are very effective in preventing noise from being added in the re-recording stage, but don't reduce noise in the original recording.) When you play conventional records through the 1000 you cut tape hiss. (Expensive direct-to-disc records are cut directly onto a master, primarily to avoid the taping stage with its inherent hiss.)

Ask your Phase dealer to play any record, tape or tuner through the 1000 Series Two. Then listen to the music. Not the noise.

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Audio etc.

Edward Tatnall Canby

I've been listening to FM radio again. Not that this is anything new. My FM listening goes back to the earliest public broadcasts, 35 years ago and more. But being a record reviewer (and column writer) I am not a very systematic tuner-in, what with all those reproachful piles of unplayed discs awaiting their turn on my fi. So I come and I go. Unless, of course, there is some very special reason for radio listening.

Like, say, my own FM program coming out to me 100 miles from the "Big City." That turns me on quick. Or trying out a new tuner, to see whether maybe I can pull in Norfolk, Virginia, once again, from far Northwest Connecticut. 350 miles? Or Delaware. Or maybe our home city, Philadelphia, down there 150 miles SW. In the past I have often combined these interesting activities, for professional reasons, i.e., this column. Now after a considerable hiatus I am back. Same old excellent roof antenna but a brand-new tuner, the latest. And am I startled at what it can do. Though it can't cure all FM problems, nor can any other tuner for that matter.

You understand, some years back I suddenly found myself no longer emanating from New York's own station WNYC after exactly 25 years of weekly

broadcasts. Shake up. One Sunday, I just wasn't there, and that is the last I ever heard. Not unsurprisingly, my 100-mile FM listening thereafter began to languish and fade away. Should I listen to the XXXX Philharmonic "live" (on tape as of summer-before-last) when 20 other Philharmonics sit unplayed in their LP jackets under my nose? So I quit. News and weather via AM became my austere radio diet.

Also, around that time (the chronology is a bit confused) my powerful antenna rotator slowly ground itself to a halt one winter day at 10 below zero and never moved again. Leaving me hind-side-foremost, the antenna pointing away from New York, vaguely towards the North Magnetic Pole. Too much! Like the fig tree, my FM listening went temporarily dormant. I lost all my fig leaves.

In any case I tend to work in cycles, and it was now a good time for interests other than FM.

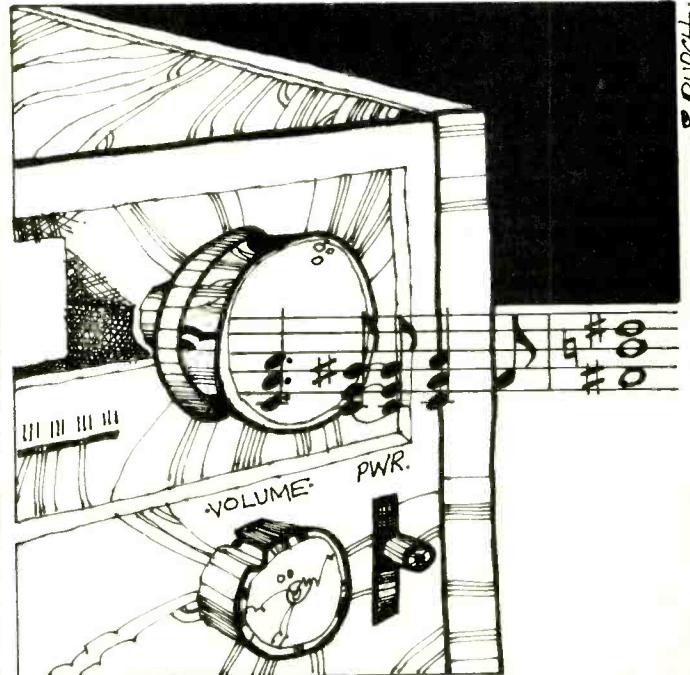
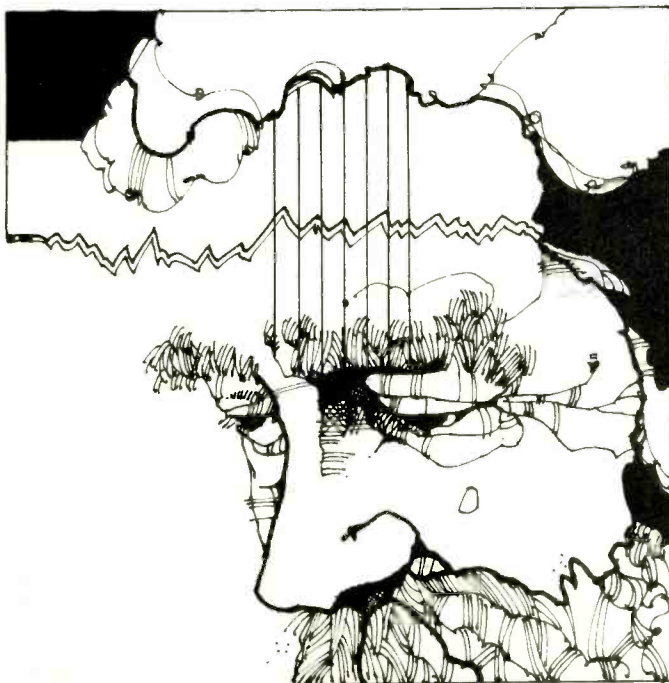
But then suddenly, unexpectedly, I was back on the FM air again. New station, also New York, also from the Empire State Bldg. Not at all to my surprise, I again discovered — after so long — a pressing need to listen to FM at 100 miles. And was I unprepared!

I fished out an old FM tuner (no — not the Fisher) and hooked it to the

leads from my Magnetic Pole antenna on the roof and to my current hi fi, hoping that the rear of the antenna array would still pick up New York. All too quickly, though, I found that my new program at 100 miles consisted of (a) a vast roar of hiss with an occasional extremely faint ghost of my voice, just to prove I was there, and (b) a veritable traffic jam of loud, boisterous FM rock and country music, two adjacent stations elbowing their way rudely on each side, straight across and far beyond my own frequency. Outrageous! I have never felt so insulted, so squashed, so impotent. One station turned out to be 40 miles off to the right, at 90 degrees but it was LOUD. The other was to the left, maybe 30 degrees and 50 miles. These distances rate (and sound) as nearby, in country FM. Together, these two fought it out full blast over my faintly gasping voice, a hideous mayhem of sonic struggle.

Atrophied Antenna

I figured I really ought to check that antenna. On the roof, I found it as you might guess. Both leads were neatly snipped off, no doubt by that last big ice storm a winter ago. Non-directional pickup via long lead-in. No wonder the 90-degree monster came in so loud.

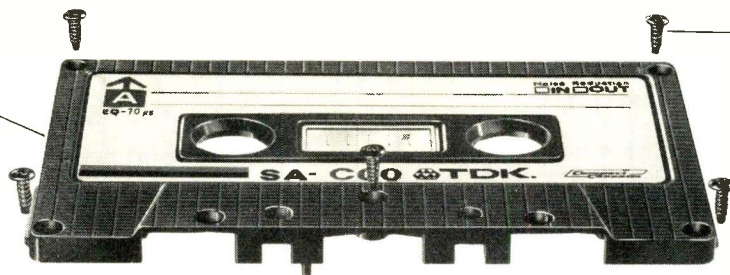


P. BURCH

To get a superb performance, you need a precision machine.

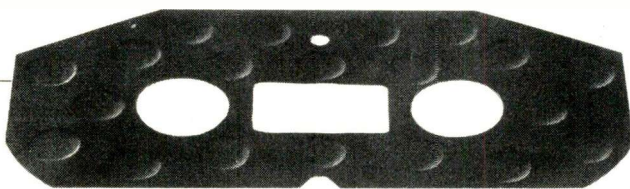
To command a great performance, a cassette shell and cassette tape must be engineered to the most rigorous standards. Which explains why we get so finicky about details. Consider:

Precision Molded Cassette Shells—are made by continuously monitored injection molding that virtually assures a mirror-image parallel match. That's insurance against signal overlap or channel loss in record or playback from A to B sides. Further insurance: high impact styrene that resists temperature extremes and sudden stress.



Five-Screw Assembly—for practically guaranteed warp-free mating of the cassette halves. Then nothing—no dust or tape snags—can come between the tape and a perfect performance.

An Ingenious Bubble Surface Liner Sheet—commands the tape to follow a consistent running angle with gentle, fingertip-embossed cushions. Costly lubricants forestall drag, shedding, friction, edgewear, and annoying squeal. Checks channel loss and dropouts.

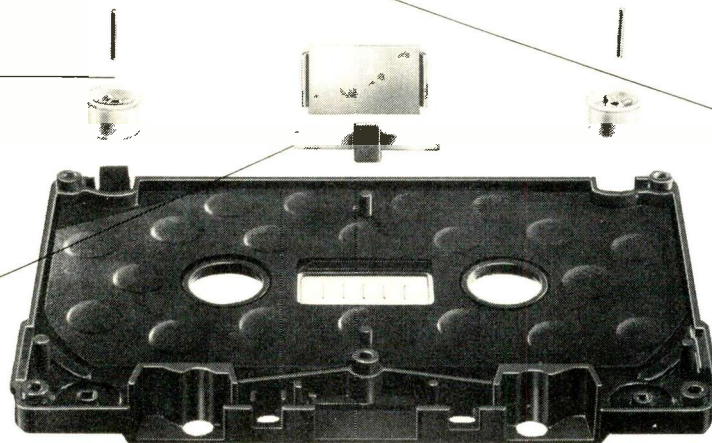


Perfectly Circular Hubs and Double Clamp System—insures there is no deviation from circularity that could result in tape tension variation producing wow and flutter and dropouts. The clamp wedges the tape to the hub with a curvature impeccably matched to the hub's perimeter.



Head Cleaning Leader Tape—knocks off foreign matter that might interfere with superior tape performance, and prepares the heads for...

Tapered, Flanged Rollers—direct the tape from the hubs and program it against any up and down movement on its path towards the heads. Stainless steel pins minimize friction and avert wow and flutter, channel loss.

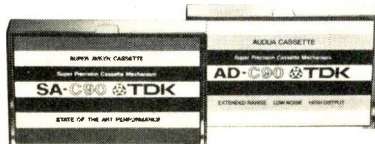


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You will believe, though, that in very short order I was suggesting to our editor it was FM time once again and how about me trying a brand-new state-of-the-market FM tuner (with repaired antenna) to see what was going on now in the same old location, same 100 miles, via the same old ears? With my antenna once more aimed at New York, there ought to be solid improvements in tuner performance, I said, and I hoped. Result: The Pioneer TX-9500 II AM/FM tuner, the first of the current breed I've tried since the big hiatus, when I fell dormant like the fig tree.

This big machine (dimensionally the largest I've had) is, with its tricky new circuits and special controls, representative of the present and very advanced state of FM tuners. I have been astonished, delighted, exasperated, and intrigued by turns, as the unit has gone to work in my time-honored spot right where the great tuners of older days worked so well for me. But this one did better. It even brought me listenable 100-mile stereo. More on that at a later date.

Of course, it picked up my new New York station with ease. In fact, the first day I did a rush hookup to an indoor attic antenna that was orientated crosswise (to get a station I often used for weather info) and even so I got instant complete limiting in mono for New York with no audible interference. Selectivity, in the narrow-band position — Pioneer and others offer wide-band and narrow-band i.f. — for precisely this sort of situation as well as the easy tuning sort. Ha! My two monsters had vanished.

When the repaired and reorientated roof antenna was hooked in, I found that every New York station I knew peaked out on the signal-strength meter at between 3 and 5 on a scale of 5 (full mono limiting begins just beyond 1) and most were up in the near-saturation range (marked by a heavy black bar) between 4 and 5. That, my friends, is what sensitivity can do, along with selectivity, for us distant country listeners. At 100 miles! Right there, I figured my FM update was a success.

Citified Sound

It occurs to me, as I write this, that what most of us hear about FM is geared strictly to what's nearby and metropolitan. Reading the accounts, you wouldn't think there was any FM beyond those far-distant suburbs of the big and the little burgs, all of 20 or 25 miles out. (Same with the weather info. Rain in New York, they say, maybe some snow in the Northern sub-

urbs, and we get two feet up here.) FM, at least in words, is city bound.

Now it is true that most do live in cities and therefore us country folks are a minority. Who needs minorities in a booming market? (Well, even in a non-booming market.) But we do exist, and I often wonder how you people out in the great Western open spaces manage to get along with your FM. There is, of course, the universal law of diminishing returns: The fewer the inhabitants, the fewer the stations to interfere with your distance reception. With us, in the Northeast, it's war, a concentration of stations that leaves nothing to, shall I say, chance. The slightest weakness, the mildest misalignment, the tiniest overproduction of transmitter signal, and there's a sonic massacre. Outside the city, I mean.

In the city, FM tends to be much like TV. You get only the city stations — everything else in the whole wide country is swallowed up and silent. Every local station comes in whammo on the meter and like cat's paws out of your speaker via muting — which always works. (In the country, muting circuits neatly knock out all but the noisiest rock stations.) Your city problems are not a hundred FM competitors all over the place but very nearby things like trucks in the streets, elevators, refrigerators, and most of all, multi-path reflections from all those buildings. It's a world in itself, this city listening, and for us who are outside often strange and hard to believe. So it is no wonder that good tuner makers provide all the circuitry they can to help the city people with their special problems. Notably on the 9500 II, a 75-ohm unbalanced antenna input in addition to the usual two-way balanced 300-ohm connection. Also a whole section of multi-path test circuitry, built right into the tuner. One part of it works by ear, at the flip of a front switch, so you can adjust your antenna for minimum multi. With more finesse, there's an output for a scope whereby you may look right at the multi-path element and, hopefully, do something about it. The circuit itself can't do a thing.

I flipped the multi-path switch a couple of times and hastily flipped it back again — such a roar of distortion! So we, too, have multi-path. But it isn't likely to be off buildings, if my geometry is any good. At 100 miles a skyscraper reflection near the transmitter might look like part of the point source. But we do have mountains. And do we have planes! In the city, a plane every half minute is nothing but the signals mostly override, as they do

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on TV, and only a few get through to the screen or the ears. Out in the country, where signals are enormously attenuated (and more credit to the currently ultra-sensitive tuners), these transient multi-path plane reflections can be very annoying. Horridly pulsing swishes. You can't really adjust your antenna to them, unless you mount it on a telescope and lie in wait. So I'm leaving multi-path for later experiments, when I can get back up on the roof again.

Country Color

Country FM, in spite of all this, is a challenge and often intensely interesting when you put your mind to it. We get a lot more variety and plenty of variously local color, even if much of it is bedraggled with interference and/or drowned in sawtoothed noise. We even get distance, of a sort. I got Norfolk only once — a shortwave-type freak. But Wilmington, Delaware, used to pester me right next to New York's WNYC (and right behind it directionally), sometimes overlapping its signal with ours. (What — there isn't supposed to be any overlap? Says you!) And that's over 150 miles, maybe nearer 200. It does happen and often with (temporary) full limiting. In mono, of course.

I am unable to hear a sound from the whole expanse of Northern and Middle New England because, unfortunately, there is a hill right behind my house to the NE and it must be made of solid iron; this is iron country and used to be a mining center in the early days. But to the South and West, downhill (I am up a few thousand feet), I have a whole panorama of the good and the bad, the best and the worst of the great Northeast Corridor. Mostly, alas, the worst.

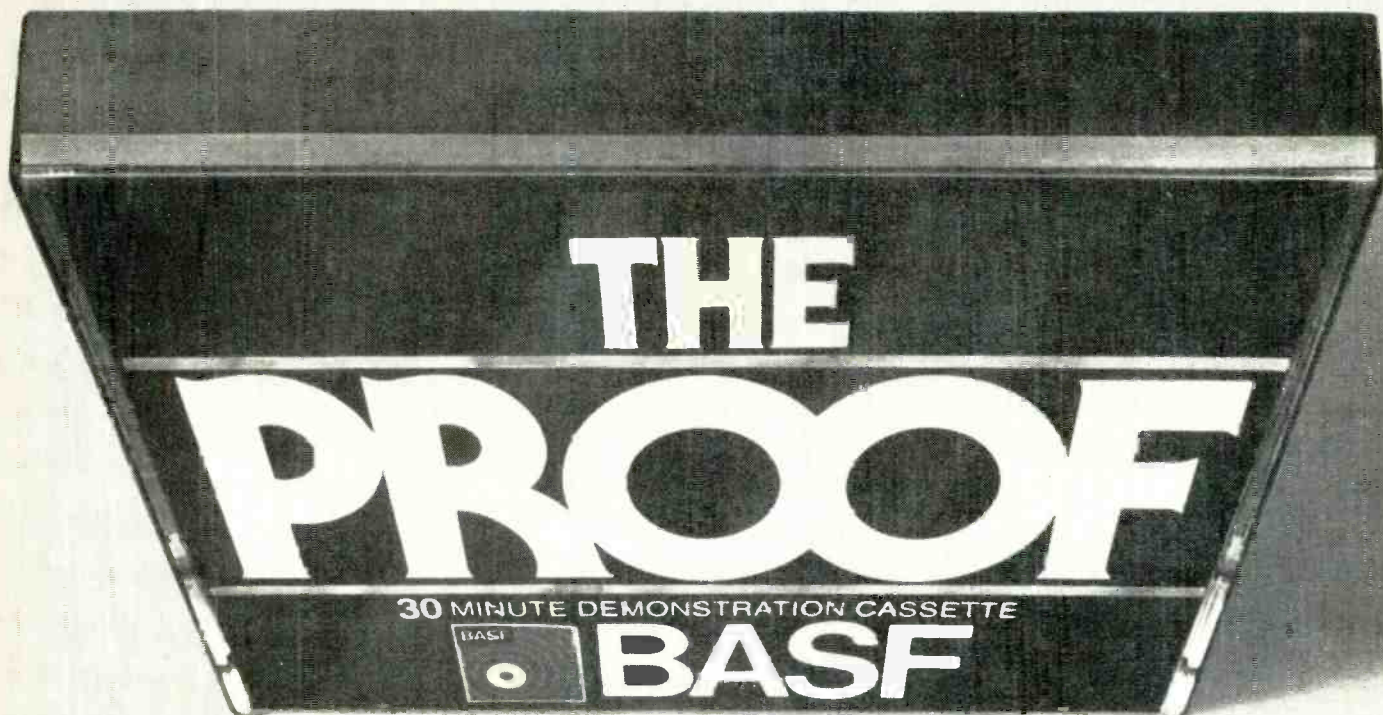
What I notice most of all now, as compared to a few years back, is the proliferation of — well, need I say more? I am aware that right now at those very stations, there are some of our engineer readers busy perusing this very page, so I must keep my big trap half shut. But really —! Such noises. Most tuners provide a good big signal-strength meter and another for tuning, and over the years I myself have learned to read meters even faster than music. What comes forth from some of these new stations not only insults my meters, but my ears too. You should see the levels, for a similar signal strength, as I read my Sony 2010 (two and four channels, four meters, very useful switches). Without any doubt, my ears and eyes tell me, the louder the levels, relatively speaking,

the uglier the sound. And I will NOT blame either Pioneer or Sony or any other element of my good hi fi for the hideous blasts I have been getting out of this latest FM listening. I'll say no more, for fear of sliding into a technical morass. *You argue.*

Yea, I know. The more the level, the more attention you get. Not from me, brother.

Curiously (and just to show you how impartial I am — well, fairly impartial), the "beautiful music" background stations within my range not only run at lower over-all levels, it seems, but also produce a far cleaner and nicer sound. This surely is deliberate and in the nature of the programming. Rock/pop/country music, automated or no, is not put out to lull anybody to sleep at the receiving end, least of all the jumping teenager. On the other hand, "beautiful music" by its very nature is designed to soothe the troubled ear. Too bad I'm allergic to it. So, of course, the engineering department goes out of its way (with pleasure) to produce a lovely, smooth, gentled signal, with those silky violins sneaking along the top. So clean indeed that you don't even know it's there — not consciously, anyhow. Or am I crazy? That's what my ears tell me. When I am conscious, that is.

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And all BASF Pro-Series cassettes have a patented Security Mechanism™ for jam-proof performance.

Sensitivity is impossible to prove on paper. But easy to prove by simply going to your audio dealer and asking for The Proof. Or, you can send for it. Either way, once you hear it we're sure you'll believe it.

TO HEAR IT IS TO BELIEVE IT™



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Send \$3.50 with this coupon to: The Proof, Box 18367, Boston, MA 02118. We'll send you The Proof (Professional II C-90, \$4.99 value). Or, for a free demonstration of The Proof, bring this coupon to your audio dealer.

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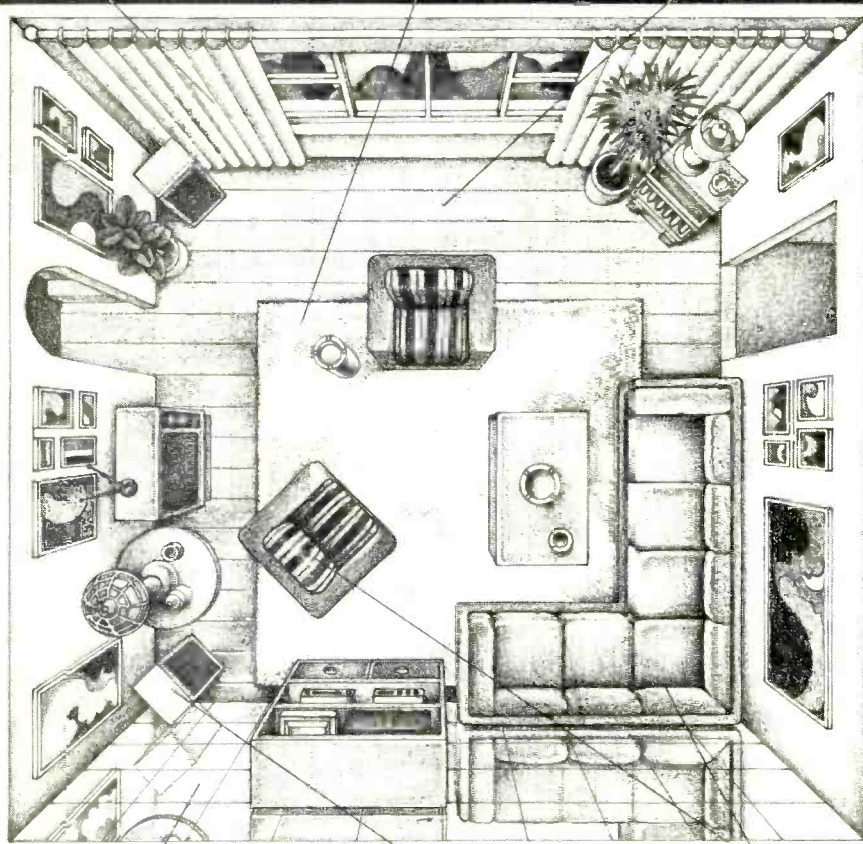
THE INVENTOR OF MAGNETIC TAPE.

Fine tune your living room.

Drapes muffle lows.

Rugs soak up lows.

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Poorly placed speakers, poor sound.

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Your stereo probably doesn't have the sound you thought you bought. Because you first heard it in a sound room. Unfortunately, most stereos are set up in rooms designed for living. Not listening.

That's why you need a Sound Shaper® One or Two. The frequency equalizers that re-shape music to fit your ears. And your living room.

Sound Shaper One has ten frequency controls, five for each stereo channel. And beautiful styling. But if your system is more sophisticated, you'll want Sound Shaper Two Mk I with twenty-four frequency controls (twelve for each stereo channel). Plus, internal switching and monitoring. So highlight the vocal. Suppress the bass. Wipe out the flute entirely. And if you want the professional touch, get the new SLM-2 Sound Level Meter. With it, sound levels can be read directly on the Sound Shaper Two, so no longer will you have to run back and forth between the listening area and the equalizer.

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Classical Connoisseur


As for classical music, that vast area is my own favorite and my delight (when it is good), and we do have it in our region more than most, except on the other coast. Not only the three or four full-time outlets in New York but a number of Public Radio stations over to the West, 80 miles or more into New York State and even up into Massachusetts, at the edge of my iron hill.

Now, I have long understood, myself, that as an audio signal almost any classical music runs at an average level far below that of pop music, which is basically designed for efficient audio reproduction. In comparison, the classical stuff usually sounds weak, as it should. There's also the huge dynamic range of the heavier classics, meaning a "ceiling" that puts the dynamic floor 'way down — or leads to vitiation via limiters. Problems for records, even worse on the air. But this isn't all. By its nature (not intended for audio sound) much reproduced classical music actually sounds less loud to the ear than it reads on the meter. Less punch, if more content.

You can hear all this only too easily as you wheel across the FM dial. The classical stations often sound thin and ineffective as you pass by them from the adjacent noise stations (if you will pardon the phrase). Too bad, because a lot of new listeners think it's classical's fault.

Not really. It wasn't designed for broadcast. Yet even so, with (a) some understanding and (b) a maximum of technical ingenuity, both in the broadcasting and in the receiving, your classical music can come very much into its own via radio as thousands of our readers know.

Who cares, after all, if that nasty station next on the dial is much louder — just so long as it doesn't interfere when the classical music is playing. You can always turn up the volume control. For this, the tuner manufacturers are helping us enormously with their newly high-selective circuit designs, to keep all that noise in its rightful place. Which means you can take it. Or leave it. Period. Even at 100 miles and the competition much nearer. Am I glad. And thanks, you tuner makers.

Well, I do declare. Speaking of fig trees, I have one right at my elbow. When I brought it inside last fall it went dormant, dropping all its leaves. I just looked and, do you know, the thing is putting out green buds, right at the bottom of winter. It must be frequency modulated. More on FM next month. And on 100-mile stereo. 

We just can't quit when we're ahead.



Consider the Sony Audio PS-X70 turntable.

Think of it as a professional transcription turntable, for home use. At a price your audio conscious home can afford.

Think about two discrete servo-controlled motors. One for the platter. Another for the tonearm.

And while you're thinking about motors, think about Sony's hesitation-free BSL motor. No brushes. No slots. And absolutely no cogging. Just even, uniform rotation. Hour after hour. Year after year.

Our own Quartz-locked Magnedisc servo control system makes Sony direct-drive turntables immune to voltage fluctuations. It takes servo control to a new level of accuracy, by measuring turntable speed at the outer rim of the platter—not at the motor.

There's more you should know: front-mounted feather-touch

controls, electro-magnetic braking, special four-clamp head-shell connector, even resonance-free SBMC cabinet with fluid-filled feet to eliminate acoustic feedback.

But perhaps the most amazing thing about our PS-X70 is that it's not alone.

It's just the top of our line. A whole line of new Sony Audio turntables, most of which have most of the features we've listed here.

And every one is designed as a system. With electronic, magnetic, and mechanical technologies contributing to a balanced level of audio performance no single innovation could achieve.

We know about turntable innovation. We practically wrote the book: direct drive, servo control,

Quartz lock, carbon fiber tonearm, Sony gave you them all. Long before almost anyone knew they existed.

But we also know that innovation alone can't make a great audio component. Sound makes a great audio component.

Like the sound you get from our PS-X70 turntable.

Quit, just because we're ahead? Not Sony Audio. Not on your life.

SONY AUDIO

Sony Industries, 9 West 57th Street, N.Y., N.Y. 10019.
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Enter No. 53 on Reader Service Card

What's new



Revox Amplifier

The Model B750 is an integrated amplifier with an output of 80 watts into 8 ohms and a frequency response from 20 Hz to 20 kHz, ± 0.5 dB. The THD is rated at 0.2 percent, and the S/N ratio better than 90 dB, unweighted. A switch separates the preamplifier and power amplifier permitting their use via individual input and output connectors. Price: \$999.00.

Enter No. 71 on Reader Service Card

RF Products Tape Reels

22

The Model 1805-17 10½-in. metal tape reels and the Model 2809-9 7-in. reels offer a positive means of attaching the beginning tape end to the reel in preparation for takeup; the device automatically releases the tape at the end of the rewind cycle. The satin-anodized aluminum reels are for either takeup or supply, and are available with either the EIA or NAB mounting. Prices: Model 1805-17, \$16.75; Model 1809-9, \$13.95.

Enter No. 72 on Reader Service Card

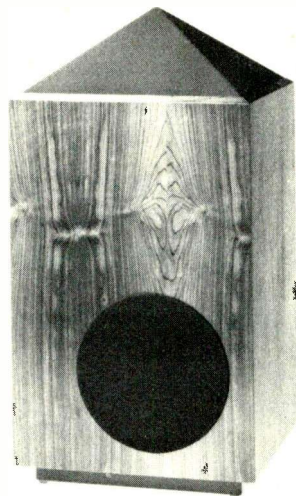


Electronic Specialists Surge Suppressor

The Isolator is designed to protect audio components from power line surges and disruptive power line hash. Featuring three individually filtered a.c. sockets, each isolated from the others, the unit can accommodate a

total of 1875 watts, with each socket handling up to 1000 watts. Price: \$49.95.

Enter No. 73 on Reader Service Card



Shahinian Speaker

The Obelisk is a two-way, passive-radiator speaker system with an 8-in. woofer and three 1-in. mylar dome tweeters. The frequency response is 35 Hz to 18 kHz, +2, -3 dB, with a nominal impedance of 6 ohms. Power handling capability is 150 watts with a minimum recommended power of 10 watts. Price: \$350.00.

Enter No. 74 on Reader Service Card

Pedersen Acoustics Speaker System

The Model HF 1 utilizes a 15-in. woofer, two 2-in. soft dome midranges, and a 1½-in. dome tweeter. Frequency response is 20 Hz to 20 kHz, and crossovers are at 350 Hz and 3.5 kHz. The enclosure is a folded horn below 350 Hz and a direct radiator above. Efficiency is 98 dB for 1 watt/1 meter on axis at 1 kHz. The system features passively filtered electronic equalization and bi-amp capability with independent level controls. Suggested minimum amp power is 25 W rms, maximum 150 W. Finished in walnut, each unit weighs 350 lbs. Price: \$6000.00 per pair.

Enter No. 75 on Reader Service Card



Mayware/Polk Tonearm

The Formula 4 MK III tonearm features a redesigned, rigid low-mass construction, lower height with optimal damping capacity, a removable non-resonant headshell, leadout wires and cartridge tags, an integrated arm rest, geometrical optimization for minimum distortion from 12-in. discs, and adaptor plates for easy installation on turntables with SME-type cut outs, such as Technics SL150, Thorens TD160, Lux, etc. Price: \$179.95.

Enter No. 76 on Reader Service Card



Audiocean Meter

The Model PW 500 is a continuous-reading, digital, peak-power watt meter for use while the system is in operation. The unit has two modes of operation: *Manual* shows new peak readings the instant they occur, while *Auto* updates the readings each second. Two ranges of operation are provided: The first range measures in 0.1-watt increments from 0-100 watts, while the second range measures from 0-500 watts in 1-watt increments. Price: \$299.00.

Enter No. 77 on Reader Service Card

B & O Cassette Deck

The Beocord 500 cassette deck features Danish design in rosewood, a polished-steel control panel, and a smoked-plexiglass lid. Touch controls are featured, along an electronic fade-in/fade-out control, a high accuracy tape transport system, an automatic demagnetizing tape head, and an automatic stop. Price: \$595.00.

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excellence. Society recordings are selected by experts and supported by critics worldwide.

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Heritage Review magazine. Issued every 3 weeks (18 times a year), this definitive publication contains the Society's latest releases along with over 1200 pages annually of news, reviews and colorful editorial coverage of great music from all periods.

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23

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■ Two, sometimes three musical selections will be scheduled for you to audition—without obligation—from each issue of the *Review*. To accept these audition selections, do nothing. They will automatically be shipped to you to audition free. But if you'd prefer an alternate selection, or none at all, just return the RESPONSE FORM included in each issue of the *Review*.

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Mail this application to:

Musical Heritage Society Dept. AU001
Musical Heritage Society Building
14 Park Road
Tinton Falls, New Jersey 07724

YES. I would like to become a member of the Musical Heritage Society.

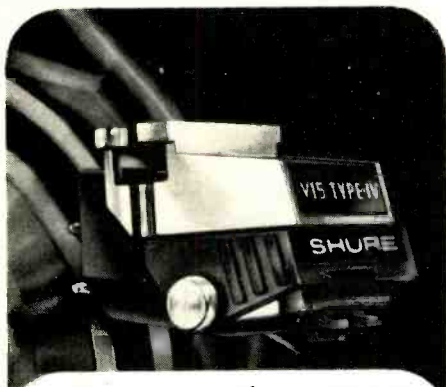
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fact: the IV does more... much more!

Era IV begins! The new Shure V15 Type IV phono cartridge is an altogether new phono cartridge system that exceeds previous performance levels by a significant degree — not merely in one parameter but in totality. The Type IV offers:

- Demonstrably improved trackability across the entire audible spectrum.
- Dynamically stabilized tracking overcomes record-warp caused problems, such as fluctuating tracking force, varying tracking angle, and wow.
- Electrostatic neutralization of the record surface minimizes clicks and pops due to static discharge, electrostatic attraction of the cartridge to the record, and attraction of dust to the record.
- An effective dust and lint removal system.
- A Hyperelliptical stylus tip configuration dramatically reduces both harmonic and intermodulation distortion.
- Ultra-flat response — individually tested.

V15 Type IV **SUPER TRACK IV** Stereo Dynetic® Phono Cartridge

For complete details on this remarkable new cartridge write for the V15 Type IV Product Brochure (ask for AL569) and read the exciting facts on the V15 IV for yourself.



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Manufacturers of high fidelity components, microphones, sound systems, and related circuitry.

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Sonic Systems Speaker

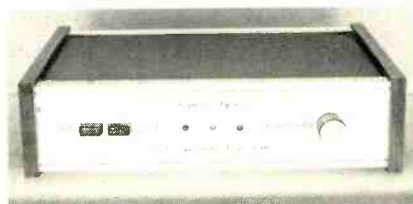
The Monitor loudspeaker system has a ported reflex enclosure utilizing a 12-in. woofer and compression high frequency driver. Set up for bi-amping, the crossover point is 1200 Hz with an 8-ohm nominal impedance. Frequency response is 45 Hz to 18 kHz, ± 4 dB, and efficiency is 92 dB SPL for 1 watt at one meter. Peak power handling capability is 250 watts, while minimum recommended power is 10 watts. Price: \$1195.00 per pair.

Enter No. 109 on Reader Service Card

DB Power Amp

The DB-6 power amplifier has 40 W rms power, both channels driven into 8 ohms. THD with full power at 8 ohms is less than 0.003 percent from 20 Hz - 20 kHz, TIM distortion less than 0.04 percent, IM distortion less than 0.002 percent, frequency response 20 Hz - 40 kHz, $+0, -1$ dB, and the slew rate is greater than $15V/\mu S$. The unit also features a Butterworth subsonic filter with -12 dB/octave slope down 3 dB at 15 Hz, and instantaneous peak reading LEDs, loudspeaker protection fuses enclosed in the feedback loop, and no relays. Price: \$650.00.

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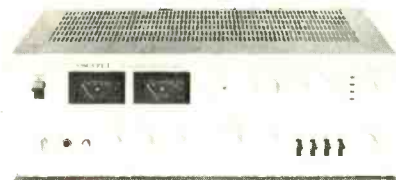


Logical Systems Noise Filter

The Model 8800 dynamic noise filter is designed to provide up to 15 dB hiss reduction at 10 kHz with a maximum filter slope of 9 dB/octave. Connected

to either a preamp or receiver, the circuit contains a low-pass filter whose bandwidth is continually changing to accommodate the music and eliminate noise. At maximum bandwidth, the filter response is flat ± 0.5 dB. Price: \$249.00

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Scott Amplifier

The Model 480A is a 85 watt integrated amplifier with an 0.03 percent THD, two independent phono preamplifiers, separate input and record rotary selector switches permit the user to record from any one function while simultaneously listening to any other, and active subsonic and high filters. The unit also includes dual logarithmic power meters reading in watts and dBW, and bass, midrange, and treble controls that may be bypassed for completely flat response. Price: \$449.95.

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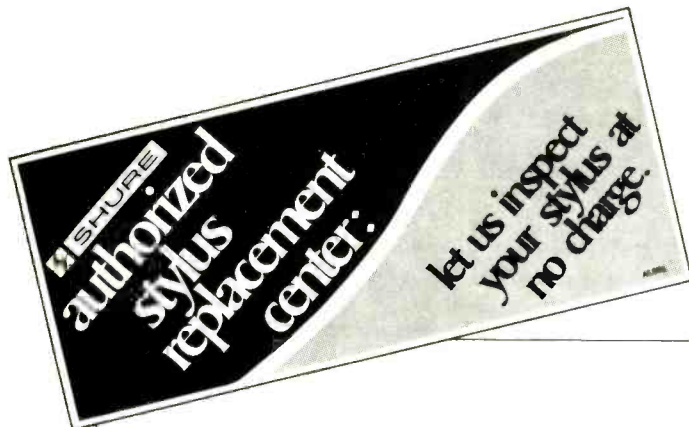


Martin Loudspeaker

The Gamma 310 is a three-way loudspeaker system with a 10-in. woofer, a convex midrange, and a compression horn tweeter. The system, rated at 8 ohms impedance, carries a five-year warranty. Price: \$179.00.

Enter No. 113 on Reader Service Card

fact: February and March are be-kind-to-your-records/ check-your-stylus months...



FREE! Stylus inspection and cleaning wherever you see this sign:

A cartridge is forever—your stylus isn't! Even though you can't see stylus wear, it affects the performance of your entire hi-fi system. A worn stylus could even ruin your records! We urge you to have your stylus professionally inspected *no less than once a year.*

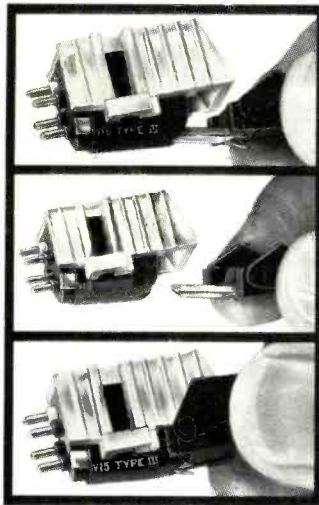
During February and March, audio dealers displaying this sign will have trained personnel and the equipment necessary to examine your stylus for wear or damage. They'll professionally clean your stylus and tell you if it's time to replace it.

Stylus replacement is very simple and requires no tools or special skills. To remove, grasp the stylus grip between the thumb and forefinger. Gently withdraw the stylus by pulling it forward out of the cartridge.

To replace, grasp the stylus grip between thumb and forefinger and insert into stylus socket. Press the stylus into the socket until the molded housing of the stylus touches the cartridge case.

To prevent damage to the stylus tip or shank, be careful not to allow the finger to slip off the stylus grip.

NOTE: Stylus guard when present should be in "down" position when replacing stylus.



FREE! stylus cleaning brush

A practical and safe way to clean your stylus! Synthetic bristles with the right amount of stiffness to remove dust and lint buildup efficiently without damaging the stylus tip. Free when you have your stylus inspected at a participating Shure dealer.

Bring your cartridge back to original specs

The performance of your cartridge depends largely on the stylus assembly and only a genuine Shure replacement stylus can restore your cartridge to its original performance! Give your record collection the protection it deserves, insist on the words "This Stereo Dynetic® stylus is precision manufactured by Shure Brothers Inc." on the box, and the name SHURE on the replacement stylus you buy. Don't settle for substitutes—your record collection is too valuable!



Replacement styli by ...



Special Note:

Genuine Shure replacement styli are available for virtually *all* Shure stereo magnetic cartridges—whatever their age. If your dealer doesn't have yours, write to us.

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Behind the scenes

Bert Whyte

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In my report on the Audio Engineering Society's 61st convention last month, I gave priority to the exciting new developments in digital technology. I sincerely believe such concentration is completely warranted in light of the profound changes that will be wrought when the audio industry converts to the digital realm. These changes are already in progress, and the onrush of digital technology will not be impeded by the cynics and naysayers and those who hide their heads in the familiar and comforting world of analog audio. How well I remember the die-hard mossbacks of the monophonic era who had to be dragged, kicking and screaming, into the realm of stereophonic sound!

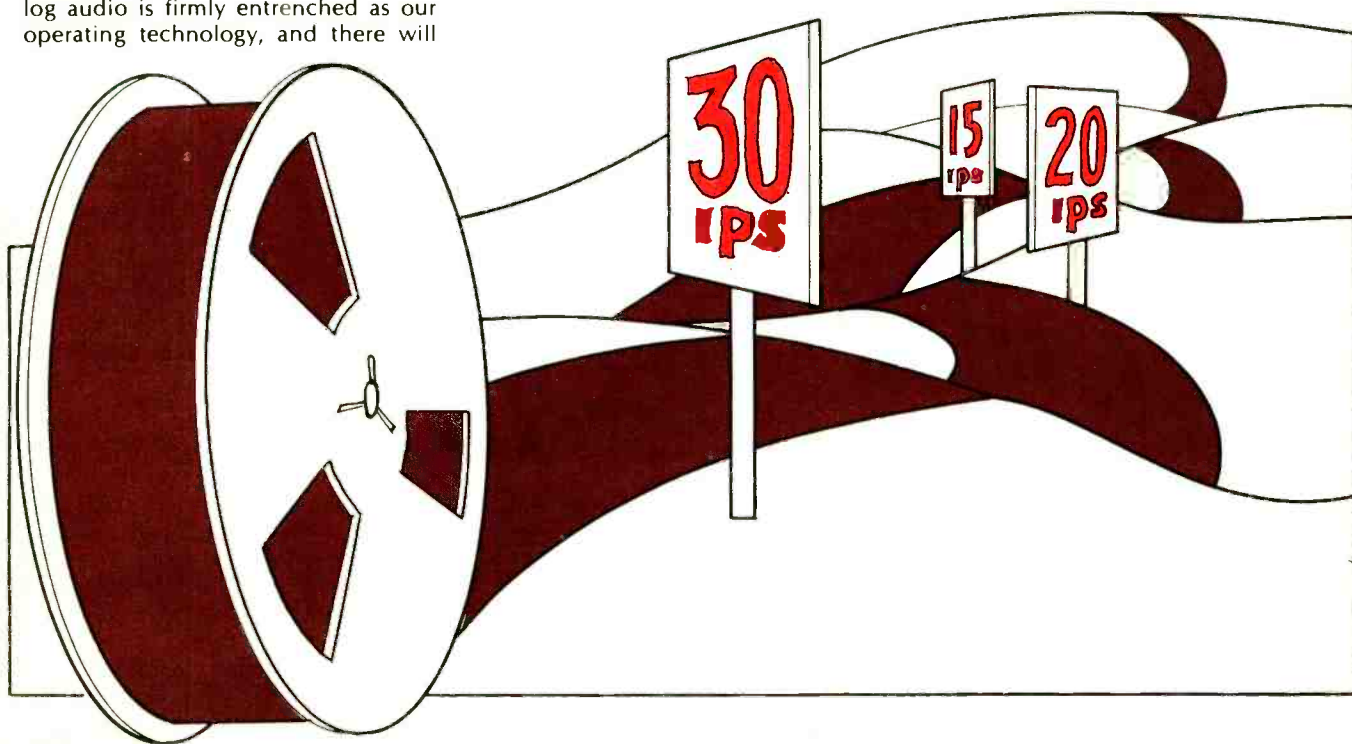
New Tape Speed

While the evidence on every hand indicates that digital technology will become the dominant factor in audio much sooner than most engineers anticipated, it is also obvious that analog audio is firmly entrenched as our operating technology, and there will

be ongoing developments in analog audio for some time to come. Some significant examples of progress in analog audio were on display at the 61st AES convention at the Waldorf. Perhaps the most eyebrow raising item was the MCI introduction of their JH-32 studio tape recorder, utilizing 32 tracks on three-inch wide magnetic tape, with standard tape speeds of 15 and 30 ips, and the entirely new tape speed of 20 ips. A number of companies have been experimenting with studio tape transports designed to handle tape widths beyond the 2-inch industry maximum. Several years ago when I visited the Studer plant in Switzerland, they had a 3-inch transport. They and some others apparently didn't pursue these projects, and there were some reports concerning problems of tape skew with ultra-wide tape. Some years ago I struggled to lift a reel of *six-inch wide* tape, which I

was shown by a tape manufacturer and which I fervently hoped was a gag!

Evidently MCI has conquered any tape skew problems, since the JH-32 is a production model. The 20-ips speed is an interesting development inasmuch as some people with variable drive equipment on their recorders have been using them to provide speeds of 22-23 ips, in the interest of tape economy, as compared to the usual 30 ips. I have no idea what they did to modify equalization for these oddball tape speeds. In providing 20 ips as a standard tape speed on the JH-32 recorder, MCI presumably has worked out complementary equalization. The combination of the 3-inch tape and the 20-ips tape speed evidently allows 32 tracks to be recorded



THE JVC QUARTZ-LOCKED TURNTABLE.

First we invented it. Now we've made it more precise than ever.

The turntable evolution comes full swing with the introduction of the new Quartz turntable series. We introduced the first quartz-controlled turntable in 1974, and we've been improving our designs ever since. Including:

Super Servo Frequency Generator

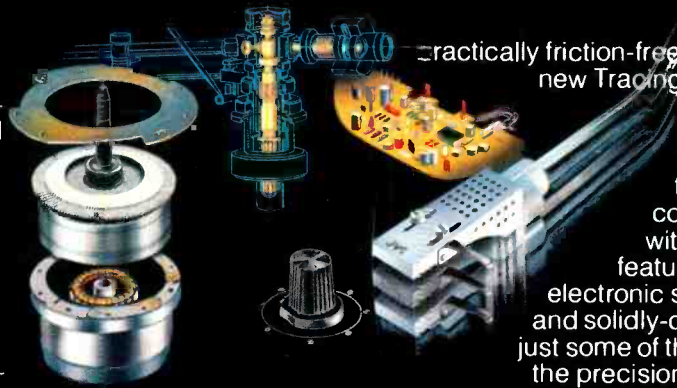
To detect minute variations in platter speed, and send corrective information to the electronic circuit controlling turntable rotation, it provides near-perfect speed accuracy. And, our Super Servo is factory-set for years of accurate, dependable use.

Direct Drive DC Servomotor

For quick-start/stop and high-torque operation. Our powerful motor drive system and its companion speed-monitoring circuits reduce wow-and-flutter and speed drift nearly to the vanishing point.

Gimbal Support and TH Tone Arm

Our exclusive unipivot gimbal support holds the tone arm firmly, yet is



practically friction-free. We also developed a new Tracing Hold (TH) tone arm to provide stability and tracing accuracy needed for a cartridge to follow even the most complex record grooves without error. These, plus features like digital readout, electronic switching mechanisms and solidly-constructed bases, are just some of the reasons to consider the precision of JVC's Quartz-Lock series for your music system.

And you can choose from manual, semi-automatic or totally-automatic models—JVC's most comprehensive turntable line ever.

See them at your JVC dealer soon.
JVC America Company, Div. of US JVC Corp., 58-75 Queens Midtown Expwy., Maspeth, N.Y. 11378. Canada: JVC Electronics of Canada, Ltd., Ont.

JVC



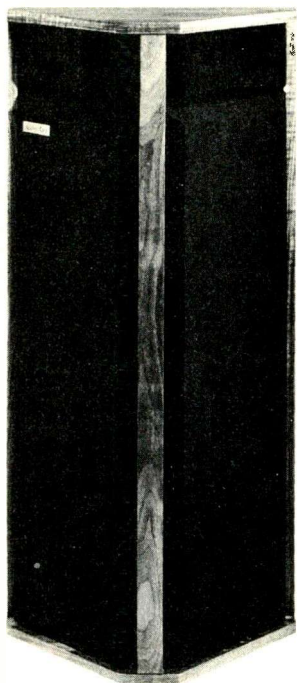
QL-A7



QL-F4

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A problem solved



ALLISON ONE \$420*

28

Research on the room-loudspeaker interaction has shown that reflected impedance from the room boundaries increases the loudspeaker's power output at some frequencies but decreases it significantly at others. These effects simply do not exist in anechoic chambers, where loudspeakers are commonly tested, and so have gone undetected. But typically the variation in power delivered to an actual room is 6 to 12 dB within the woofer range.

ALLISON loudspeaker systems virtually eliminate variations in low frequency power output in the environment that really matters: a room for listening to music. The result is an improvement by one order of magnitude in the accuracy of the reproduced sound field.

Complete technical specifications for all Allison loudspeaker systems, and a statement of Full Warranty for Five Years, are available in our new catalog (free on request).

ALLISON ACOUSTICS

7 Tech Circle, Natick, Massachusetts 01760

*Higher in West and South

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with the equivalent fidelity of the MCI 24 track/2-inch recorder. While quite a few studios have been running two 24-track recorders in tandem, with 2 tracks used as control tracks in the lock/sync mode for a total of 46 tracks, some engineers feel this is a rather cumbersome expedient. No doubt many devotees of multi-track recording will welcome the flexibility afforded by this new MCI JH-32 recorder, but you can bet that some "far out" engineer will realize that two of these JH-32 units can be "synchro-locked," for a mind-boggling total of 62 tracks!

While we are discussing multi-track professional tape recorders, if you have ever done a complete alignment on a two- or a four-channel tape recorder head, you can only imagine how tedious and time consuming a task this is for a 24-track head assembly. An interesting new device for alleviating this problem is the Promix One multi-track head mounting assembly, manufactured by Grandy, Inc., of Fairfield, N.J. When the standard head mounting is replaced by the Promix One, the head adjustments for azimuth, zenith, tape wrap, and track height are independently handled by a linear-type control, with easy-to-handle knurled knobs for most of the adjustments, rather than the usual fumbly Allen wrenches. Grandy also builds a complete line of replacement heads and is also well-known for its head-relapping services.

In the area of smaller open-reel tape recorders, Technics was showing its RS-1800, an offshoot of its RS-1500 isolated-loop recorder, featuring tape speeds up to 30 ips, quartz-lock pitch control, and automatic adjustment of bias and equalization for the various tape formulations. Tandberg was showing its TD20A open-reel recorder, which we reported on some time ago, and which, if you recall, can handle the new metal particle tape. Unfortunately, the tape was a "no show" and thus no demo, except for a fine presentation with conventional tape. Otari has an open-reel deck, the MX5050-B which also features automatic equalization adjustment, a facility that appears to be gaining favor and which will feature prominently in quite a number of cassette recorders at the WCES at Las Vegas.

Metafine Tape

Speaking of metal particle tape, one of the most impressive demonstrations at the AES convention was Inovonics' duplication setup, which had masters duped onto 3M Metafine cassettes, using both Dolby and dbx noise reduc-

tion. If you confine the results to Dolby which, after all, is the noise reduction system most commonly in use in cassette recorders, the approximately 3 to 5 dB more output afforded by the Metafine permits a S/N ratio and dynamic range that clearly can put pre-recorded cassettes into head-to-head competition with the best disc recordings. Of course, it was quickly pointed out, that while these Metafine dupes were of very high quality, the demonstration was strictly an exercise in technology, as it is highly unlikely there would be any demand for pre-recorded cassettes using metal particle tape. This assumption is based on what the consumer would have to be charged for such a product, in consideration of the high cost of the metal particle duplicating tape, and the equipment modifications that would be necessary in the duping setup. Well, I disagree 100 percent with this idea. In the first place, as we go to press we have word from 3M on the pricing of their first Metafine cassettes. It is a pleasant surprise to report that the prices are substantially less than anticipated . . . the C60 Metafine to sell at \$6.95 and the C90 to sell at \$8.95. Now remember, these are the retail list prices to the consumer. Remove the retailer's profit, jobber's profit if that applies, and the quantity discounts which would be available to a duplication house, and the price, while still quite high, would not be all *that* deterring. Especially since I can virtually guarantee to the recording companies that the audiophiles will gladly pay a premium . . . and I mean a substantial premium . . . for metal particle pre-recorded Dolbyized cassettes of really high quality. And that is what a metal particle pre-recorded cassette would be . . . a premium product for the audiophile. Give him a cassette with S/N ratio and dynamic range that can be superior to a disc, that does not have the ticks and pops, that does not have the wear problems or the warp problems of a disc, and believe me, oh thou record company executives, you have a highly salable product.

Amplifiers

Amplifiers at the AES conventions are usually of the type involved in PA applications, with a smattering of types of interest to the audiophile. This year, there was a change in the overall coverage, with more emphasis on high quality units for the audiophile and monitoring markets. Sansui has formed a Professional division to market its new high power B1 amplifier, for which slew rates as high

AUDIO • March 1979

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The RS2010, below, has great performance specs like superb 1.7 μ V (9.8 dBf) FM sensitivity, and plenty of power (100 watts min. RMS per channel, into 3 ohms, 20-20,000 Hz, with no more than 0.09% total harmonic distortion). Other models are available from 30 to 150 watts per channel.

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as 1000 volts/μS are claimed. (Production models are said to run about 300V/μS.) Pioneer, taking a venture into the separates market, was showing a new non-switching amplifier, the SA8500, with a dynamic biasing circuit a la Threshold, to afford Class-A type performance of 150 watts/channel. Class-A performance claims are also made for new amplifiers from JVC (again with some innovations to achieve Class-A specs), and Technics was again showing its huge 350/watts per channel "Class-A Plus" amplifier. Both Crown and BGW showed new

"slimline" power amplifiers both with 50 watts per channel output rating.

Not too much in the way of new loudspeakers at the AES convention. However, much interest was created with what is said to be the first really new horn driver in many years, the Pioneer TAD TD4001 which has a four-inch voice coil, with four-inch beryllium diaphragm. Designed by Bart Locanthi, this driver is said to be the first computer-assisted design for a horn driver, with performance said to surpass the legendary Western Electric drivers. Osawa was showing the well-

known British LS35A BBC-type monitors made by Chartwell, along with a subwoofer, the SW-135, to augment bass response. Also demonstrated was the Chartwell PM450 studio monitor system, bi-amplified with built-in Quad 405 amplifiers. When I was a guest of Decca Records during my recent recording of the London Philharmonic, they were using this Chartwell monitor in their listening room, and it was a smooth and impressive performer in many respects.

Time Delay Units

I have reported on various delay units in past columns, including the excellent AKG BX20 and BX10 delay/reverb units. I related how I had seen a relatively inexpensive prototype unit at the AKG plant in Vienna about three years ago, but alas, it never appeared. At the AES convention, AKG was showing its BX5 2-channel reverberation unit, somewhat simplified from the earlier units, but nonetheless offering reverb times of one, two, and three seconds with provisions for mixing from full dry to full reverb. At a proposed \$1000.00, it is half again as much as the prototype I saw, but it does more, and this price is substantially less than the BX10's.

As for the ubiquitous digital delay lines, some of the units announced at several previous conventions are now reaching production. The Lexicon Prime Time Model 93 at just under \$1500.00 is now reaching dealers. I am still waiting for them to produce their digital reverb unit, which, in the demonstration I heard a year ago, produced a very realistic approximation of a concert hall ambience.

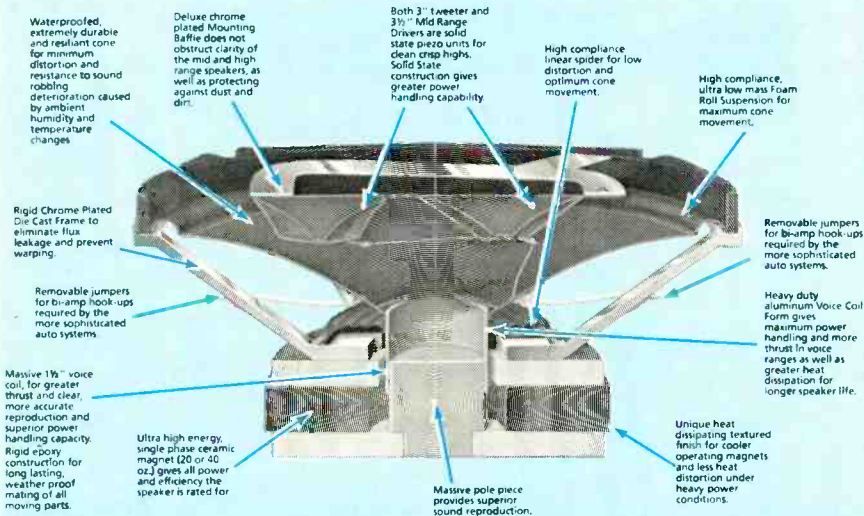
For the well-heeled Nagra owner (and you have to be in that category to own one!) there is now available from Future Film Developments in London, a portable Dolby A noise reduction system. Specifically for the stereo Nagra 4S, it mates with the recorder, weighs under 10 pounds, and is battery-powered to afford 10-hours recording in mono and six in stereo. When the capstan motor is not driving the tape, the system is on standby and uses little power. It's all yours for \$2600.00.

As usual, tons more at the 61st AES . . . I could write a book. I am off to the the WCES at Las Vegas, where the hi-fi industry is going to mount a major effort to get out of the sales doldrums that it is presently in. At last count, I have announcements on seven new cassette decks capable of handling metal particle tape, and I'm sure there will be others at the Show. It is a trend, for sure!



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COMPARISON CHART — TRUSONIC VS. COMPETITION

| FEATURE | TRUSONIC | WELL KNOWN COMPETITOR | BENEFIT | FEATURE | TRUSONIC | WELL KNOWN COMPETITOR | BENEFIT |
|-------------------|----------|-----------------------|--|---|--|--|--|
| Die Cast Frame | Yes | No | Cannot warp or bend due to heat or vibration. | Power *20 oz. | *40 RMS 80 Peak 60 RMS 120 Peak | *30 RMS 60 Peak not made | Heavier magnet structure materials coupled with an over-hung voice coil increases linearly at high power levels and enhances the bass frequency reproduction thus minimizing distortion. |
| Chrome Plate | Yes | No | Chrome plating in conjunction with die cast construction prevents rust. | Response: | | | The selection of totally solid state mid-range and tweeter elements produces superior sound in the 2,000 Hz range and beyond. Superior magnets and 50% larger voice coils provide greater low end performance. |
| Bi-Amp Capability | Yes | No | Permits hook up to the newer, more powerful dual output automotive systems being introduced. | 20 oz. 5" x 7" coax 20 oz. 6" x 9" 3-way 40 oz. 6" x 9" 3-way | 40/25,000 Hz 30/25,000 Hz 25/25,000 Hz | 50/15,000 Hz 40/20,000 Hz not made | |
| Waterproof | Yes | No | Completely waterproof design is necessary for marine and outdoor use. | Warranty | 5 Years | 1 Year | Superior construction and design insures years of flawless performance without material or sound deterioration. |
| Voice Coil | 1 1/2" | 1" | 50% larger voice coil handles greater power and reduces distortion. | Price* | \$60.00 | \$55.95 | Great performance at a comparable price. |
| Unitized Magnet | Yes | No | Offers 1.6 times more energy than stacked magnets. This permits higher efficiency. | | | | |

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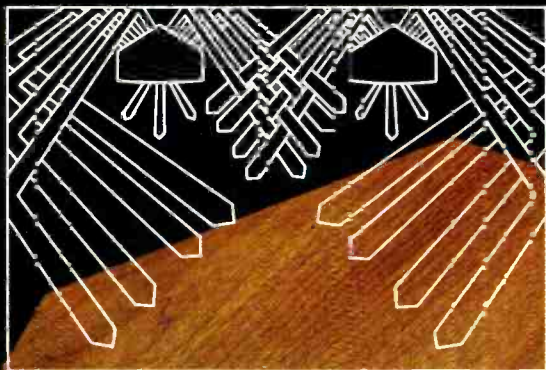
cipal effects can be isolated to specific types of frequency unbalances.

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than conventional electronics, and make possible superb performance in almost any home listening room.

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But your greatest enjoyment will surely come from the unusual sonic accuracy of these units. They are acoustically as transparent as can be imagined.

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That experience is reflected in new computer-aided circuit designs. In the *Straight Line One* phono pre-amp section, for instance, internal noise is so low that thermal noise from your cartridge will be the dominant source of noise.

This circuit technology has also made possible other features you're bound to enjoy. The phono pre-amp is a separate module, much like the system developed by Crown in the DL-2. It eliminates troublesome RFI. Note also that Crown put distortion indicators on *both* units. The amplifier has both the unique Crown IOC circuit plus new peak output voltage LED's. Front-panel speaker switching and a new concept in DC speaker protection provide flexibility of layout and security of operation at high levels.

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SPECIFICATIONS

| | Frequency Response, 20 Hz-20 KHz | Phase Response 20 Hz-20 KHz | Hum and Noise dB below rated output | | IM Distortion at rated output, Max. | Total Harmonic Distortion at rated output 20 Hz-20 KHz, Max. |
|---|----------------------------------|-----------------------------|-------------------------------------|--------------|-------------------------------------|--|
| | | | unweighted | "A" weighted | | |
| Straight Line One 2-channel pre-amplifier | ±0.1 dB | ±10° | 97 | 101 | 0.00055% | 0.0009% |
| Switching module | | | | | | |
| Phono pre-amp (RIAA) | ±0.5 dB | ±5° | 88 | 94 | 0.0005% | 0.002% |
| Power-Line One 2-channel amplifier | ±0.1 dB | +10° to -15° | 110 | 115 | 0.00095% | 0.05% |

Power rating: 50 WATTS/CH. MIN RMS INTO 8 OHMS, 20 Hz-20 KHz, THD 0.05% .
30 WATTS/CH. MIN RMS INTO 4 OHMS, 20 Hz-20 KHz, THD 0.05% .



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Any device that converts one form of energy to another is called a transducer. A phono cartridge is a transducer that converts the mechanical energy provided by a phonograph record to electrical energy delivered to an amplifier. Any transducer system can, in principle, be used as the generator of a cartridge, although in practice, there are certain constraints.

Two transducer systems dominate the cartridge market today; the ceramic or crystal-based transducer at the less expensive end of the market and variations of the magnetic transducer at the higher end. Other systems have been used, but have never really been commercially successful. This article deals with the operation of magnetic cartridges.

Interfaces

While in a theoretical discussion, it may be adequate to assume that external elements are perfect, when evaluating the ability of a cartridge to reproduce music from records, we must take into account the interaction with its interfaces. There are three important interfaces for a cartridge: The record which it is playing, the tonearm in which it is mounted, and the amplifier to which it delivers its output. Each of these interfaces sets limitations on final performance.

The record is a disc made of vinyl, with a spiral groove containing recorded information modulated into each side of

the groove wall. As the record rotates, the cartridge stylus is vibrated by the groove. It is these vibrations which must be transmitted to the amplifier in the form of electrical energy.

The tonearm is expected to position the cartridge above the record to give it ideal working conditions at all times. Its ability to do this is partly determined by the cartridge itself. This will be illustrated in the section on compliance.

The modern amplifier receiving the cartridge output has a more or less standardized sensitivity. This means that for a given groove modulation, a minimum voltage must be supplied to the amplifier. Also, the cartridge load, a parameter that follows from design details of the amplifier together with the cables connecting the cartridge to the amplifier, can affect the electrical working conditions of the cartridge.

Recorded Information

The phonograph record master is cut on a mastering lathe, using a specially made disc. After various processes, the commercial record is stamped in vinyl plastic and *should* be an exact copy of the original master.

The input to the mastering lathe is an electrical copy of the sound received at the microphones. In stereo records, the groove walls are modulated so that the information from the two channels are at right angles to each other, as shown in Fig. 1. The left channel is on the inside wall, and the right on the outside.

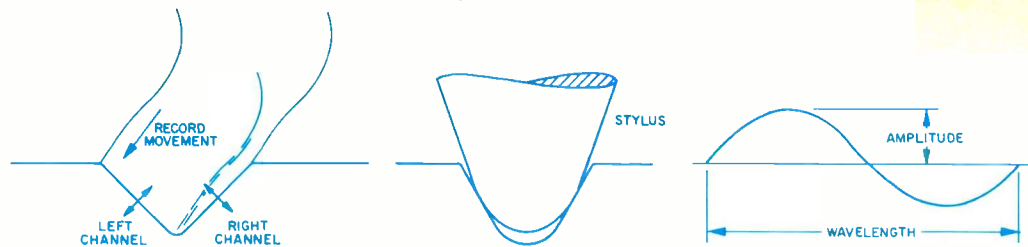


UNDERSTANDING PHONO CARTRIDGES

S.K. Pramanik*

*Engineer, R&D (Audio)
Bang & Olufsen
Struer, Denmark

Fig. 1 — Stereo signal in record groove, fit of stylus in groove, and relation of amplitude and wavelength.



When a record is reproduced, the stylus makes contact with both walls, and as the record rotates, it follows the vibration as engraved in the groove. This vibration is then transferred to another part of the cartridge, where it is converted into electrical energy. The voltage of the electrical output of the cartridge is determined by the velocity the stylus attains at any point while tracking the groove modulation. This means that for an engraved sine wave, the pitch depends on the wave length, and the volume on the speed of the stylus perpendicular to the direction of record rotation. The actual wave length engraved on the record will decrease with the distance of the groove from the record center, as the groove speed relative to the stylus falls. The lateral velocity, which is directly related to the output voltage, remains the same at all groove diameters for the same signal.

For a given sound input at low frequencies, groove amplitude will be large compared to that for the same input at high frequencies. Acceleration of the stylus will be low, as there is a relatively long time available to reach maximum velocity. For high frequencies, modulation amplitude will be small, but because of the relatively short time available to reach maximum velocity, acceleration will be high. In order to limit the width of the groove, a standardized equalization curve is used to reduce levels at low frequencies. In addition, to reduce random noise which is most audible at high frequencies, the high end of the spectrum is amplified. The opposite curve is later used in the amplifier to recreate the original sound. In spite of this, low frequencies are characterized by large groove amplitude, and high frequencies by high levels of acceleration.

Magnetic Transducers

All magnetic cartridges are based on the same physical principle. If a magnet, some soft magnetic material (which will be referred to as iron), and a coil form a magnetic circuit, movement of any one of the elements with respect to the other two will induce a voltage in the coil. The element that moves is called the armature. In all three systems, movement of the armature induces a voltage in the coil by altering the magnetic flux through it. If the coil and the change in flux through the coil were the same, the electrical output would be identical, irrespective of which of the three elements move to cause the change in flux. The three principles are illustrated in Fig. 2.

The moving-coil transducer, also called dynamic, has a fixed magnet flux in the air gap. The flux relative to the coil

changes, however, as the coil in the air gap connected to the stylus moves, inducing a voltage.

In the moving-magnet transducer, the magnet is connected to the stylus and located in the air gap. Flux in the magnetic circuit is changed directly as the distance of the magnet to the poles changes, inducing a voltage in the coils wound on the iron.

The moving-iron transducer, also called variable reluctance or induced magnet, changes flux by altering the magnetic path in the air gap, as the iron armature moves. The coils are wound on iron poles which form part of the magnetic circuit.

In order to get sufficient output, the size, materials, and layout of the elements in the three cases will not be the same. But none of the principles, in themselves, have any performance advantage over the others. Performance will depend on how accurately the stylus can be made to follow groove modulation, how accurately stylus movement can be transferred to the armature, and how accurately armature movement can be converted to a change in flux.

The sections that follow illustrate some of the important design and performance parameters; some aspects of a major problem in record reproduction, record and stylus wear, will also be covered.

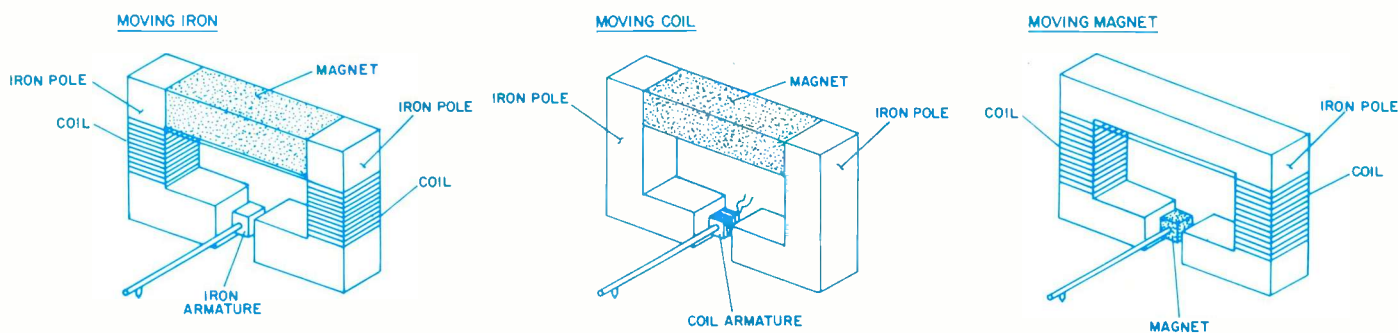
Vertical Tracking Force

Terms such as stylus pressure, tracking weight, etc., are also used to denote the Vertical Tracking Force (VTF). This force is set on the tonearm to ensure contact between the stylus and the groove. The stylus makes contact with the groove wall in two small areas, the size of which depends on the shape of the diamond, as shown in the diagram. Force per unit of contact area is pressure, and in this case will be called the stylus pressure generated by the VTF.

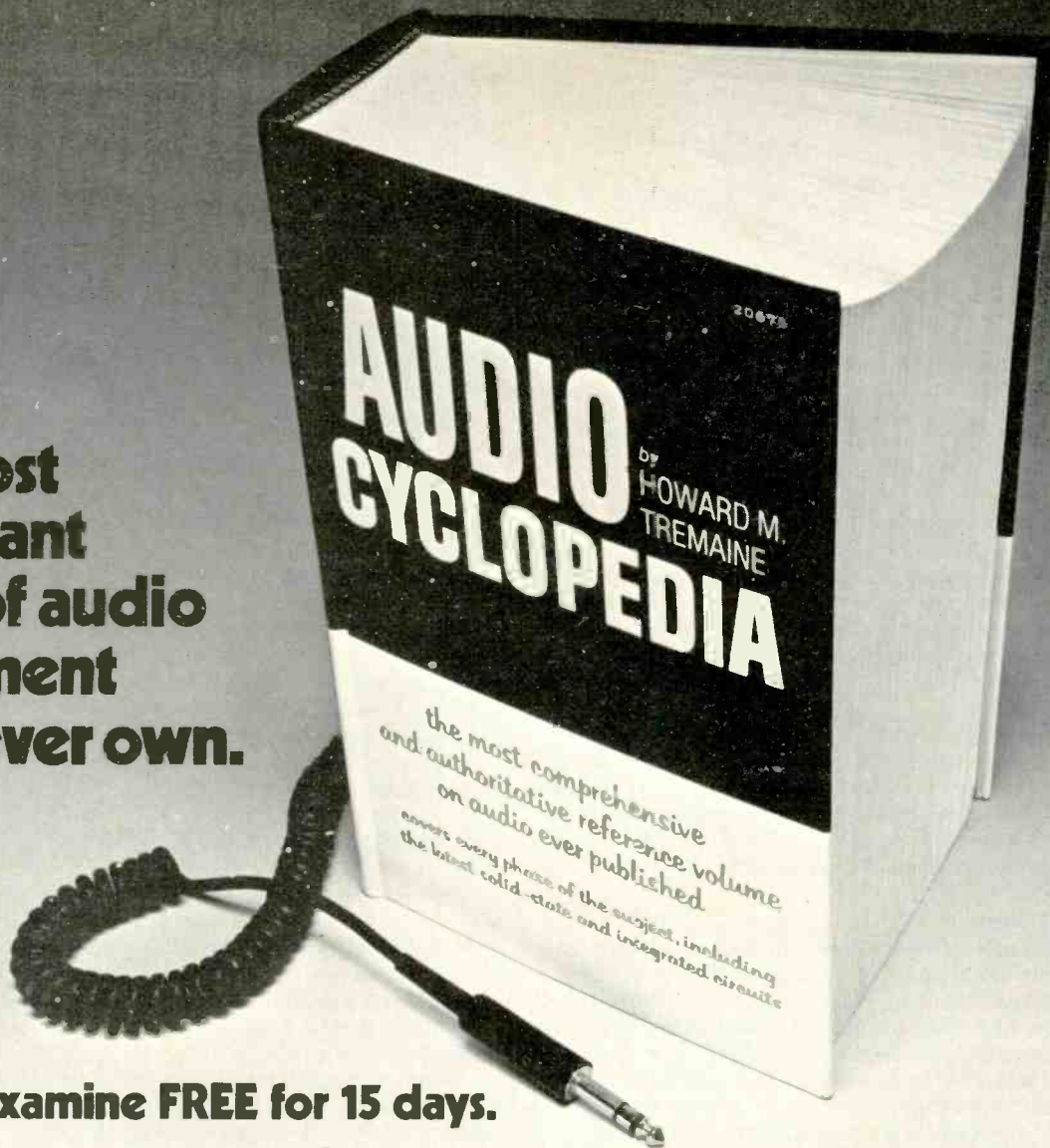
Vinyl plastic, of which modern records are made, is not completely rigid and deforms under pressure. Like other plastics, it has two main zones of deformation, although there is no sharp transition between them. At low pressure, up to point A in Fig. 4, deformation is said to be elastic, and the vinyl returns to its original shape when the pressure is removed. For higher pressures, such as at B, C, and D, the material is deformed progressively deeper into the plastic region, so that it only partially returns to its original shape when pressure is removed.

Thus, for any reasonable VTF, stylus pressure is comparatively low, and while the groove deforms under the stylus, it returns to its original shape after the stylus has passed. But for VTF above a certain level, stylus pressure is so high that

Fig. 2 — The three basic types of magnetic transducers.



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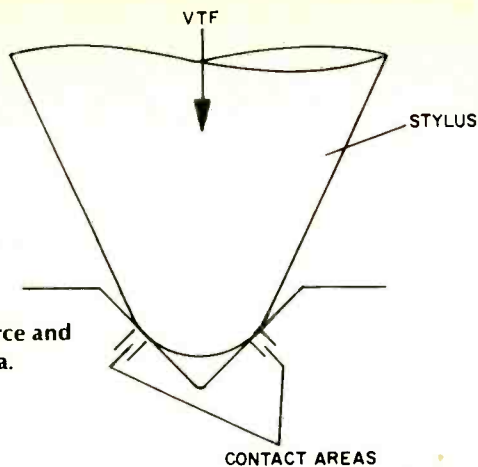


Fig. 3 — Vertical tracking force and contact area.

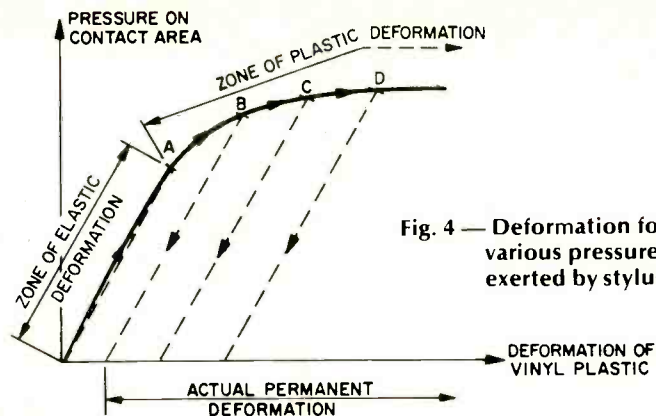


Fig. 4 — Deformation for various pressures exerted by stylus.

plastic deformation occurs and the vinyl suffers permanent damage. For unmodulated grooves, this point is not reached until the VTF is well above 30 mN (approx. 3 grams).

But when grooves are modulated the picture changes. It will be shown that the stylus pressure on the record changes with modulation, giving wear depending on whether the vinyl remains within the elastic region or if it is deformed into the plastic region.

A misconception about VTF is that the wear is sometimes directly attributed to this VTF factor, but wear which can only be caused by friction between the stylus and the groove walls. If the stylus is correctly shaped and well polished, wear is negligible. However, if the stylus is badly polished, worn, or damaged, wear can increase dramatically.

Effective Tip Mass

The moving parts of any cartridge have an equivalent mass associated with them. Called the Effective Tip Mass (ETM), it is a mathematical concept, but has a very real effect and practical value. The main elements contributing to the ETM are the armature, the cantilever which connects the stylus to the armature, and the stylus itself, which together form the stylus assembly. The weight of the individual elements alone should not be confused with their contribution to the ETM, as their relative positions play an equally important part.

The stylus assembly is usually suspended so that it rotates about a point. While in practice this is not strictly true, it is assumed for the sake of simplicity.

Given a generator system design including an armature, we can reduce the contribution of the armature to the ETM by increasing the length of the cantilever connecting it to the stylus. A longer cantilever is heavier than a short one, giving a larger contribution to the ETM. The contribution of the stylus does not change with the length of the cantilever.

The interplay between these factors is illustrated in Fig. 5. It can be seen that as cantilever length increases, the contribution of the armature decreases. At the same time the contribution of the cantilever increases, while that of the stylus remains constant. The sum of the factors shows a minimum value at a particular cantilever length, which is optimum for that armature and that kind of cantilever. If we wish to alter the ETM or if the cantilever length found is unsuitable, the design must be changed and a new optimum for the combination found.

At the same time minimum voltage output must be provided, and this is also related to the size of the armature and the movement transferred from the stylus to the armature. In addition, the cantilever length must be adequate for clearance between the cartridge and the record. Because these factors conflict with low cartridge ETM, this is a very fundamental and difficult parameter for the designer, one that sets its mark on the rest of the design and on overall performance.

The need for low ETM follows from Newton's first law of motion, which says $F = M \times A$, where F is force, M is mass, and A is acceleration. If we find a mass, M , which for a given force, F , accelerates at the same rate, A , as the moving parts of our cartridge, then this mass is the ETM of the cartridge. The ETM can be thought of as being concentrated at the stylus tip, and as the exact equivalent of all masses of the individual moving parts for forces applied at the stylus tip.

Newton's law now tells us that for any given acceleration on the record, the force between the record and the stylus is proportional to the ETM. Of course, acceleration on the record is not constant, and we also know that for the ETM of a given cartridge, that force is proportional to the acceleration.

Consider the stylus at the bottom of the groove modulation. A force is provided by the record to move the stylus, defined by the ETM and the acceleration at that point. When the stylus reaches the top of the modulated groove and attempts to go down, there is no force available in the record to maintain contact. This is provided externally by the VTF, which must be at least as large as the force defined by the ETM and the largest acceleration on the record. If this VTF is not provided or it is too low, the stylus will momentarily lose contact with the record, but will return further down the groove causing severe damage at the point of contact (see Figs. 6 A and B).

Even when VTF is adequate, the pressure at the bottom of the groove is now due to the sum of the force required to accelerate the ETM and the VTF, which is constant. The larger the ETM, the larger the combined force, and the resultant pressure can easily be sufficiently high to cause plastic deformation and permanent damage.

Since high acceleration occurs only with relatively high frequencies, low ETM is important only at the high end of the recorded spectrum. Wear caused by high ETM will occur on a record with a large high frequency content, where distortion due to wear is most audible.

Compliance

To generate signals, the armature must be able to move under the action of forces at the stylus tip. To allow this, the entire stylus assembly is suspended so that it can rotate about a point, generally on an elastomer at the armature. The distance the stylus moves for a given force is quoted as compliance and is determined by the stiffness of the elastomer and the length of the cantilever. Inversely, for a given stylus movement due to record modulation, the suspension exerts a force attempting to restore the stylus assembly to its mean position of rest. The stiffer the suspension, the larger is this force. Elastomer stiffness is not constant, however, but varies with frequency. Thus, if frequency increases, compliance decreases (becomes stiffer). That is, for the same vibration at a higher frequency, the restoring force is larger.



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chrome-equivalent bias recording (70 microsecond equalization). It gives a 3 dB better signal-to-noise ratio at low and high frequencies than chrome cassettes. Our Master III Cassette is a ferri-chrome formulation (FeCr) with a 3 dB output improvement at low frequencies and 2 dB at high frequencies.

All three tapes are housed in transparent shells and equipped with precision guidance systems. Technology this advanced doesn't come cheap. But when you hear how magnificently the Scotch Master Series lets the truth come out, you'll agree that for the slightly higher price—you've got something priceless.

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3M

The Sansui AU-919 set for amplifier

Now, there's a tuner the digital-controlled,

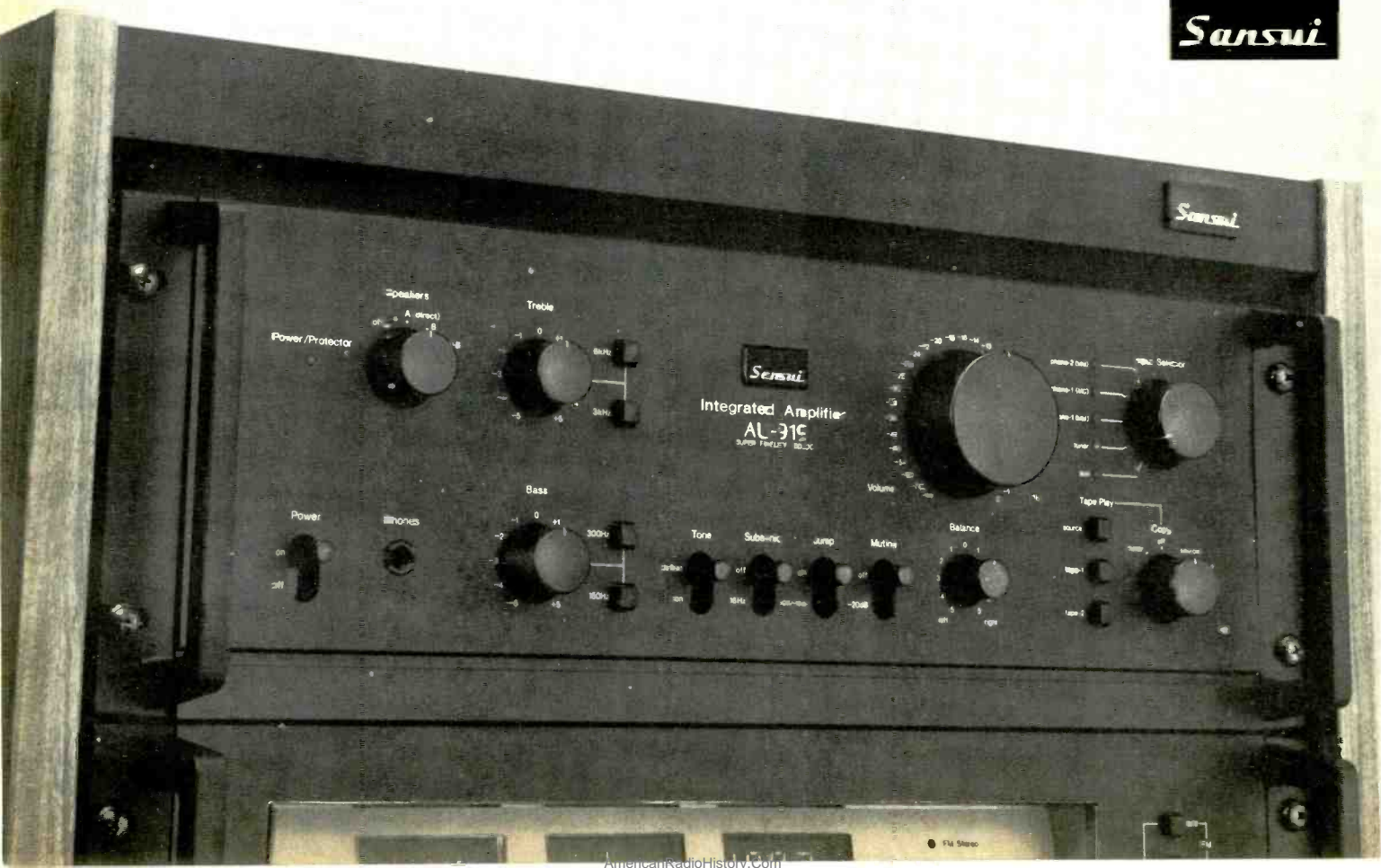
It takes a lot to complement the performance of an amplifier good enough to have become the standard for the industry. Sansui's ultra-high speed AU-919*, with its Diamond Differential DC circuitry (patent pending), eclipses all previous DC amplifier designs. Consider an amplifier with TIM so low that it can barely be measured. The effect is of enormous importance to the ultimate tonal quality of the music you hear. And that may be one of the many reasons why the AU-919 made such a sensational debut among music lovers. 200V/ μ Sec. slew rate. 0.5 μ Sec. rise time. Frequency response from zero Hz (DC) to 500,000Hz. DD/DC phono equalizer, accurate to ± 0.2 dB from 20-20,000Hz. And selectable DC operation straight through from Aux. input to speaker output.

The result is an extraordinarily clean sound quality and uniquely accurate music reproduction in every important performance characteristic. Sansui's newest tuner perfectly complements this superior amplifier.

The Sansui TU-919 is super-high technology through and through. Unlike some so-called digital tuners, the TU-919 doesn't just provide a digital read-out for an analog tuning system. Sansui's patented, self-correcting digital circuitry, with wide-range lock-in to a precision quartz reference oscillator, provides drift-free tuning for lowest distortion (0.03% mono, 0.05% stereo). And an incredible sensitivity of 8.7dBf (1.5 μ V IHF T-100), with 50dB quieting at only 12.5dBf.

With this unique technology, we frankly don't need

Sansui



the industry standard excellence.

good enough to match: quartz-locked TU-919.

the wide, frequency-linear dial and center-tune meters in FM. The digital tuning circuitry automatically locks the TU-919 onto the selected station to minimize distortion and interference effects. S/N is 86dB, and capture ratio a superb 0.8dB. Even when the tuning knob is touched or the unit bumped, the station remains locked in. Always.

To maximize selectivity and minimize distortion, wide and narrow selectable bandwidths are included not only for FM, but also for AM. And the AM section of the TU-919 is perhaps the only true Hi-Fi AM available today — which is really important if you listen to AM, or live in an area where AM predominates.

To ensure that your AU-919 can give you the full pleasure of additional performance capabilities, Sansui

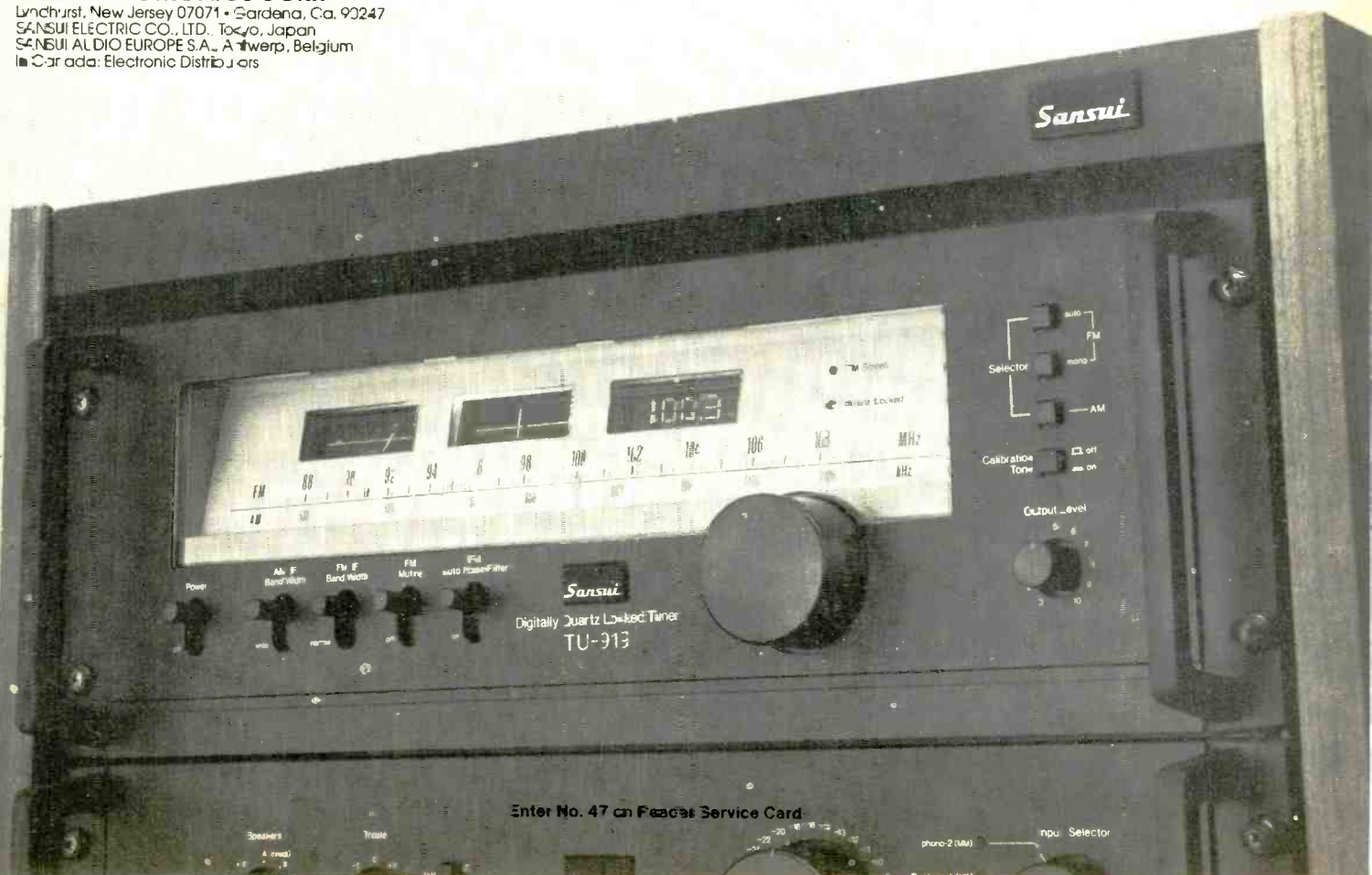
engineers have included more technological innovations in the TU-919. Flat group-delay response, for lowest distortion, isn't in the IF section alone: our unique circuitry extends back to the RF front end as well. The output stage of the TU-919 uses the Sansui pure DC configuration to match the outstandingly high slew rate and low TIM of our DC audio amplifiers.

The design, engineering and performance characteristics of both the AU-919 and TU-919 are measurably superior. But the real proof of their excellence is in the sound. Come listen. At your nearest authorized Sansui dealer. Today.

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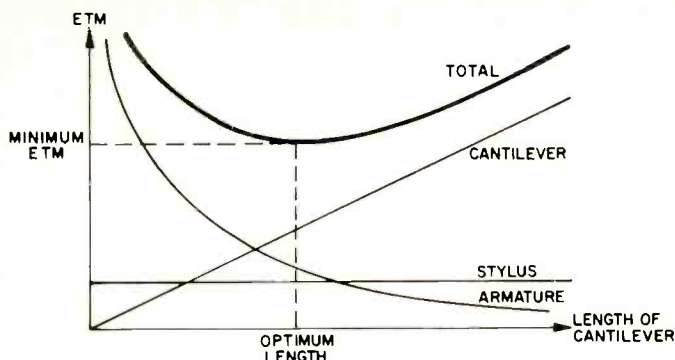


Fig. 5 — Effect on effective tip mass of increasing various cartridge parameters.

The static compliance generally quoted by manufacturers is therefore of little value in estimating the performance of a cartridge. More important is a frequency-related *dynamic* compliance, which is not quoted by manufacturers due to the lack of an accepted standard method of measurement.

The static compliance does, however, have some importance, in that it sets an upper limit on the VTF that can be applied. The cartridge needs a minimum clearance from the record, and this height is reduced with increasing VTF. The height without VTF is determined by the designed cartridge geometry, and the recommended VTF quoted by the manufacturer normally gives a mean position so that the armature is in its optimum working position. Too much variation from this recommended VTF value can alter the working position, leading to distortion.

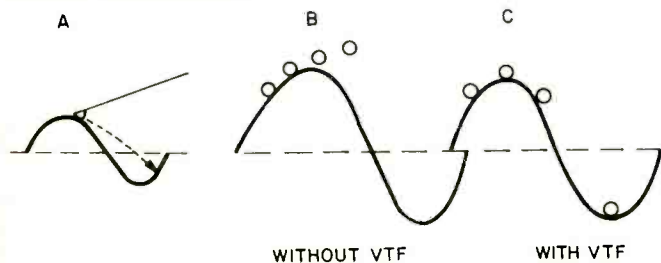
As record modulation vibrates the stylus and the stylus attempts to move below its mean position, there will be no force on the stylus enabling it to maintain contact with the groove, unless a force is supplied externally. This force is the VTF; it acts through the suspension and must be at least as large as the restoring force to maintain contact with the record.

If VTF is too low or smaller than the restoring force, the stylus will lose contact with the groove, and severe damage will occur where the stylus again contacts the groove.

It is evident that when the stylus is moved above its mean position, the total force on the record is the sum of the restoring force and the VTF. If cartridge compliance is low and sufficient VTF is applied to maintain contact with the grooves for the largest amplitude found on records, the sum of the VTF and the restoring force can be so large as to result in stylus pressure that deforms the groove into the plastic region, causing permanent damage.

Large forces due to compliance occur only for large stylus movements, that is, at large groove amplitudes, which occur only at the lower end of the recorded spectrum. Thus, compliance is a parameter that affects only the low frequency tracking ability of a cartridge, and wear can occur in passages with a large low frequency content if compliance is too low.

Fig. 6 — Motion of stylus tip with and without vertical tracking force.



Resonance

If a mass is suspended at one end of a spring, the other end of which is fixed, the spring will extend, depending on its stiffness and the size of the mass, to attain a fixed "mean" position. If the fixed end is now oscillated the mass will also move, but its movement will depend on the oscillation frequency. At a very low frequency, the end being oscillated and the mass will virtually move together, and relative movement between the free end and the mass will be virtually zero.

With increasing frequency, amplitude of the mass movement increases, but the movement of the other end follows a short time after the movement of the other end. At a certain frequency, dependent on the mass and spring stiffness, a resonant condition is reached, where the mass and the opposite end move "out of phase." When the opposite end moves down, the mass moves up, and vice versa. Relative movement between the mass and the free end will be largest at this frequency.

As frequency increases again, this out-of-phase movement decreases and the movement of the mass progressively decreases. Relative movement will also decrease. At a very high frequency, the mass will be completely still, even though the opposite end moves more vigorously than ever. The relative amplitude is plotted as a graph against frequency in Fig. 8B. The amplitude of movement at the opposite end is held constant.

Tonearm

The cartridge makes certain demands on the tonearm if it is to provide optimum performance. The most fundamental is on friction in the tonearm bearings. The tonearm must hold the cartridge firmly in the correct position above the modulated groove at all times and must remain completely steady at all frequencies that are modulated in the record. However, the record groove is a spiral, and the force to move the arm is provided by the record, through the stylus. If the bearing friction is sufficiently high, a force similar to the VTF, but acting sideways, will be applied at the stylus assembly suspension, pulling the armature out of its central position.

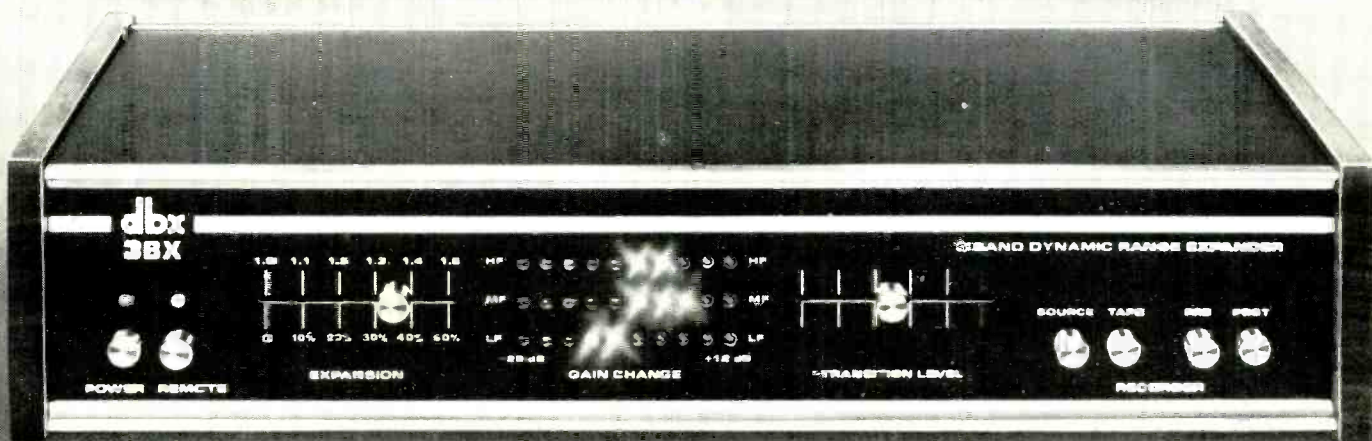
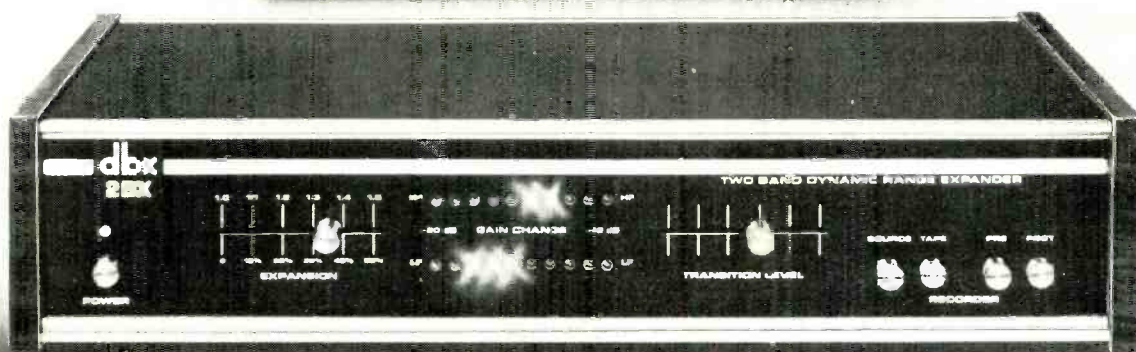
Similarly, if the arm is subjected to vertical movements, such as may be caused by a warped record, bearing friction will add to or subtract from the VTF depending on the arm movement, and stylus pressure will vary. If the bearing friction is small compared to the VTF both in the vertical and horizontal directions, distortion due to armature displacement is minimal.

Tonearm resonance also affects stylus pressure, with similar results. As the cartridge body is rigidly connected to the arm, it may be regarded as being a part of the arm itself. The arm has an equivalent mass, which depends on the weight and distribution of the various sections of the tonearm, together with the weight of the cartridge. This equivalent mass and the stylus assembly compliance form a resonant system when the stylus assembly is vibrated by the record. Therefore, there will be a resonant frequency which, with arms and cartridges available today, lies between 5 and 25 Hz.

Using the information on resonances, it is seen that at frequencies much below the resonant frequency, such as caused by warps and similar faults in the record, the tonearm will faithfully follow the stylus movement. There will thus be no relative movement of the armature, and the electrical output will be zero. The suspension will act as a rigid connecting member, and the only force exerted on the record is that required to move the equivalent mass of the arm. It is thus an advantage to have a low arm mass, and this includes low weight of the cartridge.

Again, at frequencies much above resonance, the tonearm will not move, and stylus movement is transferred directly to the armature without any influence from the tonearm.

Restore the impact of "live" ...easy as 1-2-3.



No matter how accurate your stereo system is, it's only as good as the records and tapes you play on it—and they leave much to be desired. The recording process does some terrible things to live music, and one of the worst is robbing it of dynamic range, the key element which gives music its impact.

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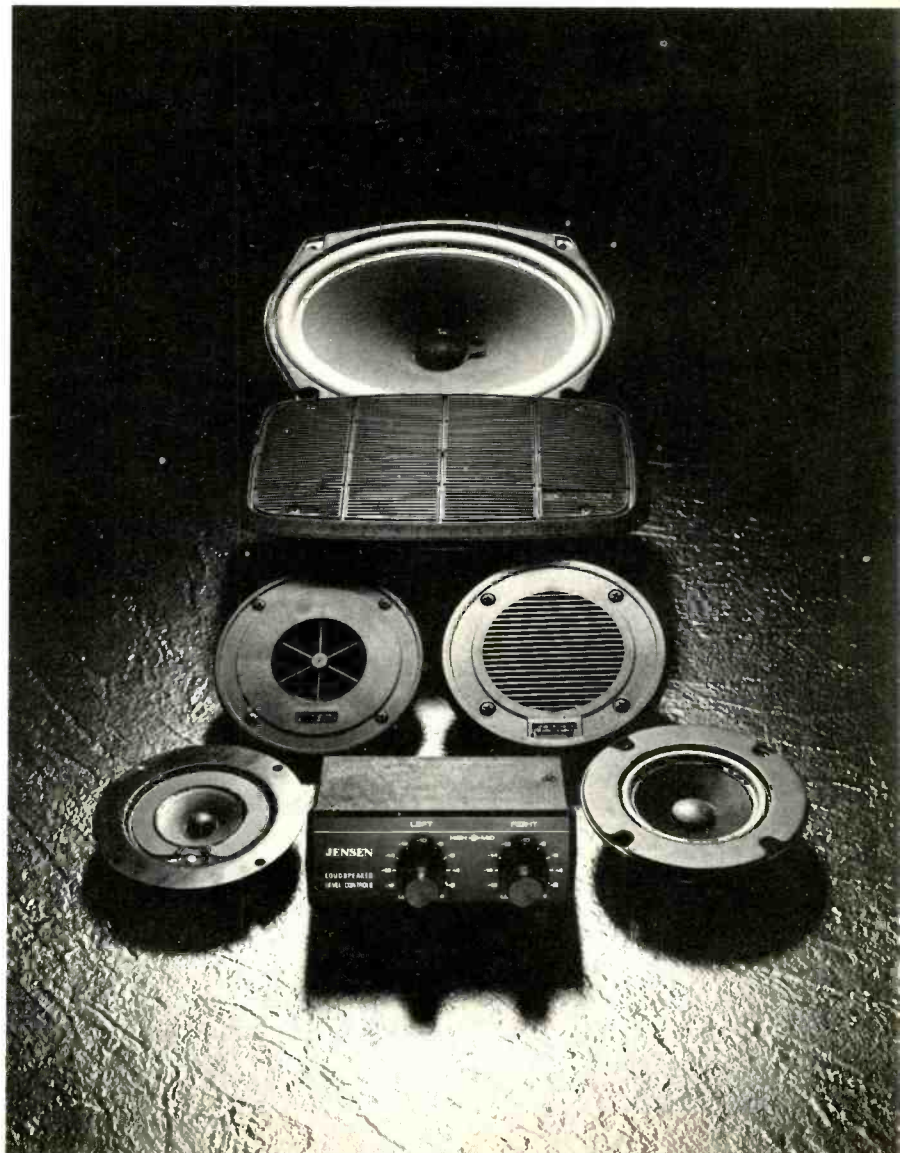
The Jensen Separates even come with an under-dash control/crossover unit with individual controls for each tweeter and each mid-range. This speaker system is also ideally suited for the advanced function of bi-amplification.

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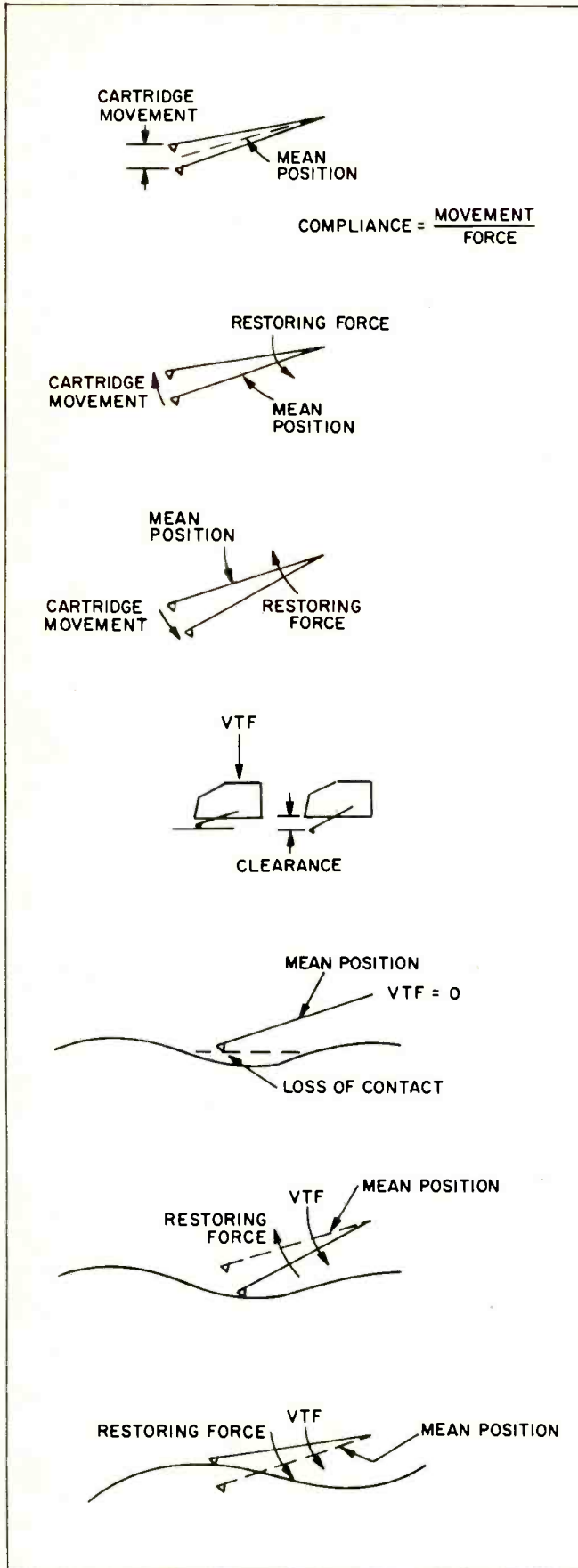


Fig. 7 — Illustrations of the effects of compliance on stylus motion.

At the resonant frequency and near it, the tonearm moves in a direction opposite to the direction of stylus movement. This is an out-of-phase condition, and the tonearm can move many times more than the stylus. The large relative movement between the cartridge and the stylus produces a peak in the frequency response curve. The movement can be so large that contact between the record and stylus is lost.

Tonearm damping at the bearing can reduce this problem, but cannot solve it. The out-of-phase movement at resonance is reduced, at the cost of an extension of response below resonance. This means that the tonearm with damping is more difficult to move below the resonant frequency than one without damping. A better solution is to place the resonant frequency of the tonearm and cartridge at a point where warp frequencies are seldom small; that is, as close as possible to 15 Hz and certainly above 10 Hz. This demands not only a light tonearm and cartridge, but a compliance that is not too high and matched to the tonearm mass.

Frequency Response and Damping

The ETM of a cartridge supplies the mass for another resonance system. Together with the elasticity of the record material, which acts as a spring, there is a resonance which in most modern cartridges lies between 15 and 50 kHz. This may be called the high frequency resonance of the cartridge. Since the elasticity (or compliance) of the record is essentially constant, the resonant frequency depends on cartridge ETM alone. The lower the ETM, the higher the resonant frequency.

The reasoning applied to any resonance is also valid here. At and around the resonant frequency, there will be out-of-phase effects which leads to increased relative vibration of the armature compared to the amplitude of the groove modulation. This gives a peak in the frequency response curve.

Further, due to the out-of-phase movement, stylus pressure acting on the record will vary, and at points where pressure is maximum and minimum, the stylus may cause plastic deformation or loss of contact with the groove leading to damage on making contact again. This is the most prevalent form of wear and distortion for cartridges in general. In cartridges with high ETM, it is possible to measure the effect as a "footprint" in a frequency response curve due to wear at the resonant frequency after a single playing of a record. The high frequency resonance results in a peak at the upper end of the frequency response curve of the cartridge, after which response falls sharply. A square wave test shows ringing on the horizontal sections of the curve.

To avoid these effects, the resonance is usually damped, using the suspension elastomer as the damping medium. Careful choice of the material, size, shape, and position of the elastomer is required to match the damping properties to the high frequency resonance, to give the necessary compliance, and the optimum frequency response characteristics.

Distortion

Differences between the recorded signal and the electrical output from the cartridge can be due to mechanical, magnetic, or electrical causes. Specific forms of distortion will not be discussed, but the most important causes will be detailed.

Mechanical causes are those where armature vibration is not identical to that of the stylus. Some of these are the many resonances described earlier in the tonearm, the stylus assembly, or the record. Particularly those factors which move the armature away from the designed working position lead to effects which are audibly unpleasant.

A resonance that has not been mentioned earlier is that of the cantilever itself, which can add both harmonic and intermodulation products to the armature vibration. Another

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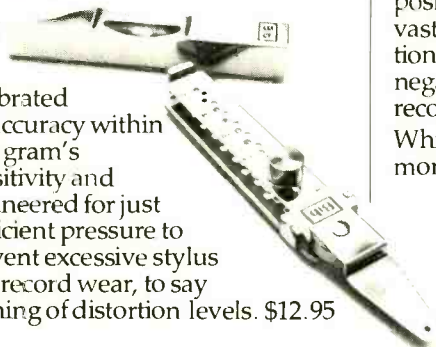
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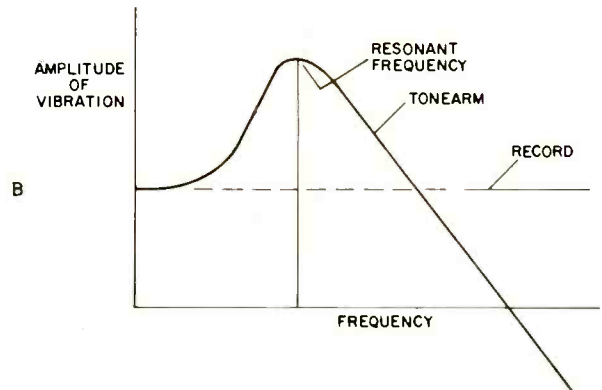
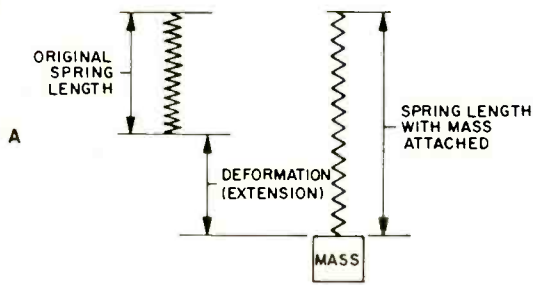


Fig. 8 — A, deformation of a spring by adding mass; B, change in amplitude of vibration at resonant frequency.

cause of false vibration is a longitudinal oscillation of the stylus assembly, often called precession. This oscillation, besides moving the armature out of its designed working position, can generate a signal of its own. Precession is also a resonant mode and can add harmonic products of its resonant frequency, as well as intermodulation distortion.

Compliance that is unnecessarily high can also lead to similar effects, especially in cartridge designs where the accuracy of lateral location of the armature is inadequate. The stylus assembly will then rotate about a point which itself moves sideways, leading to inaccurate movements of the armature.

Finally, among the mechanical causes, are the differences in shape between the cartridge stylus and the stylus that cut the record. This distortion is almost pure second harmonic and less audible than the types mentioned above.

Distortion due to magnetic causes may be defined as those where the change in flux is not identical to the armature vibration. The reasons can be non-linear armature induction or non-linear function of the iron.

The armature can give rise to distortion if the flux change due to movements of the armature is dependent on armature position. This can occur if the armature is not centered in the gap because of manufacturing tolerances, because of dynamic factors while playing a record for any of the reasons stated earlier, and also because a design has fundamentally non-linear armature induction.

Non-linear function of the iron is due to a property called hysteresis. Hysteresis is inherent in all magnetic materials, so that change of flux in the material is not identical to the change in magnetic field induced by armature movement.

The non-linearities due to problems of armature induction, as well as those due to hysteresis are minor, not only due to refinements in the design of all types of modern cartridges, but basically because the amplitude of armature vibration is small. Whatever transducer system is used, distortion due to these causes is small compared to those due to other causes.

When the flux through the coil changes, a voltage is induced in the coil. How accurately this voltage is transferred to the amplifier depends on the impedance of the coils in the cartridge and on the amplifier load. The impedance of the coils depends on the number of turns of wire on the coil and the magnetic characteristics of the iron on which the coil is wound. If the impedance is high, the electrical output will be sensitive to amplifier load.

The amplifier load consists not only of the resistance and capacitance designed into the amplifier input stage, and, as far as the cartridge is concerned, also those of the cables connecting the cartridge to the amplifier. The total capacitance together with the inductance of the cartridge coils

form an electrical resonance, which can have an audible effect on sound quality. In many cases the cartridge must be specifically matched to the amplifier for best performance.

A special case is the moving-coil cartridge, which generally has very low coil impedances, as well as low electrical output. These require special output transformers or extra preamplifiers to give the necessary matching and the required output level. Inevitably the extra components add some noise and distortion, although modern, high-priced products have performances which are close to perfection.

Crosstalk

If the signal from one of the channels of a stereo pair breaks through into the other, the phenomenon is called crosstalk. The main cause is that the axes of the generating system are not parallel to the axes of the signal recorded in the grooves. This can be due to manufacturing tolerances or can be inherent in the transducer design, which may be sensitive to vibrations in the opposite channel. A small amount of crosstalk will not normally be audibly unpleasant, as it will only result in a minor reduction in stereo separation.

It becomes unpleasant if distortion products are present in the crosstalk signal. This can occur for any of the reasons given for distortion especially cantilever resonance, non-centered armature, lateral movement of the point of rotation due to excessive compliance, or a precession. Other causes of crosstalk are incorrect mounting of the cartridge in the tonearm relative to the record and resonances in the tonearm itself.

Conclusion

The objective for a cartridge designer is to balance a large number of factors, each of them requiring solutions that may be contradictory. The final result depends as much on decisions about the relative stress to be given to the various parameters, as on the skill in engineering design, and on precision in manufacture.

Very often stress on a single parameter has led to exceptional performance in one area. High compliance can give excellent tracking at the low end of the spectrum, undamped high frequency resonance to clear, sharp treble with a transparent or open sound. In the long run however, it is just as important that the cartridge treats records gently as the sound it produces. And if the listener has a wide range of musical interests, the cartridge must have above average performance in all aspects of sound reproduction, and not excel in only a few.



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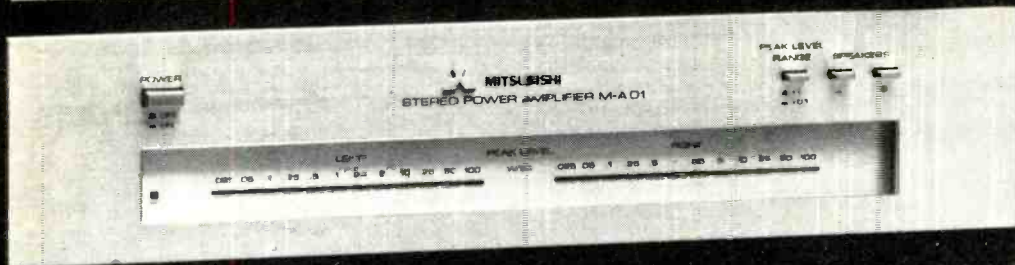
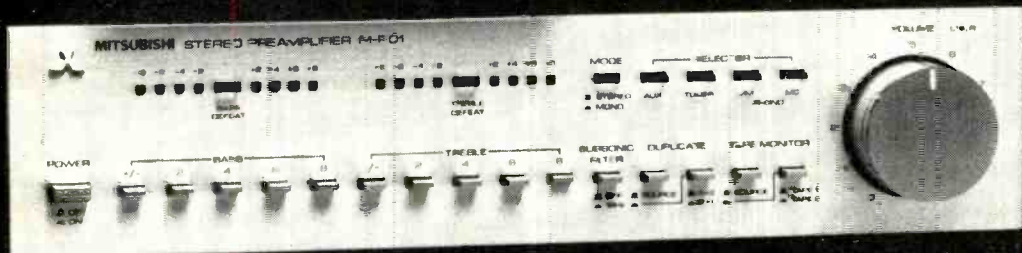
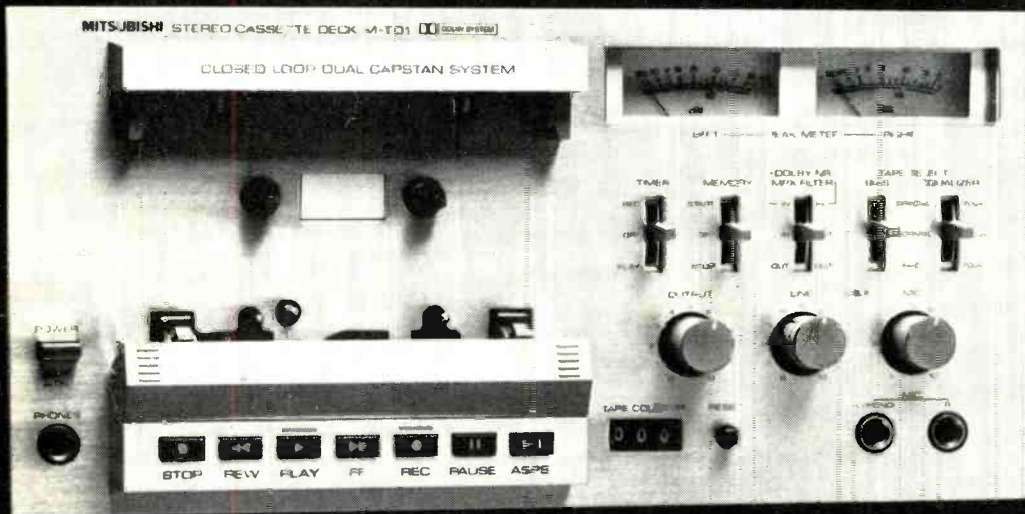
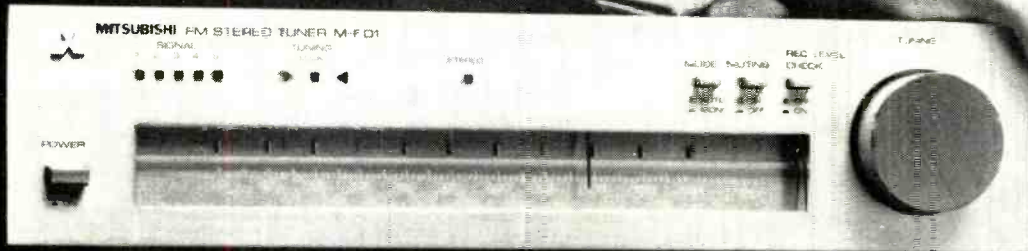
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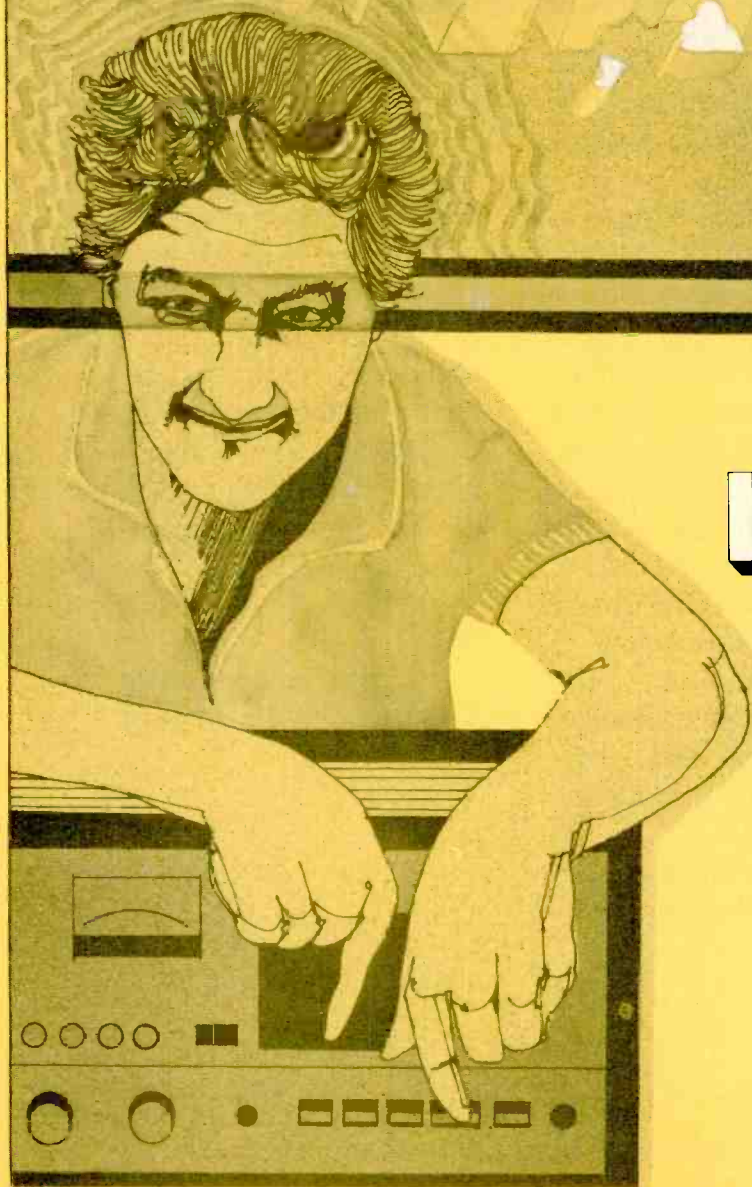
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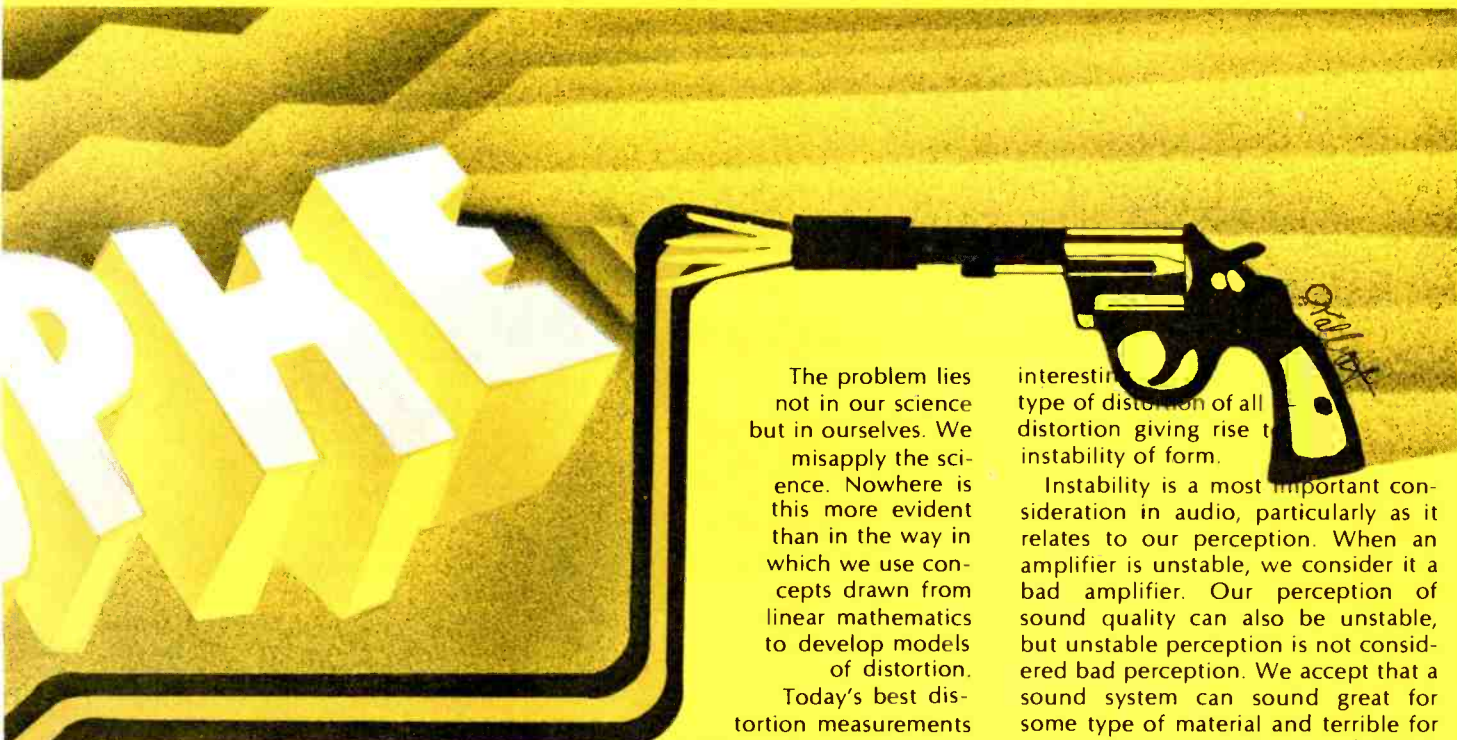


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AND ITS EFFECT ON AUDIO

There is evidence from studies of the brain that the perception of music is different from the perception of language, and that words which are spoken are perceived differently than words which are sung. There is also evidence that the way in which we perceive certain natural sounds, whether as music or language, may be related to cultural differences and learning experience. If these, and many other such things in our perception of sound, be true, then where in our audio technology do we address such factors? If not, then why not?



In an earlier discussion I broached the issue of the end product of audio. The end product is the listening experience. The end product is not advertising specs, it is not meter readings, or wiggles on an oscilloscope, or piles of charts and graphs. The end product is that very private and personal experience we have when listening to reproduced sound.

If we are ever going to put a number on the quality of that experience, then it is clear that we must do more than specify the cosmetic perfection of a waveform or pursue an endless quest of reducing measurable distortions on laboratory signals which may have little bearing on the process of perception of sound.

Somehow in our technical considerations of audio we must also recognize the role played by human emotion. Aggression, paradox, strength of opinion, and conflict of interest may not be considered as control variables by an audio designer, but they can be very important in determining the success of the product which he designs.

Under The Lamppost

Achieving a satisfactory illusion of reality is a goal of present audio technology. But understanding how to achieve this goal demands that we consider a great deal more than some of us may be willing to admit. I know from firsthand experience the feelings of frustration that can result when an audio component measures well but sounds bad. Fancy mathematics and precision test equipment tend to lose their charm when they disagree with our ears.

The problem lies not in our science but in ourselves. We misapply the science. Nowhere is this more evident than in the way in which we use concepts drawn from linear mathematics to develop models of distortion.

Today's best distortion measurements

are based on linear theory. Need we wonder why it does not always work?

A suitable parable for this misapplied attitude can be found in an old theater routine. The curtain opens to show a man, obviously well in his cups, muttering incoherently and scrambling around on his hands and knees under a lamppost. Soon a policeman strolls by, looks at the drunk's frantic motions, and asks the cause of his actions. The drunk replies that he dropped his last coin and must find it since it was his carfare home. So the kindly peace officer gets down on his own hands and knees and commences to help look for the coin under the lamppost. After a while, the policeman asks if the man is sure he dropped the coin in this place. "No," the drunk replies, "I dropped it over there," pointing to the dark bushes away from the post. "What," the policeman bellows, "are you doing looking for it here?" "The light is better here," answers the drunk.

That corny old stage routine is a good analogy for many of the things we tend to do in the name of science. We solve the linear math problem because the light is better there. And, just like the man in his cups who can justify his deeds because he can see what he is doing, we can produce dazzling mathematical chicken tracks to defend our choice of mathematics.

But it is not the mathematics that is wrong; the folly lies in its misapplication. Nor can we excuse our use of linear concepts by assuming that a so-called "piecewise linear" approximation will always work for nonlinear situations. It won't always work. And where it fails the worst is in the most

interesting type of distortion of all distortion giving rise to instability of form.

Instability is a most important consideration in audio, particularly as it relates to our perception. When an amplifier is unstable, we consider it a bad amplifier. Our perception of sound quality can also be unstable, but unstable perception is not considered bad perception. We accept that a sound system can sound great for some type of material and terrible for others. Our opinion of a sound system can change dramatically, but we seldom think there might be some underlying pattern of behavior which, if better understood, could help us understand why it sounded good one minute and bad the next. Nor could our preoccupation with linear lamppost math ever lead us to believe that there could be a branch of mathematics which could be applied to problems of perception and to problems in equipment design.

All of this is a lead into the subject I would like to present for your consideration.

Jumping

Let us think in terms of what I shall call *factors* and *response*. Factors control response. As the controlling factors of a process smoothly change we may find that the response to those factors suddenly changes. There is a jump in response, and there may even be a jump to a new type of response. Jumping is a property that shows up for certain types of distortion and non-linearity, and is not something handled by our present linear audio math, no matter how impressive the pedigree of that math may seem. Jumping is a manifestation of instability of form.

The split which we get when we jump from one response to another is called *divergence*. A relaxation of the controlling factors back to the values they had before the jump will not generally produce a backward jump in response. Usually the factors must be substantially reduced before the backward response jump occurs. This means that if there is a jump — if there

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is an instability in the nonlinear process — three additional properties will appear. These are the properties of *hysteresis*, *bi-modality*, and *inaccessibility*.

Hysteresis is the name given to the lag in response under cyclic changes in factors which control that response. In the hysteresis region between jumps the response has an "either-or" nature — it is *bi-modal*.

The response jumps from one state to another state and there is no possibility of finding a response between these two end states — the region is *inaccessible*.

These properties of *jump*, *divergence*, *bi-modality*, *hysteresis*, and *inaccessibility* are interrelated such that the appearance of one of them usually means that the others are around.

Nor are these the only properties of a nonlinear process which are not revealed when we attempt to use linear math (because the light is better there). *Irreversibility* is one such property. Once we jump, or cross some decision threshold, it may never be possible to get back to the original response, no matter how the factors change.

Splitting is another nonlinear property. Splitting is an ambivalence in response under certain combinations of conflicting factors. It is a coexistent response state.

Indeterminacy is a property like splitting, but more diffuse in nature. Not an "either-or" state, indeterminacy could be characterized as a "maybe" state. Indeterminacy is an amorphous response.

Catastrophe Theory

Evolution and change. Genesis. Structural stability with preservation of form, then sudden catastrophic change. I doubt if there is any aspect of human endeavor that does not involve the development or unfolding of circumstance. We develop rules and expectations concerning the outcome of an evolving process; and then, suddenly, there may be a surprise. Perhaps the surprise is a part of a grander set of rules which we had not anticipated, or possibly it is a sudden switch to a new set of rules — like a train being shunted onto a different set of tracks.

The concept of stability has concerned mathematicians for a long time. But it was not until the 1960s when the brilliant mathematician, Rene Thom, perceived that sudden changes in form — catastrophes — could be classified in a finite number of ways. Up until that time there seemed to be no way to put a handle on the problem. Thom was able to show that a stable unfolding of a pro-

cess near a point where change can occur, can have any change that does occur categorized as one of a few basic types. Thom called these *elementary catastrophes*.

Even in its elementary form, Catastrophe Theory stunned applied mathematics. Suddenly (a catastrophe in its own right) a nonlinear theory was available which correctly modelled processes evolving in the four dimensions of space-time. Whereas a truly original mathematical concept may remain hidden for decades until a need is found for it, Catastrophe Theory was an instant success and has been applied to disciplines as diverse as biology, economics, human behavior, and mechanical structures.

In fact the fantastic success of Catastrophe Theory has almost killed it. In a manner well known in high fidelity circles, a new idea can be picked up by overzealous proponents and trumpeted as the final breakthrough of breakthroughs and grandly applied to everything from toenails to tweeters. The voice of Thom has almost been drowned out by those who would take parts of this still-evolving theory and apply it indiscriminately; then reject the whole thing when it may not seem to work in certain applications.

Catastrophe Theory can, with caution, be applied to certain fundamental problems of audio and our perception of audio quality. Being a genuine mathematics of nonlinear processes, we can expect to apply it not only to physical equipment but also to our perception. But PLEASE. Catastrophe Theory is only one of several evolving mathematical concepts. While it can explain certain things that we know happen in audio, but which seem to make no sense in terms of our linear math, and it can do this in stunningly simple fashion, Catastrophe Theory is not going to be the end-all for understanding audio. Let us not make it an ad copy "zip phrase." We have quite enough of that nonsense going on now without making it worse.

In this brief discussion I want to introduce the concept of Catastrophe Theory to audio. All I can present in the short space available for such a discussion is a simple, almost naive, look at how it can be applied. My intent, as always, is to stimulate thought. In what follows I will attempt to explain the mathematical basis in terms which I hope will be understandable.

Factors — Response

Factors control response. In discussing the nature of a response (also called a behavior or reaction) we want to know those conditions under which the response has stabilized when the

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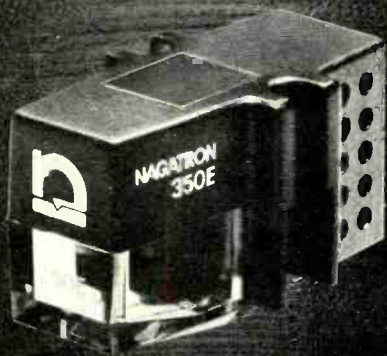
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controlling factors are steady. We want to try to understand the response that has no tendency to drift when the controlling factors are held constant. This will occur when the response is in those stable locations in which there is no attraction capable of pulling it away. Translated into mathematical language, the behavior pattern experiences no gradient in response when each possible control factor is held constant.

The behavior lies at a stationary point (either a minimum or point of inflection) in some sort of a response potential. The potential can be expressed as an equation in which the response is the independent variable and the control factors are coefficients. If, for example, there are two controlling factors and one type of response, the potential will be an equation in one variable with two coefficients. The condition that the gradient of this potential be zero means that the slope of this equation, with respect to the response, be set equal to zero. The set of relationships such that the gradient of the response potential is zero will define a special type of topological surface called a *manifold*. This manifold defines the location of all possible stationary responses.

For two factors and one response we have a three-dimensional behavior space. The manifold will be a two-dimensional surface that folds and curves through this three-dimensional behavior space.

While this may sound highly complicated, it is actually a reasonable way of conceptualizing the interaction of response and control factors. Normally, the math would stop here because we might think that there are a hopelessly large number of manifolds which could correspond to all possible situations. But Rene Thom proved a brilliant theorem that broke this problem wide open. He proved that the only possible potentials were derived from a universal unfolding of a finite number of forms. These forms are what the mathematicians call "germs of singularities." It wasn't an infinite number of surfaces after all, but a very few; and these were of known type. The concept of germ and of unfolding is much too complicated to go into in this discussion, but the results can certainly be appreciated.

If the number of control factors is five or less, then there are only a few types of potential which will determine the response to those factors. The dimension of the response manifold, derived from these elementary potentials, is always equal to the number of control factors. The way in

which the response will be observed in terms of the set of control factors is a special type of mathematical map from the manifold's surface onto the space of control factors. This map is called a *projection*. In naive terms we could think of the projection as the *shadow* which the manifold response curve casts on the control space. This map, induced by the projection on the control factor space, is called the *catastrophe map* of the behavior potential.

Thom proved that any singularity (wild change) in the catastrophe map is equivalent to one of a finite number of types which he called *elementary catastrophes*. In any dynamic system there are a precise number of topologically distinct discontinuities which can occur. The number of elementary catastrophes depends *only on the number of control factors*, when there are five or less. For five factors, there are 11 types of elementary catastrophe. For four factors, there are seven types; for three factors, there are five types; for two factors, there are two types; and for one factor there is only one type of elementary catastrophe which can occur. For six and above, there are an infinite number of catastrophes.

If we stop, for a moment, to think what this might mean in audio terms it gets pretty interesting. Do we like the sound of a certain loudspeaker or don't we like the sound; that, of course, is a response. What are the conflicting factors which might be involved in creating that response?

Here, you can put in your own set, but suppose there are only two conflicting factors: how much we listen to live music, and how much we listen to music reproduced from this loudspeaker. The solution of this audio problem will involve the *Cusp Catastrophe*.

Cusp Catastrophe

If that is the ball game — two factors and one response — then there are only two kinds of elementary behavior we can expect. The names given to these are the *fold catastrophe* and the *cusp catastrophe*. Of the two, the cusp catastrophe is the more interesting from the standpoint of the behavior pattern which it predicts. In order to understand how it can be applied to this audio problem, it is necessary to continue a bit more with the basic math discussion.

Let us take the case of two factors and one response and show how the cusp catastrophe develops. The potential for this particular case is the universal unfolding of a germ which is the response coordinate raised to the fourth power (that fact is not obvious

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Amid the confusion . . .

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**Catastrophe Map
 ... shrunk down to
 stylized chicken tracks
 pregnant
 with meaning.**

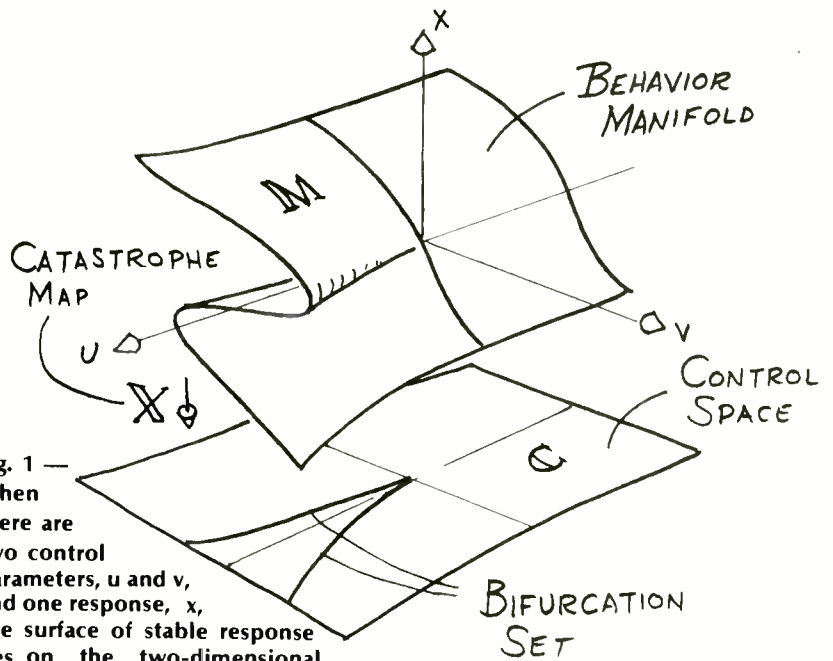
The response will be stationary for those values of x , u , and v where the derivative of P with respect to x is zero. The response, in that case, will be at a stable point of the behavior potential. This occurs when:

$$x^3 + ux + v = 0$$

The two-dimensional manifold, which we will symbolize by the letter M , is then that surface in the three-dimensional x , u , and v space which is described by the equation we have just developed.

"Stereo Sound is Japan's principal hi-fi magazine. The Summer '78 issue carries an article compiled by seven leading critics. Of forty-three arms they recommend the SME Series III as the best and the Series II improved as good."

Fig. 1 — When there are two control parameters, u and v , and one response, x , the surface of stable response lies on the two-dimensional behavior manifold, M .



If we put this manifold in the three-dimensional x , u , and v space we will get the folded surface shown in Fig. 1. This is perhaps the most widely publicized example used to describe Catastrophe Theory. The reason is because, being a two-dimensional surface in a three-dimensional space, it can be sketched and its geometry readily grasped. Like everyone else, I am guilty of showing this because it is both easy to draw and understand. There is no convenient way of sketching a three-dimensional swallowtail catastrophe in a four-dimensional space, or any of the other higher-dimensional geometric catastrophe sheets.

In Fig. 1 the first thing we note about the manifold M is that for values of control parameter u above a certain level, the sheet becomes folded. The projection of this fold onto the two-dimensional control space, shown as the surface labelled C , is a sharp pointed curve which forms a cusp. The projection of values found on M onto the plane C is the catastrophe map of the behavior potential. The catastrophe map is symbolized here by the capital X . Capital X , the catastrophe map, denotes the operation of dropping perpendicular projections of what is happening on M onto the plane C .

All highly symbolic, and, in typical math fashion, is shrunk down to stylized chicken tracks pregnant with meaning. But don't get hung up on the symbols or the fancy names. Think of the actions which give rise to those things. The surface M is the hypothetical manifestation of the position of unchanging response, x , under controlling factors u and v . We, who at-

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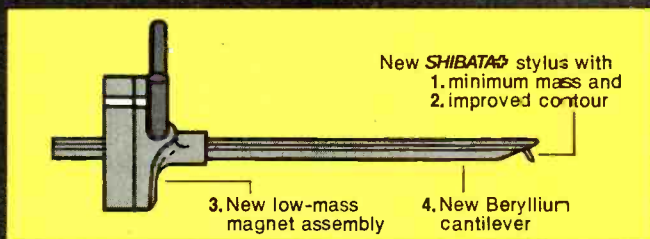
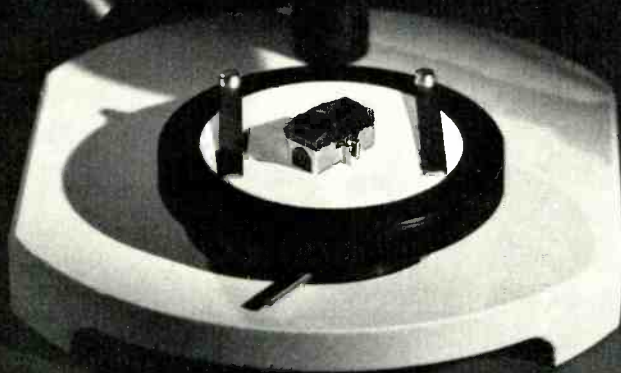
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tempt to observe the response in terms of controlling factors, cannot see the surface M. All we can observe is what happens in terms of those controlling factors. We must observe what happens on the surface C. We see the projection of M onto C. We see the shadow of the bird flying overhead, but not the bird itself.

The projection of the fold onto C forms two intersecting segments called the *bifurcation set*. The term bifurcation relates to two-forked or dual transition behavior. The cusp lines show the thresholds for sudden and catastrophic response changes which occur under action of the controlling factors. This is what gives rise to the name *cusp catastrophe* for the kind of behavior change we will observe.



When we change the control factors and a response is induced . . .



When we change the control factors and a response is induced, this is mathematically equivalent to our moving from one place to another on the manifold M. But because the point on M is controlled by changes in coordinates u and v, the point must jump whenever the increment in control passes a cusp boundary corresponding to the passage of a fold. This can be visualized by referring to the simple sketch of Fig. 2. The trajectory of response induced by a certain change in control factors is shown as curve R. The place on surface M where the response occurs is found by projecting a perpendicular, upward from the corresponding u and v coordinate location, to the place where it intersects the surface M. When the control locus passes the bifurcation line at point (a), the point projected on M must jump from the lower sheet to the upper sheet as shown in this sketch. Looking at the three-dimensional geometry, it is obvious what happens: In order to remain on the stable surface M, the response point must jump the gap whenever the control factors go past the fold. But, looking at the result only in terms of the control plane C, we would see a seemingly bizarre behavior: The response was continuous and well-behaved as the factors were changed, then all of a sudden without warning

AUDIO • March 1979

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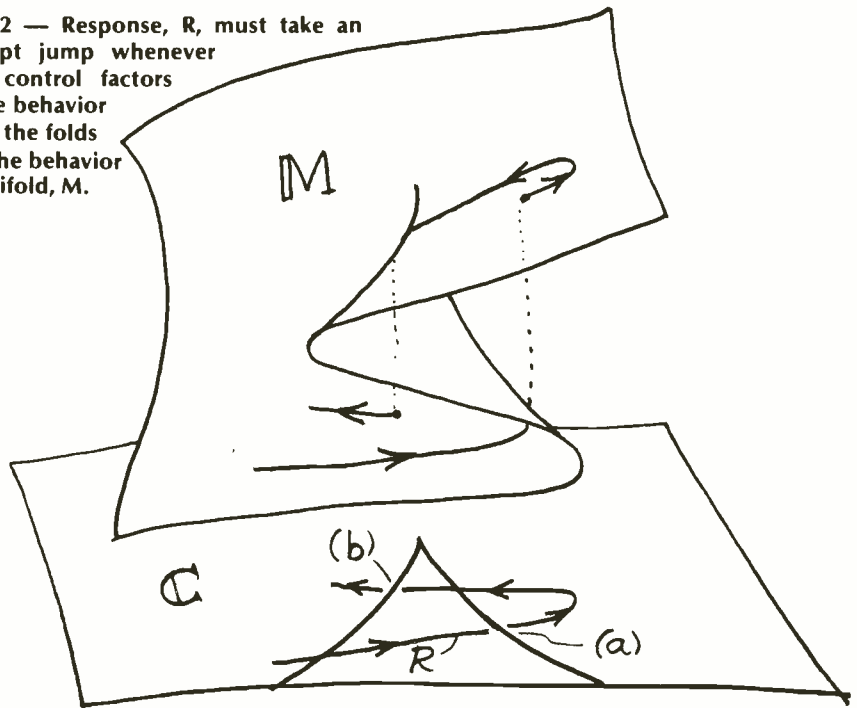
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Fig. 2 — Response, R , must take an abrupt jump whenever the control factors drive behavior past the folds in the behavior manifold, M .



the response dramatically jumped to a new behavior.

If we try to restore the original response by relaxing the control factors back to the value they had before the jump, we would not see the response come back to its former value. Instead, we would have to continue reducing the control factors back to the place where they cross the bifurcation line at (b). Then all of a sudden the response pops back to its former value. Of course, what is happening is that the trajectory on M comes back over the upper sheet until it falls over the edge of the fold, and then it is back on the lower sheet.

Flatland

If you remember one of our earlier discussions (*Audio*, Feb., 1979, "A View Through Different Windows"), surface C is like a Flatland. A flatlander, living on C , knows only that there are magic lines which change the way people act when passed in one direction, but which cause no change when passed in the opposite direction. A higher dimensional being can observe the surface M and comprehend why a flatlander observes a seemingly magic boundary. But any attempt to convey this fact to a flatlander will be fruitless unless the flatlander is willing to accept the reality of dimensions above those of the world which he sees.

And there is a lesson here for us. For we, too, are flatlanders who sense patterns of response under conditions of varying factors. We can "see" the external factors and their relevance to

the situation at hand. And we can observe how a dynamic system responds to those factors. But the hypersurface of behavior control is invisible to us. We sense the effect, but not the control. What Rene Thom has done is bring a higher dimensional concept to we flatlanders who could observe catastrophic changes in response, but could not reason why they should occur.

If we look at the behavior predicted by even this simple cusp catastrophe it is obvious that the properties we discussed earlier (jump, divergence, bimodality, hysteresis, and inaccessibility) are handily explained. In our next discussion, let us apply this new theory to audio. Δ

References

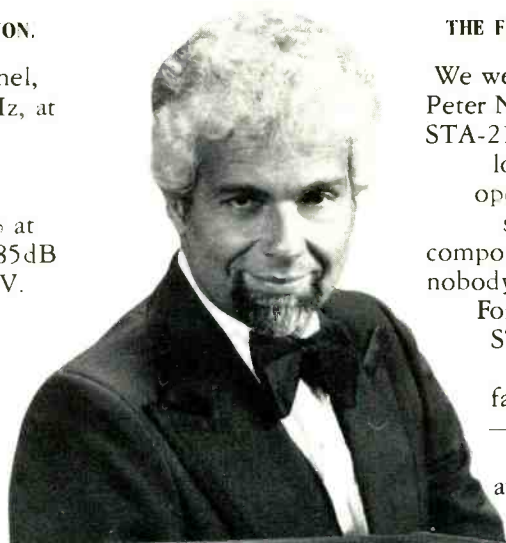
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The specs are superb,
but they can't say it all. The
proof is in listening to the music.

Last November 17th
Peter Nero listened.
And became the proud owner
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VERY HIGH POWER. VERY LOW DISTORTION.

Power Output: 120 watts per channel,
min. RMS at 8 ohms, 20-20,000 Hz, at
no more than 0.1% total harmonic
distortion. Amplifier Response:
15-70,000 Hz \pm 2dB at 10 watts.
Intermodulation Distortion: 0.05% at
85 watts. S/N Ratio: 65dB phono, 85dB
aux. Phono Input Overload: 220mV.
FM Sensitivity: 2.8 μ V for 50dB
quieting. Capture Ratio: 1.3dB.
FM Alternate Channel Rejection:
80dB. FM Channel Separation:
50dB at 1kHz. FM Stereo Total
Harmonic Distortion: 0.1%. FM
S/N Ratio: 70dB.



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components? None that we know of. And
nobody builds 'em better. In a test in our
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STA-2100 at full power, 24 hours a
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Equipment profiles

Tandberg Model TD 20A Open-Reel Tape Deck

TANDBERG

TANDBERG



MANUFACTURER'S SPECIFICATIONS

Frequency Response: 15 Hz to 26 kHz at 7½ ips, 15 Hz to 20 kHz at 3¾ ips.
Harmonic Distortion: 2 percent for 1 kHz at 0 dB.
S/N Ratio: 66 dBA at 7½ ips.

Separation: 54 dB.

Crosstalk: 64 dB down.

Erasure: 70 dB.

Input Sensitivity: Mike, 0.2 mV; Line, 50 mV, and Radio, 5 mV.

Output Level: Line, 1.5 V; Headphone, 5 mW at 8 ohms; Radio, 0.775 V.

Flutter: 0.09 percent Wtd. Peak at 7½ ips, 0.15 percent at 3¾ ips.

Speed: ±0.5 percent.

Dimensions: 18.5 in. (43.5 cm) W x 19.1 in. (45 cm) H x 8.3 in. (19.5 cm) D.

Weight: 37.5 lbs. (17 kg).

Price: \$1500.00.

Anybody who does this has rocks in his turntable.

You have to be a little crazy to place a turntable directly on a speaker. Because vibration can cause acoustical feedback and uncontrolled howling.

We did it here to make a point about our new direct-drive, fully automatic KD-5070.

You see, the unique-looking white base is made of actual *resin concrete*. To virtually eliminate vibration and keep things steady as a rock.

And while we always recommend separating a turntable from a speaker, you should know that the KD-5070 will stand up to all sorts of inter-

ference without any hops, skips, or jumps from the tone arm.

We used an extra-heavy platter to improve speed accuracy. And reduced wow and flutter to a mere 0.025% (WRMS). Even the DIN-weighted rumble is better than -73dB.

At last, you can get the specs and features of an esoteric manual turntable with the convenience and record-care advantages of a full-automatic.

At \$260.00* it just might be the smartest move you can make.



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For the dealer nearest you, see your Yellow Pages, or write Kenwood, P.O. Box 6213, Carson, CA 90749.

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The Tandberg TD 20A open-reel deck incorporates a number of innovations which contribute to its outstanding performance. Perhaps the most significant is the new recording system, which Tandberg calls Actilinear. The improvements were readily apparent in the tests, as discussed later. For a detailed description of the system, the reader is referred to Herman Lia's article in the July, 1978, issue of *Audio*. The TD 20A continues the current Tandberg design motif with the use of black in contrast with brushed aluminum, large square pushbutton switches, and orderly layout of the lever switches and rotary controls. The three pushbuttons to the left of the head assembly select power *On/Off*, speed low/high, and reel size small/large. The deck evaluated was a ¼-track stereo unit with 7½ and 3¼ ips speeds. The TD 20A is also available with 15 and 7½ ips speeds in either ½- or ¼-track versions, which are slightly more expensive. To the right of the head assembly are the counter and the light-touch, logic-controlled pushbuttons for control of tape motion. They are the standard complement with a status light for each function, plus one for *Standby* and one for *Free*. The *Standby* indicator, just above the record button, turns on when either record selector is switched on, confirming that recording can be initiated. If *Stop* and *Wind* are pushed at the same time, the brakes are released and the reels are free to rotate for editing purposes. Pushing *Stop* again causes tape slack to be pulled up and the brakes to be reapplied. There is no pause as such, but it is possible to go in and out of recording with just *Record* and *Stop*, and flying start recording is a simple matter of pushing *Record* with *Play* held in.

Below are the input level pots, two for each channel, plus a master control which has movable detented marker and level references every 6 dB. One set of input pots can be used not only for line, but for mike if desired. Thus, line/line or line/mike mixing is possible for each channel in addition to master control of the two mikes, a potentially valuable feature for the user. The *On/Off* record selector lever switches are neatly placed under the respective input pots, and the always nice bias pots have access holes in between. The mike sensitivity switch, just below the master pot, allows inserting 25-dB attenuation to prevent input overload, always a possibility with present day levels and high-output mikes. The socket for the remote control is just above the master pot.

With the removal of the head assembly covers, accessibility for maintenance tasks is excellent. Of particular interest was the motor-driven shifting of guides, etc., when going into play mode. Tape threading is straight-line with the covers in place, and there are tension arms on both supply and take-up. The level meters have unusual, but easily read, horizontal scales with back illumination. The feeds to the meters are *post* record equalization, which this reviewer prefers because of the better indication of the actual levels to the tape. The peak-reading response of the meters aids in this regard. The headphone and the two microphone jacks are immediately below. At the left are separate output pots for the two channels, and lever switches for *Left/Stereo/Right* playback mode, *Off/On Sel Sync*, *Source/Tape* monitor and *Off/On edit/cue*. The inclusion of *Sel Sync* is another nicety, essential for adding that second track without re-recording. The edit/cue switch turns on the electronics for monitoring during fast winds. Muting is normally applied in wind as the tape does touch the *playheads*, albeit lightly.

Inputs for Lines 1 and 2 for each channel and the line outputs are all phono jacks on the back panel, where the DIN socket is also located. Removal of the recorder from the cabinet revealed two large PCBs which contained the majority of the circuitry. Of particular note was the fact that the logic ICs were in sockets, an expense for the manufacturer, but of great value for anyone who has to do any troubleshooting. The soldering was excellent, with multi-pin plugs

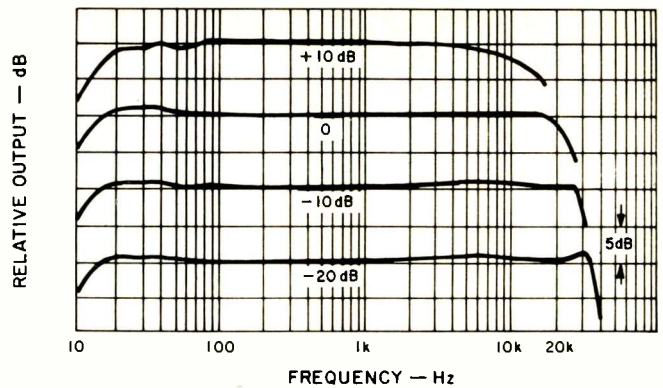


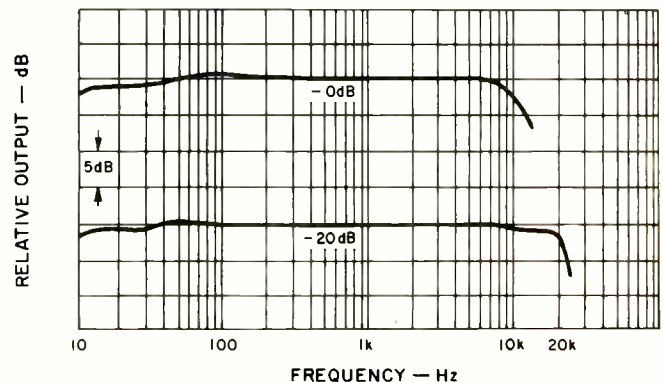
Fig. 1—Response with Maxell UD-XL at 7½ ips. (Zero reference level is 200 nWb/m which indicates -8 dB on the meter.)

used for many of the inter-section connections. The three large capstan and turntable drive motors and other components were mounted within a rugged box chassis. There was good accessibility for service.

Performance

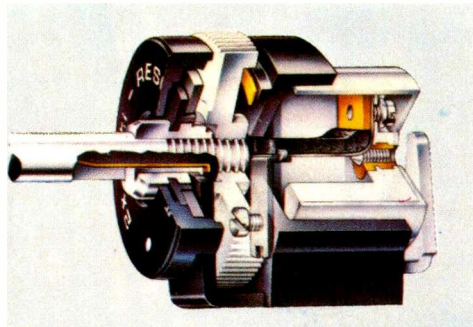
The playback responses of the Tandberg deck were checked at both speeds with Ampex alignment tapes. There was very little deviation from flat response with the exception of a rise at the highest frequencies at 3¼ ips, which is believed to be a property of the particular test tape. The meter indications were within a dB for the standard levels for all cases. Tape speed was about 0.4 percent fast. The majority of tests were run with Maxell UDXL tape which had been supplied with the deck. Zero on the TD 20A meters is specified to be 10 dB above 185 nWb/m. The reference level for the tests run was 200 nWb/m at 1000 Hz, which was -8 dB on the meters. Record/playback responses at 7½ ips (Fig. 1) were run with 10-dB steps from +10 dB to -20 dB (re: 200 nWb/m). It should be immediately obvious from the plots that these results are exceptional in a number of respects. First of all, with the exception of the highest level, the lower 3-dB down point was at 10.8 Hz, with minor variations in response from head contour effects. The response above 100 Hz shows very little variation out to 20 kHz, and to over 30 kHz at -20 dB. The responses shown were swept from 20 Hz to 20 kHz, with additional points taken at the extremes to find the end points. In other words, that ruler-flat response at 0 dB was really there. What is shown is *not* the result of drawing a line between two data points. The response at +10 dB extends from 14 Hz to 11.0 kHz, definitely an outstanding result. Finally, I would note that these superb, smooth responses show the results for both channels, one plotted on top of the other. At 3¼ ips (Fig. 2) the responses extended from 8.4 Hz to 10.7 kHz at 0 dB, and from 7.7 Hz to 21.3 kHz at -20 dB, both exhibiting ruler-flat playback over most of the range.

Fig. 2—Response with Maxell UD-XL at 3¼ ips.



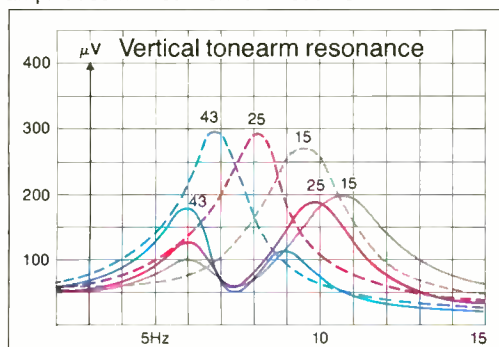
If the bass isn't as clean as you'd like...

The problem may be your tonearm. Not your amplifier or speakers.



Cutaway view of anti-resonance counterbalance.
(A feature of Dual models 604, 621, 721 and 1246)

Solid lines show effectiveness of anti-resonance filters in damping resonant amplitudes of three different cartridges (compliance 15, 25 and 43 x 10⁻⁶ cm/dyne). Broken lines show higher resonant amplitudes with conventional counterbalance.



If you've been wondering why your high-powered amplifier and great speaker system don't deliver deep bass as cleanly as you'd like—especially at high listening levels—the problem may well be the effects of resonance on the stylus.

Ideally, the stylus should move only in response to the contours of the record groove. But in reality, the stylus tip also responds to various resonances: its own (with the stylus shank) and the combined resonance of the tonearm/cartridge system.

These subsonic frequencies, though inaudible in themselves, can have very audible effects. Especially with warped records. They can drain amplifier power and cause excessive movements of the low frequency driver. They can cause the tonearm to vibrate and even to momentarily leave the groove. All of which results in audible distortion.

Competent tonearm designers know all this and do their best with materials, masses and compliances to establish the inevitable resonances at the least harmful frequencies (usually between 8 and 10 Hz) and with the lowest possible amplitudes.

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The unique counterbalances of our direct-drive models (604, 621 and 721) and our top belt-drive multiple-play model (1246) contain two mechanical anti-resonance filters.

These are specially tuned to damp resonant energy in the tonearm/cartridge system and chassis.

The startling effectiveness of these filters in lowering the resonant amplitude of three cartridges having different compliances can be seen in the graph. Whether the improvement in the bass is subtle or obvious to you depends on the other components and your listening environment.

We've prepared a technical paper on this subject which we'll send to you if you write us directly. You may discover that you don't have to replace your amplifier or speakers after all.



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Yamaha goes its separates performance,

We've never done things the conventional way. Witness our legendary B-1 and C-1 separates. These components, utilizing Yamaha-developed Vertical-FET technology, brought into being a new level of natural, accurate sound, advanced features and dramatic styling. Our new C-4 and M-4 separates follow in this tradition, while doing some precedent setting of their own.

C-4 We were determined that the performance of the C-4 should put you in touch with the outermost limits of the audio art. So it has the most advanced circuitry imaginable to give you sound so real and true, you'll swear it's live. State-of-the-art DC circuitry in the phono preamp section reduces distortion to a miniscule 0.0035% at 2V output. Signal-to-noise ratio has been tamed to the virtually inaudible level of 97dB at 10mV. Plus we've added an exclusive Current Noise Reduction Circuit to maintain this high S/N ratio regardless of varying impedances caused by using different cartridges. But the sound of the C-4 goes beyond super specs and state-of-the-art circuitry. You have to hear the sound to believe such pure, musical tonality could pass through a piece of electronics.

The C-4's features put you in total command of its superb sound. Unheard-of tone control is yours with the exclusive, continuously variable turnover frequencies for the bass and treble controls. No need to hook up an expensive outboard parametric or graphic equalizer to make meaningful tone adjustments. The C-4 gives you the

best of both at the twist of a finger. And with the C-4, you don't have to settle for anything less than the absolute optimum performance from your choice of phono cartridge. Select from five ranges for both capacitance and resistance to perfectly



match the amp's load resistance to your cartridges' characteristics. You also have the luxury of indulging in the beautifully transparent highs available from a moving coil cartridge, because we've outfitted the C-4 with its own head amp. It provides the boost necessary for a moving coil cartridge, saving you the expense of buying a separate head amp or transformer. Completely independent Input and Output selectors give you the freedom of listening to a signal from one source while recording a signal from another. Features

like these make the C-4 a super-sophisticated device whose possibilities and applications are limited only by your imagination. With graceful, yet bold styling, executed with ease-of-operation in mind, the C-4 is a marvel of modern technology leaving nothing to be desired but its ownership.



way. With unprecedented features and price.

M-4 Our passion for pure tonality reaches toward perfection in the M-4. To deliver the cleanest, most musical sound possible, we built it with DC circuitry in a dual mono amp configuration, each with its own signal path from input to output. The input section consists of dual-FET's in a differential configuration with a cascode bootstrapping circuit. So you get the unbeatable advantages of DC circuitry—minimal low frequency phase shift and maximum low frequency accuracy and musicality—while beating the inherent instability of DC circuitry.

The M-4's specs are nothing short of spectacular. THD takes a bow at an incredibly low 0.005% at rated output of 120W per channel into 8 ohms, 20Hz to 20kHz.

0.005% THD

Signal-to-noise ratio is, (please hold the ap-

please) an utterly silent 118dB.

Again though, specs can't do the sound of the M-4 justice. When it comes to doing justice to amplifying a signal from a preamp (especially the C-4) we feel the M-4 deserves a standing ovation. If you love musically accurate sound coming from your speakers, you will be equally enthralled with the sound of the M-4.

And with its functional features.

Visually arresting LEDs monitor your amp's power output, while overload indicators allow you to see when you're pushing it beyond its intended limits. The M-4 is a musical experience you participate in. Drive two sets of speakers independently or simultaneously with the simple push of a computer-grade switch, as well as select

the DC or AC operating mode with the back panel switch.

And while you are driving your M-4, its drilled metal-mesh top allows the amp to "breathe." It's just one example of the unique design philosophy of form-follows-



function in styling, features and performance.

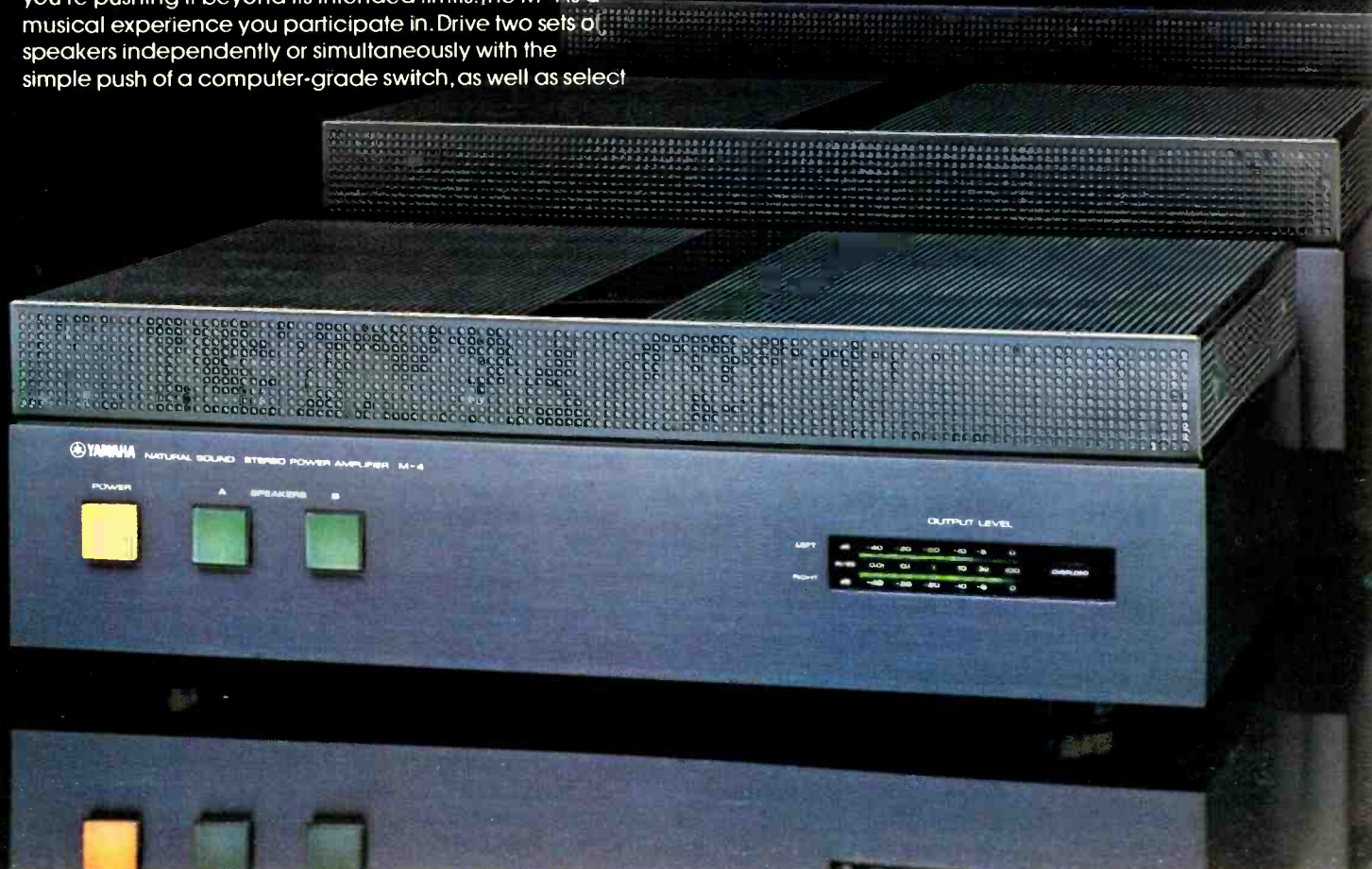
And that's what our new separates are all about. Unprecedented performance, features and styling. And price? Well, you can benefit from what we learned with our cost-no-object B-1, C-1. Without paying the price. Audition our new, rack-mountable (with optional kit), super separates, the C-4 and M-4, for yourself. It's an ear-opening experience you won't want to miss. For the name of your Yamaha Audio Specialty Dealer, check your Yellow Pages or write us.

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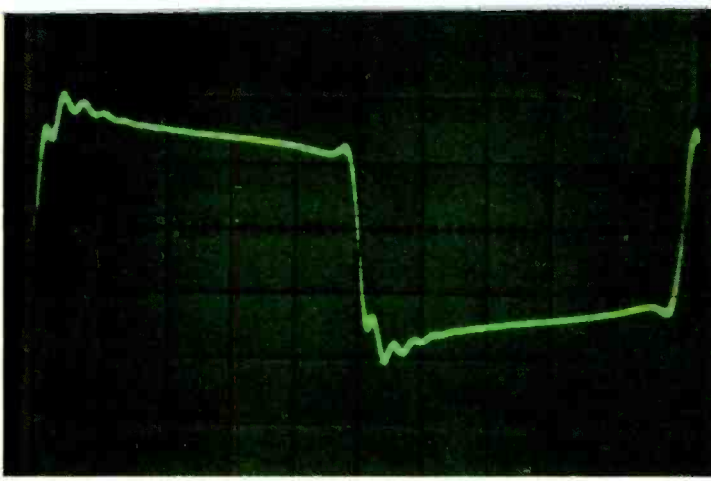
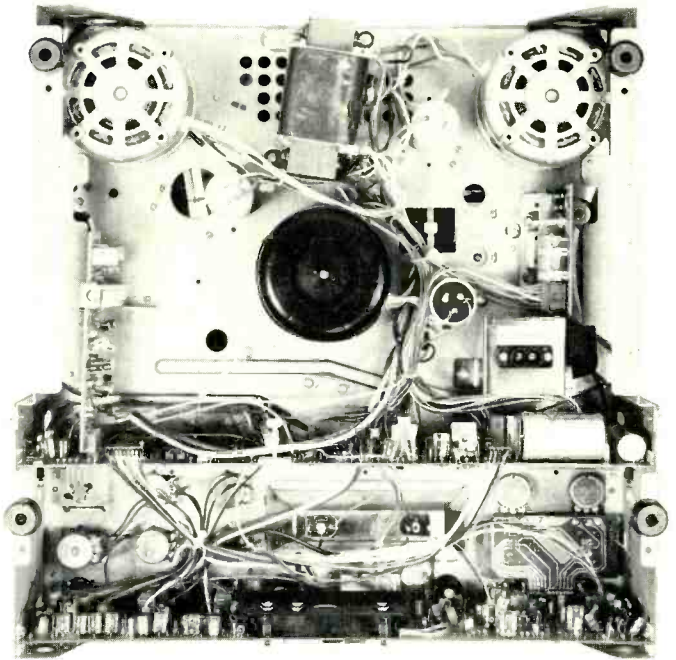


Fig. 3—Playback of 1-kHz square wave shows little overshoot or ringing.

The results with TDK Audua were substantially the same, and those with Ampex 456 and Memorex Quantum were very close. A slight touch with the front panel adjustable bias would have eliminated the discrepancies. The response in Sel Sync was from 180 Hz to 6 kHz at 7½ ips and from 180 Hz to 2 kHz at 3¾ ips. This is satisfactory for the purpose at 7½ ips, but was judged somewhat marginal at the lower speed.

Input sensitivity on *Mike* was 0.16 mV and on either line input was 46 mV, both a bit better than spec. The input overload point was at 21 mV for *Mike*, 7.0 V for *Line 1* and 5.2 V for *Line 2*. Output clipping occurred at a level equivalent to +13.4 dB relative to meter zero, lots of headroom above maximum tape levels. Settings of the separate input pots for the same gain were close to each other, though not exact. Switching off the record selector for one channel automatically feeds its pots to the other channel if it is in a record mode, making a 4-input mono mixer. The two sections of the master pot were within a dB of each other over a 50-dB range from maximum setting. The mike attenuator and the level markings around the master pot were accurate enough for the intended purposes. The output levels were right to spec: 1.5 V from line and 5 mW with an 8-ohm load on headphone. The frequency response of the meters extended to 9.7



Hz on the low end, certainly needed with the excellent low-frequency record/playback response. At the higher frequencies, the meters had greater deflection, being post record EQ, reaching a peak of +18 dB, relative to 1 kHz, at 23 kHz before rolling off. The dynamic response was much faster than a VU meter, requiring about 100 mS for full deflection. This is not as fast, however, as called for in standards for peak reading meters. Decay time was about 2 seconds. The readability was excellent with lighting behind the translucent scales. The calibrations were within a fraction of a dB from -24 to +3 dB. The needles were slightly short for easy reading above 0 dB, but such levels should be a rare occurrence.

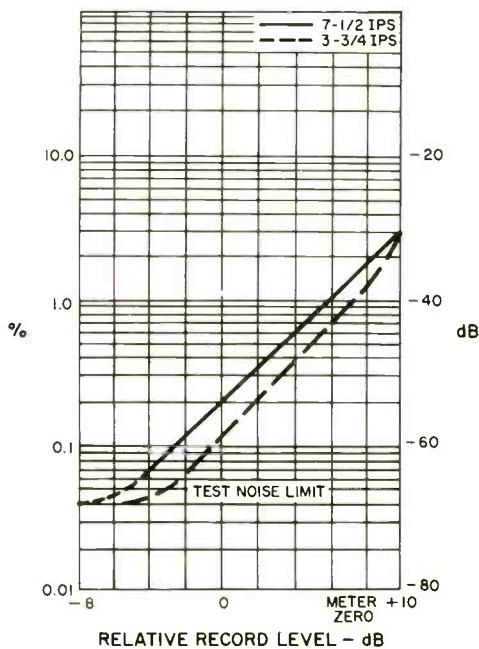
Variations in line voltage from 110 to 130 V caused barely measurable changes in tape speed, quite insignificant. Tape speed varied most right near the end of a 7-inch reel, but the plots showed just minor deviations. The flutter at 3¾ ips was typically 0.07 percent W rms and 0.10 percent Wtd Pk, and at 7½ ips the flutter was 0.018 percent W rms and 0.03 percent Wtd. Pk. All of the results were within manufacturer's specifications, but the figures for 7½ ips are especially good. The average wind times for 3600 feet on a 10½-inch reel were 115 seconds, which is quite good.

All tape motion actions were smooth and prompt, without any foul-ups in the purposeful button punching. Going from fast wind to play mode took 4 seconds at most, and that was with 10½-inch reels at maximum speed. Pushing *Stop* and *Wind* always obtained the free condition unless there was a purposeful delay between actuating the two buttons. *Stop* usually pulled up most of any slack to allow going back into *Play*, but if extra tape had been pulled out, a little hand snugging was needed before hitting *Stop*. The 7-inch reels were held on securely with spring-loaded retainers. Slip-in adapters were used to accommodate the 10½-inch reels.

Listening and Use Tests

All maintenance tasks were very easily accomplished after removal of the snap-on covers. The TD 20A was operated through a number of cycles without the covers to allow observation of the motor-driven guide-lifter and play-head shield. The actuation was always smooth and much quieter

Fig. 4—Third harmonic distortion vs. level of 1-kHz signal using Maxell UD-XL. (Zero reference level is 200 nWb/m.)





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These are just three of the exciting new components in Technics Silver Edition. Each was designed to please the eye, but, of course, their real beauty lies in what you hear.

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3 DA is a computer measuring system designed by Hewlett-Packard and Technics. It gives audio engineers and you a far greater insight into amplifier performance than is possible with conventional separate measurements of frequency response, power, and distortion.

4000 precise measurements are plotted on a three-axis graph with power measured from 0.2 watt to rated output across a frequency band of 10 Hz to 100 kHz. Distortion is evaluated from 0.0001% with distortion components measured out to 1 million Hz. The result is a picture of performance you won't get with conventional specs.

Even elusive amp behavior like slewing rate and Transient Intermodulation Distortion (TIM) are easily identifiable, which helped our engineers design Silver Edition amps with appropriate slewing rate and inaudible TIM distortion.

That's one good reason the SU-8099 is hard to beat. Another is it's a true DC integrated amp. With no coupling capacitors from input to output. And the output devices are our new Super Linear Power Transistors (SLPT) with an f_T of 100 MHz which enables us to achieve a closed-loop frequency response from DC to 200 kHz - 3 dB.

In the preamp section, our engineers added an extremely quiet phono equalizer complete with Technics-developed ultra-low-noise transistors. The result: an incredible phono S/N ratio of 96 dB at 5 mV. They also made it

easier and less expensive to use a moving coil cartridge, because there's an MC pre-preamp built into the SU-8099.

To maintain dynamic range and avoid clipping, you need highly accurate power meters. Like our fluorescent FL power meters. They're completely electronic, highly accurate and extremely fast. So you can easily get true peak readings.

To complement our integrated amp, there's the ST-8077 tuner. A highly sensitive front end boosts sensitivity to the point where even remote FM stations can be received with a great degree of clarity and fidelity.

For inaudible distortion and excellent selectivity, the IF stage features a five-stage, differential amplifier and surface acoustic wave filtering. There's also a 19 kHz pilot-signal cancel circuit for extremely wide frequency response with excellent transient characteristics.

For accurate and easy tuning, center-of-channel indication is located on the tuning dial where it's easy to see. Two LED arrows point you in the right direction for fine tuning. And Active Servo Lock (ASL) keeps it perfectly tuned.

What you get with the RS-M44 cassette deck is just as impressive. Starting with an IC-controlled FG servo DC motor for inaudible wow and flutter and a patented HPF head for extended frequency response and head life.

For fast recognition of musical peaks, the RS-M44 features fluorescent bar-graph meters with a device attack time of five millionths of a second. Also included are separate three-position bias and EQ selectors. An oil-damped ejection door. And three memory modes: auto rewind, auto play and auto rewind/play.

The Silver Edition from Technics. Their real beauty lies in their performance.

SU-8099

ST-8077

RS-M44

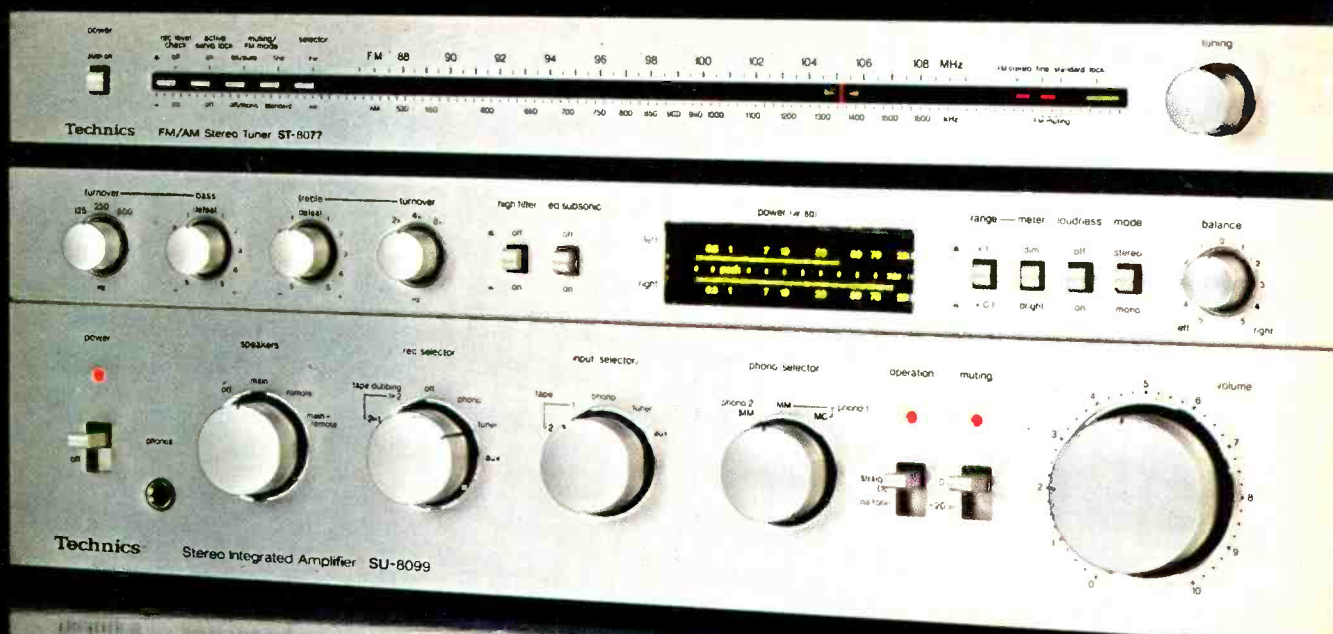
| Continuous Power Per channel into 8 ohms | Total Harmonic Distortion at Rated Power | Phono S/N | FM Sensitivity 50 dB (stereo) | FM Selectivity | Stereo Separation (1 kHz/ 10 kHz) | Total Harmonic Distortion (stereo) | Wow and Flutter | Frequency Response | S/N |
|--|---|-------------|----------------------------------|-------------------|--|---|-----------------|--|-----------------|
| 115 watts (20 Hz ~ 20 kHz) 100 watts (5 Hz ~ 100 kHz) | 0.007% (20 Hz ~ 20 kHz) 0.05% (5 Hz ~ 100 kHz) | 96 dB (5mV) | 37.2 dBf | 75 dB | 45/35 dB | 0.1% | 0.05% WRMS | 30 Hz ~ 17 kHz (FeCr/CrO ₂) | 67 dB Dolby* in |

*Dolby is a trademark of Dolby Laboratories, Inc.

Introducing the Silver Edition. Their real beauty lies in their sound.



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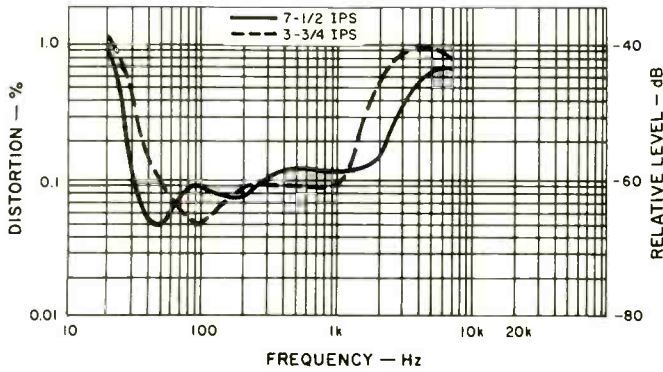


Fig. 5—Third harmonic distortion vs. frequency with Maxell UD-XL at a constant record level, that for 200 nWb/m at 1 kHz, which indicates -8 dB on the meter.

than some solenoid types. There had been some question on the desirability of having the tape contact the play head in a wind mode. There was a definite advantage in being able to cue by ear, but would wear be a problem? It was determined that the tape/head contact pressure was very low, leading to the conclusion that such wear should be minimal.

All knobs were of medium size with fluting for easier turning, which was quite smooth. The lever switches were spring loaded which gained positive action from one position to another. All switchable functions performed as called for with complete reliability. The instruction book has 32 pages of helpful information. The format is quite open, making for easy reading of the excellent exposition. There are many well-chosen illustrations including signal-path block diagrams showing how to connect for sound-on-sound, echo, and other special effects. There is no schematic to satisfy the circuit freaks, but the instructions required by the serious audiophile are there, presented with a refreshing clarity.

In the recordings made, stop clicks were down into tape noise and just detectable. At no time were record clicks observed. Making recordings brought satisfaction both in the results obtained and in the utilization of the various features. The TD 20A easily met the challenges of the sources I had available. There was no way to really exercise the low end: 10 Hz from what and through what? Recording levels had to be very high before there was much evidence of strain. The meters were easy to work with, and the calibration did appear to

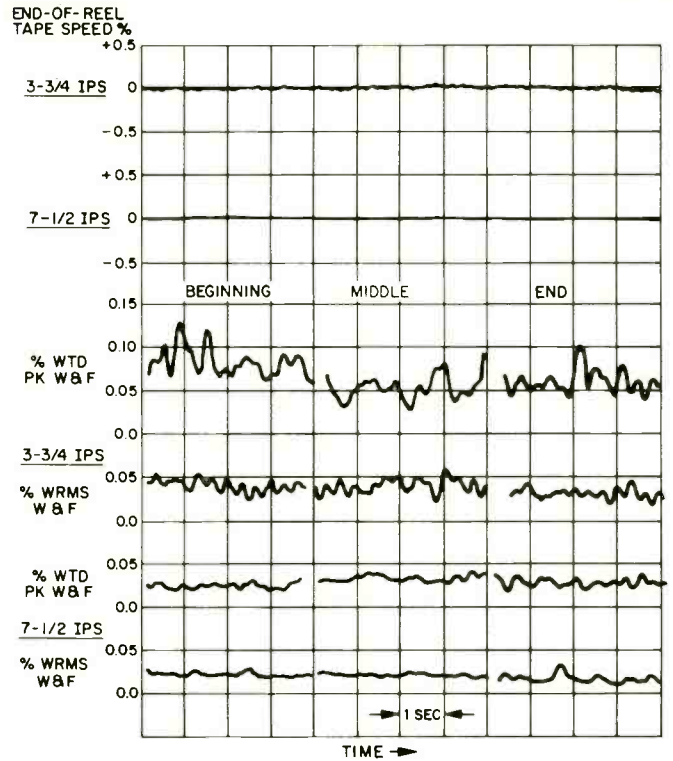


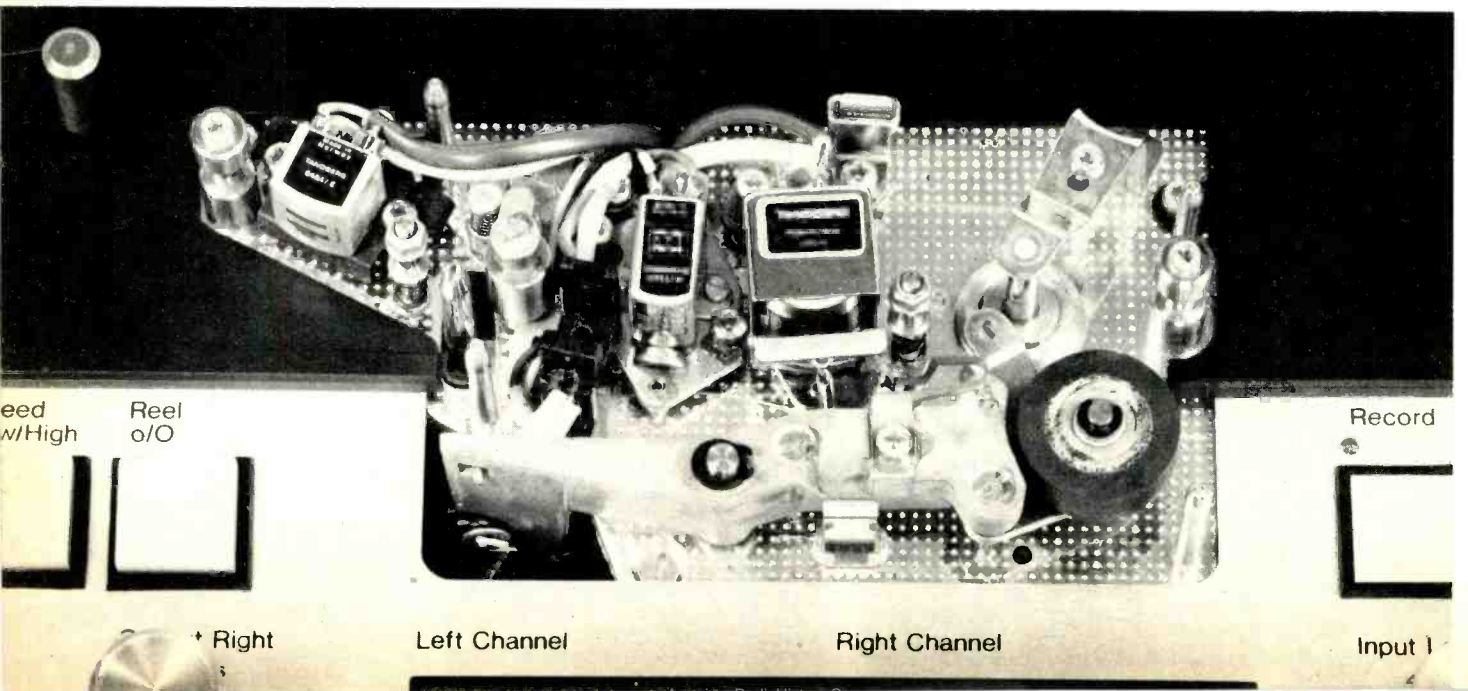
Fig. 6—End-of-reel tape speed variations at 3¾ and 7½ ips together with wow and flutter at both tape speeds, weighted on both peak and rms basis.

be quite appropriate for the post-EQ feed. I did not have a convenient way to take the Tandberg for on-location recording. That would be a good use for the deck with its light weight and high quality, and there is an accessory travel/shipping container available. There is also a wireless PCM infrared remote-control unit that sells for about \$200.00.

The Tandberg TD 20A open-reel deck is an outstanding machine with unsurpassed flatness of frequency response and very low distortion. Also not to be overlooked is the fact that the machine's heads and bias circuitry have the capability of matching the yet-to-be-marketed open-reel metal-particle tapes. This and other features of the recorder make it most worthy of consideration by the serious audiophile.

Howard A. Roberson

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Luxman R-1050. 55 watts per channel, total harmonic distortion no more than 0.05%.* 12-LED peak level display with selectable sensitivity. Dual-gate MOSFET front end. Direct-coupled preamplifier equalizer stage and direct-coupled DC power amplifier. Connections for two decks, two phonos, auxiliary; tape-to-tape dubbing.

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*Minimum continuous power, both channels driven into 8 ohms, 20-20 kHz.

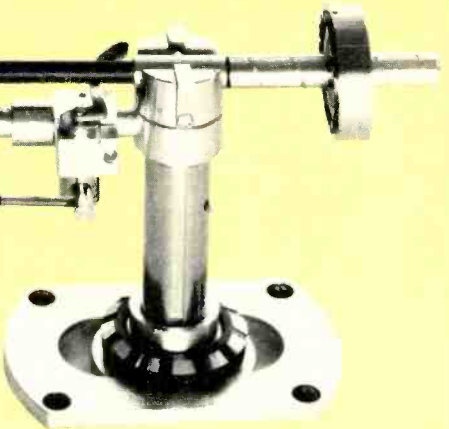


Infinity Black Widow Tonearm

MANUFACTURER'S SPECIFICATIONS

Overall Length: 11¾ in. (30 cm).
Pivot-to-Stylus Distance: 9½ in. (23.7 cm).
Effective Tonearm Mass: 3 grams.
Cartridge Weights Accomodated: 4 to 8.5 grams.
Stylus Force Adjustment: Calibrated in half-gram steps.

Anti-Skating: Calibrated fine-spring adjustment.
Cueing: Oil-damped device.
Bearing Friction: At stylus point, vertical bearing (knife edge), 0.005 gm; Lateral (fine miniature ball bearing), 0.01 gm.
Price: \$245.00.



The Infinity "Black Widow" tonearm is a sleek, black and silver beauty intended to vie for top honors with the finest low mass arms now available. It is produced by a company which, since its inception in 1968, has had as its goal, production of "state-of-the-art" audio components. Infinity Systems has established its reputation as a producer of excellent loudspeaker systems. Infinity's first product was the Servo-Statik I loudspeaker system. The company was started by Arnold Nudell, who is still its president, along with Cary Christie. Infinity is now a subsidiary of Electro Audio Devices.

The "Black Widow" arm has a very low effective mass, which means that it can be used with very light, high compliance cartridges. The main arm tube is made of graphite fibre, a material which is very light and stiff and appears to have good internal damping of structural resonances. The tests were made using an ADC ZLM cartridge, which is ADC's top cartridge. We checked with Infinity and they indicated that the ZLM cartridge was compatible with the "Black Widow" arm and that the combination should provide excellent results. The ADC ZLM Serial No. 7E7021 was used.

The mounting of the arm to the turntable is simple, if your turntable has a cutout or an adaptor for the SME tonearm, since the "Black Widow" uses the same size mounting hole. If not, it is a little more difficult since the hole must be oblong. A good template and detailed pictorial instructions are provided for cutting the hole and mounting the arm. The sequence of photos and instructions is excellent.

Since the Pioneer PLC-590 turntable we used as a test platform has an SME arm mounting adaptor, we had the Infinity "Black Widow" mounted in a very short time with no problems. The arm rest is integral with the arm, so no extra hole is needed. The main arm pillar extends below the surface of the turntable 1.5 inches when the arm is set for the minimum

height, as would be the case for a very shallow turntable. In this position, the center of the arm is about 1.5 inches above the turntable surface. The arm can be adjusted upwards to accommodate any turntable. The slender graphite fibre arm tube has an integral phono cartridge mount and finger lift. There is no interchangeable headshell but this convenience is offset by the great reduction in effective mass thus afforded. Keeping the mass low at both ends of the arm is very important if optimum results are to be achieved. The counterweight design is also excellent in this respect. It is about 1.25 in. (3 cm) in diameter, about 0.344 in. (0.87 cm) thick, and weighs 49.6 grams.

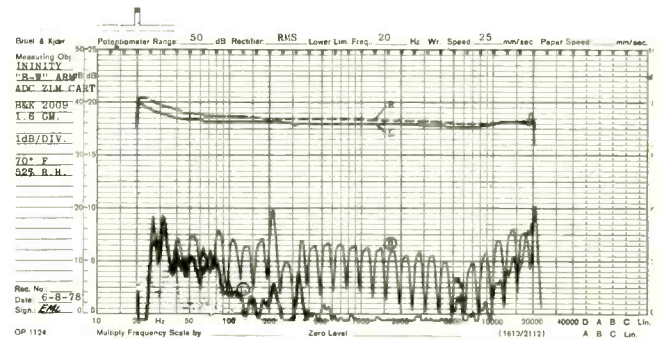
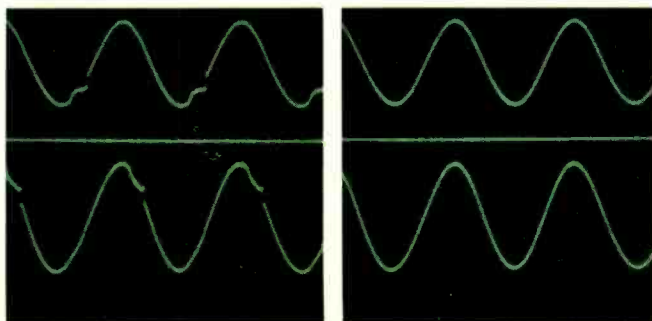


Fig. 2—Interchannel output and crosstalk vs. frequency. Notches in crosstalk signals are due to filter switching. Increased crosstalk at 200 and 315 Hz are related to small "glitches" in main channel outputs.

Fig. 1a—Left, Infinity Black Widow tonearm with ADC ZLM cartridge playing band 9, 300 Hz, on CBS STR-112; level is +18 dB re: 11.2 µM. Tracking force is 1.25 grams, sidethrust is 1.5 grams. Fig. 1b—Right, as in a, but tracking force is 1.9 grams and sidethrust 2.5 grams.



This shape factor and weight means that it can be located close to the pivot, when used with a low mass cartridge like the ADC ZLM, which weighs 5.5 grams, and the tracking force is adjusted to as much as 2.0 grams. At a lower tracking force which would normally be used, the counterweight is close to the arm pivot which is very good. It appears that cartridges weighing as little as 3.5 grams could be used. The counterweight can be positioned out as far as 2.5 in. from the pivot, if heavier cartridges must be used, but this would not be as good a mode of operation and should be avoided if possible.

The arm tube is very slender. It is only about 0.156 inches (0.4 cm) in diameter out at the cartridge end. Despite its thin cross-section, it appears very stiff. More importantly, it seems to have a high internal damping. This means that mechanical energy, which is transferred to the arm from the cartridge (this happens with all arm/cartridge combinations to some

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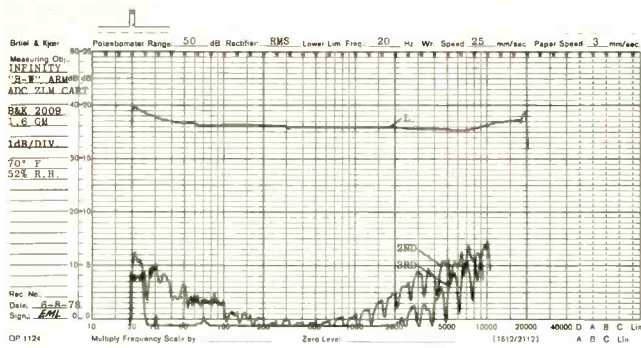


Fig. 3—Second and third harmonic distortion vs. output of left channel. Part of this distortion is probably due to the B&K 2009 test record.

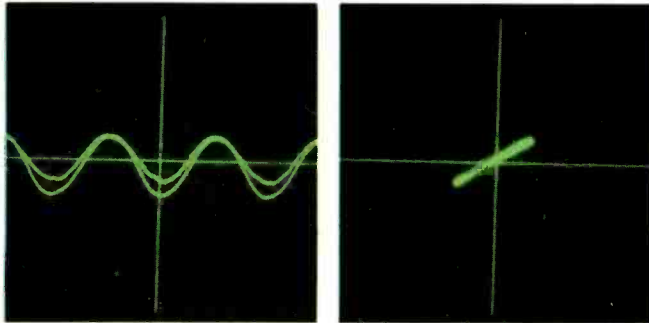


Fig. 4a—Left, amplitude vs. time (Y-T) for 3-kHz signal from B&K 2009. Fig. 4b—Right, right vs. left channel (X-Y). If both channels were identical, then the sine waves in 4a would be superimposed and there would be a straight line at 45° in 4b. The vertical and horizontal lines are cursors in both 4a and 4b and are not intended to represent a zero center, X vs. Y grid; this is true for all similar waveforms in this report.

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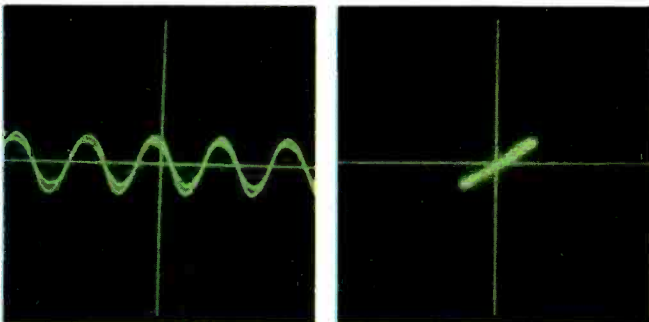


Fig. 5a and b—As in Fig. 4 but with a 5-kHz test signal.

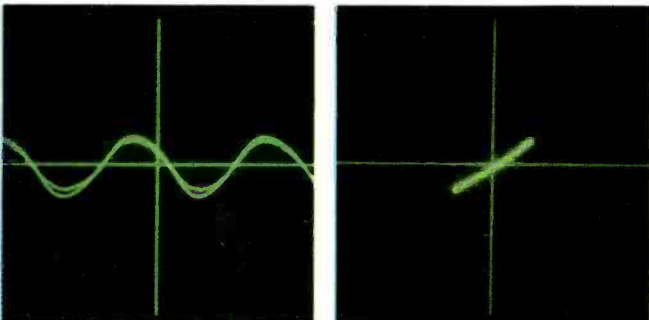


Fig. 6a and b—As in Fig. 4 but with a 10-kHz test signal.

degree), tends to be absorbed and dissipated by the arm. The ill effects of undamped, mechanical standing wave energy in tonearms has been known for years. Such audio pioneers as Joseph Grado and Paul Weathers used wood as an arm material because they wished to obtain good damping of these structural vibrations. The reduction of coloration due to this internal vibration damping of the arm is very dramatic.

A special template is provided so minimum tracking angle error may be achieved. The template is used to set the correct position of the arm pillar by sliding a locking collar in the oblong cutout. This is a geometrically excellent method of adjusting for minimum tracking angle error. We measured the amount of stylus “overhang” after using the template. It was approximately 1.5 cm which is a “normal” value with respect to other geometric considerations of the “Black Widow” tonearm. Side thrust correction (also called anti-skating or bias) is provided by adjusting a slip-fit ring on a post which extends out from the front of the main pillar. We found that it needed to be set at a little higher value than indicated, but it was calibrated closely enough to be of no concern. The method of setting the side thrust also lent itself to real-time, visual adjustment while reproducing the tracking adjustment bands on B&K 2010 (1 kHz), CBS STR-112 (300 Hz), and HFS-75 (300 Hz). We found that the tracking force and side thrust correction needed to be increased a bit at the inner grooves, which would seem normal enough.

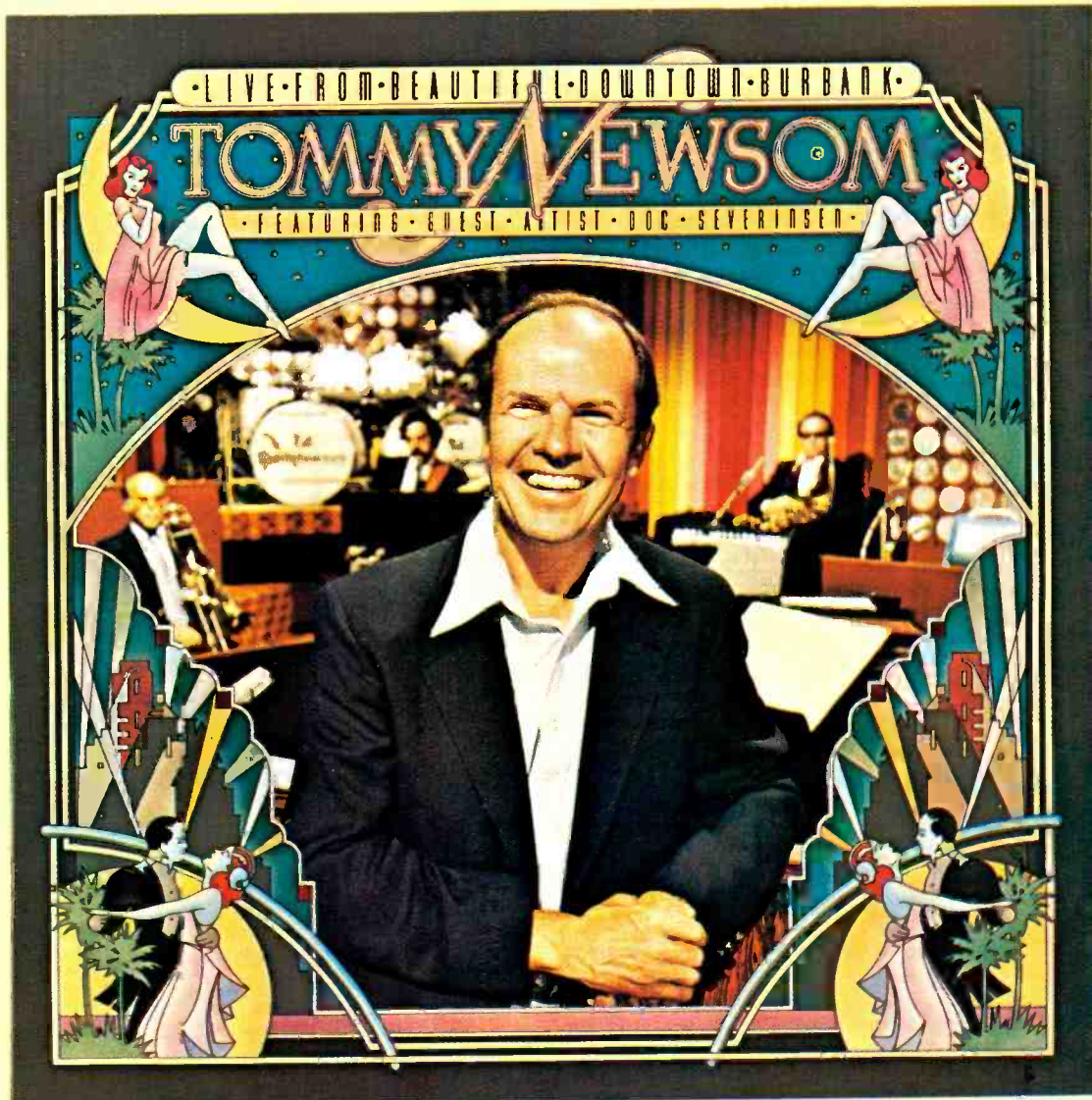
A good cueing lever is integral with the arm. It is damped in the direction of descent and undamped in the lift mode.

A low frequency resonance damping device is included as an integral part of the arm. This consists of a small trough attached to the main pillar and a small post attached to the arm tube. A viscous fluid is placed in the trough and the post on the arm tube must travel through it. The drag of the viscous fluid allows the slow movements required in reproducing a record but offers resistance to “quick” movements of the arm. “Quick” in this case would mean small movements at about 10 to 12 Hz which is the desired arm mass/cartridge compliance frequency of resonance.

The capacity of the internal wiring is 15 pF which is very low. The external cable supplied measured 85 pF, so the total value of capacity is 100 pF per channel. Our technical measurements were made with a total of about 225 pF. Our previous report on the ADC ZLM mounted in the ADC LMF-2 arm and using the high capacity ADC cable supplied caused a total of 335 pF to be loading the cartridge. It would appear that value of 275 pF recommended by ADC is about right, since it is apparent that the output of cartridge is rising with the 225 pF load.

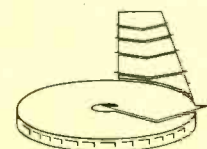
Figures 1a and 1b show the left (upper) and right (lower) channel outputs when reproducing the 300 Hz tone on CBS test record STR-112. The same format is followed for all other photos in this report. Both photos show the response to the highest level band on the record. This level is extremely difficult to reproduce but, by increasing the tracking force and side thrust correction beyond that recommended, it was possible, as shown in Figure 1b. Since it is not good to exceed the manufacturer’s recommended tracking force by a large amount; it was reduced to 1.6 grams for the technical measurements and the listening tests. During the listening session, panel members did comment that they heard occasional distortion which is normally related to mistracking. It only occurred during very high-level passages in the music and wasn’t severe. Since the clarity was excellent during normal passages, perhaps a clue to this phenomenon can be seen in the way the tracking varies with level. The figures for tracking the 1000 Hz test signals of B&K test record 2010 indicate that the tracking force requirement for bands 4 through 7 are low, indicating an exceptional combination of arm and cartridge. However, in order to track band 3, the force required had to be increased rather dramatically, from 1.0 gram to beyond 2.0

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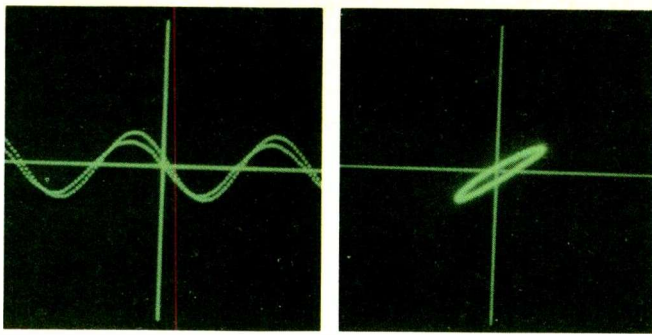


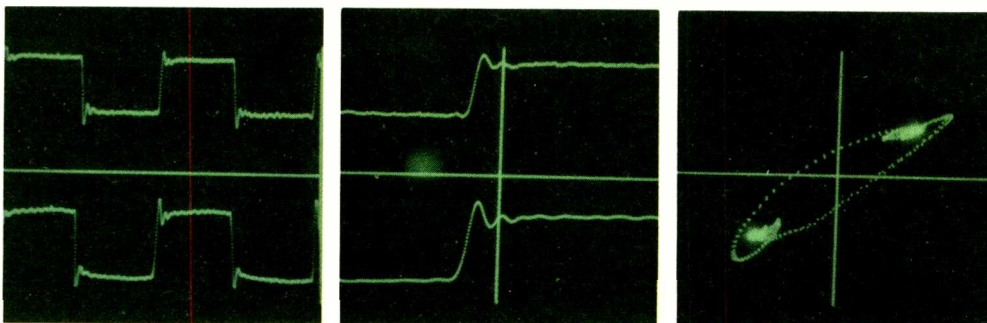
Fig. 7a and b—As in Fig. 4 but with a 20-kHz test signal.

grams. Even at 2.0 grams, visual and audible distortion was present. This would indicate that the distortion due to mistracking an occasional peak would be more easily heard with respect to a very clean signal reproducing condition which would predominate. By contrast, a listener who becomes accustomed to a constant level of distortion, albeit low, is less able to hear momentary increases in distortion. As shown in Figure 1b, the 300 Hz signal of CBS STR-112, band 9, was tracked at 1.9 grams but this was also touchy.

The same high quality system used as a reference in the report on the ADC ZLM cartridge and LMF-2 tonearm was used again as means of gathering subjective comments from the listening panel. A certain amount of coloration in the reproduction of vocals was noted by panel members. This effect could be related to Fig. 2. The crosstalk data shows an increase in output from the left channel, at about 315 Hz when reproducing a signal recorded in the right channel only. The right channel shows a similar effect in the crosstalk at about 200 Hz. This effect causes a slight resonance in the vocals to be heard as a coloration. It appears to be caused by a resonance between the arm and the vertical knife bearings. These bearings are not tight, in order to reduce friction to a minimum. We advise users of the "Black Widow" to make certain that the arm is free and properly centered in the bearing supports. Apparently, when we measured the data shown in Fig. 2, the arm was not centered as well as it could have been, which could partially account for the difference in the amount of crosstalk.

The downward "glitches" in the crosstalk curves are due to the fact that the crosstalk output of the cartridge is being scanned by a 1/3-octave wide filter which is switching in steps. During the switching the output drops momentarily, producing the dip in the crosstalk curves. The use of this filter scanning technique allows the signal-to-noise ratio to be increased enormously so that details in the crosstalk signal can

Fig. 8a—Far left, response to 1-kHz square wave signal at 3.54 cm/Sec modulation on CBS STR-112 record. Fig. 8b—Middle, expansion of leading edge of Fig. 8a. Fig. 8c—Complex signal condition for both channels. With perfect reproduction, only two bright dots in the first and third quadrants would appear (see text).



be seen easily. The dip in response at 18 kHz is an artifact of the B&K 2009 test record.

Despite the slight rise in the measured response at high frequencies, the panel members were consistent in their comments, on all program material, that there seemed to be a lack of overtones or top end as compared to the reference system. The reference system measured as being smoother than the Infinity Black Widow and ADC ZLM combination, so amplitude vs. frequency response, due to steady state signals, does not give a correlation with this perceived effect, and in this case appears to contradict it. It appears that we will have to look elsewhere for an explanation.

The general clarity of reproduction is corroborated by the distortion data shown in Fig. 3, which is very low. The data shown in Figs. 4, 5, and 6 correlate very well with the subjective comments of the listening panel with respect to the stereo imaging, when reproducing relatively simple program material. This was judged to be excellent. Figure 7b shows the interchannel relationship when reproducing a 20-kHz signal. A bit of phase shift can be seen and perhaps this may indicate a bit of correlation with the comments about the lack of top harmonics. While phase shift between the channels does not prove that a subjectively perceivable time delay effect is occurring in the individual channels, it does indicate that some time delay must be occurring.

The stereo imaging for both simple and complex musical passages remained very stable according to the panel, and this is corroborated by the measurement of interchannel relationships shown in Fig. 8c for a 1000-kHz square wave modulation. The ripple shown on the square waves of Figs. 8a and 8b indicate that the resonant frequency of the stylus mass and record material compliance is at 28.6 kHz. Figure 9 shows that the rise time of the ADC ZLM cartridge is again 24 microseconds as it was in the report on the ADC ZLM and LMF-2 arm combination. This bears out the fact that the resonant frequency and rise time of a cartridge is unaffected by the tonearm in which it is used.

It must be concluded, at this point in our investigation of cartridges and tonearms, that if the tonearm is allowing the cartridge to stay in intimate contact with the grooves and all else is generally the same, the difference perceived in overtone reproduction or in the transients produced by percussive instruments between high quality magnetic and moving-coil cartridges is probably due to the time delay effects caused by the high inductance of the magnetic cartridge and the associated input load capacity. This effect was verified in another experiment which was conducted with a moving-coil type cartridge in which a time delay was introduced.

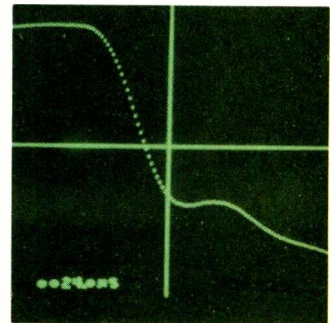


Fig. 9—Rise time of the ADC ZLM cartridge in the Infinity Black Widow tonearm.

The listening panel made some other comments which touched on the interrelationship between the arm and cartridge. The upper bass register of the acoustic guitar sounded tighter and more well defined, while the lower register of such instruments

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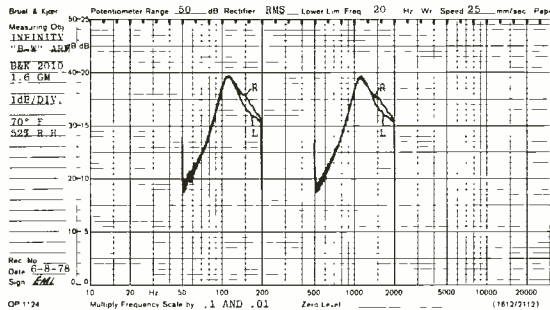


Fig. 10—Low frequency resonance due to arm effective mass and cartridge compliance. Left curves without damping; right curves with damping; little or no change is noted. Each curve is from 5 to 20 Hz; Q is 2.9 for both modes.

as the double bass and drums was less tightly controlled, when compared to the reference system. Figure 10 shows the low frequency resonance effect caused by the effective mass of the arm and the compliance of the cartridge. The resonance is at 11 Hz and the Q is 2.9. This frequency is about right according to the latest research. The curves at the left of Fig. 10 show the response without the viscous damping applied while the curves at the right of Fig. 10 are with the damping system operating. The frequency range for each of the curves is 5 Hz to 20 Hz. The tendency of the low bass to excite this 11 Hz resonance and thus produce a modulation effect is most probably the cause for the comments by the panel members regarding the lack of precision in the very low bass. The lack of effect by the damping system appears due to the small size of the damping post (sometimes called a paddle) and the low viscosity of the damping fluid. This is

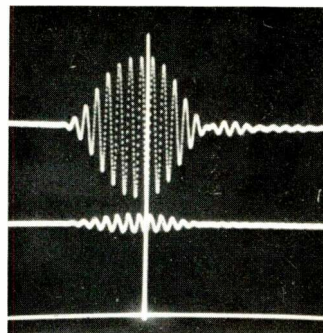


Fig. 11—Filtered tone burst using 10.7 kHz from Shure TTR-103 record; left is upper trace. Peak modulation level is 30 cm/Sec.

being worked on by the people at Infinity and in fairness we must say that the arm used in our report had a prototype damping system. By the time that you read this report, the damping system should be made effective in reducing the Q of the low frequency resonance. This should cause the reproduction in the low bass register to become excellent.

Figure 11 shows the response of the left and right channels when reproducing the 10.7-kHz filtered tone burst of band 4 on Shure test record TTR-103. This band is recorded at 30 cm/Sec which is a very high level. A small amount of delayed signal can be seen in the left channel as well as some distortion in the right channel crosstalk output. At this point in our investigation of various arm/cartridge combinations, the reproduction of this test signal by the Black Widow arm and ADC ZLM cartridge has to be classed as very good.

The Black Widow arm is very easy to set up and use, but we recommend that to achieve the maximum potential, it should be mounted and adjusted by a qualified person who has the proper equipment, although this is not absolutely necessary. We also recommend that, to obtain the full benefits of this excellent arm, a high quality, low mass, high-compliance cartridge be used.

Edward M. Long

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Measured Data Infinity Black Widow tonearm

ADC ZLM phono cartridge

Dynamic Tracking Force, grams
required to track

B&K 2010 (Gms x 980 = dynes)

Band 3, +8 dB Distorted

Band 4, +6 dB 1.0

Band 5, +4 dB 0.8

Band 6, +2 dB 0.6

Band 7, +0 dB 0.5

Tracking vs. Radius, HFS-75, grams

Outer Grooves 0.8

Middle grooves 0.9

Inner grooves 1.0

Microphony: Very low

Low Frequency Resonance: 11 Hz.

Low Frequency Resonance Q: 2.9.

Recommended Tracking Force: 1.6 gms.

Infinity Black Widow tonearm

Pivot-to-spindle Distance: 8.75 in. (22.2 cm).

Pivot-to-stylus Distance: 9.34 in. (23.7 cm).

Pivot-to-rear of arm Distance: 2.44 in. (6.2 cm).

Spindle-to-rear of arm Distance: 11.125 in. (28.3 cm).

Overall Height Adjustment: 1.5-3.5 in. (3.8-8.9 cm).

Tracking Force Adjustment (Maximum): 4 grams.

Tracking Force Calibration: 8 grams.

Tracking Force Accuracy: 0.55 at 0.5, 1.05 at 1.0, 1.6 at 1.5, and 2.7 at 2.5; good accuracy.



Cartridge Weight Range: 3.5 to 8 grams.

Counterweight: 49.6 grams.

Counterweight Mounting: Slip fit on damped rod with spiral thread.

Sidethrust Correction: Marked for 0 to 2.5 grams with excellent uniformity.

Lifting Device: Finger lift plus lever, damped down, instant up.

Cartridge Offset: 20 degrees.

Overhang Adjustment: 1.5 cm.

Template: Good.

Bearing Alignment: Good in both planes.

Bearing Type: Vertical knife; horizontal, ball race.

Bearing Play: Vertical, large amount; horizontal, very low.

Bearing Friction: Less than 50 mGm in both directions; too low to measure accurately.

Lead Torque: Very little effect.

Arm Lead Capacity: 15 pF internal, 85 pF external, 100 total.

Arm Lead Resistance: 0.72 ohms internal, 0.18 ohms external, 0.90 total.

Lead Length: 48 in. (122 cm).

Structural Resonances: Extremely dead, dull "clack" when tapped.

Base Mounting: SME type, elongated hole, will mount in SME cutout.

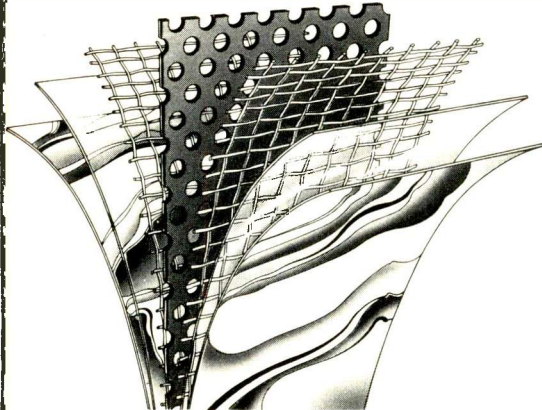
General Comments: Total capacitance at preamp should be about 175 pF. Make certain that vertical knife bearings are seated properly during use.

ELECTROSTATICS TURNED INSIDE OUT.

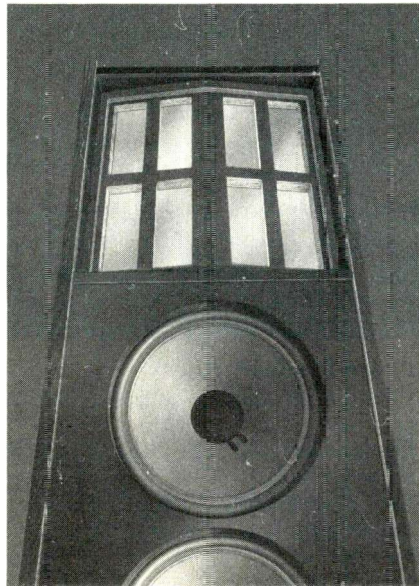
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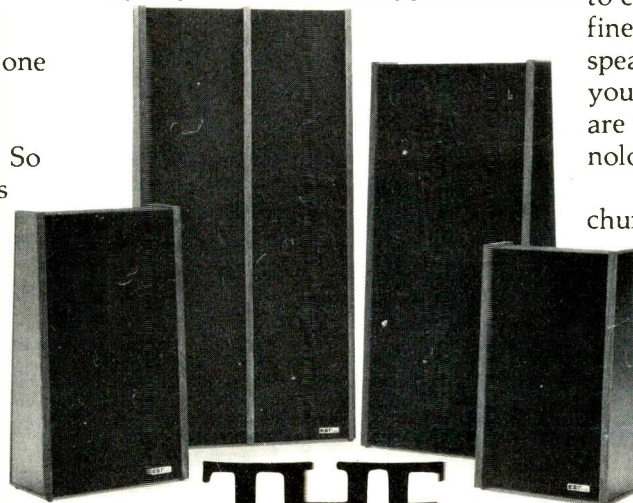
83



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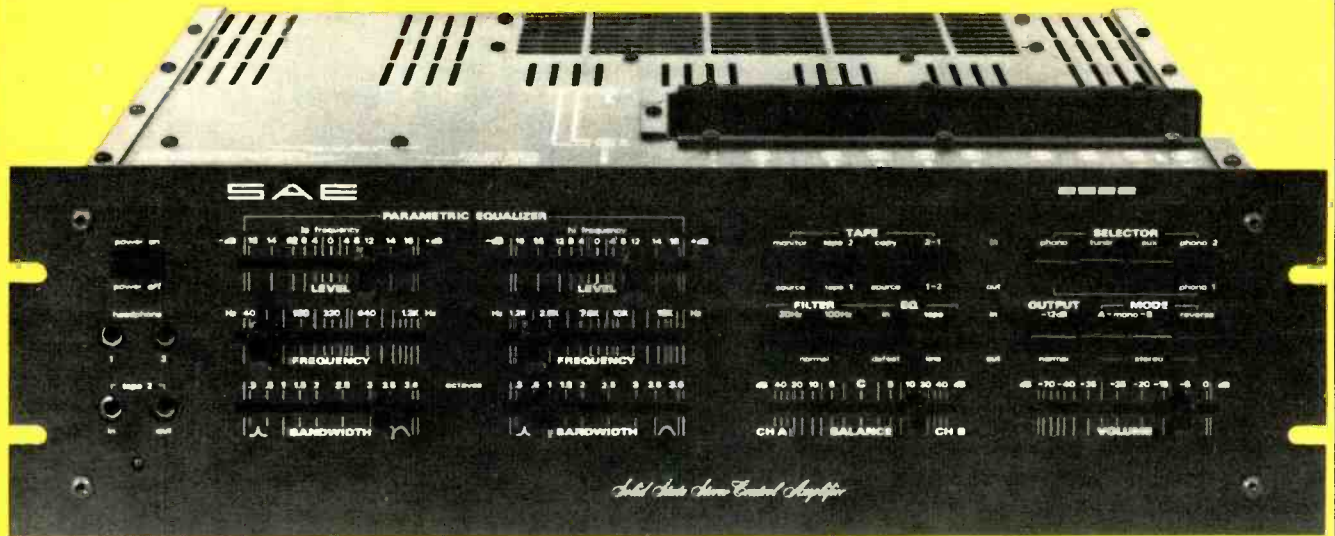


THE TRANSLATORS.

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SAE Model 2922 Integrated Amplifier



MANUFACTURER'S SPECIFICATIONS
THD (To rated output): 0.01 percent.
IMD: Any two mixed frequencies from 20 Hz to 20 kHz, 4:1, 0.01 percent.
Rated Output: 2.5 V.
Frequency Response: Phono, RIAA ± 0.25 dB; Line, 20 Hz to kHz, ± 0.25 dB.
S/N Ratio: Phono re: 10 mV input, "A" weighted, 90 dB; Line re: 2.5 V out, "A" weighted, 110 dB.

Phono Overload: 150 mV.
Phono Input Termination: 47k and 100 pF.
Phono Gain (To tape out): 35 dB; 60 dB to pre out.
Gain (Line input): 25 dB.
Power Amplifier Section
Power Output: 100 watts continuous per channel from 20 Hz to 20 kHz, 8 or 4 ohm loads.

Rated THD: 0.05 percent.
Rated IMD: 0.05 percent.
S/N Ratio: 100 dB below rated output.
Square Wave Rise Time: 2.5 microseconds.
Slew Rate: 40 V/ μ S.
Damping Factor: 150 at 100 Hz.
Input Sensitivity: 1.5 V rms.
Price: \$850.00.

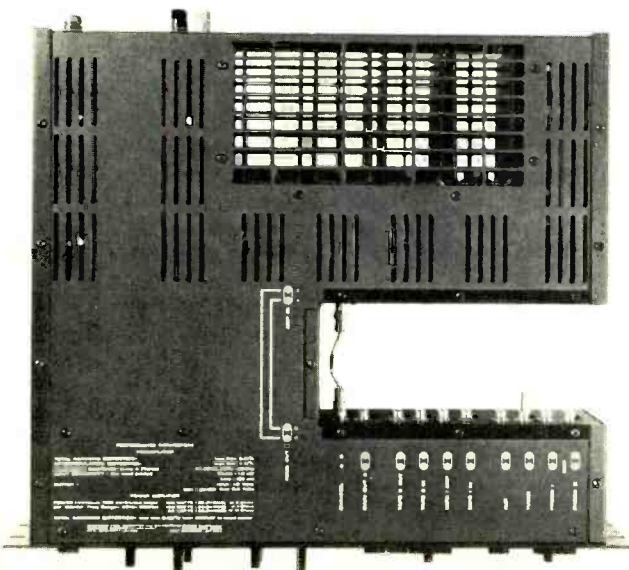
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We've all heard it said that an integrated amplifier is really nothing more than a power amplifier and a preamplifier assembled on one chassis. In the case of SAE's Model 2922 that is almost literally true. SAE calls this unit a preamp/amp, rather than an integrated amplifier, and the reason is obvious when one looks at the unit. They have taken their Model 2200 power amplifier (which carries a price of \$500.00) and "attached it" to their Model 2900 Parametric Equalizer/Preamplifier (which is also designed to sell for \$500.00). By eliminating a couple of frills such as the peak-power LEDs of the 2200 and assembling everything that's left on a single, large chassis, the resulting 2922 comes out costing considerably less than the sum of its parts. All of the signal handling circuitry of the 2922 is identical to that used in the equivalent separate units.

In fact, the shape of the chassis is a sort of dead giveaway. The rear power amplifier section is "attached" to the front preamp section by a sort of "bridge" at the left, but remains separated from it at the right to form a U-shaped recess as one looks down on the unit from the top. Input and output cables relating to the preamp are connected within this open U-shaped area, while speaker outputs and A.C. connections are on the rear of the amplifier section as one would normally expect. Short pin-to-pin cables interconnect the preamp outputs to the main amp inputs, just as if the two were separate units.

The front panel of the SAE 2922 is black, like other SAE products, and has no rotary controls or switches whatever. All functions are controlled either by pushbuttons or slide levers. At the left is a power on/off button and just below it are twin stereophonic jacks plus Tape 2 in-and-out jacks which permit connection of a tape deck via the front panel. The left side of the panel also contains six continuously adjustable slide controls, arranged in two groups of three each, which take care of the parametric equalization functions of the preamp-control unit.

As most readers probably know by now, a parametric equalizer provides three degrees of response control. Instead of simply varying the degree of boost or cut at some specified center frequency (as is the case with graphic equalizers), the controls on a parametric equalizer let you adjust the center frequency to be boosted or cut, as well as the bandwidth or "Q" of the resonant circuit associated with each frequency band to be controlled. Because of this increased degree of flexibility, fewer frequency bands or sets of controls are required with a parametric equalizer. Some separate parametric equalizers provide three, four, or five bands or sets of controls. The SAE 2922 offers only two, but each covers a wide range of center frequencies. The low-frequency control can place the desired center frequency at any point from below



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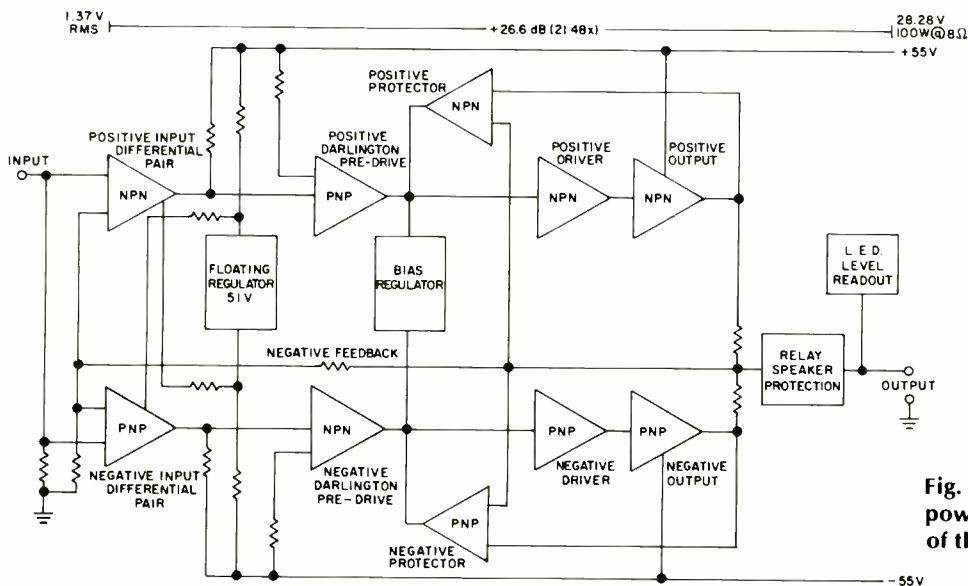


Fig. 1 — Block diagram of the power amplifier section of the SAE 2922.

40 Hz to 1.2 kHz, while the high-frequency control varies center frequencies from 1.2 to 16 kHz. As much as 16 dB of boost or cut can therefore be applied at any two desired center frequencies selected by the user. The bandwidth controls adjust the shape of the boost or cut curve from 0.3 octaves to 3.6 octaves.

Two slide controls at the lower right of the panel are used for channel balancing and master volume control. Above the balance control are four pushbuttons, two of which activate the low-cut filters, while the other two turn on the EQ and provide for pre- or post-equalization at the tape outputs as required. Above these buttons are four more which select tape monitoring and dubbing or copying functions. The number of possible combinations using these eight buttons is staggering. The owner's manual describes 21 possible combinations of dubbing, copying, monitoring, and assignment of equalization, and provides simple-to-understand diagrams and flow charts to help the user become familiar with all the possibilities available.

Two more rows of four pushbuttons each are located above the volume control slider. The upper row takes care of program selection (phono 1, phono 2, tuner and AUX), while the lower four buttons select various modes of output (including 12 dB audio muting) such as left-mono, right-mono, stereo, and reverse.

As we mentioned earlier, input connections are made in the U-shaped area which separates the preamp and amplifier sections of the chassis. Two sets of outputs are supplied, so even with the preamp outputs connected to the associated amp section, one could drive a second, remote power amp by connecting to the alternate output pair.

Circuit Highlights of The Power Amp Section

As can be seen from the block diagram of Fig. 1, the circuitry of the SAE 2922 power amplifier section is totally complementary from input to output. This is made possible by the

use of dual-complementary differential input stages which are followed by the full complementary push-pull predriver stages. All stages up to this point are operated in Class A. The drivers drive a full complementary output stage. This output design, according to SAE, results in high current capability without loss of power bandwidth, a high slew rate, and low leakage current.

Bias current in the output stage is controlled by a compound transistor regulator circuit. SAE takes the position that d.c. amplifier coupling is undesirable and uses a.c. input coupling instead. However, the low-frequency cutoff point is set at an ultra low 0.01 Hz. Four triple-diffused output transistors and four driver devices are used. SAE states that output stage capability is so great that the amplifier will deliver rated power into any load, whether resistive or reactive.

The amplifier is also equipped with relay protection circuitry which not only protects loudspeakers from possible damage but also protects itself under severe load conditions. A thermal cutout is employed to protect against high temperature operation. In addition, a low-impedance electronic sensing circuit limits output current with loads below 2 ohms without in any way limiting current for loads of 4 ohms or higher, or when the amplifier is used with highly reactive loads such as electrostatic speaker systems.

Power Amplifier Measurements

We measured available power output at 1 kHz for both 4-ohm and 8-ohm loads, since SAE rates the 2922 for both of these load impedances. With 8 ohm resistive loads, the amplifier delivered 120 watts per channel, both channels driven, before reaching its rated THD and IM distortion levels of 0.05 percent. At rated output, THD measured only 0.0065 percent while IMD measured 0.015 percent. Results of our power-vs-distortion measurements are shown in Fig. 2, for 8-ohm loads, while in Fig. 3 we have plotted the same information for 4-ohm resistive loads. In 4-ohm operation, the amplifier

Fig. 2 — Power output vs. distortion with 8-ohm loads at 1 kHz.

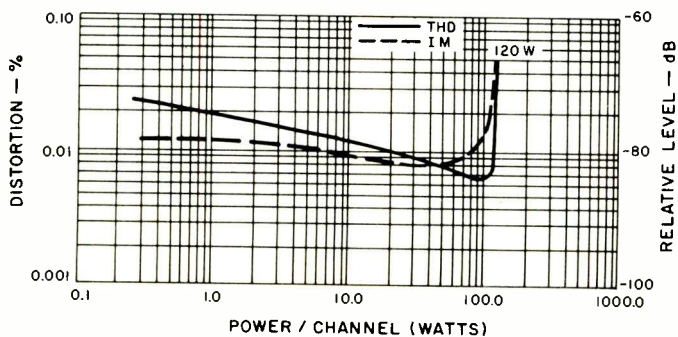
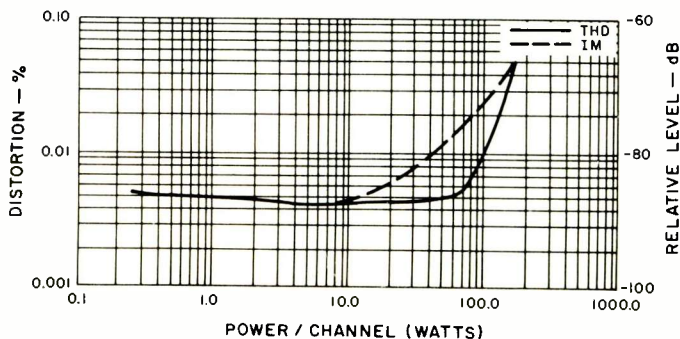
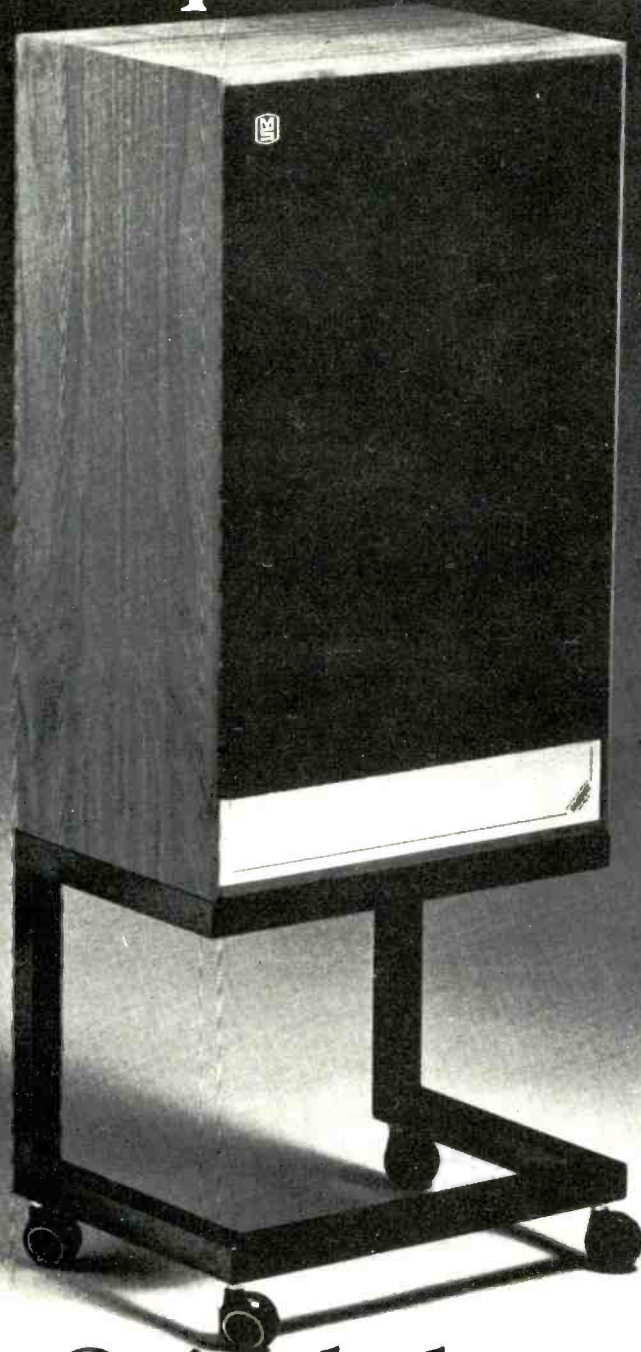


Fig. 3 — Power output vs. distortion with 4-ohm loads at 1 kHz.



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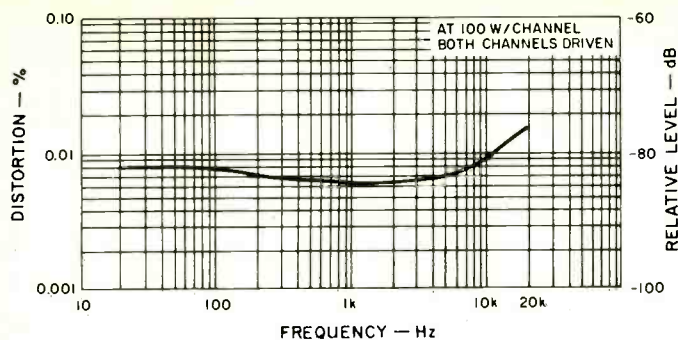


Fig. 4 — Distortion vs. frequency with 8-ohm loads.

delivered 156 watts per channel at 1 kHz, but of course, continued operation at such high power levels would result in thermal shutdown because of high current levels drawn, hence the more conservative rating of 100 watts, even for 4-ohm operation.

Figure 4 is a plot of harmonic distortion versus frequency for 100 watts of constant output level, both channels driven into 8-ohm loads. Even at 20 Hz, THD remained a very low 0.008 percent, while at the 20-kHz high frequency extreme, it measured 0.015 percent. Damping factor was measured at 50 Hz, rather than at the 100 Hz specified (50 Hz is the required frequency at which this is measured in accordance with the new IHF Amplifier Measurement Standards), and obtained a relatively high reading of 112. Full rated power at rated distortion was available over a frequency band from 16 Hz to 26 kHz. Dynamic headroom measured exactly 1.0 dB.

The slew rate of 40 volts per microsecond was confirmed as was the square-wave rise time, which, in our tests, actually measured a bit better than claimed, 2.0 microseconds. The amplifier consumed approximately 80 watts under no-signal conditions, with power consumption increasing to slightly more than 500 watts when driven to rated output into 4-ohm loads.

Preamplifier/Control Section Measurements

RIAA equalization of the phono input stages was accurate to within +0.5 and -0.2 dB from 20 Hz to 20 kHz. Input sensitivity in phono (referred to 1.0-W output) measured 0.17 millivolts, while 8 mV was required to drive the amplifier to a 1.0 watt output level via the high level inputs. Phono overload at 1 kHz measured a very high 200 mV. Frequency response via the high level inputs from input to amplifier output was flat from 4 Hz to 60 kHz, -1.0 dB, and from 3 Hz to 120 kHz, -3.0 dB. Signal-to-noise ratio in phono (measured with a 5-mV input and with amplifier gain control set to deliver 1-watt output) measured 70 dB ("A" weighted), while for high-level inputs, S/N (measured with a 0.5 V input and gain adjusted to produce 1.0 watt output) measured 77 dB, "A" weighted.

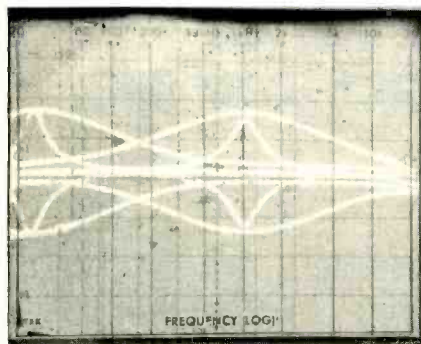


Fig. 5 — Range of frequency, bandwidth, and amplitude adjustment for the low frequency section of the parametric equalizer.

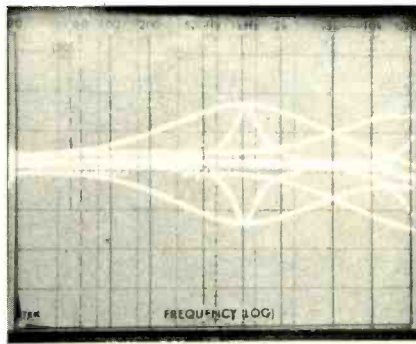


Fig. 6 — Range of frequency, bandwidth, and amplitude adjustment for the high frequency section of the parametric equalizer.

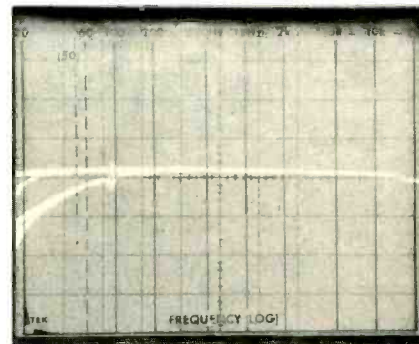


Fig. 7 — Response of the low-cut filters.

Operation of the two sets of parametric equalizer controls can best be understood by referring to Figs. 5 and 6. The multiple plots displayed on the face of the frequency-calibrated log-sweep 'scope in Fig. 5 show the entire range of control possible with the three low-frequency parametric equalizer slide controls. As claimed, the center frequency can be shifted from below 40 Hz to just above 1 kHz, and bandwidth affected by these controls can also be varied over a wide range, as shown.

Action of the high-frequency parametric equalizer control set precisely overlaps that of the low-frequency controls, beginning as it does with a center frequency of just above 1 kHz which can be varied up to around 20 kHz. In experimenting with these controls we discovered that if both the low and high frequency controls are set to 1.2 kHz, the action of the two sets of controls is cumulative and one could, theoretically, achieve a boost or cut at that particular frequency of more than 30 dB. (That's hardly a practical setting, but of interest nevertheless).

The 'scope photo of Fig. 7 shows the response of the low-cut filters which are set to 30 Hz and 100 Hz. By depressing both of these filter buttons at once, it is also possible to obtain a somewhat steeper sloped cut-off below 100 Hz as shown by the lowest response curve in the photo.

Listening and Use Tests

I, personally, have always liked the sound of SAE amplifier and preamplifier products, and the SAE 2922 is no exception. While I confess that SAE's reasons for staying away from fully d.c. coupled designs don't seem entirely justified to me in view of present-day design philosophies, I must confess that I could not hear any form of sound degradation that might be attributed to that a.c. coupled input, even when I listened to the power amplifier alone and bypassed the preamp section. On the contrary, sound was tight, well defined, and transients were reproduced effortlessly and with no smearing whatever.

If you haven't worked with a parametric equalizer before, you'll find that they take some getting used to. My own feeling is that if you are going to go with parametric equalization because your system really needs it (either in terms of room problems or speaker problems), you may find that limiting the number of bands to only two could pose problems. On the other hand, compared with even the most elaborate "bass and treble" tone control arrangement (however augmented they are with selectable turnover frequencies, etc.), even this two-band parametric equalizer system wins by a mile. SAE should have no problem selling this honestly designed and ruggedly built integrated amplifier (or preamp-amplifier, if you insist on using their terminology). If it causes any problem at all for SAE, that problem is more likely to be how to continue to sell the separate 2900 and 2200 models upon which this design is based. I guess they will have to rely upon the fact that some people have very shallow shelves.

Leonard Feldman

Enter No. 92 on Reader Service Card

Crown Model DL-2 Digilogic Control Center



MANUFACTURER'S SPECIFICATIONS

Frequency Response: 1 Hz to 100 kHz ± 0.5 dB.

Phase Response: $\pm 8^\circ$, 20 Hz to 20 kHz.

THD (29 Hz to 20 kHz): Less than 0.0008 percent at 2.5 V (rated) output; less than 0.0025 percent at 10 V output.

IMD: Less than 0.0003 percent up to 10 V output.

S/N Ratio, "A" Weighted: From 101 dB (at maximum gain) to 118 dB (minimum gain) below rated output.

Maximum Output: 11 volts (22 V in balanced mode).

Maximum Headphone Output Level: 17 V rms.

Headphone Output Frequency Response: 10 Hz to 50 kHz, ± 0.1 dB.

Bass Control Range: ± 15 dB at 20, 40, or 80 Hz.

Midrange Control & Range: ± 15 dB at 400, 800, or 1600 Hz.

Treble Control Range: ± 15 dB at 5, 10, or 20 kHz.

Low-Cut Filters: -3 dB at 20, 30, 50, or 100 Hz, 18 dB/octave.

High-Cut Filters: -3 dB at 4, 7, 12, or 20 kHz, 18 dB/octave.

Phono Module Section

Frequency Response (10-kilohm Load): RIAA, ± 0.25 dB, 20 Hz to 20 kHz.

Flat Position: 10 Hz to 30 kHz, ± 0.1 dB.

Phase Response: $\pm 5^\circ$, 20 Hz to 20 kHz (in RIAA).

THD: Less than 0.002 percent at 2.5 V out, 20 Hz to 20 kHz.

IMD: Less Than 0.0005 percent at 2.5 V out in flat position.

S/N Ratio: 94 dB in RIAA, 89 dB in flat position re: 10 mV, "A" weighted.

Gain: Adjustable from 30 to 50 dB, 0.75 mV input for rated output at maximum gain.

Input Overload: 100 mV at 40 dB gain (varies from 33 to 330 mV depending upon gain setting).

Input Impedance: 47k/100k selectable, parallel C less than 5 pF.

Power Supply Module

A.c. Outlets: Seven switched and two unswitched.

D.c. Outputs: ± 28 V at 500 mA, ± 18 V at 500 mA; +10 V at 2 amps.

General Specifications

Dimensions: Control Module, front panel fits 19-in. rack; chassis behind front panel; 17 in. (43.2 cm) W x 7 1/2 in. (19 cm) H x 14 in. (35.6 cm) D. Power Supply Module (fits 19-in. rack); 17 in. (43.2 cm) W x 3 1/2 in. (8.9 cm) H x 7 1/2 in. (19 cm) D.

Power Requirements: Less than 40 W at 120 V a.c.

Price: \$1995.00.

To begin with, let me say that when I was confronted with the published specifications of this magnificent, three-piece preamplifier/control system I had to completely rethink my laboratory test procedures. Normally, I like to measure the equipment on the bench first to confirm published specs and only when I am satisfied with these do I subject a given piece of equipment to extensive listening tests and use evaluation. In the case of the Crown DL-2 system, I must confess that the unit was on the bench for less than an hour. No way was I able to measure the distortion of either the control module section or the phono module section. The residual distortion and noise levels of my test equipment are just not up to the job. The brief time devoted to measurement was more than offset by the overly long use tests to which I subjected this equipment. The DL-2 is so feature-laden that no report of this restricted length could possibly cover all its features. Still, let's try.

Turning our attention first to the control module's front panel we find 8 light-touch buttons at the upper left. The upper two are for power switching and audio muting, six are labelled *tape* and *AUX* (three each), and the remaining two are called *Phono* and *Tuner*. Actually, all of these buttons control identical high-level inputs (since the phono module is connected separately), and it is up to the user to assign buttons to appropriate input sources. The labels can be switched around from button to button and a light next to each button glows when that particular input is chosen. The buttons simply supply d.c. switching voltage to the control logic circuitry which activates reed-relays that do the actual selection.

Six vertical sliders at the right of the panel, calibrated in 2- or 3-dB steps, operate the bass, midrange, and treble tone control circuitry (separately for each channel). The center frequency of each tone control can be changed to any of three

frequencies by means of slide switches below each slider.

Perhaps the most intriguing control element of the DL-2 is its gain control arrangement. Six buttons at the center of the panel are used to alter gain. Two buttons at the center, when touched, raise or lower gain in both channels simultaneously by exactly 0.5 dB increments, over a total range of 63.5 dB, while pairs of buttons to the left and right of these control individual channel gain in the same manner. Gain of each channel is displayed on three-digit, seven-segment numerical displays. The displays operate at full brilliance during the *Operate Mode* and at reduced brilliance during *Standby*. At a reading of 43.5 dB actual gain of the module is unity. The gain buttons are speed conscious, operating slowly when first depressed but increasing the speed of gain increments if held in the depressed mode. If gain is raised to beyond clipping level of any input signal, two peak indicators below the gain buttons glow to warn the user to reduce gain.

A separate loudness contour control, located below the gain buttons, reduces gain in precise 5-dB increments as it is rotated *clockwise*, over a total range of 50 dB. This control is calibrated in "phons."

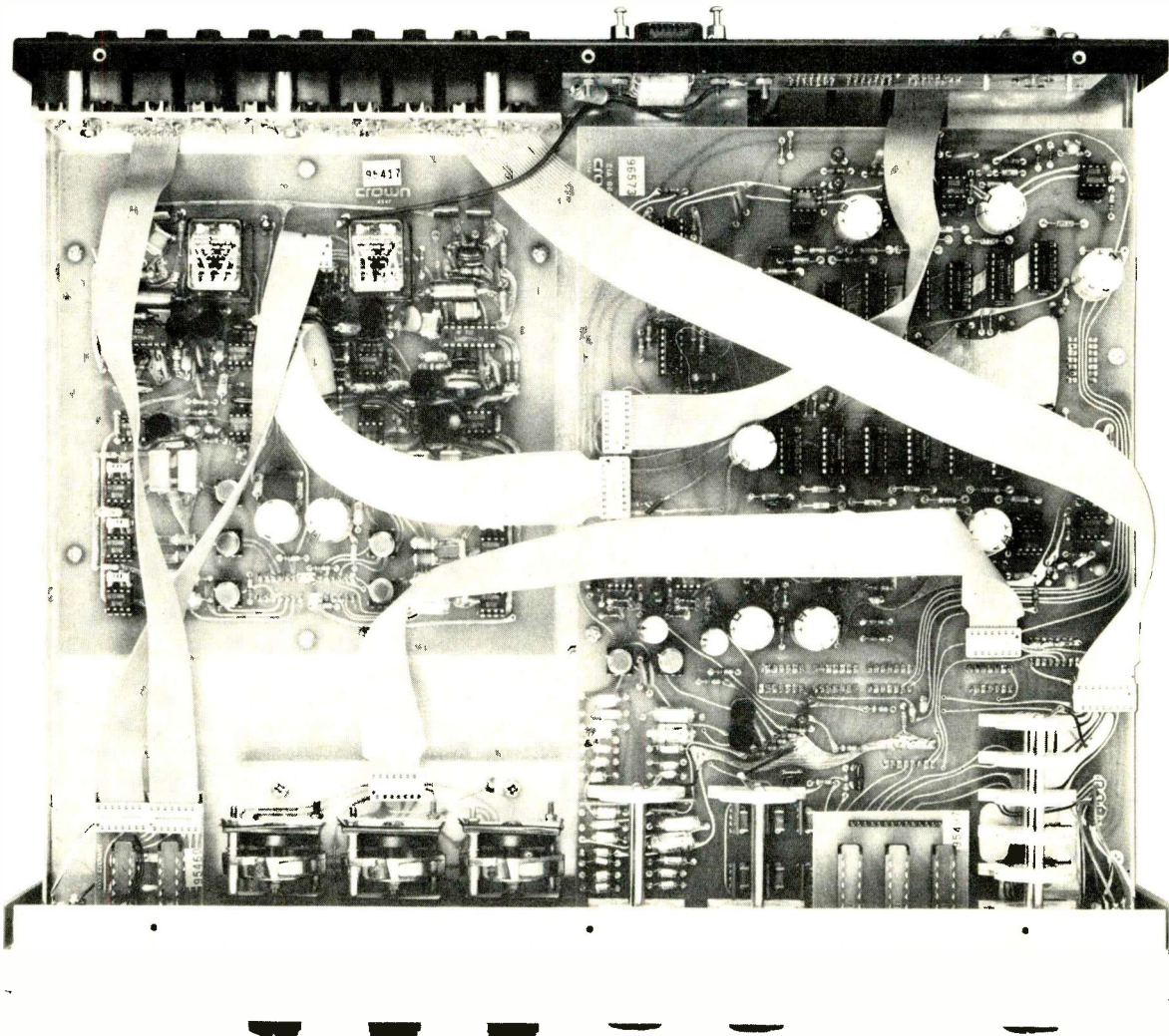
Additional pushbuttons to the left and right of the loudness knob activate tone controls, high- and low-cut filters, permit insertion of up to two signal processors (such as expanders, equalizers, noise reduction systems, etc.), and insert these processors either ahead of or after the tape recording output.

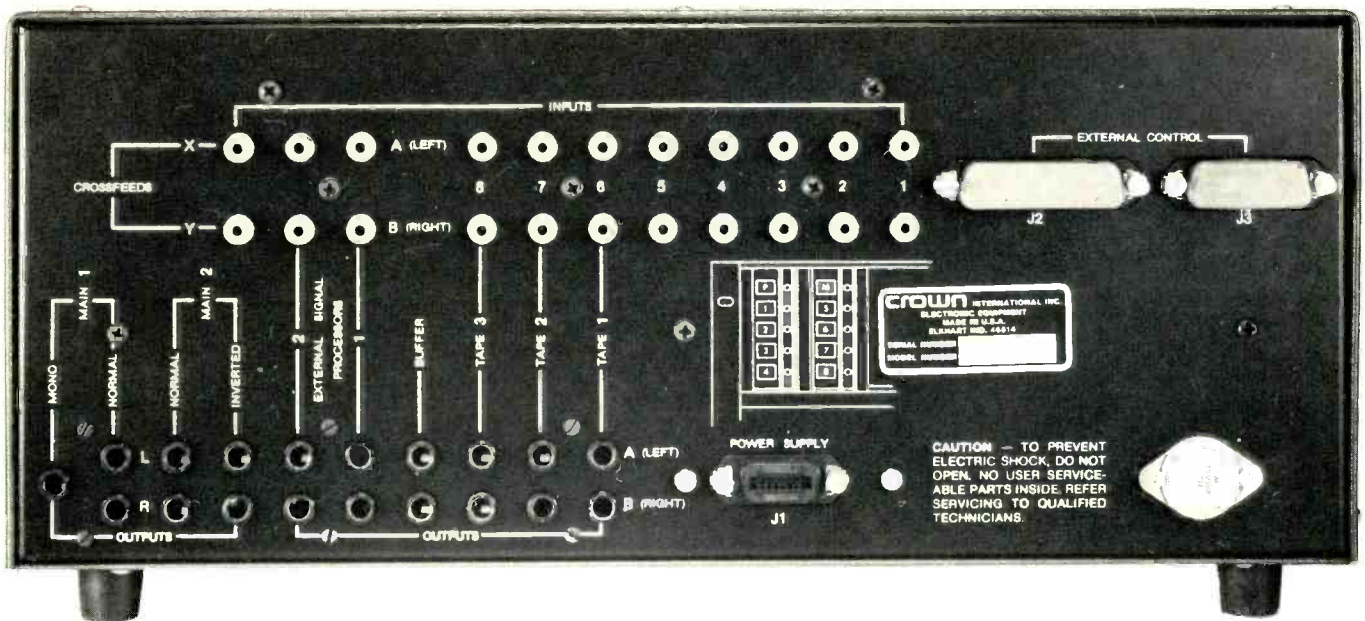
Tape 3 in/out jacks are located at the lower left of the panel, and near them is a tape-copy switch (which permits

direct copying from one tape recorder to two others), three tape monitor buttons, signal-processor locating switch (either before or after tape outputs), high- and low-cut frequency selection switches, a pair of main-output selector switches, two phone jacks, and three controls collectively identified as audio imaging controls. Each of these controls is a concentric pair of knobs that can be used to vary the proportions of the two input channels that appear in the two output channels. Each control has 32 discrete switched settings, using precision resistors, including a full "off" position. The first imaging control sends signals from A and B inputs (program source inputs) to left and right outputs. The second set of controls sends A signals to the right and B signals to the left output. The third pair controls two different pairs of inputs. Since all of these controls are nearly continuously variable, the audio imaging possibilities are almost limitless, providing the DL-2 with the flexibility of a small mixer and panning control system.

The rear panel of the DL-2 Control Module contains the five sets of input jacks, three tape in and out pairs of jacks, two pairs of external signal processor input and output jacks, the extra "cross-feed" inputs for the mixing function described in connection with the stereo imaging controls, buffered outputs, and several main outputs including stereo and mono, normal and inverted.

In addition, the rear panel contains a multiple-pin connector to which the power cable is connected from the separate power module of the DL-2, plus a pair of other connectors which are intended for connection to a home computer





which, presumably, could be programmed to control level power, and input selection. Crown advises that the capability of the DL-2 is, in fact, checked by means of a computer.

The separate "Phono Module" supplied as part of the DL-2 system is also connected to the power supply module by means of a supplied cable. It is intended, however, to be located as close as possible to the turntable system with which it is used so as to minimize possible hum pickup. The module may be operated as a "flat amp" (without equalization) or with RIAA equalization, and its gain is variable and can be set separately for each channel (in case cartridges provide unequal left and right signals) over a range from 30 to 50 dB. Normally, one sets the gain for 40 dB. The particular module supplied with our test unit is known as Phono Module A, and another Module (B) will soon be available for use with moving-coil cartridges.

The separate Power Module of the DL-2 has a power indicator light and a single pushbutton switch. During normal operation, the power module is left turned on at all times, remaining in "standby" mode until one of the input selector buttons on the Control Module is touched. This activates the a.c. switched receptacles on the Power Module and powers the Control Module. At the same time, digital display of gain increases in brightness.

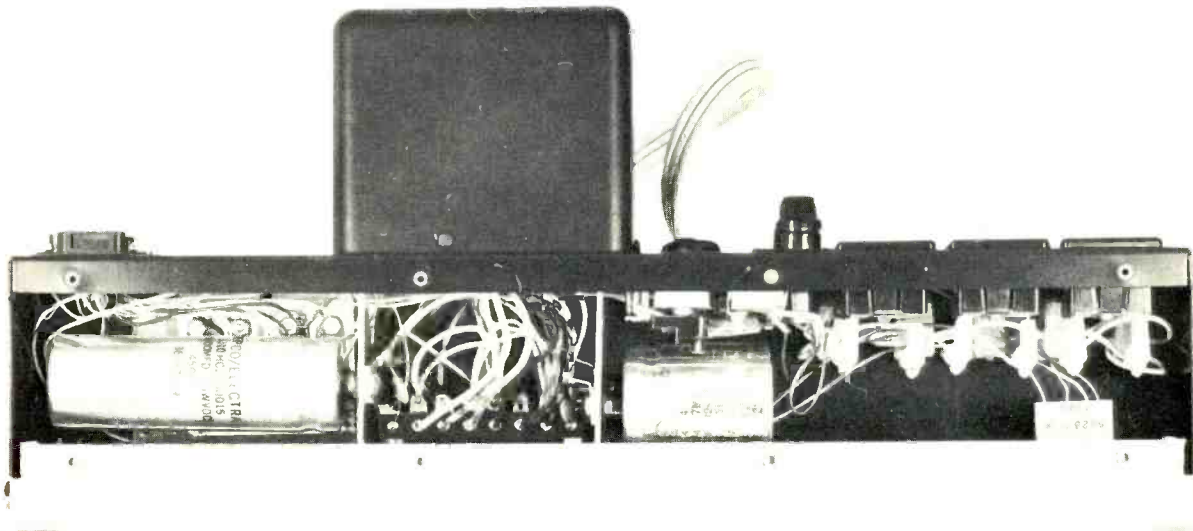
Touching the power button on the Control Module returns the system to "standby" mode. Though the suggested price

of the system is given as \$1995.00, individual prices for the separate sections of the unit are \$1450.00 for the control module, and \$250.00 each for the power supply and phono modules. Presumably, one could operate more than one phono module off the same power supply module by means of an available Y-connector and could simply relabel an additional input button accordingly.

Laboratory Measurements

Any attempt on our part to measure distortion levels of either the control module or the phono module of the DL-2 was rewarded by utter frustration. The residual distortion levels of our Sound Technology audio generator and distortion measurement system (around 0.002 percent) were the governing factors here. We were, however, able to measure a few operating characteristics of the unit. RIAA equalization of the phono module was found to be accurate to within ± 0.1 dB from 20 Hz to 20 kHz and the phono inputs required a signal level of 8.5 millivolts for 2.5 volts rated output. With gain set for IHF reference levels (0.5 volts out for 5 mV in), overload occurred with an input of 100 mV at 1 kHz. Noise level from this module was below our measuring capabilities!

Frequency response of the DL-2 Control Module high level inputs was flat to within 1.0 dB from below 5 Hz to 150 kHz, with the -3 dB roll-off occurring at 230 kHz.



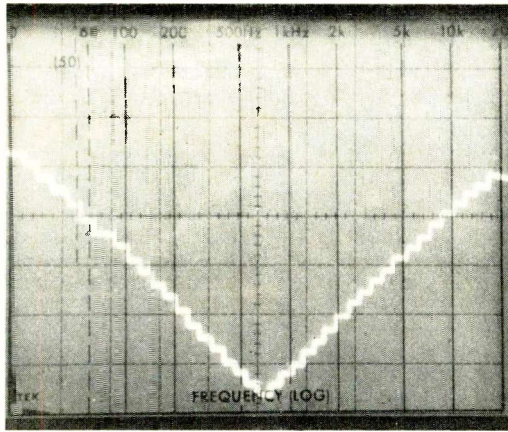


Fig. 1—Action of precision 0.5 dB/step attenuator system.

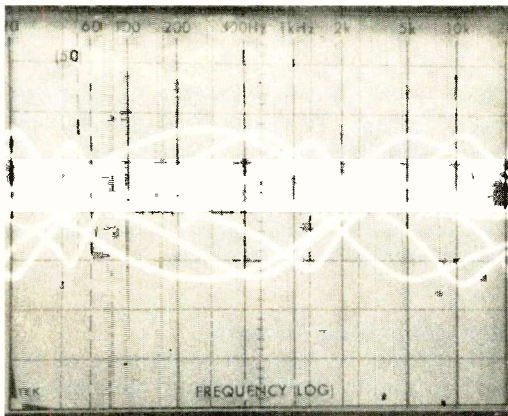


Fig. 2—Bass, midrange, and treble controls have selectable center frequencies as well as boost and cut capability of ± 15 dB.

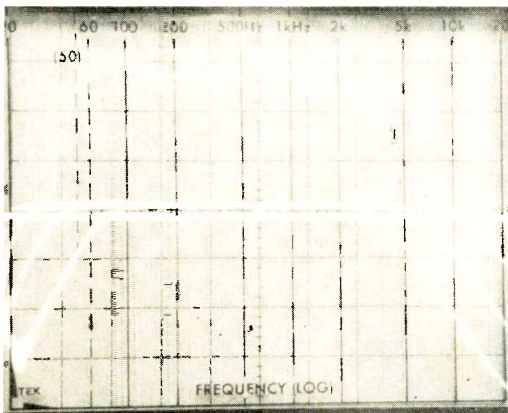


Fig. 3—Four position high- and low-cut filters provide cut-off slopes of 18 dB/octave.

Fig. 4—Separate loudness control is calibrated in precise 5-dB steps.

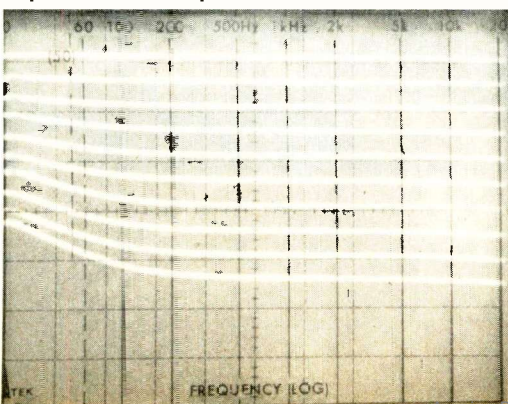


Figure 1 illustrates the precise action of the gain control "steps." In this 'scope photo, our spectrum analyzer was tuned to a single frequency (that being applied to the DL-2), so the frequency notations at the top of the display should be ignored. We then allowed the 'scope beam to sweep slowly across the face of the CRT to display only amplitude, as we tapped the gain control successively downward and then upward. The vertical sensitivity of the scope was set to 2 dB per vertical division and, as you can see, four steps of our descending and rising "staircase" occupy exactly one division, confirming the 0.5 dB per step accuracy of the novel gain control system of the DL-2.

Figure 2 illustrates the versatility of the tone control system of the DL-2. Shown are a composite of the low, mid and treble controls, each operated at maximum boost or cut and at their three available center frequencies. The resulting display shows that the tone control system has two of the three degrees of versatility of a parametric equalizer (variation of bandwidth is not possible). (Sensitivity of the 'scope is now 10 dB per division.)

Action of the four-position high- and low-cut filters is plotted in the 'scope photo of Fig. 3. Have you ever encountered such precision filtering in a home consumer preamplifier? We haven't!

Finally, in Fig. 4 we show the action of the loudness-contour control as it is rotated in 5-dB steps clockwise from highest gain to its lowest setting. A few other preamplifiers we have tested do provide separate loudness control function (in addition to the master volume control), and we consider this to be the only kind of loudness control arrangement that can hope to provide proper loudness compensation. But rarely have we seen one so precisely calibrated as this one supplied on the DL-2.

Listening and Use Tests

It almost goes without saying that the sound reproduction capability of the DL-2 is limited only by the quality of the program source being fed into it. As we all know, the actual static distortion levels are so low that they cannot contribute any perceivable differences between the original and reproduced signals. But even those for-the-moment intangible forms of distortion we all talk about (but can't agree on how to measure, such as TIM) were totally absent from the sound reproduced via the DL-2.

But an evaluation of the merits of the DL-2 goes far beyond an appraisal of the way in which it delivers signals to an associated power amplifier and a pair of loudspeaker systems. We must address ourselves to the question of who might be the ultimate user of this equipment. Is it the super-audiophile who demands the kind of "straight wire with gain" sound of which this unit is capable and nothing more? That doesn't seem very likely, since that individual is often "turned off" by expensive control features, many of which contribute little to ultimate sound quality.

More likely, the unit will find favor with the audiophile who is also a serious recordist. Probably, the potential buyer of the DL-2 owns more than one open-reel or cassette tape deck, plus a variety of add-ons and signal processors, all of which can interface nicely with the DL-2 and can be controlled from its front panel in masterly fashion. Nor should we overlook the audio enthusiast who, when confronted with the awesome control capability of the DL-2, will simply fall in love with it, much as a child falls in love with an irresistible toy. For the computer fan who also happens to be an audio devotee, the possibilities are endless. Frankly, if my own funds were less limited, I would opt for a control unit such as this, for the sheer delight one experiences in using it, but unfortunately, my funds are not that unlimited. Sigh!

Leonard Feldman

Enter No. 93 on Reader Service Card

In the past two years, quite a few articles have been written on the cartridge-preamplifier interface. An excellent discussion of the possible problems appeared in the article by Tomlinson Holman in *Audio*, February, 1977. As Mr. Holman pointed out, the capacitive load presented to the cartridge is very important in determining its performance, and many cartridges and preamps do not make the best possible combination. The resistive

termination is also important, and discrepancies were found in this area as well. Recently, a number of manufacturers have introduced preamps with switchable loading, and the trend to include this is expected to continue.

For the audiophile who wants this refinement but is reluctant to replace his present preamp, there are two possible approaches. For one thing, he can dig out the trusty soldering iron and add shunt capacitance on the

phono inputs to make the total with the cables equal to the pickup manufacturer's recommended value. A change in the terminating resistor may also be called for. Some trial and error may be involved to get the preferred sound, of course. If you shy away from even simple circuit modifications or if you expect to be changing cartridges with some regularity, the use of one of the products discussed below would be a better way to go.

DB Systems DBP-6 Phono Equalization Kit

Scheme: Phono "Y" adapter with capacitor plugs.

Capacitor Selection: 100, 150, 200, 300, and 400 pF (picofarads).

Resistive Load: 100 ohms for moving-coil cartridge.

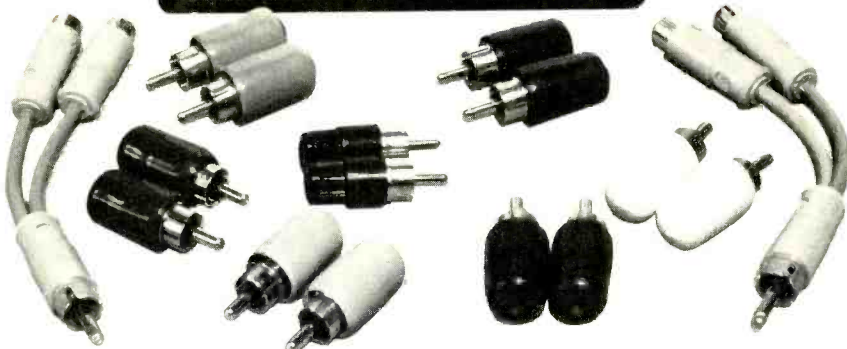
Price: \$24.95.



DB Systems DBP-6

This phono equalization kit is simple in construction and use. The turntable leads are disconnected, and the supplied phono Ys are installed with the desired added capacitance on one arm and the phono lead reconnected to the other. All such connections, of course, should be made in a no-power or at least volume-down condition, making it slightly difficult to make A-B tests. DB Systems provides listings of load requirements for many cartridges and of tonearm and output cable capacitances for the great majority of units. These lists are very useful, particularly, as many manufacturers do not supply much information.

DB Systems tells us that they will shortly bring out a capacitance switch box to allow changing capacitance while listening. Values from 100 to 400 pF can be independently selected for either of two cartridges, and the projected price is \$75.00.



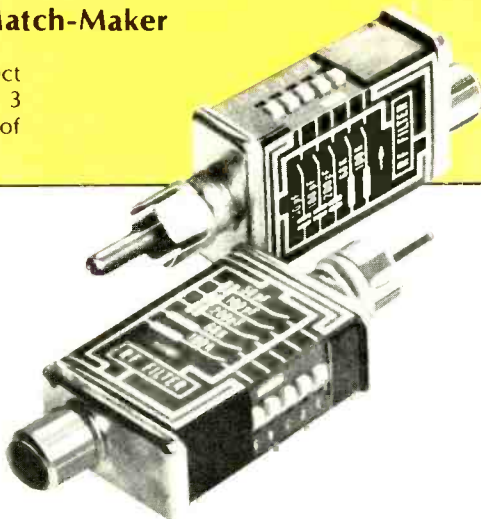
The values of capacitance were measured with a GR impedance bridge, and the results include the effect of the Ys. There was a set of two for each value, of course, and they were always in close agreement. The values were as follows, for nominal/measured: 100/112, 150/144, 200/207,

300/302, and 400/415 pF. The largest percentage discrepancy was at 100 pF, but it was not considered significant. The capacitors all had very high Qs, excellent quality. The "100-ohm" moving-coil plugs had measured values of 99.9 and 99.8 ohms — how close can you get?

Enter No. 94 on Reader Service Card

Berkshire Audio Products Match-Maker

Scheme: Small box, suitable for direct plug-in with separate switches for 3 values of capacitance and 2 values of resistance.



Capacitor Selection: 50, 100, 150, 200, 250, 300, and 350 pF, by choice of 50, 100, and 200 pF values.

Resistive Shunts: 68 and 100 kilohms.

Price: \$49.95.

Berkshire Audio Match-Makers & CCM Meter

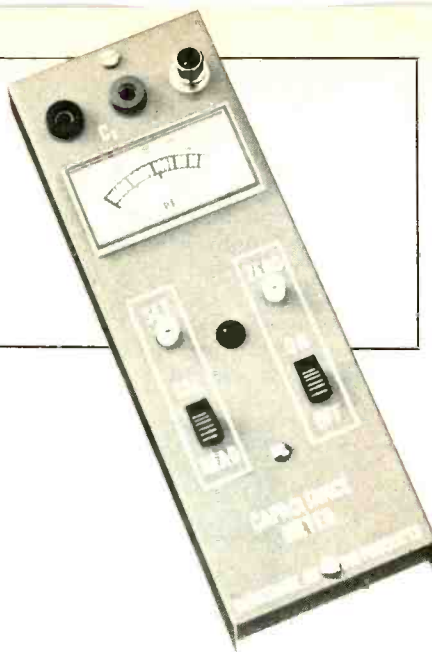
This is a compact assembly with five computer-type slide switches, a phono jack for the turntable cable, and a phone plug for connection to the preamp. Three of the switches provide On/Off selection for capacitance of 50, 100, or 200 pF individually or can be used in combinations up to a total of 350 pF. The other two switches function the same way for resistors of

68 and 100 kilohms, with the load also affected by any termination already in the preamp. The unit also includes an r.f. filter. The design makes it possible to change the loading while listening, a helpful feature.

The pair of units provided had capacitance values very close to each other. The bridge gave the following results, nominal/measured: 50/58, 100/114, 150/157, 200/191, 250/236, 300/290, and 350/334 pF. The largest

Berkshire Audio Products Model CCM Capacitance Meter

Range: 0 to 1000 pF.
Resolution: 25 pF.
Meter Accuracy: 5 percent.
Price: \$89.95.



percentage discrepancy was at 50 pF, but the actual difference was only 8 pF. All measured Qs were high, indicating very good capacitor quality. The "68K" resistors were 69 kilohms, and the "100K" resistors were 98.5 and 100 kilohms, plenty close enough. The built-in r.f. filter was 6 dB down at 1.4 Mhz.

The Model CCM capacitance meter from Berkshire Audio Products is a compact, simple-to-operate means of measuring the capacitance load presented to a cartridge, including the input capacitance of the preamp. The battery-powered device includes zeroing and a calibration-set function, referenced to an internal capacitor. The scale is from 0 to 500 pF, but readings are possible to 1000 pF if the cali-

bration is set to half its normal indication. Zeroing and calibration were straightforward and measurements were easily made. The percentage errors were greatest for small values of capacitance as there was a constant discrepancy of about 20 pF (not significant) compared to results with the bridge.

In-Use Test

The two matching systems were used with two different turntable systems, although with the same preamp. Many types of music were played with discs of various ages. There was no doubt about the noticeable improvement in the sound in most cases with either scheme with a total capacitance just a little less than that recommended by the cartridge manufacturer. The exceptions were a few discs that were too peaky with the added capacitance and a couple over-the-hill discs that showed more shatter. If you don't want to get into the try-and-solder routine, either approach could be very worthwhile for your system. The DB Systems kit provides what you need most of all at lower cost. The Berkshire Audio Match-Maker allows making changes more conveniently and provides resistive termination switching as well, albeit at twice the cost. The CCM capacitance meter would be high in price for many audiophiles, but one might be shared, and such a unit would be good for dealers to have for loan and demonstration.

Howard A. Roberson

Enter No. 96 on Reader Service Card

94

Cotter Model MK-2 Transformer

MANUFACTURER'S SPECIFICATIONS

Frequency Response:
3 Hz to > 150 kHz.

Channel Separation:
> 100 dB.

Square Wave Rise Time: < 3 μ S.

Phase Linearity (10-30,000 Hz): $\pm 2^\circ$.

Type X

Special order, made to specification.

Type S

D.c. Resistance: < 12 ohms
referred to primary.

Voltage Ratio: 8.88 to 1.

Gain: 19 dB.

Pickup Impedance Range: 20 ohms or
higher.



Type PP

Specifications same as Type S, but optimized for a specific pickup in the 20- to 30-ohm impedance range.

Type P

D.c. Resistance: < 3 ohms
referred to primary.

Voltage Ratio: 16.8 to 1.

Gain: 24.5 dB.

Pickup Impedance

Range: 2 to 30 ohms.

General Specifications

Dimensions: 2 in. (5 cm)

D x 3 in. (7.6 cm) W

x 5 7/8 in. (15 cm) L.

Input: RCA jacks.

Output: 24-in. (61 cm)
triaxial cable terminated
with special precision
RCA plugs.

Grounds: Lugs on each cable plus
binding post for turntable and arm-
shell.

Price: \$450.00; restrapping, \$35.00 plus
shipping.

When we first saw this transformer, we wondered what it could be worth such a high price. After examining the transformer in detail and discussing its construction and use with maker Mitch Cotter by phone, we are reasonably well convinced that the materials used in the construction of this transformer and the tender, loving care lavished upon each unit during construction could well be worth this price.

The MK-2 step-up transformer consists of two individual, non-toroidal transformers, one for each stereo channel. Both primary coil windings are absolutely identical and, similarly, the coils making up the secondary windings are also absolutely identical. All coils are terminated on a wiring strip behind the input-output panel of the transformer. It is here that the many windings are brought together in the configuration

required to obtain the desired impedance and voltage gain. The input connectors are RCA jacks, and the outputs are two 24-inch triaxial cables terminated in special precision RCA plugs. These plugs are made by Cotter Co. The outputs have both a system ground and an audio ground. The RCA plugs have the usual audio ground when properly connected, but the ground lugs associated with each output cable must be connected to the system ground since their other end is connected to the transformer shell and the outer shield of the cable. This type of grounding reduces electrostatically and electromagnetically induced noise to an insignificant figure. The output cables are connected directly to the phono input of the preamplifier. If the turntable is located too far from the rest of the system, the manufacturer recommends that the

cables from the table to the transformer be extended, rather than the output cables from the transformer. Triaxial cables to extend the cable length from the table to the transformer are available from the manufacturer.

The MK-2 is immune to noise, utilizing a seven-element, magnetic-lens shield design and triaxial cable for the output. The triaxial cable completely shields the signal-carrying path from any outside interference by means of a third conductor completely encompassing the inner two signal-carrying conductors.

Measurements

Like all transformers, the MK-2 requires neither an a.c. power source nor batteries since it is a very efficient passive device. The transformer is available in one of four types, with each type having the capability of being transformed to any other type at the factory. Any tampering with the terminal strapping automatically terminates the warranty.

Type P is for very low impedance cartridges (2 to 30 ohms) such as the Nakamichi, Supex, Ortofon, Entré, GAS, Fidelity Research, Signet, and other similar types for which it provides the highest signal-to-noise ratio.

Type S is for cartridges of 20 ohms and higher, such as the Denon and the Satin, for which it supplies the appropriate gain and gives the best low-frequency response.

Type PP is optimized for phono cartridges in the 20- to 30-ohm range, such as the EMT. However, it is possible to use either the Type P or S for cartridges in the 20- to 30-ohm range, but the transformer will not necessarily be optimized for these cartridges.

Type X is for special requirements where the transformer is optimized for a given cartridge and preamplifier combination in order to obtain the best performance possible from the particular cartridge.

In the laboratory, we confirmed that the gain of the Type S

and Type P is 19 dB and 24.5 dB, respectively. This is sufficient gain for just about any moving-coil cartridge, however, the gain is insufficient for the ribbon (velocity) cartridge such as the Nagatron HV9100, which requires a minimum gain of 35 dB and preferably around 40 dB. We know of no moving-coil or ribbon cartridge that can overload this transformer at any audible frequency.

We tried to induce hum into the system by placing the transformer on top of an autotransformer and into a magnetic field, but without success. We concluded that the shielding used in this device is very efficient.

The frequency response is flat to well beyond 100 kHz and a 1000-Hz square wave is relatively flat on both the top and bottom.

Listening & Use Tests

We auditioned both the Type P and S step-up transformers with a variety of moving-coil cartridges, using our special test preamplifier and the Crown IC-150 A and the Nikko Beta 1 preamplifiers connected to our music system. At no time were we able to discern an aural signal degradation due to the transformer, and it was quite apparent that the MK-2 introduces no coloration or sound of its own, performing in all aspects as claimed by the manufacturer. We can recommend this transformer without hesitation to anyone in need of such a device for their moving-coil cartridge.

About the only criticism which can be made is really not of the unit itself, but rather of its initial high price, plus the high cost of converting the unit to another configuration for a different moving-coil cartridge whose impedance is significantly different from the first cartridge. What might be done here is to offer one or two free conversions for any single transformer. Should this be done, the MK-2 transformer would then be much more reasonably priced in today's market place.

B. V. Pisha

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LP-1 VARIABLE LOW PASS FILTER



MX-1 PASSIVE MATRIXING CROSSOVER



DQ-1W LOW-BASS MODULE

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If the price of DQ-10's (\$425. each) seems expensive at first, remember that they are truly the speaker system for today *and* tomorrow. In the long run, spending a little more than you planned will save you much more than you expected.

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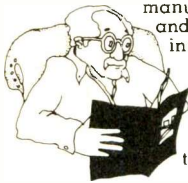
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TDK HD-01 Head Demagnetizer

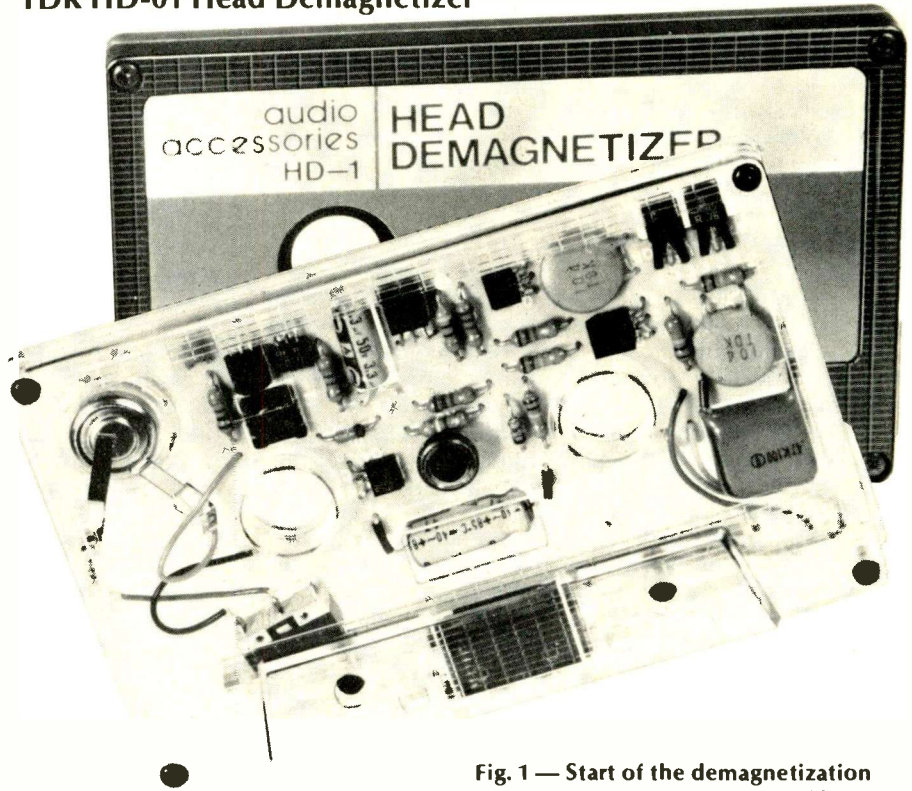


Fig. 1 — Start of the demagnetization cycle with each sweep at 1 mS/div.

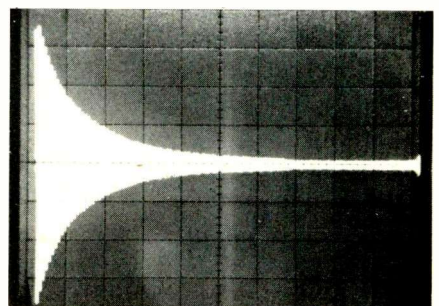
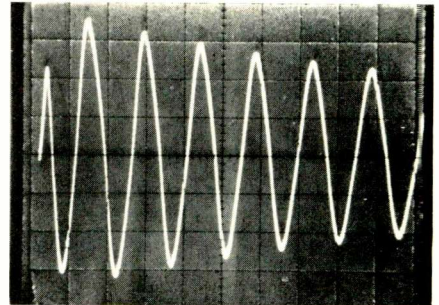


Fig. 2 — Sweep of the demagnetization cycle at 20 mS/div.

Price: \$21.99.

The TDK HD-01 head demagnetizer is the latest accessory from that major tape manufacturer, and an innovative one also. Made in the form of a cassette the device is easily inserted into a tape deck. Pushing the play button on the recorder initiates the erasing process automatically. The demagnetizer is battery operated and a built-in LED shows both the battery condition and when the unit is switched on. Very simply, when the play head moves into the demagnetizer, it contacts a pole piece which then actuates an oscillator which puts out a decaying 630-Hz burst. As the pole piece is coated, there is no damage to the play head. As would be expected, it is best to either have the deck power turned *Off*, or set the controls to zero.

Using a readily accessible cassette head, output checks showed that the TDK device generated more current in the head than most of the hand-held (60-Hz) demagnetizers available. It was only bettered by the Annis Handi-Mag. The decay of 630 Hz with the HD-01 was very smooth for about 140 mS down to a small fraction of the initial output. Then, the decay was more rapid, but smooth, down to zero. There was no measurable d.c. offset, and the decay was symmetrical at all times. During the testing, it was observed that some of the hand-held

units generated large output spikes when turned off, even at distances of several feet.

The TDK HD-01 does the demagnetizing job well, much better than some hand-held units. For those decks with poor accessibility, it is the best and most convenient way to go.

Howard A. Roberson

Enter No. 98 on Reader Service Card

AUDIO • March 1979

Top of the pile

A Salute to Ethel Waters: Diahann Carroll with the Duke Ellington Orch., Mercer Ellington cond. **Orinda Records ORC-400** (231 Altarinda Rd., Orinda, Calif. 94563), \$12.95.

Holst: Suites #1 and 2 for Band; Bach: Fantasia in G; Handel: Royal Fireworks Music. Cleveland Symphonic Winds, Fredrick Fennel cond. **Telarc 5038** (4150 Mayfield Rd., Cleveland, Ohio 44121), \$14.95.

These two records are the first U.S.-produced digital recordings to be released. (Digital recordings by Denon have been available in Japan since 1972 and have recently become available in the U.S.) Both were made via the Soundstream process but in spite of this commonality, these two recordings give completely different impressions of the digital recording process.

The Orinda disc just doesn't impress me very much. The sound is good, the pressing excellent, but there isn't anything special about the recording to make it stand out over any number of conventional multimike recordings. Part of the problem may be due to the arrangements by Bruce Miller and performances by Ms. Carroll which seem more suited for a Las Vegas revue or a TV special. A lot of polish but no real substance.

It also seems as if the recording engineers ran the session the same old way with no allowances made for the improved capabilities of the digital process. (It should be noted here that Soundstream provides just the digital machinery. The studio provides its own producers and recording engineers who make all the musical and balance decisions.)

The Telarc recording, on the other hand, is very impressive. Here, all the advantages of the Soundstream process have been more fully exploited, giving super wide dynamic range, low distortion (helped by half-speed cutting) and, with an excellent Japanese pressing, virtually no noise. There is also a bass drum that is guaranteed to crumple all but the sturdiest of woofers.

I must confess that I have long been an admirer of Fredrick Fennel. His recordings with the Eastman Wind En-

semble for Mercury were my musical Bible during my high school and college days when I was playing in the concert band. After listening to the Telarc disc, I brought out my well-preserved copy of the original 1954 Mercury mono recording of the Holst suites. I was very shocked to discover that what I had always considered to be an excellent recording was actually very distorted, noisy and highly colored in comparison to the Telarc disc. So much for nostalgia.

The only criticism I have of the Telarc disc is a minor one, and this is with the balances between the woodwinds and brass. The woodwinds tend to be overpowered in the loud tutti sections, but one could always argue this also happens in concert.

I'm eager to hear more digital recordings from both Orinda and Telarc. One recording, good, bad, or indifferent, using a new technique doesn't really prove very much. It's the results over a long period of time that matters. These two records show that the recording machine (digital or analog) is only a small part of the end result. The prime factor required is still people, the musicians and the engineers, in order to produce a superior recording. *Charles P. Repka*

Orinda

Performance: B- Sound: B Surfaces: B+ **Telarc**

Performance: A Sound: A+ Surfaces: A+

Elgar: Introduction & Allegro Op. 47, Serenade for Strings Op. 20, Sospiri for Strings, Organ and Harp Op. 70, Elegy for Strings Op. 58, Suite from the Spanish Lady. Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 573**, stereo, \$8.95.

Wagner: Adagio for Clarinet and Strings, Siegfried Idyll; **Strauss:** Metamorphosen. Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 604**, stereo, \$8.95.

Stravinsky: Capriccio for Piano and

Orchestra; **Shostakovich:** Concerto for Piano, Trumpet and Strings; John Ogdon, piano; John Wilbraham, trumpet; Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 674**, stereo, \$8.95.

Mozart: Violin Concerto in G Major, K.216; Concertone in C Major for 2 Violins and Orchestra, K.166b. Alan Loveday, Iona Brown, Carmel Kaine, violins. Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 729**, stereo, \$8.95.

Prokofiev: Classical Symphony; **Bizet:** Symphony in C. Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 719**, stereo, \$8.95.

Prokofiev: Visions Fugitives (arr. Barshai); **Walton:** Sonata for Strings. Academy of St. Martin-in-the-Fields, Neville Marriner, Director. **Argo/Barclay-Crocker ARG E 711**, stereo, \$8.95.

Available from Barclay-Crocker, 11 Broadway, N.Y., N.Y. 10004, and from selected dealers.

These recordings represent the initial release by Barclay-Crocker of recordings from the distinguished English label, Argo. They all feature performances by the Academy of St. Martin-in-the-Fields under the direction of Neville Marriner, the recently appointed director of the Minnesota Symphony Orchestra.

It's surprisingly difficult to write a review when the only words that come to mind are superlatives. The Academy of St. Martin-in-the-Fields is one of the best (if not *the* best) chamber orchestras in the world. There just are not many other orchestras that can play the variety of styles displayed here. Mozart or Stravinsky, Elgar or Shostakovich, it doesn't seem to matter. All are played superbly. A good part of the credit belongs to their conductor, Neville Marriner, who besides his conducting duties in the U.S. and England, is in great demand all over the world as a guest conductor. Argo's engineering is more than equal to the standards set by the musicians with superb, well-balanced sound evident in all the

recordings. Barclay-Crocker's Dolby B duplication is equally flawless with noise levels that are nearly as low as the finest studio master tapes.

While all the recordings were excellent, my personal favorite was the Elgar (ARG E 573). The string sound can only be described as being luscious, and there is an intensity of playing not usually associated with English musicians or English composers for that matter.

I'll be looking forward for more Argo recordings from Barclay-Crocker as well as those from L'Oiseau-Lyre and Telefunken, the other "secondary" labels from the London/Decca group of recording companies.

Some of you more budget-minded readers may have noticed that Barclay-Crocker's price for these tapes is actually less than the list price of the equivalent record (and Argo records are rarely discounted). In the past, open-reel tapes have had as much as a \$2.00 premium over the price of the disc version. Barclay-Crocker has managed to avoid that price increase and, because of their careful quality control, have produced tapes that are equal to the best commercial records. Also, if one considers open-reel tape's long-term immunity to damage (dust,

dirt, scratches, pops, ticks, etc.), it becomes obvious that these Argo tapes are an excellent bargain!

Charles P. Repka

Note Smoking: Louie Bellson **Discwasher Recordings DR 002 DD**, stereo, direct-to-disc, \$14.50.

Note Smoking presents Louie Bellson and his 18-piece big band, Explosion, in a direct-to-disc format. This recording proved to me that the direct-to-disc process is a flexible one that not only brings out the subtle nuances of small, laid-back groups, such as Charlie Byrd or Earl "Fatha" Hines, but it can also handle the volatile mass of sound generated by a band like Bellson's.

The mix on such a crowded disc is important, and this one succeeds in every respect. Each instrument is heard with all its individuality intact, whether in the ensemble passages or out in a solo context. The definition between sections is even used. The brass is recorded in the left channel and the reeds in the right so they get a stereo or ping-pong effect between the sections without stereo panning. This is used to exciting effect in the punctuating horn lines of *Spitfire*.

The clarity in the mix also gives the album a wide dynamic range, accentuated in the Duke Ellington standard, *Don't Get Around Much Anymore*. Here a biting horn passage drops in and out for laid-back piano fillers from Ross Tompkins. The contrast is sharp but Tompkins piano maintains its presence throughout. There's also a strong sensation of depth in this recording which puts the horns not in front of you, but right next to your chair, with the other instruments spread in a 180-degree semi-circle in front of you.

Of course, Louie Bellson is a drummer, so special care was obviously taken here. His set is spread between the speakers with an impression of both side-to-side and back-to-front-positioning. This is especially evident on the "roto tom" runs.

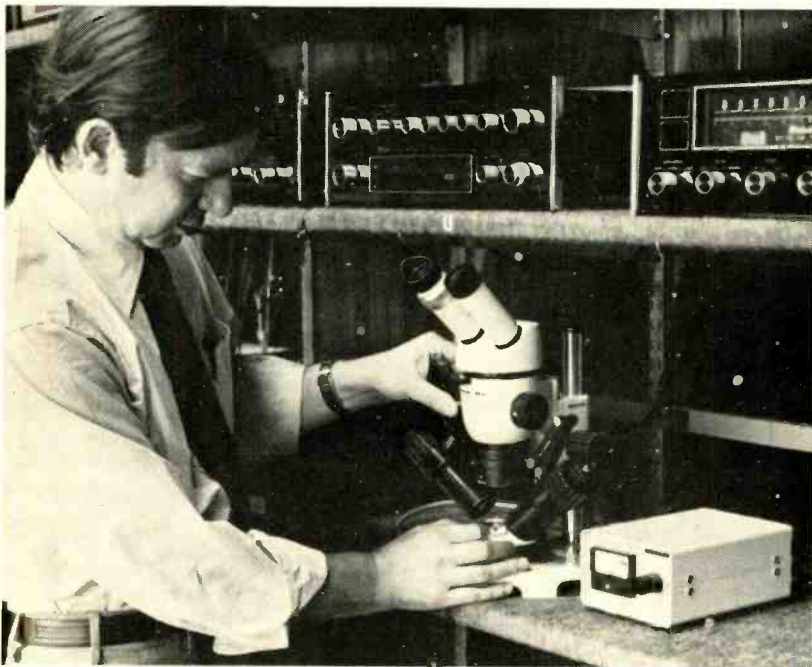
The direct-to-disc procedure used here insures that the disc surfaces are free of noise and hiss. It's a freedom which markedly enhances the brilliance and bite of this record, particularly with its powerful horn sections. Write to Discwasher Recordings, 1407 N. Providence Rd. Columbia, MO 65201.

John Diliberto

Sound: A

Performance: B

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The bookshelf

IC Timer Cookbook by Walter G. Jung. Howard W. Sams, 1977, \$9.95.

Texts in the form of "cookbooks" have become popular, and the efforts of Walter Jung have been most notable, particularly the widely-used *IC Op-amp Cookbook*. In this paperback on IC timers, the author has continued his approach of providing discussion of many specific circuits supported by fundamental background. Detailed discussion on the 555 general-purpose timer and other important types lays the groundwork for the majority of the book. A chapter on operating procedures and precautions to observe includes an excellent review of requirements for the timing components and possible sources for them.

Part II on timer applications includes two 30-page chapters on monostable and astable timer circuits and a chapter of 90 pages on systems applications. Circuits covered are of interest to the audio engineer for many tasks. For example, how about a one-shot or a delayed pulse for triggering a scope or function generator, a linear ramp to drive a VCO, or a function generator, to say nothing of V/f and f/V converters and PLLs.

Part III has appendices with manufacturers' data sheets, lists of sources for components, and a bibliography. The seven-page index is excellent with good cross-referencing. The *IC Timer Cookbook* will be of value to those who need to generate their own timing circuits, and it is also a good text for those who simply want to understand the functioning of such circuits.

Howard A. Roberson

Handbook of Noise Assessment, Daryl N. May, Ed. Van Nostrand Reinhold, 1978. \$22.50.

This 400-page hard-cover text has two major sections with the first, and larger, one on psychological effects. The first chapter covers basic subjective responses to noise and the various measurement schemes that might be

applicable for such assessment. The discussion includes dBX (A, B, etc.) scales as well as phons, sones, articulation index, and many others. Extensive coverage is given to transportation noise and its effects on non-travelers in the two following chapters. Here, and in later chapters, various regulations and standards are presented. I had hoped to see spectra of the different sources, but they were given only for aircraft. (Such spectra can be excellent aids in determining the sound insulation needed for a studio.)

Other chapters on recreational vehicles, transportation noise to travelers, interior noise, hospitals, industrial area noise, construction sites, and noise in and around the home complete the first section. Levels are given for guidelines on what is acceptable, usually in dBA. Standards and regulations are discussed where appropriate. The assessment is in terms of human response, not to generate design guidelines for tasks such as the isolation needed in a studio wall.

The second section on physical assessment starts with a chapter on occupational deafness and hearing conservation. Other chapters are on non-auditory effects of noise, noise and sleep, and the effects of noise on work efficiency. There are seven short appendices, including a very good list of acoustical standards and one of regulating agencies with addresses. The index is good, but would be improved with additional entries. In general, the references at the end of each chapter are extensive and up to date.

For the audio engineer, this volume will have relatively limited interest, as there is little or no coverage on noise problems that he may have to assess. This text also does not tell the reader much about measurement methodology. For those who are involved in noise surveys or acoustical consulting, however, this handbook provides the best single-volume source on the various elements of assessment of human responses.

Howard A. Roberson

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The column



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**My Own House, David Bromberg
Fantasy F-9672, stereo, 7.98.**

My Own House is the first album of the eight David Bromberg has done that is entirely given over to acoustic music. As such, it marks a return full circle to roots where he began his musical career.

On the album David (fiddle and guitar) is joined by co-producer George Kindler (fiddle and mandolin), and Dick Fegy (fiddle, mandolin and banjo), both mainstays of The David Bromberg Band, a project that appears to be on the back-burner for now. And possibly just as well, for impressive a unit as David's road band has always been — Bromberg never tolerates less than class musicianship — the last couple of Bromberg Band albums have each felt like a bit less than the one preceding, especially the most recent **Bandit in a Bathing Suit**.

Ah, but **My Own House** is a whole other kettle of fish. All but three selections, if not traditional, are derived from traditional sources. These exceptions include David's very first composition, an instrumental called *Lower Left Hand Corner of the Night*, and as bookends of a sort the old Phil Spec-

tor/Teddy Bears hit *To Know Him is to Love Him* and Hoagy Carmichael's *Georgia on my Mind*. The rest is a collection of jigs, reels, airs, country pieces, and blues. The album is so consistently strong that picking highlights is most difficult, but I can cite some favorites. The medley featuring *Don't Let Your Deal Go Down* is hot, spitting fire made of the wood of the instruments. The Irish air *Sheebeg and Sheemore* is quite simply one of the loveliest melodies imaginable. Luke Jordan's *Cocaine Blues* is an overlooked classic of its genre, fast and very funny. My favorite is Paul Siebel's *Spanish Johnny*, a song Paul found in an Alan Lomax book and which is based on a Willa Cather poem. Special thanks to Mr. Bromberg for this one, reminding me of a long-forgotten beauty.

The dust sleeve contains David's notes about the selections, their origins, and how they came into his repertoire, who plays what plus some personal observations. An excellent set of liner notes.

Bromberg, Kindler, and Fegy have been playing together for some time now and they have strong rapport and

empathy. Their collective love for the material is obvious. A high spot is David's singing which continues to get better and better. He's been working hard to polish the edges.

Like many Bromberg albums, **My Own House** is split between studio and concert recordings. The recording, done by Tom Flye and Eddie Bill Harris, is excellent. The full beauty of the acoustic sounds and overtones is present. The tracks recorded in concert at The Inn of the Beginning in Cotati, California, are especially lively with the setting's electricity and performer-audience chemistry.

Obviously **My Own House** is an album about which David Bromberg cares a bit extra. That little bit insures that his acoustic album would probably be something special ... which it is!
M.T.

Sound: A- Performance: A

Rogue Waves: Terry Reid
Capitol SW-11857, stereo, \$7.98.

One of the great vocalists of our day, Terry Reid is wasting his time when he should be making incredible records. His last listenable record **River**

was a bit obscure in nature (Reid himself described it as "Brazilian Cowboy music"), but at least it was coherent, interesting, and artistically bold. Since then he has taken to tempos that never move faster than a snail's pace; attacking Phil Spector's *Baby I Love You* and *Then I Kissed Her*, Michael Brown's *Walk Away Renee*, and the Everly Brothers' *All I Have To Do Is Dream* at speeds literally twice as slow as the originals. Although I must say he's not exactly bowing to tradition, and I similarly don't like the idea of Reid doing a disco album, a relief from this pace would surely be in order.

What happened to the power of *Silver White Light* and *Superlungs*? It's simply a distressing situation to hear that voice, once acclaimed by everyone from Aretha Franklin to Jimmy Page, singing on top of such lifeless tracks. I think that Chris Kimsey, the engineer behind *Some Girls* and the slightly less artistic but certainly commercial *Frampton Comes Alive* would supervise a project like this seems difficult to believe. Someone send out for pep pills and get Terry Reid out of California! J.T.

Sound: C Performance: Zzzzz

Give 'Em Enough Rope: The Clash
Epic JE 35543, stereo, \$7.98.

The Clash are what might be termed punk populists, as they are by far the most political of the British New Wave and seem sincere in their stance. Their first album was sparsely produced but hard hitting, stylistically akin to The Ramones with a little reggae thrown in for good measure. The band's second album (the first to be released in this country) is no more commercial but slightly more erratic; it seems that The Clash and producer Sandy Pearlman deliberately sought to make an album of pure chaos. In the face of radio adversity and the 1978 Anti-Punk Backlash, these fellows have chosen to flaunt a big middle finger to everyone from CBS Records as if to say "we don't accept any of your standards." An admirable gesture, given the current state of the music business, but strictly suicidal in terms of being a successful financial entity.

Take, for example, *Safe European Home*, which is by nature a very catchy rock 'n' roll tune with what sound like amusing lyrics. First off, as on the rest of the album, it is almost totally impossible to discern any words, not to mention vocal qualities, inflections, or guffaws — the singer is more than buried, the guitars erect a tombstone over his vocal while the

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drums' twenty-gun salute finishes the deed. Producer Pearlman then proceeds to pull all the drums out when the songs apparent conclusion is upon us, brings them back in suddenly moments later, lets the song drag on unmercifully for a minute or so, and then brings it to a disastrous finish by apparently stopping the tape dead. Revolutionary? Methinks not, merely deliberately ruining what is ostensibly a good track. This kind of stuff happens all over **Give 'Em Enough Rope**, and the only track spared this nonsense is an amusing *Julie's in the Drug Squad*.

Oh, there are some plain old duff tracks, like *English Civil War*, but even some of the best are ruined by playing which would seem to indicate that the band hadn't even learned the songs when they recorded them. Irrelevant guitars are left in, proper credits are left off the cover (one song is even mistitled on the jacket), and you're lucky if you can make out the song title — it's no wonder that people at CBS have their doubts about The Clash's chances in this country. It doesn't help when they put out a record as if it was a national secret, but they should at least have a decent chance to prove themselves stiff as Network, Champion, and the rest of the dreck that CBS throws against the wall every year. Yes, this is a good band (for a sample of The Clash at

their best, try *Jail Guitar Doors*, a single that resembled Mott the Hoople more than Iggy Pop), but albums such as this seem a throwback when they are obviously capable of things much better. *J.T.*

Sound: D for Disjointed
Performance: C for Crude

Babylon By Bus: Bob Marley & The Wailers

Island ISLD 11, stereo, \$12.98.

Bush Doctor: Peter Tosh

Rolling Stones COC 39109, stereo, \$6.98.

Don't Look Back: Peter Tosh & Mick Jagger

Rolling Stones Disco-disc DSKO 130, stereo, \$3.98.

Marley and Tosh are well-entwined in their musical ventures, as Tosh is a former Wailer (he wrote *Get Up, Stand Up*) who occasionally joins his former comrade for a little jamming, but each has his own career. Bob Marley is now a big star all over the world, but his recent albums haven't had the fire of some of his earlier efforts; he has taken to recording his latest record on tour and successfully recuts both early and more recent tunes. Tosh is still a cult figure, but with his latest album **Bush Doctor**, he is bound to get more attention due to the presence of Mick Jagger and Keith Richards; in the case of the one conjunctive effort the attention is warranted, but, as for his album as an entity, he has let slide some of the spirit in composition and playing that made **Legalize It** a classic.

My recommendation would be to buy the 12-inch version of (You've Got To Walk And) *Don't Look Back*, an old Motown hit featuring the tandem vocals of Jagger and Tosh. Upon first listening, it didn't really strike me as being all that great, but after the local reggae station drilled it into my head repeatedly, I grew to like it very much, but not quite so well as the dub flip-side *Don't Look Back* (Don't Space Out). When the album arrived, however, it was a bit of a disappointment, particularly the lyrics on songs like *I'm The Toughest* which seem forced. The two tracks which feature Jah Keefer (Richard) are probably the best things on the album next to the single, but I find the record much more difficult to listen to than I expected. The variety of his previous LPs is not there, so you almost are forced to listen to no more than two cuts at one time. Enough of that — get your hands on the disco version of the single and be a happier person for it.

Peter Tosh



Bob Marley

Marley's album is a surprise, with the fast version of *Lively Up Yourself* far superior to the previous live version, *Positive Vibration* truer to the lyrics than the studio rendition, and at last a stage *Stir It Up* for DJs to dig their teeth into. Junior Marvin and Al Anderson are, of course, crucial to the live sound of the Wailers, and thank the stars they are captured in fine form here. My only complaint is that *Jah Live* is not on the record, but we can't have everything — we should only be so lucky as to have a studio album from Bob Marley as good as this one next time around. *J.T.*

Marley

Sound: B+ Performance: A-

Tosh

Sound: B- Performance: B-

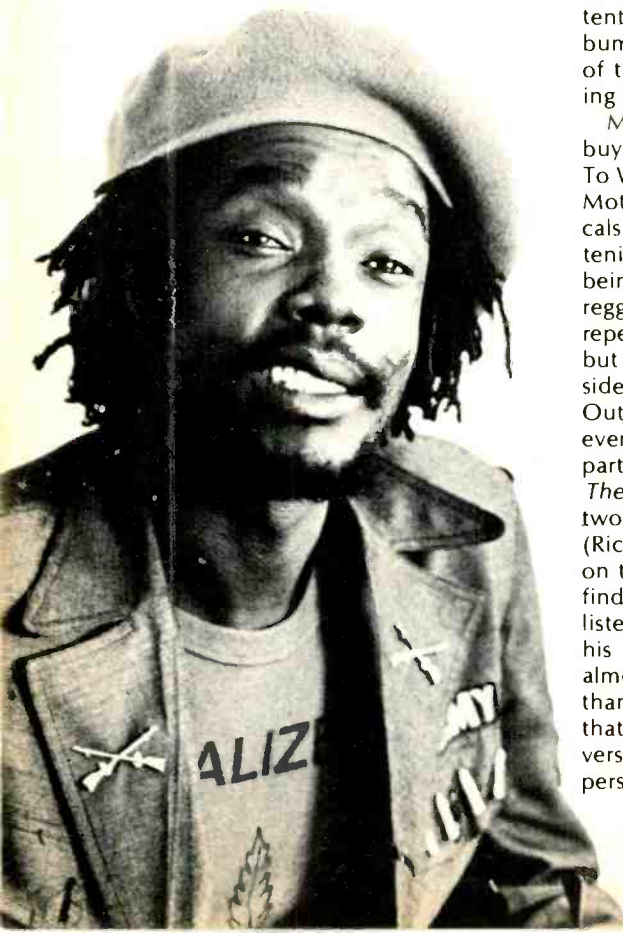
Jazz: Queen

Elektra 6E-166, stereo, \$7.98.

Ghosts of Princes in Towers: Rich Kids
EMI EMC 3263, stereo, \$7.98 (import).

In one corner we have the old guard incarnate, Queen — once touted as the last of the Glitter bands — and in the other, Rich Kids, who have been characterized as both New Wave and Powerpop, whatever either of those terms means. Taken strictly as rock artists, both of these groups have a certain amount of validity and an undeniable sense of self, but in each case the "production," so to speak, clouds the issue.

Queen has been around for a while, and being perhaps the ultimate in rock production, its members should know



a little more about the pitfalls of going overboard. Then again, those blessed with talent do not always have the taste to channel it properly, and producer Roy Thomas Baker tends to push the limits of overdubbing rather than make the four-man band sound like a rock band. Baker's best contribution is his clever drum sound, which, together with the care he takes in recording guitars (particularly Brian May's solos), seems to balance out negatives such as Freddie Mercury's backing vocals which do annoy at times. The best moments of this album are to be found in *Leaving Home Ain't Easy*, *Don't Stop Me Now*, *If You Can't Beat Them*, and *Fun It*. Those not already attuned to Queen's sound will most likely not take to this one any better, as numbers like *Bicycle Race* and *Mustapha* are fairly interesting but only to initiate, and driving rockers like *Fat Bottomed Girls* and *Dead On Time* lose their visceral appeal in the production. Somehow I get the feeling that Queen is scared to come all the way down to Earth even for a four-minute tune, and it's kept them from reaching the Led Zeppelin fans and such — then again, I'm sort of glad they're not the next Kiss.

The Rich Kids album seems to have it together on every level except somebody forgot to add the drums in the mix. Former Sex Pistol Glen Matlock writes rock songs that nobody else is capable of, the band plays with the fury of the old Small Faces, and the general feeling of the album is tremendously uplifting. However, producer Mick Ronson seems lost in the producer's chair in his ability to choose what should be heard and what shouldn't; the beat gets lost, the vocals get the shaft, and what could easily be the album of the year (based solely upon the musical value) somehow ends up as one of the more interesting but still eclectic efforts — the American label will not even release it! As Queen is the last of a dying breed who took three albums to really conquer America, Rich Kids could well take just as long to make their impression here, and by then terms such as New Wave and Power Pop will be obsolete. Let us only hope that they, unlike Queen, will be able to continue with the drive and energy three albums later when they are Rich Old Men. J.T.

Queen

Sound: B+ Performance: B

Rich Kids

Sound: C- Performance: A

Gordon Payne

A&M SP-4725, stereo, \$7.98.

Near as I can tell, this Gordon Payne guy is the newest graduate of the Wailors, Waylon Jennings' band. His album, as produced by Audie Ashworth and J. J. Cale, is a livelier and brighter version of Eric Clapton's recent Cale-inspired style with catchy songs amid easy-going arrangements.

Most of Gordon's songs are trouble-with-women numbers with *Down on Love* and *Bare Naked* as prime examples, and *Go Ask Her* as a standout. *Red Light* in medley with Tom Waits'

Fumblin' With the Blues is a dandy low down thing with a hot trumpet part.

Gordon Payne is an uncluttered and often swinging little record, the kind of rough gem that usually winds up remaindered first at \$2.49 and then later at 99¢ in Woolworth's. If it goes unheard, it's only because it doesn't quite pigeonhole anywhere, it's not rock, not country, nor even MOR, and it's certainly not 'cause it isn't good enough. M.T.

Sound: B- Performance: B+

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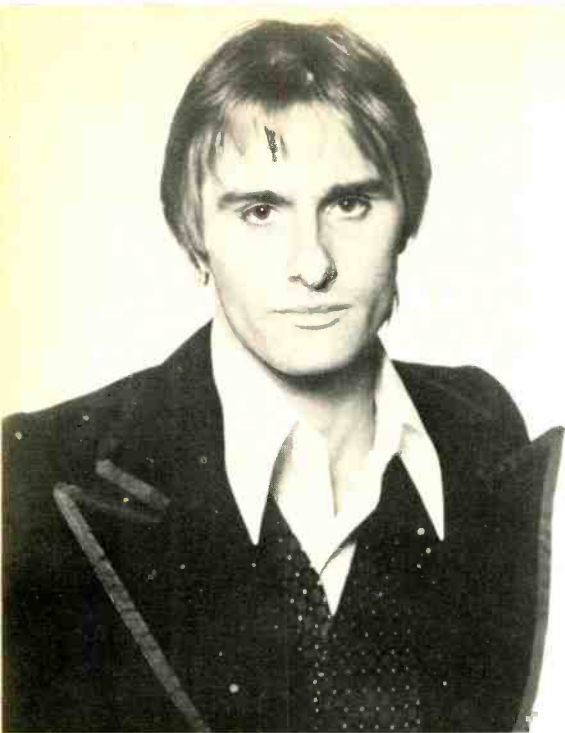
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Hobo With A Grin: Steve Harley
Capitol SW-11770, stereo, \$7.98.

Harley had a few moments in the spotlight, if only in his native England; the very popular David Bowie chose his group, Cockney Rebel, as the bright new hope to rave about and even introduced them at their London debut. There were a few hits since then, and a highly theatrical concert during which Mr. Harley created the optical illusion that he was walking on water, but at the current time Stevie Boy is practically a dead issue in the music world. Somehow all the momentum came to a grinding halt when he failed to keep a grip on the trends which made him chartworthy, and he couldn't exactly fall into the punk rock movement with any ease.

Where Mr. Harley is, as of late, is California — allegedly the music business capitol of the world. Accompanied on **Hobo With A Grin** by a motley crew of musicians, primarily of British extraction, our boy Steve sounds not unlike what Bryan Ferry would if aimed at the easy listening audience. It seems these days people like to resort to the Aphex Aural Exciter when there is a total absence of any other kind of aural excitement on the tracks, and Mr. H. is no exception. The music is not bad nor is it wholly uncreative, but there is nothing even remotely extraordinary about it; not one track encourages me to listen to more than the first minute. I sincerely wish Mr. Harley all the success in the world, but if he continues to make records like this one, I have suggested trying something other than the music business.

J.T.

Sound: C-

Performance: D

Ol' Blue Suede's Back: Carl Perkins
Jet KZ 35604, stereo, \$7.98.

Carl Perkins wrote not only *Blue Suede Shoes* but *Honey Don't*, *Glad All Over*, *Dixie Fried*, *Everybody's Trying To Be My Baby*, and *Matchbox* to name just the hits kept alive by the records of The Beatles, Jeff Beck, and Jimmy Page. The story is that he got in a car accident on the way to the Perry Como Show where he was to perform *Blue Suede Shoes*, and while he was in the hospital recuperating, he saw his friend Elvis perform it on the Ed Sullivan TV Show. The rest is history. Now Carl Perkins isn't exactly poor, but we know who's credited with the fame and glory — so what kind of albums is Carl making?

The kind that's a little bit better than Elvis, but not by much. He's recorded 12 tunes (only two of which he wrote) which are assorted remakes of 50s hits. Now I wouldn't say that Carl Perkins can compete with the Foreigners and Bostons for the hearts of young America, but he hardly has to be booked as a mere nostalgia act either, especially when he's still one of the best guitar players around. Felton Jarvis did a fair job of producing the Perkins disc technically, but I would judge, by this latest work, that he isn't all that interested in Perkins' talent as a songwriter and superb guitar player, but merely as a vocalist and a vehicle for certain songs. I would suggest a dramatic change in recording techniques; if it

Stardust: Willie Nelson
Columbia JC 35305, stereo, \$7.98.

The songs Willie Nelson sings on **Stardust** are standards in the very best sense of the word, landmarks of 20th century American song, and delivered absolutely straight by Willie in a remarkable and tender performance both as singer and guitarist. The band is Willie's own augmented by producer Booker T. Jones on organ.

The album's success lies in the sim-

ple dog-headed restraint used throughout. It is cleanly recorded with no tricks. The arrangements are loving, and they use the entire ensemble with strings applied only for coloring and texture, not sweetening. The sequencing is thoughtful, too.

Stardust is a lovely album.

You're not likely to hear classics like these read better than "Willie Nelson has here" in a long while.

M.T.

Performance: A- Sound: B+

Sound: B-

Performance: D+

Take No Prisoners, Lou Reed Live
Arista AL 8502, stereo, \$11.98.

As records go, this resembles pure cheese nearly covered with thick green mold. All that and tin-can recording, too.

M.T.

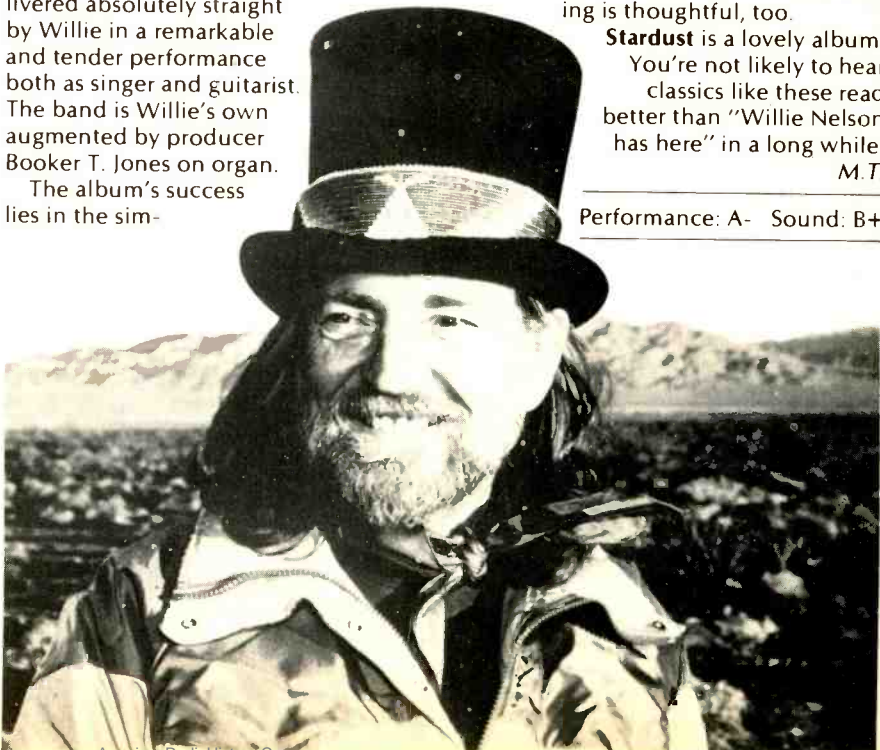
Sound: D-

Performance: D

Live Spirit, Spirit
Potato PR 2001, stereo, \$7.98.

Way back in the psychedelic segment of the '60s and '70s, Spirit was one of the best and most underappreciated bands making records ... their early records are still treasured. Among fans there are factions that claim each of the first four Spirit albums is the bonafide masterpiece ... and nobody is wrong.

With **Live Spirit** there is a fifth candidate ... and completely unexpected. Guitarist Randy California had rejoined drummer Ed Cassidy to attempt to relaunch Spirit in 1975. With the at best uneven albums they put out it never got too far off the ground. But as **Live** shows they've been working on



the live act. The album comes from shows taped in London, Miami, and Tampa. The bulk of the material is the best of the classic Spirit catalogue that Randy California wrote. (The other writing force of early Spirit was Jay Ferguson who resurfaced with last summer's *Thunder Island*.) You get hot, snazzy versions of *Nature's Way*, *Animal Zoo*, 1984, their hit *I've Got a Line on You*, and a 10-minute jam on *It's All the Same*. The band, a trio with bassist Fuzzy Knight, sounds terrific.

Their playing is — dare I say it? — spirited and true to the essence of the band. Even the location recording is unusually vivid. However Potato's pressings leave something to be desired.

Finally the Spirit reunion album the band deserved is out. Being on Potato may make it hard to find, but it's worth looking up. M.T.

Sound: C+

Performance: A-



Flint

Columbia JC 33574, stereo, \$7.98.

Only at CBS Records do they sell the names of cities rather than groups — Chicago, Kansas, Boston, and now Michigan's own Flint. Unfortunately these Grand Funk Railroad rejects can't come up with much that would make them a household word, even after resurrecting five Grand Funk tracks and eradicating Mark Farner's voice from them. I'm sure that was done so they could use Frank Zappa's and Todd Rundgren's names on the

album, but nothing can save them from being a historical nonentity — they are doomed to oblivion. They don't play or sing badly, they just write songs that you'll never remember, no matter how many times you hear them, and haven't found a front man who can write songs and save them from the void. Sorry Craig, Don, and Mel but you've had your day, and it's somebody else's turn now. J.T.

Sound: B

Performance: F

Peter Rowan

Flying Fish 071, stereo, \$7.98.

Peter Rowan's career has been full and one might say checkered. He has played and sung in situations as diverse as Bill Monroe and his Bluegrass Boys, Earth Opera, Seatrain, Jerry Garcia's bluegrass group on **Old and in the Way**, and with brothers Chris and Lorin as the Rowans. And probably some more I've missed.

His is a passionate voice that seems to ring back over centuries. His songs have a timeless quality like the best

newly made traditional balladry. *Midnite Moonlight* and *Land of the Navajo* are excellent examples. *Panama Red* is a New Riders of the Purple Sage theme song that sprang from Rowan. That and *The Free Mexican Airforce* have rich, wild humor. And these are only the more famous songs included.

Rowan has surrounded himself with some great pickers, and the album has a special class for its musicianship. It's a rare treat to hear fiddler Tex Logan on record.

Peter Rowan's first solo album is

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studded with pearls from his career and some new gems as well. He is adventurous and worth the wild and woolly ride. M.T.

Sound: C+ Performance: B+

Other Songs by Lieber & Stoller: Joan Morris & William Bolcomb

Nonesuch H-71346, stereo, \$4.98.

The Lieber-Stoller byline appeared on so many of the best rock-and-roll songs of the 50s that you might almost think they had a stranglehold on wit for that decade. Among their hits were the great Coasters material, songs like *Charlie Brown*, *Yakkety Yack*, *Smokey Joe's Cafe*, *Along Came Jones*, and more. Elvis' *Hound Dog* was theirs too, as was *Kansas City*.

This album is a voice and piano recital of some of L&S's more recent cabaret material. There is a noticeable bent toward nostalgic themes as titles like *Humphrey Bogart*, *Let's Bring Back World War I* and *Longing for a Simpler*

Time indicate. The classic wit so evident in the oldies is honed very sharp in the newer stuff. Even set alongside of the Cheers' *Black Denim Trousers and Motorcycle Boots*, a very funny song in itself, there is a continuity.

Intelligent liner notes and a lyric sheet add no small measure of clarity to this album. The recording itself is pretty bare-boned, but the collection's urbanity and wit are ample compensation. M.T.

Sound: C Performance: B

Love Brought Me Back: D. J. Rogers
Columbia JC 35393, stereo, \$7.98.

Love Brought Me Back was one of the most infectious, creative, and well-presented r&b singles of last year — the use of numerous basses, D.J.'s ad-lib vocals, and the aggressive string arrangement set it apart from the rest of the mire. After hearing it incessantly on the radio, I expected the album would be an aural delight, but unfor-

tunately it appears that the single was a fluke. The rest of the album is relatively humdrum, at no time equaling the vibrance and originality of the title track. If D.J. Rogers is a one-hit wonder, at least go out of your way to purchase the 45 rpm version and stay tuned for further developments on this character. J.T.

Sound: B Performance: C (inconsistent)

Alive on Arrival: Steve Forbert
Nemperor JZ 35538, stereo, \$7.98.

This one's an out-of-the-box find. Forbert is denim-clad and disarming on his debut disc ... cocky, too. His songs and presence have the quirkiness and unpredictability of a Loudon Wainwright or a John Prine.

What Kinda Guy? and *Grand Central Station, March 18, 1977* are introspective, personal pieces with funny kinks. *Going Down to Laurel* works with a *Like a Rolling Stone* feel.

Producer Steve Burgh has handled the iconoclastic Forbert with wise studio restraint. He knows when to leave the kid alone and play solo, and when to reach for horns and rock out. Still Forbert's personality is what is indelibly stamped throughout the album. M.T.

Sound: B Performance: B+

Give Us A Break: Proctor & Bergman
Mercury SRM-1-3719, stereo, \$7.98.

Give Us a Break is a collection of media satires arranged as a broadcast day of a mythical radio station. Proctor & Bergman, Phil and Peter, were the more vaudeville oriented half of the Firesign Theatre, and with this their third album, they have finally realized on record what they have been very successful with live. Sharp writing and slick production, particularly on the jingles, makes the difference.

Using the form of the radio commercial and public service announcement gives P&B sharply defined targets, and when they have targets they tend to hit them. When they hit targets they can be devastatingly funny, and that happens with more than respectable frequency (pun intended).

As a life-long radio junkie I love the jingles "All the Hits/All the Time/All the Same!" And how about "Hot Rock Radio/If the records weren't free/We'd be/All News!"

The special effects, mostly radio incidentals, are accurate, clever, and well deployed. Good recording here. M.T.

Sound: B+ Performance: B+



Mother Factor: Mother's Finest
Epic JE 35546, stereo, \$7.98.

Two years ago Mother's Finest promised to bring hard rock to soul brothers and r&b-influenced riffing to white punks, but they never seemed to find their audience. Having reverted to a much more straight-ahead funk style, they are far more successful musically but still too polite. Joyce Kennedy's powerful vocals always hit home but the rest of the band seems far more restrained than they deserve to be — Wizzard's bass doesn't grab you by the throat as it can in performance, Mo's guitar seems like it lost its

amplifiers on the way to the studio, and B.B. Queen's drive gets buried beneath the percussion. This is a very good album by anyone else's standards, but, like their previous records, the energy and punch that make Mother's Finest an absolute killer live are missing. You can blame the producer for making this just a good album instead of a great one, because these MFs could be the dynamo of the Commodores and Led Zeppelin rolled into one. Instead they end up sounding like another Rufus. J.T.

Sound: D Performance: B

Classical reviews

Edward Tatnall Canby



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Bach: The Goldberg Variations. Seymour Hayden, harps. **SEP (Consortium) 301**, \$6.98.

Ah, California! At the top of the jacket in which this excellent performance is housed, there is this notice: NOTE ON SIX SECOND SPACE. AT THE BEGINNING OF THIS ALBUM, THERE IS A SIX SECOND DELAY TO ALLOW TIME FOR THE LISTENER TO PREPARE FOR THE GOLDBERGS Thus Meditation comes to the disc medium! Obediently, I assumed a yoga position, but it really takes more than six seconds at my age.

The Goldbergs are indeed unique. This is one of the greatest masterpieces of Western musical art, and yet it is pure entertainment and so intended, urbane, tuneful, brilliant, decorative, and easy on the ears. Not at all the Bach you have heard about, the old curmudgeon, the master of the heavy weight! Nobody in his right mind, if he listens, will find these variations anything but a pleasure. Maybe you didn't

know Bach could write music like this?

The marvelously intricate circular structure — the end returning to the beginning after two whole LP sides (omitting most repeats) is a thing that grows on you effortlessly, as you play and play again. No need to study the details, which can seem forbidding; it all tells its own story. But if you want to, when the time is ripe, there is the pattern of threes, a canonic variation, a solid straightforward one, and a fancy thing for two keyboards and flying crossed hands. The canons begin at the unison — the tune imitated at the same pitch — then progress, at the second, third, and so on, the imitative tune one step, two steps, three steps removed from the original, all the way to an octave plus one. In due time, any ear can get to hear these canons, which is a pleasure in itself.

Seymour Hayden's performance is relaxed and intimate, very much suited to the living room listener; too many performers play all too tensely to a

vast concert audience. This is not the most profound version I have heard (probably the very first on records, Wanda Landowska) but it has excellences even so. The pace is not hurried, the phrasing and shaping is good, the added ornaments, quite elaborate, in the French manner almost, are naturally and musically done to good effect. There is a definite sense of enthusiasm, of communication with *you*—this man somehow knows the recorded medium. This makes for enjoyment.

Miracle—after the theme at the beginning, called *aria*, there is a brief pause: I was astonished; *complete silence*. Not a tick, not a rumble, not a bit of hiss. I was almost afraid to look and see who had made the excellent pressing. They do not say! I pray fervently that it was U.S. pressed. The modern harpsichord, based on English models, is beautifully recorded.

Sound: A- Recording: A- Surface: A

Ralph Shapey: String Quartet #VII. Quartet Contemporary Chamber Players Univ. Chicago. **CRI SD 391**, stereo, \$7.95.

Charles Harold Bernstein: Rhapsody Israelien; Poème Transcendental; String Trio "Nostalgic." Yoshiko Nakura, vl., Milton Thomas, vla., Charles Brennand, cello. **Laurel LR-105**, stereo, \$6.98.

String music — what astonishing shapes it takes! Here are two "contemporary" composers — they are alive and healthy, what more do you ask? — so different, and yet so aware of that

ancient family of instruments the violins (plus viola and cello). As one young rock critic said, some years back, you cannot judge contemporary music as to good and bad — you can only *describe*; for who knows?

First, Shapey. In all my innocence, I had never heard the name; but he is hailed as one of our most substantial composers. No dates — his picture makes him less than young and no more need be said except that here is one more of our obdurate curmudgeons, like, say, Charles Ives and Harry Partch, rock-hewn geniuses of total

individuality. Charles Harold Bernstein — what a sonorous name — is also dateless but apparently is not a youth; he began composing for strings in 1970, before which time he had no "formal" musical instruction — but, then, neither did Telemann nor Haydn nor, for that matter, Ludwig van Beethoven. The first of these, Shapey, is not Charles Ives. Nor is Bernstein, as alleged, a sort of Grandma Moses; he is much more skillful than that. Both men are, indeed, craggy individuals and the wonder of it is that their string idiom is so different. Our times! We are the geniuses of multiple culture. Interesting listening.

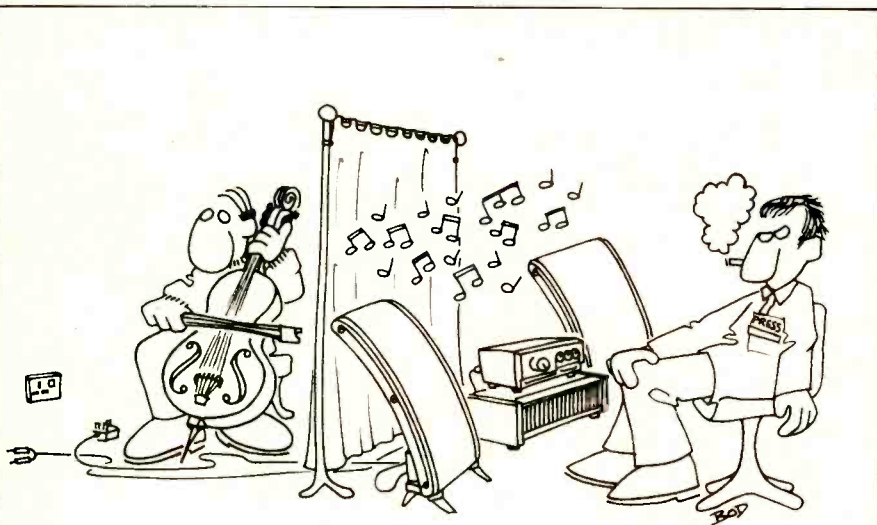
Shapey writes extremely dissonant quartet music for four instruments in unconventional stance, the two violins standing backstage, the viola and cello forward, for a genuine stereo spread. But what stands out in Shapey is not the dissonance, but the wide Schoenbergian leaps, screeching up and down, but rather, the persistence of two or three tones, keys in a sense, which will not go away and repeat *ad inf* in the bass parts — like one of those electronic music things built on a single sound. For three movements those tones drove me nuts — in the fourth, a "passacaglia," there was suddenly more movement and I felt relieved. Strong, difficult music, somewhat fanatic in expression and by no means easy listening, even with extreme stereo spread.

Charles Harold Bernstein — well, he isn't Leonard, after all — writes a nominally much more conservative idiom, based on 18th-19th century ways of using harmony. Yet, like Sibelius, he is not nearly as "old fashioned" as he first sounds. There is a very strong and modern individuality to his work, very much an evocation of late Beethoven, and his technique is fantastic — only a handful of composers have written better sounding string music for solo violin or string trio. I kept telling myself that this stuff was hopelessly old fashioned, and my inner sense told me right back that here was an *authentic genius* of sorts (that's the words used to describe Shapey, above) — and to heck with what "language" he chose to use.

Moreover, this Japanese violinist, out of the Toho school and, later, Juilliard, plays a really powerful Strad. She is a tremendously communicative and authoritative musician with a fine technique, beautiful pitch (in double stops, etc.) and a sense of leadership that one can hear every moment of the recording. She is the boss in these playings and no two ways about it.

AUDIO • March 1979

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Very fine and unusual music, I would say, conservative or no.

Sound: B+ Recordings: A-
Surfaces: A-

The Western Trio, Vol. 2: David Baker, Robert Muczynski, Malcolm Williamson. Laurel LR 106, stereo, \$6.98.

It really doesn't matter to the outside listener how many grants and awards and performances and Professorships a composer may have received in his academic career (as duly recorded on the blurb segments of a record like this); nor, oddly, do the composers' own accounts of their music seem very relevant for the distant home listener, mainly intent on his own sonic enjoyment — and why not? He bought the record. I really liked the first side of this disc but found the second side more pretentious and show-off. With excellent recording of piano, violin, and cello, on good surfaces, and excellent playing, too, the enjoyment factor is not bad at all, for any of us, either side.

David Baker, whose *Contrasts* fill up Side 1, is a modest, very melodic and motivic composer (ideas that you can remember); he is supposed here to

be combining "Western art music" with jazz and black folk elements, in particular "Bird" Parker in jazz and Charles Ives in classical recent-modern. This isn't what I heard, though I recognized the Parker and the Ives easily enough. What struck me was, instead, a delicate yet steady touch of old Paul Hindemith (unmentioned in the notes) — Hindemith at his best too, that contemplative, sweetly dissonant melody that he often wrote; Baker writes the same kind of poignant and well-styled melody with the same compulsive counterpoints of fast notes. *Not* imitation Hindemith! Rather a healthy and positive influence, leaving David Baker very much himself, and the same for the jazz parts and the Ives, full of quotations from that old curmudgeon's brusque manner. Ives, too, is there but Baker is never absent. Good musical thinking, and in truth Baker is able to bring unlikely elements of great contrast together in an easily unified manner, for any ears.

The works on Side 2, Muczynski (Chicago) and Williamson (Australia and England — he is now "Master of the Queen's Music") are, for the same three instruments, more showy and stagey, rather than too big and ener-

getic for the living room — these, after all, are concert works. Muczynski seems to me stylistically unstable; his music begins turn-of-the-century mystic, slides back into neo-Brahms, reconverts into various modernities, expertly crafted but not really very consistent. Malcolm Williamson, the Queen's man, is equally stagey but the sound, though sharply dissonant, is better integrated and of a piece. He has a curious way of assigning crunchy dissonant chords to the piano against suave melodies in the strings, and vice versa, his jazzy neo-classic rhythms are persuasively bouncy.

The Western Arts Trio is as good as the blurbs say, though I wish we could forego such words as *renowned*, which is almost as meaningless as *acclaimed* these days. The Trio is surely a musical mirror for the composers' intentions; you hear *through* them, not at them. That's my best praise.

Intensity-type stereo sound (Neumann SM-2), with, if I am right, minimal phase differences between channels but plenty of volume diffs, to spread things left and right. That diminishes ambience effects, but for this music it is excellent, just the same.

Sound: B+ Recording: B+ Surface: B+

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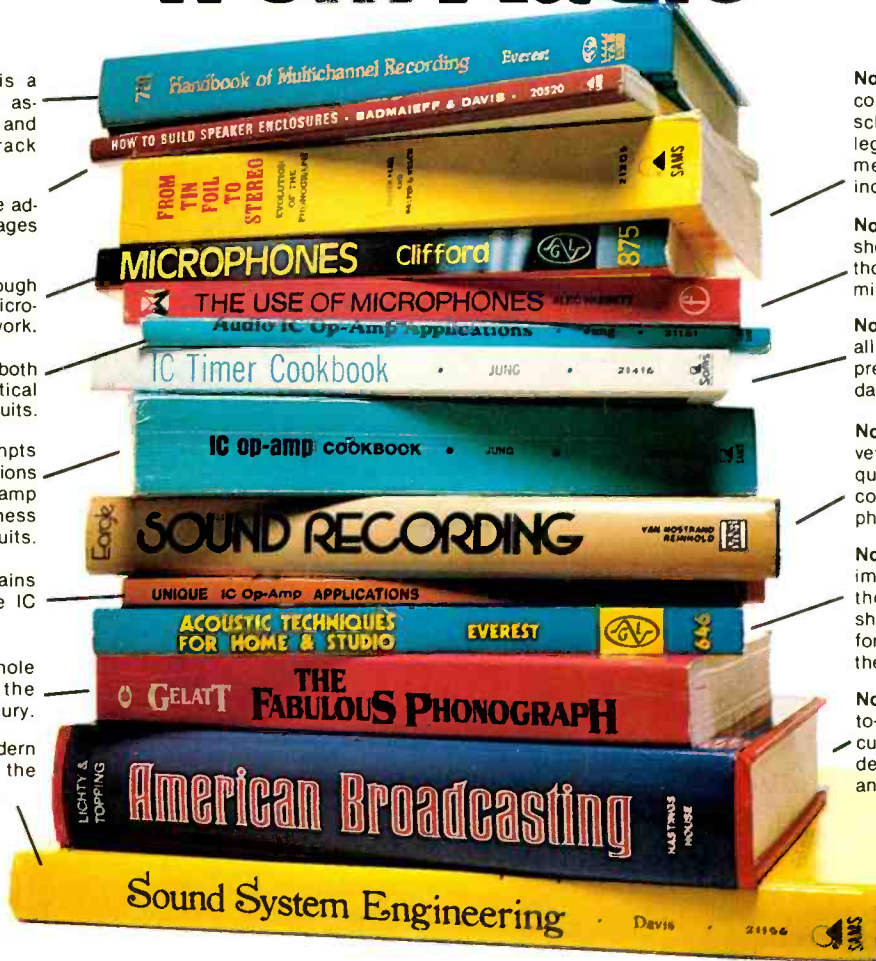
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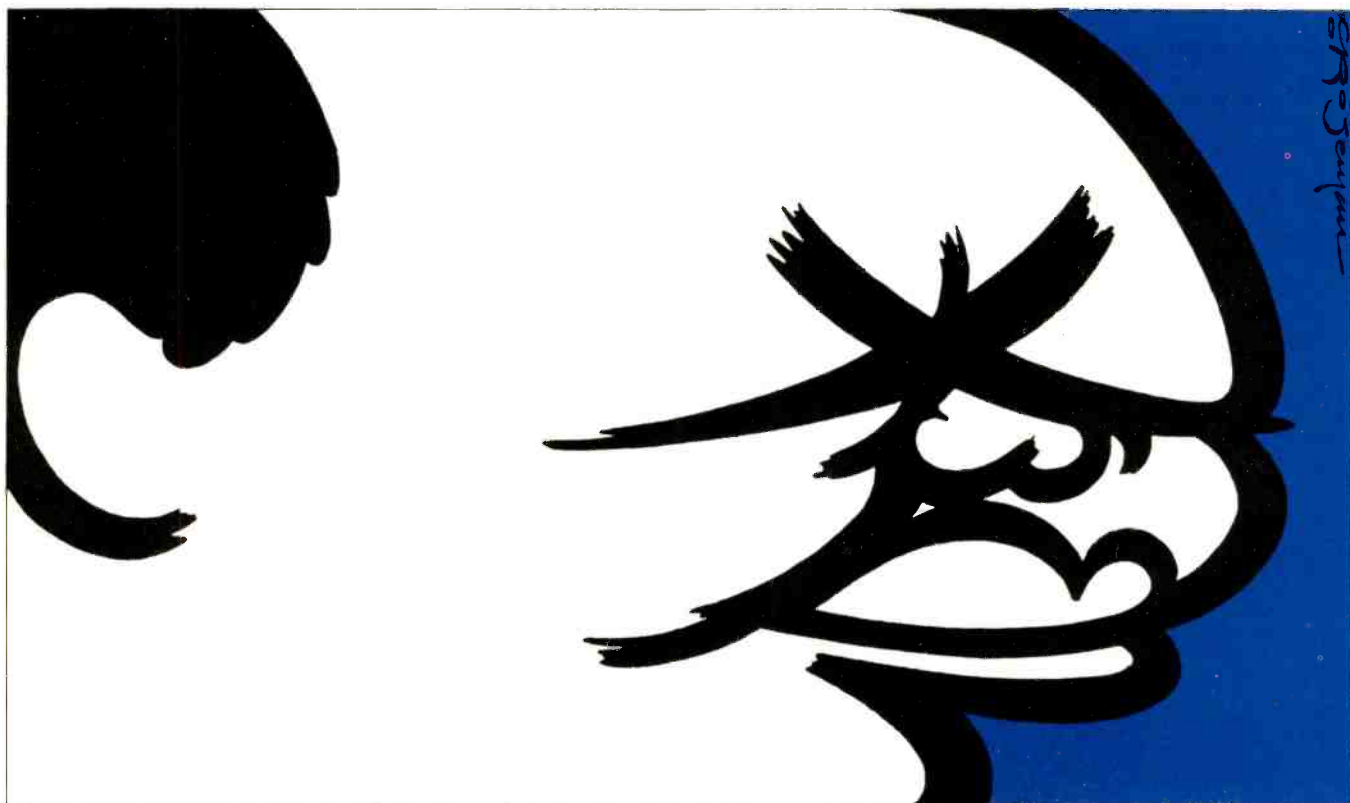
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Jazz & blues



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Jay McShann, Last of the Blue Devils
Atlantic SD 8800, stereo, \$7.98.

For years Jay McShann was known as the Swing-Era pianist-bandleader who introduced Charlie Parker to the jazz world. But since Bird's death, the 65-year-old McShann has gradually grown in repute and stature as a pianist with a deep feeling for the blues. Indeed, McShann, a product of the southwest blues tradition, flourished in Kansas City and beyond during the Pendergast era, eventually leading a big band that attracted national attention, one that briefly ranked with the Count Basie and Andy Kirk ensembles. As big bands moved off center stage in the post war era, McShann retreated to obscurity in Kansas City, but recently his undiminished ability to play powerful blues, boogie woogie, and barrelhouse piano has brought him back into the spotlight, leading small combos.

This past year has seen McShann perform several exciting stints at Michael's Pub, a NYC swing-oriented jazz club, and between the exposure and this outstanding album, McShann should get the attention he richly deserves.

Last of the Blue Devils, recorded during three sessions in the summer of '77, rocks and swings with a hard-blown, earthy exuberance. Personnel include ex-Basie trumpet man Joe Newman and former Basie tenor men Buddy Tate and Paul Quinichette. Tate is in fine form on *Jumpin' At the Woodside* and *Blue Devil Jump* as he stomps out long, loping lines in his crisp, declarative style. Quinichette's sinuous sound is equally featured as he trades robust choruses with Tate. The rhythm section includes swing stalwart Milt Hinton on bass, Jackie Williams on drums, and guitarist John Scofield. The group is loose and extremely cohesive as it solos, lays down ensemble riffs, and gives backup support with vigor and taste. This is what jazz is all about. Some high points include gritty vocals by McShann on *Taint Nobody's Business* and *Hootie Blues* and a lovely reflective piano solo, *Just For You*. **Jay McShann, Last of the Blue Devils** is not to be missed. It is cleanly recorded by Atlantic engineer Jim Crotty in RCA's Studio B in NYC.

John Lissner

Sound: A-

Performance: A

Montreux Suisse Air: Air
Arista/Novus AN 3008, stereo, \$7.98.

With the recent disbanding of the Revolutionary Ensemble and the absence of any new recordings from the Art Ensemble of Chicago, Air is the only standing group of improvising musicians in jazz. In existence since 1971, Air has only had albums released in the United States within the last year. **Montreux Suisse Air** is their third such release. It continues a motherlode of creative music that began with two Japanese albums.

Montreux Suisse Air wastes no time in telling you about the individual musicians or their collective intent. The opening cut, *Let's All Go Down To The Footwash*, is a twisting flurry of exchanges and instinctive rapport between the musicians. For the first portion, Fred Hopkin's arco bass line is a locus around which Henry Threadgill on alto and Steve McCall on drums devise their thrusting lines. When Hopkins switches to pizzicato, the locus becomes undefined, but mutually understood.

Though *Footwash* has the funky title, it's *Abra* that contains the earthy blues riffs that are always implied in

their works. McCall and Hopkins lock into an slow, grooving pattern while Threadgill lays out a plaintive tenor line that becomes increasingly agitated. The rhythm section slips into free time as McCall becomes the perfect foil for Threadgill's writhing tenor. Just as Threadgill had led them into the free section, McCall and Hopkins take them back down to the blues groove and into a gusty solo by Hopkins.

Suisse Air takes up the second side with a ritualistic percussion dance driven by a muscular Hopkin's bass line. Threadgill plays his oddly colorful hupkaphone (like a vibraphone, except with hubcaps) as a melodic adjunct to McCall's primitive jungle drums. The piece builds into a spiritual fervor of clamoring rhythms until Threadgill jumps onto his baritone sax for a fierce blast of animal fury to close it out.

This album is part of Arista's Novus line of records dedicated to the new jazz. It joins ECM (since they switched to Warner Bros.) in a positive domestic trend directed at recording jazz with precision, pressing the discs on clean vinyl, and packaging them in high-quality plastic inner sleeves. This live recording is especially clear. On the title cut, the percussion is naturally colored with a crispness, resonance, and stereo separation that make it both a sonic and musical delight. The dynamic range is such that Hopkin's bass always comes through with all its depth, whether in the frenetic blowouts or his unaccompanied solo on *Abra*. For *Air* and their music, it's been a long time coming and we should all take advantage while it's this good.

John Diliberto

Sound: B+

Performance: A

Pure Gold: Paul Desmond
RCA ANL 1 2807, stereo, \$7.98.

Somehow Paul Desmond emerged musically unscathed after all those strange but highly profitable years with Dave Brubeck. It was towards the end of his Brubeck tenure (about 1963) that this solo album was recorded — and extremely well recorded — at the New York RCA studios by producer George Avakian. The album, originally issued as *Desmond Blue*, was aimed at the "mood jazz" audience and meant to be played primarily on background music stations at 2 AM. Despite these limitations, this is a most satisfying, thoroughly engaging, and utterly relaxing album. It is, unapologetically, a lyrical outing that focuses on Desmond's beguiling sound and acute melodic sense.

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Stylistically, Desmond occupies a position somewhere between Art Pepper and Lee Konitz; however he is a prettier player than either of these talented gentlemen as he demonstrates by performing numbers such as *My Funny Valentine*, *Then I'll Be Tired of You*, *I Should Care*, and *Body & Soul* with an unabashed romanticism that is never cloying. Label this collection commercial if you will; one must succumb in sheer admiration for Desmond's beautiful sound, for his built-in sense of form, and his gift for a graceful phrase. My favorite track is *Desmond Blue*, an original instrumental which the saxophonist ambles through very gently at a medium pace.

John Lissner

Sound: B

Performance: A

Travelin' With The Blues: Tom McFarland

Arhoolie 1079, stereo, \$7.98.

Travelin' With The Blues strikes this listener as the unfinished basic tracks for a projected album before most of the sidemen overdub their parts. That's a measure of how unhappily incomplete almost all of these performances sound, as electric guitarist Tom McFarland performs a set of original tunes backed solely by a bass player and a drummer.

The sparse instrumentation works in a few spots, notably the doomy *Telephone Blues*, but is positively deadly to the several up-tempo numbers, which are cast along the lines of r'n'b shuffles. Such material cries out for a crisp backing with a prominent brass section or, at the very least, a driving



In Concert: Milestone Jazz Stars
Milestone M-55006, stereo, \$7.98.

The Milestone Jazz Stars is a marketing concept designed to bring that label's three best-known instrumentalists together for a tour and subsequent album. But beyond exploiting the popularity of McCoy Tyner, Sonny Rollins, and Ron Carter, no one seems to have any concept of exactly what they wanted to do musically. Hence, *In Concert* comes off as a pastiche of each individual's previous work with no new ground broken. In fact, the whole point of this record is undermined since the trio, with the addition of Al Foster on drums, plays only 37 minutes together in the span of a two-record set. I would think they could've left the individual solos to their own recordings.

There couldn't help but be some fine music here, however. Of the quar-

ter tunes, McCoy Tyner's *Nubia* and Ron Carter's *N. O. Blues* work best. Tyner's left-hand power chords sweep the ensemble along while his left hand sketches the orchestration which the others fill in on *Nubia*. Carter is particularly supportive, bending his warm tones around Tyner, while Rollins plays with the melody. It's also nice to hear McCoy play in front of a drummer who's not pounding the walls down. But then, the whole tenor of this performance is one of a casual jam.

In Concert is a pleasant album with a surprisingly crisp sound that will please everybody, but won't stand as the milestone of creative music which these cats are capable of.

John Diliberto

Sound: B

Performance: B-

rhythm guitarist. The lack of such sidemen forces West Coast bluesman McFarland to continually switch between lead and rhythm guitar parts. He's unable to take the sort of lengthy solo that would establish a strong musical identity, as even his brief lead guitar lines are robbed of much of their potential power by the lack of an adequate rhythmic background. Not only are his sidemen unable to fill the rhythmic void when he solos, but the overly mannered drumming of Bobby Broadhead throughout this disc is anathema to McFarland's flirtations with dynamics.

McFarland has a light touch to his playing and a loose, smooth style, a mixture of the Texas blues with a touch of swing popularized by T-Bone Walker with traces of contemporary jazz guitar as exemplified by Kenny Burrell and Barney Kessel. He's a thoroughly modern bluesman who requires an appropriate setting, as opposed to a simple blues trio concept which lends itself more readily to older blue styles.

Further, little excitement is added to these tracks by McFarland's subdued vocals, which are often just a few steps removed from speech. This set demonstrates that he's sufficiently talented, however, to deserve a better showcase for his ability than **Travelin' With The Blues**.

Roy Greenberg

Sound: C+

Performance: B-

In Disco Order, Vol. 4: Gene Krupa
Ajax II, mono, \$7.98.

Gene Krupa with Roy Eldridge & Anita O'Day

Fanfare 10-110, mono, \$7.98.

Gene Krupa and His Orch. with Anita O'Day Featuring Roy Eldridge
Columbia KG 32663, mono, \$7.98.

The Ajax reissues are great for dyed-in-the-wool Swing Era buffs who want every recording made by their favorite bands; the collectors' label is up to Vol. 10 in its Krupa series of old Brunswick and Columbia 78s reissued on LP, sides gathering dust in the Columbia vaults. I doubt that Columbia will ever reissue them, and quite frankly most of these early Krupa recordings are either bland ballads or corny, dated novelties. At its early stage, from the time Krupa cut loose from Goodman in 1938 until trumpeter Roy Eldridge joined him in 1941, Krupa's band had developed little character and didn't play much jazz, at least on its recordings. Unless you insist on Krupa discographical completeness, you can skip most of the Ajax releases through Vol. 10, with the exception of **Vol. 4** which does swing, offering some fine Sam

Cry: John Klemmer
ABC AA-1106, stereo, \$7.98.

John Klemmer has been one of the more profound exponents of the Echoplex as a tool to expand an instrument's vocabulary. Though he's only used it to swath his light funk in a sensual glow in recent years, there was a time when Klemmer used it to extract a wide range of emotions from his tenor saxophone. His albums on Impulse, especially **Waterfalls** and **Intensity**, contained furious displays of



passion where Klemmer could not push out enough sound from his axe to tell all he had to say. The Echoplex gave his statements a broader attack. It doesn't just echo a horn's lines, but allows the player to build chords and scales that all sound simultaneous.

Well, you can't play the kind of sophisticated muzak Klemmer's been putting out and not expect to lose some intensity. But **Cry**, an album of solo saxophone and Echoplex improvisations, is the closest we're likely to get to the raw nerves of John Klemmer. Without accompaniment, Klemmer scales his saxophone through the wide-open spaces with an unfettered abandon that makes me ask . . . why do they want to play that other stuff anyway? I know the answer, but when I hear Klemmer move effortlessly from tiny rivulets of echoed sound into torrents of ecstatic cries, I still have to ask.

Klemmer has lost that edge which gave so much of his early work that immediate sting of understanding. He still comes through with an honesty that's so pure that it's often maudlin. And just to show us he can do it, he gives a virtuoso reading of *Round Midnight* on acoustic sax. *John Diliberto*

Sound: A-

Performance: B

Donahue arrangements such as *Quiet Please*, *Roll Em*, and *Challenger Chop*: Donahue also has some neat tenor licks on Johnny Hodges' *Hodge Podge*, and we can also hear some puckish swing clarinet by Sam Musicker and mellow trumpet by Chuck Frankhausen. **Volume 4** also has two decent 1939 pop tunes — *The Lady's in Love With You* and *You Taught Me to Love Again* sung in a sprightly manner by Krupa's first vocalist, Irene Day.

The arrival of trumpeter man Roy Eldridge together with singer Anita O'Day in 1941 turned the Krupa band around. The *Fanfare* release, made up of well-recorded broadcast airchecks, covering June 7 of 1941 through Dec. 25, 1942, offers us music of real quality and scintillating excitement. These cuts reveal that O'Day was the hippest white "thrush" in the band business. Numbers like *Kick It*, *Cow Cow Boogie*, *Drummer Man*, and *Drumboogie* are handled with a sensual zest and a driving, insinuating swing. (The last two numbers were originally recorded with Krupa by Irene Day, but Anita adds a gritty down-home quality to her versions.) Eldridge, one of the great jazz trumpet influences in the early '40s until the rise of bop, kids around a bit with vocals like *Knock Me a Kiss* and *I'd Rather Sleep in a Hollow*

Log, but punches across some fiery choruses on Anita's vocals and on instrumentals like *Jersey Bounce*, playing with a lyricism and drive that electrifies the Krupa band. The aircheck of Eldridge's solo on *Rockin' Chair* is a collector's item — the Armstrong-like variations differ slightly from Roy's Columbia version recorded with Krupa, but this broadcast performance offers much the same emotional impact and crackling invention.

The uninhibited Krupa-O'Day-Eldridge Columbia double-set reissue is an outstanding collection; it's been out for some time, and is likely to disappear from the record bins when Columbia's accountants get around to comparing its sales with those of Neil Diamond; pick it up before it's deleted. The sound transfer job from the original, well-recorded 78s is lustrous. There are 25 tracks, all of them focus on O'Day's throaty wailing and supple, horn-like phrasing. Her warm, husky sound and vibrant, jazz-driven attack sparks such splendid Krupa swingers as *Opus 1* and *The Boogie Blues*.

Opus 1, recorded in 1945, the album's kick-off number, is a skillful rearrangement by Sy Oliver of his big hit for Tommy Dorsey. The Krupa band gets a bright, brash sound; the

section work is taut and crisp, Anita swings hard, and trumpeter Don Fagerquist contributes a fiery, explosive chorus in which he shows his debt to Eldridge.

The rapport between Eldridge and O'Day sparks fine performances on *Thanks for the Boogie Ride*, *Massachusetts*, *Murder He Says*, *Bolero at the Savoy*, and *Green Eyes*. The 1941 *Let Me Off Uptown* is another exuberant O'Day/Eldridge vehicle. Everyone has a ball on this session — Krupa's drums pace the ensemble with a firm, driving swing; the bouyant vocal duet by Anita and Roy has O'Day egging Eldridge on ("well BLOW, Roy, BLOW!"), and Little Jazz delivers a flamboyant trumpet chorus accompanied by a fusillade of Krupa rimshots.

Perhaps the single, finest cut in this collection is the 1945 *Boogie Blues*, a stunning study in pulsating excitement. Originally planned as an instrumental featuring the leader, O'Day expressed a strong desire to sing it and gentlemanly Gene deferred to her. O'Day really pours it on, socking the blues refrain across, with the big band punching hard behind her. Heard briefly are potent choruses by the Hodges-influenced altoist Johnny Bothwell and trombonist Leon Cox playing an earthy obbligato to O'Day's rough-hewn vocal.

Skylark is a ballad beauty; Anita sings the Hoagy Carmichael classic with a throaty warmth and Eldridge takes a poignant chorus using his unique buzz mute. O'Day has another relaxed, flowing vocal on *Georgia on My Mind*, her approach here has definite Billie Holiday overtones. The Krupa-O'Day semi-scat hit, *That's What You Think*, shows off more of the singer's pliant, horn-like phrasing, and, for a novelty recorded back in 1942, it stands the test of the time remarkably well.

These Columbia recordings suggest that during her formative years with Gene Krupa, Anita O'Day was one of the Swing Era's outstanding stylists. So outstanding was her talent in combination with Roy Eldridge, that Krupa built most of his music around them. The results, as demonstrated in this fine collection, are still worth hearing.

John Lissner

Disco Order

Sound: C Performance: B+

Eldridge & O'Day

Sound: B Performance: A-

Orch. with O'Day Featuring Eldridge

Sound: B Performance: A

AUDIO • March 1979

John McLaughlin, Electric Guitarist
Columbia JC 35326, stereo, \$7.98.

McLaughlin's original Mahavishnu Orchestra was an inspirational outfit that brought together the visceral crunch of heavy metal electric rock with the cerebral virtuosity of jazz improvisation. With the addition of McLaughlin's raga-styled structures and improvisations, they generated an intense emotional power of ecstatic involvement in their performances. But after many changes in his group personnel and a spiritual upheaval in his own life, McLaughlin abandoned his electric group and guitar. But not

before he spat on his creation with the utterly crass *Inner Worlds* album.

McLaughlin has, for the last two-and-a-half years and three albums, been plying a fervent brand of acoustic Indian music with his group Shakti. Though close to the original Mahavishnu Orchestra in concept, it freed McLaughlin from many of his own clichés and made him an even more intuitive improviser.

The release of **John McLaughlin, Electric Guitarist** does not herald a return to the passion of The Mahavishnu Orchestra. Instead he returns to where he left off, at a dead end. **Electric Gui-**

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st teams McLaughlin with all the stars he's played with from his early days with Miles Davis through the end of the Mahavishnu Orchestra. McLaughlin is a great electric guitarist, but this is the best argument I've heard for him going acoustic. By teaming with all his old mates, he begs for comparison with their seminal work and suffers next to it.

A different group is featured on each track making this a very disjointed album. But whether he's reunited with Billy Cobham and Jerry Goodman from the original orchestra or lined up alongside fusion super stars Chick Corea, Stanley Clarke, and Jack DeJohnette, the results are uninspired ensemble work followed by perfunc-

tory solos where only McLaughlin seems to have a sense of purpose. One of the biggest disappointments is *Are You the One? Are You the One?* I expect much more from Jack Bruce and Tony Williams when they reform three-quarters of Tony Williams Lifetime (the late Khalid Yasin/Larry Young, conspicuously absent). The roaring electric storm this group used to mount is represented here by a brief, light-hearted goof that only testifies to the lost ardor of these musicians.

But the album is not without moments. *Friendship* pairs McLaughlin once again with Carlos Santana for a free-wheeling display supported by multiple percussion of Narada Michael

Walden, Alyrio Lima, and Armando Peraza. Tom Coster's organ offers the support and textural colors so lacking in the other pieces. *My Foolish Heart* is an electric guitar solo, something McLaughlin hasn't explored enough on record. Its introspection is reminiscent of *My Goals Beyond*, but with gentle overtones you can only get from an electric guitar.

My Foolish Heart also shows one of the major faults in this album. With the exception of Jack DeJohnette and the group of *Friendship*, there are very few musicians who are free enough in their conceptions to play with McLaughlin without either hindering him or holding themselves back. When challenged McLaughlin is a delirious experience. When he isn't challenged, he's still pretty exciting.

John Diliberto

Sound: A-

Performance: C+



Lanquidity: Sun Ra

Philly Jazz PJ 666, stereo, \$7.98.

Sun Ra has had a varied output in the last two years. Rather than exploit his reputation as the Space Master in this age of Star Wars hype, he has opted to expose his roots in the form of solo piano improvisations on traditional hymns and Arkestrations of big band classics like Billy Strayhorn's *Take the A Train*. Unless you've heard the obscure *Media Dreams* or *Disco 3000* on Ra's own Saturn label, this is the first time Ra has traveled the spaceways since **Astro Black** on Impulse.

Lanquidity, with its flawless production (unheard of in any other Ra record), is a quintessential album of Ra's spacial cake-walks. With his electric and acoustic keyboards, plus his 14-piece Arkestra and three vocalists, Ra creates an Egyptian caravan moving through the dark, liquid textures of space. The title track is a mysterious incantation with Marshall Allen's sinewy oboe playing against droplets of electric sound.

The caravan makes a stop at the Be-Bop Bar for *Where Pathways Meet*.

Danny Thompson anchors the ship with a deep bass reed bottom aimed right at the groin, while John Gilmore's tenor sidles up to the bar to vamp on some blues. Ra points them back towards the sun on *Twin Stars of Thence*, where, instead of the usual Ra rocket blasts of keyboard washes, we hear delicately balanced aerial displays insinuated between the comic dust of Dale William's Hendrix inspired guitar work.

It all dissolves in mystical voices whispering "There Are Other Worlds (They Have Not Told You Of)" out of some primeval psychosis. **Lanquidity** is the Ra album I've been waiting for since I first stepped into his heliocentric worlds. It combines that sense of timeless space of someone who arrived from the past and came from the future. The clean, translucent production heightens the effect of not having your feet quite rooted to the ground.

Available from New Music Distribution Service, 6 West 95th St. New York, N.Y. 10025.

John Diliberto

Sound: B+

Performance: A

The Journey: Dollar Brand

Chiaroscuro CR 187, stereo, \$7.98.

If you're looking for an album which highlights the spiritual piano of Dollar Brand, then this is not the place to look. Instead, **The Journey** features Brand in the role of composer and bandleader for an impressive array of New York's *avant-garde*.

Side one is a loose showcase for soloists on the featured track, *Jabulani*. It means joy, and after a vibrant opening it turns into a celebration of solos from most of the band. Hamiett Bluiett takes the opening solo with a controlled run through the honks, squeals, and guts of his baritone sax. Don Cherry picks up with the staccato flight of a nervous bumblebee. Bassist Johnny Dyani has a nice thumping solo as does drummer John Betsch who uses his drums for high contrast coloration. Dollar Brand appears only in the ensemble on this side playing soprano sax.

But side two, taken up by *Hajj*, is an elevating composition of organic unity. *Hajj* means the journey . . . it's a spiritual hymn of search built around a four-note modal pattern that Brand maintains throughout the piece. He sets a churning medium-tempo rhythm underneath and on top, a prayerful call and response between Talib Rhynie's whining oboe and the reeds of the ensemble. Throughout, Cherry's crying trumpet and Dyani's eerie arco bass intertwine like vines around the main theme until Cherry steps out with a poignant, nomadic

solo. Brand's solo arises as if he were awakened from a trance. Still maintaining the modal pattern, he makes a few meditative statements, then slips back into his hypnotic instrumental chant, as if his actions might disrupt the tune's delicate balance.

The Journey is a venture into Dollar Brand's fulfilling spiritual life. If the first side is somewhat disconnected, it does serve as an introduction to the musicians who blend in such harmony on the title track. *John Diliberto*

Sound: B- Performance: B

The River: Khan Jamal and Bill Lewis
Philly Jazz PJ 2, stereo, \$7.98.

The River is an album of marimba and vibes duets by two mature musicians who are little known outside their native Philadelphia. Bill Lewis plays vibes with an unusual lyrical warmth coupled with a primitive rhythmic approach. He builds the simple melody of the title track with gentle overtones and punctuations derived from a naivete that thrives on the sounds he is producing.

Khan Jamal has recently been documented with Sunny Murray's Untouchable Factor. His playing is marked by a cerebral introspectiveness marked by periods of sparseness and involuted cycles. These are contrasted against his more energetic searches that reach the edges of his instrument.

On **The River** these two men complement each other in this set of three improvisations. The shimmering gleam from Lewis' vibes are a springboard for Jamal's pulsing melodies. Rather than a display of four-handed tuned percussion, they have given themselves over to the mood of the moment. The airy spaces of warm meditation give way to primal energy dances.

The River, recorded live, is a quietly joyful album. The recording captures all the natural purity of these instruments with a natural transparency. Available from New Music Distribution, 6 West 95th St, New York, NY 10025 *John Diliberto*

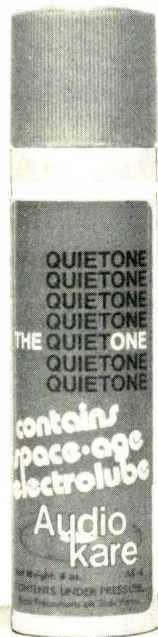
Sound: B Performance: A-

Duet: Lester Bowie/Phillip Wilson
Improvising Artists, Inc. IAI 37.38.54, stereo, \$7.98.

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between the performers. Groups like the Art Ensemble of Chicago perform with an inner logic that allows them to both anticipate and initiate changes of direction and feeling within an improvisation. While spontaneous interactions occur in most music, the concept of music based on spontaneity is at the ideological foundation of jazz, or Black Classical Music. This instinctive freedom is tempered by the discipline and expertise of the performers to turn it into creative expression.

The duet situation allows this interplay easy access. The feedback between performers is immediately heard and more easily understood, even in its most abstract forms. The principles of this duet are also giants of the *avant-garde* music scene. Lester Bowie is his generation's trumpet master and a mainstay of the Art Ensemble of Chicago. Phillip Wilson is one of the music's most original voices. He has played with the Art Ensemble and the Paul Butterfield Blues Band. Recently, he's been based in New York playing with David Murray, Perry Robinson, and others.

On *Duet* they play in a relaxed groove which places Bowie up though both musicians seem to take turns at directing things. Bowie is in fine form and humor as he interpolates bugle

charges, *Three Blind Mice*, and other quotes. He'll spring playfully around the drums, then slip into a terse introspective section only to break that mood with a growling fart. Wilson, like the best jazz drummers, plays his set musically, rather than just rhythmically. He presents subtle, darkly shaded hues for Bowie to ponder and moving displays on which he can dance.

Duets never reaches the rapturous heights of the John Coltrane/Rashied Ali duets on *Interstellar Space*. Bowie and Wilson take a more cerebral and austere approach compared to Trane's passionate cries. The music here is not involved with spilling their guts, but with giving vent to their fancies.

The album is recorded in fine detail right down to the spittle in Bowie's trumpet. Improvising Artists provide clean, noiseless surfaces for the airy spaces of this music. *John Diliberto*

Sound: A Performance: B+

Buck & Bud: Bucky Pizzarelli & Bud Freeman

Flying Dutchman BDLI 1378, stereo, \$7.98.

If you missed this superb album, issued about a year ago by Bob Thiele's Flying Dutchman label, now is the

time to grab it before it disappears. This is timeless, joyous jazz performed by a group co-led by the fine guitarist Bucky Pizzarelli and the remarkable, now 71-year-old tenor saxist Bud Freeman. Mellow and relaxed are the words Dan Morgenstern uses to describe the session in his liner notes; I would call the overall feeling positively exhilarating.

Freeman, on *Way Down Yonder in New Orleans*, *Tea For Two*, *Easy to Love*, *Sweet Sue*, *Blues for Tenor*, *At Sundown*, *I Could Write a Book*, *You Took Advantage of Me*, *Dinah*, and *Just One of Those Things*, spins out light, billowing, melodic, and always swinging variations. His horn speaks forthrightly in concise, pithy phrases that directly touch on the chords; indeed, his solos are neat lessons in the classic jazz improvising style — they have a beginning, a middle, and a climactic end. Pianist Hank Jones is, as always, perfectly splendid as he picks up Freeman's statements extending and elaborating on them. His flawless solos are full of rippling, single note phrases that reflect his bop roots. Pizzarelli has some lovely choruses and offers Freeman fine support; his rich comping for Freeman's long solo lines create a subtle ebullience that colors each track. Bassist Bob Haggart and

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drummer Ronnie Traxler offer strong rhythmic support. Vividly recorded by RCA engineer Bob Simpson.

John Lissner

Sound: B Performance: A+

Tapesongs: Joan La Barbara
Chiaroscuro CR 196, stereo, \$7.98.

Joan La Barbara is a singer who is not afraid to sublimate her vocal talents to the creation of her art. **Tapesongs** places La Barbara in three settings which are differentiated by their use of magnetic tape. The record begins with a professional singer defending her virtuoso or "freak" talent by claiming that she can also "sing in the true sense." La Barbara renders this type of argument irrelevant by electronically manipulating a tape of the speaker and interpolating it with a multi-tracked vocal reading by herself. A slightly fluctuating carpet of held tones makes up a background for Joan's vocal sounds that include clucking, a bleating clarinet tone, and a muted trumpet with spittle in it. Throughout, chopped and phased phrases from the speaker whistle in, finally ending with "the freak element is all."

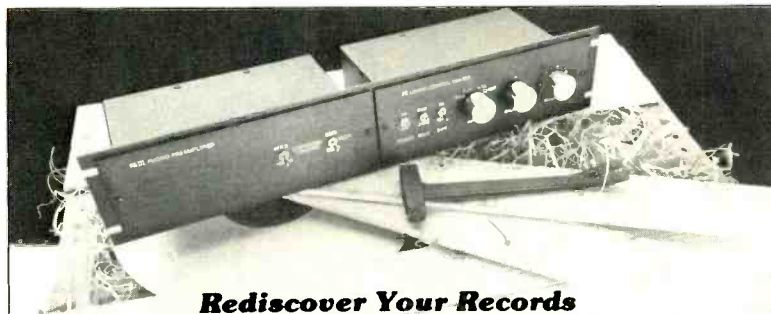
Solo for Voice 45 by John Cage employs the 16 tracks of a tape machine to devise a dynamic spatial effect. La Barbara's voice, singing syllables with French and English pronunciations, comes from points of the stereo spectrum. The final piece was actually written by La Barbara for percussionists Bruce Ditmas and Warren Smith. *Thunder* is designed to recreate the coming and going of a thunderstorm. The tympanis roll across, creating the thunder and rain, La Barbara's electronically altered voice is mixed in sounding like the scurrying insects of a Raid commercial. Its effect is to create an aural equivalent of the spatial displacement that's caused by flashes of lightning.

Tapesongs, like her previous work **Voice is the Original Instrument**, is frequently hard to grasp because there are few reference points. It's a music of sound and impressions that, despite their remoteness, are not without humor.

This record is an unusual direction for the Chiaroscuro label which usually puts out more traditional jazz records. The actual recording is fine but they will have to lessen the noise on their record surfaces if they continue with music which requires so much space and delicacy. John Diliberto

Sound: B Performance: B+

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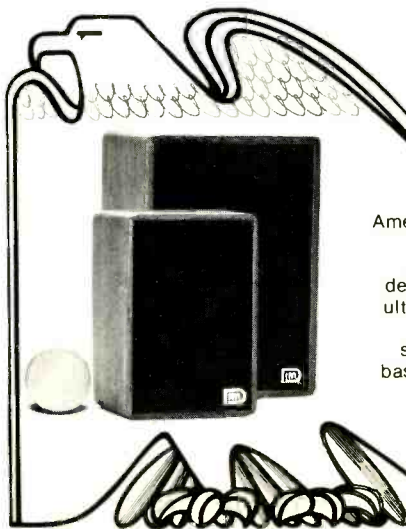
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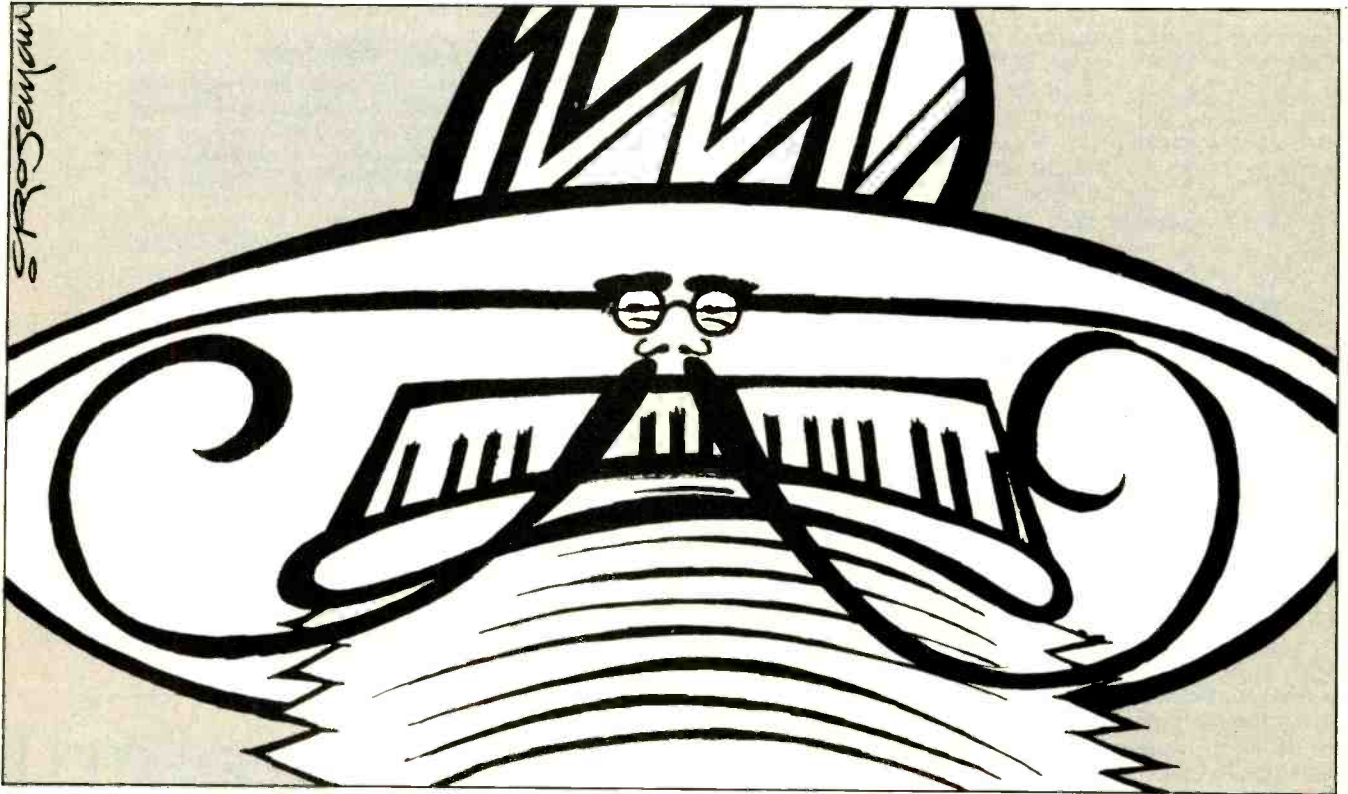
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These five new additions to Folklyric's extensive survey of early recordings of South Texas Chicano music continue to expand our knowledge of one of America's richest, yet least appreciated cultural traditions.

Volumes 6 through 9 constitute a four-record sub-series entitled **Cancioneros de Ayer** ("Songsters of the Past, 1920s/1930s"). The tradition of folk and lower-class popular music represented here closely parallels that of the *corridos* (narrative ballads) covered in Volumes 2 and 3 (Folklyric 9004, 9005). In fact, several of the same performers are present here, though most of the artists make their first LP appearances on these records.

Musically, the *canciones* (songs) follow many of the melodic and rhythmic conventions of the *corridos*, though the *canciones* are by and large much more tuneful. They are sung in typically dulcet two-part Mexican harmonies and accompanied by uncomplicated guitar and *bajo sexto* backdrops. In

contrast to the social-oriented *corridos*, though, the lyrical emphasis is more often on love — generally unhappy, sometimes tragic, yet almost always expressed in very sentimental, often highly poetic terms (translations are provided). A knowledge of the language would help, but the records can be enjoyed on musical and performance grounds alone. Try Volume 6 (9011) for starters.

Volume 10, **Narciso Martinez: His First Recordings, 1936-1937** (9017), is the first album in this series to be devoted to a single artist. No performer is more worthy of the honor than the acknowledged inventor of the Norteno accordion style.

Earlier Tex-Mex accordionists played in a manner derived from their German and Czech immigrant neighbors. Martinez developed the first truly Chicano style by dispensing with the dense, drawn-out bass chords of the European accordionists. The bass line's rhythmic/harmonic role was given over the Martinez' indispensable *bajo sexto* player, Santiago Almeida (his lone accompanist). This left Martinez free to concentrate on lively, light-

fingered melody lines with rapid, cleanly articulated ornamentation.

There's nothing the least bit stiff or metronomic about Martinez' pliable rhythmic sense (or Almeida's either), though his tempos generally seem rather fast for dancing. They certainly make for exciting, instantly appealing listening, though. The 17 all-instrumental tracks include nine polkas, three mazarukas, two redovas, a waltz, a schottische, and a Mexican *huapango*. There's not a forgettable tune or a sub-par performance in the bunch.

If you've managed to evade the lure of the Norteno accordion thus far, ask your dealer for Folklyric 9017 and be prepared for a foot-tapping great time.

Tom Bingham

Cancioneros Martinez Performance: B+ to A
Performance: A

I Love Fiddlin'!: Jana Greif
American Heritage AH-401-516, stereo, \$4.95.

Jana Greif is better known as Jana Jae, the TV show Hee Haw fiddler, whose three-day marriage to Buck

Owens resulted in country music's hottest public scandal of 1977. This album was recorded prior to her unfortunate rise to ill fame.

Jana's style is basically Northwestern, though she's also been influenced by Benny Thomasson's buoyant Texas blues-swing approach (as on *Brown Skilled Gal* and *Grey Eagle*), as well as Canadian fiddling (hear *Angus Campbell* and *Lime Rock*). I get the impression she was a bit nervous on her first trip to a recording studio, as her playing seems a bit stiff — though never ragged — on a few cuts (most obviously *Sally Johnson*).

She has a special talent for waltzes, which are by fan the album's highlight. Her bowing is superb — most likely benefitting from her classical training — and her timing is unequalled. What's more, her bittersweet double-stops can melt your heart. *Zenda Waltz* and *Blue Valley* are especially lovely in this regard.

Congenial accompaniment is provided by an acoustic string band which plays in an "updated old-time" vein that flirts with bluegrass on the more arranged cuts *Arkansas Traveler*, and *Black Mountain Rag*). Joe Hopper plays tasty flat-picked guitar licks, supported by Lee Brushett's relaxed rhythm guitar and inventive mandolin fills and breaks by Robert Snyder. Jim York pumps out a firm bass line underneath. The band adds an appealing lilt which helps lift such over-exposed standbys as *Billy In the Low Ground* and *Sally Goodin* out of the "Oh, no, not again" rut.

Jana's flashy workouts on *Black Mountain Rag* and *Devil's Dream* suggest her capabilities may be best suited to the kind of "commercial" fiddle record which was quite common some 15 to 20 years ago. I don't doubt that someday she'll cut an album which will instantly silence all detractors. Until then, **I Love Fiddlin'!** should make a lot of new friends for Jana Jae — and these days she could use a few more!

The band is mixed quietly on up-tempo cuts, but is overly prominent on the waltzes. The guitars have a nice, crisp tone, while the fiddle is convincingly full-bodied. Available from American Heritage Music Corporation, 1208 Everett, Caldwell, ID 83605.

Tom Bingham

Sound: B - Performance: B

Mick Moloney with Eugene O'Donnell
Green Linnet SIF 1010, stereo \$7.98.

Ireland has contributed dozens of first-rate artists to America's ever-expanding traditional-music revival, but few as unabashedly multi-talented as

Philadelphia's Mick Moloney. Moloney's *Green Linnet* debut is so filled with memorable instrumental performances, elegant singing, and superb material, it's almost too good to be true.

Of all of Moloney's talents, none is so astounding as his matchless tenor banjo picking. Moloney replaces the unyielding inflexibility associated with many Irish banjoists with a light, supple, rhythmic resiliency. His triplet ornamentations have a crisp, dancing snap that's truly unparalleled. His quick, agile touch on mandolin is equally unique and thoroughly engaging.

His guitar accompaniments are sensitive, carefully formulated, and beautifully executed. His break on *The Limerick Rake* is decorated with the same triplets which enliven his banjo and mandolin work. His use of the Greek bouzouki (an increasingly audible component of the Irish-music scene) adds novel and refreshing chordal textures. On *West Limerick Medley* and *John of Dreams* (a contemporary song based on Tchaikovsky's *Pathetique Symphony*), it has an effect not unlike strummed harpsichord strings. Moloney is also an excellent singer with a strong sense of lyrics, thoughtfully phrased, and neatly embellished.

Moloney's "co-star," fiddler Eugene O'Donnell, contributes much to the album's success. His slow air, *Killin's Fairy Hill*, is so impassionately wistful, it can't help but bring a tear to your eye. His sweetly mellow tone and smooth bowing on the dance tunes augurs well for his forthcoming *Green Linnet* album of set dances.

Joe McKenna (uilleann pipes, tin whistle), producer Patrick Sky (tin whistle), and Shelly Posen (guitar, concertina, harmony vocals) also add much to the album. McKenna in particular shines on an intricate pipe-banjo duet (*Sean Reid's Reel/Toss the Feathers*) with Moloney. The horn-pipe set opening side two is arguably the best of the expanded-ensemble tracks, an inspired combination of irrepressible melodies, springing rhythms, and striking tone colors.

This is the best-recorded *Green Linnet* album I've heard yet. There's quite a bit of overdubbing (generally considered a *no-no* by folk purists), but the parts have been mixed so skillfully and naturally you'd never know the difference. The surfaces could have been quieter, though.

Available from Innisfree, Inc., 70 Turner Hill Road, New Canaan, CT 06840.

Tom Bingham

Sound: B+ Performance: A

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Dear editor

Profile Plaudits

Dear Sir:

I have the feeling that a phono cartridge and tonearm have, at last, been fully, thoroughly, and thoughtfully reviewed. Ed Long's review of the ADC combination (January, 1979) strikes me as something of a milestone in the art of properly examining a transducer.

I might hasten to add that I've read *Audio* (or *Audio Engineering*) since 1949 and keep pace with most of its English language competition as well. I guess that in that 30 years I've either used or owned, perhaps, 30 phono cartridges, and tried about half as many tonearms. Never have I had the feeling that phono cartridge and tonearm design and installation were anything more than an art — too many parameters unspecified, therefore unknown. Never, that is, until now.

No small part of Long's success in this review is the listing of these parameters and of the test data for future comparative validity as test criteria are refined.

The "by guess and by golly" approach of the subjective set published in the "underground infrequents" has a validity, too, beyond being good for a laugh. But, for lasting value, Long's approach — as with many *Equipment Profiles* in *Audio* of late — wins, hands down. It's good to see such a review in an American publication.

Kent Waterman
General Manager
Sight & Sound of San Francisco
San Francisco, Cal.

Consumer Confusion

Dear Sir:

In reference to the statement on page 44 of your December, 1978, issue of *Audio*, let me assure you that *Consumer Reports* was never known by the name *Consumers' Research*. The magazine *Consumers' Research* was in existence several years before *Consumers Union*, which publishes *Consumer Reports*, was established.

Consumers' Research is strictly a non-profit, independent, non-political organization whose primary work is the testing by physical, chemical, and engineering methods hundreds of kinds of products sold to the ultimate consumer, and has not, at any time, been connected with or had any sort

of relationship with *Consumer Reports*.

It may be of interest to know that in 1938 (14 years before 1952) we published the first article on high fidelity amplifiers and have dealt with the subject in many subsequent issues up to the present time. As you can see, we were a very early entry into the field of high fidelity, well before any other consumer organization or popular magazines took an important interest in this subject.

F.J. Schlink
Consumers' Research Magazine
Washington, N.J.

Finest Fi

Dear Sir:

With Canadian mails being what they are, I finally received the October, 1978, Annual Equipment Directory issue a month-and-a-half late. The issue is another triumph for your editorial staff, and with this issue I can now complete the world's finest hi-fi system, bar none.

This issue brought me the Rabid Audiophile Notions Bazoom 2000 Mk 78 amplifier (pg. 73), and coupled to that is the Savage One preamp (pg. 62). I should mention that I have last year's Parapalegic 45 Equalizer inserted between the preamp and amp.

Feeding through this is the finest tuner on the market, the LIRPA I (April, 1977). And, of course, to play those fancy see-through colored vinyl discs, is the Lirpa "VDRS" (Vehicular Disc Reproduction System), diesel powered as it's cheaper in Canada (April, 1978).

To hear the results of the above via acoustical coupling I have a pair of O. Gadfly Hertz' Ultimate LSH Loudspeakers as introduced in the *JAES*, March, 1974. There were, in turn, updated as per I. Rogue Acoustin's article in the June, 1974, *JAES*.

While I feel that this is, undoubtedly, one of the finest systems of its type in the world, I may have missed a piece of equipment somewhere. If any of your readers know of a piece of similar equipment that could be used to update the above to digital standards, I wish they'd let us know.

David Lee
Don Mills, Ontario
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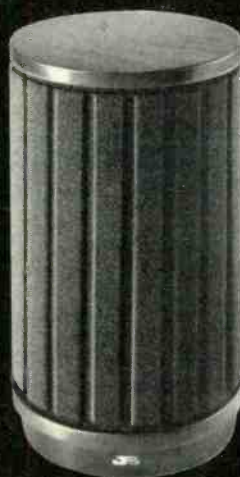
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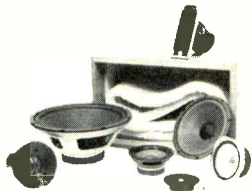
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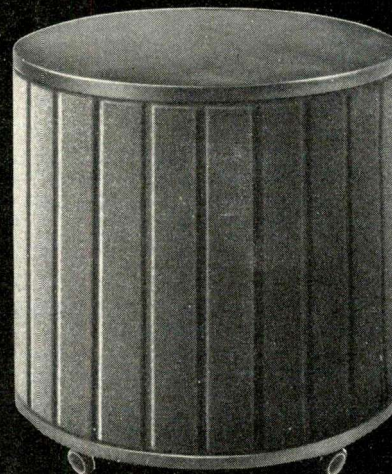
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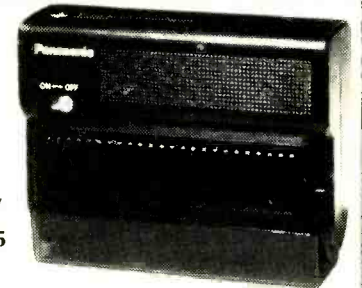
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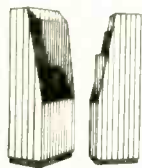
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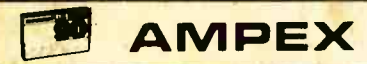
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