Audio

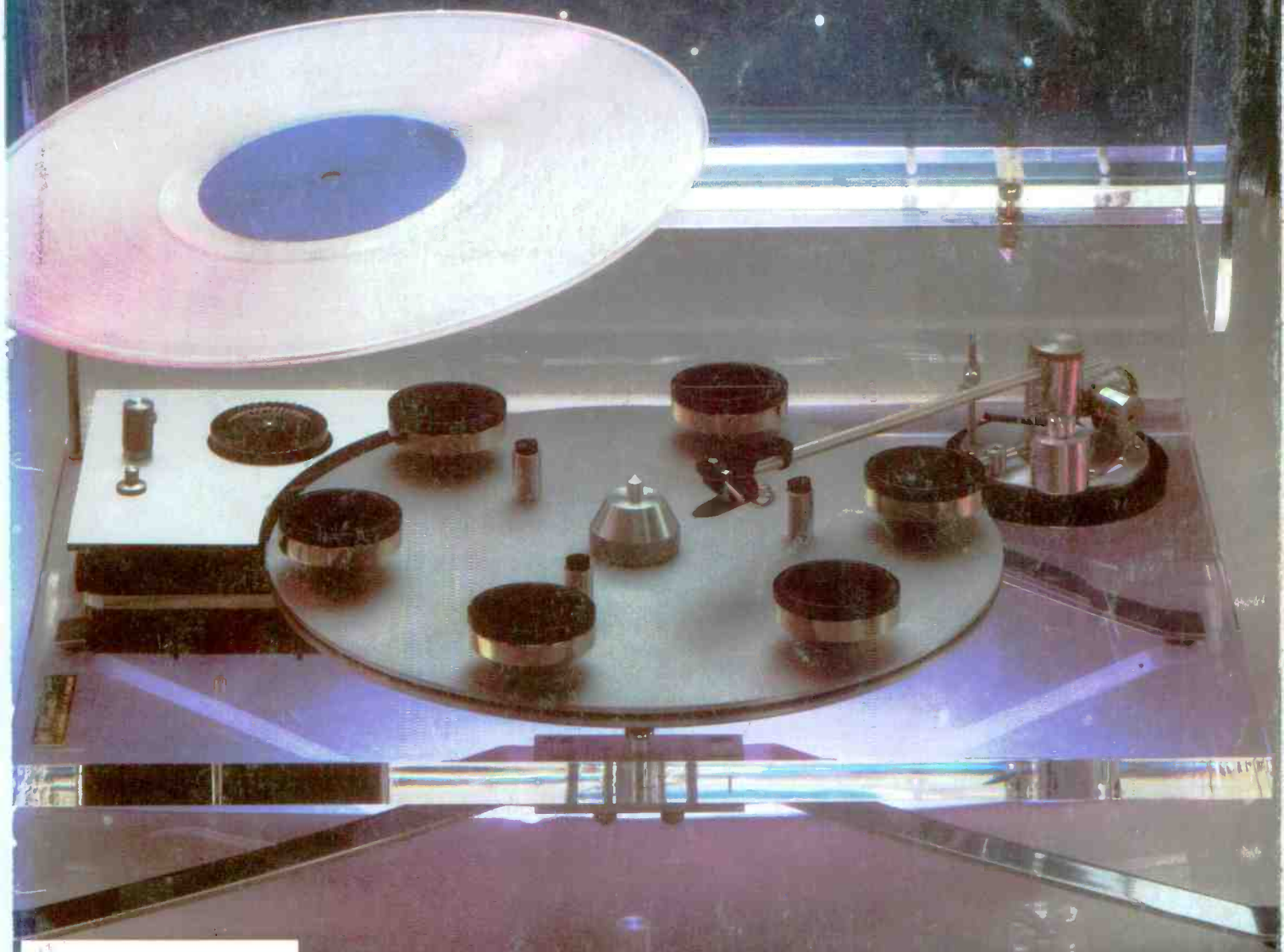
First Test Anywhere! NAD's Hot New Receiver

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • JUNE 1980 $1.25

(F)06030

PRAMANIK ON TONEARMS

MAKING RECORDS



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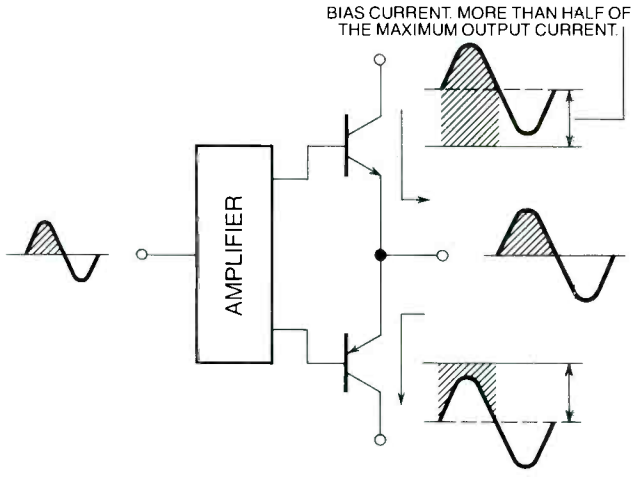
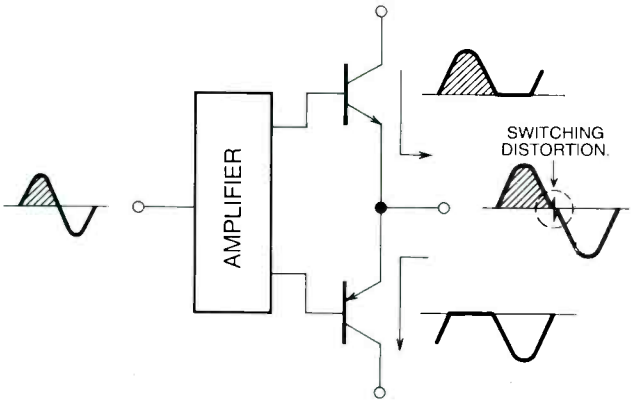
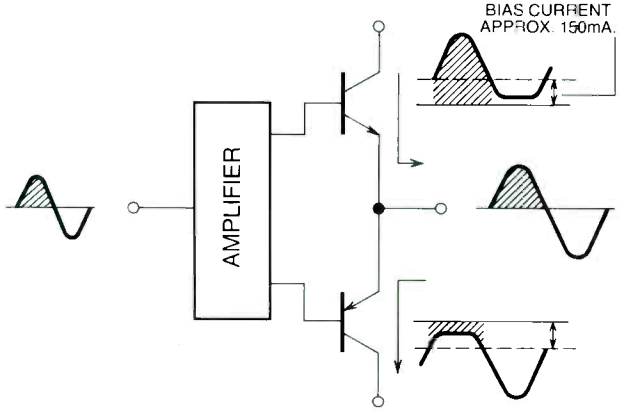


CLASS-A OPERATION. *Paired transistors are always turned on, amplifying its assigned waveform within the range above and below its quiescent operating point. Therefore, no switching distortion can occur. But that bias current is always at the center point and thermal loss is considerable.*



CLASS-B OPERATION. *Paired transistors alternately turn on and off, amplifying the positive half-cycles and negative half-cycles. This lets amplifiers run cooler with high efficiency. But, as the power transistors are driven below its idle current into cutoff, switching distortion (also called "notching distortion") occurs.*



"NON-SWITCHING" AMP OPERATION. *Paired transistors are always turned on: they do not switch on and off. Since the bias is controlled by our new Pioneer Non-Switching circuit to prevent either output transistor from being driven below its idle current into cutoff, no switching distortion is generated and the thermal loss is low.*

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levels.

"Indeed, our listeners did detect a subtle difference in the SA-9800, mainly in the ultra treble region. Brushed cymbals sound cleaner than we're accustomed to hearing them, and the highs a mite crisper than usual. You can, so to speak, reach down through the general cacophony of a loud passage and pick up the tinkly details that often remain submerged. Several words come to mind to describe the quality; scintillating, brilliant, transparent." – *High Fidelity Magazine, September, 1979.*

THE LESS DISTORTION, THE LESS NEED FOR FEEDBACK.

An important result of having such a clean, practically distortion-free amplifier, is a significant reduction in the need for negative feedback.

In most amplifiers, as feedback increases distortion decreases. And frequency response increases in proportion.

But when the basic amplifier suffers from the problem of switching distortion, even a feedback network that feeds back most of the signal can't significantly reduce it.

Pioneer, because of its Non-Switching design and Ring Emitter Transistors (RET's) has extended frequency response and totally eliminated switching distortion. Because of these characteristics, feedback is not needed to obtain impressive specifications. And neither are exotic slew rates and rise times. An unheard of .005% distortion is proof of that.

"...it is certainly a technical achievement of no mean proportions. From our measurements alone, we would have guessed that this was a pure Class A amplifier of exceptional quality, except for the fact that it runs cooler than most AB amplifiers of similar power." – *Stereo Review, October, 1979.*

THE TECHNOLOGY OF OUR FINEST AMPS IS ALSO FOUND IN OUR FINEST RECEIVERS.

Most audio buffs would think technology as advanced as Pioneer's Non-Switching circuitry, would only be found in Pioneer's latest amplifiers, but the truth is the same engineering can also be found in Pioneer's finest receivers.

Pioneer's SX-3800 and SX-3900 do not sacrifice true high fidelity for the sake of compactness in size or savings in price. In fact, the total harmonic distortion in the 60 watt/channel output of the SX-3800 is a mere 0.005% or less. The lowest of any receiver on today's market. And the price is a lot less than those receivers whose slew rates and rise times are almost ten times Pioneer's.

So, if you're looking for the best components you can buy, don't look for one that gives you "high speed."

Look for one that gives you high performance. Pioneer.

PIONEER®
We bring it back alive.

NEW ELECTRONIC DESIGN ANTIQUATES SO-CALLED "HIGH SPEED" TECHNOLOGY.

Since its inception in the 1960's, there's been a lot of debate as to whether "high speed" is just a lot of fast talk or whether quick rise times and high slew rates are effective in lowering distortion.

Now Pioneer's latest technology brings an end to the heated "high speed" debate. Because Pioneer's new Non-Switching Amplifier design has been recognized as a most significant technological advance. It produces distortion levels so vanishingly low (.005%), its sound purity and specifications are comparable to the very best most expensive power amplifiers.

In fact, further study of Pioneer's new Non-Switching technology will show why "high speed" has become obsolete.

NO MATTER HOW FAST YOUR AMP, IT'S STILL BEHIND THE TIMES.

The truth is, "high speed" is just a fancy name recently given to an electronic technology that dates back nearly two decades. The terms slew rate and rise time were around when most amps had vacuum tubes and transistors were rarities. In fact, the only thing new about the terms slew rate and rise time is their recent abuse.

THE HIGHER THE SPEED, THE BIGGER THE CON.

Kenwood, Sansui, and other manufacturers of high fidelity components boast that their units offer higher fidelity because they offer higher slew rates than the competition.

A slew rate of 200 volts per microsecond (v/μs) and a rise time of 0.85 μs. do indeed sound impressive. They are at least three, four and sometimes even up to 10 times faster than those found on most of today's equipment.

But the truth is you no more need rates like this to get superior high fidelity reproduction of music than you need to be an Olympic weightlifter to turn the page of this magazine.

HIGH SPEED GOES NOWHERE FAST.

To understand why "high speed" is really "all talk and no action," you must first understand what's meant by slew rate and rise time.

Slew rate is the maximum rate of change or slope of a signal measured in volts per microsecond. Like miles per hour, it's a rate of how fast something is traveling. And in this case that something is the musical signal.

All it takes is a simple calculation to show what slew rate would be necessary to handle the most extremely demanding musical signal.

Let's assume 20,000 hertz to be our musical analog with a peak value of 40 volts which will deliver 100 watts of power into 8 ohms.

The steepest part of the wave, where the slew rate is greatest, is at the zero crossing point. The slope at this point is the derivative of the sine wave with respect to time (dt):

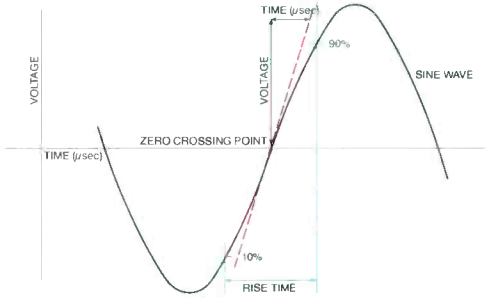
The waveform is $40\sin 2\pi ft$; and taking its derivative,

$$\frac{d(40\sin 2\pi ft)}{dt} = 2\pi f(40\cos 0)$$
$$= (2)(\pi)(20{,}000)(40)(1)$$
$$= 5.0 \times 10^6 \text{ volts/sec.}$$
$$= 5 \text{ volts}/\mu\text{sec (slew rate)}$$

So this extreme case signal only has a slew rate of 5. And if the power was increased to 400 watts, the slew rate would only double.

A slew rate of 200 volts per microsecond like Kenwood boasts, only adds one thing to your amp. A high price tag.

Rise time is the time it takes for a signal to go from 10% to 90% of its peak-to-peak value.



Another simple calculation will show the rise time necessary to handle a 20,000 Hz. sine wave.

The arcsin of -0.8 is the angle at which a sine wave is at 10% of its peak-to-peak value and +0.8 when it's at 90% of its peak-to-peak value.

$$\sin^{-1}(-0.8) = -53.13^\circ$$
$$\sin^{-1}(+0.8) = +53.13^\circ$$

So the time it takes to go from -53.13° (10%) to +53.13° (90%) is:

$$\frac{[53.13-(-53.13)]/360}{20{,}000} = 14.76 \text{ usec. rise time}$$

And the rise time needed to handle a 40,000 hertz signal is half of that; 7.38 μs.

So what's the necessity of a rise time 0.85 μs or faster? Well, some audio companies believe they need it to justify an inflated price tag. And some use it to keep your focus away from audible distortion they can't rid themselves of.

IF KENWOOD AMPS HAVE A LOT HIGHER SLEW RATE THAN PIONEERS', HOW COME THEY ALSO HAVE A LOT MORE DISTORTION?

Unless you own an eleven-year-old "tube job" it's almost certain the distortion you're hearing is not caused by insufficient slew rate and rise time.

In fact, this most significant form of audible distortion can, at the most, be reduced with "high speed" technology. But it takes Pioneer's new Non-Switching technology to totally eliminate it.

This form of distortion is known as "switching distortion."

And, most likely, the reason you haven't heard of it before is because most high fidelity companies are still grappling with it. Trying to rid themselves of the audible noise that occurs every time a musical signal is handed over from one transistor to another.

In more detail. Most power amps today use high-speed bipolar transistors in their output stage. Operating in pairs, one handles the positive part of the output waveform and the other the negative. The audio signal alternates between these transistors thousands of times a second. With each cycle, one transistor switches on and the other switches off. When the switch occurs so does distortion.

But unlike other forms of distortion that are more noticeable at very high power levels, switching distortion is also a problem at lower listening levels. And the lower the listening level the greater the amount of switching distortion you hear.

OTHERS REDUCE SWITCHING DISTORTION. PIONEER'S NON-SWITCHING TECHNOLOGY ELIMINATES IT.

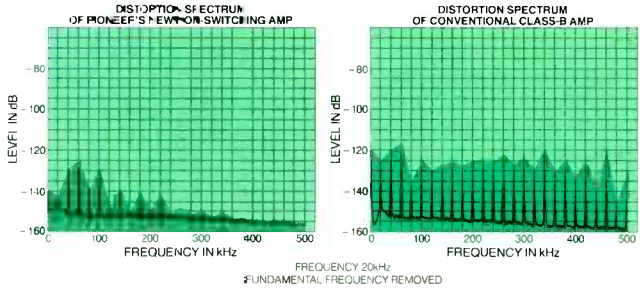
For years, people have clashed over which amplifiers to buy.

The output transistors in a Class A amplifier are passing high currents at all times, regardless of the signal driving them. True, since the transistors never switch on and off, there's never any switching distortion. But, due to the high idle currents, over 50% of the available power is dissipated as heat.

Because of this, Class A amplifiers need larger heat sinks, greater power supplies, greater size, weight, and most important, a greater price tag.

A pure Class B amplifier or an AB amplifier, like the "high speed" models touted by Kenwood, are more energy efficient than those in Class A. But instead of paying through the nose for a heat producing Class A, what you're really doing is paying through the ear for an amp that produces distortion. Because transistors on Class B amplifiers constantly switch on and off.

And no matter how high the speed of the amp, they can't lose the distortion that's created when these transistors begin to switch.



NOT CLASS A. NOT CLASS B. BUT IN A CLASS BY ITSELF.

Unlike Kenwood and other manufacturers of high fidelity who remained with the technology of the sixties to reduce the problem of switching distortion, Pioneer forged into the eighties with a new design that totally eliminates it.

So impressive is this technology that it was accepted for presentation at an Audio Engineering Society convention in New York City.

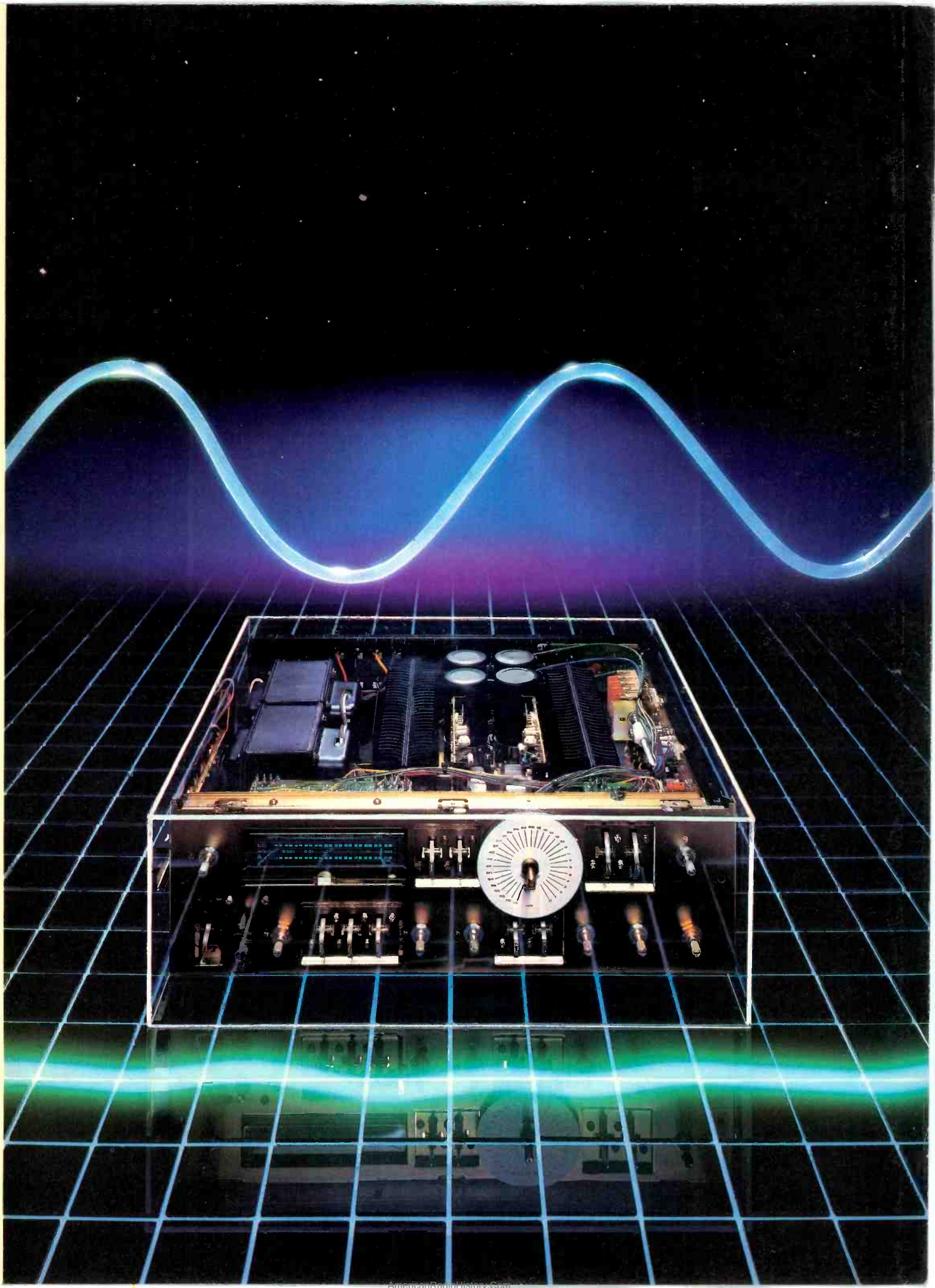
Pioneer's new Non-Switching Design performs like pure Class A without any of its drawbacks.

This new technology instantly monitors the amplitude of the signal, and like a servo, automatically controls the amount of bias current fed to the output transistors.

Unlike transistors in other amplifiers, these transistors receive a trickle of current during "no-signal" periods. Just enough to keep them from switching off. But not enough for them to waste energy creating added heat and expense.

The result of this technology is absolutely clean sound at all levels.

"The technological advantages of the NSA circuit are evidenced by the low distortion of the SA-9800. At 0 dBW (1 watt), no harmonics can be found in a spectral analysis of the output, and, at rated power, (20 dBW, or 100 watts), only the smallest vestiges of (mainly) third harmonic emerge above the noise. Up through 10 kHz, this amp also is essentially free of intermodulation at higher frequencies, especially at high output



June 1980 Vol. 64, No. 6

Audio

"Successor to RADIO*, Est. 1917"*

Feature Articles

Equipment Profiles

Record Reviews

Audio in General

About the Cover: Understanding phono systems of the future will require a thorough grounding in the basics of tonearms, as explained in S. K. Pramanik's article which begins on page 52. The turntable is J. A. Michell Engineering's Prisma model with Fluid Arm. Photo by Susanne Buckler.

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The Pickering XSV/4000 with low mass samarium cobalt magnet is the ideal choice for playback of today's most advanced direct-to-disc and digital recordings.

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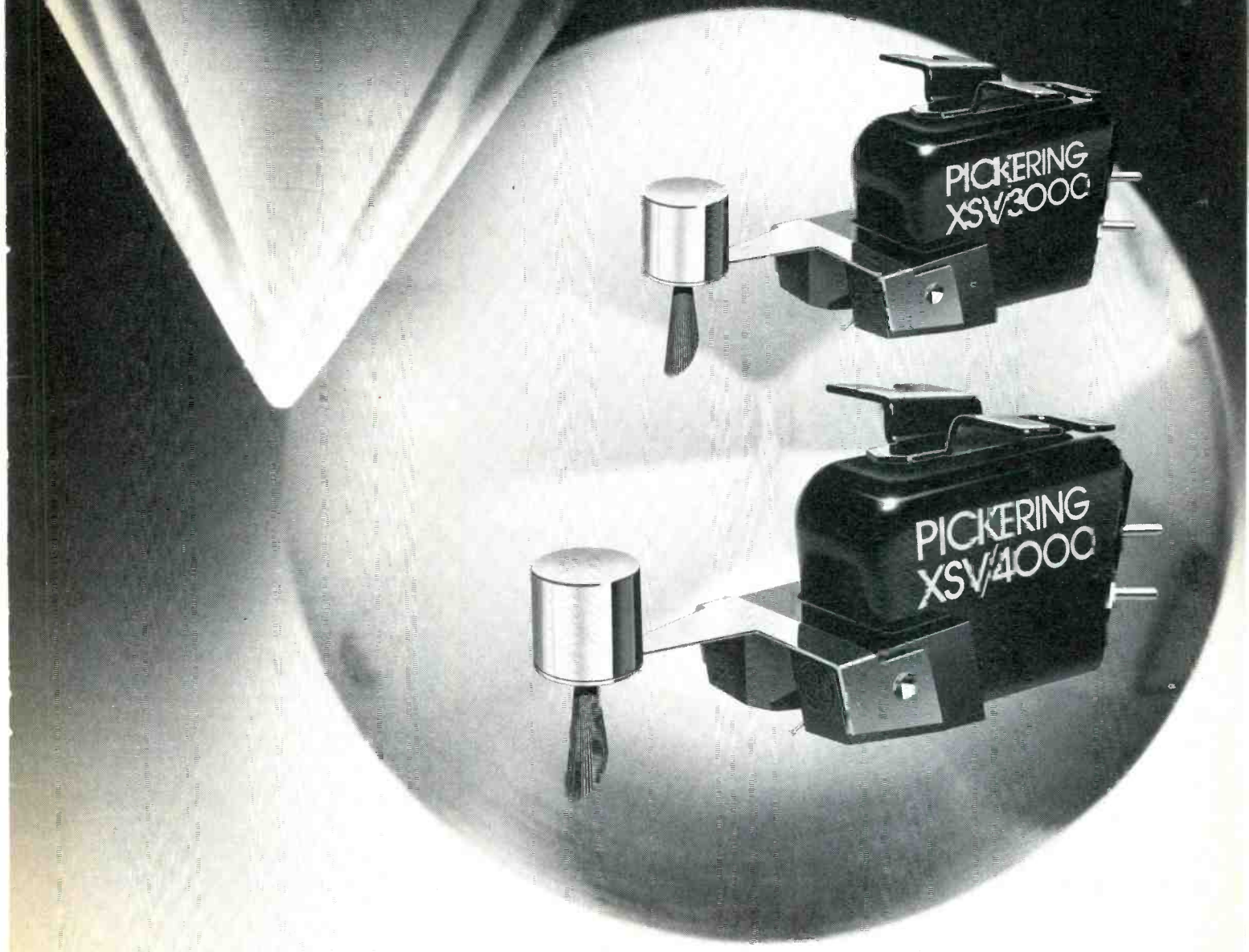

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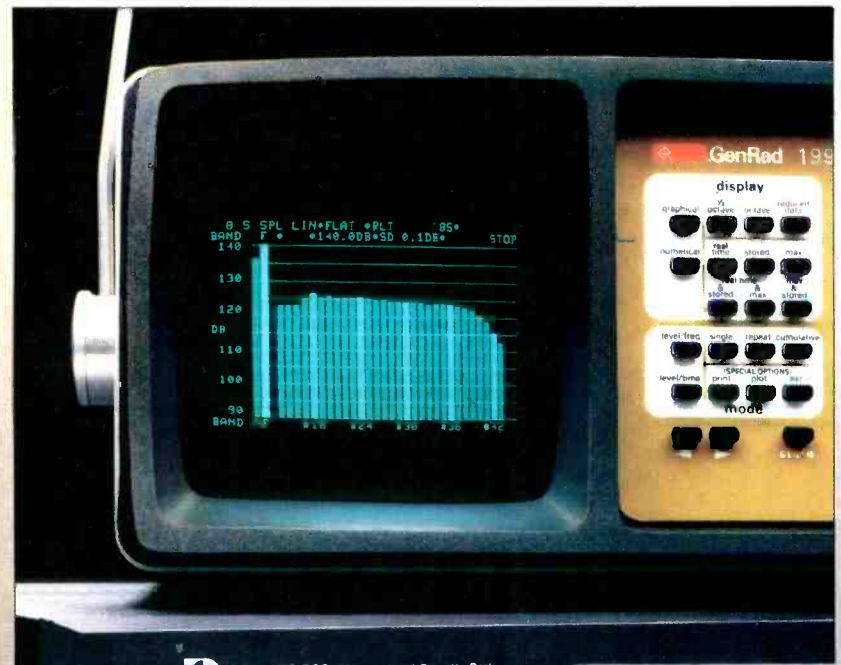
MEMOREX HIGH BIAS TEST NO. 5.

WHICH HIGH BIAS TAPE STANDS UP TO A GENRAD REAL-TIME ANALYZER?



The GenRad 1995 Integrating Real-Time Analyzer measured signals from a Nakamichi 582 cassette deck. Input signal source was "pink noise" at OdB (200 nanowebers—standard record level). If you'd like a copy of the test results, please send a self-addressed, stamped business-size envelope to the address below. Ask for the GenRad Test.

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The GenRad 1995 Real-Time Analyzer is among today's state-of-the-art devices for accurately measuring and displaying audio signals. That's why we used it to show that MEMOREX HIGH BIAS is today's state-of-the-art high bias cassette tape.

When tested at standard recording levels against other high bias tapes, none had a flatter frequency response than MEMOREX HIGH BIAS.

And, the signal/noise ratio of MEMOREX HIGH BIAS proved to be unsurpassed at the critical high end.

Proof you can't buy a high bias cassette that gives you truer reproduction. And isn't that what you buy a high bias tape for?

Is it live, or is it

MEMOREX®

For unbeatable performance in a normal bias tape, look for Memorex with MRX_3 Oxide, in the black package.

Memorex Audio Development Center, P.O. Box 988, Santa Clara, CA 95052, U.S.A.

Audioclinic

Joseph Giovanelli

Updating a Stereo Console

Q. I converted an old console in a few respects, hoping to improve it. Included in this conversion are a magnetic cartridge and a preamplifier.

The sound that resulted is extremely boomy! In the magnetic preamplifier I included an equalizer for the RIAA curve. Could the amplifier stages in the console be something other than "flat" for use with the original ceramic cartridge? Even with the bass turned down as far as possible, the rumble is bad. How can I solve this problem?—Nario Brenes, Brooklyn, N.Y.

A. There are a number of possibilities why the conversion of your stereo console was not successful. First, perhaps the new preamplifier is not correctly equalized; this unit might be bass heavy. To check this out, obtain an RIAA test disc and make a frequency run on the preamplifier, measuring at the output of the device. Check both channels.

It is possible that the tonearm is contributing to the boomy sound because of resonance problems. I suggest that you try this cartridge/preamplifier combination with a tonearm known to be relatively free from audible resonances. You will then know if the arm or something else is at fault.

It may be that the original ceramic cartridge was bass shy, which was compensated for in the original design of the console. It may also be that the designer figured that the user would want a "boomy" sound. To check these out, sweep the console with an audio oscillator. To do this, first disconnect the preamp. Connect the output of the oscillator to the point which was fed by the ceramic cartridge or by the new preamplifier.

If you do find that the amplifier is not flat, you will have to trace out the circuit to see if you can determine where and how the bass is boosted. The circuits responsible for this will have to be either removed or modified so that the amplifier has flat response as measured at its speaker terminals. Of course, a resistor load must be substituted for the speaker when making such measurements.

You indicated that you hear rumble all the time. Perhaps the turntable is not a good one, in which case you will not cure the rumble even when producing a more reasonable frequency response than may now exist. It may even be that you are hearing hum. Changers used with ceramic pickups do not necessarily employ well-shielded motors; they are unnecessary for ceramic cartridges. Therefore, there could be excessive hum fields being induced into the magnetic cartridge.

The simplest cure for this is likely to be the use of a turntable designed with magnetic cartridges in mind.

Discs and Films Still With Us

Q. With today's technology it seems that both phonograph records and motion picture films should have died away. They have not. Why?—Name withheld.

A. As for motion picture films, they are with us because of their comparative ease of editing, as opposed to the new and complex problems related to the editing of video tape. Further, movie theater owners are reluctant to replace existing, functional, optical equipment. Doing so would require a tremendous investment and also the training of projectionists to work with a completely different technology.

Disc recordings remain with us for a number of reasons. First of all, the disc-manufacturing process is such that discs can be made more quickly and more cheaply than can tape formats. High-quality, open-reel tapes have been produced, but the public never accepted this medium to any very great degree; it was, therefore, largely withdrawn from the market. It appears that the cassette format is gaining good public acceptance, but it will still be some time before the best mass-produced cassettes can sound as good as or better than the best mass-produced disc recordings.

Remember, too, that if you are looking for a particular selection on disc, you simply examine the disc, count the bands, and then set the stylus down on the proper one. There are now automatic scanning mechanisms for doing this, making the process even more efficient. While it is true that there are some means now available for locating a particular selection on a tape, these systems are still not as quick and efficient as finding one's place on a phonograph record.

Power Amplifier "Burn-Out"

Q. Having worked in a factory service department of an established high-fidelity equipment manufacturer, I am amazed how some solid-state power amplifiers are "blown up." The driver and output transistors are internally shorted. Many power amps seem to "blow up" or "fry" because of an accidental dropping of the tonearm onto a record, and yet these same types of amplifiers, however, are used by rock bands for sound reinforcement. In such an application extreme transients occur, often driving these amplifiers into clipping, yet they do not fail.

What is it about a dropped tonearm that causes these amplifiers to "go?" What are some other causes that can do this to amplifiers?—Robert C. Doak, Glassboro, N.J.

A. The dropping of a tonearm onto a disc results in a tremendous pulse of low-frequency signal. This is not simply a transient pulse; it is virtually d.c. and is present for a comparatively long time at the point of driving the amplifier into clipping. This is a far more serious problem than what would happen in a rock performance. There, the amplifier may run at a higher power level, but the nature of the program is such that the duty cycle is not as great as it would be in the case of the cartridge being dropped onto a record. Much of this and similar problems would be eliminated if a subsonic filter were used.

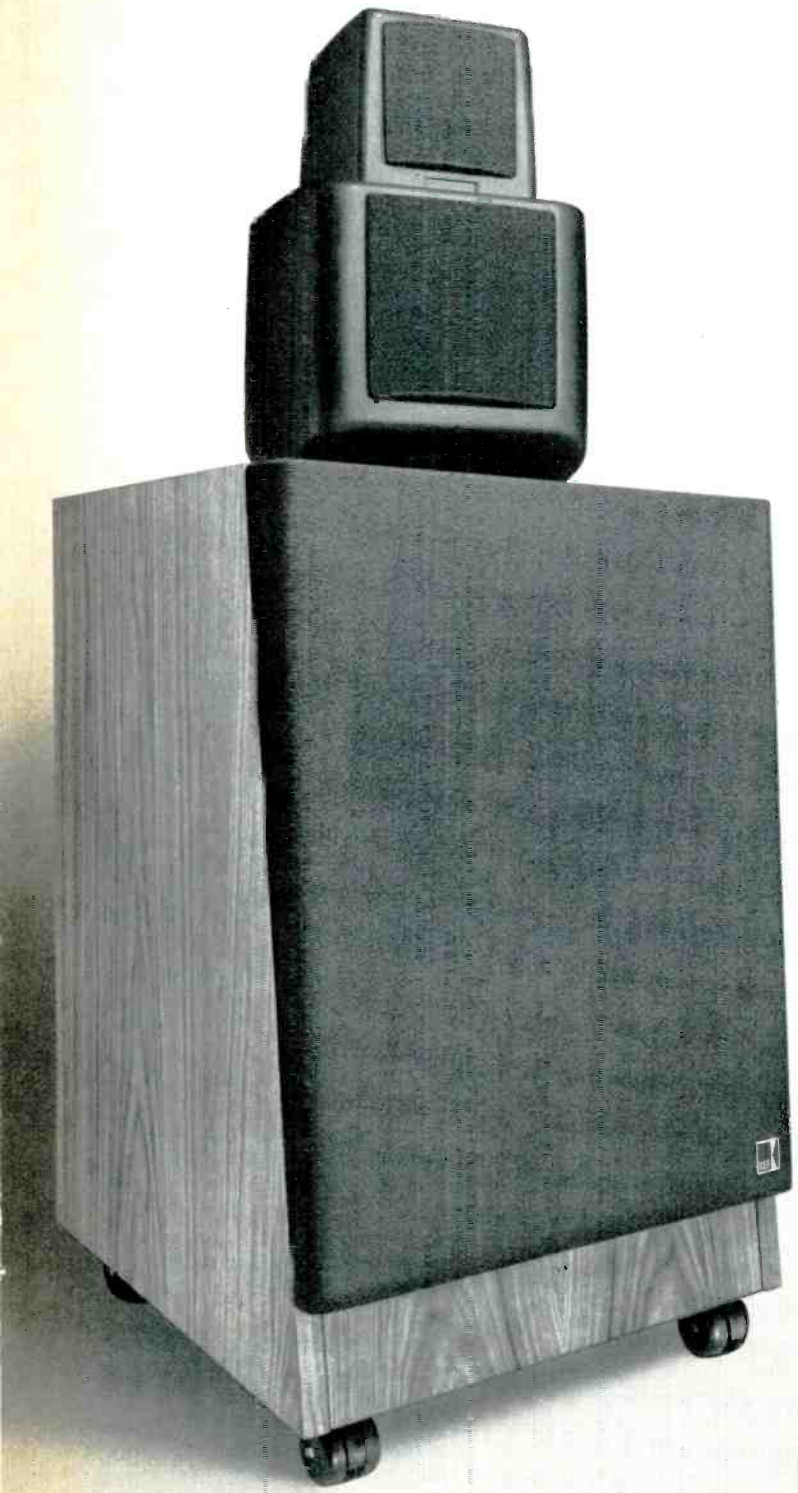
Any other cause of this kind of amplifier failure would have a similar nature, capable of producing virtual d.c. at high levels for a few microseconds. Rapidly tuning an FM receiver could produce a similar situation, especially if the tuner has a really large output coupling capacitor.

Added to this might be a case where an amplifier does have a few coupling capacitors in association with resistors which could produce large time constants. A very high pulse of signal could cause such a network to take a charge. This charge would have to bleed off slowly, keeping the amplifier biased into very heavy conduction.

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

KEF Reference Model 105 Series II:

Unique Protection, Extraordinary Performance



The KEF Model 105 is now acclaimed as of one of the most respected and reliable speaker systems. Since its introduction in 1977, the Model 105 has been adopted by audio testing laboratories and speaker manufacturers as a reference for evaluating other loudspeakers and audio products.

KEF now introduces the Model 105 Series II, embodying several significant technical features and improvements never before available.

Acknowledged Technical Capability

KEF was the first company to develop computer-aided digital analysis for loudspeaker research and evaluation.

The impulse measuring method which the company pioneered in the early 1970's is far more accurate and comprehensive than conventional analog techniques, and has been widely adopted throughout the audio industry.

The benefits of digital techniques are not confined just to research & design alone. KEF's leadership position in this field has enabled the company to employ similar methods to production processes, revolutionizing the standards of quality and consistency that can be achieved in production quantities.

Every vital characteristic is monitored by computer during the entire manufacturing and assembly process. Drive units and filter networks are measured individually. Performance data is recorded digitally and used to group carefully matched sets of components prior to assembly.

Completed speakers also undergo rigorous measurement. Paired Model 105's differ in frequency response by less than 0.5dB, and vary from the original prototype by only 1dB over the entire frequency range.

Thus, for the very first time, it can be claimed that the standard of performance achieved in the original prototype is assured for each and every purchaser.

Electronic Protection Circuit

The Model 105 Series II is fully protected against accidental overload by a self-powered electronic device called S-STOP (Steady State and Transient Overload Protection). This KEF development provides comprehensive protection against excessive voltage, thermal overload, and low frequency excursion:

PEAK: The peak protection mode causes the S-STOP circuit to operate whenever peak voltages to the system are so high as to be damaging to the dividing network, or likely to cause unacceptable distortion levels on program peaks.

THERMAL: The input level to each drive unit voice coil is continuously monitored, and whenever a safe operating temperature is exceeded, S-STOP is activated.

LOW FREQUENCY EXCURSION: The excursion of the low frequency unit is also monitored, and S-STOP is again activated whenever the input level on program peaks is sufficient to cause the maximum linear excursion of the bass unit to be exceeded.

The original Model 105 has become an industry reference point. KEF's continuous research & development has now produced the Model 105 Series II—a home speaker system that promises to be even more remarkable.

We would recommend that you visit your authorized KEF dealer for a thorough demonstration of the Model 105 Series II. The speaker system is available with an optional full grille (not shown) and in various wood finishes. For the name of the dealer nearest you, write: KEF Electronics, Ltd., c/o Intratec, P.O. Box 17414, Dulles International Airport, Washington, D.C. 20041. Available in Canada.

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Audio etc.

Edward Tatnall Canby

I have to describe to you a new kind of recording experience I had recently. No — not the latest in digital, nor a Canby experiment. To my own great interest, this was on the largest possible scale, as big as anything in all audio. *Television!* Big-time network TV. And by a sheer happenstance, there I was, right in the middle of it.

What really knocked me for a loop, and is the reason for this writing, was the unexpected comparison between our own pure-audio recording session and this, my first experience with the parallel world of TV, sharing so many techniques with our own. It was most instructive and, from an audio viewpoint, heartening. We're doin' OK, we audio people! Just let's not let big TV swallow us.

I do have an *alter ego*, as some know, conductor of a small choral outfit called the Canby Singers. We sing Renaissance music, unaccompanied, Brahms and Mendelssohn the same; we sing in four parts, five, six, up to eight, and we give concerts. Tough music and no piano to help us. Kind and appreciative audiences of a hundred or so, with luck. No audio. If they can't hear us, we don't sing. Only one professional audio man that I know of goes to all our concerts. He's a top pro in architectural sound reinforcement and lives his life with mikes and loudspeakers. Except when he comes to listen to us. Good for him! Good for any audio man's soul.

Suddenly, early last winter, we found ourselves scheduled to appear "live" (on tape) on a network TV show, one of those daily programs, the biggest. It was for Christmas day — hence the singing — and we would be heard and seen via hundreds of television outlets at an ungodly hour on the holiday morning — hence the taping. Same hour, of course, in each time zone, from New York to Hawaii. I will not name the show since everybody who looks at TV knows it. It is so big that it is incorporated and ends its name with "Inc." The male host, or anchor, or whatever you call him, reputedly achieves some 500 kilobucks per year and his humble female helpmate on the show makes 300. (Scuttlebutt.) Both of these worthies assisted us in person, reading genial scripts in large letters off the backs of the TV cameras — big-time, yes.

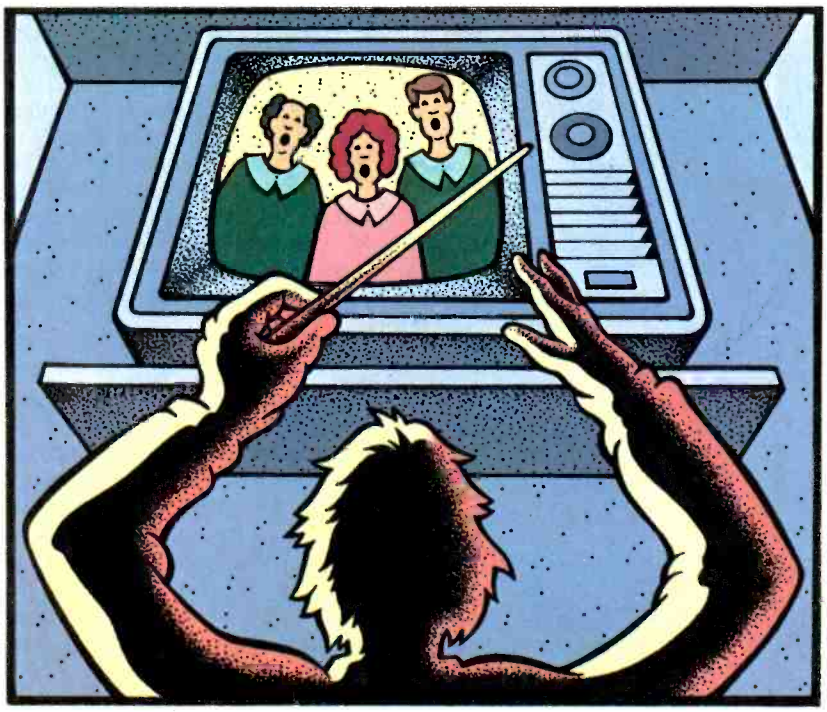


Illustration: Leo Pando

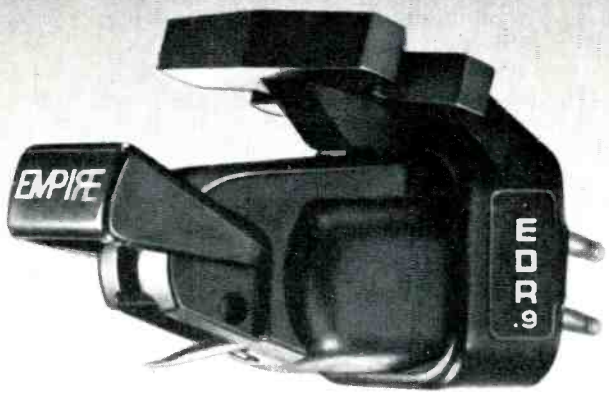
I am no TV man but I have long been in and around what I now must call pure-audio recording and broadcasting, on my own, inside big studios and little, in concert halls, control rooms and all the rest — it's my biz. I don't operate a "board" but I've looked at a hundred thousand of them and am nicely acquainted (though not as well as Bert Whyte) with most of the vast array of procedures we have developed over the years for getting out our audio software, on the air or recorded. I went into this TV show as a conductor of music, but you may be sure that I had eyes and, especially, ears to see and hear how a TV recording session worked, as compared with the same in audio, which is sound for sound's sake. After all, we too have producers and engineers, we have talk backs and red lights going on (ON THE AIR, or RECORDING), people who rush about moving equipment and saying TESTING TESTING; we have control rooms with glass panels, we have monitors, we have banks of big tape recorders, the works. Pictures aside, the situation in TV is not that different — at least in theory.

There is one real difference. We got there first. We in audio developed all this production business, in radio, in recording, in "public address," in taping, before TV ever got there. So they obviously have borrowed OUR techniques. And one would expect, considering TV's size and opulence, it would improve them too, adapting our experience to fit the newer needs of the video art. So I looked forward to this big show with a lot of eagerness. It should really be something.

No Business Like . . .

Now understand. This daily program runs for two solid hours, divided into four half-hour segments, with commercials (natch) in between. Each segment is treated as a unit and on normal days is mostly done live, in real time (on tape), with prerecorded segments or remotes dropped in, including the news. There's an assortment of artists or groups for entertainment, each taking only a few minutes but reappearing several times on the different segments. We were to be on three of the four segments, including the first and the last.

As any recording person knows, a session like this must be very skillfully managed if there is to be other than sheer chaos, plus enormous amounts of valuable lost time. It's not so different, say, than recording the Boston



INTRODUCING THE EMPIRE EDR.9 PHONO CARTRIDGE. IT SOUNDS AS GOOD ON A RECORD AS IT DOES ON PAPER.

It was inevitable . . .

With all the rapid developments being made in today's high fidelity technology, the tremendous advance in audible performance in Empire's new EDR.9 phono cartridge was bound to happen. And bound to come from Empire, as we have been designing and manufacturing the finest phono cartridges for over 18 years.

Until now, all phono cartridges were designed in the lab to achieve certain engineering characteristics and requirements. These lab characteristics and requirements took priority over actual listening tests because it was considered more important that the cartridges "measure right" or "test right"—so almost everyone was satisfied.

Empire's EDR.9 (for Extended Dynamic Response) has broken with this tradition, and is the first phono cartridge that not only meets the highest technological and design specifications—but also our 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 advance, 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.

Empire Scientific Corp.
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EMPIRE

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Symphony, or an opera, or some pop extravaganza. There are always those armies of people, artists, equipment, engineers, producers, all to be marshalled into some sort of productive order. In my own small way I have had to do the sort of careful planning that this requires — it is the same even on a small scale. Disaster is always around the corner, crises abound, and time flies at $$$$ per second. Be prepared! Be efficient! Use time for all it's worth, which is plenty. Amen.

OK — I arrive at the big New York TV center at 8:45 in the morning of taping day (some days before Christmas itself) and check in at Reception. Or try to. In three seconds I am jammed into a sort of dentist's waiting room, six or eight chairs and a tiny coat rack, along with about two dozen other artists, mostly standing and holding their coats. The official waiting room! Huge TV monitor and the end of the current day's show, a remote sports commentator from Hawaii whose face is a bilious greenish yellow. Phase problems? Can't understand a word he says. They return to the home studio, right around the corner from us, and the color is OK. Good — I didn't really want my singers a bilious yellow, thanks.

Coffee. The place gets more and more crowded. Finally we are siphoned off into a set of dressing rooms, one for each "act," next to the big main studio where it all happens. Another monitor and lots of mirrors. Outside our door the studio is only a few feet away down the corridor and I note with amazement that there is *no door*. Wide open, and people moving in and out while the action is rehearsed inside. They continued even when the show was being taped. So much clutter and so much soundproofing in that huge studio that nothing audible carried more than a few yards. All the sets were already in place, one for each act, around the edges, with all the cameras in the middle and a million vast lights hanging from a steel latticework above, and vast dark spaces on beyond to an invisible ceiling.

At this point I discovered that this entire show, too, was to be taped *in real time*, half hour by half hour, without breaks. Everybody had to be in place, in the studio, at the beginning — we would each perform in our turn, each from our own set, the cameras swinging around to find us. No walking on and walking off; we were *there*. We had all of four or five minutes in each segment and would have to wait around and be "on stage" for the entire two hours. Worse, our first appearance, I discovered, was after *26 minutes* of real time — we were to stand on our set, motionless, with all the lights on and in our faces, for those entire 26 minutes — then we were supposed to start joyfully singing! Enough to kill a chorus of horses. Was *this* the best way they could figure to do it? I was appalled — such a clumsy, impossible means to achieve "real time." And WHY? Just the usual, I guessed.

Worse still. Remember, we sing unaccompanied. We do not have absolute pitch. Most musicians don't. All we use is a tiny pitch pipe, one peep at the beginning. Our audiences are impressed by our ability, from this one little peep, to sing complex pieces of music and go on for 10 minutes or so, ending exactly where we began via sheer pitch memory. So —

Hey, I said to a roving producer, catching him on the fly, when do I get to blow my pitch pipe (after 26 minutes of standing there, listening to all the other musical acts)? PITCH PIPE?? Consternation. They hadn't thought of that. Couldn't we, er, well, just start? Just begin singing? Oh yeah, only minutes after a wah-wah jazz trombone in some unknown key, over across the studio! No pitch pipe, he said. BUT — **!!, I fumed.

At that point I was screaming, internally, *For — sake, do a simple edit!* Let me blow pitch, a quarter of a second, then edit it out afterwards. So simple! (So simple in audio, anyhow.) No need to stop the show. But suddenly my producer was swept away in the crowd and I got no further. There was time. No rush. I'd figure something — later.

Plenty later. By now the place was swarming with hundreds of people. The artists and all their friends and relatives, vast numbers of producer-like characters, scratch pads in hand, dozens of technicians, prop men, ladder carriers, the coffee lady, the make-up head, millions more coming in every minute. Never saw such a mob, like Macy's. All over the studio, in and around the separate sets, jumbled props and equipment lying all over, lights being lowered, huge elephant cameras tooling around on dollies, eight feet high and almost as wide. The two hosts trailed fat cables for their lavalier mikes (they walk from set to set on the show) and kept backtracking to unsnarl themselves.

Nine o'clock, the starting hour, and soon the monitor shows us one act being pushed around into place, then the host, mumbling script, trips over a cable and runs head-on into a crouching technician, nobody paying him the

Morning Concert

You've driven to the end of the world. Alone.

The engine is still warm.

Amid the roar of the waves and the cries of the gulls, you fire up your mobile high-fidelity system for a morning concert.

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least attention. Everybody frowning, no smiles — until the act starts. We waited, and watched. Then we were made up, one by one, just a dash of powder, mostly, to take off the shine. Glasses! Sudden crisis — would they ask us to remove them? We all needed glasses to read our music, including me. No sweat. These people have their video techniques beautifully in hand. We kept our glasses, and on the show not a glint of reflection ever appeared in spite of dozens of huge lights all over the place.

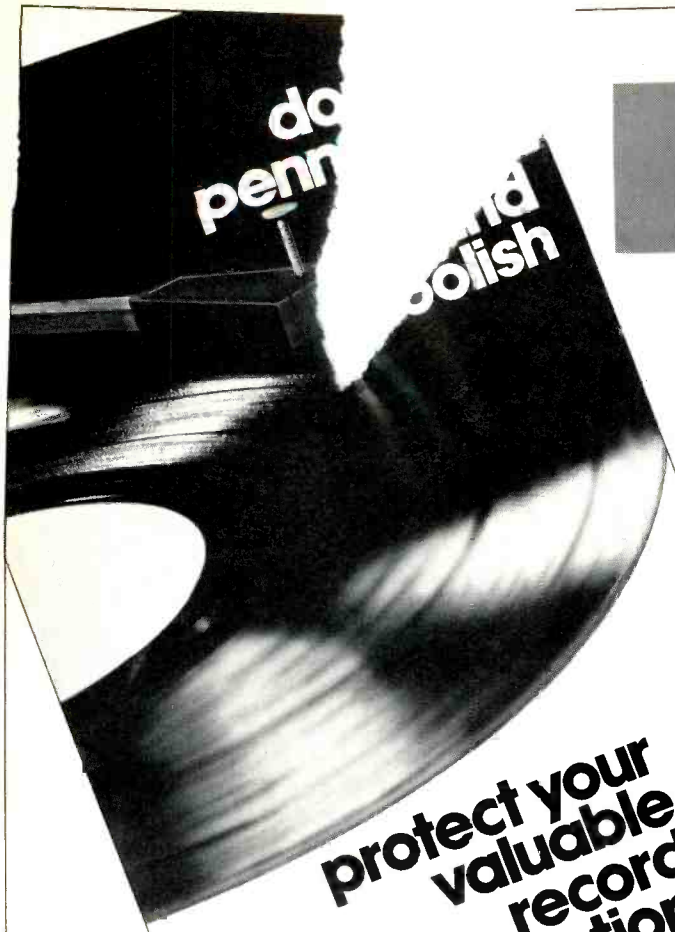
Across the corridor from us was the immense video control room, a dozen or so intent operators each with a console and picture in front of him, a vast main board or something up front (we couldn't see it). Huge operation. Over to one side was a small cubicle with glass front, in it a man and a half-size audio mixing board, sort of rebuilt looking. They probably try to keep it up to date. The audio control room! One channel of sound, out of all that confusion. Mono. One technician. Why more? (Maybe if they had stereo they would use two.) That's TV audio. It knows its place, all right.

Waiting for the Go

We sat and we sat, amid the increasing confusion. More and more people kept arriving, more and more hectic conferences were going on, here and there, the various acts were all rehearsing, mostly simultaneously, people dashed from control room to studio and to dressing room with messages; the tempo was getting faster. We were ushered out, 'mid all the din, for an audio test — thank the Lord, the single omni mike was placed right over my head, a good distance from the singers; we would at least have a proper mono blend and no close-up mikes. But the sound would be totally dead. Too bad, since the music was meant for liveness, even a cathedral sound. But a good blend, anyhow.

We were tried for video — lovely. Gorgeous color, nice pink faces against a big fake blue-sky background and green and red Christmas wreaths. Nothing wrong there. Back to the dressing room. More and more excitement. Nothing new. At around 10:00 they said the first real-time segment might be taped at 11:00.

At 11 o'clock — nothing. Somebody said we might start at noon. More milling about, more rehearsals, more conferences. Around noon, our producer took me into a corner and we revised the order in which our music would come. Now — at this late moment! I had been in touch for weeks, of course, and had sent timings, and so on. A better musical sequence, now



fact: a Shure stylus is a sound investment

A new stylus (needle) can actually save you money. Even a precision crafted diamond stylus eventually wears out, and a worn or broken stylus tip can damage your records in a single play! Protect your records by checking your stylus at least once a year. Your Shure dealer can inspect it, and if necessary, replace your stylus with a Genuine Shure replacement stylus that will bring your cartridge right back to its original specifications.

FREE! Shure Music-Lovers Stylus Guide

Cartridges don't wear out: styli do! This and many other helpful facts are discussed in a new pamphlet recently prepared by Shure. It includes everything you need to know to keep your Shure cartridge in perfect operating order. It even contains details on how you can improve the performance of some Shure cartridges *beyond* their original specifications. To get your copy, stop in at your Shure dealer, or write to Shure at the address listed below and ask for AL633.

GENUINE SHURE

Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204

In Canada: A. C. Simmonds & Sons Limited Outside the U.S. or Canada, write to Shure Brothers Inc., Attn: Dept. J6 for information on your local Shure distributor.

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

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that I saw what was involved. But could this enormous show be improvised in this casual fashion? Indeed it could, and I wasn't complaining.

We took to watching the monitor again, which was hooked into the studio line and showed us whatever was heading towards the still-inoperative tape machines. Really beautiful handling of colors and shapes and designs. A bevy of long-gowned maidens, a string quartet in delicate pastels, their instruments a rich deep brown, their hair beautifully auburn, blonde, black. On the 19-inch tube it was really fascinating — this was TV at its best,

so sure and *right*, out of all th
a few feet from us. But the aud
ensemble with piano, cymbals,
I saw the cymbals playing but
not hear them. No highs. I saw
drums and heard a faint crunch.
lows. It all came out of a monster
three-inch speaker, somewhere in that
big TV monitor.

By one o'clock we were steeped in despair. Nothing had changed. We had seen everything; all the acts had rehearsed and got themselves ready. Still, the vast coming and going went on and on. Four hours of it already and we had not so much as started. And,

we would have to stand
utes before we could even
a note — and this only the
t. I began to think it would
ght then, I decided I would
st blow my pitch pipe be-
could stop me, in the si-
before we began to sing.
perfectly well edit it out
ole shebang ground to a
more fool them. I had to
g! Time was crawling.

Did ay improvise? *After four hours,* the session's entire game plan was suddenly junked. Brilliant thought: Instead of the customary real-time operation, which didn't seem to be working very well for *this* session (!), we would now do the entire recording *via tape editing.* That is, they would record everything on the program in bits and pieces, each act doing its complete offerings all at once, and the program would be spliced together later on. Thus we would not have to wait a dozen or so hours more to tape our real-time segments one at a time.

Brilliant innovation, huh?

If you ask me, any reputable audio producer would have thought of that one in approximately nine seconds from the word go. What have we been learning, all these years?

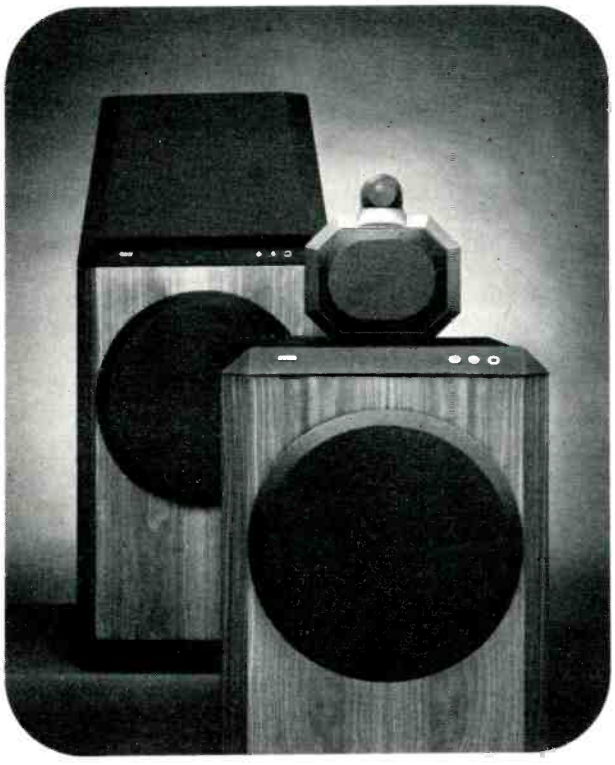
In no time at all (that is, only an hour or so more), we were through our work and out of that place. We went and did our stunt, all the music for all three segments, one piece right after the other, in ONE take, no more, and that was that. It took less than 15 minutes and we got applause from the other acts, around the room on their various sets, when we finished.

I still am dumbfounded. (Or is it dumfounded?) Did they really think they could pull off four separate real-time recordings, no breaks, in this extraordinary fashion? Well, after four hours, they certainly were not going to. Couldn't they have guessed? Where ARE these TV people? Somewhere back in prehistory? I don't think they even KNOW what we audio workers have been doing for so long and with such a wealth of invention.

Maybe in another installment I'll tell you how it all came out when we finally got going the right and proper way, via tape edit. Especially the audio. I saw the show on Christmas morning, and heard it. Not bad sound — for a so-so one-channel signal, forced through some sort of drastic compression, sent out to a pipsqueak FM tuner in a home TV and spewed forth through a micropower amp into a miniwoofer. That's TV audio. But the *color* — the color was gorgeous. Just gorgeous.

Not the sound color, the picture.

INTRODUCING THE B&W 801. THE END OF THE BEGINNING.



Speaker design, as any engineer will tell you, traditionally involves compromises and trade-offs. Visions of perfection sacrificed to practical considerations.

But does it have to be this way?

B&W doesn't think so and they've designed the loudspeaker to prove it, the B&W 801.

No more compromises.

With the 801, B&W engineers have broken with conventional design practices, not to mention conventional technology, to create a loudspeaker that surpasses, in every audible respect, the finest currently available.

The outstanding performance of the B&W 801 is directly traceable to a massive investment in research and development. From the computer models employed in its design to the laser interferometry used to measure the behavior of its individual components, this landmark in loudspeaker technology represents an uncompromising commitment to excellence.

Critically matched drive units using new materials and fabrication techniques are employed throughout. A computer optimized, 4th-order crossover network maintains uniform sound pressure/frequency response and correct phase characteristics. In addition, a unique electronic overload protection device continually senses the voltage applied to each driver and if safe values are exceeded, cuts off the signal. A convenient reset button restores operation.

The striking two-part enclosure has been precisely matched to the individual drive units with a staggered, in-line driver configuration insuring wide horizontal dispersion and the time arrival correction needed to yield a coherent wavefront. Finally, the enclosure has been contoured to minimize secondary diffraction effects.

For the discerning few.

To be sure, the 801 isn't for everyone. Both price and limited production effectively preclude widespread use. However, if you are unwilling to settle for anything less than a supremely accurate loudspeaker fully capable of recreating every nuance of the original performance, the B&W 801 is for you.

A visit to your B&W audio specialist will prove conclusively that the B&W 801 represents a quantum leap in loudspeaker technology—a singular end to the beginning.

For additional information write: Anglo American Audio Co., Inc., P.O. Box 653, Buffalo, N.Y. 14240. In Canada: Remcron Electronics Ltd.

B&W Loudspeakers. The next step up.

Dear editor

Lirpa Sloof

Dear Editor:

In your January, 1980, issue, the Car Stereo Directory Addenda has a rather bizzare listing for Lirpa Labs. I take it this listing is all in jest — no one can say we audiophiles are a humorless bunch.

Then again, maybe you did it to monitor reactions, just to see how many of your readers actually read these Directory listings. If that's the case, do I win anything for pointing it out?

J. Michael Ferrara
Alexandria, Va.

The Editor Replies: Yes, the listing is in jest, and yes, you do win something for being the first to point it out — one case of belly laughs, newly patented by Prof. Lirpa, which come in two sizes, large and extra large, and which will be shipped direct from Lirpa Labs in Bucharest.

More on Tonearm Geometry

Dear Editor:

I was glad to read the excellent article, "Tonearm Geometry and Setup Demystified," by Martin D. Kessler and B. V. Pisha in your January, 1980 issue. However, I would like to take issue with the remark "the earliest complete mathematical study being that of H. G. Baerwald in his paper on optimum geometry in 1941." One can never say with certainty when any study will be complete, but the earliest mathematical study that I know of was published in England by my father, Percy Wilson, in *The Gramophone* magazine in September 1924 [1]; it was reiterated in his book *Modern Gramophones and Electrical Reproducers* in 1929 [2] and was referred to in Kogen's historical review in the Centennial Issue of the *Journal of the Audio Engineering Society* [3].

While my father's study was in terms of the absolute error rather than the weighted error which later authors have used, the difference is small and, I believe, outweighed by all sorts of other errors mentioned by Kessler and Pisha in all but the most sophisticated and fastidiously aligned systems. Alas, the prototype of my father's alignment protractor which was sold by *The Gramophone* in the 1920s disappeared in his various moves or on packing up his effects; otherwise I would be using it now.

Geoffrey L. Wilson
State College, Pa.

References
1. P. Wilson, "Needle-track Alignment," *The Gramophone*, Vol. 2, September, 1924, pp. 129-132.
2. P. Wilson and G. W. Webb, *Modern Gramophones and Electrical Reproducers*, Cassell & Company Ltd., 1929.
3. James H. Kogen, "Record Changers, Turntables and Tone Arms — A Brief Technical History," *Jour. of the Audio Engineering Society*, Vol. 25, No. 10/11, October/November 1977, pp. 749-758.

The True Caruso

Dear Editor:

Children can be cruel . . . especially in respect to a fallen artist like Caruso. Very shortly after writing about the famous tenor's supposed death on stage in the middle of a high note (from my faithful child's memory), I stumbled on a detailed account of his last years, written by his wife Dorothy, which includes dozens of the charming daily letters he wrote to her in his best misspelled English.

Caruso's death, actually, was agonizing and brave; he seems to have "burnt himself out" and in his later years contracted a series of dreadful infections, including acute pleurisy and pneumonia, followed by deep-seated abscesses and finally acute peritonitis. Alas, our present-day antibiotics would surely have prolonged his life by many years.

The episode that set us kids off on our Caruso parody (*Audio*, January 1980, page 18) was surely the time when a small blood vessel in his throat burst during a performance. Though he continued to try to sing, the curtain had to be brought down on the somewhat grisly scene. Such events are material for legend, especially for kids. P.S. Caruso ate only moderate amounts of spaghetti.

Edward Tatnall Canby
Connecticut

HOW TO CHOOSE FROM SOME OF THE CHOICEST MICROPHONES WE'VE EVER MADE.

ECM-33F ECM-150 ECM-260F ECM-990F ECM-56F ECM-23F

Among recording professionals, Sony is widely recognized as an expert on microphones. That's because we're continually applying new technology to deliver better sound.

Our latest innovation is the exclusive Back Electret condenser microphone capsule, which delivers response truer than ever thought possible.

You can get this capsule in a variety of Sony mikes. And that's a bit of a problem: it's hard to know which mike is appropriate for your recording needs.

Therefore, let us clear up any confusion:

MICROPHONES THAT ARE AT HOME IN YOUR HOME STUDIO.

If you're involved in the music business and have a home studio, you need a microphone as professional as the rest of your equipment.

For all-purpose recording, we recommend the Sony ECM-56F. It's a uni-directional Back Electret condenser mike with excellent transient response, good for close miking of both instruments and voices.

For recording instruments only, the uni-directional Back Electret condenser ECM-33F is ideal. It provides flat frequency response over the entire range, and picks up amplified and non-amplified instruments equally well.

Both of the above plug into mixers for multi-channel recording.

LOCATION MIKES, FOR STUDIO SOUND WITHOUT THE STUDIO.

But suppose you want to record on location. At a rock concert, say, or a performance of your church choir or glee club. Sony has mikes that, combined with your tape recorder, practically make up a portable studio.

Take the ECM-990F, an especially versatile and lightweight stereo Back Electret condenser mike. You can vary its directional quality to adapt for everything from solo voice to small groups to full orchestra.

Or choose an ECM-23F. It runs more than 6,500 hours on a single AA battery, and it's uni-directional. Use a pair when you want to create a stereo effect. The ECM-23F also incorporates Sony Back Electret technology.

RECORD FOR RECREATION AND STILL RECREATE NATURAL SOUND.

Maybe you just need a mike to use at home, to record family sing-alongs. Or someone's performance on guitar or piano, for your own enjoyment.

You can still get a Sony Back Electret mike at a very affordable price. It's the ECM-260F, which plugs into a tape recorder and makes whatever you record—instrumentals, singing or speech—sound true to life.

For greatest versatility, use our ECM-150 omni-directional condenser mike. It's Sony's tiniest mike, smaller than a dime in circumference, and you can clip it to the fingerboard of a guitar or use it as a lapel or tie tack mike. (Incidentally, it's great for business conferences or any occasion when you want the mike to be inconspicuous.)

Whatever you need to record, and wherever you need to record it, there's a choice Sony mike to do the job.

And now that you know which mikes to choose, all you need to do is see your Sony dealer.

SONY.

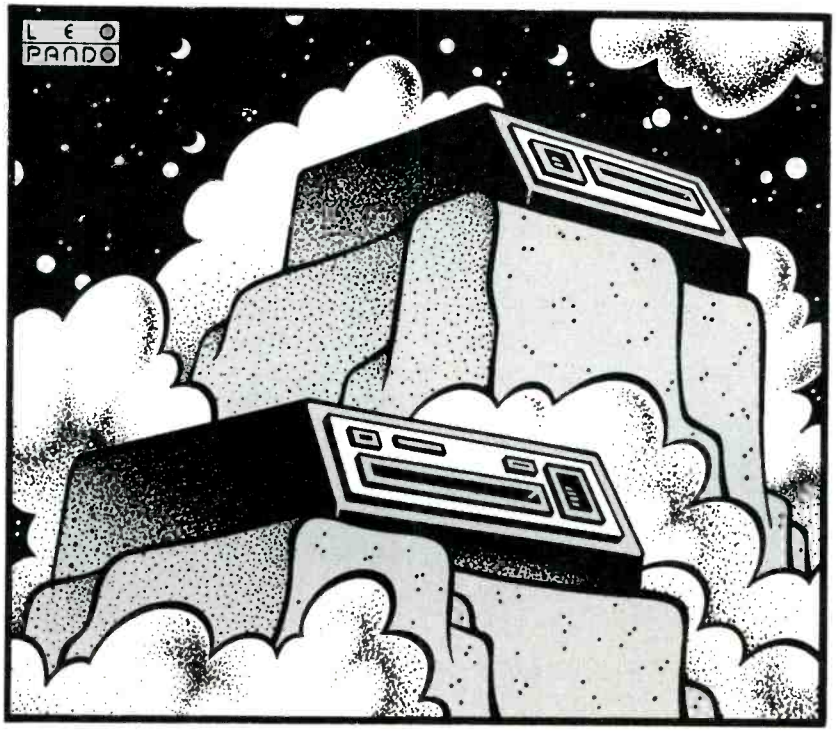
We've never put our name on anything that wasn't the best.

Enter No. 40 on Reader Service Card

Video scenes

Bert Whyte

In recent months, this column has been reporting the ongoing saga of the video disc. Never has any video product been so long in gestation. But it finally gave birth with the introduction of the MagnaVision system, and developments in the video-disc field have accelerated dramatically. With corporate giants vying for dominance with their particular video-disc system, compatibility between the various systems has evidently been assigned a very low priority. Their rationale seems to be that there appears to be little chance for an agreement that would establish a video-disc standard, so they have decided to forge ahead on their own systems, perhaps in the hope that with their video disc on the market a de facto standard might emerge.



In line with this philosophy, Pioneer held a press conference on March 26th at the Waldorf Astoria in New York, where they announced they would market a consumer laser/optical video-disc player and software in June of 1980. The system initially will be introduced in Minneapolis/St. Paul, Dallas/Ft. Worth, Madison, Wisconsin and Syracuse, New York, with plans to add four more markets every 60 to 90 days thereafter. The suggested retail price of the Pioneer video-disc player is $749, with the video discs ranging in price from $5.95 to $24.

The Pioneer player uses the basic technology and patents of the laser/optical video-disc system developed jointly by MCA and Philips. Yes, it is the same system used by MagnaVision, and the MCA video discs can be played on either playback unit. The press conference was actually a joint affair between U.S. Pioneer Electronics Corp. and DiscoVision Associates. Who is DiscoVision Associates? Follow this tangled web: In July 1977, MCA DiscoVision, Inc. and Pioneer Electronics Corp. (Japanese parent of U.S. Pioneer) formed Universal Pioneer Corp. During 1978, Universal Pioneer produced and delivered approximately 11,000 industrial video-disc players to General Motors Corp. for use in their dealers' showrooms. In September 1979, MCA and IBM formed DiscoVision Associates to handle marketing of the video-disc industrial players and to master and replicate video-disc software. Subsequently, the 50 percent interest in Universal Pioneer Corp. that was held by MCA DiscoVision was acquired by DiscoVision Associates. Thus, the consumer video-disc player shown at the Waldorf press conference was manufactured by Universal Pioneer Corp., which is 50 percent owned by Pioneer Electronics Corp. and 50 percent owned by DiscoVision Associates.

So now we have a video-disc line-up which has Magnavox and Pioneer using the Philips-developed laser/optical system, RCA's SelectaVision stylus-and-groove capacitance system (with CBS and Zenith as licensees), and Matsushita's JVC VHD grooveless capacitance video disc. Regardless of the competing systems' technical virtues and faults, it is obvious that the laser/optical proponents will have gained an advantage by having two companies marketing their video-disc system as of June, 1980.

The Pioneer video-disc player appears to be a more refined and sophisticated version of the MCA/Philips laser/optical video-disc player. In the basic laser/optical video-disc system, the video disc is mastered by applying a thin uniform coating of a positive photo-resist material on an optically flat and polished plate-glass disc. Video and audio signals are then combined in an FM signal which is used to modulate a laser beam that alternately passes or blocks the beam focused on the rotating photo-resist master disc. Thus, the laser beam is exposing discrete microscopic areas on the disc at a rate of up to 10 million per second. When the photo-resist glass disc master is developed, the exposed areas become microscopic holes or "pits" arranged in a spiral pattern known as the track. Each subsequent revolution of the disc produces tracks which are separated by only 65 millionths of an inch! After the photo-resist glass master has been developed, the recorded surface is metalized with an evaporated metal coating. Then it undergoes electrochemical plating, analogous to the normal process used in phonograph records, and a nickel mother is produced, as well as a submaster identical to the master. From the mother, stampers are prepared. The stampers are used in an injection molding process to produce plastic video discs. The manufacturers are very secretive about the nature of this plastic, saying "poly-methyl something or other," and I guess it is something akin to an acrylic plastic. Final process-

Illustration: Leo Pando

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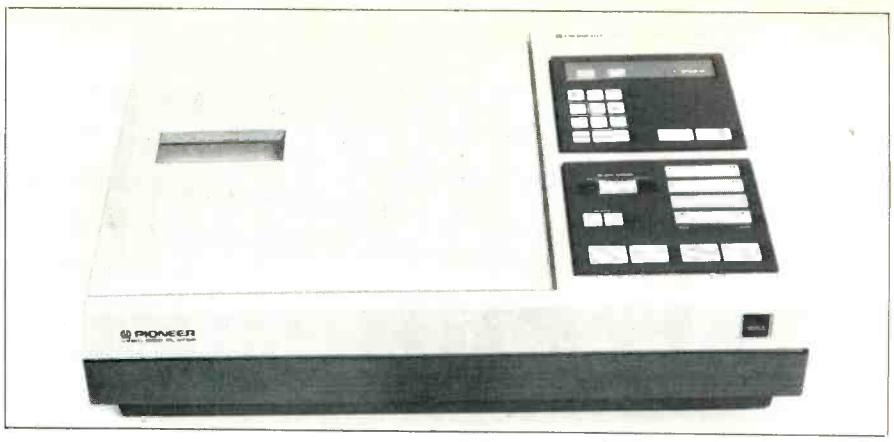


Pioneer's Model VP-1000 video-disc player.

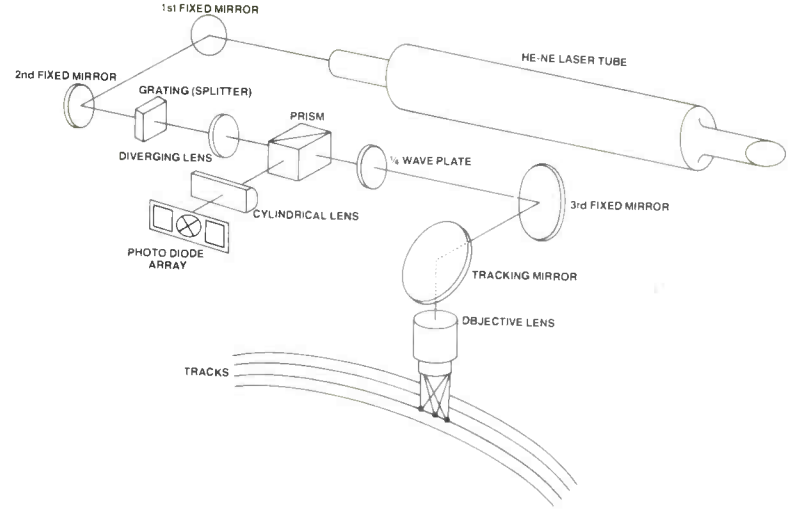
ing involves applying a reflective metal coating to the discs and, on top of that, a clear plastic protective "scuff" coating.

Playback of these video discs is via a helium/neon laser beam passing through a series of fixed mirrors, grating splitter, diverging lens, prism, quarter-wave plate, another fixed mirror, a tracking mirror, and finally the objective lens. Three positional servos keep everything lined up on the information pits in the spiral tracks. The laser beam is focused down to a thirty thousandth of an inch through the plastic scuff layer, striking the pits which interrupt the reflected beam. This "on-off" reflected beam is then translated into electronic pulses. On the video disc there may be as many as 14 billion of the signal pits, arranged in up to 54,000 spiral tracks.

Special Effects

Now we come to the special features of the DiscoVision video disc and the Pioneer video-disc player. Each of the 54,000 spiral tracks is equivalent to one television frame, making it possible to have 54,000 *individual* pictures on one half-hour side of the video disc. On the DiscoVision discs, when the discs are mastered each frame of the disc is encoded with a reference number. There is virtually instant random access, by touching a button, to any of the 54,000 frames. If you know there is a scene you like beginning at frame 29,611, program the player for that number, press the button, and zip . . . you're there. When you program the Pioneer VP-1000 video-disc player so that the laser beam plays the same track over and over, this gives you excellent freeze-frame results. In the demonstration I saw, the picture retained all of its good brightness and resolution, with no distortion, jiggling, or jitter whatsoever. Since only the laser beam is reflecting from the surface of the video disc, there is no wear and the freeze-frame mode can be maintained for any time desired. The playback unit can also move one frame at a time, either forward or reverse. Slow motion is possible by

Fig. 1—Playback laser path.



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repeating a series of frames, and the rate of slow motion can be varied. By speeding up the slow motion, rapid scanning across the disc is possible without losing picture transmission. All of this special-effects trickery is available only on the standard half-hour per side DiscoVision disc. In the one-hour per side extended play mode, only the ability to rapidly scan across the disc without picture loss remains unchanged.

Pioneer strongly emphasized that their video discs play back with stereophonic sound or can be used for dual language educational purposes. The stereo emphasis was of course directed at the RCA SelectaVision video disc, which only has monophonic sound. Also emphasized was that the playback unit has provision for a future adaptor for playback of true PCM digital audio recordings. This certainly is an important point, and I have reason to believe that when such an adaptor becomes available, it will be in the nature of a plug-in large scale integrated (LSI) chip.

The Pioneer VP-1000 DiscoVision video-disc player is an attractively styled, compact (21 in. W x 15 in. D x 5 in. H) unit weighing 38.6 pounds. A full-function remote-control unit, model RU-1000, is an optional accessory priced at $50. In the demonstration, picture quality was outstanding, with good definition, high brightness-to-contrast ratio, clean whites, and clean pure colors. The one drawback to this (and the MagnaVision player as well), as cited by the competition, is that the DiscoVision software does not use regular PVC compound and cannot be pressed in existing standard record plants. Thus far only one plant is capable of mastering and pressing

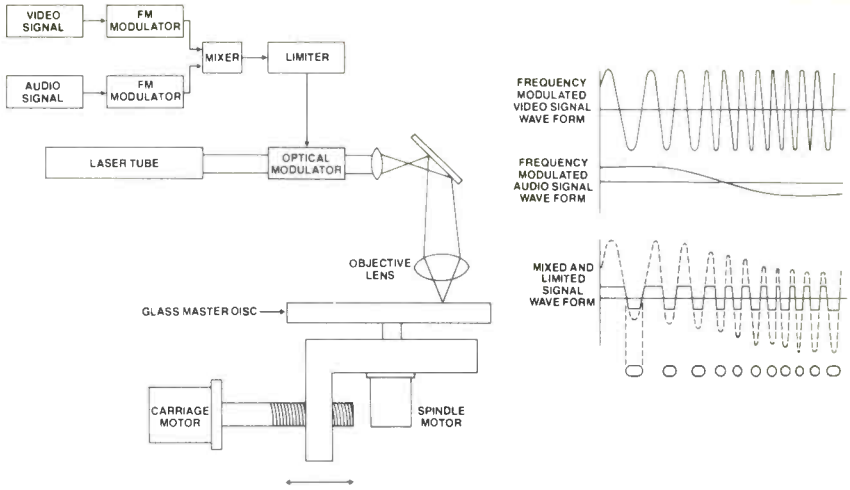


Fig. 2—Video-disc recording system.

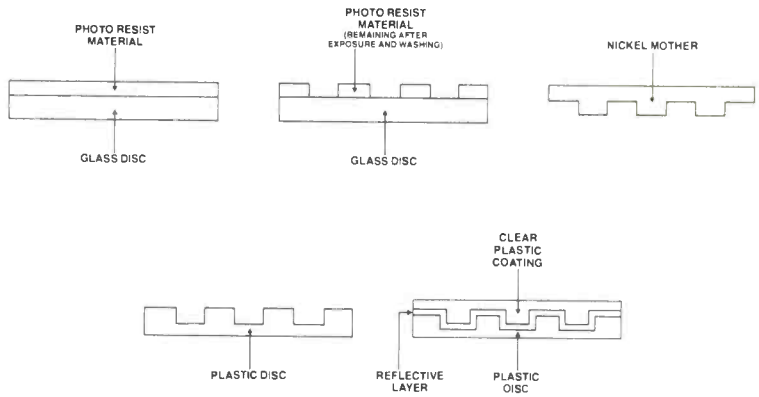
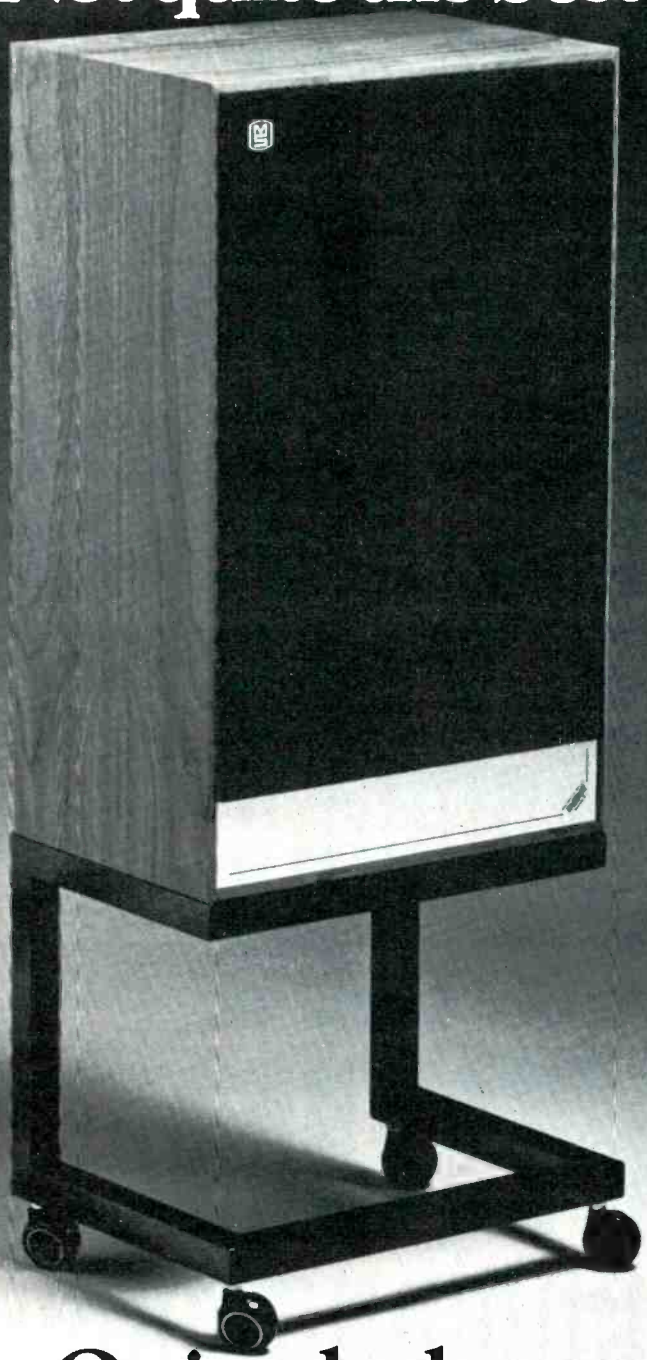


Fig. 3 —Video-disc mastering process.

the DiscoVision video disc, and there is speculation that if the two laser/optical players go into national distribution, adequate supplies of software could be a problem. Obviously, the answer would be to build more of the specialized pressing plants, and while there is no doubt this is both expensive and can't be done overnight, surely these companies have contingency plans geared to the demands for their products.

Not quite the best known name?



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Tape guide

Herman Burstein

Pitch and Frequency

Q. In "All About Tape Recorder Equalization" in the October, 1972 issue of Audio, *you stated in connection with noise frequencies, "Clearly there are more frequencies between, say, 3,000 and 6,000 Hz than in the preceding octave of 1,500 to 3,000 Hz." This is incorrect. A mathematician will tell you that both intervals contain the same number of frequencies (although the number is uncountably infinite). In fact, there are as many frequencies between 0 to 1 Hz as between 0 and infinity.*—William Anderson, Gaithersburg, Md.

A. Your criticism of my statement about the number of frequencies per octave is justified. A better explanation would be as follows:

White noise consists of random frequencies distributed throughout a stated bandwidth during a stated time. The bandwidth in our case is the audio range of about 20 to 20,000 Hz. At a given instant, each frequency within the bandwidth has equal chance to occur. Correspondingly, at a given instant a noise voltage may equally well occur at any frequency, i.e. anywhere in the bandwidth. If we subdivide the bandwidth, the probability of a noise voltage occurring at a given instant within the subdivision varies with the width of the subdivision. If we subdivide the total bandwidth into two equal parts, say 20 to 10,000 Hz and (for exactness) 10,000 to 19,980 Hz, there is equal chance of a noise voltage occurring in either subdivision. If one subdivision is twice as great as the other, say 20 to 6,660 Hz and 6,660 to 19,980 Hz, at a given instant there is twice as much chance of a noise voltage occurring in the larger subdivision as in the smaller one. If we divide the audio range into octaves, where each successive bandwidth is twice that of the preceding bandwidth, within a given period of time twice as many noise voltages will occur within a given octave as in the one just below. In technical terms, the spectral voltage density doubles with each octave.

We perceive pitch essentially on the basis of ratios between frequencies. For example, the pitch difference between 80 and 160 Hz seems to human ears to be of about the same order as the pitch difference between 40 and 80 Hz, because both involve the same ratio (2:1). Thus, successive octave intervals represent about equal pitch differences. But if each ascending interval contains double the random energy as the preceding interval, the total effect is that of high-pitched sound.

In sum: An infinite number of random frequencies can occur within each octave. But within a finite time span, the number of random frequencies (noise voltages) that do occur tends to double with each ascending octave.

Setting Standard Level

Q. I have three tape recorders and have found that it is not easy to know if I am putting the correct level of signal on the tape. The meters in one of the machines are too far out of balance to be of much value, but if I have a tape that I know is recorded with the right levels, I can adjust the meters for proper readings. The damping of the meters is different from one machine to the other. One of my machines does have good meters, properly adjusted, and I can use it for checking the tapes from the other two machines. I have an Ampex full-track test tape. What VU reading should the meters produce when playing the "standard level" tone on the test tape? — William Benjamin, San Jose, Calif.

A. When referred to a test tape bearing a "standard level tone," the VU meter should ordinarily read about 0 VU in recording. Specifically, one does the following. (1) Play the test tape's standard level tone. Note the meter reading in playback or note the reading of an external meter connected to the machine's output. (2) Record a test tone of the same frequency as the standard level tone, which is usually in the range of 400 to 700 Hz; this test tone is supplied by a signal generator or (less desirably) by a phono disc. Record this signal at a level such that when the tape is played back, the playback meter reads the same as for the reference tape. (3) When recording at such a signal level, adjust the VU meter to read 0 VU.

Poor Treble Response

Q. I am interested in improving the high frequency response of my tape recorder. Playback of tapes I have recorded and of prerecorded tapes all lack adequate high frequency response. When recording I set record level to just below the distortion point; in terms of output this compares favorably with the output levels of prerecorded tapes. Can I increase bias current to improve response? Will a change in bias affect playback of prerecorded tapes? Playback of tapes I have recorded lack good high frequency characteristics when played back on a friend's tape machine. Help! — Christopher Battista, New York, N.Y.

A. The problem may be due to some extent to heads that haven't been adequately cleaned and demagnetized. Somewhat more likely is the possibility that high frequencies are attenuated in recording due to excessive bias (not too little bias). That is, you might try reducing bias. You also appear to have a playback problem in view of the fact that prerecorded tapes sound dull. The fault here may be a playback head with gaps that are too wide owing to wear or other reasons. Playback equalization may be incorrect. Bias does not affect playback.

Open-Reel vs. Cassette Decks

Q. Isn't it true that any better than average open-reel deck will out-perform any cassette deck in terms of sound quality and perhaps reliability? — Gerald Woods, Santa Rosa, Calif.

A. While true or nearly true some years ago, this is certainly not true today, except at speeds of 7½ ips and higher for open-reel decks. Thanks to continuing improvements in cassette transports, heads, electronics, tapes, tape shells, etc., a truly high-quality cassette deck today out-performs any open-reel deck operating at 1⅞ ips, rivals or out-performs many open-reel decks operating at 3¾ ips, and comes

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

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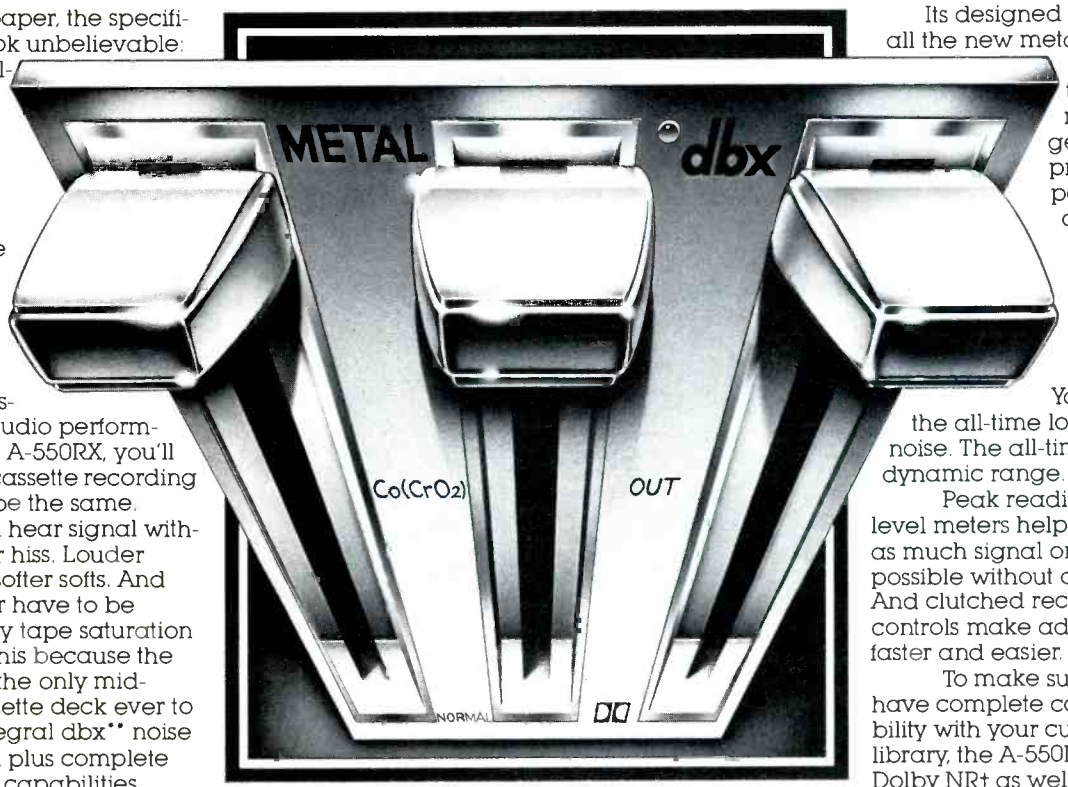

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TEAC

*Measurements made with metal particle tape
**dbx is a trademark of dbx, Inc
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close to the performance of some open-reel decks operating at 7½ ips — so far as the human ear is concerned. This is especially true when metal tape or one of the most advanced ferric-oxide or cobalt-modified tapes is used. At the time this was written, at least one manufacturer had already achieved response beyond 20,000 Hz in the cassette format at 1⅞ ips, along with low distortion, high signal-to-noise ratio, low wow and flutter, etc. In fact, the same manufacturer had achieved response out to 15,000 Hz at 15/16 ips, along with good performance in the other aspects.

When you take into account other important developments in the cassette format, such as automatic adjustment of bias, record equalization and record head azimuth, the superiority of open-reel decks becomes less and less apparent to more and more listeners.

Head Protection

Q. The typical quality recorder today has three or more expensive heads. Since many of us spend much time playing rather than recording, all heads but one are being worn down needlessly. Would it be feasible to install a small head cover or pin to divert the tape from unused heads during playback? That way, the recording head would be preserved longer. The cover could trigger a microswitch recording interlock so one could not attempt recording with the cover in place. In future models, perhaps the tape path could actually be changed automatically in accordance with the record interlock.—John Stith, Seabrook, Md.

A. I suppose you could work out a mechanical arrangement to divert the tape from the record and erase heads during playback, but I doubt that it is worth the effort. In changing the tape path you risk a change in response at the very low frequencies, where the entire head, not merely the gap, responds to the tape; the angle of approach of the tape to the head affects this response. You also risk an increase in wow and flutter. Finally, you risk poorer contact between the playback head and the tape, resulting in treble loss. Further, keep in mind that the head whose performance is usually the most adversely affected by wear is the playback head. With use, the gap may widen, resulting in treble loss. Therefore, measures to protect the erase and record heads are not as important as would be the case if they were equally susceptible to the effects of use.

One reader has suggested that, instead of a head cover, one might wrap an appropriate thin, plastic (non-sticky) material about the heads not in use. However, this would have to be very smooth to avoid an increase in wow and flutter.

The Reel Truth

Q. What are the relative advantages of the following three types of 7-inch reels? (1) Regular 2¼-in. diameter hub, plastic reel; (2) low-torque, 4-in. diameter hub, plastic reel, and (3) 2⅜-in. diameter hub, metallic reel. — Paul Gilchrist, Chicago, Ill.

A. Metallic reels have the advantage of being least subject to warp. As the tape unwinds from the outside diameter to the inside, this tends to affect the torque (pull) exerted by the take-up reel as well as the resistance exerted by the supply reel. The greater the difference between the outside and inside diameters, the greater the change in torque and resistance, which in turn can affect such things as tape speed, wow and flutter, and tape-to-head contact. Hence a reel with a wide-diameter hub results in less change in torque and therefore helps achieve better performance.

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Behind the scenes

Bert Whyte

In recent months I've been discussing various aspects of recordings with wide dynamic range. I have pointed out the difficulties of coping with the 64-dB dynamic range that appears to be the maximum on present analog recordings, let alone the problems that will arise with the potential 90-dB range of true digital recordings.

It is quite unfortunate that the proponents of the laser/optical and capacitance types of digital discs are still battling each other to establish their supremacy. The various systems are incompatible with each other, and agreement on standardization still seems to be a long way off. Industry pundits are prophesying that digital discs are at least 5 to 10 years away from commercial reality. Well, friends, this reporter believes that we will have some form of true digital disc (not necessarily a standardized version) within three years, and I wouldn't be at all surprised if it arrives on the scene considerably earlier.

The main problems we encounter with the reproduction of analog disc recordings with ultra-wide dynamic range are groove tracking (especially with high-energy low frequencies), adequate amplifier power to avoid clipping, and loudspeaker efficiency related to the full-frequency-spectrum-power-handling capacity of the speakers. Now let us assume that some form of digital disc has been introduced. Whether the disc employs the laser/optical or capacitance system, groove tracking will no longer be a problem since the traditional phono cartridge groove/stylus relationship of present analog discs will not exist. A step forward to say the least. But what about a typical playback system, as found in the homes of myriads of music lovers, and its ability to handle the dynamics of digital recordings? Usually there is a receiver with low to medium amplifier output coupled with a pair of low-efficiency loudspeakers. To put it bluntly, such a combination simply cannot reproduce the 90-dB dynamic range of digital recordings. In a typical situation, allowing for a fairly quiet room with an ambient noise level of about 45 dB and with the volume controls set so that pianissimo passages are barely audible, as soon as the first "blood and thunder" fortissimo passages occur in the digital recording, the system will blow its protective fuses or circuit breakers will trip. Adjustment of the volume controls so that the fortissimos will be heard without activating the protective devices is of no avail, since the pianissimo and probably even the mezzo-piano passages will not be audible at all!

It should be noted that the elements in either analog or digital recordings that principally will cause the fuse blowing are the high-energy low frequencies of bass drums and tympani. I should also point out that I am not singling out "cheapie" low-power, low-efficiency systems for their inability to handle wide dynamic range, since many very expensive combinations of exotic amplifiers and speakers are similarly plagued by inadequate dynamic headroom. The hard fact of the matter is that very few amplifier/speaker combinations presently available will be able to reproduce the full dynamic range of the digital disc without distress. It is obvious that whatever the sonic attractions of low-efficiency loudspeaker designs, except for a few special cases, manufacturers will have to develop new high-efficiency designs for the proper playback of digital recordings.

The above dissertation on dynamic range is a preamble to my main thrust this issue. One of the special pleasures of writing this column for *Audio* is that from time to time the various manufacturers of audio equipment tender invitations to visit their plant and laboratories for a behind-the-scenes (plug intended) look at their activities. Sometimes these visits are in company with other audio journalists; on some occasions I make solo visits, although I must admit I'm usually accompanied by my wife, Ruth. Incidentally, as a personal aside and a perspective on her visits, Ruth is that rarest of creatures: A woman who knows and loves music and audio. She has sold hi-fi equipment at retail, handles the take sheets on my recording sessions, sets up mikes, knows how to handle any audio equipment, and has a very critical and discerning ear, a fact well-known to many manufacturers. Best of all, she prefers records played back at

Illustration: Leo Pando

The first prototype of the M-7050 power amplifier measured virtually perfect.

Three generations later, we were finally satisfied.

Theoretically and measurably, the first prototype of the M-7050 power amplifier was virtually faultless. It incorporated JVC's "Super-A," a method by which class-A output is maintained without high idling current. Driving the output stage was a constant-gain driver stage. All stages were direct coupled and DC. The slew rate was ±300 V/μSec. And tremendous current reserve was provided by a power supply incorporating a 33 lb., 500 VA toroidal transformer.

As you would expect, complex signals fed into this amplifier were passed with no measurable change. There were no signs of difficulty with transient, switching or crossover distortion. No significant ringing with complex capacitive or reactive loads.

Perhaps some companies might have rushed into production at this point. Not only did the amplifier sound exquisitely clean and musical; we also had an arsenal of theory and measurements which "proved" its superiority. But after coming this far, we decided that wasn't good enough.

So we auditioned the M-7050 and compared it at length with the best offerings from companies like Audio Research, Mark Levinson and Threshold, listening for any faults which detracted from an impression of total transparency.

During the following eight months, we produced three more prototypes after exhaustive experimentation with component types, component values and circuit layouts. The fourth prototype, which became the production model, at last achieved the elusive ability to make the loudspeakers "disappear."

Interestingly, the final prototype measures no differently than the original. We are convinced that no existing measurements can isolate the difference between a good amplifier and one that allows a vivid recreation of the live performance.

We invite you to test our assertions for yourself at one of the listed JVC Pro Audio dealers, where you'll be able to compare our M-7050 with the best of our competition, just as we did. Vic Pacor, Pro Audio Sales Manager for JVC, would be interested in hearing your impressions. Please call or write him and let him know how well you think we've achieved our goals.

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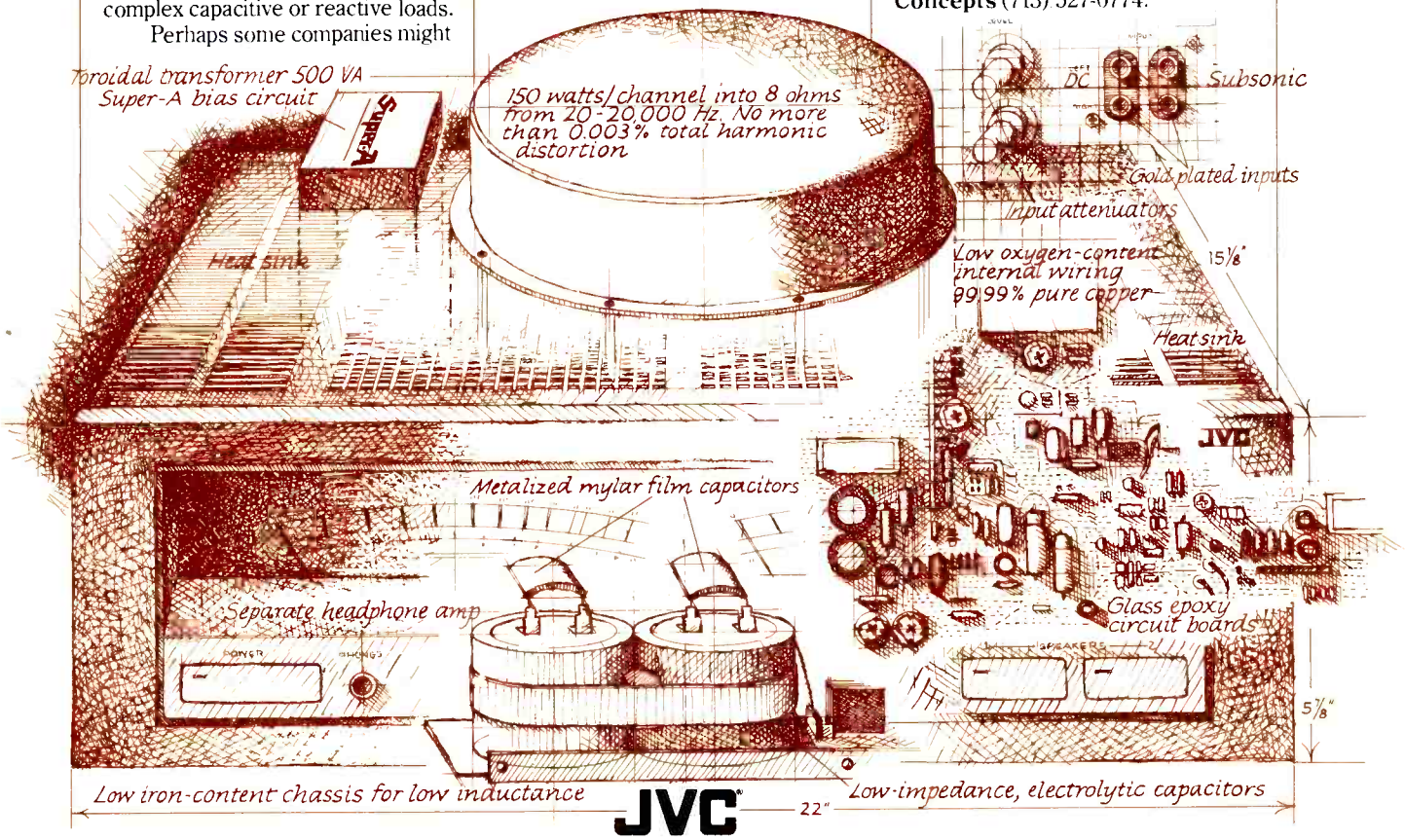

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Production of loudspeakers at Cerwin-Vega's plant in Arleta, Calif.

the requisite SPL for full dynamic expression.

Cerwin-Vega's Founding

Thus it was that we were invited to visit with a gentleman whose company has long been identified with high-efficiency speaker designs, Gene Czerwinski, the genial head of Cerwin-Vega. I've known Gene for about 15 years and have ribbed him in these pages through the years about his speaker demonstrations with their awesome sound pressure levels. But he is a very serious engineer with impressive credentials which help explain his preoccupation with high SPL and his design philosophy. Like many other engineers in the audio industry, he was involved with a number of disciplines in the aerospace industry. With Bendix Corp. he worked on high-powered sonar transducers and related equipment, and at Douglas Aircraft electro-acoustic instrumentation for sound and vibration phenomena, including the design of wide-range speaker systems capable of 150 dB SPL!

Gene founded Vega Labs in 1954 as a part-time adjunct to his aerospace work. In 1957 he introduced the first solid-state amplifier, with 125-watt output, a huge amount back then. In 1967, Gene's love of music and audio prevailed. He left the aerospace industry, changed the name of his company to Cerwin-Vega, and devoted his energies to its growth. With his commitment to high-efficiency speaker designs, he became a big OEM supplier to the musical instrument amplifier manufacturers. In the early '70s, Gene was supplying 50,000-watt amplifier systems and huge high-efficiency speaker clusters for rock concerts of more than a hundred thousand people. In 1972, he began to concentrate on the audio consumer market, with an extensive line of high-efficiency loudspeakers. These were bread-and-butter designs, but they found a ready market with rock music fans with their seemingly insatiable thirst for high playback levels. Gene didn't neglect his research into innovative ideas for high-quality loudspeakers, however, always the underlying design philosophy of high efficiency. He developed an 18-inch woofer rated at 1,000 watts, and one of his stunts at hi-fi shows was to plug this brute into an a.c. outlet, with obviously an almighty 60-Hz signal! One of his company's most interesting designs was the Magnastat. This had a thin-film diaphragm, approximately 6x9 inches, which was inserted into an intense magnetic field, and coupled to an exponential horn. The Magnastat produced a very clean, high-level output from 300 Hz to beyond 20 kHz. Unfortunately, the device proved to be too costly to manufacture.

Earthquaking Speakers

Some years later, Gene designed the special effects speaker for the film "Earthquake." This was what he called a "corner plug," a huge exponential horn that coupled into each corner of the theater. Driven by 1,800 watts of power and turned on by a signal cue from the optical sound track at the precise moment the "earthquake" started on the screen, each of these monsters put out huge 16- and 20-Hz waves which shook your whole being with its powerful roar. Sure it was a gimmick, but very effective! Not long

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afterward, at the banquet of the Audio Engineering Society at the Los Angeles Hilton Hotel ballroom, the entertainment was an electronic synthesizer concert, using Moog and Arp systems. The main speakers, one at each corner of the ballroom, were huge Altec theater systems. Augmenting these from 50 Hz down to 16 Hz was a Cerwin-Vega "earthquake" corner plug behind each Altec. When the Arp performer played *MacArthur Park*, you wouldn't believe the awesome sonorities this system generated. Most of the assembled audio engineers responded with a standing ovation, but quite a few of the old guard stalked out of the ballroom in high dudgeon as a protest against the sound levels.

On this recent visit to Cerwin-Vega in Arleta, Calif., Gene proudly showed me his new 40,000-sq. ft. plant, with ground being broken for a similar plant in the rear of the property. Over 400 people work for him now, and the factory is a beehive of activity. I simply couldn't believe the stacks upon stacks of thousands of speaker basket castings, in every size from three inches to imposing 24-inch units for woofers. The same vast quantities applied to speaker cones, voice-coils on formers, and pallet after pallet of magnets in all sizes. There are long assembly lines where high-power amplifiers are put together and a cabinet plant for all the enclosures they make. Gene tells me that their production of two- and three-way bookshelf speakers, which are covered with vinyl, constitutes the largest output of this kind of speaker in the country.

The company maintains complete lab and research facilities, replete with spectrum analyzers and all manner of other goodies from HP, Tektronix, B&K, and others. Gene was one of the first people in the country to acquire a Sony PCM-1 digital recording unit, and he made a considerable number of jazz and rock recordings to demonstrate both his big disco systems and his high-efficiency consumer tower-type speakers. The PCM unit is particularly useful to him for its 85 dB of dynamic range and the fact that he can use high playback levels and not be bothered by hiss.

Speakers for the Future

I remarked that with the coming of digital discs Cerwin-Vega is in a particularly advantageous position in respect to their speakers being able to handle wide dynamic range. Gene replied, "You know we have always made speakers of high efficiency, and they were rugged, because of the sustained high levels for which they are intended. Sure it is true that in most rock music there is really very little dynamic range, perhaps on the order of 10 to 12 dB, but that doesn't mean our speakers can't be used for classical music with 90 dB of dynamic range." He pointed out that for the most part the company uses cast speaker baskets, and the cones are chosen for the combination of mass and acceleration, compliant surround, and restoring force of the spider, plus large high-efficiency magnets that will give the closest approach to true pistonic action. Add a special high-temperature voice-coil for reliability. Gene added, "In classical music, the low frequencies are the problem areas in the achievement of full dynamic range. You've got to move large masses of air, and efficient pistonic motion is the way to do this. This also will probably require certain amounts of bass equalization, which uses up gobs of amplifier power. Hence, high-output amplifiers will be needed."

I said to Gene that while many people admit the efficiency of his speaker systems, and that his motto "Loud is beautiful . . . if it's clean," is apt, they also feel that some coloration is evident. He answered that they were entitled to their opinion and then pointed out they were not likely to find fault with his first speaker specifically designed to handle the recordings of the digital decade with the highest possible quality. This is his Metron SUFT-FET-2 (Spiral Uniform Force Thin Film Electromagnetic Transducer), a mid-/high-frequency unit using 72 spiral voice grids on thin film diaphragms suspended in an intense radial magnetic field. Response is from 200 Hz to 30 kHz. The SUFT-FET-2 is coupled with the new Metron subwoofer, which incorporates a 15-inch woofer for sub-bass, and an 8-inch mid-bass driver with what is termed a "boundary layer air bearing" replacing standard annulus suspension. Crossover points are at 80 and 200 Hz. This system is said to have an SPL of better than 115 dB! At $4,000 a pair including the subwoofers, this kind of quality comes high, but Gene claims he is working on other audiophile speaker designs which can handle digital recordings with very high quality at more modest prices.

An interesting and modest man, Gene Czerwinski rarely fails to present some intriguing ideas whenever I see him.

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With tuners, Lux took an equally effective approach. The Closed Locked Loop System for infinitely precise tuning accuracy. And the Acculock System, an electromechanical locking device to reach and hold that tuning precision.

Duo-Beta

Negative feedback is a corrective measure to maintain sound purity by lowering THD. While doing that, however, it can increase TIM. A "no-win" solution. So Lux designed amplifiers that needed no correction.

Too much feedback can destabilize amplifiers and cause damage. Too little reduces damping and increases low frequency noise and rumble.

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Most good tuning systems use quartz lock synthesizers. And they work. But they only work on the local oscillator or front end. Lux's CLL circuitry, on the other hand, controls all the stages of a tuner, from front end to IF and detector circuits.

CLL circuitry, based on the crystal controlled frequency transmission of the broadcasting station provides total tuning...stable and accurate.

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This is the typical Lux touch. A simple way to assure tuning precision. So simple, you can't mistune even if you want to. Because at the exact center tuning point, the Acculock system puts a mechanical lock on the tuning knob. For about one second, you can't even move that knob. The CLL system says when. The Acculock system does it.

Pure and simple systems

T-400 AM/FM Stereo Tuner

T-450 CLL Acculock AM/FM Stereo Tuner: IHF usable sensitivity: 10.3dBF (1.8μV)

L-450 Integrated Amplifier: A Duo-Beta unit; 50 watts per channel RMS, both channels driven into 8ohms, from 20-20,000 Hz with no more than 0.03% THD.

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Borgia Column

Nadine Amadio

Like all those interested in man's achievements, I visited the CES this January. To be quite honest, in spite of my usual cool and sophisticated exterior I was secretly quite impressed with all the electronic glitter.

It was like an Electronics Renaissance with large modern sculptures of equipment heavily bejewelled with small, cunningly intricate components.

I wandered around the halls several times, heard some really excellent sound, and occasionally experienced man's inhumanity to man at intolerable levels. Then I spied a tiny booth in a corner, which I could have sworn was not there before. Presiding over it was a very ancient man with a long white beard. He had an array of unusual back-to-front circuit designs in front of him, and behind him was a large color projection of a lady with an enigmatic smile.

"What are you doing here?" I asked, "The old men's home is that way. You must have taken the wrong turn."

"No, no," he said querulously. "My name is Leonardo, I'm here to display my product, and I thought this might be a likely place to meet a genius."

"A what?" I spluttered.

"A genius. A twentieth-century genius. Could you please introduce me to one?"

I collapsed, "You simply have to be joking."

"I can't see what is so amusing. I am widely known to be a genius."

I tried to pacify him, for I felt inclined to be benevolent to a fellow Italian of culture. "Is that your wife?" I asked, pointing to the lady with the knowing smile. She looked vaguely familiar.

"No," he shrugged impatiently, "she's just some dame I painted once. Everyone seems to like it so I brought it along as an entry ticket. On the other hand I have some interesting plans for a submarine here."

"Cool it Leonardo, submarines are old hat. Mainland China has just invented a new class of amplifier and the Russians and Americans romp around in outer space."

"Well, now I'm here, I'd better look around," said Leonardo. "You can guide me. Please feel free to introduce me as your father."

"Try grandfather," I snapped.

"What is that?" he asked, pointing to a turntable, "A horizontal version of the wheel?"

I ignored that one.

"And that's a very strange spinetta," he grumbled, indicating a white Yamaha piano.

"It is not a spinetta, it is a piano. The strings are hammered, not plucked. And I suppose you know all about television?" I asked, a little unfairly.

"Well, I was experimenting with light waves and photography hundreds of years ago," he countered, "but what are all those hysterical faces doing? They are positively erupting from the screen. They're all mouth and rolling eyes and they are eating metal rods. Ah, I know," he nodded wisely, "they are your politicians."

"No, they are our pop stars."

"The popular choice of the people." He was puzzled. "And why are they swallowing those metal rods?"

"They're microphones for projecting the sound of their voices."

"Can't they be heard without it?"

"No," I said sadly, "they never learned to produce their voices properly."

Leonardo started skipping stands. I tried to slow him down.

"I suppose it's fair progress," he mumbled to himself, "but it was all there waiting to be discovered."

"Aren't we blase?" I said coldly.

"There's a lot more to come yet. You haven't really started." A little smile played around his lips. He looked like the "dame" he'd painted once a long time ago. But I was irritated.

"They didn't have those things in your time. You couldn't cook your chops in five minutes, and you couldn't fit two hours of music on one of these. And get that!" I cried, kicking a video tape recorder in sheer chagrin. "And have you tried a calculator?"

Leonardo flipped the calculator out of my fingers with scorn. "You'll never grow any geniuses with all that rubbish around. Laziness! That's the disease of your age."

But, suddenly, a smile of happiness spread over the craggy face. "Oh, I rather like that."

"What?" I asked, somewhat mollified by his sudden graciousness. "Do you mean this amplifier, or was it that speaker?"

"Neither, you imbecile." The beatific smile had returned to his face. "The music, who wrote that music?"

Illustration: Leo Pando

Speaker for higher.

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For example, a tweeter mounted directly in the grille.

It's the Jensen 6½" Coax II car stereo speaker. And by putting the 2" tweeter where it is, we've improved the high frequency dispersion. And slimmed down the speaker.

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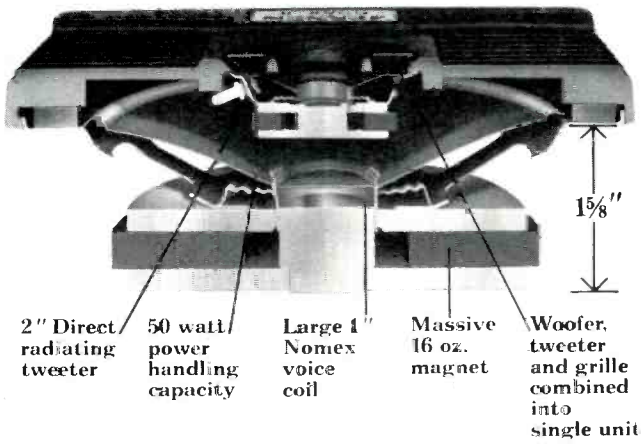
That's what you'll get from the 6½" Coax II. Music with plenty of meat on its bones. Music with a frequency response that stretches from 50 Hz to 40,000 Hz.

Not only from the tweeter in the grille. But also from the 6" woofer behind it. This woofer's hefty 16 oz. magnet and large 1" Nomex® voice coil serve up a second helping of full, balanced bass. While a responsive rim suspension and meticulous cone design give this speaker extra sensitivity.

This highly efficient, 4 ohm Coax II will handle up to **50 watts** of continuous power. And make the very most of it.



A slimmed down speaker.

No extra fat on this speaker...it's only 1⅝" deep and it fits your current 5¼" cutout. So it will fit in more car doors, more rear decks, and more tight spaces than ever before.

The Jensen 6½" Coax II is also easier to install, thanks to its new uni-body construction. The grille is permanently affixed to the speaker unit. Which not only makes installation easier, but also means a sturdier speaker with less vibration.

Excellent references.

Give a listen to the new Jensen 6½" Coax II's. The speakers with the grille-mounted tweeters.

We think you'll agree that they're just the right speakers to fill the position in your car.

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"Stravinsky, Igor Stravinsky."

"I'd like to meet him."

"Well you can't," I said flatly. "He died in 1971. He asked to be buried in Italy," throwing him a small sop.

"Oh, I'll meet up with him some time," grinned Leonardo. "In the meantime I am reassured. You have produced at least one genius this century."

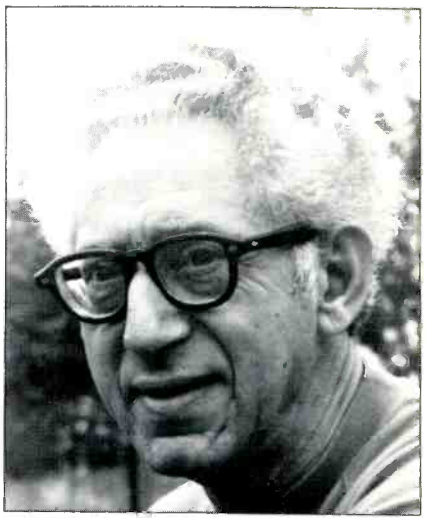
I smiled, feeling almost personally responsible for his happy state of affairs.

Leonardo wandered off on his own. Later I went looking for him, for in spite of his quirkishness I had become rather fond of him. He had a strange charisma.

He was gone, and so was his vaguely familiar painting. In its place was pinned a large note that read: "You haven't invented time travel yet."

I could see that ancient, mischievous grin disappearing into the centuries like a mighty and immortal Cheshire cat. A

Obituary



Robert M. Schmetterer

Robert M. Schmetterer died on January 17, 1980, following a short illness. Mr. Schmetterer, 71, founded Hartley Products Corp. in 1953, the American counterpart to the Hartley Company, Ltd. of England. He served as President of Hartley Products and was the firm's Chairman of the Board until 1976.

In his early career, Mr. Schmetterer worked for Paramount Studios in New York and later opened retail electronics stores there. He was the first importer of Ferrograph tape machines and also sold the first loudspeakers with polymer cones as well as the first loudspeakers with magnetic suspension.

Bob Carver dancing in his laboratory.

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*401 watts RMS minimum, one channel driven into 8 ohms from 20Hz-20kHz at no more than 0.05% THD. 201 watts RMS minimum per channel into 8 ohms from 20Hz-20kHz at no more than 0.05% THD.

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How Records Are Made

Gary Stock

Our special thanks to:
Audio-Technica U.S. Inc., Fairlawn, Ohio
KM Records, Burbank, Calif.
Sheffield Lab, Santa Barbara, Calif.
Sound 80, Minneapolis, Minn., and
Stanton Magnetics, Plainview, N.Y.
for their assistance.

Like a thousand other things in our daily lives — from shoelaces to beefsteaks to automobiles — the phonograph record appears on store shelves with nary a clue as to where it came from or how it came to be made. Indeed, a visit to a fabric mill, a slaughterhouse, or an auto assembly plant often changes one's perspective on the object in question dramatically. Almost everything we use in the course of our lives turns out to be complex, difficult, and exacting to make.

To extend one's appreciation of this, you might visit in turn a recording studio, a disc-mastering facility, and a record-pressing plant, just to see the incredible chain of steps that separates the performer's voice in the studio from the sonic replica in your living room. So that you may see these steps, we've assembled just such a tour on the following pages. Right this way please . . . .

Sound 80/Steve Barnett

1 The record-making process begins in the recording studio, with the near-continuous process of equipment maintenance and calibration. Basic recorder-maintenance procedures are often performed on a daily basis in busy studios. Here a technician uses a calibration tape to check and readjust an MCI Model JH-114 24-channel recorder.

Sound 80/Steve Barnett

Sound 80/Steve Barnett

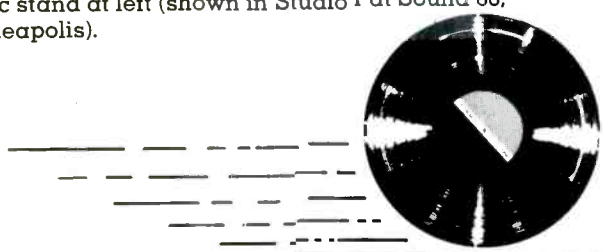
2A & 2B The musical elements of a record begin to come together when the musicians "lay down" the individual tracks which make up the multi-channel tape, either simultaneously as shown here where three members of a jazz group are recording, or individually as with the vocalist who often adds his material later. Note the acoustical isolation of each performer in the jazz group. Each mike thereby picks up only the sound of one instrument, permitting later manipulation of the balance between instruments. The performers hear one another through headphones; this signal is usually an entirely separate "mix" of the sound of the individual instruments, which is used solely for monitoring and is not recorded by the multi-channel recorder.

Sound 80/Steve Barnett

3 The levels and initial equalization of the multi-track tape are controlled by a recording console, such as this Trident unit, which functions to preamplify, equalize, route, and monitor the level of each individual track being recorded. The recorder is the 3M Company 32-track digital recorder, with the remote control for its transport functions on the music stand at left (shown in Studio I at Sound 80, Minneapolis).

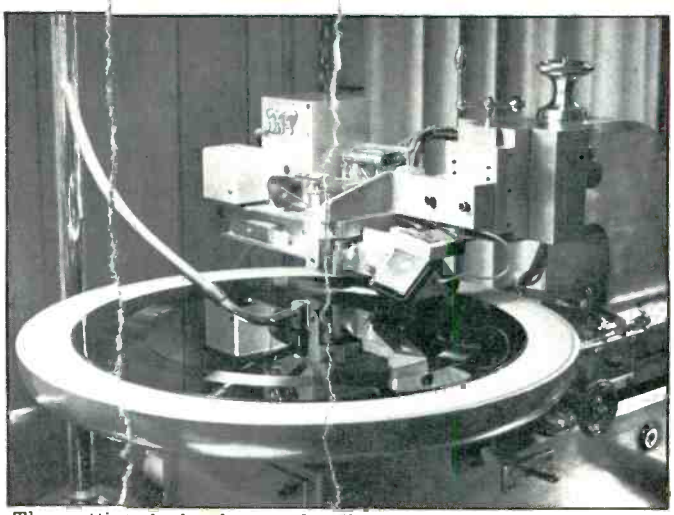
Sound 80/Steve Barnett

4 The final multi-track tape must be mixed down to a two-channel master, a process usually performed in a separate mixdown room. It is at this stage that most of the special-effects devices used to influence the final sound are put into circuit and where most of the equalization is done. The monitoring loudspeakers are particularly important since what the engineers hear strongly influences their changes and the consequent final musical balance. Note the wide range of speakers, from minispeakers to full-sized studio monitors; these are used to determine how the recording will sound on different types of equipment. Since different records will have different target audiences, some will be equalized and modified to be played primarily on low-cost or portable phonograph units, while others are intended for listeners with audiophile-grade equipment.



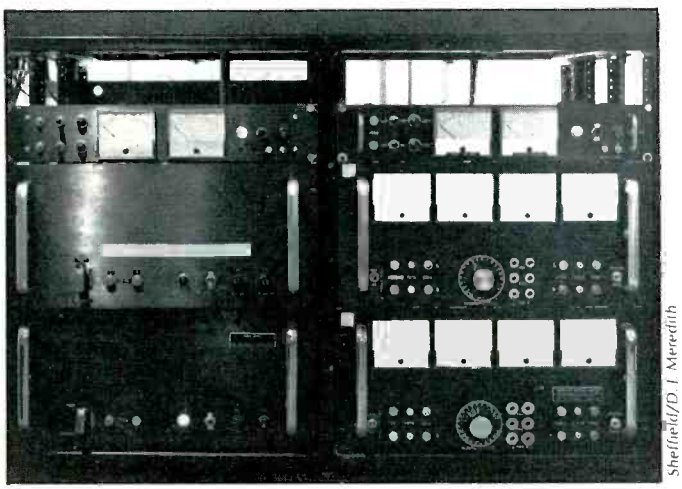
Sheffield Records/D. I. Meredith

5 The completed two-channel master tape, which now includes all effects and equalization, is taken to a disc-mastering facility (some studios have their own) for the disc-cutting operations. Here the blank lacquer on which the disc will be cut is being extracted from its protective packaging. The lacquer is actually an aluminum disc covered with an extremely flat, mirror-smooth coating of lacquer material and is somewhat larger than a finished LP, between 13¼ and 14 inches. The outermost segment may be used to set groove depth, check for correct cutting stylus temperature, or other tests before the actual cutting begins, and it will also become the folded rim which holds the stamper in place in the record-pressing machinery.



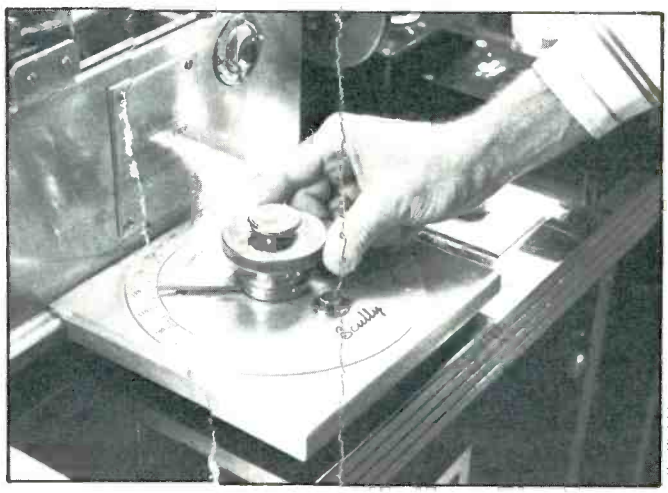
Sheffield/D. I. Meredith

6 The cutting lathe, here a Scully, moves the cutter head, a Neumann SX74 in this case, radially across the surface of the lacquer while cutting. Note the vacuum assembly attached to the lathe at the center of the lacquer disc; this holds the lacquer tightly to the platter surface.



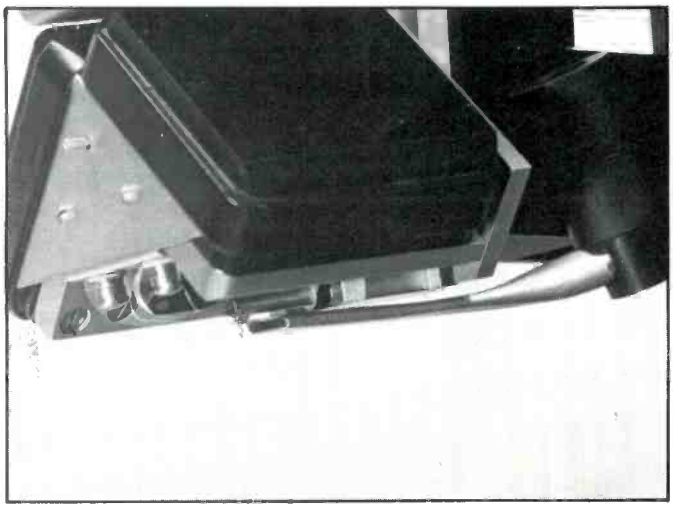
Sheffield/D. I. Meredith

9 The coils in the cutter head are powered by a stereo amplifier similar but not identical to a conventional high-power amplifier. Such cutting amps, which typically have about 200 watts per channel output, differ from conventional units in their capability to drive the highly reactive loads presented by the cutter heads. Shown are the cutting amplifiers and associated electronics at Sheffield.



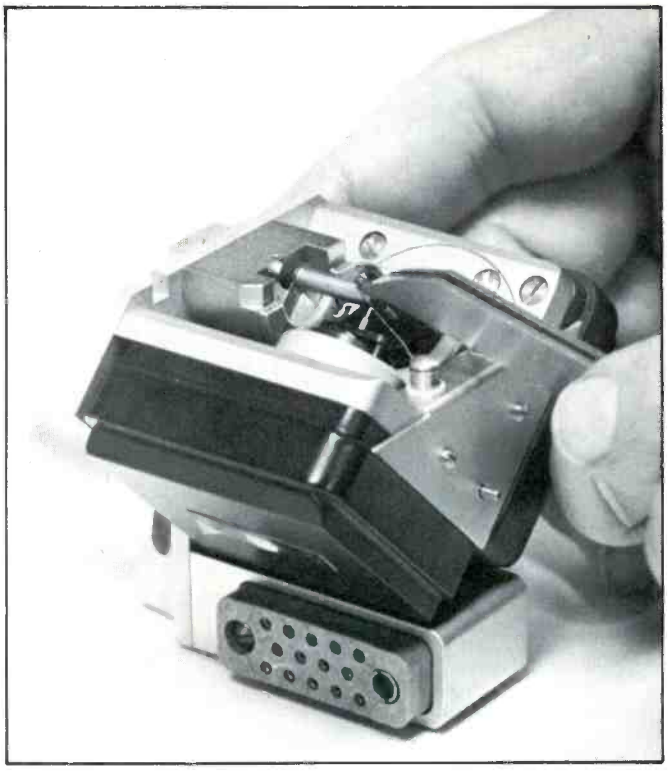
Sheffield/D. I. Meredith

10 During cutting, spacing between adjacent grooves is controlled by one or several means. On a direct-disc record, it must be adjusted by hand, as shown here, since the precise level of signal being cut onto the disc cannot be known beforehand, the cutting engineer must make an educated guess based on his recollection of signal levels during rehearsal, neither allowing adjacent grooves to cut into one another nor spacing them so far apart as to run out of cutting area. Discs cut from tape utilize a preview head which automatically adjusts groove spacing. Advanced versions employ techniques such as "groove nesting," cutting with very small distances between adjacent tracks based on computer analysis of groove modulation.



Sheffield/D. J. Meredith

7 A close-up of the cutter head, showing the cutting stylus with the two fine wires leading to the heating element, as well as the nozzle of the vacuum assembly which picks up the fine thread of lacquer created by the groove-cutting process.

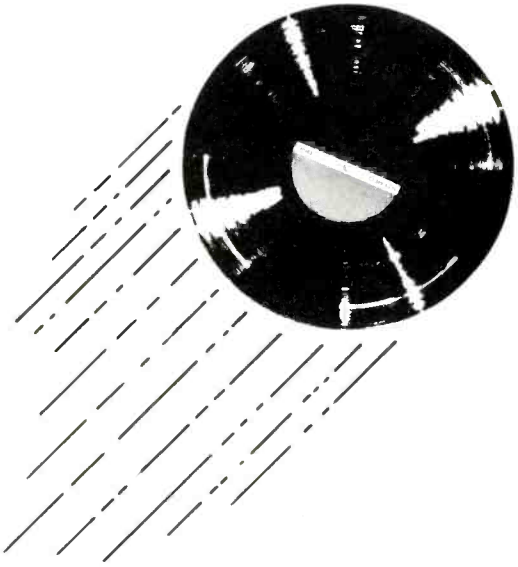


Sheffield/D. J. Meredith

8 The cutting stylus is installed in the cutter head by fastening the rear of the cantilever to the head assembly through a compliant rubbery mounting, much in the fashion of most moving-coil and some moving-iron phono cartridges. The head functions in much the same way as a moving-coil cartridge, but in reverse. Electrical current from the cutting amplifier flows through two coils attached to the stylus at 45-degree angles from the horizontal, and the coils are alternately repelled and attracted by two large magnet structures.

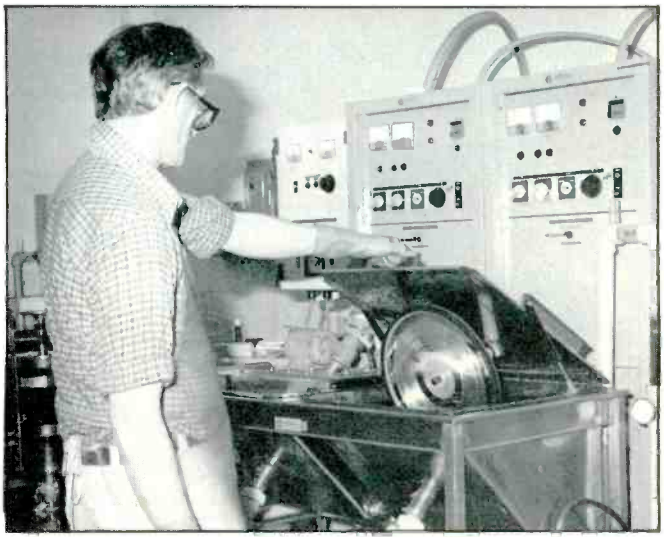
Sheffield/D. J. Meredith

11 After the finished lacquer is removed from the cutting lathe, the grooves have a tendency to "relax" or change shape slightly for the next few days so that many audiophile-disc manufacturers attempt to plate the lacquer within a few hours of cutting.



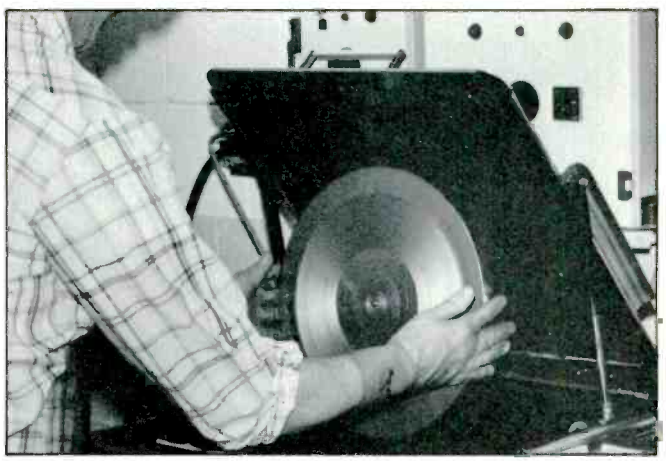
Sheffield/D. J. Meredith

12 The sequence of steps by which the lacquer is converted into metal stampers for the pressing machines is called the "matrix" stage. Here the lacquer is being silvered — coated with an extremely thin (about two molecules thick) layer of silver that is formed when three separate solutions are sprayed onto the surface of the lacquer. This silvering renders the lacquer electrically conductive so that it can be electroplated. The purity of the solutions and the skill of the operator doing the spraying strongly influence the sound quality of the final record.



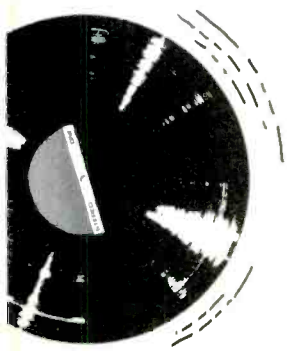
Sheffield/D. J. Meredith

13 The lacquer, now silvered, is put into the "bath," as technicians call the plating facility, where it acquires a heavy coating to nickel. The temperature of the solution, the purity of the water, and the speed with which the operator attempts to plate the disc all contribute to the final sound of the disc because of their effect on the plating process. Note that the lacquer is held on a platter-like support and spun while being plated, which prevents uneven build-up of metal on the surface. These plating facilities are made by Europadisk and owned by The Mastering Lab.



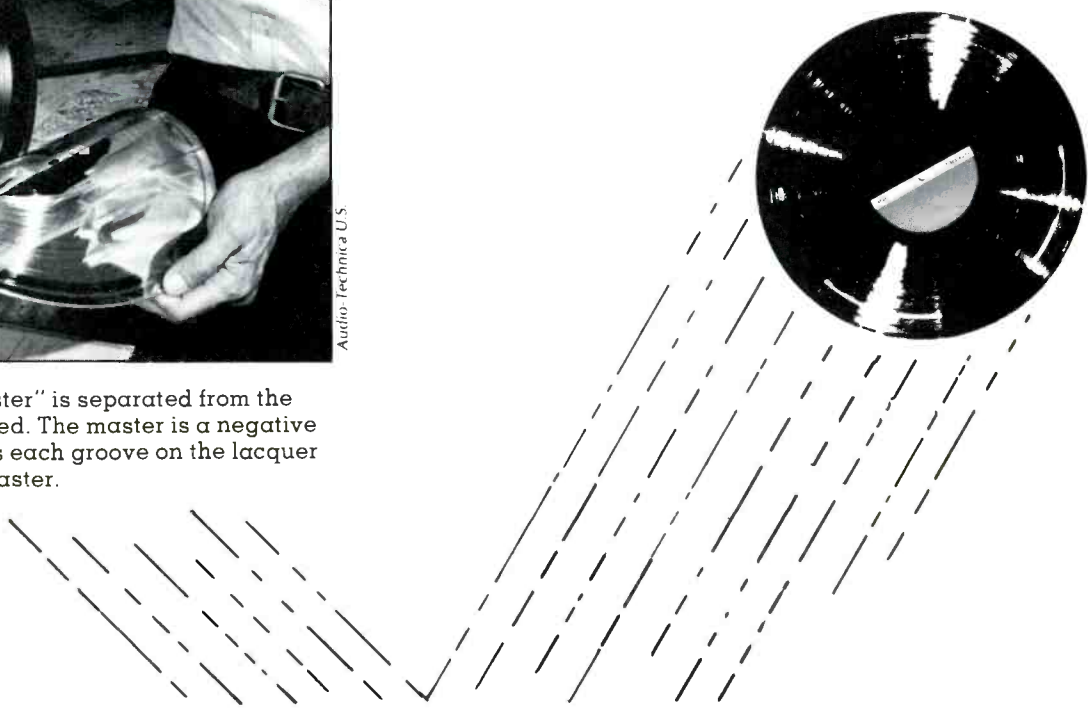
Sheffield/D. J. Meredith

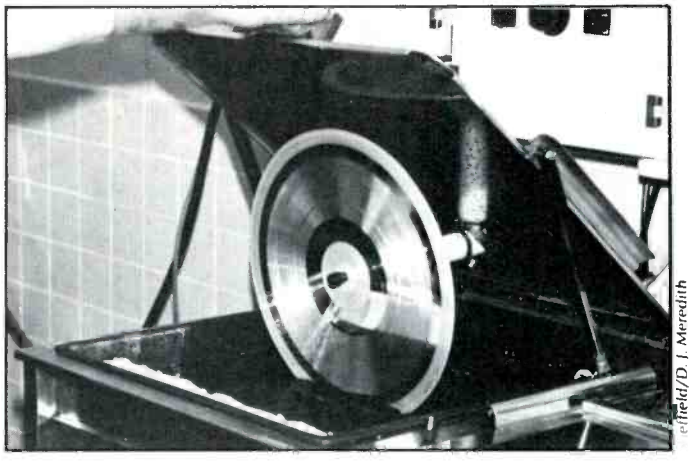
15 The nickel master is plated again, this time forming a metal "mother," which is a positive, that is each groove on the original lacquer now appears as a groove.



Audio-Technica U.S.

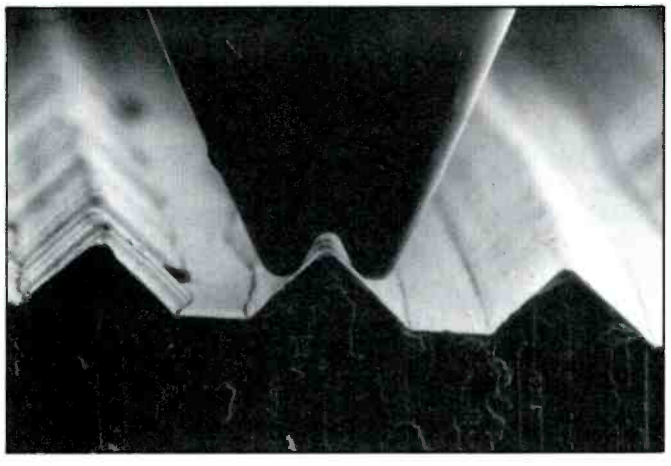
14 After plating, the nickel "master" is separated from the lacquer on which it was formed. The master is a negative of the original lacquer, that is each groove on the lacquer has become a ridge on the master.





Sheffield/D. J. Meredith

16 The metal mother is in turn plated, producing a second negative copy of the lacquer, which is called the "stamper." It is this copy which forms the molds for the record presses. Note that many copies, depending on the particular stage, can be made of each of the metal stages. Hit records produced in great volume may be pressed on any one of dozens of different stampers, taken from any one of several different mothers or masters, and with taped recordings, even the lacquer may be replicated.



Stanton Magnetics

17 While the negative copies of the lacquer cannot be played back using conventional equipment, both the mother and the lacquer can be, although playing usually ruins the lacquer. However, to check masters and stampers, a special turntable which turns in a counterclockwise direction and a notched-tip stylus, such as this one developed by Stanton, can be used.

K-M Records

18 After the edge of the stamper is crimped, it is mounted in the record pressing equipment by fastening it in place both at its rim, by the crimp, and near its center. A second stamper, which presses the other side of the disc, is installed in the upper mounting place of the press.

Audio-Technica U.S.

With a stamper mounted in the press and very carefully aligned with its matching stamper on the upper plate, the record-pressing phase is ready to begin. 19

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Unlike conventional amplifier circuits which drive only one terminal of the loudspeaker and fix the other terminal at ground, the Balanced Bridge drives both sides of the loudspeaker 180 degrees out of phase. Consequently, power supply voltages are reduced and the output devices are operated very conservatively. More important, this configuration results in a perfectly balanced design that is fully complementary and symmetrical from input to output.

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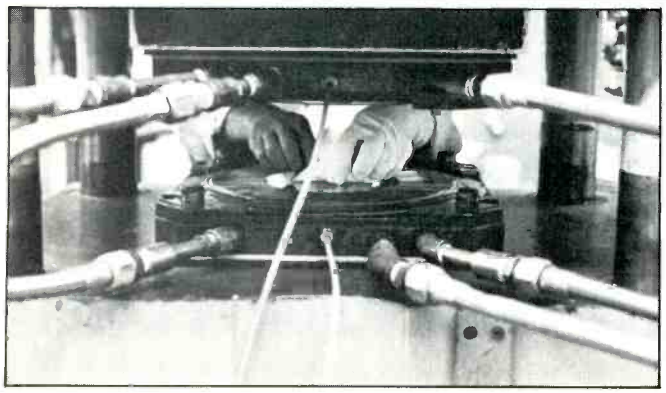
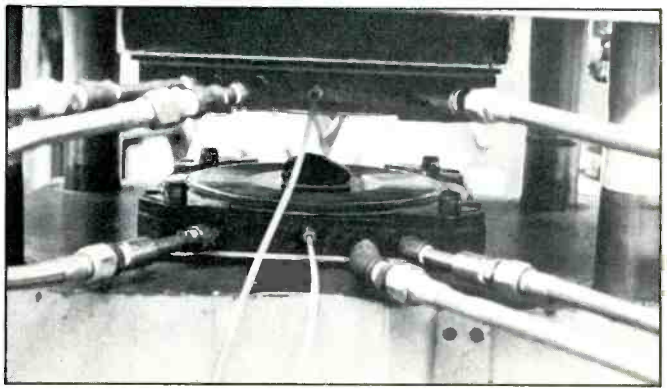


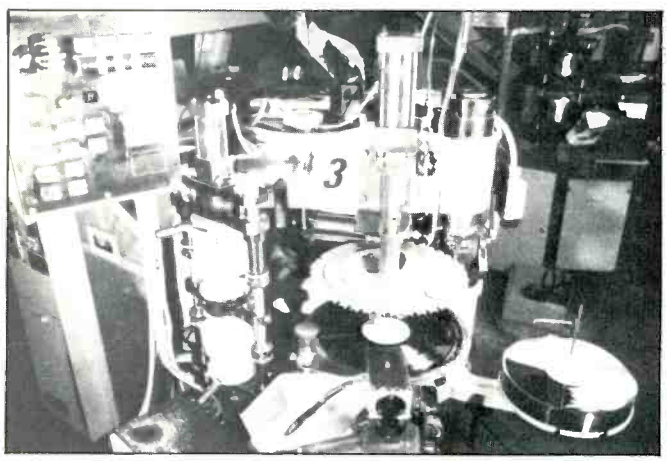
Audio-Technica U.S.

20A On a manually operated press, the operator places the lower paper label on the stamper first, and follows it with a "patty" or "biscuit" of vinyl, which has the consistency of soft putty. The patty is far too hot to handle without gloves, having been heated to about 350 degrees F. The upper label is the third layer of this sandwich. These operations are performed by automatic label and patty arms on an automatic press.



Audio-Technica U.S.

20B The patty of softened vinyl has been extruded out of another machine, then weighed automatically, and placed in the press. In its original form, record vinyl is either pea-sized pellets of virgin material or reground powder made from scrapped albums and excess plastic material. Rather than being pure polyvinyl chloride, most record vinyls contain lubricants that act as release agents so the finished disc doesn't stick to the mold, as well as an assortment of softer plastics, such as polyvinyl acetate, and stabilizers which keep the combination homogeneous at all temperatures. Another element in most disc vinyls is carbon black, an extremely fine dispersion of carbon particles which colors the material and is claimed by some to aid in heat transfer. A few makers have in recent years converted to the use of dyes to color the vinyl in an effort to reduce surface noise, although, like many points of record technology, the effects are debated by experts.

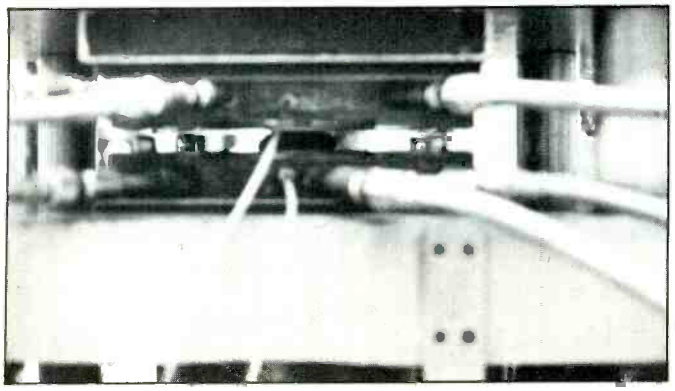


KM Records

23 A high-volume automatic press, such as this one at KM Records, performs the edge-trimming operation automatically, using the toothed wheel in the center of the photo.

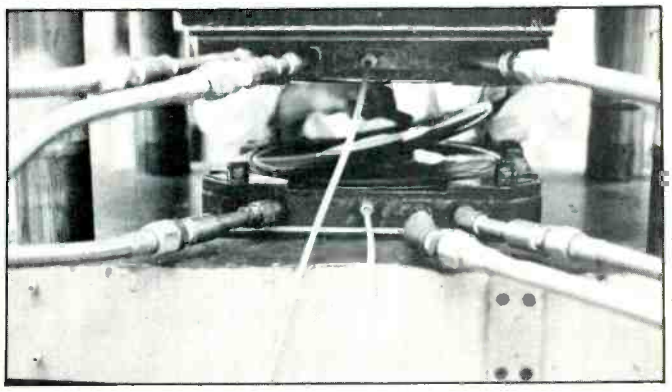
KM Records

24 The automatic press then stacks the disc on a spindle to cool, while an operator adds a sleeve to separate the discs every dozen records or so. When cool, the discs will be packaged and shipped without any further mechanical steps, save for random inspections.



Audio-Technica U.S.

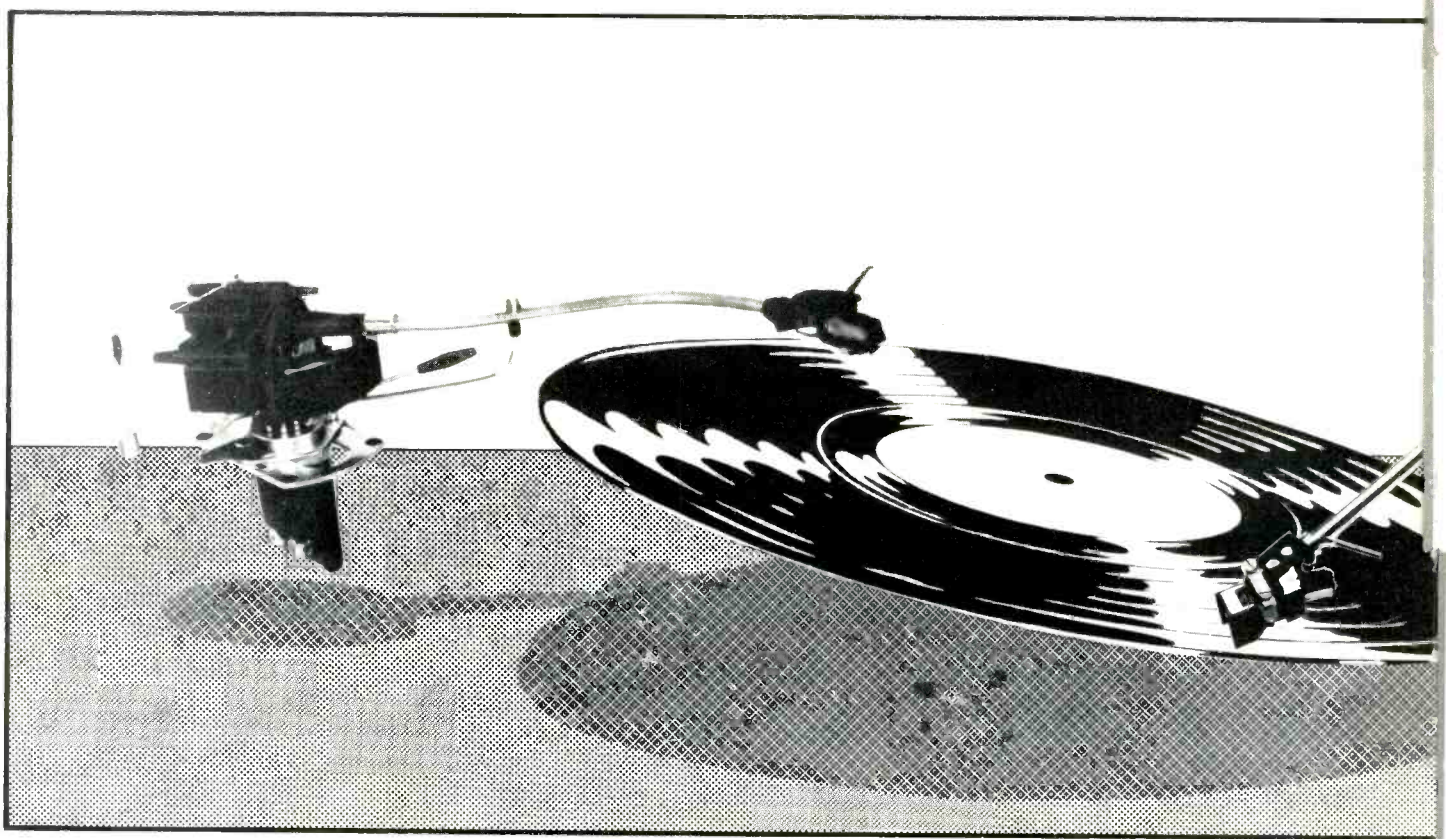
21 The press descends and compresses the patty to form the record. The press remains closed for a specified time cycle, typically somewhere in the range of 20 to 30 seconds, to assure that the vinyl has filled every part of the stamper completely. Both the temperature of the patty and the cycling time influence the exactness of the groove impression, as well as stresses in the vinyl which show up later as record warps. In the opinion of most experts, longer cycling times and hotter initial patty temperatures usually improve the final sound. Both must be balanced against production volume considerations, since a hot patty and slow cycling time reduce daily output of the press. This is one of the reasons for the higher retail cost of specialty discs.



Audio-Technica U.S.

22 After the press has been cooled by water, the finished disc is removed. At this point it is solid but still somewhat pliable and hence should be cooled while flat. The label has been attached without the use of adhesive, as heat and pressure fuse it to the record surface, while the center hole is formed by one or two center pins, depending on the particular machine. On a manual press, such as this one, trimming of the edge, which is oversized and has a lip of excess vinyl, would be performed on another machine.

Understanding



The function of a phono cartridge was described in an earlier article (*Audio*, March, 1979) in which the tonearm was assumed to be virtually ideal. Its only influence on cartridge performance was taken to be the effect of a single parameter, the equivalent mass. We can perform a similar exercise with tonearms, this time assuming the cartridge to be virtually perfect.

To understand the function of a tonearm and its contribution to the overall quality of a hi-fi system, it is necessary to remember one basic fact. Electrical signals are generated in the cartridge when, and only when, a relative movement occurs between the record surface in contact with the stylus tip and the surface on which the cartridge is mounted at the end of the tonearm. Such signals will be generated regardless of the cause of the relative movement.

To be strictly accurate, signals are generated when there is relative movement between the vibrating section (the armature) and the static sections of the transducer elements within the cartridge. However, if the cartridge is perfect, the stylus tip will move in a manner identical to the record surface so that an identical movement is transferred to the armature. Also, the static section of the generating elements will be rigidly connected to the end of the tonearm. Thus, a relative movement between the stylus tip and the end of the tonearm will generate signals, whether audible or inaudible (except induced signals such as hum or r.f. breakthrough.)

To analyze the performance of the tonearm and its contribution to audio quality, it is necessary to examine the effect on the tonearm of the various sources causing movement in a record playing system, and thereby to deduce the movement of the tonearm relative to the record surface. This analysis concerns the dynamic properties and includes what may be called the performance of the tonearm. But unless the cartridge is correctly aligned relative to the record, relative movement of the transducer elements will not be the same as the recorded signal. The tonearm also has static properties which make a contribution, and these causes are cartridge mounting and tonearm geometry.

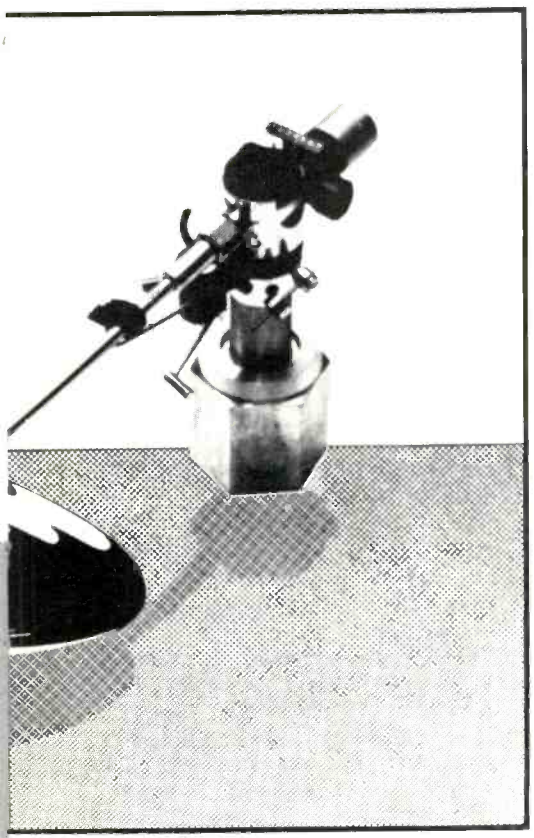
Illustration: Sandy Young

Tonearms

S. K. Pramanik

Engineer, R & D (Audio), Bang & Olufsen

Struer, Denmark



Cartridge Mounting

The cartridge is mounted on a tonearm in a fixture which in turn is mounted either permanently or so that it is removable at the end of the arm tube. Incorrect mounting can lead to two types of errors.

First, unless the cartridge stylus coincides with its designed position, the effective length of the arm is altered, leading to tracking error due to tonearm geometry.

The other error arises when the static transducer planes in the cartridge are not parallel to the planes of modulation on the record. This happens, for example, if the cartridge is mounted so that it is rotated on its horizontal axis. In this case, a small component of the signal from an undesired channel is picked up and mixed with the desired signal, as the relative movement of the generator elements is not identical to the signal engraved in the record grooves, as shown in Fig. 1. Since crosstalk is introduced, the stereo image suffers. The same result occurs if the transducer elements are rotated because the tonearm is incorrectly mounted; any other mounting error leads to the same result. In all cases the necessary correction may be applied at the cartridge.

For the best stereo image, the cartridge should be mounted to give equal separation in both channels. Rotating the cartridge on its horizontal axis will increase separation in one channel at the cost of separation in the other channel, but the rule about equal separation remains unaltered. Records themselves are often less than perfect, and the two channels may not be recorded at right angles or may be tilted with respect to the vertical. In such cases it is generally not possible to get the optimum degree of separation from the cartridge by conventional means.

Tonearm Geometry

The mathematics of the geometry for conventional or radial tracking tonearms has been known for many years and is well documented, most recently in a comprehensive article by Kessler and Pisha (*Audio*, January, 1980). It is therefore sufficient to repeat a few of the most important points here.

Distortion due to tracking error, the angular error between the cantilever axis and a true tangent to the record groove, is not dependent on the error angle alone, but also on the speed of the record groove moving past the stylus.

Figure 2 shows an arm of effective length (l), mounted at a distance (d) from the turntable spindle. The arm length is the sum of the mounting distance and the effective overhang. At a radius (r) from the center, the angle

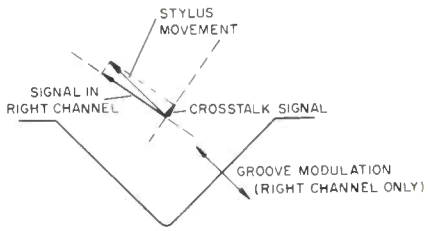


Fig. 1—Effect of crosstalk on stylus movement.

between the line connecting the stylus and the tonearm bearing and the tangent to the groove is (x), and the angle with the radius is (90 - x). By the cosine law of triangles:

$$d^2 = l^2 + r^2 - 2lr\cos(90 - x)$$

$$\text{or, } x = \sin^{-1}\frac{(l^2 + r^2 - d^2)}{2lr}.$$

If the offset angle is (y), then the angular tracking error is (y - x). The distortion due to tracking error at radius (r) is proportional to (y - x)/r. Distortion due to tracking error is quoted in specifications as the error factor, which is the maximum angular error over the recorded surface divided by the radius at which this occurs (degrees/cm).

Unless qualified, this specification is misleading as it fails to specify the limits of groove radii for which the arm is designed. While the maximum radius is effectively fixed by the outside diameter of the record, and in any case is less critical, a small change in the minimum radius considered can alter the calculated error factor of a tonearm appreciably.

The minimum modulated groove diameter is not the same on all records, as it depends on the playing time, groove width, etc., and in practice can

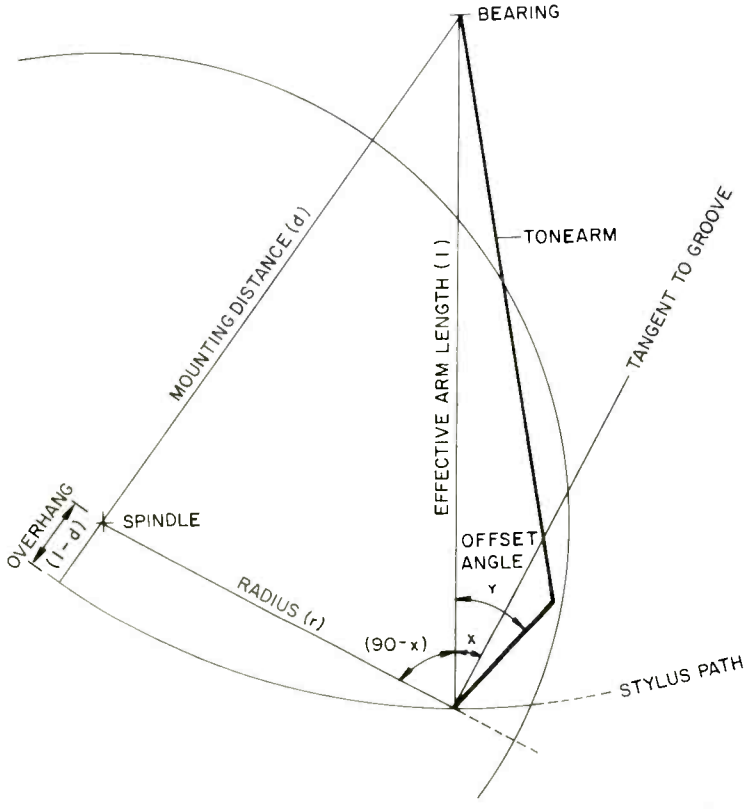


Fig. 2—Geometry of radial tonearm movement across a record.

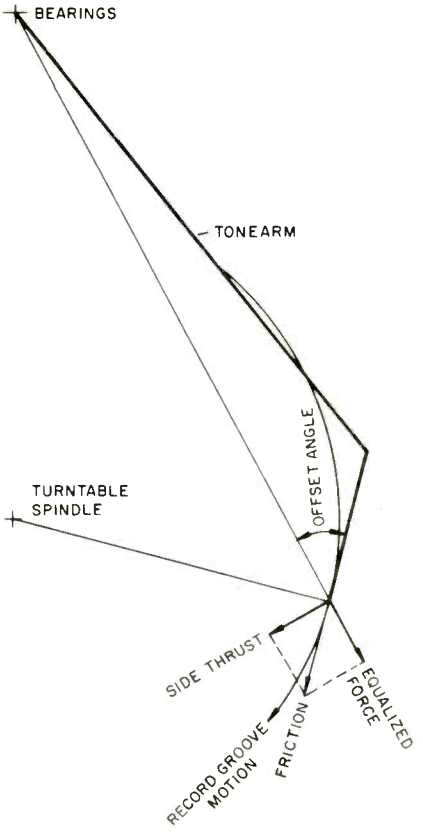


Fig. 4—Geometry of side thrust on the stylus tip.

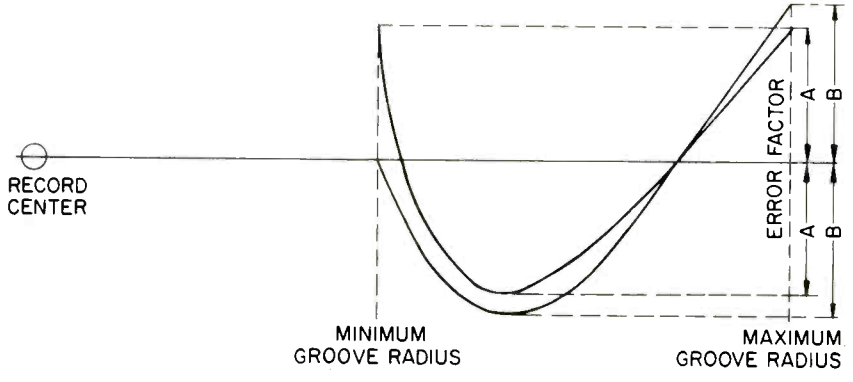
vary by 2 cm or more on commercial records. Further, although national standards for the minimum permitted groove radius do exist, the various world standards do not specify the same radius. In other words, arms can differ slightly in their geometries simply because the designers have assumed different values for the maximum and minimum limits of groove radii.

Another source of small differences in tonearm geometry can occur because of different design philosophies. An arm can be designed so that the error factor is equal at the minimum and maximum record diameters, as well as at the point of maximum error somewhere in between, as shown in Fig. 3, Curve A. One could with justification say that since tracking distortion also rises with modulation level, and most recordings have high modulation levels at the end of the record, tracking error at minimum radius should be zero, as shown in Curve B.

Small errors in mounting distance from the center of the platter or in overhang adjustment can make comparatively large differences in angular errors, as well as the groove radii at which maximum and minimum errors occur. It is therefore important that the arm support is mounted correctly relative to the turntable spindle and that the effective arm length with the cartridge mounted is correct. This also means that where overhang is adjustable, an arm can be optimized to track any particular record. If the minimum and maximum radii of the modulated grooves on the record being played are measured, optimum overhang can be calculated for the offset angle of the arm, and the necessary adjustment in effective arm length made.

Note, however, that distortion generated by tracking error consists mainly of second and higher order even harmonics, which are the least objectionable of the various types of distortion. Also, tracking error distortion increases and decreases smoothly across the record surface, and no sudden changes occur to make the distortion more obvious. Thus, for any correctly mounted rational design of tonearm, small differences in geometry do not give rise to large audible differences.

Fig. 3—Error factors for different tonearm layouts.



Side Thrust or Skating Effect

The expression "skating effect" goes back to the days when a smooth disc

small wonder

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was used to demonstrate this effect or to check the compensation applied. Since this method gives incorrect compensation, the term may also be said to be misleading.

Side thrust occurs due to the offset angle necessary for optimum angular tracking in radial arms. Friction between the stylus and the rotating record pulls the stylus in a direction tangential to the groove, as shown in Fig. 4. Since the force is not in line with the arm bearing, a rotating force is generated forcing the arm towards the center of the record. This force, called side thrust, depends on the instantaneous magnitude of the frictional force between the stylus and the groove walls.

In the absence of side thrust, pressure is equal on both walls of the groove at the points of contact due to the vertical tracking force (VTF), as shown in Fig. 5A. If side thrust acts in conjunction with the VTF, the two forces combine to give a result which

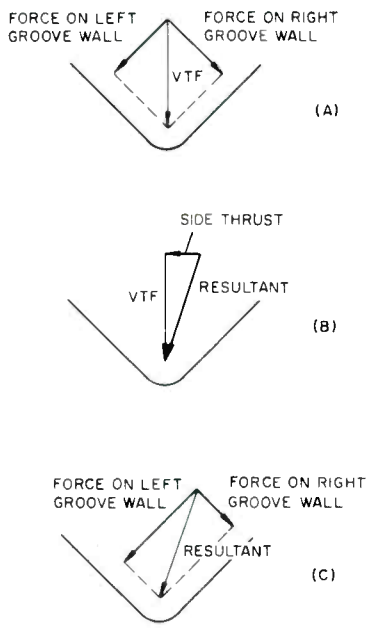

Fig. 5—Analysis of side thrust.

is not vertical but is inclined towards the center of the record, as shown in Fig. 5B. The effect of this inclination is that there is more pressure on the inner groove wall (left channel) than on the outer, as shown in Fig. 5C. It is obvious that where this happens the cartridge cannot have ideal working conditions. The effect of side thrust can be compensated by applying a force at the tonearm bearing. If an otherwise correctly mounted and adjusted tonearm distorts due to mistracking on the right channel only on high-level signals, the cause can be inadequate side-thrust compensation; mistracking on the left channel only indicates overcompensation. Side-thrust compensation can be applied in many forms and ideally should give exactly the same force outwards that side thrust causes inwards. Various methods are used in commercial applications, such as a thread and weight, springs, opposing magnets, etc.

It should be remembered that side thrust is affected not only by relatively constant factors such as the shape and polish on the stylus and by vertical tracking force, but also by the material from which the record is made and by such varying conditions as groove radius and modulation. Since side thrust varies more or less at random over the surface of the record, it can never be compensated exactly. A good compromise is to adjust compensation to cope with the highest level of modulation likely to be met on records. Although overcompensated for all lower levels of modulation, no mistracking will occur at any modulation level because the pressure will always be higher than the minimum required for the stylus to maintain contact with the groove walls.

Tangential Tracking

The conventional tonearm is pivoted on fixed axes to allow movement in the vertical and horizontal planes. Another approach to the design of tonearms is the tangential tracking tonearm.

In the tangential arm the horizontal bearing (which allows tonearm movement in the vertical plane) is a conventional bearing, but the vertical bearing is replaced by a carriage which moves as required to keep the cartridge tangential to the groove, as shown in Fig. 6. Such tonearms are also called parallel or straight-line tracking arms.

The most obvious advantage is that tracking error can theoretically be zero, and the cartridge is allowed to track the record with geometry identical to that when it was cut. In practice this advantage is less important than it might seem, as the errors in correctly designed and mounted radial tonearms are so small that a tangential tonearm provides only minor audible improvement. Also, small tolerance errors in mounting a tangential tonearm can lead to a constant tracking angle error over the whole of the record surface, virtually negating its advantages (a 1-mm error in length gives approximately a 1-degree error at minimum radius).

Assuming that the moving carriage functions ideally, the tangential arm offers two major advantages. Since the minimum length required by radial arms for adequate tracking becomes unnecessary, the tangential arm can be short and straight. The short arm weighs very little and leads to a fairly large reduction in the effective mass of the tonearm. Further, since the bearings are always directly behind the stylus in line with the cantilever, the frictional force at the stylus is taken up by the bearing. Thus, there is no side thrust under any conditions, and no compensation is necessary. The contact force on both groove walls provided by the VTF is the same over the whole surface of the record, and it does not vary.

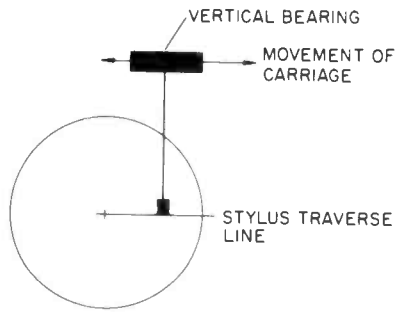

Fig. 6—Geometry of tangential tracking tonearm.

Many forms of tangential tracking can be devised, from the purely mechanical to contactless electronic servo systems. While the method used is a matter of engineering application, the requirement for the mechanism remains the same for all kinds of tonearm, i.e. that the mechanism should have no (or as little as possible) influence on the function of the cartridge.

Bearings

The primary requirement for the bearings is that they be free from friction, a force that always opposes motion. As the stylus tracks and the arm is moved inwards in a slow spiral by the groove acting on the stylus tip, friction in the vertical bearing (allowing horizontal tonearm movement) exerts a force attempting to stop the arm from moving. The outer wall of the groove must therefore exert a larger force to move the arm, resulting in a higher pressure on the outer groove wall (right channel) with a corre-

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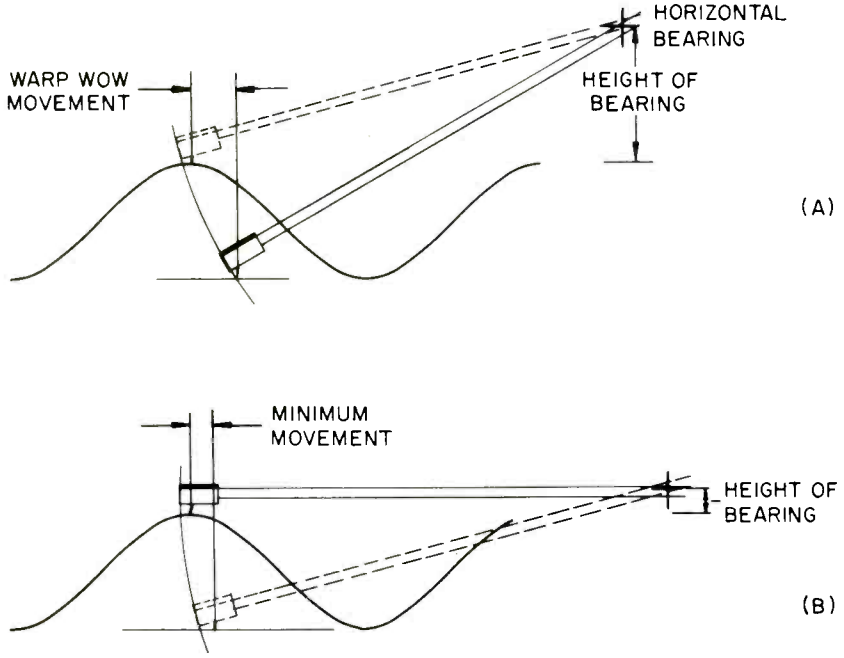

Fig. 7—Effect of different bearing heights on stylus movement with record warp.

sponding decrease on the inner wall. If a correctly mounted and adjusted tonearm mistracks on the left channel only on high-level signals, the cause can be friction in the vertical bearing.

If a record is eccentric, there will also be an outward motion of the tonearm for every half-rotation (if the eccentricity is very small, it may just compensate for the inward motion of the groove at that point with no net outward movement). On the other half-rotation the inward motion will be larger by the amount of eccentricity. Bearing friction will have the same effect, but the increase and decrease in contact pressure will alternate between groove walls.

Friction in the horizontal bearing (vertical movements) has a similar effect when tracking a warped record. In this case, however, the arm is stopped from moving with the warp, resulting in an increase or decrease in the effective VTF on both groove walls simultaneously, depending on whether the stylus is being forced up or down by the warp. The effect will also occur when the stylus is lowered onto the surface to play a record, with a consequent decrease in the effective VTF.

Undesirable effects also occur if there is play in the bearings. Such effects do not lend themselves to easy mathematical analysis, because they depend on the complex interplay between the design of the remainder of the tonearm and the amount and type of play. It can be seen that under the influence of external forces (such as friction) between the stylus and the groove, the whole arm will move. If the movement is in the line of the arm tube, it will result in wow, similar to warp wow explained below. But movement can also be sideways or up and down, with results which will depend on a combination of many factors. All that can be said in general is that the result will not be an accurate reproduction of the recorded signal, and the effect is likely to be unpleasant.

Two bearing types require a little elaboration. The first of these is called a knife edge, sometimes used for the horizontal bearing. The entire weight of the tonearm rests on the bearing "edge," which is supported in a suitably shaped slot. In bearings of this type, there is theoretically no friction; vertical movement of the tonearm results in one of the surfaces rolling on the other, rather than sliding. The rolling action will alter the effective length by a small amount as the end of the tonearm rises, but this can be used to advantage to compensate for warp wow. The other type of bearing is the unipivot, in which a single point, on which the arm rests, is used for both vertical and horizontal movements. While the complexities of the design are a subject in itself and cannot be discussed here, a correctly designed unipivot can provide extremely low friction with minimal side effects.

Finally, an important aspect of bearing design is a consideration of the lead wires from the cartridge. These have to pass through or around the vertical bearing, and they are attached to a point below the surface of the turntable base. As the tonearm moves horizontally, the lead wires twist and may generate torque to move the tonearm either inwards or outwards. Both the leads and their layout can therefore play an important part in overall performance and may even be a determining factor in the choice of the type of bearing used.

Warp Wow

The height of the horizontal bearing above the record surface is important for reproduction quality. As the tonearm moves up and down under the influence of record warps, the stylus moves in an arc with the axis of the horizontal bearing as its center. If the bearing is well above the record surface, as in the exaggerated sketch of Fig. 7A, the stylus will move forward simultaneously with its upward movement, and the speed of the record groove relative to the stylus will decrease. The effect is identical to a decrease in turntable speed, and it lowers the pitch of the reproduced signal. The reverse occurs as the stylus moves down the warp and the pitch returns to its nominal value. This variation in pitch due to the combination of bearing height and warped records is known as warp wow.

The ideal bearing position is at a height above the record surface equal to the height of warps, which results in minimum changes in relative speed, as shown in Fig. 7B.

The axis of the horizontal bearing can lead to another undesired effect unless it is perpendicular to the axis of the cartridge cantilever. As the tonearm moves up under the action of warps, the arm "twists" simultaneously with respect to the record surface, as shown in Fig. 8A. The result is a changing crosstalk pattern as the arm moves up and down, depending on the angle

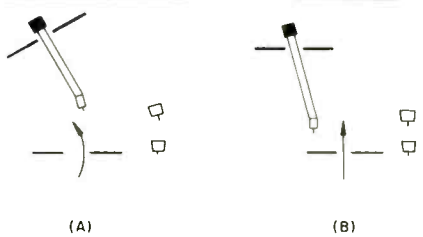

Fig. 8—Effect of undesired axis in the horizontal bearing on tonearm movement with warps.

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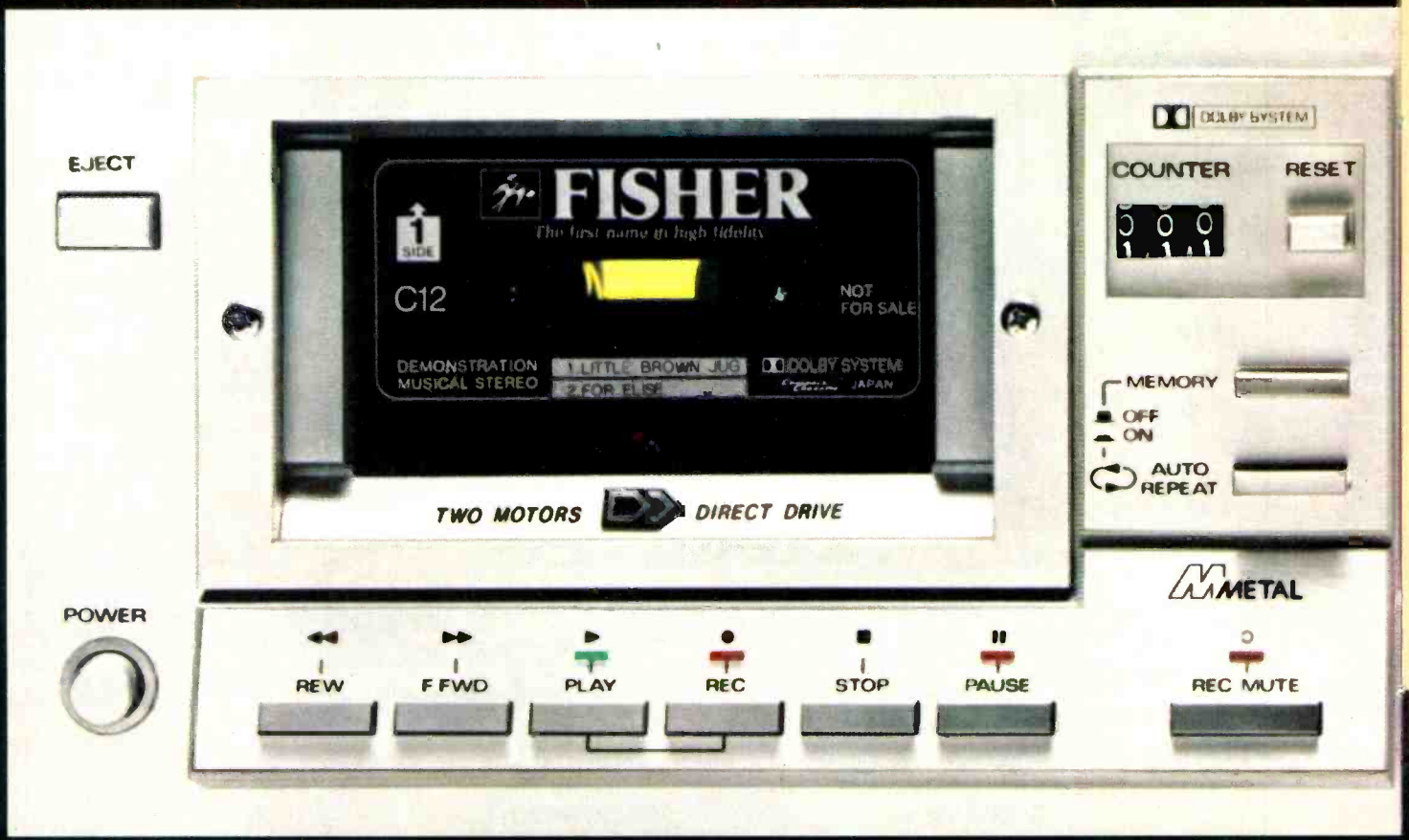

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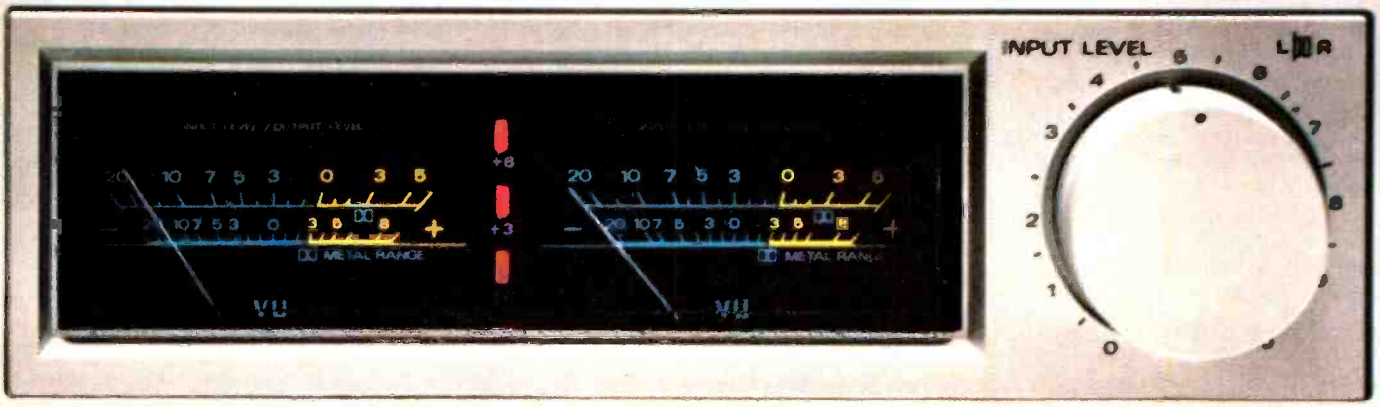


OUTPUT LEVEL

PHONES

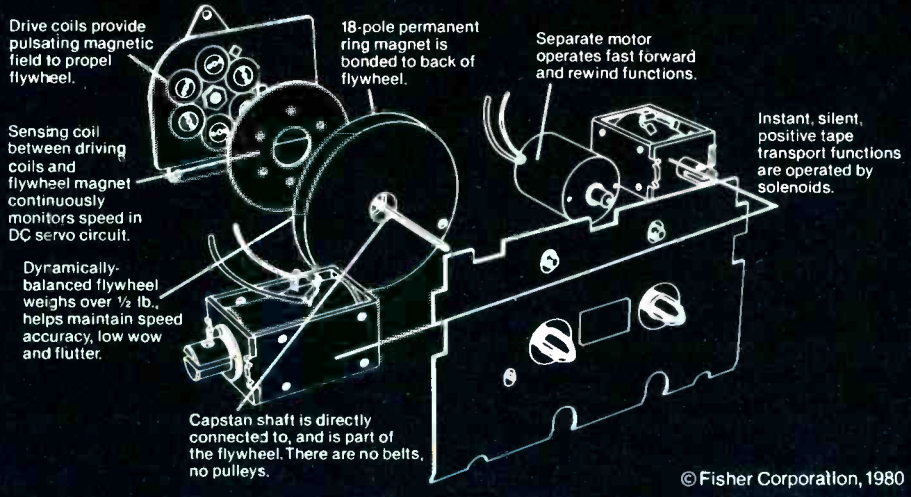
TIMER STAND-BY
REC OFF PLAY

DOLBY NR
OFF
MPX
ON ON OFF ON

TAPE SELECT
METAL NORMAL FeCr CrO_2 EQUIVAL

INPUT SELECT
LINE MIC

MIC
LEFT/MONO
RIGHT



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between the transducer elements and the record surface, and this leads to an unsteady or unstable stereo image. In an ideal case the horizontal bearing will be perpendicular to the axis of the cantilever so that the cartridge does not twist, as shown in Fig. 8B.

Equivalent Mass

For static balance, the mass of the arm tube, the headshell and mounting accessories, and the cartridge itself, which lie on one side of the horizontal bearing, must be balanced by a counterweight on the opposite side. The counterweight can usually be moved to first achieve perfect balance and to another position to supply VTF. In some designs, additional weights or springs are used to provide vertical tracking force, but these are ignored for the sake of simplicity in the analysis below.

Consider the arm of Fig. 9, consisting of a weightless tube and a cartridge of mass M including the headshell, etc., counterbalanced by a counterweight 10 times the mass of the cartridge, or 10 M. Then, if the distance of the cartridge from the bearing is 10 x units, the distance of the counterweight for perfect balance is x, or one-tenth of the distance of the cartridge. This arm has an inertia given by the various masses times the square of their distances from the bearing. Thus, the respective contributions will be:

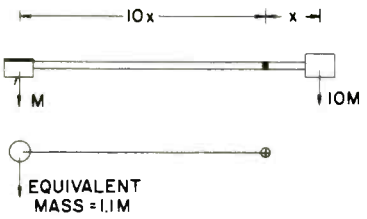

Fig. 9—Analysis of equivalent tonearm mass considers the length from stylus to pivot point (10 x) and length from counterweight to pivot (x).

Cartridge inertia
$= M (10 x)^2 = 100 M x^2$;
Counterweight inertia
$= 10 M (x)^2 = 10 M x^2$.
Therefore, total arm inertia
$= 100 M x^2 + 10 M x^2 = 110 M x^2$.

It can be seen that the contribution of the cartridge, although only one-tenth the weight, is much larger than that of the counterweight, because the cartridge is further from the bearing. Also, if a longer arm tube is used, the inertia of the arm increases as the square of the tube length (x), given the same cartridge and counterweight. Arm inertia can be lowered by reducing either mass or the length of the arm.

We can now introduce the concept of the equivalent mass of the tonearm. By Newton's second law of motion, force equals mass multiplied by acceleration, or acceleration equals force divided by mass. If we can find a mass which, when substituted for all the arm masses and placed at the stylus, will accelerate at the same rate as our arm when subjected to the same force applied at the stylus, this will be its equivalent mass. The equivalent mass can be calculated by the reverse process used for calculating inertia, since the distance of the cartridge was 10 x and inertia was $110 M x^2$.

Equivalent mass
$= 110 M x^2 / (10 x)^2 = 1.1 M$.

Note that the mass of the cartridge alone was M and that the calculated equivalent mass, 1.1 M, includes the contribution of the cartridge and the counterweight, but not of the rest of the arm. In a real case, similar contributions will be made by every component in the arm according to its mass and to its distance from the bearing. While the calculation will be more complex, it is based on the same principle.

It can also be shown that if a lighter counterweight is used, the equivalent mass of the arm increases. If the counterweight is used, the equivalent mass of the arm increases. If the counterweight mass is halved to 5 M for static balance, it will have to be placed at twice the distance from the bearing, or at 2 x. Then,

Equivalent mass
$= 100 M x^2 + 5 M (2 x)^2 / (10 x)^2$
$= 1.2 M x^2$.

Thus, the equivalent mass increases to 1.2 M by halving the weight of the counterweight.

The equivalent mass plays its primary role as a part of the vibrating system (as explained under tonearm resonance), but it also has a secondary role. For slow movements of the record surface, such as with track warps, the force required to move the arm depends on its inertia or equivalent mass. The higher the equivalent mass of the arm, the larger the force required from the record to push the arm up. Conversely, the larger the inertia, the larger the VTF required to pull the arm down to maintain contact between the stylus and the record.

Resonance

If a mass is suspended at one end of a spring (Fig. 10), 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 of rest. If the mass is displaced from its position of rest and released, it will oscillate at a frequency called its natural, fundamental, or resonant frequency. The resonant frequency (f), a function of the stiffness of the spring (k) and the suspended mass (m), is given by the equation:

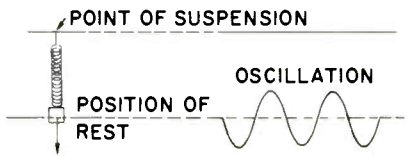

Fig. 10—Basic analysis of oscillation.

$$f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}.$$

The equation shows that resonant frequency rises for stiffer (or lower compliance) springs and for lower masses. If the point of suspension vibrates, the mass will also move, but the movement will depend on the oscillating frequency. The mathematical analysis of the phenomenon is known as the theory of forced vibration.

Below the resonant frequency, the end being oscillated and the mass move virtually together as if they were rigidly connected, and relative movement between the mass and the point of suspension is virtually zero, as shown in Fig. 11A.

With increasing frequency, amplitude of the mass increases but the movement of the mass follows a short time after the movement of the other end. The resonant condition occurs at the same frequency as for free oscillation, where the mass and the point of suspension move "out of phase." When the point of suspension moves down, the mass moves up, and vice versa. Relative movement between the mass and the point of suspension will be largest at this frequency and equal to the sum of the amplitudes of the forcing vibration and the resonance movement, as shown in Fig. 11B.

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 remains completely still, even though the point of

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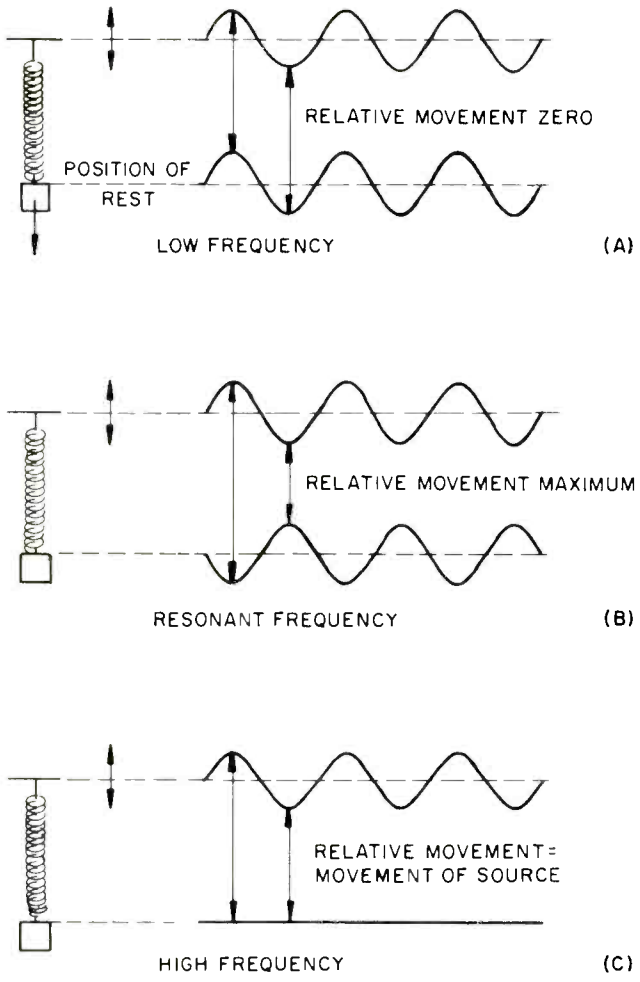

Fig. 11—Relative movement of the weight depends on the oscillation frequency.

suspension moves as vigorously as ever, as shown in Fig. 11C.

The relative amplitude of the mass is plotted in Fig. 12 against frequency, the amplitude of the point of suspension which forces vibrations being assumed to be constant. This is a very important phenomenon and can be used to explain many facets of performance in cartridges, tonearms, and turntables. Resonance phenomena occur wherever masses are connected by springs (all materials have some flexibility and mass); the only differences are the amplitudes and frequencies of the resonant modes.

Tonearm Resonance

All tonearms form a resonant system, with the equivalent mass of the tonearm acting together with cartridge compliance as the spring. This resonance may be called its primary resonance (also called bass, fundamental, or simply tonearm resonance), and in commercial systems available today, the resonant frequency generally lies between 5 and 25 Hz.

Applying forced-vibration theory to tonearms, it is seen that if the oscillating frequency is far below the resonant frequency, such as is caused by low-frequency warps and similar faults in the record, both the stylus of the perfect cartridge and its tonearm faithfully follow the record warps. There is no relative movement between the record and the tonearm so that the electrical output is zero. The cartridge suspension acts as if it were a rigid connecting member, and the only force exerted by the record is that required to move the equivalent mass of the arm. This is one of the advantages of a tonearm with a low equivalent mass.

At frequencies far above the resonant frequency, such as at the audio frequencies of the signal on the record, the tonearm does not move. Stylus movement is transferred directly to the armature and converted to an electrical signal. The primary resonance of the tonearm has no influence on cartridge performance.

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 tonearm movement can be many times larger than the stylus movement. The large relative movement between the tonearm and the stylus produces a peak in the frequency-response curve at the resonant frequency. Response on either side of this peak will fall at 12 dB/octave below the resonant frequency. A typical response curve is shown in Fig. 13.

The movement in a direction opposite to that of the record can be so large that the cantilever cannot move the required distance, and contact between the record and stylus is lost. In less violent cases, tonearm vibration results in changing VTF at a rate corresponding to the resonant frequency, with unpredictable effects on cartridge tracking.

Another undesirable effect is the accentuation of rumble. Signals generated in the cartridge at low frequencies are boosted by up to 20 dB in the phono preamplifier because of the replay equalization necessary to compensate for recording characteristics. Any rumble present in the turntable or on the record will first be amplified by the tonearm resonance and then boosted by the record equalization. Also, the presence of a large subsonic signal induced in the cartridge by the movement of the tonearm at its resonant frequency can modulate the audio signal and create intermodulation products. These distortion products cannot be removed by any later process once they are generated.

The effects of the primary tonearm resonance are minimized if its frequency is at a point where warp frequencies seldom occur and amplitudes are small. Studies made of the distribution of warps in phonograph records show that the majority of warps lie at frequencies below 10 Hz. It is therefore logical to design the tonearm resonance to lie well above this frequency.

However, if the resonant frequency is too high, the electrical output of the cartridge will be influenced by audio frequencies, resulting in a boost at the lower end of the audio spectrum. A tonearm resonance well above 10 Hz, but below the recorded audio signal frequencies, demands not only a light tonearm and cartridge, but a cartridge compliance that is closely matched to the equivalent mass of the tonearm.

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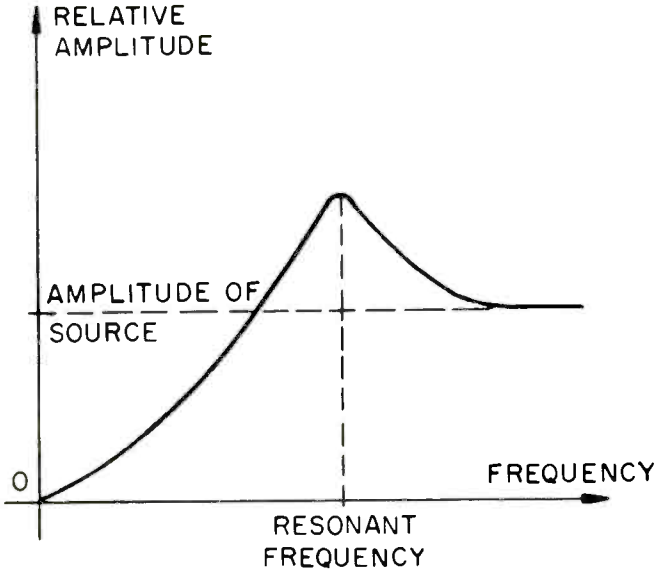


Fig. 12—Amplitude of the mass versus frequency, with the amplitude of the source held constant.

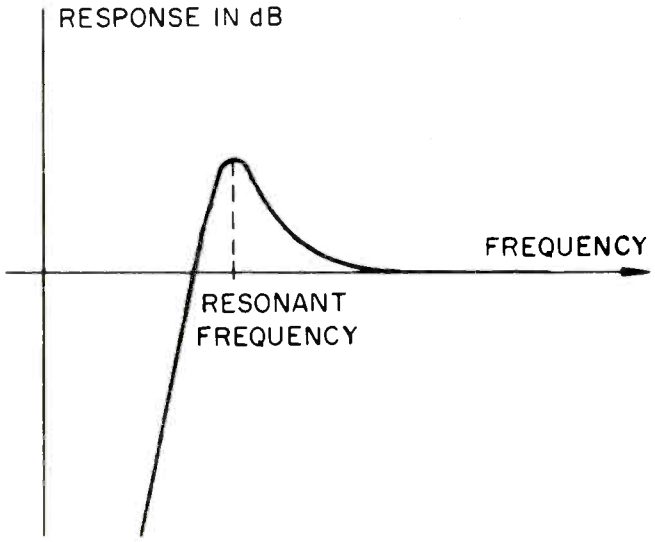


Fig. 13—Typical tonearm-cartridge resonance curve.

a flexibly mounted counterweight and damping the tonearm.

Flexible Counterweight Mounting

In the majority of tonearms the counterweight is rigidly mounted, but in some, a flexible mounting is used. Although a reduction in equivalent mass is often claimed when such a "decoupled" counterweight is used, the actual explanation is more complex. To understand what happens, the properties of a "dynamic absorber" must be examined, which is an extension to the forced vibration theory explained above.

If the mass in Fig. 10 is divided into two parts that are rigidly connected, the resonance phenomenon will be unchanged from that explained in the theory of forced vibration. However, suspending one of the parts flexibly below the other results in the system shown in Fig. 14A. It can now be seen that there are two resonant systems, the first or main mass on the first spring, while the second mass, which is called the dynamic absorber, has its own natural resonance when the main mass acts as the forcing source. The equivalent tonearm with a decoupled counterweight is illustrated in Fig. 14B.

At frequencies far below its own resonant frequency, the mass will act as if it were rigidly connected to the point of oscillation and will move together with it. If this frequency is also far below that of the absorber, it will also move together with the mass. By the same argument, at frequencies far above either resonant frequency, both the mass and the absorber will remain still. Thus, at frequencies not near either resonant frequency, the system acts as if both the mass and the absorber were a single mass and as if the second spring did not exist. Extending this result to a tonearm, it can be seen

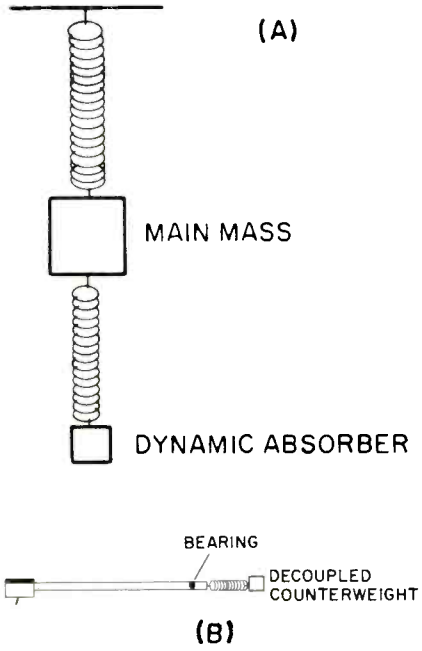


Fig. 14—Analysis of oscillation in a tonearm with a decoupled counterweight.

that a flexibly mounted counterweight has no effect on resonances at frequencies far below or above the natural resonant frequencies of both the tonearm and its counterweight.

If the individual resonant frequencies of the main mass and the absorber are identical and the forcing vibration operates at this frequency, the main mass will not move since all the energy supplied at the point of oscillation of the main mass is being used to move the damper. Relative movement between the point of oscillation and the mass is the same as the movement of the point of oscillation alone, and relative movement is zero. Extending this result, in the case where the resonant frequency of the counterweight is identical to the tonearm, there will be peaks in the response below and above the natural resonant frequency of the tonearm.

A typical response curve for an arm with a decoupled counterweight, with

Introducing the new Dual 839 cassette deck.

Consider what it would be like to own one.

The new Dual 839 is so different from all other cassette decks that, rather than list its many features, we'll guide you through them as if the 839 were in front of you.

First, the 839 is bi-directional in record and playback. This doubles the length of every cassette.

You'll notice there's no door between you and the cassette compartment. Insert a cassette and it will lock in precise alignment. That's Dual's Direct Load and Lock system. (A subtle but important touch; any slack in the tape is immediately taken up.)

Follow us carefully on this next one. Even when the tape is in motion, you can pull it out and replace it with another . . . and the previous mode resumes automatically. Useful? When the tape nears the end at a crucial moment, you can have a new tape in place without missing a beat.

The 839 is just as innovative in playback. If a tape made on another deck is too sharp or too flat, no problem. Playback pitch can be varied over an 8 percent range.

And previously recorded tapes with clicks, pops and disc jockey interruptions can be cleaned up electronically—smoothly and permanently. Dual's fade/edit control lets you do that with complete confidence, because it functions in playback.

Back to recording. The peak-level LED indicators react faster than any other metering system. And more accurately, because they're equalized. They read the full processed signal—including the high frequency boost other decks add but only Dual reads. No more risk of overloading a tape into distortion.

There's still more. Much more. Full metal record and playback. 6-way bias/equalization. Two-motor, twin-capstan drive system. Computer logic solenoid-activated controls. Switchable multiplex filter. Switchable limiter. Line/mic mixing. Two-way memory stop with automatic replay. Headphone level controls. And operation by external timer or optional wireless remote control.

What about the 839's audible performance? The specifications can give you a hint. Wow and flutter ±0.03 percent WRMS. Frequency response from 20 to 20 kHz, ±3 dB. Signal-to-noise better than 69 dB.

Of course, there's a price for all the 839 offers. $850. If that seems to be more deck than you really need, there are three other new Dual cassette decks. They start at $330, and they all feature the Direct Load and Lock system, DC servo motors, twin-belt drive systems, tape-motion sensor/protectors and equalized meters.

For complete details on all four Dual cassette decks, please write to us directly. United Audio, 120 South Columbus Avenue, Mt. Vernon, NY 10553.

Dual

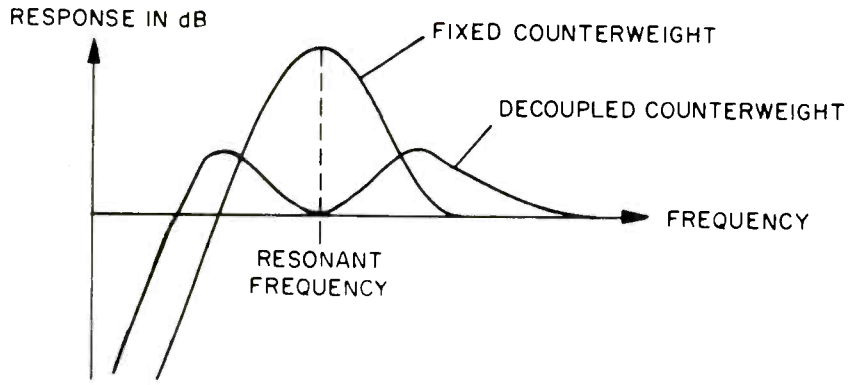


Fig. 15—Typical tonearm-cartridge resonance curve when the tonearm has a decoupled counterweight.

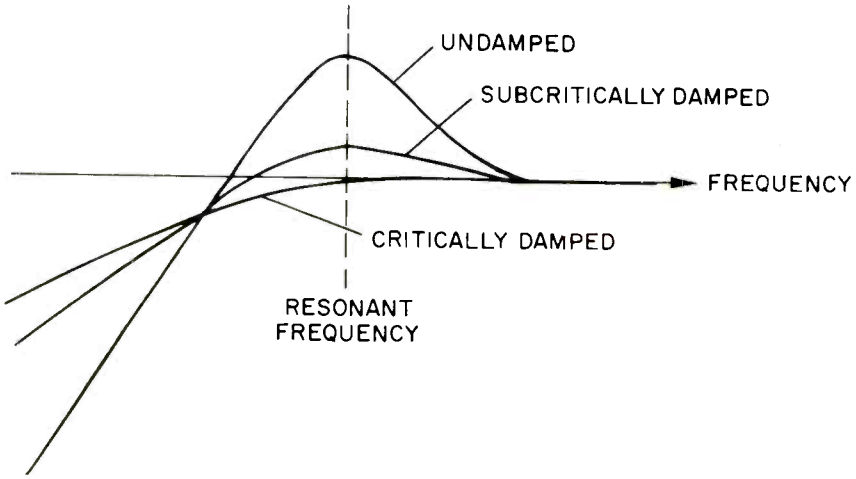


Fig. 16—Effect of bearing damping on tonearm-cartridge resonance.

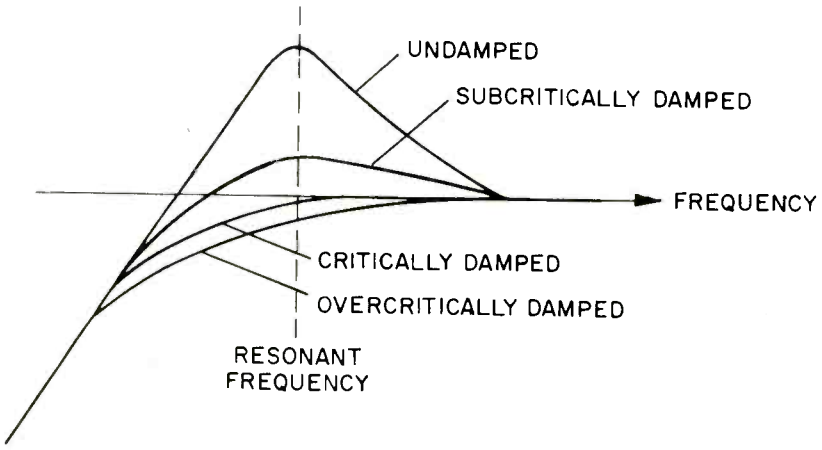


Fig. 17—Effect of damping which "tracks" the record on tonearm-cartridge resonance.

suspension tuned to the tonearm resonance, is shown in Fig. 15. There is a major advantage in that the peaks have smaller amplitudes, and at least the higher of the two resonances can be placed at a safe frequency near 15 Hz. The disadvantage is that the lower resonance extends the system response below that of the conventional arm, although damping can be added to prevent this. It can be seen, however, that critical matching between the tonearm, the counterweight, and the cartridge is required for the system to function correctly.

The case where the resonant frequency of the absorber is well below that of the main mass is unlikely to occur, because it implies a counterweight suspended more flexibly than can be tolerated in a practical tonearm.

If the resonant frequency of the absorber is well above that of the mass, the mass will begin to oscillate in the frequency region where the absorber is rigidly connected to the mass. Main resonance effects are therefore unaltered. At the higher absorber resonant frequency, the mass remains still so that no forces exist to move the absorber. The net result is a system identical to the single mass system.

Many tonearms with decoupled counterweights have a stiff rubber suspension, providing a resonant frequency appreciably higher than the tonearm resonance. Such arms are obviously not helped by counterweight decoupling but, in fact, may add to unpredictable and undesired resonances in the audio bandwidth. This is always a danger with any flexible member in a tonearm.

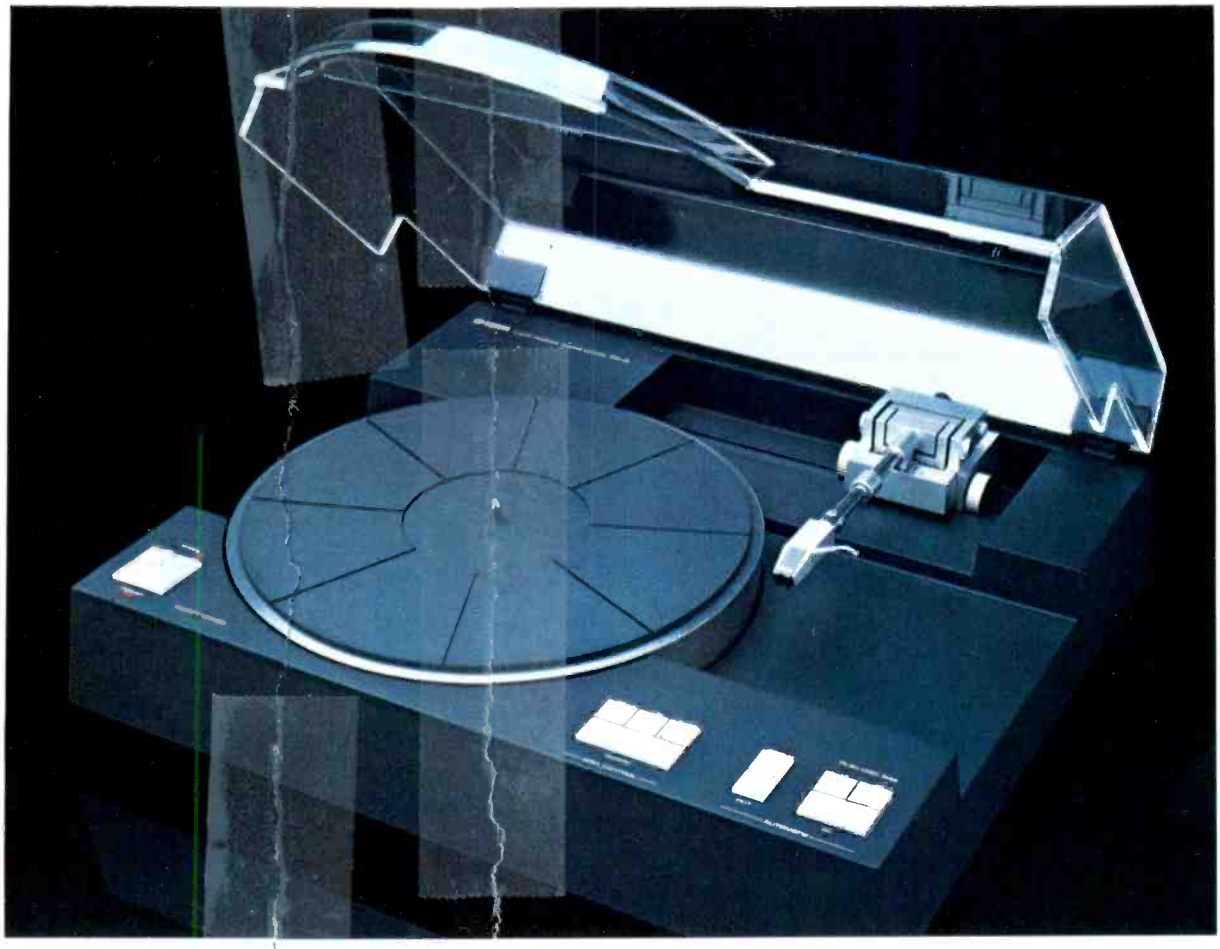
Tonearm Damping

Damping in a tonearm is usually applied at the bearing in the form of a piston moving in a viscous fluid. This form of damping applies a force proportional to the velocity of tonearm movement and opposes the movement. The out-of-phase movement at resonance is reduced at the cost of an extension of response below resonance. This means that the damped tonearm is more difficult to move below the resonant frequency, as shown in the response curves of damped and undamped tonearms of Fig. 16.

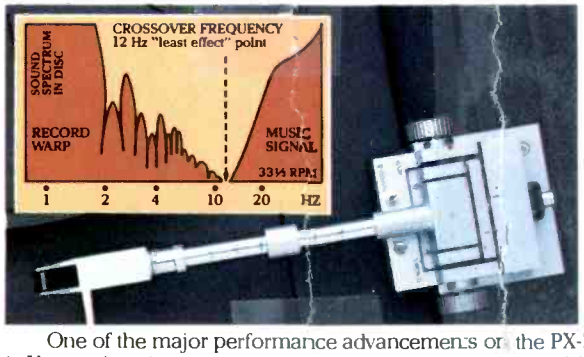
Another method is to apply damping between the tonearm and the record. A pad or brush which tracks the record is connected to the rest of the tonearm through a viscous link. If this method is used with a "critical" amount of damping, the tonearm resonance peak is removed without any extension of response below resonance. Critical damping is the amount that is just sufficient to flatten the resonant peak, but not so much as to cause a fall in response curve above the resonant frequency. Response curves for various amounts of damping are shown in Fig. 17.

Theoretically this is the ideal condition, but in practice it may function less than perfectly. This method is dependent on the tracking of the member resting on the record surface, which can add its tracking forces to those of the stylus and effectively change the tracking conditions for the

Yamaha's PX-2 linear tracking turntable. A class of one.



Yamaha's new PX-2, the flagship of a remarkable new series of turntables from Yamaha, is destined to become the new standard of the audio industry. It is a masterpiece in the art of music reproduction. Totally in a class by itself.



One of the major performance advancements on the PX-2 is Yamaha's unique optimum mass straight tonearm assembly. This design concept is Yamaha's direct challenge to the industry trend of low-mass tonearms. Among the most significant benefits of optimum mass is that it specifically addresses two of the most critical elements of music signal tonal quality—tonearm resonant frequency characteristics and high trackability with a wide range of cartridges. Tonearm mass is such a critical element in sound reproduction (especially in the low and high frequency ranges) that Yamaha has designed this optimum mass tonearm to insure its resonance frequency is at the "least effect" point. (See graph.) As a further benefit, the vast majority of available cartridges can be effectively matched with the Yamaha tonearm. Even MC types.

But the optimum mass tonearm is only one factor that puts the PX-2 in a class by itself. There's much more. Like an extraordinary 80dB S/N ratio, with incredibly accurate tangential tracking—constantly monitored by an opto-electronic sensor. The PX-2 is also a study in durability with its solid, anti-resonant monolithic diecast aluminum base. And the combined effect of the hefty platter and the heavy-duty DC motor depresses wow and flutter to below 0.01%.

Yet with all this performance, the PX-2 is deceptively easy to operate. All the microprocessor-activated controls are easily accessible—without lifting the dustcover.

The balance of the turntables in our new line (the P-750, P-550, P-450 and P-350) all incorporate this same optimum mass tonearm philosophy. Each will set new standards for performance per dollar invested.

Visit your local Yamaha Audio Specialty Dealer for a personal test of our remarkable PX-2 and the other superb turntables in our new series. You'll hear music that's truly in a class by itself.

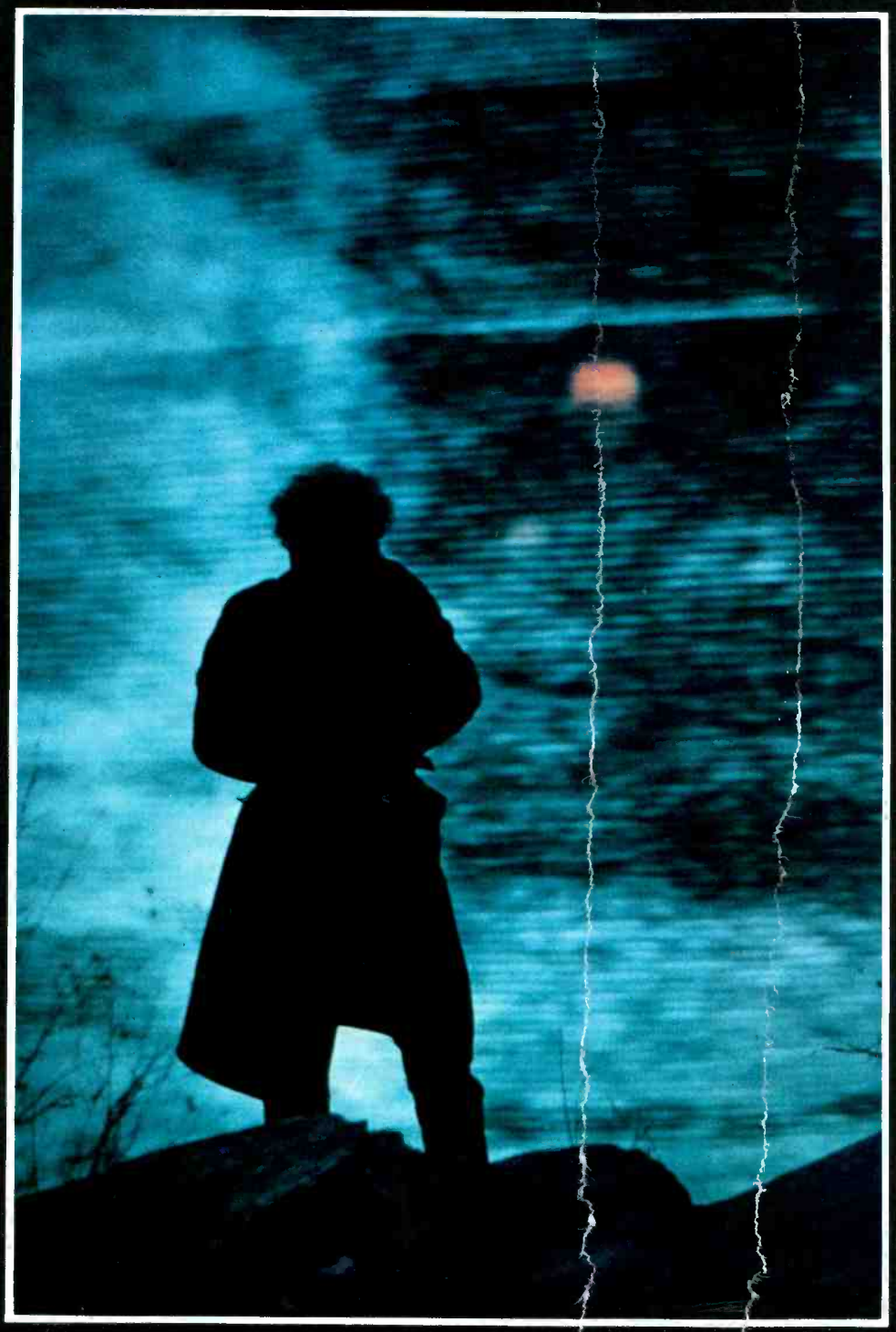
For more information write us at Yamaha, Audio Division, P.O. Box 6600, Buena Park, CA 90622.

*Yamaha cartridges shown (MC-1X and MC-7) on both models are optional.

YAMAHA

The secret of Onkyo.

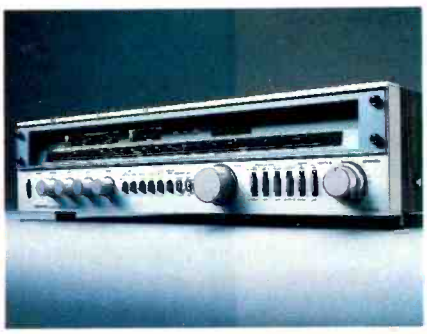
You'll find it in all four of our new stereo receivers.



Let Onkyo transport you to a world beyond electronics . . . to a world of more perfect sound. Where you'll hear music of such stunning purity and sensual richness, that you'll forget you're listening to an audio system.

That's the secret of Onkyo . . . and Onkyo's dramatic success. The unique ability to take you several steps beyond pure technology . . . to experience more exciting sound. And you'll find it all in our new stereo receivers.

■ The Onkyo TX-7000 Quartz-Locked AM-FM Stereo Receiver is an outstanding example. Both its power amplifier and FM sections



The Onkyo TX-7000

are rich with important new design concepts.

The TX-7000's power amplifier provides two major innovations never before present in a stereo receiver. The first is called Super-Servo and it totally eliminates the sonic "ghost signals" common to DC power amplifiers. As a result, each instrument and voice sounds purer and more individually real . . . regardless of volume level. Perhaps for the first time, you'll experience stereo with true depth, spaciousness, and a remarkably discernable third-dimension.

The second innovation is Linear-Switching which lets us provide Class A amplifier sound quality with Class B power efficiency. Crossover distortion is significantly reduced. And output power is very high and efficient . . . 90 watts per channel with no more than 0.02% Total Harmonic Distortion*.

The TX-7000's FM section is also clearly superior . . . picking up weak stations noiselessly and strong stations without distortion. Precise drift-free Quartz-Locked tuning is just one of the reasons.

A unique Human Touch Sensor automatically controls the Quartz-Locked system for more reliable and convenient operation . . . releasing the system instantly when it senses your touch on the tuning knob . . . then engaging it again as your fingers leave the knob.

Special circuits also monitor both left and right channels . . . detecting and cancelling out sound distorting FM signal noise. Other circuits remove interference noise from TVs and other nearby appliances.

Digital FM readout . . . separate bass, mid and treble controls . . . 2-way tape dubbing facilities . . . and dozens of other important features are all found in the TX-7000.

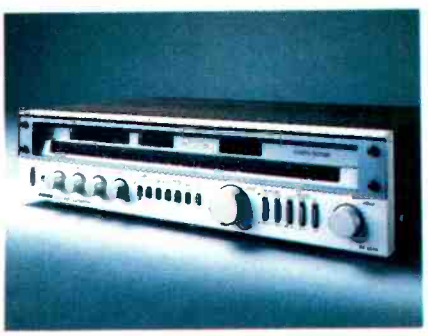
■ The Onkyo TX-5000 is equally impressive. Except for power, it shares virtually all of the sound improving innovations present in the TX-7000 . . . Quartz-Locked tuning with Human Touch Sensor control . . . Super-Servo circuitry for greater sound purity and depth . . . Linear-Switching for significantly reduced crossover distortion.

The TX-5000's output power is very high and efficient . . . 65 watts per channel with only 0.03% Total Harmonic Distortion.*

Both a digital FM frequency display and illuminated dial with pointer are provided. As are three meters, two tape inputs for tape-to-tape dubbing, and outboard signal processing facilities.

■ The TX-3000 provides many of the same innovations for truly superior sound . . . but here we use our unique Servo-Locked tuning system instead of Quartz. This system automatically fine tunes FM stations and keeps them fine tuned, regardless of the temperature and humidity variations that cause drift in conventional tuners and receivers.

Along with the TX-7000 and TX-5000 . . . the TX-3000 utilizes Super-Servo circuitry, Linear-



The Onkyo TX-5000

The Onkyo TX-3000

Switching and Human Touch Sensor. It delivers 45 watts per channel with only 0.04% Total Harmonic Distortion*.

■ The TX-2000 is incredible . . . in both performance and affordability. Its full array of advanced features and new design concepts provide a purity and realism of sound never before available in a relatively low-cost receiver.

The TX-2000 delivers 27 watts per channel with no more than

The Onkyo TX-2000

0.06% Total Harmonic Distortion*. It utilizes the same precision Servo-Locked tuning system with Human Touch Sensor that we use in the higher-end TX-3000.

■ Styling of all four new receivers is superb. Brushed silver metal with black, thick smoked glass front-mounted face plates, even rosewood-grained vinyl cladding on the metal chassis housings. An accessory case . . . as shown with the TX-3000 above . . . is available for all models as an optional extra.

■ Hear "the secret of Onkyo" now at your Onkyo dealer. Hear receivers so advanced, they transcend mere technology.

Onkyo USA Corporation
42-07 20th Ave., Long Island City
N.Y. 11105 (212) 728-4639

* Minimum RMS at 8 ohms both channels driven from 20 to 20,000 Hz.

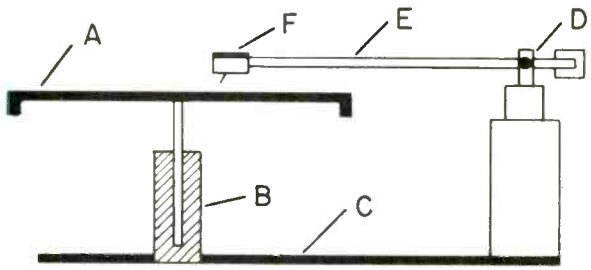


Fig. 18—Possible points of resonance (see text).

cartridge. It can also add resonances of its own or alter the frequencies and amplitudes of other resonances, which can be even less desirable.

Other Resonances

In discussing other resonances, it is insufficient to analyze the tonearm in isolation. Extending the argument stated in the introduction, it can be seen that undesirable signals can be generated due to any relative movement between the turntable platter and the tip of the tonearm (the cartridge is still assumed to be perfect). For example if the turntable platter does not run true, it will move up and down for every half-rotation. The effect is the same as a warped record.

Less obvious sources of relative movement are resonances, shown in Fig. 18, in the chain from the platter (A), the spindle and its bearing (B), the bearing support and its connection to the tonearm support (C), the tonearm bearings (D), the tonearm tube (E), and finally the mounting surface at the end of the tonearm (F).

No known material, either metal or plastic, is completely rigid, and therefore in physical terms every material always acts like a spring. Rigidity of any component can be increased by increasing the thickness of material used or by using suitable shapes with the same amount of material. Increasing stiffness without altering the distribution or size of the masses raises the resonant frequency but does not affect the amplitude. Each component in the chain has mass, and increasing the amount of material used increases its mass. Increasing mass without altering the stiffness of the components lowers the resonant frequency, but at the same time decreases the amplitude for the same external oscillation force. Each mass together with the elasticity of the materials in the chain form a resonant system, and, together with other resonances in the system, a complex series of dynamic absorbers, or to use the correct expression, a vibrating system with multiple degrees of freedom.

Conclusion

Provided all the masses and coefficients of elasticity are known (they can be measured or calculated), the resonant system can be analyzed. It should be remembered that the only point of interest is the relative movement between the turntable platter (hence the stylus tip) and the end of the tonearm. Such an analysis is only the starting point in a tonearm design.

Resonances and other factors can be traded off against each other, and the best design will be the best set of compromises for a particular application. In the final analysis, the matching of the tonearm to the cartridge and to the rest of the system will play an equally important part in the overall system performance, as will the design of the tonearm itself.

Sansui is breaking up a very successful relationship. The TU-717 has a new mate: The AU-719.

Sansui has just introduced an exciting new integrated amplifier, the AU-719. It represents the very latest developments in audio and electronics technology. It is so good, in fact, that it has replaced its rave-reviewed, best-selling predecessor as the partner of the TU-717 tuner.

The TU-717's performance has been extravagantly praised by professional critics and knowledgeable consumers alike. With advanced features like switchable IF bandwidth and specs like 81dB signal-to-noise ratio and 0.06% THD, it's only natural.

We expect the tuner's new mate to receive a tremendous reception and set industry amplifier standards for a long time to come. Here's why.

INTRODUCING DD/DC

What particularly distinguishes the new AU-719 amp is Sansui's patent-pending DD/DC (Diamond Differential/DC) circuitry that provides the extremely high drive current needed to reduce THD by adding large amounts of negative feedback without compromising slew rate or adding TIM.

Slew rate refers to an amplifier's ability to respond to rapidly changing musical signals. The slew rate of the AU-719 is an astounding 170V/μ Sec.

MAGNIFICENT MUSIC

Many modern amplifiers have extremely low total harmonic distortion specs. And that's important. But THD is measured with steady test signals and is not really representative of an amp's ability to deal with music. Sansui alone, with it's DD/DC technology, is able to provide both low THD and lowest TIM simultaneously. Instead of the harsh metallic sound you sometimes get on a conventional amp when the musical signals are complex, with the AU-719 you hear only magnificent music.

THD is less than 0.015% at full rated power of 90w/channel, min. RMS, both channels into 8 ohms from 10 - 20,000 Hz. Overall frequency response is awesome: DC - 400,000 Hz, +0, −3dB. Hum and noise are a super-silent −100dB on aux and −88dB on phono. The phono equalizer, which adheres to the standard RIAA curve within ±0.2dB from 20 - 20,000 Hz, also uses our unique DD/DC circuit for record reproduction that's second-to-none.

CONTROL YOURSELF

The unit is equipped with a full complement of versatile controls and connections to create the system and sound that's right for you, including two phono and two tape inputs, defeatable tone controls with switchable center frequencies, deck-to-deck tape dubbing and a very convenient 20 dB muting switch.

Audition the new AU-719 and matching TU-717 at your authorized Sansui dealer. We think it will be the start of a very successful relationship.

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Now there are two approaches to low THD.

Ours gives you better sound.

Harman Kardon introduces low negative feedback design. High Technology Separates with low THD *and* inaudible TIM— for incredibly clean, open sound.

For the last few years, audio manufacturers have been rushing to bring you newer, lower THD (Total Harmonic Distortion) levels in their amplifier sections. And every year, they've accomplished this objective the simplest way they could. By adding more and more negative feedback, a form of electronic compensation that feeds the amplified music signal back through the circuit.

Unfortunately, this universal "cure" for THD—high negative feedback, typically 60-80 dB—creates a new form of distortion. It's called Transient Intermodulation Distortion, or TIM. And it's much more audible than THD. TIM causes music to become harsh, metallic and grating. And the spatial relationship of the instruments to become vague, smearing the image.

At Harman Kardon, our new 700 series amp and preamp give you low THD figures, too. But we did it the right way—by properly designing the amplification circuitry to deliver low THD even before we apply negative feedback. That keeps our negative feedback at just 17 dB. And our TIM level at just .007%. Well below the audible threshold.

The result is pure, clear, transparent sound and stereo imaging that places instruments and vocals precisely.

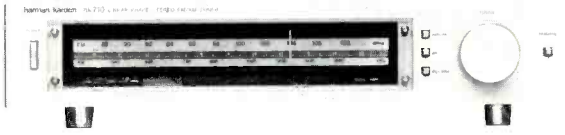
Beyond TIM.

Of course all the Harman Kardon components incorporate our traditional ultrawideband design, which provides fast transient response and phase linearity. We also use discrete components instead of integrated circuits, because ICs create their own IC distortion.

But beyond these major design considerations, we've also paid attention to all the small details.

In the hk725 preamplifier, for instance, we used fixed resistor pushbuttons for tone controls. They introduce less distortion than rotary knobs. We also incorporated DC coupled FET front ends in both our 8-stage phono section and our high level stage. Again, less distortion, and improved signal-to-noise ratio.

On the hk770 power amplifier, we used two separate toroidal power supplies, which eliminate cross-talk and hum. And DC coupling which provides tighter, more articulate bass.



Performance matched separates.

Once we designed the heart of our new 700 series High Technology Separates, we addressed the remaining components just as carefully.

The hk715 digital quartz-locked tuner gives you a full complement of features. It locks in to the channel center every time. And stays there, drift-free. It also has a memory subsystem that lets you store up to 8 stations and recall them instantly at the touch of a button.

We designed a linear phase analog tuner as well. The hk710. With an improved version of the phase-locked circuitry we introduced to the industry nearly 10 years ago. It remains the industry standard today for quality tuners.

The first cassette deck with Dolby* HX.

In 1970 Harman Kardon introduced the first cassette deck with Dolby NR. In 1980, we're bringing you the first cassette deck with the new Dolby HX headroom extension circuitry. The hk705. With the Dolby HX headroom extension circuitry, you get an added 10 dB of high frequency headroom, as well as a 68 dB signal-to-noise ratio. That's comparable to open reel decks that cost twice as much. And thanks to Dolby HX and metal tape capabilities, the 705 provides an impressive frequency response of 20-19,000 Hz (±3dB).

Once we finished the inside of our components, we went to work on the outside. To bring you a striking system of modular separates. Each measuring a compact 15″ wide x 3″ high.

These performance matched separates stack beautifully. They give you a noticeably cleaner, clearer, less distorted sound than any system anywhere near the price.

We suggest you audition them. But only if you're serious.

Once you hear the difference, you'll never be satisfied with anything less.

(For the location of the Harman Kardon dealer nearest you, call toll-free 800-528-6050, ext. 870.)

*"Dolby" and the double-D symbol are trademarks of Dolby Laboratories.

harman/kardon

55 Ames Court, Plainview, NY 11803.
In Canada, E.S. Gould Marketing, Montreal.

Equipment profiles

New Acoustic Dimension (NAD) Model 7020 Stereo Receiver

Manufacturer's Specifications

FM Tuner Section

Mono Usable Sensitivity: 10.8 dBf (1.9 μV).
50-dB Quieting Sensitivity: Mono, 16 dBf (3.5 μV); stereo, 37 dBf (40 μV).
S/N: Mono, 75 dB "A" weighted; stereo, 70 dB "A" weighted.
Frequency Response: 30 Hz to 15 kHz, ±0.5 dB.
Selectivity: 65 dB.
Capture Ratio: 1.5 dB.
Image Rejection: 50 dB.
I.f. Rejection: 75 dB.
AM Suppression: 60 dB.
THD: Mono, 0.2 percent at 1 kHz, 0.2 percent at 100 Hz, and 0.3 percent at 6 kHz; stereo, 0.3 percent at 1 kHz, 0.3 percent at 100 Hz, and 0.4 percent at 6 kHz.
Stereo Separation: 42 dB at 1 kHz; 32 dB from 30 Hz to 15 kHz.

AM Tuner Section

Usable Sensitivity (Internal Antenna): 250 μV/m.
Selectivity: 30 dB.
Image Rejection: 50 dB.
I.f. Rejection: 40 dB.

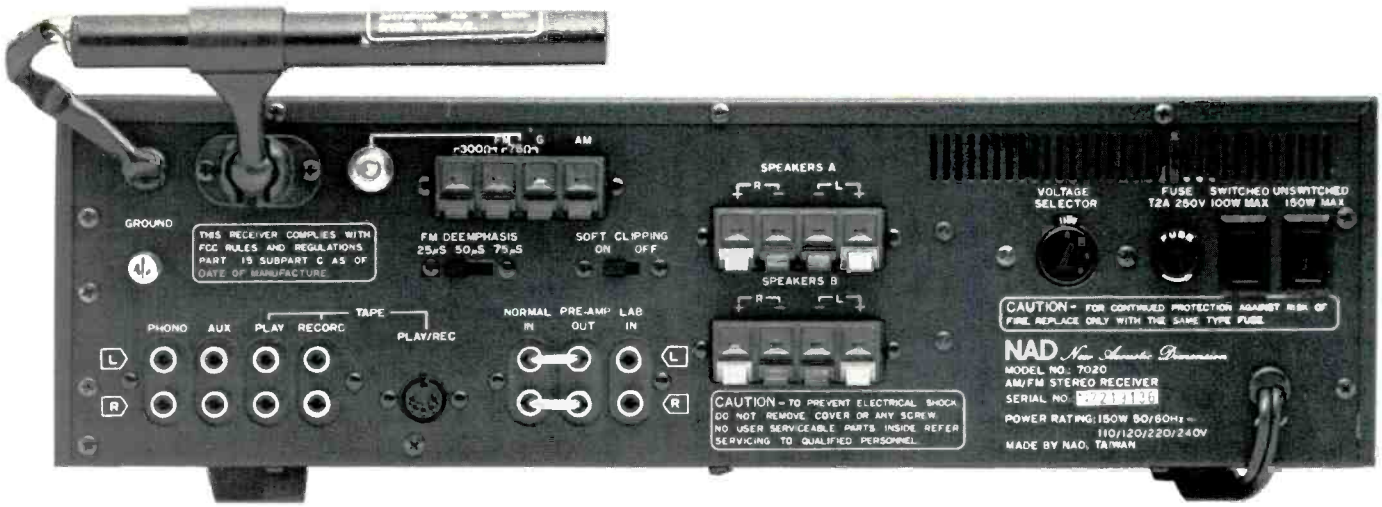
Power Amplifier Section

Power Output: 20 watts/channel, 8-ohm loads, 20 Hz to 20 kHz.
Rated THD: 0.02 percent.
SMPTE-IM: 0.02 percent.

Every once in a while we run into an audio product which turns out to be unexpectedly excellent, the proverbial "sleeper." Running into two such products from the same company (and a relatively new company, at that) was *really* a surprise, but that is exactly what happened when we tested the new NAD 7020 receiver delivered by NAD (USA) Inc., a company that believes in concentrating on audibly superior performance rather than on superficial cosmetics or superb-looking numerical specifications. We had had an earlier opportunity to test one of the firm's separate components, their highly acclaimed Model 3020 integrated amplifier, and were extremely impressed with its measured as well as its sonic performance. The 7020 receiver clearly follows the same design philosophy as the earlier introduced separates. If anything, this NAD receiver entry is a bigger bargain for the budget-minded audio enthusiast, if that is possible.

The all-black front panel of the NAD 7020 is fitted with a minimum of controls, but it does have those that are really necessary. A separate power on/off switch is at the lower left, adjacent to the usual stereo headphone jack. A rotary speaker selector switch follows, and next to it are bass and treble controls, each with a detent-stop at center of rotation for easy return to flat response. The cluster of four push-button switches that follows includes an audio muting switch (which NAD elected to identify as "low level"), a loudness circuit switch, a mono/stereo selector switch, and a tape monitor switch. The program selector switch is a rotary type and includes settings for AUX, Phono, FM Mute, FM, and AM. Concentrically mounted but separately operable volume and balance controls are at the lower right of the panel, and above them is the tuning knob.

The dial cut-out area of the receiver incorporates a linearly calibrated FM frequency scale with calibration marks at every 200 kHz, a long AM frequency scale, and a series of indicator lights located above these scales. Two of the indicator lights are shaped like arrows, each pointing in opposite directions. These red lights tell the user in which direction to fine-tune as station signals are encountered on the FM dial. A green indicator light between the arrow indicators illuminates when precise center tuning has been achieved, and its inten-



TIM: Less than 0.02 percent.
IHF-IM: Less than 0.02 percent.
Dynamic Headroom: 3.0 dB.
Clipping Headroom: 1.5 dB.
Slew Factor: Higher than 50.
Slew Rate: 15 V/ μS.
Damping Factor: More than 50.
Frequency Response: Through "Lab" input, see text, 10 Hz to 70 kHz, -3.0 dB.

Preamplifier/Control Section
Phono Input Sensitivity: 0.5 mV.
Phono Overload: 270 mV at 1 kHz.
RIAA Response Accuracy: ±0.3 dB.
Phono S/N: 75 dB.
High Level Input Sensitivity: 30 mV.
High Level S/N: 86 dB.
Frequency Response: 20 Hz to 20 kHz, ±0.5 dB.
Bass Range: ±10 dB at 50 Hz.
Treble Range: ±7 dB at 10 kHz.
Filters: Infrasonic, 15 Hz, 12 dB/octave; infrasonic phono, 15 Hz, 12 dB/octave, may be cascaded with infrasonic for 24 dB/octave; ultrasonic, 35 kHz, 12 dB/octave.
Audio Muting: -20 dB.

General Specifications
Dimensions: 16½ in. (41.25 cm) W x 4-11/16 in. (11.72 cm) H x 9½ in. (23.75 cm) D.
Power Requirements: Switchable between 50/60 Hz, 110/220 V.
Weight: 15 lbs. (6.82 kg).
Price: $330.00.

sity is a measure of signal strength. How's that for doing away with cumbersome and expensive mechanical meters that don't do the job nearly as well as these lights?

A third indicator light turns on when a rear-panel switch is flipped to the so-called "soft clipping" position, about which more presently. Other facilities located on the rear panel include spring-loaded 75-ohm, 300-ohm and external AM antenna terminals, the required low- and high-level input jacks, tape out jacks, and a European-type DIN multi-pin connector for record/play connection of tape decks equipped with that type of plug.

Just below the antenna terminals is a three-position slide switch which offers a choice of de-emphasis values (75, 50 or 25 μS), making the receiver suitable for use in other parts of the world as well as for reception of Dolby FM broadcasts (with the additional aid of a separate Dolby adaptor). Jacks identified as "normal in," "preamp out," and "lab in" come next and require a word of explanation. Normally, the pair of wire jumpers supplied with the receiver would be connected from the "preamp out" terminals to the "normal in" jacks. This choice of connections inserts an infrasonic and an ultrasonic filter in the signal path between the preamp and main amp. The subsonic filter cuts off below 15 Hz, while the ultrasonic filter has a cut-off point of 35 kHz. With these jumpers connected between preamp-out and lab-in, response extends well beyond these frequency extremes. The jumpers may, of course, be removed altogether if the user wishes to interpose a signal processing component such as an audio time-delay unit, a graphic equalizer, or a speaker equalizer such as those supplied by some loudspeaker manufacturers.

The soft-clipping switch mentioned earlier is located just above these in/out jacks, while to the right are two sets of color-coded spring-loaded speaker connection terminals. A pair of a.c. convenience outlets (one switched, the other unswitched) are located near the right end of the panel, along with a line fuseholder.

Circuit Highlights

The NAD 7020 contains a rather sophisticated six-transistor circuit for the phono preamp section which is designed to

interface correctly with the impedance of phono cartridges. The receiver combines modular circuit elements such as solid-state i.f. filters and ICs in the tuner circuitry to obtain good performance at reasonable cost. FM signals are amplified first through a junction FET r.f. amplifier. A total of three linear-phase ceramic i.f. filters are used in the FM i.f. section. An integrated circuit phase-lock-loop multiplex decoder, supplemented by crosstalk cancelling circuitry, is used in the stereo FM-decoder circuitry.

The power-supply circuitry for the output stages of the NAD 7020 is of the very "soft regulation" design, supplying relatively high voltages to the output stages at 8-ohm loads and during musical waveforms of short duration, hence the very high dynamic headroom specification. An entirely separate supply circuit, operating from another secondary winding on the power transformer, is used to provide regulated operating voltages for the preamplifier and tuner stages. The receiver is equipped with thermostatic circuit breakers which will interrupt sound to the speakers if excessive output current flows through them. When that happens, it is necessary to turn the volume down, as there is no way for the user to defeat the protection circuit breakers externally.

FM Measurements

The FM tuner section of the NAD 7020 exceeded the manufacturer's published specifications in every respect. Usable sensitivity in mono FM measured 1.7 μV (9.8 dBf), while in stereo it was 28.3 dBf or 8.0 μV. Fifty-dB quieting was reached with input signals of only 12.4 dBf (2.3 μV) in mono or 34.7 dBf (30 μV) in stereo, compared with the 3.5 μV and 40 μV claimed by NAD. Signal-to-noise ratio in mono, for strong 65-dBf signals, was an impressive 78 dB, while in stereo the S/N measured 68 dB, still somewhat better than the 65

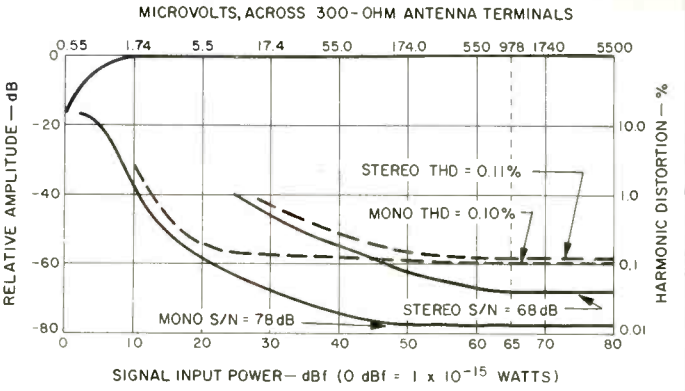
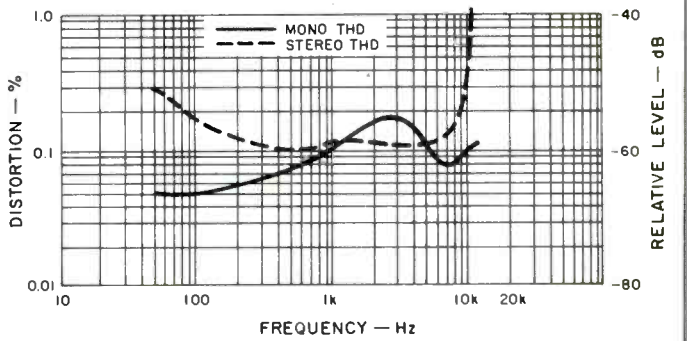
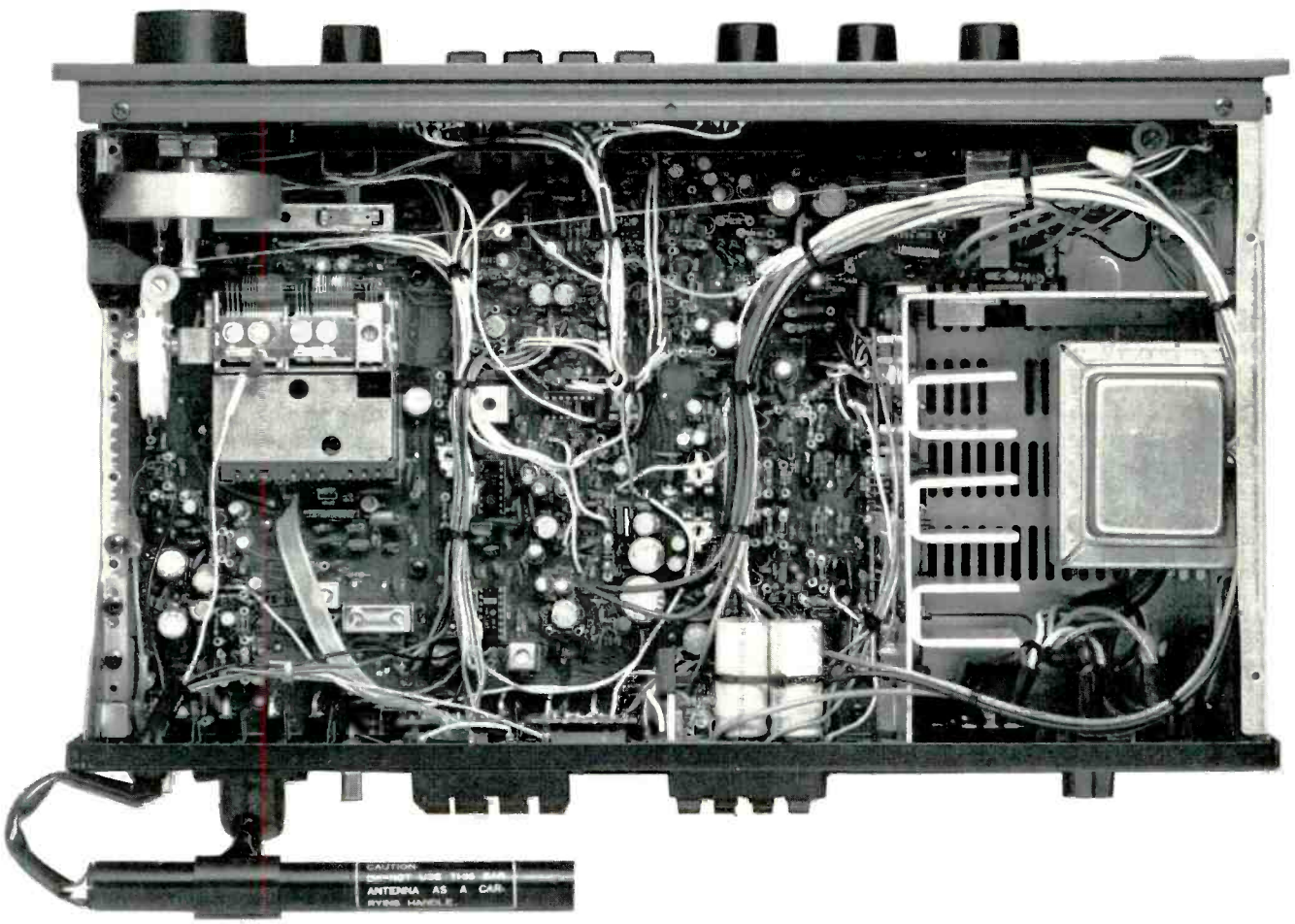


Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

Fig. 2—Mono and stereo FM distortion vs. frequency, NAD 7020 receiver.





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RETROFITS TO MOST STEREO SYSTEMS!
Any unit with a tape monitor facility (internal tape loop) can mate with an 801 Omnisonic Imager™. It also has a built-in tape monitor button so you don't lose your existing tape monitor facility.

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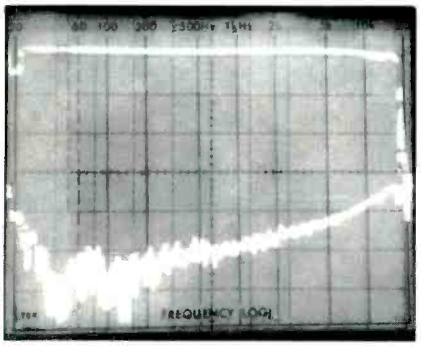


Fig. 3—Frequency response and stereo FM separation characteristics.

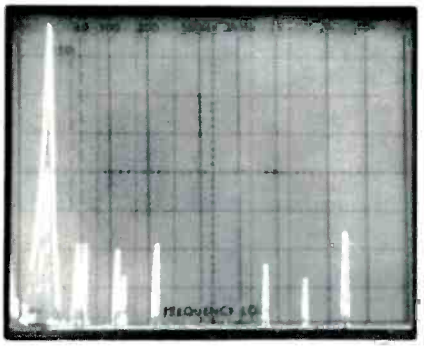


Fig. 4—5-kHz left-channel stereo FM output (tall peak at left) compared with right-channel crosstalk and other components, including distortion.

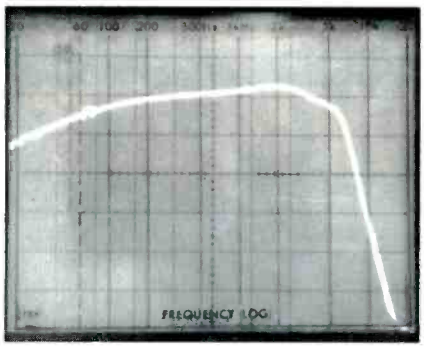


Fig. 5—Frequency response, AM tuner section.

dB claimed. Mono THD for a 1-kHz test signal was 0.1 percent, while in stereo it was very nearly as low with readings of only 0.11 percent.

These numbers, in and of themselves, do not tell the entire story concerning this remarkable tuner section. Referring to Fig. 1, a plot of noise and THD for mono and stereo, you can see that the THD level of 0.1 percent in mono is reached, or very nearly reached, with relatively low signal strengths so that an incoming signal of, say, 30 dBf (around 18 μV) provides as distortion-free reception as does a much stronger signal. Relatively speaking, the same holds true for stereo signals though, of course, greater signal strengths are demanded for equivalent performance levels.

Distortion remained extremely low in mono across the entire audio spectrum, with readings of 0.05 percent at 100 Hz and 0.075 percent at 6 kHz, the other two test frequencies at which THD is supposed to be reported. Again, these results are far better than claimed by NAD. As for THD in stereo, it too is amazingly low from around 200 Hz to above 6 kHz, as can be seen from the curve plotted in Fig. 2. The apparent rise in THD as test signals approached 10 kHz is, in reality, caused by the appearance of "beats" which appear in the output. Though undesirable, they are not, strictly speaking, *harmonic* distortion components. In any event, even taking these extraneous components into account, the distortion analyzer read a combined percentage of these components equal to 1.0 percent — far better than we have measured on many receivers costing a good deal more. Stereo separation measured 49 dB at mid-frequencies, decreasing to 45.5 dB at 100 Hz and 35 dB at 10 kHz. A graphic plot taken directly by means of a sweep signal from our spectrum analyzer is reproduced in Fig. 3 and shows frequency response (upper trace) and separation. In this figure, sweep is from 20 Hz to 20 kHz and is logarithmic, while vertical spaces represent 10-dB increments.

In Fig. 4 the sweep has been altered and is now linear, extending from 0 kHz to 50 kHz. The tall spike at the left represents the left-channel output of a 5-kHz signal modulating left only. Switching to a right-channel modulation, but continuing to read left-channel output, a second sweep was made. The spike within the tall spike is the actual 5-kHz separation between channels (approximately 40 dB), while the other spikes to the right of the display represent distortion components and sub-carrier components of the crosstalk signal observed at the left-channel output.

Capture ratio measured 1.3 dB, while AM suppression measured exactly 60 dB as claimed. Our sample had an alternate channel selectivity of 68 dB, as against 65 dB claimed. Image, i.f., and spurious rejection measured 55, 75, and 90 dB respectively. Stereo threshold as well as muting threshold both measured between 7 and 8 μV (around 22.5 dBf), a perfectly reasonable threshold setting for most listening conditions.

Even the AM frequency response, plotted in Fig. 5, was better than average, with the -6 dB cut-off points extending from 50 Hz to just beyond 5 kHz. The superiority of this AM section was later verified during our extended listening tests, and you would be amazed at how much better an AM set with reasonably good response out to 5 kHz sounds compared with the run-of-the-mill variety that cut off at around 2.5 to 3.0 kHz.

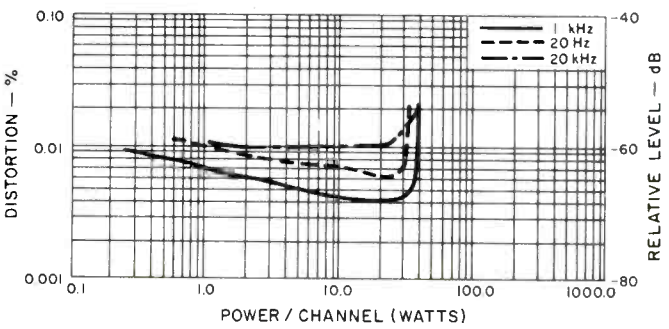


Fig. 6—Power output vs. distortion, both channels driven into 8-ohm loads.

Amplifier Measurements

Impressed as we may have been with the excellence of the tuner section in such a low-cost receiver, our real amazement occurred when we began to measure the power amplifier section. At mid-frequencies this amplifier delivered exactly twice its rated power output per channel, or 40 watts into 8-ohm loads, before we observed a THD reading of 0.02 percent. Even more amazing, the same power output was observed for a test frequency of 20 kHz and for our SMPTE-IM tests, using 60-Hz and 7-kHz two-tone equivalent signals. The power output available for 0.02 percent THD decreased to 32 watts at 20 Hz, but remember that this amplifier is officially rated (in terms of the FTC rule) at only 20 watts per channel! Figure 6 plots output power versus distortion for test frequencies of 20 Hz, 1 kHz, and 20 kHz.

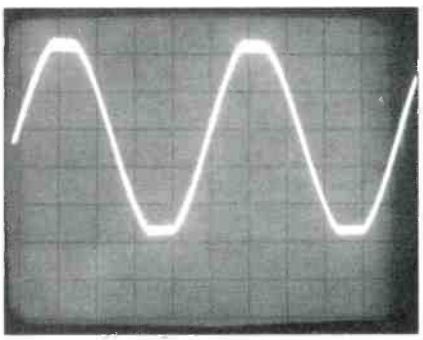
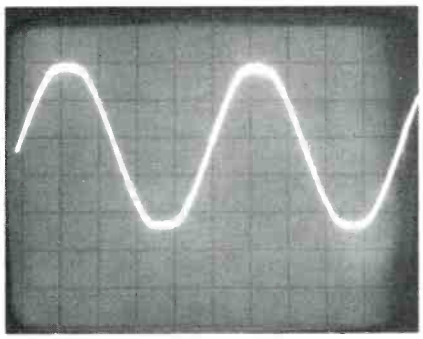


Fig. 7—Normally, clipping during overload of the NAD 7020 is sharply squared off, as in most solid-state amplifiers (A).



When the "soft clipping" circuit is switched on, clipping resembles that of a tube amplifier (B).

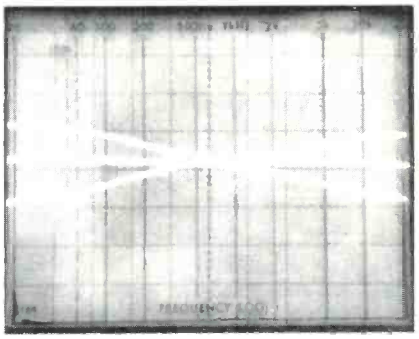


Fig. 8—Tone control range.

Using the IHF-prescribed test signal required for measuring dynamic headroom (20 mS of a 1-kHz burst followed by 480 mS of the same frequency at lower amplitude), we observed IHF dynamic headroom of 3.2 dB. This means that for short-term musical peaks, the amplifier could be expected to deliver around 41.8 watts of power per channel into 8-ohm loads before any evidence of clipping would occur.

Speaking of clipping, we wanted to find out just what the "soft clipping" circuit of the NAD 7020 was all about. Therefore, with this switch in the off position, we drove the amp hard into clipping with a 400-Hz sine wave tone; the output waveform was that shown in the 'scope photo of Fig. 7A. The sharp cornering of the waveform as it enters the region of clipping is clearly evident. It is this sort of clipping that produces harsh power-supply buzz sounds as well as even-order distortion components that prompt some people to talk about the harsh sound of solid-state amplifer designs.

Without changing input signal levels in any way, we now moved the rear-panel switch to the soft clipping on setting, and the waveform immediately took on the appearance shown in the 'scope photo of Fig. 7B. Notice that the waveform near the peaks is now softly rounded. The appearance of the waveform of Fig. 7B should bring back memories of tube amplifiers to those readers who can remember them and who were involved in audio "way back then."

We attempted to measure IHF-IM but found that even using our spectrum analyzer to detect the unwanted spurious components generated during these twin-tone tests, such

components were too low to be detected, meaning that the IHF-IM was well below the 0.02 percent claimed by NAD.

Preamplifier and Control Section Measurements

Range of the bass and treble tone controls provided on the 7020 is shown in the sweep frequency plots of Fig. 8. Sweep is again logarithmic, from 20 Hz to 20 kHz in this presentation, and vertical sensitivity of the display is 10 dB per division. Note how the manufacturer has elected to shelve the response of these controls when they are in their extreme positions instead of allowing the boost (or cut) to continue to increase with increase or decrease of frequency. This is a wise approach for use in a receiver of limited power output and acts to prevent overly enthusiastic (but tone deaf) users from overloading the amp by turning everything fully clockwise!

Before going any further we wish to commend the people at NAD who wrote the specifications. They are among the first to fully utilize the new IHF Amplifier Measurement Standards. We have been using these standards since shortly after they were approved, and readers will, for the first time, actually be able to compare our S/N and input sensitivity results with those claimed by the manufacturer without having to perform any mathematical manipulations or conversions. For example. NAD claims a S/N ratio in phono (properly referred to 5-mV input and 1-W output) of 75 dB. We measured a superb 80 dB, using the same input and output references. They claimed 86 dB of S/N for the high-level inputs, and that's precisely what we measured. Phono overload at 1 kHz measured 280 mV against a claimed 270 mV. With the jumpers connected to the "normal" inputs, high-level frequency response was down 1 dB at 16 Hz and 35 kHz; 3 dB down points were at 14 Hz and 40 kHz, indicating the swift takeover of those permanently in-circuit 12 dB/octave filters (not the phono filter, incidentally).

Use and Listening Tests

The NAD 7020 is, in our opinion, one of the best sounding receivers in its power and price class that we have ever had the pleasure of auditioning. Whether we listened to FM or to our own selected and demanding discs, we had to repeatedly remind ourselves that this receiver is nominally rated at only 20 watts per channel and that its suggested retail price is barely more than $300.00. We can definitely attest to the fact that the "soft clipping" feature does reduce audibility of clipping significantly. However, we had to go some to cause the amp to clip in the first place, since we were using relatively high-efficiency ported speaker systems to test the unit and even we have an SPL tolerance limit. Of course, when we wore ear protectors and continued to increase loudness (and gain) levels beyond first clipping, eventually we could hear the overload distortion even with the soft clipping circuit activated. We wouldn't venture to guess what power level we were at when that happened.

Most of our listening was conducted under more sensible conditions, and we found the NAD 7020 to be a receiver that delivers the kind of good sound we like to live with. FM stereo reception was superb, and accurate FM tuning was easily done thanks to NAD's unique tuning indicators. The low image-rejection figures offered by this tuner may cause some problems for those living in areas where transmission outside the FM band has a way of creeping into the public frequencies (e.g. if you live near an airport control tower), but we encountered no such difficulties in our difficult listening locale. If NAD can maintain the quality of the 7020 at the level which we encountered in this first production sample, they clearly have a winner on their hands, both in performance and in price. *Leonard Feldman*

Enter No. 90 on Reader Service Card

Optonica RT-6905
Stereo Cassette Deck

Manufacturer's Specifications
Frequency Response: 30 Hz to 16 kHz; with FeCr, 30 Hz to 19 kHz; with CrO_2, 30 Hz to 18 kHz; with metal tape, 30 Hz to 20 kHz.
S/N: 60 dB; with Dolby NR, 70 dB.
Input Sensitivity: Mike, 0.2 mV; line, 50 mV.
Output Level: Line, 1 V; headphone, 125 mV into 8 ohms.
Flutter: 0.038 percent W rms.
Timekeeping Accuracy: ±15 S per month.
Programming Capacity: 42 operations.
Dimensions: 17 in. (430 mm) W x 8⅜ in. (211 mm) H x 14⅝ in. (371 mm) D.
Weight: 34.9 lbs. (15.8 kg).
Price: $1600.00.

One look at the front panel of the Optonica RT-6905 and the viewer has to conclude that this is not just another high-cost deck. There are over 60 push buttons, to say nothing about controls, meters, etc. Optonica calls the deck "computer controlled," and there are many things that can be programmed, some of them in conjunction with the attached timer-control unit. Immediately, the array of buttons and displays is rather overwhelming, but by considering one section at a time, there is a growth in confidence that the deck can be made to do *your* bidding.

The LCD panel at the upper left displays whether the unit is under control of counter memory, APMS (Automatic Programmable Music Selector), or is being programmed (flashing indication). Up to 15 selections on a tape may be programmed in any order with APMS, which requires four-second blank spots for the system to find beginnings and endings. Inputs to the program memory are made with 10 buttons (0 to 9), entered with *Set* or removed if necessary with *Clear*. The same buttons make entries for *Counter Memory*, when in that mode. The *Direct Memory* mode permits entering the counter number displayed into memory, and small bar and "M" symbols above the mode selection buttons indicate status and whether entry has been made into a memory. Two digital displays show current address and next address for APMS and counter memory, as well as regular tape counter indications. To one side is a button selector for tone on/off to sound with any of the mode or entry buttons pushed; I found this helpful and left it on all the time. The associated tape motion controls are grouped under *Auto* and provide *Play*, which includes fast wind to the start point;

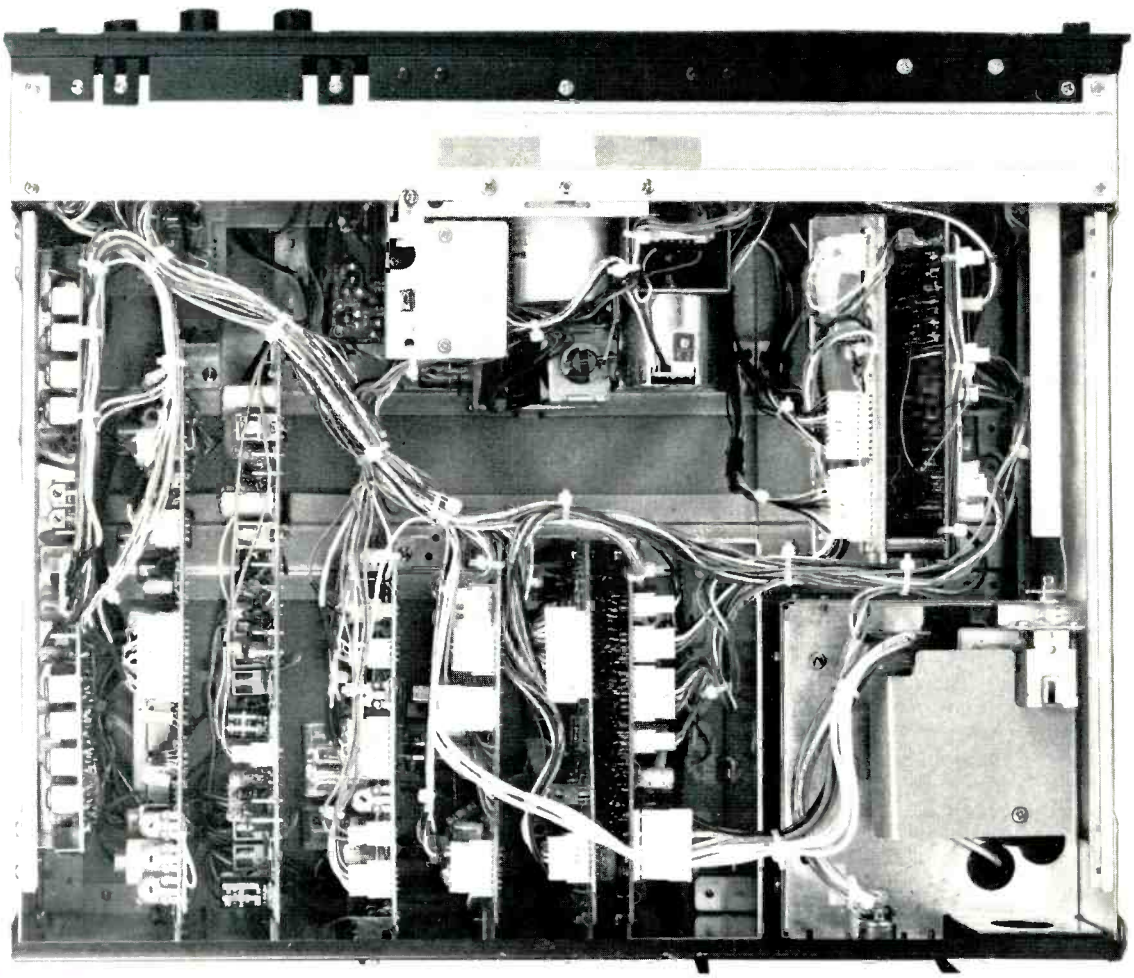
Repeat, which will repeat the program continuously, and *Cue*, which calls for fast wind and stop at the start of the program.

Just to the left is the receptor for the infrared remote control and the jack for headphones. The battery powered remote-control unit repeats all of the deck's light-touch tape motion switches, including *Auto Spacing* and APSS (Automatic Program Search System) reverse and forward. *Auto Spacing* automatically mutes the signal, records a blank space of five seconds for use with APMS (or APSS), and switches back to *Record/Pause*. APSS allows fast winding to the beginning or end of the selection being played, and switching to *Play* at that point. The status lights above each of the buttons (except *Stop*) can be easily seen across a room. Pushing any of the buttons on the remote control causes an indicator to turn on above the infrared receptor, confirming reception of the instruction. When using normal tape-motion control, the current address display operates as a three-digit tape counter. *Stop* is effective in all deck modes.

The fluorescent bar peak-level display is scaled from -20 to +8 dB. There are button switches for *Peak Hold* and *Auto Reset* on/off. With *Auto Reset* off, the highest peak will be held until *Peak Hold* is switched off. With *Auto Reset* on, any peak is held for about a second. Dual-concentric mike and line input pots provide mike/line mixing, of considerable value to some users. Friction between sections was slightly high for easy channel balancing, but the knob design is good for the purpose. It was nice to see a switchable limiter included, particularly with the time-control features of this deck. Three-position rotary switches control Dolby modes and record calibration. The latter injects a 400-Hz tone for adjusting record sensitivity and an 8-kHz tone for setting bias, used in conjunction with the level display and the tape/source monitor switch. There are concentric trim pots for sensitivity and bias trim, both with worthwhile detents. Four button switches select among the tape types.

The mike input jacks are unusual in that plugging into the left jack only will feed the mike signal to both channels. This is quite a useful feature, for there are times when there is a vocal to be added, and the Optonica scheme automatically "centers" the mike. There is also a line-in stereo-type phone jack on the front panel; its use disconnects the line-in phono jacks on the rear panel.

The bottom part of the RT-6905 is the timer section, which is a rather sophisticated device all by itself. An array of button switches program the various modes of the timer: *Clock*, *Timer*, *Time Counter* and *Time Signal*. The clock can be operated in 12 or 24 hour modes, and a number of on and off operations of the two sets of outlets on the back can be programmed for every day in the week. The time counter can be synchronized with tape motion control with a cable between the two sections and an on/off switch. The display shows any of the time functions, the function being used, and what memories have entries. Setting the clock is very easy, and built-in batteries keep it on time even if a power failure should ever occur.



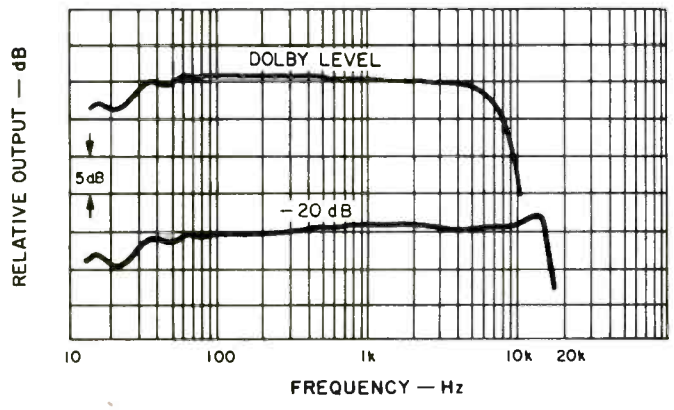


Fig. 1 — Frequency responses of the Optonica RT-6905 in Dolby mode with Maxell UD tape.

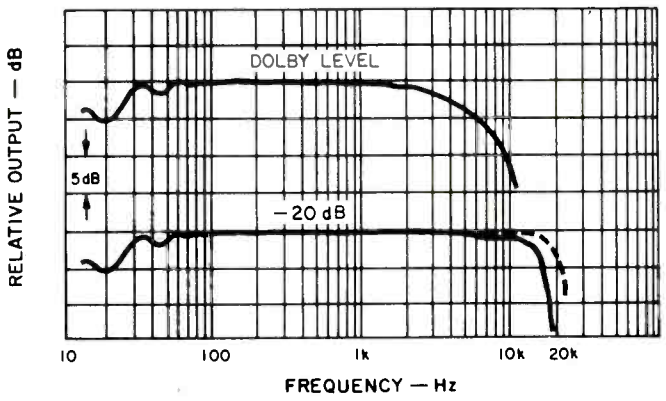
Fig. 2 — Frequency responses in Dolby mode with Sony FeCr tape; high-end response without Dolby NR indicated by (---).

On the right side of the system are access holes to the basic adjustments for bias as well as sensitivity for the four tape types, with *L* and *R* pots in each case. The line in/out jacks, timed power outlets, and synchronization cable switch and connections are on the back panel, as indicated earlier. There is also a compartment for the two AA cells used for the clock in case of line power loss.

Removal of the top and side wraparound cover revealed the internal complexity of this unusual unit. There were nine large p.c.b.s in the deck portion, to say nothing of some smaller ones and the timer section p.c.b. Soldering was generally excellent with a few cases of flux residue. The boards were screwed to vertical brackets, and interconnections were made with multi-pin plugs. Adjustments were identified with part number, and all parts were identified on *both* sides of the p.c.b.s — a great plus if servicing is needed. The chassis was very rigid with girder construction. The dual-motor drive system appeared to promise long-term reliability, with two flywheels and two solenoids part of the rugged design.

Performance

The play responses of the RT-6905 were excellent at both equalizations, within a dB except for droop at 31.5 Hz with 70-μS EQ. Playback of standard levels indicated correctly on the bar graphs. The record/playback responses were outstanding with the aid of some bias and sensitivity trimming. One channel was poorer than the results shown, but copies of the manufacturer's data led to the assessment that an adjustment probably shifted during shipping. The pink noise/RTA checks showed that many formulations could be matched for excellent performance. Maxell UD and UDXL-II, Sony FeCr, and TDK MA were the reference tapes used by Optonica, and they did secure the best results. The swept-frequency plots were all run in Dolby NR (Figs. 1 to 4), and



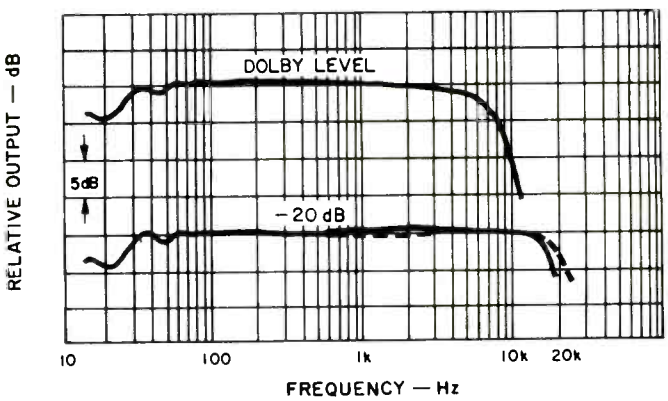


Fig. 3 — Frequency responses with and without (---) Dolby NR with Maxell UDXL-II tape.

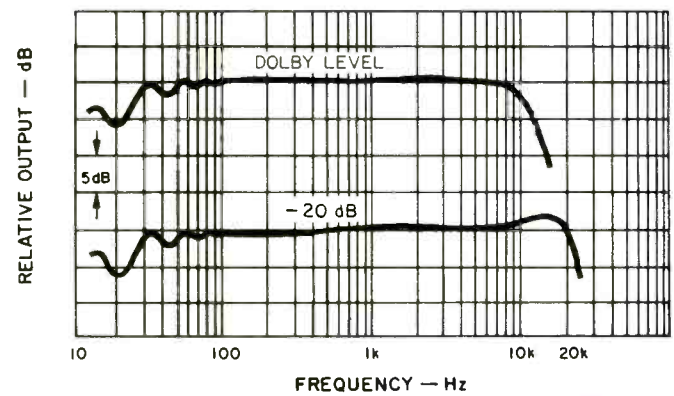


Fig. 4 — Frequency responses in Dolby mode with TDK MA tape.

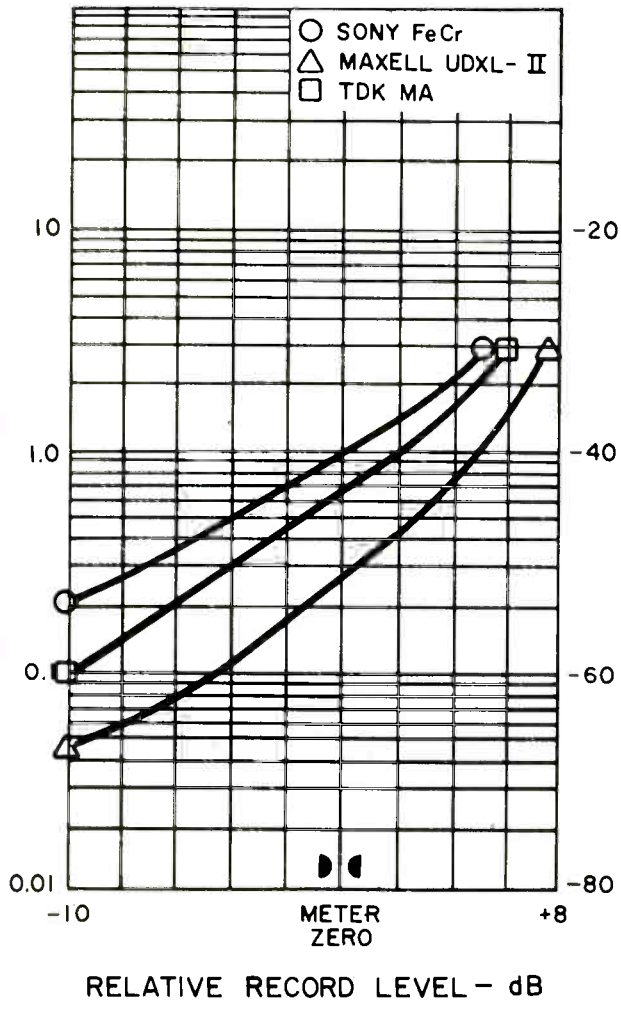


Fig. 5 — Third harmonic distortion vs. level in Dolby mode at 1 kHz with Sony FeCr, Maxell UDXL-II, and TDK MA tapes.

they were among the best ever seen in this mode. In particular, note the flatness between 50 Hz and 10 kHz at -20 dB. Without NR, the responses were even flatter and a bit more extended at the high end, as shown in two cases. The response limits at -3 dB are listed in Table I. The headroom with three of the tapes is not impressive, but the results with TDK MA are excellent.

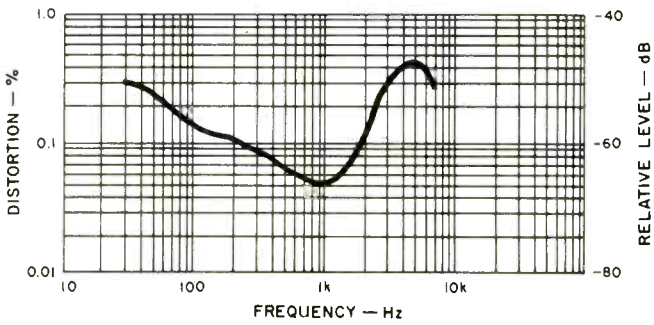
The record-sensitivity test tone (417 Hz actual) had an adjustment range of +4/-2.5 dB with Maxell UD. The bias test tone (8482 Hz actual) range was ± 4 dB at that frequency with Maxell UD. Both tones had good waveforms. The alignment between the play and record heads, which are in the same structure, was excellent — very close to zero-degree phase difference with a 10-kHz test tone. Phase jitter was about 35 degrees, better than the average deck. The multiplex filter was 3 dB down at 15.5 kHz and 39 dB down at 19 kHz, with the notch almost exactly aligned. Bias in the output during recording was very low.

HDL_3 vs. level was measured with a 1-kHz tone using Sony FeCr, Maxell UDXL-II and TDK MA, all in Dolby mode. The results were very good, as shown in Fig. 5, with the performance with Maxell UDXL-II particularly noteworthy. Tests of HDL_3 vs. frequency covered from 30 Hz to 7 kHz and were conducted with Maxell UDXL-II (Fig. 6). The results were excellent, superior to most cassette decks. Other harmonics were satisfactorily low in all of the distortion tests. Without Dolby NR, most figures increased about 30 percent. Table II lists the signal-to-noise ratios with the same three tapes with both IEC "A" and CCIR/ARM weighting. The results are excellent for all of the tapes, even though slightly below spec with Dolby NR. Separation was outstanding: Greater than 57 dB. Crosstalk was way down, more than 82 dB. Erasure of metal tape was over 80 dB at 1 kHz and 67 dB at 100 Hz, excellent for this low frequency.

Mike sensitivity at 0.24 mV and line sensitivity at 62 mV were over spec, but considered quite acceptable. Mike input overload was 14.1 mV, not as high as many units, although line input overload at 30 V was the highest measured to date. The output clipped at a level equivalent to +15 on the meter. The sections of the input pots tracked within a dB from maximum down 45 dB. The limiter gain reduction started at 0 dB on the meter, with high-level inputs limited to +2. Response was smooth and had a time constant of about 10 mS. The line output was 0.9 V, and the headphone drive to 8 ohms was 120 mV, which generated very high levels in all phones tried. The output pot sections tracked within a dB from maximum down 35 dB.

The frequency response of the level indicators was down 3 dB at 25 Hz and 19.4 kHz, slightly restricted. Response time was very fast, reaching zero dB with a 15-mS tone burst. This and other data indicated that they met the requirements of IEC Standard 268-10, with the exception that the one-second decay time was too fast. Scales were accurate down to -10, yet read high below that. The display was easy to read in dim to medium illumination but seemed faint in bright room light. The 5-dB steps below 10 dB were judged to be too large for easy reading of lower level signals. The red boxes at zero dB and above aided in setting maximum record levels. Tape

Fig. 6 — Third harmonic distortion vs. frequency in Dolby mode at 10 dB below Dolby level with Maxell UDXL-II tape.



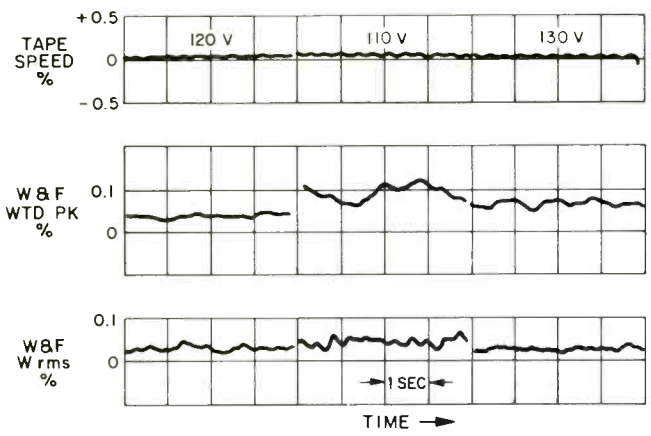


Fig. 7 — Tape play speed vs. line voltage and weighted peak and W rms flutter (three trials each).

Table I—Record/payback responses (-3 dB limits).

	With Dolby NR				Without Dolby NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
Tape Type	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Maxell UD	25	6.5	28	13.7	25	6.6	25	15.9
Sony FeCr	24	4.2	26	17.3	24	4.3	25	19.8
Maxell UDXL-II	25	6.6	25	16.8	25	6.7	25	18.6
TDK MA	26	12.5	27	23.2	26	13.0	26	24.2

Table II—Signal/noise ratios with IEC "A" and CCIR/ARM weightings.

	IEC "A" Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby NR		Without NR		W/Dolby NR		Without NR	
Tape Type	At DL	HD=3%	At DL	HD=3%	At DL	HD=3%	At DL	HD=3%
Sony FeCr	62.2	67.5	54.4	59.4	61.5	66.8	52.2	57.2
Maxell UDXL-II	61.1	68.6	55.2	60.7	60.9	68.4	52.3	58.8
TDK MA	61.9	67.9	54.0	59.6	61.0	67.0	51.9	57.3

speed was about 0.5 percent fast. Average tape play speed was affected very little with any changes in line voltage, but a small ripple in speed appeared with offsets from 120 V. There was some variability in the flutter from one trial to the next, but the typical results were excellent: 0.030 percent W rms and 0.060 percent weighted peak. Wind time for a C-60 cassette was 105 seconds, rather slow, but it was smooth. The RT-6905 includes a loose-loop take-up, a worthwhile feature that should be part of all premium-priced decks. Upon loading, the counter is set to "000," there is a second of fast forward, and then the tape is wound at a slower speed back to "000." Logic response time was a second or less.

In-Use Tests

Loading and unloading and all maintenance tasks were easily accomplished. *Eject* required more force than expected, perhaps because the button used is quite small. Everything worked completely reliably, and I cannot fault the deck for some of the programming mistakes I made. It did take quite awhile to learn to operate all functions of the RT-6905 system, and patience is recommended to those who use this recorder/timer for the first time. I would have liked the inclusion of flying-start recording, but there are lots of other features it does have. The calibration scheme was easy to use and worked well in obtaining good results. The meters were also easy to use in setting levels, but a higher brightness level and a slower decay time would have been helpful. All uses of the APMS, APSS, and counter and timer functions worked consistently well. I think that I would have preferred the counter *not* resetting with ejection, but longer usage could have changed that opinion.

The instruction book is a detailed 64 pages, generally well written. There are many illustrations, but some are perhaps too close up — a picture of a single switch is not as helpful as one of a section including the switch. Sources recorded included *The Great Organ* with Michael Murray and Mike Auldridge's *Blues and Blue Grass*. The playback was mighty fine in all cases, with the exception that there was a little lacking in the lowest notes on the organ. The results with the limiter in use were very good, with the sound remaining quite clear even with several dB of limiting. Record, pause and stop clicks were all in tape noise, barely detectable.

The Optonica RT-6905 computer-controlled deck is not for everyone, but not just because of the premium price. The use of all the features, not covered here completely even with the detail above, requires time and attention. For those who can use and want these functions, this unusual cassette deck does them very well and offers mechanical and electrical performance matching any other deck tested to date.

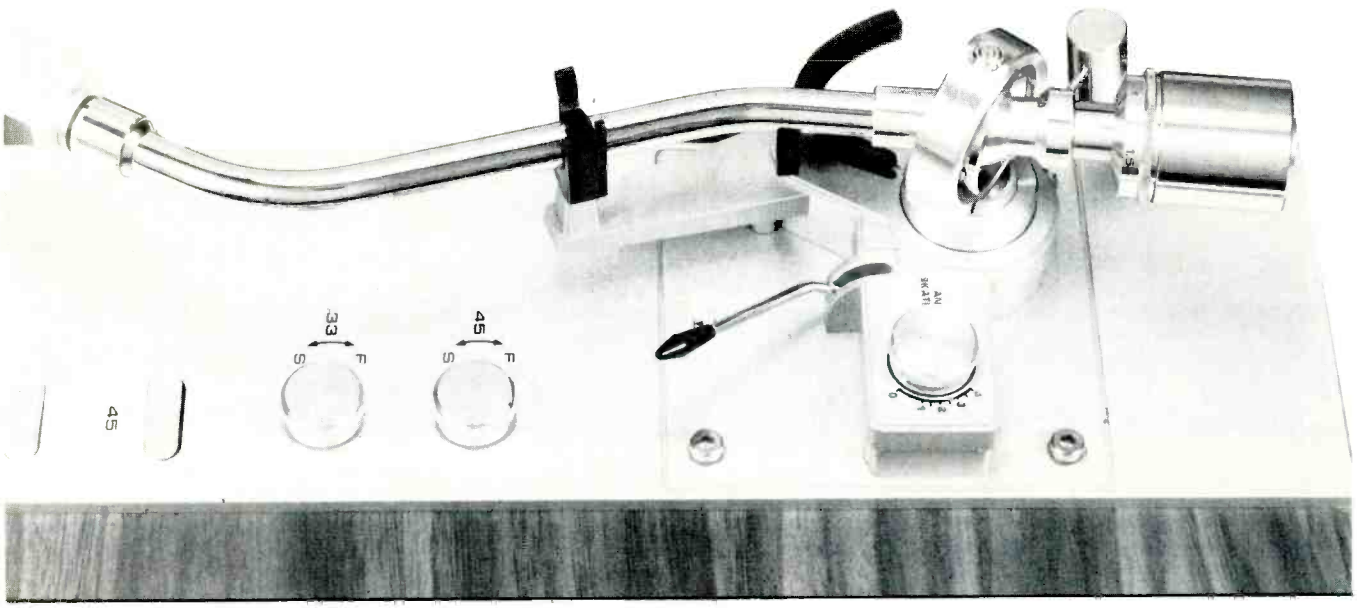
Howard A. Roberson

Fisher MT-6250 Linear Motion Semi-Automatic Turntable

Manufacturer's Specifications
Type: Two speed.
Motor Type: 120-pole, quartz-controlled direct drive.
Wow and Flutter: 0.03 percent W rms.
Rumble: -70 dB (DIN B).
Speed Control Range: ±6 percent.
Dimensions: With dust cover, 17¾ in. (43.375 cm) W x 14 in. (35 cm) D x 6½ in. (16.25 cm) H.
Price: $300.00.

Direct-drive turntables have become very popular over the past two years, and they come in all price ranges with many different designs. The drive motor can be a.c., d.c., or Hall effect, while servo-control systems include phase-locked loop circuitry (with or without a quartz reference), frequency generator (FG) configurations, and others using all kinds of error-sensing variations. Fisher's Model MT-6250 is unlike its competitors as the motor is a three-phase 120-pole a.c.-type using the platter as a rotor. The coils are mounted on the top plate, and the drive force is transmitted to a magnetic band attached to the periphery of the platter. This linear motion concept is not new, and I am sure many readers will remember the Simpson turntable which made its appearance in the early 1950s. It was a very streamlined, low-profile design that never really caught on, probably because the platter needed a push to start! The Fisher unit uses more poles and is much more sophisticated, but the principle is the same.

Servo control is provided by a PLL circuit which can be switched off so the speed can be adjusted with a vernier control. (There are two; one for each speed.) The tonearm is an S-shaped design made of polished aluminum tubing and measuring nine inches from pivot to stylus. It rotates on a horizontal thrust-bearing mounted in a gimbal, but the vertical bearing is a conventional pivot type. The rear counterbalance is calibrated from zero to three grams, and a tiny lateral balance weight is mounted on a projecting rod near the pivot. An anti-skating dial is near the arm base; the cue lever is next to it, just in front. The arm is mounted on a satin-silver finished panel which extends from the front to the rear of the unit and which also contains two variable controls for speed plus three push buttons. One is for the *Reject* function, while the other two select the speeds. On the other side of the platter is a small sub-panel containing the on-off button, the quartz control unlock switch, and a strobe light. To the right of the platter, adjacent to the main control panel, is a spirit level which also functions as an overhang indicator. The dynamically balanced platter has a highly polished serrated edge and weighs 2.2 lbs. Styling is most attractive with the



vinyl walnut-covered base making a pleasing contrast to the bottom section, finished in black. The unit stands on four large adjustable spring-loaded feet.

Measurements

For test purposes, a Stanton 881S cartridge was mounted in the lightweight headshell, and overhang was adjusted using the spirit level reference. This was not too easy, and the alignment was checked with a DB Systems protractor before making any measurements. Wow and flutter, using the DIN 45-507 weighting, came out at 0.035 percent and rumble measured -62 dB (ARLL), both excellent figures. Tracking error was less than 0.5 degrees per inch, and the calibration of the counterweight was found to be right on the nose. Vertical arm bearing friction was too low to measure accurately, but the horizontal thrust suspension was higher, at 0.15 gram. In theory, the anti-skating dial should be set that much lower but I did not find this necessary. Arm resonance measured 8.5 Hz with a rise of 2 dB using the 881S cartridge. Optimum tracking force, incidentally, was 1.5 grams and the anti-skating dial was turned to a similar figure. Speed variation measured -8 and +6 percent, slightly more than claimed.

Moving the arm from its rest position starts the motor, and the cue lever can be employed to set the stylus in its required place. At the end of the record — or if the *Reject* button is depressed — the arm automatically returns and the motor is switched off. The cue lever is nicely damped in the downwards direction, but there was a tendency to swing to the right as the arm is lifted — especially if the lever is moved too quickly. Other than that, I have no criticism to offer.

As the measurements indicate, the overall performance of the MT-6250 is on a par with the best turntables in its price range. The provision of a spirit level is an excellent idea, as is the adjustable feet which also help in reducing the possibility of acoustic feedback. Those with tight budgets might want to save $70 or so by buying Fisher's Model MT-6225. This unit offers a similar performance and uses the same kind of linear motion motor, but is minus the quartz control.

George W. Tillett

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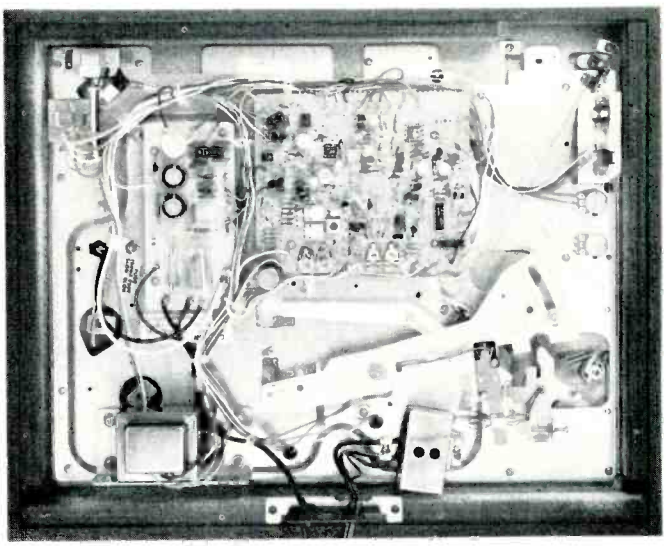
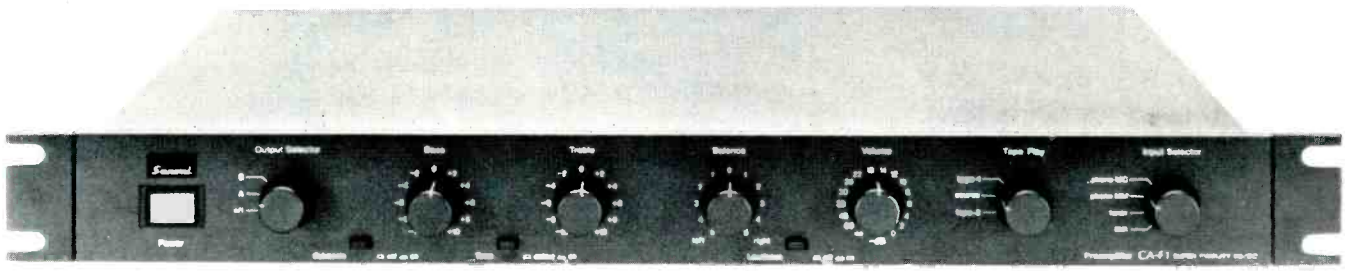


Sansui Model CA-F1
Preamplifier



Manufacturer's Specifications

Frequency Response: Phono, RIAA, 20 Hz to 20 kHz, ±0.2 dB; high level, 5 Hz to 100 kHz, +0, -0.2 dB.

Rated Output: Main, 1 V; tape, 150 mV.

Maximum Output: 10 V.

Maximum Phono Input: MM, 350 mV; MC, 24 mV.

THD: Less than 0.005 percent at or below rated output.

IM Distortion: Less than 0.005 percent at or below rated output.

Input Sensitivity: Phono MM, 2.5 mV*; phono MC, 0.1 mV*; high level, 150 mV* (see text).

S/N: Phono MM, 90 dB**; phono MC, 75 dB**; high level, 100 dB* (see text).

Bass Control Range: +7, -9 dB at 50 Hz.

Treble Control Range: ±7 dB at 15 kHz.

Subsonic Filter: -3 dB at 16 Hz, 6 dB/octave slope.

Rise Time: 0.6 μS.

Power Consumption: 45 watts.

Dimensions: 16-15/16 in. (42.34 cm) W x 17-3/16 in. (42.97 cm) D x 2-3/8 in. (5.94 cm) H; with rack-mount adaptors, 19 in. (47.50 cm) W.

Weight: 13.4 lbs. (6.09 kg) with rack-mount adaptors.

Price: $495.00.

This slimly configured preamplifier-control unit from Sansui, as its model number might suggest, is intended to serve as a companion component to that company's Model BA-F1 power amplifier, tested for *Audio's* March '80 issue. Both units are rack mountable and have front panels finished in matte black. Unlike the rather hefty looking BA-F1, however, the CA-F1 preamp is an extremely slim unit, requiring just a little over two inches of vertical panel space. What the unit lacks in height, it makes up in depth — requiring an extremely deep shelf on which to place it if you don't go the rack-mount route.

All of the CA-F1's major controls, as well as its push button on/off switch, are arranged in a single row across the face of the unit. The on/off switch becomes internally illuminated when power is applied. Rotary controls from left to right include the *Output Selector* (there are two separate pairs of output jacks at the rear of this unit, either of which may be selected by means of this switch), click-stepped *Bass* and *Treble* controls calibrated in approximately 2-dB increments, a *Balance* control, master volume control, tape mode switch, and an input program selector switch. The *Input Selector* has settings for moving-coil cartridge as well as moving-magnet inputs, in addition to the usual AUX and tuner settings. This preamplifier also has a built-in pre-preamp with a flat-response gain of approximately 28 dB. Three tiny push buttons positioned along the very lower edge of the front panel are

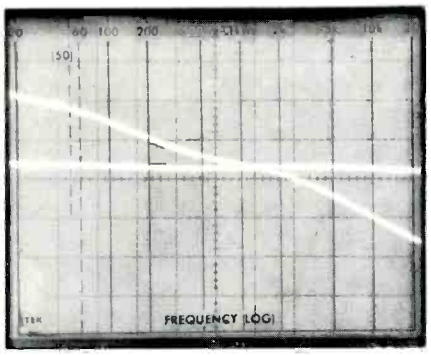


Fig. 1 — Sloped curve is the RIAA response. Flat response is obtained when applying the inverse RIAA signal.

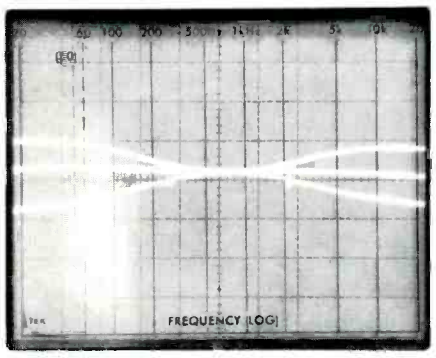


Fig. 2 — Bass and treble control range.

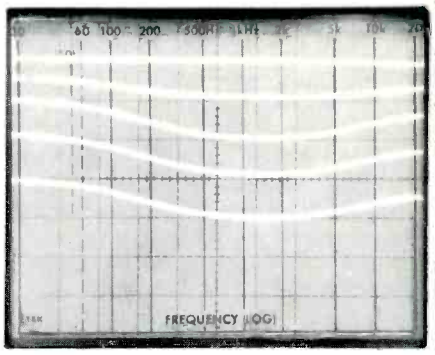


Fig. 3 — Loudness compensation measured at volume settings 10 dB apart.

used to activate a subsonic filter, defeat or bypass the tone control circuitry, and introduce loudness compensation.

The rear panel of the CA-F1 features two pairs of gold-plated phono input jacks for low-resistance contact between phono audio plugs and first-stage equalizer-preamp circuitry. A chassis ground terminal is located adjacent to these phono inputs. The remaining AUX, tuner, and tape inputs as well as two sets of tape outputs for the two available tape monitor circuits are to the right of the phono inputs, wh le further to the right are the twin output jack pairs mentioned previously. At the extreme right of the rear panel is a single *unswitched* a.c. outlet, obviously intended for connection of one's turntable system rather than for connection of an associated power amplifier. The receptacle can only safely supply 450 watts.

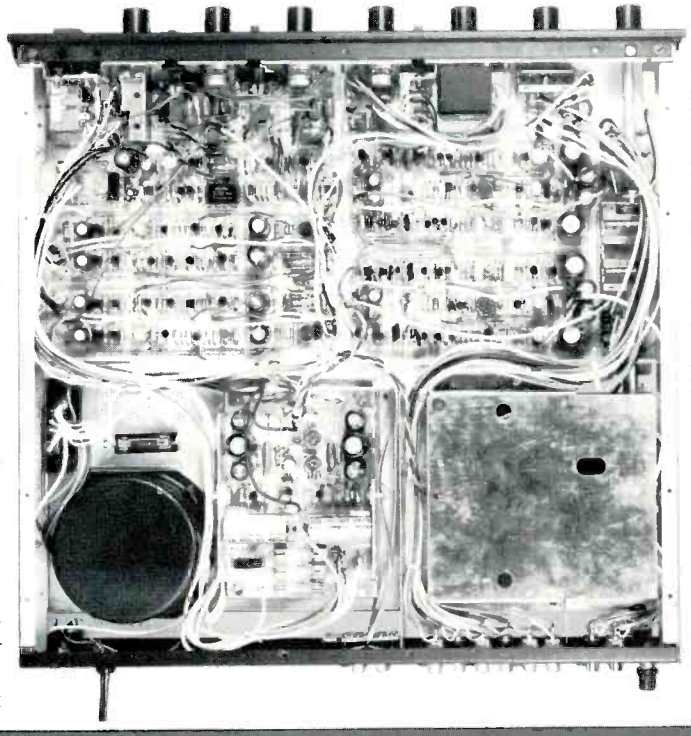
Circuit Highlights

Like the companion BA-F1 amplifier, the CA-F1 makes use of what Sansui calls a "Diamond Differential DC" circuit, this time in the phono-equalizer amplifier. The input stage consists of a pair of low-noise, high-transconductance FETs operating as a differential amplifier, followed by a cascode bootstrapping circuit. The intermediate stages which follow couple the aforementioned DD/DC circuit with a current differential push-pull driver. This DD/DC circuit is basically a dual complementary differential circuit with push-pull output formed by two pairs of NPN and PNP transistors. Input is voltage amplified by separate pairs of transistors. These symmetrical differential amplifiers feature an excelle nt common-mode rejection ratio. The other two pairs of transistors (which, combined with the first two pairs and drawn schematically, account for the "diamond" description) work as current differential amplifiers to achieve high drive current, as required. The final output of the equalizer-amp section is a Darlington-connected single-ended push-pull design that provides the desired low output impedance. The phono equalizer-amp circuit alone employs 20 semiconductors.

The so-called "flat amp" section of the CA-F1 also uses a low-noise dual-FET input stage followed by a cascode stage and a current-differential circuit. Signals pass or to a differential push-pull circuit featuring a current mirror stage for which Sansui has a patent pending, and from there to a two-stage Darlington-connected single-ended push-pull output stage. Boost and cut of the bass and treble controls are accomplished by varying the applied negative feedback.

Lab Measurements

Before discussing our measured results, it should be pointed out that Sansui, in its published specifications, has not as yet converted to the new IHF Measurements Standards (IHF-A-202, 1978) for Amp ifiers. Thus, their specifications followed by (*) in our tabulation were measured with respect to *rated* output, with volume control at maximum. Those specifications noted with (**) were measured with respect to rated input sensitivities *and* rated output. Our own sensitivity measurements are taken for an output of 0.5 V and, not unexpectedly, turn out to be just half of what Sansui speci-



fied (since their rated output is 1.0 V as against referenced IHF output of 0.5 V) — or 77 mV for the high-level input, 1.3 mV for the MM phono, and 0.05 mV for the MC phono. Signal-to-noise ratio is not as easily compared with published specs, however, since it involves both a referenced input (0.5 V for high level, 5 mV for MM phono inputs, and 0.5 mV for MC phono inputs) *and* the referenced 0.5-V output (which involves lowering the master volume control to establish these reference points). Using this technique, we measured an S/N of 84 dB for the MM phono inputs (an excellent result, by the way, compared with typical preamps we have measured in this manner) and 76 dB for the MC inputs (also better than the norm). The high-level S/N ratio was 90 dB, while residual noise and/or hum was 92 dB below 0.5 V out, with the volume control turned down to minimum.

Claims for maximum output of 10 V were precisely substantiated, while in the case of phono overload, the manufacturer's claims were actually somewhat conservative. We measured a 410-mV overload capability (at 1 kHz) for the MM phono inputs and a 25-mV overload level for the MC phono inputs. Frequency response for the high-level inputs was down 1 dB at 140 kHz, while for the phono inputs, RIAA equalization was accurate from 20 Hz to 20 kHz, within 0.2 dB as claimed. Figure 1 is a plot of the RIAA response curve as measured through the phono inputs when applying an input signal of constant amplitude swept from 20 Hz to 20 kHz. The straight-line response represents the results obtained at the output when a careful inverse of the RIAA playback curve is applied as an input signal over the same range of frequencies.

Figure 2 shows the rather moderate range of bass and treble control incorporated into the CA-F1, while in Fig. 3 we have plotted the response curves obtained at various settings of the master volume control when the loudness circuit is activated.

Use and Listening Tests

The Sansui CA-F1 preamplifier/control unit is neither overloaded with useless and superfluous controls, switches, lights and knobs nor is it the sort of "stripped-down" component sometimes favored by extreme purists. Rather, it is somewhere in between, offering those controls and switches that most users would deem essential but without going overboard. Internally, the unit is elegantly designed and assembled. There is far more sophisticated circuitry in this preamp than one would imagine by looking at its external configuration.

During the course of our listening tests using the Sansui BA-F1 as the associated power amplifier, we were impressed with the clean transient response of this combination, the inaudible noise and hum levels (even with volume turned up so as to drive the power amp close to its rated power output), and its well-balanced tonal response. Phono reproduction was, in our view, flawless, whether we used a moving-coil cartridge or one of the better moving-magnet cartridges. Together, the combination of the BA-F1 and CA-F1 would require an investment (at suggested retail levels) of more than $1,000.00 — more than most people pay for their entire component systems, including turntable and speakers. Still, for those who have the discerning taste (and the funds) to enable them to appreciate a pair of components such as these Sansui units, the price will seem more than reasonable.

Leonard Feldman

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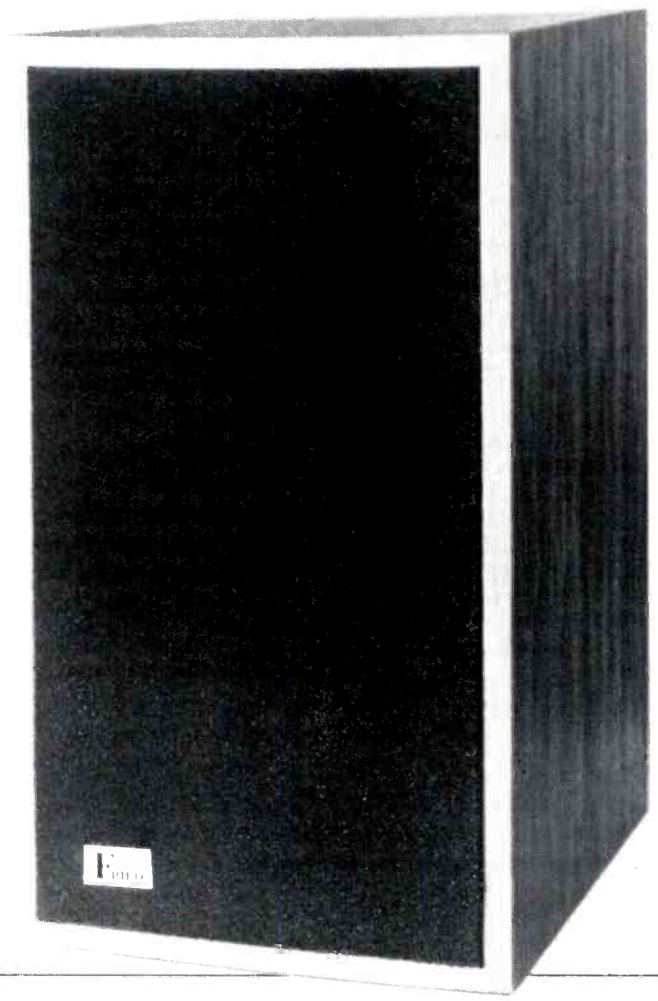
Fried Products Model Q Loudspeaker System



Manufacturer's Specifications
System Type: Two way, full range.
Woofer: 8 inch.
Tweeter: 1-inch dome.
Frequency Range: 45 Hz to 18 kHz, ±3 dB.
Sensitivity: 86 dB for one watt input at one meter.
Crossover Frequency: 2.5 kHz.
Nominal Impedance: 8 ohms.
Recommended Minimum Amplifier Power: 35 watts.
Size: 11½ in. (29.2 cm) W x 9½ in. (24.1 cm) D x 19¾ in. (50.2 cm) H.
Weight: 23 lb. (10.35 kg).
Finish: Walnut vinyl.
Price: $150.00 each.

The Model Q is one of Fried Products' "Signature Series" loudspeakers. This is a full-range system housed in a diminutive enclosure measuring only 502 mm X 292 mm X 241 mm (19¾ in. x 11½ in. x 9½ in.) and weighs less than 10½ kilograms (23 lb.). A 203-mm woofer is used in conjunction with a 25-mm dome tweeter to cover the frequency range from 45 Hz to 18 kHz. Damped transmission line loading of the rear wave from the woofer is used to provide a smooth low-frequency response. The enclosure is finished in walnut vinyl, with a removable black foam grille providing visual accent.

Connection to the system is made to well-marked binding posts in a recessed cavity on the rear of the enclosure, allowing the Model Q to be placed flat against a wall, should that be desired. This cavity also contains a three-step equalizer control for adjusting the balance of the midrange in 2-dB steps, and a replaceable 2-amp fuse for protection against overdrive.

Although the cabinet and subsequent technical investigation showed that Fried Products Company provides a quality item, I was frankly surprised by what seemed to me to be a relatively small amount of instructional material in the printed brochure supplied with the system. While the brochure mentions the three-step control and that it is marked *Plus, Normal,* and *Minus,* the samples supplied *Audic* had no such markings. The brochure fairly and clearly warns about the terrible results of accidental or deliberate overdrive, but I would like to have seen somewhat more detail concerning the correct installation and anticipated performance of this unique loudspeaker system.

The small size of the Model Q lends itself to bookshelf mounting, and, as with all overhead installations, care should be taken to avoid any circumstance where the unit could fall or be pulled down on children or pets.

Measurements

Impedance, measured at the terminals of the Fried loudspeaker, versus frequency for each of the three equalizer positions is shown in Fig. 1. The designations *L, M,* and *H* in Fig. 1 refer to the relative drive level to the tweeter, with the *H* position corresponding to a fully clockwise rotation of the control. After a small bass resonance rise at 60 Hz, the impedance drops to its lowest value of around 5.5 ohms at 150 Hz. A secondary impedance peak occurs in the 1.5- to 2-kHz range.

This system should be considered a low-impedance load to the power amplifier, and there is no hidden problem with reactance variation for the Model Q. This is verified by the polar impedance plot of Fig. 2, measured for the *M* tweeter equalizer position. The load is without substantial reactive current demands so that any good power amplifier should be able, without difficulty, to drive the Model Q to the full capability of that amplifier.

The anechoic frequency response, measured at one meter on axis, is shown in Figs. 3 and 4 for the *M* tweeter-equalizer position. Figure 3 is the amplitude response for a constant voltage drive corresponding to one-average-watt into an equivalent 8-ohm resistance. Figure 4 is the phase response corrected for the woofer and tweeter arrival times at the mi-

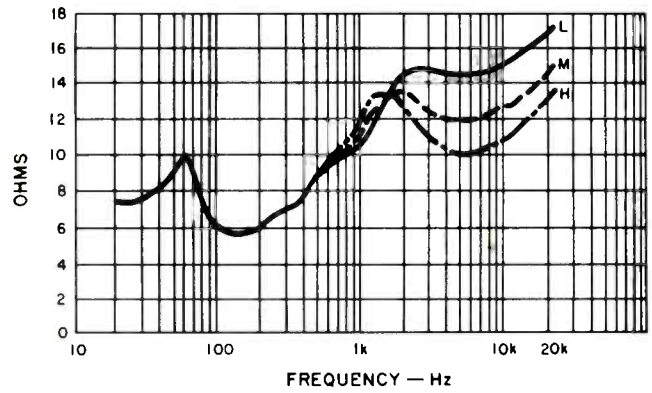


Fig. 1 — Magnitude of terminal impedance for three equalizer settings.

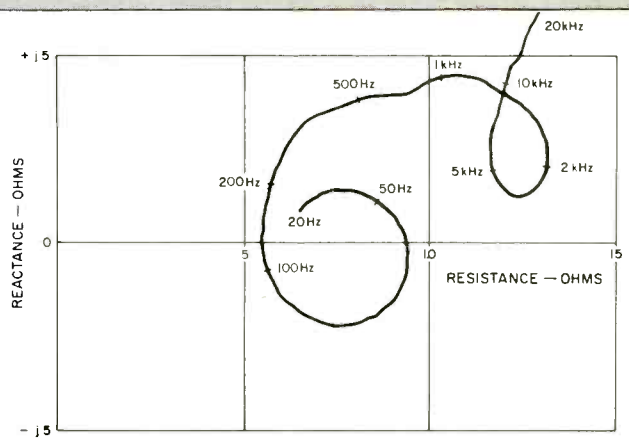


Fig. 2 — Complex terminal impedance for center equalizer setting.

crophone location. Comparison of these measurements shows that the actual acoustic crossover frequency is around 2.5 kHz and that the axial energy from the tweeter is around 5 dB lower than that of the woofer, except for a mild resonance rise at 15 kHz. This implies that program material rich in upper register energy may be somewhat dulled. The nature of the measurement suggests that a parametric or bandpass type of equalizer control may well be the best way, given this tweeter control setting, to balance the high- and low-frequency portions of the response, since the usual type of tone control provides an emphasis which increases with increasing frequency above the turnover point. Such a combination would probably prove too bright in the highest registers.

The apparent acoustic center of the woofer is such that most frequencies below about 2 kHz arrive at the listening location with an average delay of 0.560 mS relative to the air-path time delay from the physical front of the enclosure. The tweeter location has an equivalent delay of 0.061 mS. This places the arrival time difference between tweeter and woofer at approximately 0.499 mS, which amounts to one wavelength at 2 kHz. At this microphone location, which is one meter directly on the geometric axis of this system, the response should be characterized as being a nonminimum phase type. The jury is still out on the full aural significance of nonminimum phaseness, but waveform fidelity is sacrificed by such a characteristic.

The low-frequency response, just starting to roll off at 60 Hz, is quite good for such a small physical system. And the top end, above 2 kHz up to nearly 20 kHz, is also quite good.

However, we don't listen in anechoic chambers, we listen in rooms, and Fig. 5 shows the results of our three-meter room test on the Fried Model Q. The loudspeaker was placed 70 cm off the floor and flat against a hard wall. This was the position found in the earlier listening test which gave the most consistent stereo imaging with the least amount of mid-bass emphasis. The microphone was placed three meters from the front of the enclosure and one meter above a carpeted floor, which is a reasonable listening position for this speaker system. The frequency response of the first 13 mS of direct sound from the Model Q is shown in this measurement. Two microphone positions are shown, one directly on axis and the other 30 degrees off axis in a setup corresponding to this speaker used as a left channel for stereo reproduction. The curves are displaced 10 dB for clarity of presentation.

The three-meter room test shows an amplitude response quite similar to the one-meter on-axis anechoic response. There is, however, some small influence of floor and ceiling reflection in the 200-Hz to 1-kHz range. The angular dispersion of the system is quite uniform within 45 degrees of its axial direction. This accounts for the essentially similar axial and off-axis responses shown in Fig. 5. Lateral dispersion leads to rather good stereo lateral imaging and freedom from

Fig. 3 — Anechoic one-meter on-axis frequency response for constant voltage drive level corresponding to one average watt into 8 ohms.

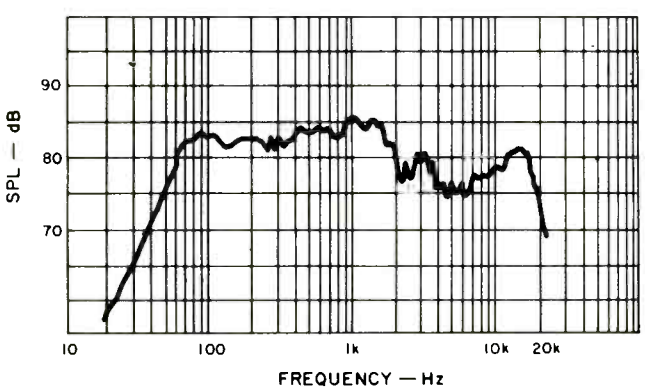
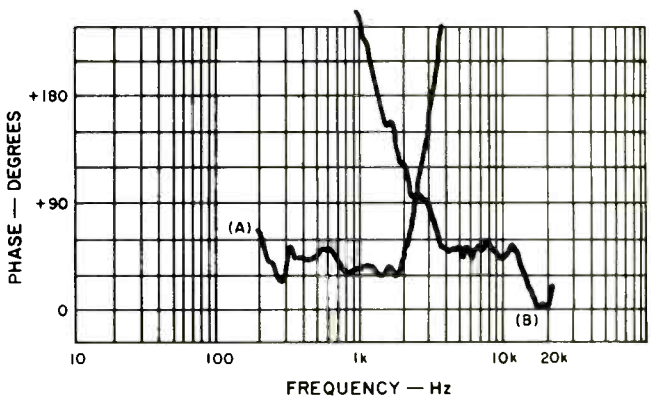


Fig. 4 — Anechoic one-meter on-axis phase response corrected for (A) acoustic time delay of woofer, 3.467 mS, and (B) acoustic time delay of tweeter, 2.968 mS.



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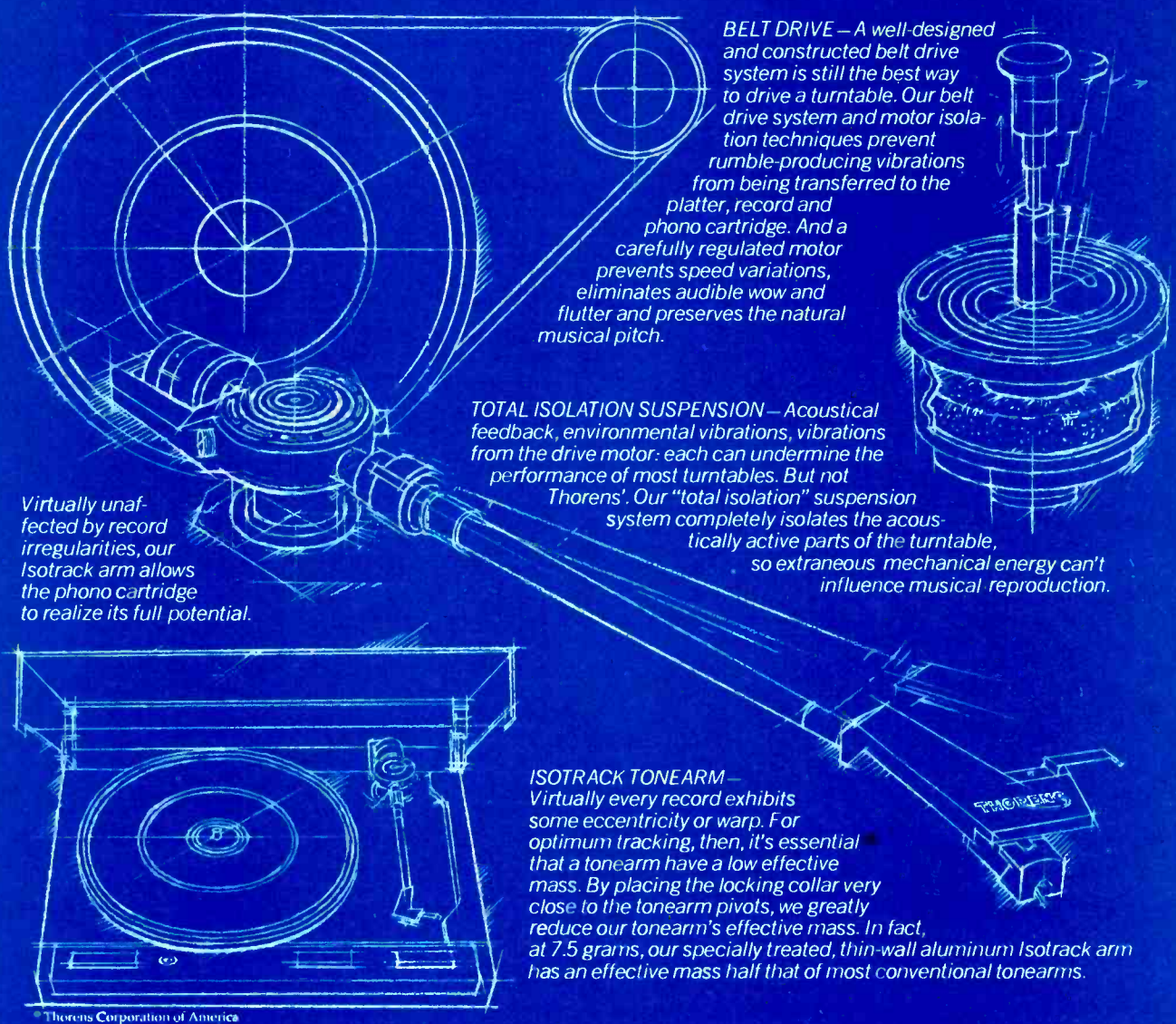

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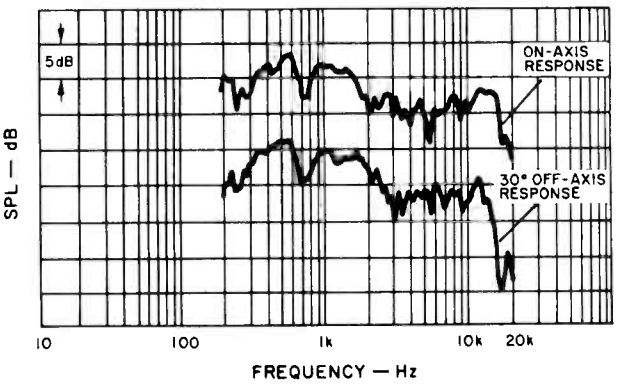


Fig. 5 — Three-meter room test.

a "best seat" listening location, but the Model Q has just a bit too much vertical spread which causes some interference between the direct sound wave and that wave which reflects off the ceiling of the listening room. The phase response of the three-meter room test (not shown) reveals some interference in the 2.5- to 8-kHz range. All in all, however, this is quite respectably good response for room listening.

The measured horizontal and vertical dispersion patterns are shown in Figs. 6 and 7 for each of the three equalizer positions. These are polar energy patterns showing the net energy from all frequency contributions in the 20-Hz to 20-kHz range. No substantial beaming exists for the Fried Model Q. The measurement shows that the response is rather uniform, on the average, within 30 degrees of the frontal axis of the loudspeaker. The action of the equalizer controls is mild, resulting in average spectral changes of slightly greater than one decibel per step with no effective change in dispersion. The wide angular response of this system, particularly in the vertical plane, indicates that the speaker should not be placed next to substantial objects which might reflect sound back toward the listening area. This system should be placed off the floor (as experimentally determined in the earlier listening test) and not put under overhanging shelves.

Harmonic distortion measurements for pure tones of 41.2 Hz (E_1), 110 Hz (A_2), and 440 Hz (A_4) are shown in Fig. 8. Distortion on the low bass E is moderately high at all power levels, consisting of about equal portions of second- and third-harmonic content. Since this tone lies below the natural low-frequency cut-off of this system, no acoustic problems should arise unless the system is overdriven by program material which has been heavily boosted in the bass. The tones of A_2 and A_4 lie within this system's passband and are handled at moderately low distortion levels up to average powers of 30 watts. One possible source of sonic distortion for those who are sensitive to such things is the second harmonic distortion levels which rise uniformly with signal level.

The IM test, Fig. 9, measures the extent to which a higher musical tone, A_4, is modulated by the presence of the lower musical tone, E_1. Both tones are mixed at equal level, and the root mean square of the acoustic crossmodulation sidebands on A_4 is shown as a percentage of the acoustic level that A_4 would have if the lower tone were not present. The data are plotted as a function of average power in watts referred to 8 ohms. Below two watts, the IM is principally due to phase modulation of the higher tone by the lower tone. An amplitude modulation component enters above that power level. The modulation gradually increases with power level such that, at 60 watts, there is a 10-degree peak-to-peak phase modulation of A_4 and a corresponding 10-percent amplitude modulation. There is also, at 60 watts, a shift in the apparent acoustic center of A_4 toward the listening location accompanied by an average amplitude reduction of about 0.1 dB. This effect is undoubtedly due to the large excursion caused by the lower frequency which lies below the acoustic cut-off of this system. These measurements indicate that musical passages containing high levels of low-frequency material may cause time base shimmer and acoustic migration of middle-range voices, even though the speaker is not driven to levels of obvious distress.

Acoustic transfer uniformity is another measure of a loudspeaker's ability to handle program dynamics. The ratio of sound pressure to driving voltage should remain constant for any tone at any power level within the system's normal range of reproduction. If this ratio changes with drive level,

Fig. 6 — Horizontal polar energy response for each equalizer setting.

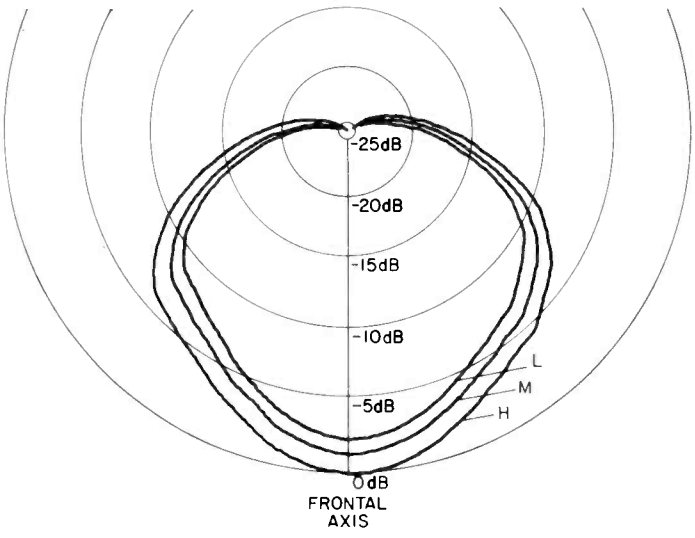
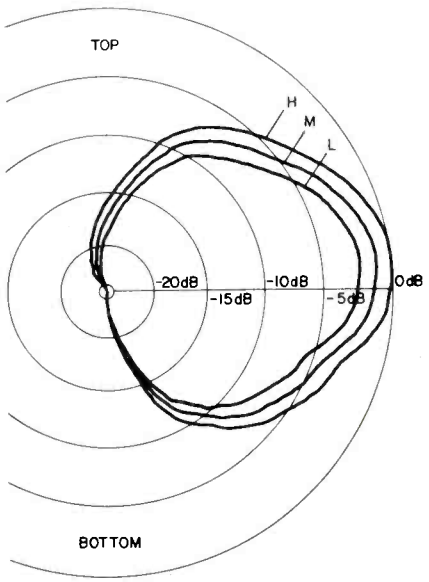


Fig. 7 — Vertical polar energy response for each equalizer setting.



then we can expect both musical timbre and image localization to alter with sound intensity. Three tones, A_2 (110 Hz), middle C (262 Hz), and A_4 (440 Hz) were used to check the Model Q. (Spot checks were also made at several other pitch values.) These are tone-burst tests in which a tone is applied for a short duration simulating a staccato passage. A_2 was handled with less than 0.1-dB deviation from perfection up to 50 average watts. Middle C remained essentially perfect up to 1 watt, dropped 0.3 dB at 10 watts, and fell to 1 dB at 30 watts. A_4 dropped 0.2 dB at 1 watt, 0.6 dB at 10 watts, and 1 dB at 30 watts. The small reduction in sound pressure for higher tones relative to lower tones indicates a slight tendency for softening of timbre with increased program level for sets of tones comprising chords.

The measurements also suggest a slight lateral migration of extreme stage-left and stage-right stereo imaging with increased intensity of sound. *All* loudspeaker systems show problems in this test, and the Model Q comes out slightly below the average for the speakers we have tested for this subjective effect.

Another form of distortion of program dynamics is checked by what we call the crescendo test. A low-level tone is measured for sound level change when broad-band incoherent noise is superimposed at an average level 20 dB above that of the tone. The intent of this test is to determine the extent to which an orchestral inner musical voice is modified by a sudden swelling of sound from nearby instruments. The Model Q fares better in this test. A tone of A_4 at a level of 100 milliwatts (0.9 volts rms) is reduced approximately 0.6 dB when 10 average watts of 20-kHz band-limited white noise (50 volts p-p) are superimposed. The tone of A_2 remains within 0.1 dB at the same drive level. The net effect of both these measurements is that stereo localization and preservation of timbre should be better under conditions of high-level orchestral dynamics than for solo instrument passages.

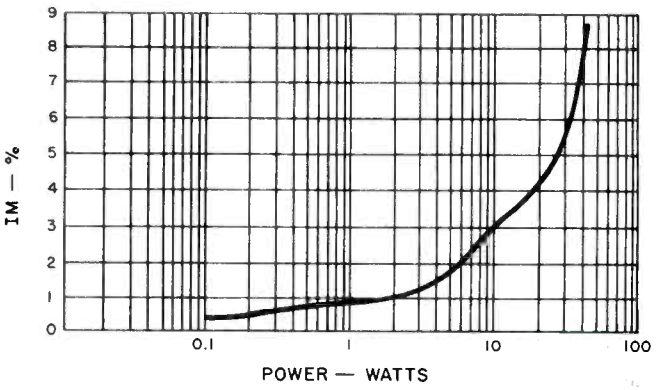


Fig. 9 — IM distortion on A_4 (440 Hz) by E_1 (41.2 Hz) when mixed in one-to-one ratio.

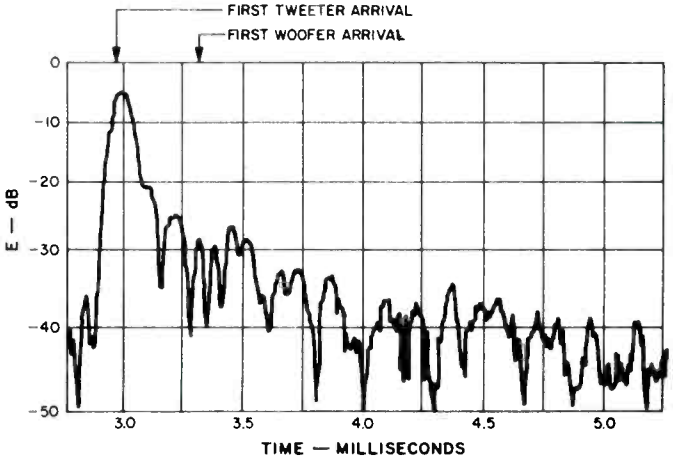
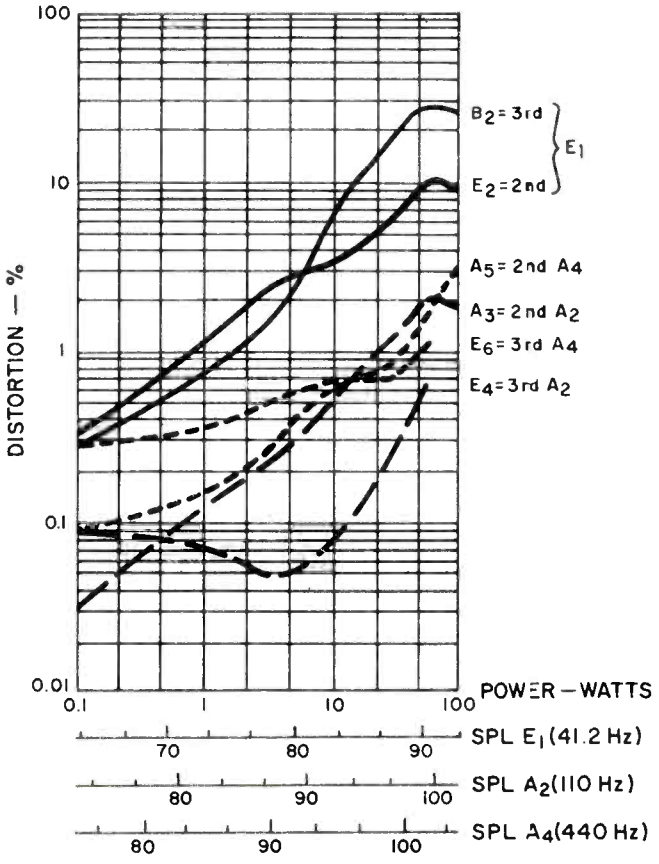


Fig. 10 — Energy-time curve.

Fig. 8 — Harmonic distortion for the tones of E_1 or 41.2 Hz, A_2 or 110 Hz, and A_4 or 440 Hz.



The energy-time curve is a measure of impulse response; the measured curve for the Model Q is shown in Fig. 10. The microphone is placed one meter from the front surface of the loudspeaker and along the geometric axis. The first sound from the tweeter arrives at 3.00 mS, followed by two low-level delayed tweeter reflections at around 3.1 and 3.2 mS. The highest frequency contribution from the woofer begins to arrive at around 3.2 mS, and since the tweeter has not finished its die-down, a small amount of mutual interference is evident in the 3.25- to 3.5-mS range. After that, the woofer arrivals dominate and provide a smooth decrease in energy from that time onward. Only a few enclosure edge reflections can be seen at levels some 30 dB below the peak energy of first arrival. The 3.25- to 3.5-mS interaction of arrivals from tweeter and woofer is the cause of the small response irregularities in the 2-kHz to 5-kHz range which is evident in Fig. 3. However, with the exception of the small differential delay between the two drivers, the impulse response of the Fried Model Q is quite good.

Listening Test

Instructions supplied with the Model Q indicate that exact positioning is not critical to listening quality, except that the speakers should not be placed in a corner or flush with the floor. After some experimentation to find the best setup and then extended listening, I felt that I got the most accurate sound from the Model Q when it was placed against a draped wall and on a firm pedestal which lifted the speaker 70 cm off the carpeted floor. The draped wall provided the least amount of reflected energy for a stereo spacing which subtended an angle of about 60 degrees at the listening location, and the pedestal lifted the center line of the speaker to about normal seated ear level.

My first impression was that the Model Q does not have extreme low bass, although it does a good job of handling music down to about an octave and a half below middle C. A thunderer it is not, so that if one is an addict of organ pedal notes or open-string bass sound, the addition of a subwoofer might be considered. However, no bass EQ is needed since the mid and lower registers are well balanced.

The upper midrange has a characteristic which handles some types of vocals well, but there is a timbre softening with percussive instruments. The treble range seemed, to my ears, to have a peakiness or strident quality in the reproduction of piano, which is one of the very most difficult of instruments to reproduce accurately. This seemed to relate to a general reduction of extreme top end relative to the upper midrange, which condition was verified later in the measurements. Attempts to restore sonic balance with the rear-mounted tweeter controls did not help, in my opinion. I finally settled on the "normal" switch position and added a small amount of treble boost at the preamp, about 2 dB at 9 kHz relative to a reference at 1 kHz.

Stereo lateralization is quite good with the Model Q, though to my ears the sense of image depth was not as effective as the good sense of lateral placement. Experiments with reversing signal polarity did not modify this impression, as can sometimes be the case, and the only improvement I could make here came when I pointed the Model Qs slightly outward and away from the listening position.

Both vertical and horizontal dispersion of sound is excellent in the Model Q, and the subjective stereo localization does not significantly migrate as one moves around the listening area. Such a characteristic relates to the smoothness of the polar plots, which were performed later, and is valuable in that it helps present a good stereo image in a variety of listening positions.

Although the extreme low bass is reduced in this system, the woofer can handle quite significant amounts of bass drive without audible distress. The now-famous bass drum on the Fennel/Holst *Suites 1 & 2* (Telarc 5038) was handled with no breakup even at a quite robust level of playback. The sonic effect was not visceral, but the system doesn't go "crunch" either, which many other systems will do at a comparable drive level.

On balance, this speaker can provide excellent service for limited to moderate budget circumstances, particularly where a loudspeaker of small physical size is advantageous. While this is not a "money no object" system, the Model Q does offer good overall performance at a modest price.

Richard C. Heyser

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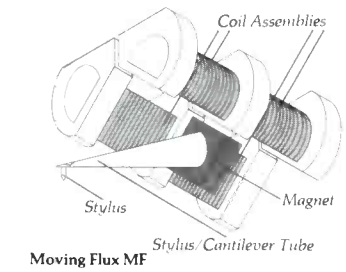
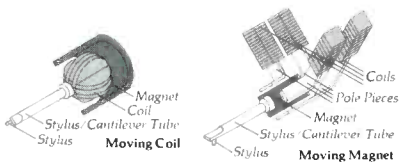


Moving Flux MF



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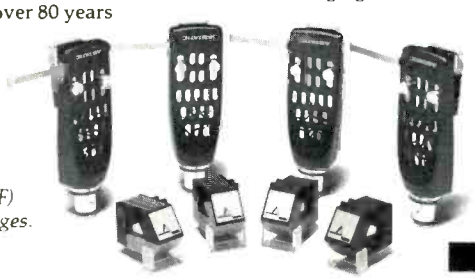
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The column

Bad Luck Streak in Dancing School: Warren Zevon
Asylum 5E-509, stereo, $8.98.

Clearly one of the most literate and hard-boiled of current songwriters, Warren Zevon continues to delight in his risk-taking on **Bad Luck Streak in Dancing School,** his first album in two years. This is a collection of songs about, naturally enough, hard luck cases and losers. And of the violence that continues to be a key fascination of Zevon's work. But, as the album illustrates, there are losers and losers, violence and violence.

One thing about Warren Zevon's songs, like those of Randy Newman, it is dangerous *ever* to assume that any song comes from Zevon's own point of view. Much in the fashion of Newman, Zevon creates a character and writes a song for the character's peculiar view. Like the sad dope in the title song swearing to God he'll change while he's begging his Pauline not to walk out. Or the panoramic view of the mercenary soldier in *Jungle Work*. Or the gink who the big ape changes places with in the hilarious *Gorilla, You're a Desperado*. Or especially the depraved hillbilly who sings *Play It All Night Long*, a vision of Southern mountain life so black that by comparison Randy Newman's sick *My Old Kentucky Home* is in Technicolor.

Helped along by Greg Ladanyi who also recorded Zevon's **Excitable Boy** and Jackson Browne's **Running on Empty, Bad Luck Streak** is a superbly crafted album. The drum sound is excellent and is spread across the full stereo mix. Voices are handled from sumptuously to cynically and always effectively. In the revival of the 1961 Ernie K-Doe song *A Certain Girl*, the purposely wimpy backing voices of Jackson Browne and Rick Marotta, all sighs and innuendo, make the song work. And *Empty-Handed Heart*. That one's a gorgeous ballad of a finished love gone totally dead. Zevon's terse lyrics alone practically imply the melody. Try to say his line "Will I fall in love again?/ It's a possibility" without feeling the rhythms of the words. And one has five syllables and works just perfectly. As the singer prepares his stand against the desolate future, from nowhere Linda Ronstadt appears to sing a lovely descant depicting the good times, and completing the desolation. Here she is mixed up-front, equal with Zevon. And on Zevon's shrewd song about baseball's most outspoken pitcher, *Bill Lee*, Glenn Frey's harmony is unexpected and just right.

Several times in the album Zevon inserts brief moments of string interlude to both set up a juxtaposition between songs and to pace the album. It is a dangerous device that misused would sound pretentious, but doesn't. The title song at the opening of the album benefits from the few bars of music preceding it. So, too, do *Jeannie Needs a Shooter* (a collaboration with Bruce Springsteen) and *Bill Lee*. The string link eases tension between *Jeannie's* violent and sudden conclusion and the pensive mood of *Bill Lee*. And without the strings acting as transition between *Empty-Handed Heart* and *Play It All Night Long*, it would

Illustration: Rick Tulka

have sounded jarring and forced. Here the interlude saves/savors the moment.

Intelligent, determined songwriting, excellent production with real stereo sound and inspired musical performances don't often come together on one album. But these are what Warren Zevon's *Bad Luck Streak in Dancing School* is made of. *M.T.*

Sound: B+ Performance: B+

It's a Beautiful Day
San Francisco Sound SFS 11790, stereo, price n.a.

After several years totally out of print and unavailable, the legendary first **It's a Beautiful Day** album is again being offered in a limited edition with the original neo-Maxfield Parrish cover and the contents intact. Songs like *White Bird, Hot Summer Day,* and *Girl with No Eyes* are as memorable today as they were 10 years back. David LaFlamme's violin has never been a more potent force than on this album, and Patti Santos' vocals are at their most mysterious.

For information on availability write to San Francisco Sound, c/o Matthew Katz Productions, 555 Post St., San Francisco, Calif. 94102. *M.T.*

Sound: B+ Performance: B

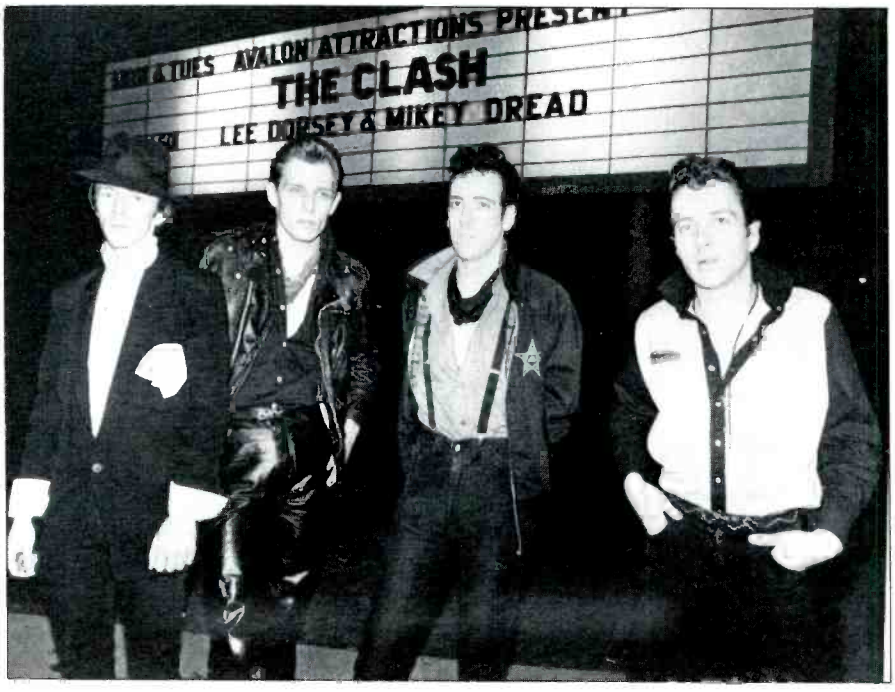
Hot Tracks: John Hammond with The Nighthawks
Vanguard VSD-79424, stereo, $7.98.

As John Hammond albums go, **Hot Tracks** is a pretty good one, due largely to the support of The Nighthawks from Washington, D.C., as good a blues band as there is hitting the boards these days. As a Nighthawks album, it is nothing exceptional because of the background stance they must assume. This doesn't allow them space to really step out nearly enough.

The material is surprisingly usual and well-known stuff from such masters as Bo Diddley, Howling Wolf, Little Walter, Jimmy Reed, the inevitable Chuck Berry, Willie Dixon, and Robert Johnson. Hammond and The Hawks do well with the songs, but I'd hope for some more obscure tunes that don't carry the weight of the originals so heavily.

Until The Nighthawks' first Mercury album is out, **Hot Tracks** will have to fill the gap. Meanwhile, try to look up some of their *superb* output for Adelphi Records. *M.T.*

Sound: B Performance: B-



London Calling: The Clash
Epic 2E-36328, 2 discs, stereo, $9.98.

The third Clash album is by leagues their best even though it is a double album including 19 cuts. Song after song is pointed and played with class. The buzz-saw attack of the first two albums has matured into something substantial and real.

This time around horns and Mickey Gallagher's organ augment the four band members, rounding the sound. Guy Stevens' production makes no attempt at slickness and instead opts for an infectious party atmosphere that serves the band admirably. Side two is the strongest, song for song. *The Right Profile,* about the car crash that broke Montgomery Clift's face, is a chiller, no less than the powerful *Lost in the Supermarket* and *Clampdown.* Over on side four is a song that some critics have cited as a trendsetter for the '80s, *Train in Vain,* which is not even listed either on the sleeve or on the disc. In England it was a final second addition to the album, and I suppose that they decided to maintain the sense of mystery in America as well. *Train* has a rollicking feel like the best Motown songs of the '60s, and it could well be a big hit. It is that accessible.

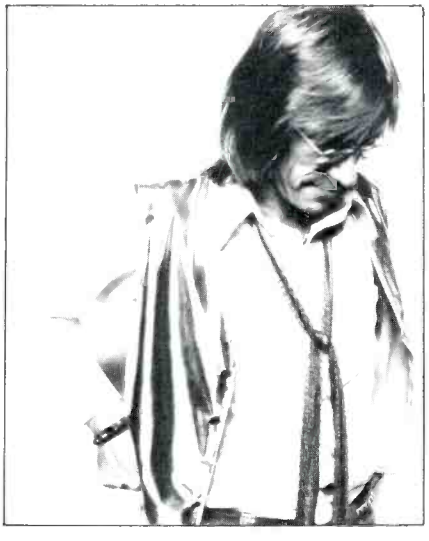
With **London Calling** you cannot ignore The Clash any longer. They ain't punks, and they ain't going away. This is an easy album to learn to love. *M.T.*

Sound: B– Performance: A

Hell of a Spell: Doug Sahm
Takoma TAK 7075, stereo, $7.98.

Sir Doug is quite a good singer and has written a song or two worth a listen, but the majority of **Hell of a Spell** is simply mundane blues. There are exceptional moments, as on *Tunnel Vision* where he lets loose with a truly inspired vocal on a song reminiscent of John Fogerty and/or The Band, but unfortunately the rest of the album doesn't live up to the expectations set by this one killer track. Some people are cult heroes because of non-aesthetic reasons, but with Sahm it seems to be a case of self-imposed nonstardom. *J.T.*

Sound: B Performance: C



The Babys

Union Jacks: The Babys
Chrysalis CHR-1267, stereo, $8.98.
Face To Face: Trevor Rabin
Chrysalis CHR 1221, stereo, $8.98.
No Place To Run: UFO
Chrysalis CHR 1239, stereo, $8.98.

Rock journalists have dubbed a new sound "Corporate Rock," a term synonymous with just about anything sounding like Foreigner, Toto, or Boston. There's nothing inherently wrong with the sound, and there's also nothing wrong with being a group that aspires to be aesthetically successful — some of the best groups in rock have made amounts of money proportional to their talent — but the intimation is that there really isn't much substance behind the basic approach, and that all you have is a form which others try to emulate as it's proven to be financially viable. I have my own way of reckoning with this type of music, which is by asking: Would the performers make any kind of impact were there not some chart success to accompany their record? In the case of all three of these albums, I can unequivocally state that no one would miss them if they were to disappear overnight.

The Babys were first created as a Bad Company for 12 year olds, hyped as if the lives of the Iranian hostages depended on their success. They finally settled into being some sort of Top-40, middle-of-the-road raunch hitmakers after some nasty music business wheeling and dealing that left former managers, groupies, and a rhythm guitarist/keyboardist seriously injured along the rock 'n' roll trail to glory. On the cover of **Union Jacks** their look is somewhere in between The Bay City Rollers and The Sex Pistols, with lead singer John Waite, having lost his good looks, starting up with leather and earring drag. It sounds like a joke, but I assure you there's a lot of money put into this project although they've got quite a ways to go before they recoup. The Babys are not about to let the New Wave pass them by, but unfortunately their album is the same old dreck that the last album had, sort of a schlocky Bad Company/Foreigner. (They used to be produced by Ron Nevison, Bad Co.'s knobtwister; now ex-Fleetwood Mac/Foreigner geezer Keith Olsen does the honors.) They really don't have any lyrical or musical moves, and ever since he quit playing bass, John Waite sounds more like he's being groomed for Rod Stewart's shoes. It's to be hoped he'll dispense with the group and posing soon and show us if he has any musical ideas, because The Babys are already sounding old and tired.

UFO has always been a vaguely successful rock band, but since guitarist/songwriter Michael Schenker left they've been trying to regain their even keel. Unfortunately, they've recorded an album of minimally musical songs (with the exception of a clever remake of *Mystery Train*), highlighted by a few nice solos by Paul Chapman (who can't write for beans) and the immaculate recording technique of Geoff Emerick and George Martin. They've done better, and perhaps they will again, but first they need to rediscover their musical identity, which ain't to be found in other groups' Top 10 records.

Trevor Rabin just wants to be the Todd Rundgren of the genre. He plays all the instruments himself and even produces his own album. Now all he has to do is learn how to do all these things at the same time *and* be exciting. **Face To Face** is just as dull as his first album, and that was no easy task.

In short, one can only remain amused that this particular style of music is peacefully coexisting with

UFO

Trevor Rabin

New Wave, which claims to be music that doesn't care whether people like it or not, and that very few proponents of either form would have any sort of *raison d'etre* if there weren't an audience for it. The evils of both are about equal; one hopes that soon musical aggregates will be able to play without clinging to the boot heels of whoever is currently the fashion. *J. T.*

Sound: B+ Performance: C-

. . . but the little girls understand: The Knack
Capitol S00-12045, stereo, $8.98.

When The Knack's first album appeared, here in the pages of *Audio* I openly posed the obvious question, "Do these guys have another album this good in them?" Based on this follow-up, they don't. The new album is top-heavy with cannibalizations of their own material — *Sharona* clones particularly numerous — and their sarcastic wit watered down into simple-mindedness.

Production, again handled by Mike Chapman, is sparkily stark, matching the material. Packaging again is totally image-mongering, but classily done. Still, the second time around, a different question nags. Will The Knack really turn out to be another in the endless string of one-hit wonders who linger too long? *M.T.*

Sound: B Performance: D+

A Great Gift Idea/Floats: The Credibility Gap
Sierra/Briar SRS-8704, 2 discs, stereo, $9.98.

The Credibility Gap was Harry Shearer (now a member of the NBC "Saturday Night Live" crew), David L. Lander and Michael McKean (Lenny and Squiggy of "Laverne and Shirley"), and Richard Beebe. They create radio humor with laceratingly sharp wit.

A Great Gift Idea was originally a January, 1974 release, just in time to completely miss the Christmas rush. It is an album mostly consisting of media satires, among them the best Johnny Carson take-off ever (Shearer's Carson is indistinguishable from the real thing), *An Evening with Sly Stone* in which Sly as an all-around intellectual (like that brilliant TV host Hugh Hefner at his "Playboy After Dark" parties) demolishes the form, and *16 Golden Bits* with Shearer as pitchman with a perfect mile-a-minute buzz-saw delivery for a perfectly ludicrous product.

Floats consists of excerpts from The Gap's legendary annual coverage of the New Year's Day Tournament of Roses Parade, replete with wigged-out imitation guest appearances from Curt Gowdy, Garner Ted Armstrong, and Woody Hayes, all impersonated brilliantly.

Just having **A Great Gift Idea** back in print again is a joy. It is a comedy record with bite that wears well over repetitions. That kind of album is hard to come by, and the addition of **Floats** makes it a fine double-pocket set. *M.T.*

Sound: B Performance: B+

Freeze Frame: Godley/Creme
Polydor PD-1-6257, stereo, $7.98.
The Age of Plastic: Buggles
Island ILPS 9585, stereo, $7.98.

The story seems all too predictable: Studio-created group records a couple of tunes, has a hit, and then the least studio-oriented members split. In 10cc, at least the performing members kept the name, while Godley & Creme, the weirdos, locked themselves in the studio and managed to come up with a bunch of wholly eccentric and uncommercial records. Their latest effort, **Freeze Frame,** is sort of interesting and the title track is almost captivating, but they sound more like a scientific experiment than a performing duo.

Buggles' most talented member abandoned the group to begin a career of his own (his name being Bruce Wooley), and the remaining pair sounds remarkably similar to Godley/Creme on their debut album. The record is a little overburdened with studio effects, and it has an appeal similar to Pink Floyd's as background music for psychedelic ingestion, except that every tune is performed against a quasi-disco/English bubblegum beat that adds to its intrusiveness. Still, the best moments are those coauthored by Wooley, *Video Killer the Radio Stars* and *Clean Clean*. *J.T.*

Sound: B+ Performance: B-

Buggles

Shooting Gallery: Philip Rambow
EMI Records EMC 3304, stereo, $7.98.

If there's one thing that comes across on this extremely musical album, it's the personality of the artist. Rambow has a voice somewhat like Van Morrison's but his attack is tougher. His approach is like Springsteen's street-level gruffness, but this boy can hit those high notes. Rambow's songwriting ability was hinted at on the tune *Night Out,* included on the 1977 **Live at Max's** album, and on his debut LP he proves that he can deliver a rocker as well as a ballad.

Since Rambow hasn't jumped on any stylistic bandwagon it's hard to aptly categorize his music. In that his lyrics are intelligent and sensitive, you might label him a singer-songwriter who knows how to rock. Songs like *Don't Call Me Tonto, Fallen,* and *The Sound and the Fury* explore various aspects of a love relationship, while *Privilege* is a social commentary about being a rich white boy and *Victim* a response to the Sid Vicious affair. Rambow's lyrics reveal a perceptive and caring person, and although his sweet ballads and tasteful rockers wouldn't convince you, his words convey the strong impression made upon him by the punk scene. *Night Out,* his second U.S. release as a solo artist, depicted the CBGB punk rock world, and such tunes as *Young Lust, Victim,* and *The Rebel Kind* continue to express aggressive anti-establishment street sentiment.

Musically Rambow is as adept as he is lyrically. Melodies are outstanding on *Fallen, Privilege,* and *Tonto,* and his rhythm guitar work punctuates the lyrics with an insistent expertise. The whole band plays well but keeps the volume to a minimum, allowing Rambow's vocals the spotlight. Compare this vocal/instrumental balance to Ellen Foley's cover of Rambow's *Young Lust,* where her screaming fails to make any headway over the blasting instrumental back-up.

The production on **Shooting Gallery** is the record's weakest point, but control-booth blandness can't flatten Rambow's remarkable talent. His voice, personality, and compositions as a whole aren't as strong as they could be, given a more dynamic and rock-oriented production, but make themselves felt amazingly well despite their somewhat drab clothing.

Sally Tiven

Sound: B Performance: A

The Best of the Stan Freberg Shows: Stan Freberg
Volume I, Capitol SM-11824; Volume II, SM-11792, mono, $4.98 each.

These two records were originally a double-set in the mid-'50s, the material lifted from a summer replacement network radio series, one of the last of its kind before video finally killed the radio stars for good. Stan was at his most irreverent for this series. Having a regular cast including June Foray, Daws Butler, and Peter Leeds creating among them a cast of thousands of character voices was no small contribution to satiric excellence.

Several of these bits are stone classics. *Elderly Man River* is one of the best shots at network censorship ever. The mock panel show *Face the Funnies* is an hysterical look at the serious side of comic strips. *Freberg in Advertisingland* is one of the best bits on Madison Ave., a favorite Freberg target, to this day. Of special interest to *Audio* readers are the two *Herman Horne on Hi-Fi* bits on Volume II.

Each volume has *over* 50 minutes of material, and with the low list price, these reissues are easily worth searching out. But if you're already a Freberg fan, you know that. *M.T.*

Sound: B Performance: A-

John Lissner

John Diliberto

Jazz & blues

Crawfish Fiesta: Professor Longhair
Alligator AL 4718, stereo, $7.98.

The death of Professor Longhair the day before **Crawfish Fiesta** was released adds the only somber touch to an otherwise joyous occasion: The issuing of a new album by one of the most unique and influential piano players in the colorful history of New Orleans. Geographically a port town with the diverse traditions of a cultural melting pot, New Orleans boasts an abundance of musical styles. It was the Professor's lasting achievement to weave these disparate threads of his city's culture into an immediately recognizable synthesis that left an indelible imprint on those musicians who heard it.

Longhair's individualistic handling of what's commercially labeled rhythm 'n' blues radiates a persistent vitality that makes it perfect for partying — in fact, two of his songs have assumed the status of semi-official anthems of this nation's best-known annual celebration, the New Orleans Mardi Gras. Yet outside that city, Longhair's syncopated rumba rhythms are known only through the work of more popular artists who came under his spell: Fats Domino, Huey Smith, and others who helped shape rock in its infancy.

For a variety of unconvincing reasons, Longhair, born Henry Roeland Byrd in 1915, never recorded much and toured even less. The Professor and his own handpicked band finally entered a local studio this past year to cut **Crawfish Fiesta,** and as hoped, it's all first-rate Longhair and simply terrific at that. The songs are forcefully arranged, his seven-piece band is well rehearsed (note the potato-chip crisp percussion and punchy brass lines) and Longhair's sprightly, infectiously rocking piano is given plenty of room to shine. Of special interest to rock archivists is the presence on guitar of Dr. John, who was once a Longhair sideman when the sometime rock star was still a studio musician known only as Mac Rebennack.

Crawfish Fiesta preserves for posterity the legacy of a local legend performing the rollicking music he loved. Professor Longhair lives on.

Roy Greenberg

Sound: B Performance: A

Waves: Sam Rivers
Tomato TOM-8002, stereo, $7.98.

Waves is a good title for a Sam Rivers album, but the first composition, *Shockwave*, is even more appropriate. His music comes at you like a megaton blast and sends you careening on the currents of continous sound. Rivers is an incessant improvisor whose ideas never stop coming. His normal performing format consists of a pair of sets in which he'll play two of his four instruments one set and two the next. Both segments are nonstop from the moment he picks up his horn or sits down at the piano.

This new recording features his current performing unit of Dave Holland on bass, Joe Daley on tuba, and Thurman Barker on drums. With its five songs, **Waves** becomes a self-edited Rivers, with all the extrapolated energy of a performance condensed into tunes between five and fifteen minutes. The opening piece is indicative of

Illustration: Rick Tulka

the entire album. It begins with Rivers playing lean, jagged lines on piano that resolve into moments of contemplation before they take off again. Then the band rushes in for a full-scale collective improvisation. Even though Dave Holland is considered to be one of the best bassists on the planet, he's still underrated. He plummets through the swirl as if it were a meteor shower. Barker's percussion rumbles, spits, and shimmers like a blast furnace. While not as coloristically subtle as his predecessor, Barry Altschul, he has a more commanding physical presence.

Joe Daley is the foil of the group. His tuba is bounced around by Barker, buffeted by Rivers, and trades licks with Holland. Partway through the piece Rivers switches to tenor sax. The improvisation becomes even more turbulent with an edge of anger.

Little is planned before a Rivers performance; he leaves it open for almost anything to happen. The turbulence of *Shockwave* gives way to the airy *Torch*. Rivers' flute is lithe and crisp over the bubbling rhythm. A probing bass and tuba duet on *Pulse* leads into a bluesy rock rhythm with Rivers blowing a twisting soprano sax line. *Flux* finds the ensemble in a wistfully romantic mood that reaches a passionate climax with Holland sawing away on cello and Rivers' engorged piano. It finally subsides in Barker's somnambulant chimes. The last piece is a blown-out screamer called *Surge* that has Rivers spinning a furious tenor solo throughout.

Waves is a successful accommodation of a free-flowing musician to disc. Rather than let an engineer edit the record with arbitrary fades, Rivers has done it first by directing his group to controlled conclusions. Getting the proper sound mix is always a problem with Rivers' groups, since densities change at will. On **Waves** everything is captured, from the blunt, low sound of Daley's tuba to the crisp, speeding notes of Holland. *John Diliberto*

Sound: B+ Performance: A-

Yr: Steve Tibbetts
Frammis Records, stereo, $7.98.

Steve Tibbetts is fast becoming one of the most dynamic exponents of the post-Jimi Hendrix musical synthesis, an area that has been exploited more for its commercial prospects rather than as a basis for far-reaching explorations. Like Hendrix, Tibbetts is a guitarist, but he also plays other stringed instruments and keyboards. The most important cues he takes are the elaborate production techniques used by Hendrix on such albums as **Axis: Bold As Love** and **Electric Ladyland.** As much as he changed people's understanding of the electric guitar, Hendrix made the recording studio itself another instrument, and Steve Tibbetts is firmly rooted in this new tradition.

His first album was justifiably self-named since Tibbetts played all the instruments, wrote all the tunes, engineered and produced the proceedings, and even created the cover art. On one side he provided atmospheric settings for his multi-tracked acoustic guitars with whispering chimes and whirling synthesizers. On side two he became more extroverted with orgiastic rhythms and screaming electric guitar riffs.

With his second album, **Yr,** Tibbetts has added several new facets and gained an even greater control of his recording techniques. He's augmented his sound with other instrumentalists in the form of two tabla players and the various percussion devices of Marc Anderson. They extend Tibbetts' music into a virtual wellspring of exotic world musics. The tabla players lay down the living rhythms of Indian music, while Anderson often hovers at the borders of perception.

Through it all, Tibbetts' guitars dominate. **Yr** mixes acoustic and electric textures in a propulsive soundscape of the mind. (It isn't on a whim that the album cover advises you to wear headphones.) He has an open-ended purity similar to guitarists such as John Fahey that he intertwines with sinewy electric stratospherics.

The sonic unity of this album is created by Tibbetts' expert use of recording and editing techniques. Using only eight tracks, a primitive number in these days of 24 plus, he overdubs up to 20 guitars on one track. Solos are turned inside out by reversing the tape as if they were a mirror image. Melodic lines are built around rhythms that are dissected and turned around until they climax in stroboscopic splendor.

Though his tools were simple and the overdubbing and editing extensive, Tibbetts has sacrificed little in terms of presence, clarity, and extraneous noise. Acoustic guitars ring clearly,

electric instruments cut sharply, and the bottom is open. When using tape as one of your colors, a little hiss is inevitable, but Tibbetts has kept it to a neglible minimum.

After the deluge is over there is a feeling of peace and fulfillment. **Yr** journeys effortlessly through the realms of serenity and searing penetration. The album is an opportunity to become a fellow traveler with Steve Tibbetts.

(**Yr** is available by mail from Frammis Enterprises, Box 6164, Minneapolis, Minn. 55406.) *John Diliberto*

Sound: A- Performance: A+

Hidden Voices: Anthony Davis/James Newton Quartet
India Navigation IN 1041, stereo, $7.98.

Pianist Anthony Davis and flutist James Newton consolidate their positions as two of the brightest young hopes in jazz with this album. As a bonus, trombonist George Lewis joins the quartet on three of the five tracks.

The closely knit voicings and sauntering mid-tempo of *Forever Charles* are a reference to Mingus no doubt. Newton flies freely in Eric Dolphy fashion, while Lewis works staccato phrases within a more restricted range. Drummer Pheeroan Ak Laff signals a brief transition to a more rhapsodic section featuring Davis' McCoy Tyner-influenced modulations. Through it all, bassist Rick Rozie maintains a pulsating, powerful, and complementary melodic line a la Mingus.

Hocket in the Pocket, written by Davis, refers to the medieval and World Music practice of hocketing, building up a line through the insertion of parts by different instruments into the others' rests. The piece goes off into free simultaneities as well as a sonorous solo by Ak Laff, but it never loses track of the mock-funky theme, the tune and rhythm of which are frequently quoted.

The introduction to *Past Lives* demonstrates Newton's advanced method of sound production, originating in, but greatly extending, Rahsaan Roland Kirk's hum-along technique. Newton uses his voice, breath, and flute together to set up multiphonic harmonies and counterpoint. The piece as a whole weaves flute, piano, and bass into an eerily lovely aural tapestry, enhanced by understated percussive commentary.

Crystal Texts Set 1, Pre A-Reflexion by Newton is the longest (12:13), most abstract piece, affected in style and construction by contemporary "classical" composition. Lewis, Newton, and Rozie play eruditely yet surprisingly soulfully (note in particular the blues inflections of Lewis' first trombone solo), though Davis and Ak Laff seem less secure in their essentially coloratives roles. Davis plays a lovely, bell-like interlude, however, seemingly touched by Messiaen.

Sudden Death is a madcap whirl of disjointed sounds, harrowing cries, flatulent sarcasm, and frenzied confusion, most of it accompanied by a maniacally flighty backdrop of bass and drums. The piece changes course several times but eventually accelerates into what seems like an all-too-inevitable sudden death.

The piano sound is somewhat constricted, though I've heard far worse. As with many India Navigation pressings, surface hiss intrudes onto the music. (India Navigation, 60 Hudson St., New York, N.Y. 10013.) *Tom Bingham*

Sound: B- Performance: A-

The Shout (Portrait for a Small Woman): Alan Silva
Chiaroscuro CR 2015, stereo, $7.98.

Alan Silva calls his 21-piece group The Celestial Communications Orchestra. Several years ago the message he had was one of universal cacophony as his orchestra tried to blow their brains out through their axes in sonic anarchy. The intervening years have shown his energy to be undiminished. In fact, his new focus and tighter orchestral arrangements have made that energy more efficient.

The Celestial Communications Orchestra is less angry and more joyful these days. This ebullient nature is reflected in the hyena clarions of the horn section, the celebratory call and response patterns, and the never less than fervent solos. Silva powers his massive orchestrations with twin drummers, Michael Coffi and the long-lost Muhammed Ali (no, not the boxer) whose powerhouse drumming hasn't been heard in a few years. With percussionist Armand Assouline they create the tribal dance rhythms that shift the orchestra through its changes.

Most of the musicians are French players who are relatively unknown in the U.S., with a few Americans in Europe like Michael Zwerin thrown in. Collectively they have an edge of sloppiness, but with this music it's a plus since it adds to the joyful spirit of the proceedings. Individually there are some strong soloists here, with a sinuous soprano solo from Jo Maka on *Golden Flower* and an elephantine stomp from Denis Colon on bass clarinet.

The recording is very simple and direct. This leads to some cloudiness between sections, especially with many of the bizarre voicings that Silva uses. More careful miking and a greater spatial awareness would have made this music even more open-endedly exultant.

Alan Silva has taken the lessons from his free jazz days in the late Sixties and early Seventies and combined them with the traditions of the music going back to Duke Ellington and Fletcher Henderson. The result is music that reaches out on several levels at once in a true communication. *John Diliberto*

Sound: B- Performance: A

Johnson's Whacks: The Jimmy Johnson Band
Delmark DS 644, stereo, $7.98.

With **Johnson's Whacks,** blues guitarist Jimmy Johnson takes a giant leap forward into the front ranks of Chicago's progressive bluesmen as he makes good on the promise evident in his tracks on the landmark **Living Chicago Blues** anthology series.

Johnson is a superior singer with a high soaring voice, the legacy of having led R&B bands before signing on for a two-year stint as second guitarist with bluesman Jimmy Dawkins, one of the Windy City's most innovative if overlooked guitarists. Most of this set consists of original songs cast along the lines of 12-bar blues, but the album's opening track of the same name humorously hints that Johnson refuses to be bound by tradition. Its lyrics gently poke fun at the basic form of most blues numbers: "I've got the twelve bar blues/I've been to ten or twelve bar tonight/I guess I've lost count/But I know I'm mighty tight." In fact, almost all his songs boast refreshingly original lyrics that set them apart from the recycling of traditional verses that all too often pop up on modern blues albums.

Jimmy Johnson

At his best, on tracks such as *Strange How I Miss You (When I Haven't Even Lost You Yet)* he mixes poignant R&B ballads with bracing doses of inventive West Side Chicago guitar that recall Dawkins in their reliance on unusual chord changes and sustained tones. The resulting evocative blues ballads have an impact comparable to Albert King's Stax sides in the same vein.

The album is a bit too polished to have the raw emotional wallop of discs by some of his Chicago peers, but the combination of Johnson's dynamic vocals, high-powered guitar work, and some genuinely new material makes **Johnson's Whacks** one of the most exciting Chicago blues albums to come out in months.

Roy Greenberg

Sound: B Performance: B+

Corea/Hancock: Chick Corea and Herbie Hancock
Polydor PD-2-6238, 2 discs, stereo, $11.98.

This two-record set is the companion to a similar double-set released earlier by Columbia (PC2 35663). Both are live recordings made during the historic acoustic piano duet tour that Chick and Herbie made in 1978, and the new release is quite the equal of the first.

Hearing these two keyboard giants working out together, stripped of all electronic toys and gimmicks, is a special treat. With nothing but two grand pianos there is very real and direct communication captured. And grace.

The separation is both judicious and necessary, with Chick on the right and Herbie on the left, just as it is on the Columbia discs.

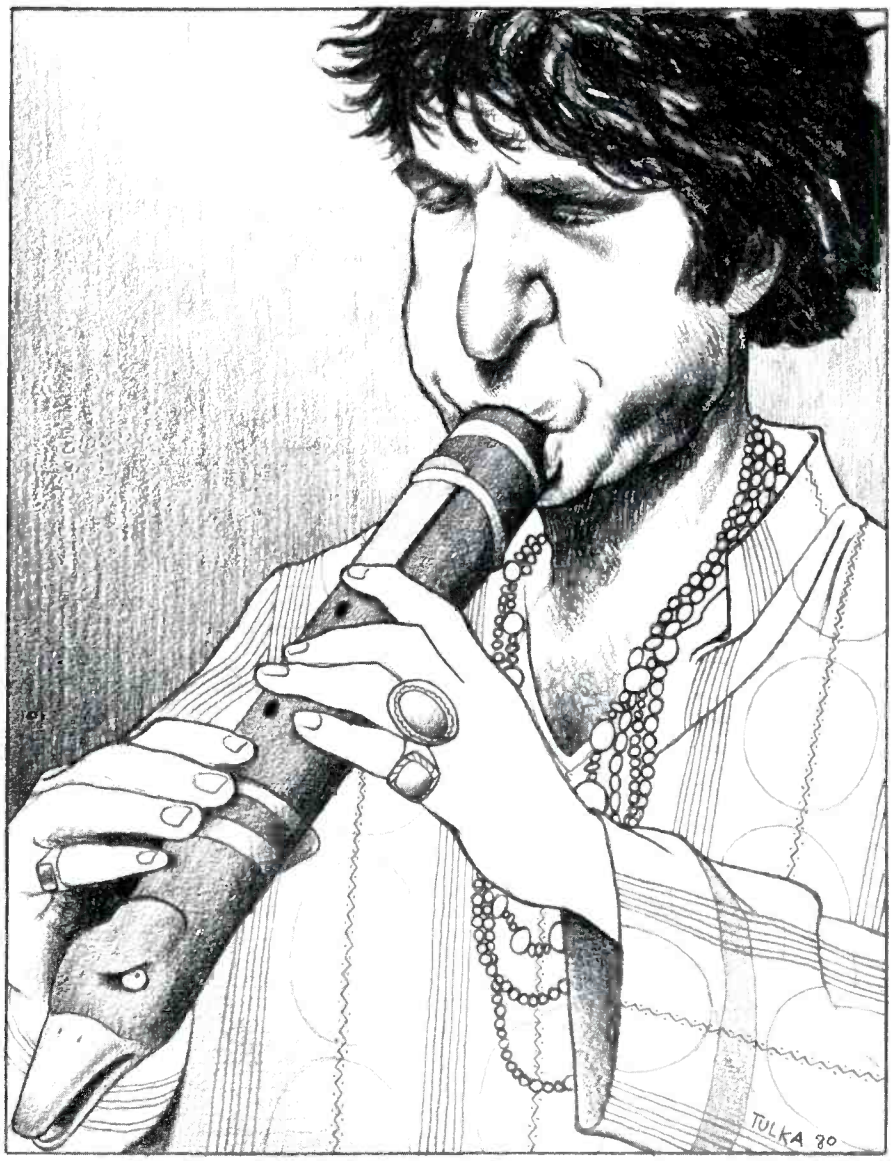
I knew I would love this album as I did the first release, but I was one of the lucky ones who saw them play on that tour, and it really was a magical experience fortunately captured now on vinyl. By the way, the performances are intact (no part one and part two nonsense). Neither have they been enhanced by studio patchwork wizardry.

Michael Tearson

Sound: B Performance: A

Folk bag

Tom Bingham



No More Walls: David Amram
Flying Fish GRO-752, stereo, $7.98.

As a longtime eclectic, I've always admired David Amram's willingness to go beyond simply listening to or talking about the so-called "many worlds of music." Instead, Amram gets right to work tearing down the artificially imposed barriers which for too long have hindered communication among these many worlds.

Yet as much as I respect Amram in this regard, I can't say I always find the results satisfying. His attempts to prove that various modes of cultural expression can merge or at least coexist have often produced hodgepodges of disparate ideas which neither cohere nor complement each other.

This album (apparently a reissue of a 1971 release, though this is left unclear in the otherwise informative liner notes) is one of Amram's most successful offerings to date. There is a wide diversity of elements here, with jazz as the primary influence, a lot of contemporary Brazilian music, plus folk and classical traditions from around the world. Fortunately, Amram resists the temptation to toss in everything he knows all at once. Rather, the various idioms are judiciously proportioned from track to track so that, in any one piece, the cultural fusion generally involves only two or three idioms combined in a thoroughly compatible and logical fashion. A good example might be *Wind from the Indies*, which combines jazz improvisation with West Indian polyrhythms. The fact that on this piece Amram solos on classical (French horn) and ethnic instruments (Irish and Indian flutes) seems almost incidental since, aside from one multiphonic flute chorus, they are played in a recognizable jazz style.

While each composition is credibly coherent, some listeners may find the stylistic leap from cut to cut a trifle unsettling at first hearing. In order, side one moves from a Villa Lobos-flavored bossa nova, through a fairly straightahead jazz waltz and the lighthearted country-folk *Going North* (with springing rhythm guitar and yodelling by Ramblin' Jack Elliott), to the aforementioned *Wind from the Indies*. On side two, we have a quirky cool-jazz film tune *(Pull My Daisy,* sung with strained high notes by Lynn Sheffield but benefitting from a superb baritone sax solo by Pepper Adams), a lovely jazz samba, and a fascinating extended composition (blithely entitled *Tompkins Square Park Consciousness Expander),* in which Arabic musicians play Middle Eastern patterns behind multicultural improvisations on a variety of instruments (Adams, baritone; George Mrgdichian, oud; Midhat Serbagi, viola; Amram, Pakistani flute, headbone, plus kazoo and bouzouki together).

Aside from Sheffield's vocal, performances are of a very high standard, with none of the hot-dogging born of overenthusiasm which has marred some of Amram's recent TV appearances. Highly recommended to eclectics of all stripes, despite a surfeit of surface crackles. *Tom Bingham*

Sound: B– Performance: A–

Illustration: Rick Tulka

Texas-Mexican Border Music
Vol. 14: The Chicano Experience
Folklyric 9021, mono, $7.98.
Vol. 15: Lydia Mendoza, Part 1: First Recordings, 1928-1938
Folklyric 9023, mono, $7.98.
Vol. 16: Lydia Mendoza, Part 2: Early Recordings from the 1930s
Folklyric 9024, mono, $7.98.

The Chicano Experience is a collection of 12 recordings from about 1930 to 1973 which illustrate how Mexican-Americans have viewed life in their adopted country from World War I, through prohibition, the Depression, and World War II, up to today's illegal immigration problem. The *corridos, canciones,* and comedy skits heard here (with complete translations printed on the jacket) present tales sometimes with humor, but more often with a mixture of pathos and defeatist resignation, of discrimination, poverty, heartbreak, and bewilderment over unfamiliar social customs.

As a corollary, the album illustrates how Chicano music has altered through the decades, from the guitar-backed duos of the '30s to the Norteno accordion *conjuntos* of the '50s, and beyond. The most unusual cut is Lalo Guerrero's 1952 *Marijuana Boogie,* which makes its social point musically, being a thoroughly Americanized jump-band R&B record with no apparent Mexican influence aside from its Spanish lyrics. A valuable album sociologically, *The Chicano Experience* is also a superb album for just plain listening as well.

Lydia Mendoza has been a top recording artist in South Texas since the mid-'30s, though her career extends back even further to a family string band called Cuarteto Carta Blanca (later known as La Familia Mendoza).

Each of the two Folklyric Mendoza reissues has one side by the family and one side of the achingly romantic solo recordings on which her reputation is based. No. 9023 includes two songs recorded in 1928, featuring ten-year-old Lydia on mandolin. Later family recordings (1934-1938) have Lydia playing violin and singing unisons and harmony to her mother Leonor's lead vocals. Though artistically on a lower level than her solo efforts, the Mendoza Family sides are valuable examples of the long-vanished string band tradition which once flourished in the Rio Grande Valley.

The solo sides, however, are the real reason for buying these albums. Lydia's lovely voice — sweet, yet with a piquant bite — her impassioned yet sincere phrasing, and her rich 12-string guitar backing are perfectly suited for the almost masochistically disconsolate lyrics and poignantly sentimental melodies of her finest songs. Among the most memorable are her classic *Mal Hombre, La Costenita* (both on No. 9023), *Sola* and the gruesomely necrophilic *La Boda Negra* (on No. 9024).

No. 9023 is of greater historical significance, but musically I find No. 9024 more appealing. (Arhoolie Records, 10341 San Pablo Ave., El Cerrito, Calif. 94530.) *Tom Bingham*

Performance: A- to A

Traditional Music of Ireland and Shetland: How To Change A Flat Tire
Front Hall FHR 018, stereo, $7.98.

How To Change A Flat Tire has undergone some important changes since the group's impressive debut album, **A Point Of Departure** (FHR-09).

Ginny Phelps, whose rather artsy vocals failed to mesh effectively with the rest of the music, is gone and has not been replaced. Therefore, this is an all-instrumental album, though founding member Jim Martin has since begun to sing in live performances.

Flute and whistle player Bo Hinrichs is also gone, giving way to fiddler Maggie Holtzberg, which is important for a number of reasons. The fiddle is much more flexible and versatile than either of the wind instruments, thus encouraging the group to open up far more spontaneously than on the first album. Second, Holtzberg is a robust, incisive, extremely knowledgeable player who would be a great asset to *any* band playing Irish and Shetland music (the latter is her specialty, having researched it first-hand in the Shetland Islands). The only loss incurred in this personnel shift is the striking textures Hinrichs used to set up with Tire's innovative recorder player Jim Cowdery, but the addition of Holtzberg more than compensates for this.

What it boils down to is that Tire's second album is as fresh, accomplished, and exciting an album of tra ditional Irish/Shetland music as one could ever hope to hear by musicians raised outside these traditions. The arrangements take full advantage of the varied instrumental combinations available to them. (In addition to recorder, which he plays like a cross between a wooden flute and *uillean* pipes, Cowdery plays mandolin, the lower-pitched tenor mandolin, and whistle; Dean Kuth plays concertina and percussion, and Jim Martin divides his time between mandolin, guitar, and tenor banjo.) Not only does the group set up some very striking voicings, they attempt some relatively advanced (for the context, that is) harmonies and counterpoint, with admirable success.

The performances by all four members are dexterous, precise, vigorous, and altogether irresistible. The repertoire steers clear of the overworked, and includes several tunes brought back from Shetland by Holtzberg. Though **A Point of Departure** was pretty remarkable when first released in 1977, this newer album is more mature, more impassioned, and more penetrating. In all, it propels How To Change A Flat Tire to the very top of

the list of American bands performing this sort of music.

The recording serves the music exceptionally well. The mandolin and tenor mandolin leap out at the listener, their duet parts balanced in perfect proportion. The *bodhran* resounds like a mighty call to battle, yet doesn't overpower the front line. A few wayward ticks are the only sonic drawback. (Front Hall Records, RD 1, Wormer Road, Voorheesville, N.Y. 12186.) *Tom Bingham*

Sound: A- Performance: A

Laduvane 1: Laduvane
Physical PR 35-008, stereo, $5.50.

Laduvane is a Cambridge, Massachusetts-based ensemble of seven women who sing a cappella arrangements of Bulgarian/Yugoslavian folk and popular songs.

The Balkan Peninsula has long been renowned for its rich tradition of women's vocal music, a tradition which many Americans first became aware of in the '60s via The Pennywhistlers. But that group, for all its well-drilled ability, was never able to capture the tight-throated excitement of genuine Eastern European women's singing the way Laduvane has. The vaguely Oriental tinge of the melodies, the gorgeous modal harmonies (somewhat dissonant by Western European/American standards), and the indigenous dance rhythms have been captured virtually intact on this album. But even more significantly, the group has come close to reproducing the taut shrillness, sudden catches and falsetto leaps, and gripping emotionalism of the most traditional peasant songs; hear, for example, *Dobro Dosle* and *Vetar Vee*. They also do a lovely job on the sweeter, more contemporary songs such as *Mi Go Zatvorile* and *Vido, Vido*.

Also included are an instrumental *Tamburitza Medley*, performed with proficiency and panache by members of The Cambridge Folk Orchestra, and a marvelous track on which the tamburitza group accompanies Laduvane members Jan Downey and Harriet Jopson.

What may perhaps be the most noteworthy aspect of this album is the way Laduvane makes the music come alive. This is no dry, academic investigation into an alien idiom. Rather, it's a highly entertaining, stimulating, often downright thrilling record which should entrance an extremely broad range of listeners, including many to whom the thought of hearing an album of a cappella choral folk music in a foreign tongue is less than overwhelmingly enticing.

The recording has a somewhat restricted dynamic range, but is respectable. The left channel conks out for a split second on a few occasions during the *Tamburitza Medley*. The surface has numerous small ticks, a few louder clicks, and frequent intrusive distortions. (Physical Records, P.O. Box 125, Cambridge, Mass. 02140.)

Tom Bingham

Sound: C Performance: A

The Best of Bert Jansch
Kicking Mule KM/TRA 334, stereo, $7.98.

Here is a collection that really does live up to its name. The set is taken from the series of solo albums Bert Jansch made for England's Transatlantic label between 1965 and 1971, both preceding and during his long and historic stretch with Pentangle.

The album has 13 selections that all rank among the best this wonderful musician has recorded. They touch all of Bert's varied interests. *Alman* is a classical lute piece played on guitar. *Nicola, It Don't Bother Me* and the intricate instrumental *Peregrinations* are jazzy originals. The were-fox story *Reynardine* and Jean Ritchie's mystical *Nottamun Town* are traditional ballads set to stunning personal guitar backings. There's some blues with *Weeping Willow Blues*. There's Bert's painfully sad *Needle of Death*, still one of the very finest anti-drug songs written. And there's the amazing Davy Graham instrumental, *Angie*, without which the collection would be incomplete.

Bert Jansch was for me *the* seminal force, the most important figure of the folk revival that happened in England in the '60s. This album very clearly shows why. Recently Bert's live performances have shown fresh vitality after a period of some lesser intensity. His new directions are strongly indicated by the classic material contained here, and I have no doubt that future recordings will carry it forward.

Michael Tearson

Sound: C Performance: A+

Sones Jarochos
Arhoolie 3008, stereo, $7.98.

Having done so much to disseminate Tex-Mex music to the rest of the world, Chris Strachwitz turns his microphones southward for the first in what promises to be another rewarding and influential series, "Music of Mexico."

Jarocho music in the Spanish-descended sound of the region immediately south of Veracruz, along the southwestern coast of the Gulf of Mexico. The most distinguishing characteristics of Jarocho music are its exciting, syncopated fandango rhythms and the unmistakable timbres of its unique instrumentation.

The lead instruments on this record are the *arpa* and the *requinto*. The arpa is a large wooden harp which has a distinctively brittle upper register supported by reverberant bass tones. The harp melodies are built up from rippling arpeggios played in a continuous, forward-moving staccato, sounding oddly like a giant stringed music box. Like its European ancestor, the instrument is capable of a wide variety of tonal colors, as Rufino Velasquez Cordoba's effervescent solo, *Siquisiri*, illustrates.

The Jarocho requinto is a small, four-stringed relative of the guitar that is plucked in a somewhat stiff, yet responsive clipped-note manner. It can be played with a surprising degree of virtuosity considering its size and apparent simplicity, as Daniel Valencia's improvisation on *El Cupido* demonstrates. Propulsive rhythm accompaniment is provided by three small guitar-like *jaranas*, which are strummed steadily and rapidly.

The music on this album represents an older style of Jarocho son than is commonly encountered today, in which the six-string guitar has increasingly supplanted the less flexible requinto. The sones heard here come from the traditional repertoire. By far the most famous is *La Bamba*, popularized in the U.S. 20 years ago by Chicano rock 'n' roll star Ritchie Valens. This *La Bamba* is played with an informal abandon that makes Valens' hit seem rigid by comparison. (Note the absence of Valens' "bom-ba-bomba" section.)

Strachwitz has labeled the album "direct-to-tape," a somewhat tongue-in-cheek indication that it was recorded as it happened, without overdubs or producer manipulations. But that's obvious, since the spontaneity and unforced exhilaration of this music would be nearly impossible to duplicate in a studio.

This is one of those albums which creates an instant craving for more. The forthcoming releases in the series already have a tough standard to live up to. (Arhoolie Records, 10341 San Pablo Ave., El Cerrito, Calif. 94530.)

Tom Bingham

Sound: B- Performance: A

Classical reviews

Edward Tatnall Canby

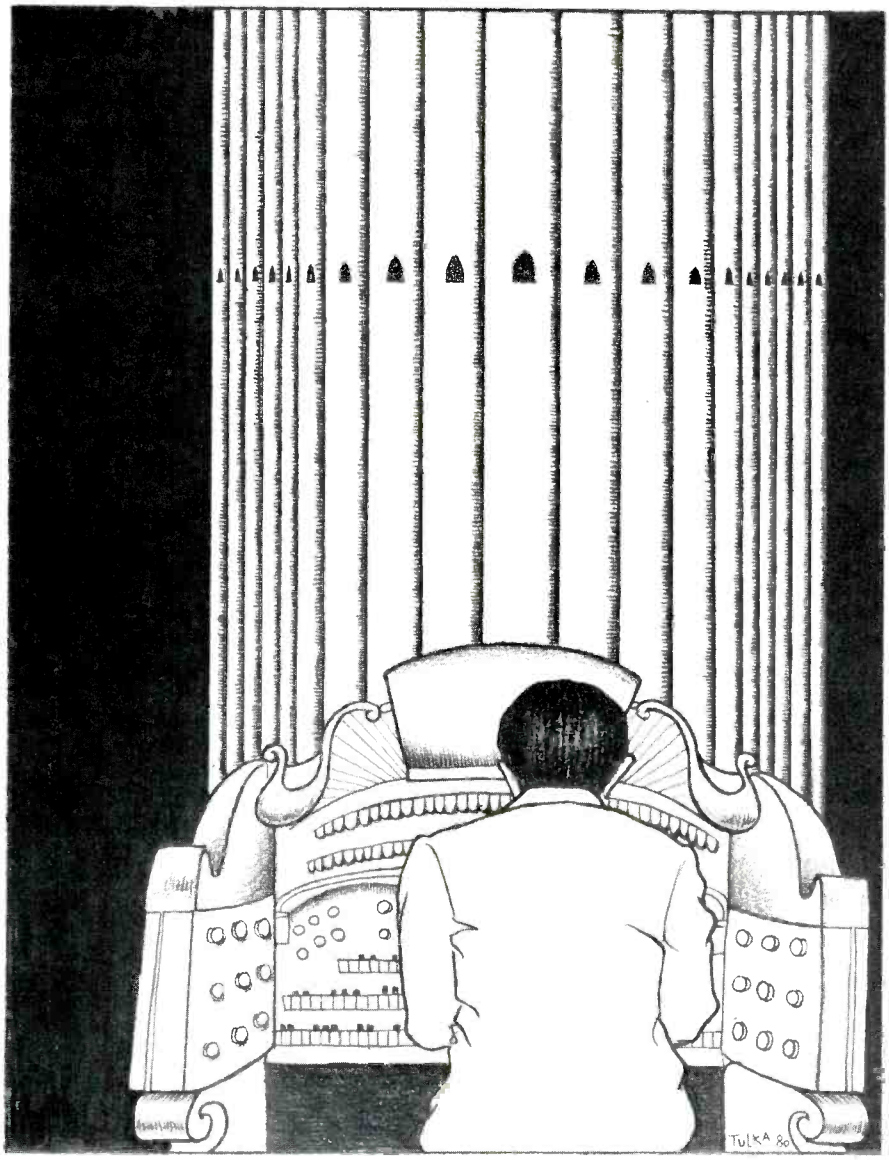


Illustration: Rick Tulka

Robert Edward Smith: An Introduction to the King of Instruments. John Rose, organ. **Towerhill T-1004,** stereo, $7.98.

Without a doubt, the inspiration for this organ opus was Benjamin Britten's **Young Persons Guide to the Orchestra** (Variations on a Theme by Henry Purcell) and it is a very creditable follow-up on the original, full of light and air — not hot air, but warm, comfortable and humorous. Both the composer, who is a first-rate classical harpsichordist, and the organist, longtime colleagues at several universities, seem to be having a fine old time and the spirit of the whole is really infectious. Only one technical flaw mars a splendid recording: A semi-intelligible mike pickup for the narrator, whose voice is hollow and bassy — sounds to me like the good old proximity effect, no doubt not intended.

Sensibly, side 2 of this record offers the music complete, without the narrator. Excellent idea, and on occasion the Britten has similarly been laid out for LP, as far back as the pre-stereo era.

Mr. Smith (Robert Edward) is one of those gifted and unpretentious composers who just think naturally in "old-fashioned" musical idioms, making no pretense at conscious modernity. Peter ("P.D.Q.") Schickele is another of the sort. In this organ work, Mr. Smith writes at leisure, letting go at length when the mood suits him, spinning out some really delightfully musical ideas as long as he seems to have a mind to — and ringing the changes on every sort of "classic" music from Couperin to Ravel: The music definitely has a French overlay to it, and Mr. Smith's performing specialty has been the complete keyboard work of Francois Couperin le grand. If my ear is tuned right, there are some lovely bits of horseplay on the Couperin organ idiom here — right out of some clearly humorous church music of that somewhat cryptic old master, who knew his French aristocracy as well as he knew anything and, especially, how to captivate them from the keyboard — any keyboard.

The music is, incidentally, instructive as to the varied sounds from the 8,000 or so pipes in this "great pipe organ," and Mr. Rose plays it all with such superb phrasing and timing and color that the message is made clearer and easier — one senses his enthusiasm. It is a vast instrument and the space is enormous, too — mikes suspended from a 110-foot false ceiling. An oddity — it is the Cathedral of St. Joseph but there is not so much as a word on this record as to WHERE in larger space, geographically speaking, this combination might be found! I naturally assumed it must be California — where else? (And the record company is based in Hollywood.) Not until I studied another record by Mr. Rose did I find that the enormous cathedral is right in my front yard, in the capital of the non-sovereign State of Connecticut. No matter! A glorious sound.

N.B. — That voice microphone. Was it by chance an old but honest ribbon or one of the two-way broadcast-type cardioids? Or one of the new mikes that deliberately promote the proximity-effect bass boost for pop-music reasons? Another possibility (probability?): A perfectly correct microphone but an attempt (misguided) to record

the narration within the same acoustics as the music? That would do it. If the speech was in fact recorded separately (as would be normal today), a later redo and remix might be well worth the trouble. In any case, don't let a minor fault stop you! You have your (regular-price) money's worth, proximity or no, and the text is printed in the accompanying leaflet if you need help.

Sound: A- Recording: A- Surfaces: B

John Rose—The French Romantics, Vol. 2. Pierné, Vierne. Organ of the Cathedral of St. Joseph, Hartford, Connecticut. **Towerhill T-1003,** stereo, $7.98.

I missed Vol. 1 of this series, also including a Vierne symphony. This is the same vast organ that is used for the Rose-Smith **Introduction to the King of Instruments** (Towerhill T-1004). Not much humor here, though the three little pieces by Gabriel Pierné have nicely delicate colors. As for Vierne and his Fourth Symphony, it is gloomy and magnificent, full of César Franck turned acid, and it fills a band on side 1 plus the whole of side 2. There's variety — a nice pseudominuet in the style the late 19th century *thought* was a minuet, for instance. But this record and its companion are probably best for those who really want Romantic organ music, over and beyond Big Sound.

The engineering/recording on these Towerhill discs is definitely of a higher order than the pressing. Too bad this one has ticks and noises, notably at beginnings and endings of sides. Only occasionally bothersome.

Sound: A- Recording: A- Surfaces: B-

George Malcolm Conducts J.S. Bach—Orchestral Suites 3 & 4. New Chamber Soloists. **Merlin MRF 78901,** stereo, $16. (S. Baird/Records, P.O. Box 17947, Memphis, Tenn. 38117.)

Here's a novel import from England, and maybe about time. It is strictly high tech and it costs, as you see, some $16 direct from the Tennessee importer. But the thing — can I believe it? — was recorded direct to tape! Yep, that's the way it was.

The English company explains that the problems usually encountered in standard recording procedures were "minimised" in various respects so that the musical result is uncompromised. Good bet, and definitely a possibility, as most of us are quite soberly aware, digital and d-to-d notwithstanding. They stress, first, the careful choice of musicians and recording locations, then the microphone techniques which are "flexible and creative" (well, I would hope so . . .), and they avoid extremes, especially the multi-track, multi-mike sort of compound-mono miking that is indeed a feature of much recent recording, notably (of course) in pop music. Then, it says, they mix "direct to stereo," which sounds OK and surely is (but does this imply a copy, at least one generation from the original master tape?) And finally (of course) there is the cutting and pressing . . . .

Well, not a word of all this but somebody in the record biz couldn't equally say it for *their* product! However, the British tend to be a wee bit more addicted to ultimate truth than ourselves, and so I would tend to take it all fairly seriously — in fact, I did. I always have admired George Malcolm's effervescent (if somewhat superficial) harpsichord virtuosics, and he ought to make a splendid conductor for the sometimes-heavyweight Bach suites.

OK — so what result? Excellent for George Malcolm! Sprightly, lilting performances, excellent trumpets in Suite #3 and trumpets-plus-oboes in Suite #4, though they are modern throughout, not the "authentic" old instruments. No sweat. The rather difficult Suite #4 gets the best and most convincing performance I have ever heard.

Sound? Top surfaces, quiet though uncoded, and a high level of cutting. For my ear the sound is not absolutely the cleanest, though, by a VERY small (and musically unimportant) margin. All this, of course, judged on high-tech basis, and for the price.

Bach lovers will have no problem. Go out and get George Malcolm, and watch for the other two Suites, Nos. 1 and 2.

Sound: B+ Recording: A Surfaces: A

Baroque Brass. The Empire Brass Quintet. **Sine Qua Non (SQN) SA 2014,** stereo, dbx encoded.

Brass music is everywhere on LP discs and it can become tiresome, depending. Like wind quintets, the same. Here is an emphatic exception — the reason being, aside from very fine recording, a matter of sheer musicality. These people play superbly, not merely in the technical sense but, more important, with warmth, impeccable phrasing and superb rhythm, no matter what the music may be — and it varies all over the (past) lot, from Bach and Handel back to Puerl, Pezel, Purcell and Palestrina, not to mention Priuli.

Of course none of this is "authentic" and could not be so with these super-powerful modern bass instruments. The originals could not ever have sounded remotely like these renditions — though without a doubt they had equal virtues in their own way. BUT — musicianship, real musical understanding, conquers all! Just try the Handel *Aria* that opens side 1 — the original could have been for solo voice and Baroque orchestra of strings and winds; it is the purest and finest Handel, in the spirit if not the letter! So with most of the others; oddly, the only real flub comes in the relatively familiar music of Henry Purcell's *King Arthur,* where the *Air* is abysmally slow.

I note that these pro brass players have been listening a bit to the "authentic" music people; a tap-tap drum appears in several items and in several others a little ding-dong bell, both trademarks of "authentic" performance on old instruments. And also one can note the care with which most of the instrumental ornaments are performed, in the large quite correctly. Most brass people haven't got around to that idea yet.

The original LP of 1977 is list-priced at a mere $4.98 and I have no cost for the dbx re-cut — but without the slightest question it ranks in the high-technology area and could be priced accordingly. The total dbx background silence and the very large dynamic range are as usual no less than startling — indeed, the dynamic range somewhat enhances the one musical mannerism I do not much like in all this playing, the constant swelling and dying, from extremely soft to very, very loud. It is hi-fi all right but musically anachronistic for all the works included. Didn't really bother me, though — the rest was so good.

My rating system simply breaks down for these encoded discs. They are not comparable to other discs, except for a few high-tech offerings with unusually quiet surfaces and/or very wide dynamic range. For the encoded disc I would have to rate surfaces as A+++. Except for a few minor and faint ticks that get through, there IS no surface sound for the ear. And the very wide dynamic range simply puts other LP products out of the running, basic quality being equal.

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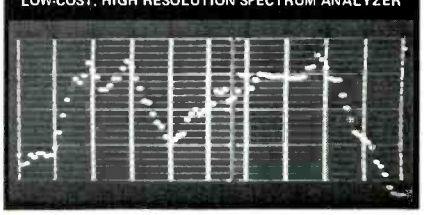

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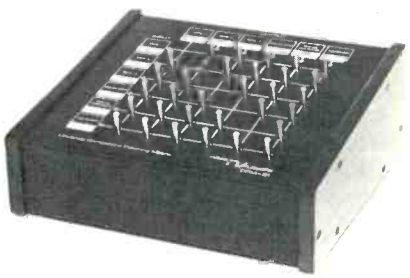

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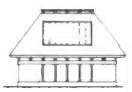

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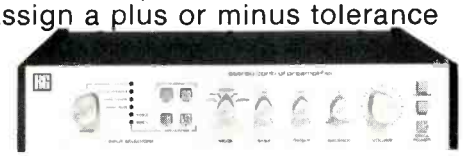

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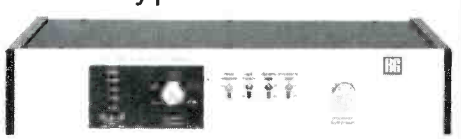

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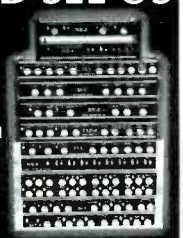

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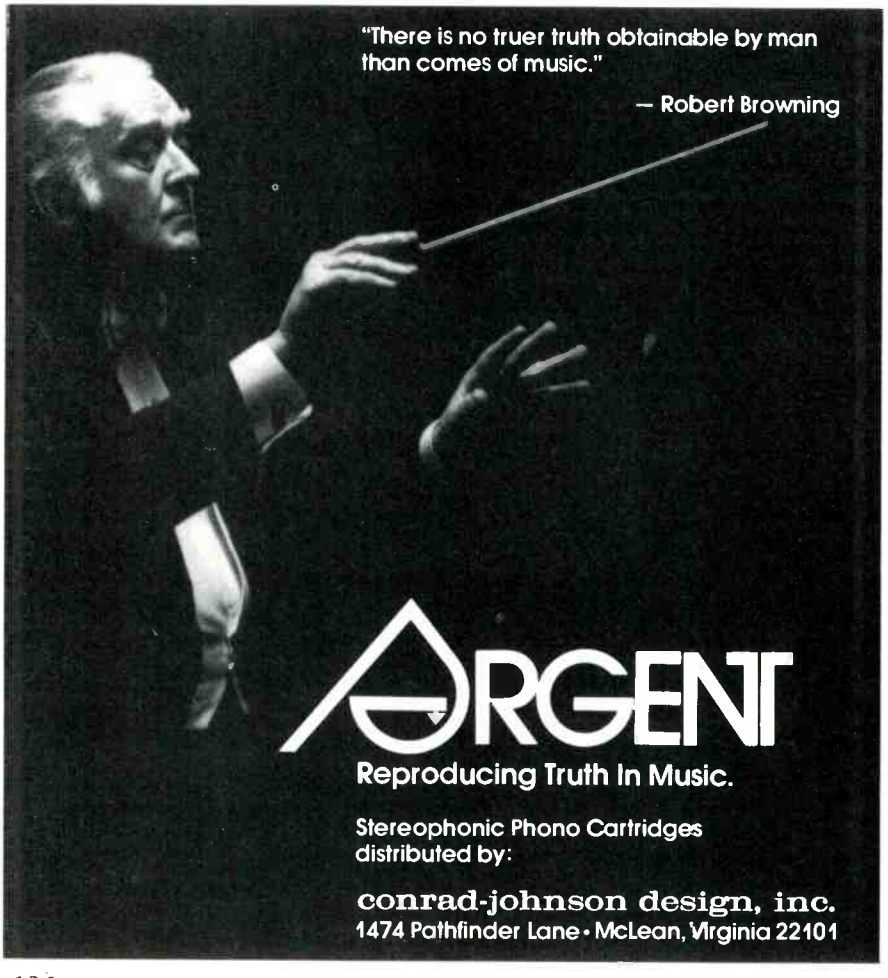

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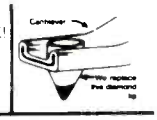

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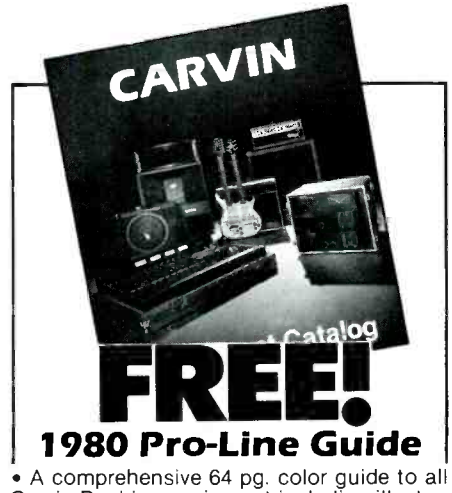

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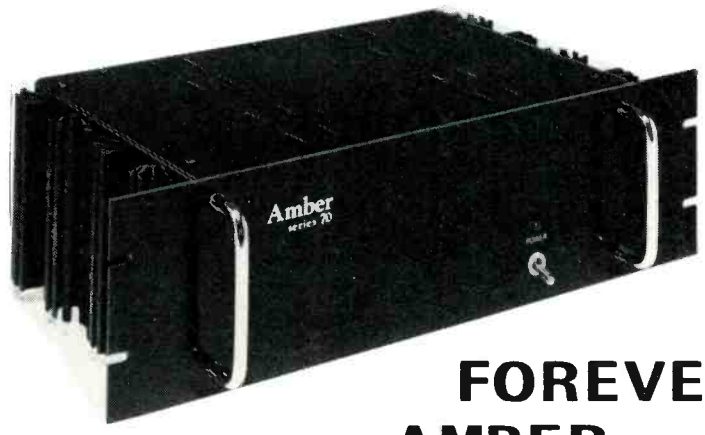

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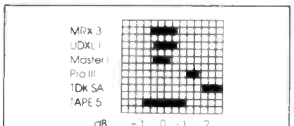
By hyping "color" (Sony), "tape of the stars" (Ampex), "truth" (Scotch), and "high octane" (Maxell), these companies are avoiding the big issue of tape incompatibility, a factor that can measurable — and audibly — affect the actual performance of **your** deck. Since each tape deck manufacturer adjusts the bias settings of its machines differently, one brand's "normal" and "chrome" settings usually differ from another brand's "normal" and "chrome" settings. This means that bias adjustments are hardly ever a perfect match for a tape. Also, your deck's bias changes as its components age. With a bias mismatch, tape complains by distorting and losing frequency response.

But with TAPE 5 WIDE-LATITUDE® cassettes, there's no incompatibility problem.



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NO MIDRANGE FUZZINESS EVEN WITH LEVELS 'IN THE RED'

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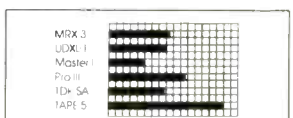

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